

INDUSTRIAL ELECTROHYDRAULICS

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MASTER CATALOG



GENERAL INDEX





PROPORTIONAL VALVES

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SERVOPROPORTIONAL DIRECTIONALS

zero overlap with LVDT transducer

DLHZO-TEB/TES DLKZOR-TEB/TES	direct, sleeve execution, on-board driver	06 ÷ 10	70 ÷ 130	FS180	8
DLHZO-T, DLKZOR-T	direct, sleeve execution, off-board driver	06 ÷ 10	70 ÷ 130	F180	22
DHZO-TEB/TES DKZOR-TEB/TES	direct, on-board driver	06 ÷ 10	80 ÷ 180	FS168	28
DHZO-T, DKZOR-T	direct, off-board driver	06 ÷ 10	80 ÷ 180	F168	42
DPZO-LEB/LES	piloted, on-board driver, 2 LVDT transducers	10 ÷ 35	180 ÷ 3500	FS178	47
DPZO-L	piloted, off-board driver, 2 LVDT transducers	10 ÷ 32	180 ÷ 1600	F178	64
LIQZP-LEB/LES	3 way cartridge, piloted, on-board driver, 2 LVDT transducers	25 ÷ 80	500 ÷ 5000	FS340	72
LIQZP-L	3 way cartridge, piloted, off-board driver, 2 LVDT transducers	25 ÷ 80	500 ÷ 5000	F340	88

HIGH PERFORMANCE DIRECTIONALS

positive overlap with LVDT transducer

DHZO-TEB/TES	discrete and the sound defines of	00.10	00 1 100	FCICE	05	
DKZOR-TEB/TES	direct, on-board ariver	06 ÷ 10	80 ÷ 180	F2102	95	
DHZE-TID, DKZE-TID	direct, on-board driver	06 ÷ 10	80 ÷ 180	FS155	110	
DHZO-T, DKZOR-T	direct, off-board driver	06 ÷ 10	80 ÷ 180	F165	118	
DPZO-LEB/LES	piloted, on-board driver, 2 LVDT transducers	10 ÷ 35	180 ÷ 3500	FS175	124	
DPZO-L	piloted, off-board driver, 2 LVDT transducers	10 ÷ 32	180 ÷ 1600	F175	144	
DPZO-TEB/TES	piloted, on-board driver, 1 LVDT transducer	10 ÷ 32	180 ÷ 1600	FS172	154	
DPZE-TID	piloted, on-board driver, 1 LVDT transducer	16 ÷ 32	400 ÷ 1600	FS158	170	
DPZO-T	piloted, off-board driver, 1 LVDT transducer	I LVDT transducer 10 ÷ 32 180 ÷				
	2 way ISO cartridge, piloted,	10 - 125		66770	100	
LIQZP-LED/LES	on-board driver, 2 LVDT transducers	10 ÷ 125	600 ÷ 22000	F3330	100	
	2 way ISO cartridge, piloted,	10 . 105		F770	205	
LIQZP-L	off-board driver, 2 LVDT transducers	16 ÷ 125	600 ÷ 22000	F330	205	
	high response 2 way ISO cartridge, piloted,	72 . 100	1800 : 16000	FC775	217	
LIQZH-LEB/LES	on-board driver, 2 LVDT transducers	52 ÷ 100	1600 ÷ 16000	F3335	213	

DIRECTIONAL VALVES

positive overlap without transducer									
DHZO-A/AEB/AES	divert off be and an an be and duited	00.10	70 + 100	FEICO	220				
DKZOR-A/AEB/AES	direct, off-board or on-board driver	06 ÷ 10	70 ÷ 160	F5160	228				
DHZE-A, DKZE-A	direct, off-board driver	06 ÷ 10	65 ÷ 130	F150	243				
DPZO-A/AEB/AES	piloted, off-board or on-board driver	10 ÷ 32	180 ÷ 1500	FS170	249				
DPZE-A	piloted, off-board driver	10 ÷ 32	180 ÷ 1500	F171	267				

		Size	Qmax [l/min]	Table	Pag
SAFETY PROPORTIONALS					-
IEC 61508 & ISO 13849, on-	-board driver with on-off signals /K				
DLHZO-TES, DLKZOR-TES	direct, zero overlap, sleeve execution, LVDT transducer	06 ÷ 10	70 ÷ 130		
DHZO-TES, DKZOR-TES	direct, positive or zero overlap, LVDT transducer	06 ÷ 10	80 ÷ 180	FY200	276
DPZO-TES, DPZO-LES	piloted, positive or zero overlap, 1 or 2 LVDT transducers	10 ÷ 35	180 ÷ 3500		
IEC 61508 & ISO 13849. on-	-board driver with double power supplu/U				
DLHZO-TES. DLKZOR-TES	direct. zero overlap, sleeve execution. LVDT transducer	06 ÷ 10	70 ÷ 130		
DHZO-TES DKZOR-TES	direct, positive or zero overlap LVDT transducer	06 ÷ 10	80 ÷ 180	FY100	284
DPZO-TES DPZO-I ES	niloted positive or zero overlap, 1 or 21 VDT transducers	10 ÷ 35	180 ÷ 3500	11100	
0120120,0120220		10 00			
HIGH PERFORMANCE PRE	SSURE VALVES				
with pressure transducer					
RZMO-R/REB/RES-010	relief, direct, off-board or on-board driver	06	4	FS010	290
RZMO-R/REB/RES-030	relief, piloted, off-board or on-board driver	06	40	FS067	300
AGMZO-R/REB/RES	relief, piloted, off-board or on-board driver	10 ÷ 32	200 ÷ 600	FS040	310
RZGO-R/REB/RES-010	reducing, direct, off-board or on-board driver	06	12	FS020	322
RZGO-R/REB/RES-033	reducing, piloted, off-board or on-board driver	06	40	FS075	332
AGRCZO-R/REB/RES	reducing, piloted, off-board or on-board driver	10 ÷ 20	160 ÷ 300	FS055	342
ISO cartridges, with pressur	e transducer				
LIMZO-R/REB/RES	relief, piloted, off-board or on-board driver	16 ÷ 80	200 ÷ 4500		
LIRZO-R/REB/RES	reducing, piloted, off-board or on-board driver	16 ÷ 40	160 ÷ 800	FS305	355
LICZO-R/REB/RES	compensator, piloted, off-board or on-board driver	16 ÷ 50	200 ÷ 2000		
without transducer					
RZMO-A/AEB/AES-010	relief, direct, off-board or on-board driver	06	4	FS007	369
RZME-A	relief, direct, off-board driver, subplate	06			
CART RZME-A	relief, direct, off-board driver, screw-in cartridae	M20	4	F005	379
RZMO-A/AEB/AES-030	relief, piloted, off-board or on-board driver				
HZMO-A	relief, piloted, off-board driver, modular	06	40	FS065	385
AGMZO-A/AEB/AES	relief, piloted, off-board or on-board driver	10 ÷ 32	200 ÷ 600	FS035	396
AGMZE-A	relief, piloted, off-board driver	10 ÷ 32	200 ÷ 600	F030	408
RZGO-A/AEB/AES-010	reducing, direct, off-board or on-board driver	06	12	FS015	413
RZGE-A	reducina, direct, off-board driver, subplate	06			
CART RZGE-A	reducing, direct, off-board driver, screw-in cartridge	M20	12	F012	423
RZGO-A/AEB/AES-033	reducina, piloted, off-board or on-board driver				
HZGO-A. KZGO-A	reducina, piloted, off-board driver, modular	06 ÷ 10	40 ÷ 100	FS070	429
AGRCZO-A/AEB/AES	reducing, piloted, off-board or on-board driver	10 ÷ 20	160 ÷ 300	FS050	441
ISO cartriages, without tran	isducer	10 . 00	200 - 4500		
	relief, piloted, off-board or on-board driver	16 ÷ 80	200 ÷ 4500	FC700	457
LIRZO-A/AEB/AES	reducing, piloted, off-board or on-board driver	16 ÷ 40	160 ÷ 800	FS300	453
LICZO-A/AEB/AES	compensator, pilotea, off-board or on-board driver	16 ÷ 50	200 ÷ 2000		
for pilot lines, without trans	ducer				
DHRZO-A/AEB/AES	3 way reducing, direct, off-board or on-board driver	06	24	FS025	468
DHRZE-A	3 way reducing, direct, off-board driver	06	24	F022	478

FLOW VALVES

pressure compensated				
QVHZO-TEB/TES	disect on be and driven LV/DT transalveen	00.10	45 . 00	FC 412 402
QVKZOR-TEB/TES	airect, on-board ariver, LVDT transaucer	06 ÷ 10	45 ÷ 90	F5412 482
QVHZO-T, QVKZOR-T	direct, off-board driver, LVDT transducer	06 ÷ 10	45 ÷ 90	F412 492
QVHZO-A/AEB/AES	direct, off-board or on-board driver,	00.10	45 . 00	FC 410 400
QVKZOR-A/AEB/AES without transducer		06 ÷ 10	45 ÷ 90	F5410 498
QVHZE-A/QVKZE-A	direct, off-board driver, without transducer	06 ÷ 10	45 ÷ 90	F400 512

ELECTRONIC DRIVERS

off-board digital, DIN-rail EN 60715

E-BM-TES, E-BM-LES	GS240 52	20	
E-BM-TEB, E-BM-LEB	for directional and flow valves with LVDT transducers	GS230 5	28
E-BM-RES	for pressure valves with transducer, fieldbus	GS203 5	34
E-BM-AES	for valves without transducer, fieldbus	GS050 <mark>5</mark> 4	40
E-BM-AS	for valves without transducer	G030 54	46

on-board, solenoid plug-in DIN 43650

E-MI-AS-IR	digital, for valves without transducer	G020	552
E-MI-AC	analog, for valves without transducer	G010	556

ACCESSORIES

E-ATR-8	GS465	912	
BA	single station subplates, mounting surfaces ISO 4401, 6264 and 5781	K280	918
HAND LEVERS	for on-off and proportional valves	E138	922
HANDWHEELS & KNOBS	for on-off and proportional valves	K150	924
CONNECTORS	for transducers, pumps, on-off and proportional valves	K800	926

OPERATING INFORMATION

Operating and maintenance information for proportional valves FS900 968

Supplementary components range available on www.atos.com

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Digital servoproportional directional valves sleeve execution

direct, with on-board driver, LVDT transducer and zero spool overlap with fail safe



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2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

3.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





3.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

4 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.



5 SMART TUNING

Smart tuning allows to adjust the valve dynamic response in order to match different performance requirements.

The valve is provided with 3 factory settings for the spool control:

- dynamic fast response time and high sensitivity for best dynamic performances. Default factory setting for directional valves
- balanced average response time and sensitivity suitable for major applications

- **smooth** attenuated response time and sensitivity to improve control stability in critical applications or in environments with electrical disturbances Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-RI-* and Quickstart, see section 2. For Response time and Bode diagrams see section 1.

6 IO-LINK - only for TEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

7 **FIELDBUS** - only for **TES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

8 ALTERNATED p/Q CONTROLS - only for TES, see tech. table FS500

S^{*} options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions. An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers

for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions. Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

9 AXIS CONTROLLER - see tech. table FS610

Digital servoproportional with on-board electronics **TEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. S* option add alternated p/Q control to the basic position ones. Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

10 SAFETY OPTIONS - only for TES

Atos range of proportional directional valves, provides functional safety options /U and /K , designed to accomplish a safety function, intended to reduce the risk in process control systems



They are TÜV certified in compliance to IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e

Safe double power supply, option /U: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table FY100

Safety function via on/off signals, option /K: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table FY200

Bluetooth or USB connection



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11 GENERAL CHARACTERISTICS

Assembly position	Any position							
Subplate surface finishing to ISO 4401 Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100								
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007							
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$							
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$							
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)							
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h							
Vibration resistance	See technical table G004							
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006							

12 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve r	nodel	DLHZO DLKZOR																				
Pressu	re limits [bar]		ports P , A , B = 350; T = 210 (250 with external drain /Y) Y = 10							ports P , A , B = 315 0 T = 210 (250 with external drain					5; n/Y) Y	′ = 10						
Spool t	ype and size	L0	L1	V1	L3	V3	L5	T5	L7	T7	V7	D7	DT7	L3	Т3	L7	T7	V7	D7	DT7		
Nomina	al flow $\Delta p P-T$ [l/min]																					
(1)	$\Delta p=30$ bar	2,5	4,5	8	9	13	1	8		26		26÷1	3 (4)	4	0		60		60÷	33 (4)		
	$\Delta p=70$ bar	4	7	12	14	20	2	8	40		40÷20 (4)		60		100			100÷50 (
	Max permissible flow	8	14	16	30	40	50		50		70			70÷4	10 (4)	11	10		130		130÷	65 (4)
Leakag	ge (2) [cm³/min]	<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400		
Respor	nse time (3) [ms]						≤ '	10									≤ 15					
Hystere	esis								≤ 0,1	[% of	max r	egulat	tion]									
Repeat	tibility								±0,1	[% of	max r	egulat	tion]									
Therma	al drift						Z	ero po	oint dis	place	ment ·	< 1% a	at ∆T =	= 40°C								

(1) For different Δp , the max flow is in accordance to the diagrams in section 15.2

(2) Referred to spool in neutral position and 50°C oil temperature

(3) 0-100% step signal

(4) For spool type D7 and DT7 the flow value is referred to single path P-A (A-T) \div P-B (B-T) at $\Delta p/2$ per control edge

13	ELECTRICAL CHARACTERISTICS
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Power supplies	Nominal: +24 VDCRectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)						
Max power consumption	50 W						
Max. solenoid current	DLHZO = 2,6 A	DLKZOR =	3 A				
Coil resistance R at 20°C	DLHZO = 3 ÷ 3,3 Ω	DLKZOR =	2,2 ÷ 2,4 Ω				
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX tolera) mA	ant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$	2		
Monitor outputs	Output range:	voltage ±10 VDC current ±20 mA @	@ max 5 mA @ max 500 Ω load res	sistance			
Enable input	Range: 0 ÷ 5 VDC (O	FF state), 9 ÷ 24 VDC	(ON state), 5 ÷ 9 VDC	(not accepted); Input i	mpedance: Ri > 10 k Ω		
Fault output	Output range: 0 ÷ 2 external negative vo	24 VDC (ON state > [oltage not allowed (e.	power supply - 2 V] ; g. due to inductive lo	OFF state < 1 V) @ n ads)	nax 50 mA;		
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100	mA (E-ATR-8 see tec	h table GS465)				
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function						
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account						
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors						
Duty factor	Continuous rating (E	D=100%)					
Tropicalization	Tropical coating on	electronics PCB					
Additional characteristics	Short circuit protect spool position contr protection against r	ion of solenoid's curr ol (SN) or pressure/fo everse polarity of pov	ent supply; 3 leds for prce control (SP, SF, S ver supply	diagnostic (only for T SL) by P.I.D. with rapid	ES); d solenoid switching;		
Communication interface	USB Atos ASCII coding	IO-Link Interface and System Specification 1.1.3	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT POWERLINK EtherNet/IP PROFINET IO RT/IRT IEC 61158		
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cables, see section 24						

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the driver energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

14 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	l temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM HFDU, HFDR		120 12022	
Flame resistant with water		NBR, NBR low temp. HFC ISO 12922			

15 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

15.1 Regulation diagrams

- 1 = Linear spools L
- 2 = Differential linear spool D7
- 3 = Differential non linear spool DT7
- $\mathbf{4} = \text{Non linear spool T5 (only for DLHZO)}$

5 = Non linear spool T3 (only for DLKZOR) and T7 6 = Progressive spool V

T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.

The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2

Note:

Hydraulic configuration vs. reference signal:

Standard:

Reference signal	$ \begin{cases} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{cases} P \rightarrow A / B \rightarrow T $
Reference signal	$ \begin{array}{c} 0 \div -10 \ V \\ 12 \div 4 \ mA \end{array} \Big\} P \rightarrow B \ / \ A \rightarrow T $

....

option /B:

Reference signal	$ \begin{array}{c} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{array} \right\} \text{P} \rightarrow \text{B} / \text{A} \rightarrow \text{T} $
Reference signal	$ \begin{array}{c} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{array} \right\} \text{P} \rightarrow \text{A} / \text{B} \rightarrow \text{T} $













Stroke [% of max]







Stroke [% of max]

15.2 Flow /\(\triangle p \) diagrams

Stated at 100% of spool stroke

DLHZO: 1 = spool L7, T7, V7, D7, D77 2 = spool L5, T5 3 = spool V3 4 = spool L3 5 = spool L1, V1 6 = spool L0 DLKZOR:

7 = spool L7, T7, V7, D7, DT7 **8** = spool L3, T3

15.3 Pressure gain









∆p A→B [%P]

Spool stroke [%]

15.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.





(*) Response time is represented only for 0-100% step; for intermediate steps, the response time increment of presets 2 (balanced) and 3 (smooth) with respect to the preset 1 (dynamic) is proportional to the step amplitude of the reference input signal

15.5 DLHZO Bode diagrams

Stated at nominal hydraulic conditions

- ±5% nominal stroke:
- 1 = dynamic
- 2 = balanced
- $\mathbf{3} = \mathsf{smooth}$
- ± 100% nominal stroke:
- $\mathbf{4} = dynamic$
- **5** = balanced **6** = smooth

15.6	DLKZOR Bode diagrams Stated at nominal hydraulic conditions

- ±5% nominal stroke:
- 1 = dynamic
- 2 = balanced
- $\boldsymbol{3}=\text{smooth}$
- ± 100% nominal stroke:
- 4 = dynamic
- 5 = balanced
- ${\bf 6}=\text{smooth}$









16 FAIL SAFE POSITION



(1) Referred to spool in fail safe position and 50°C oil temperature (2) Referred to spool in fail safe position at $\Delta p = 35$ bar per edge

17 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 15.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

18 ELECTRONIC OPTIONS - not available for TEB-SN-IL

- **F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. see 20.9 for signal specifications.
- This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 20.7 for signal specifications.
- Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal see above option /F
 Enable input signal see above option /Q
 Repeat enable output signal only for TEB-SN-NP (see 20.8)
 Power supply for driver's logics and communication only for TES (see 20.2)
- **C** = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDc. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ±20 mA.

19 POSSIBLE COMBINED OPTIONS

Standard versions for TEB-SN-NP and TES-SN: /BF, /BFI, /BFIY, /BFY, /BI, /BIQ, /BIQY, /BIY, /BIYZ, /BIZ, /BQ, /BQY /BY, /BYZ, /BZ, /FI, /FIY, /FY, /IQ, /IQY, /IY, /IYZ, /IZ, /QY, /YZ

Standard versions for TEB-SN-IL: /BY

Standard versions for TES-SP, SF, SL: /BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,

/CI, /CIY, /CY, /IY Safety certified versions for TES-SN:

/BI/U, /BIY/U, /B/U, /BY/U, /I/U, /IY/U, /Y/U /BI/K, /BIY/K, /B/K, /BY/K, /I/K, /IY/K, /Y/K

Safety certified versions for TES-SP, SF, SL:

/BC/U, /BCI/U, /BCIY/U, /BCY/U, /BI/U, /BIY/U, /B/U, /BY/U, /C/U, /CI/U, /CIY/U, /CY/U, /I/U, /IY/U, /Y/U /BC/K, /BCI/K, /BCIY/K, /BCY/K, /BI/K, /BIY/K, /B/K, /BY/K, /C/K, /CI/K, /CIY/K, /CY/K, /I/K, /IY/K, /Y/K

Note: /T Bluetooth adapter option can be combined with all other options

20 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **TEB-SN-IL** signals see section 21

For certified safety options: /U see tech. table FY100 and /K see tech. table FY200

20.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 20.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

20.2 Power supply for driver's logic and communication (VL+ and VL0) - only for TES with /Z option and for TES-SP, SF, SL with fieldbus The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V

capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

/ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

20.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).

20.4 Pressure or force reference input signal (F_INPUT+) - only for TES-SP, SF, SL

Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**). Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

20.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

20.6 Pressure or force monitor output signal (F_MONITOR) - only for TES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

20.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

20.8 Repeat enable output signal (R_ENABLE) - only for TEB-SN-NP with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 20.7).

20.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

20.10 Remote pressure/force transducer input signal - only for TES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 22.5).

Analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

20.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for TES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 VDc or a 0 VDc on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION					
PIN	SET 1	SET 2	SET 3	SET 4		
9	0	24 VDC	0	24 VDC		
10	0	0	24 Vpc	24 VDC		

21 IO-LINK SIGNALS SPECIFICATIONS - only for TEB-SN-IL

21.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

21.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

21.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

22 ELECTRONIC CONNECTIONS

For electronic connection of certified safety options /U see tech. table FY100 and /K see tech. table FY200

22.1	Main connector signals - 7 pin	(A1)	Standard,	/Q and	/F options
------	--------------------------------	------	-----------	---------------	-------------------

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
Α	V+			Power supply 24 Vbc	Input - power supply
В	V0			Power supply 0 Vbc	Gnd - power supply
6	AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 Vpc) or disable (0 Vpc) the valve, referred to V0	Input - on/off signal
	D Q_INPUT+			Flow reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
				Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
	Q_MONITOR	R referred to:		Flow monitor output signal: ±10 Vpc / ±20 mA maximum range	Output - analog signal
F	AGND	VO		Defaults are ±10 Vbc for standard and 4 ÷ 20 mA for /I option	Software selectable
			FAULT	Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

22.2 Main connector signals - 12 pin (A2) /Z option and TES-SP, SF, SL

PIN	TEB-SN /Z	TES-SN /Z	TES-SP Fieldbus	, SF, SL NP	TECHNICAL SPECIFICATIONS	NOTES
1	V+				Power supply 24 Vbc	Input - power supply
2	V0				Power supply 0 Vbc	Gnd - power supply
3	ENABLE refe	erred to: VL0	VLO	VO	Enable (24 Vpc) or disable (0 Vpc) the valve	Input - on/off signal
4				-	Flow reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
4	Q_INPUT+				Defaults are ± 10 Vpc for standard and 4 \div 20 mA for /I option	Software selectable
5	INPUT-				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	Q_MONITOF	referred to:			Flow monitor output signal: ±10 Vpc / ±20 mA maximum range	Output - analog signal
	AGND	VL0	VL0	VO	Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
	AGND				Analog ground	Gnd - analog signal
7		NC			Do not connect	
	F_INPUT+			Pressure/Force reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal	
				Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable	
	R_ENABLE				Repeat enable, output repeater signal of enable input, referred to VO	Output - on/off signal
8		NC			Do not connect	
			F_MONITOR	referred to:	Pressure/Force monitor output signal: ±10 VDc / ±20 mA maximum range	Output - analog signal
			VL0	VO	Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
	NC				Do not connect	
9		VL+			Power supply 24 Vbc for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
	NC				Do not connect	
10	VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply	
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	FAULT refer	red to: VL0	VLO	VO	Fault (0 Vpc) or normal working (24 Vpc)	Output - on/off signal
PE	EARTH				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

22.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for TEB-SN-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vpc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vpc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vpc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

22.4 Communications connectors (B) - (C)

В	USB connector - M12 - 5 pin always present			
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)		
1	+5V_USB	Power supply		
2	ID	Identification		
3	GND_USB	Signal zero data line		
4	D-	Data line -		
5	D+	Data line +		

©1)	C1 $C2$ BP fieldbus execution, connector - M12 - 5 pin					
PIN	PIN SIGNAL TECHNICAL SPECIFICATION (1)					
1	+5V	Termination supply signal				
2	LINE-A	Bus line (high)				
3	DGND	Data line and termination signal zero				
4	LINE-B	Bus line (low)				
5	SHIELD					

(1) Shield connection on connector's housing is recommended

C1 (©1) ©2) BC fieldbus execution, connector - M12 - 5 pin					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)				
1	CAN_SHLD	Shield				
2	not used	C1 - C2 pass-through connection (2)				
3	CAN_GND	Signal zero data line				
4	CAN_H	Bus line (high)				
5	CAN_L	Bus line (low)				

C1 ($\textcircled{\sc c1}$ $\textcircled{\sc c2}$ EH, EW, El, EP fieldbus execution, connector - M12 - 4 pin					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)				
1	TX+	Transmitter				
2	RX+	Receiver				
3	TX-	Transmitter				
4	RX-	Receiver				
Housing	SHIELD					

(2) Pin 2 can be fed with external +5V supply of CAN interface

22.5 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	D1) SP, SL - Sing	gle transducer (1)	D2) SF - Double transducers (1)	
	OIGHTAL			Voltage	Current	Voltage	Current
1	VF +24V	Power supply +24Vbc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vpc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vpc / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

22.6 TEB-SN-NP connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

22.7 TEB-SN-IL connections layout



(1) Pin layout always referred to driver's view



⁽¹⁾ Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

22.9 Diagnostic LEDs - only for TES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS							
L2	NETWORK STATUS		NETWORK STATUS					
L3	SOLENOID STATUS			LINK/ACT				

23 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



24 CONNECTORS CHARACTERISTICS - to be ordered separately

24.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	A1) ZM-7P	A3 ZH-7P		
Туре	7pin female straight circular	7pin female straight circular		
Standard	According to MIL-C-5015	According to MIL-C-5015		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG11	PG11		
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)		
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires		
Connection type	to solder	to solder		
Protection (EN 60529)	IP 67	IP 67		

24.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	(A4) ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

24.3 IO-Link connector - only for TEB-SN-IL

CONNECTOR TYPE	IL IO-Link			
CODE	A ZM-5PF			
Туре	5pin female straight circular			
Standard	M12 coding A – IEC 61076-2-101			
Material	Metallic			
Cable gland	Pressure nut - cable diameter 6÷8 mm			
Recommended cable	5 x 0,75 mm² max 20 m			
Connection type	screw terminal			
Protection (EN 60529)	IP 67			

24.4 Fieldbus communication connectors

CONNECTOR TYPE	CONNECTOR TYPE BC CANopen (1)		BP PROFI	BUS DP (1)	EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)	
CODE	C1 ZM-5PF	© ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Me	tallic	Metallic			Metallic
Cable gland	Pressure nut - cab	e diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure r	nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal			terminal block
Protection (EN 60529)	IF	67	IP 67			IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table GS500

(2) Internally terminated

24.5 Remote pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	SP, SL - Sing	le transducer	SF - Double transducers	
CODE	D1 ZH-5PM/1.5	D1 ZH-5PM/5	D2 ZH-5PM-2/2	
Туре	5 pin male st	raight circular	4 pin male straight circular	
Standard	M12 coding A –	IEC 61076-2-101	M12 coding A – IEC 61076-2-101	
Material	Plastic		Plastic	
Cable gland	Connector mo	ulded on cables	Connector moulded on cables 2 m length	
Cable gial lu	1,5 m length	5 m length	Connector modiced on cables 2 in length	
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)	
Connection type	molded cable		splitting cable	
Protection (EN 60529)	IP	67	IP 67	

DLHZO-TEB, DLHZO-TES

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005) (for /Y surface 4401-03-03-0-05 without X port)





DLHZO	Α	B (1)	C (1)	D	E (air bleeding)	Mass [kg]
TEB - SN - IL	140	60	-	-		
TEB - SN - NP	140	100	-	-]	
TES - SN - NP, BC, BP, EH	140	100	58	8		2,7
TES - SN - EW, EI, EP	155	100	58	8]	
TES - SP, SF, SL - *	155	100	58	8]	

(1) The indicated dimension refers to the longer connectors or Bluetooth adapter

For dimensions of connectors and Bluetooth adapter, see sections 22.6, 22.7 and 22.8 (2) Space required for connection cable and for connector removal

DLKZOR-TEB, DLKZOR-TES

ISO 4401: 2005

Mounting surface: 4401-05-04-0-05 (see table P005) (for /Y surface 4401-05-05-0-05 without X port)





DLKZOR	Α	B (1)	C (1)	D	E (air bleeding)	Mass [kg]
TEB - SN - IL	150	60	-	-		
TEB - SN - NP	150	100	-	-		
TES - SN - NP, BC, BP, EH	150	100	58	8	or	4,7
TES - SN - EW, EI, EP	165	100	58	8	13	
TES - SP, SF, SL - *	165	100	58	8		

 The indicated dimension refers to the longer connectors or Bluetooth adapter For dimensions of connectors and Bluetooth adapter, see sections 22.6, 22.7 and 22.8
 Space required for connection cable and for connector removal

Note: for /B option the solenoid, the LVDT transducer and the on-board digital driver are at side of port A

26 FASTENING BOLTS AND SEALS

	DLHZO	DLKZOR
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	Seals:	Seals:
\bigcirc	4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm (max)	5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm (max)
\bigcirc	1 OR 2025 Diameter of port Y: $\emptyset = 3,2 \text{ mm}$ (only for /Y option)	1 OR 108 Diameter of port Y: $\emptyset = 5$ mm (only for /Y option)

27 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric a	nd electronic connectors
FS500	Digital proportional valves with p/Q control	P005	Mounting	surfaces for electrohydraulic valves
FS610	Digital proportional valves with integral axis controller	QB300	Quickstar	t for TEB valves commissioning
FS900	Operating and maintenance information for proportional valves	QF300	Quickstar	t for TES valves commissioning
FY100	Safety proportional valves - option /U	Y010	Basics fo	r safety components
FY200	Safety proportional valves - option /K	E-MAN-	RI-LEB	TEB/LEB user manual
GS500	Programming tools	E-MAN-	RI-LES	TES/LES user manual
GS510	Fieldbus	E-MAN-	RI-LES-S	TES/LES with p/Q control user manual
GS520	IO-Link interface			

atos 🛆

Servoproportional directional valves sleeve execution

direct, with LVDT transducer and zero spool overlap with fail safe



(1) Not available for configuration 60(2) Possible combined options: /BY

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TEB	E-BM-TES	Z-BM-TEZ
Туре	Digital	Digital	Digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra \leq 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	150 years, see technical table P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$	/PE option = $-20^{\circ}C \div +60^{\circ}C$	/BT option = $-40^{\circ}C \div +60^{\circ}C$		
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$	/PE option = $-20^{\circ}C \div +70^{\circ}C$	/BT option = $-40^{\circ}C \div +70^{\circ}C$		
Surface protection	Zinc coating with black passivation				
Corrosion resistance	rrosion resistance Salt spray test (EN ISO 9227) > 200 h				
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model							DLF	IZO								D	LKZO	R		
Pressure limits	[bar]			T =	= 210 (port 250 w	s P , A ith ext	, B = 3 ernal (350; drain /	Y) Y =	= 10			T = 2	ې 10 (25	orts P 0 with	, A , B externa	= 315 al drair	5; n/Y) Y	′ = 10
Spool type		L0	L1	V1	L3	V3	L5	T5	L7	T7	V7	D7	DT7	L3	Т3	L7	T7	V7	D7	DT7
Nominal flow Δ	p P-T [l/min]																			
(1)	Δp = 30 bar	2,5	4,5	8	9	13	1	8		26		26÷1	3 (4)	4	0		60		60÷3	33 (4)
	$\Delta p = 70 \text{ bar}$	4	7	12	14	20	2	8		40		40÷2	20 (4)	6	0		100		100÷	50 (4)
Max per	missible flow	8	14	16	30	40	5	0		70		70÷4	10 (4)	11	10		130		130÷	65 (4)
Leakage (2)	[cm ³ /min]	<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time	(3) [ms]						≤	10									≤ 15			
Hysteresis			≤ 0,1 [% of max regulation]																	
Repeatibility			± 0,1 [% of max regulation]																	
Thermal drift							Z	ero po	oint dis	place	ment ·	< 1% a	at $\Delta T =$	= 40°C						

(1) For different Δp , the max flow is in accordance to the diagrams in section 7.2

(2) Referred to spool in neutral position and 50°C oil temperature

(3) 0-100% step signal

(4) For spool type D7 and DT7 the flow value is referred to single path P-A (A-T) \div P-B (B-T) at $\Delta p/2$ per control edge

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W		
Max. solenoid current	DLHZO = 2,6 A	DLKZOR = 3 A	
Coil resistance R at 20°C	DLHZO = 3 ÷ 3,3 Ω	DLKZOR = $2,2 \div 2,4 \Omega$	
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors		
Duty factor	Continuous rating (ED=100%)		

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluic	temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$				
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s				
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	638 class 7	see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS1	638 class 5	www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	- ISO 12922		
Flame resistant with water		NBR, HNBR	HFC			

7.1 Regulation diagrams

- 1 = Linear spools L
- 2 = Differential linear spool D7
- **3** = Differential non linear spool DT7
- $\mathbf{4}$ = Non linear spool T5 (only for DLHZO)
- **5** = Non linear spool T3 (only for DLKZOR) and T7
- $\mathbf{6} = \text{Progressive spool V}$





Regulated flow [% of max]



T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3, T7) of max spool stroke. The non linear characteristics of the spool is compensated by the electronic driver, so the

final valve regulation is resulting linear respect the reference signal (dotted line). DT7 has the same characteristic of T7 but it is

specific for applications with cylinders with area ratio 1:2





Standard:

Note:

Reference signal	0 ÷ +10 V 12 ÷ 20 mA	$P \rightarrow A / B \rightarrow T$
Reference signal	0 ÷ -10 V 12 ÷ 4 mA	$P \rightarrow B / A \rightarrow T$

Hydraulic configuration vs. reference signal:

option /B: Reference

Referer

ice signal	$ \begin{array}{c} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{array} P \rightarrow B / A \rightarrow T $
ice signal	$\left. \begin{array}{c} 0 \div -10 \ V \\ 12 \div 4 \ mA \end{array} \right\} P \rightarrow A \ / \ B \rightarrow T$





7.2 Flow /Ap diagrams

80 Stated at 100% of spool stroke 300 50 200 DLHZO: 7 30 **1** = spool L7, T7, V7, D7, DT7 Flow rate [I/min] Flow rate [I/min] 100 **2** = spool L5, T5 3 = spool V3 4 = spool L3 50 10 5 = spool L1, V1 6 30 6 = spool L0 5 DLKZOR: 3 7 = spool L7, T7, V7, D7, DT7 8 = spool L3 2 10 10 30 70 100 200 300 10 30 70 100 200 300

Valve pressure drop Δp [bar]

7.3 Pressure gain



7.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



7.5 Bode diagrams

Stated at nominal hydraulic conditions DLHZO: 1 = ± 100% nominal stroke $2 = \pm$ 5% nominal stroke DLKZOR: $3 = \pm 100\%$ nominal stroke $4 = \pm$ 5% nominal stroke





Valve pressure drop Δp [bar]

20 25

8 FAIL SAFE POSITION



(1) Referred to spool in fail safe position and 50°C oil temperature

(2) Referred to spool in fail safe position at $\Delta p = 35$ bar per edge

9 HYDRAULIC OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 7.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

10 ELECTRICAL CONNECTION

10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	1 3
2	VT-	Power supply -15VDC	
3	VT+	Power supply +15VDC	
4	GND	Ground	4 2

11 FASTENING BOLTS AND SEALS

	DLHZO	DLKZOR
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	Seals:	Seals:
\cap	4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)
	1 OR 2025 Diameter of port Y: $\emptyset = 3,2$ mm (only for /Y option)	1 OR 108 Diameter of port Y: $\emptyset = 5 \text{ mm}$ (only for /Y option)

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DLHZO-T

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005) (for /Y surface 4401-03-03-0-05 without X port)

Mas	ss [kg]
DLHZO	2,3





DLKZOR-T

ISO 4401: 2005

Mounting surface: 4401-05-04-0-05 (see table P005) (for /Y surface 4401-05-05-0-05 without X port)

Mass	s [kg]
DLKZOR	4,3



Note: for option /B the solenoid and the LVDT transducer are at side of port A

13 RELATED DOCUMENTATION

FS001Basics for digital electrohydraulicsFS900Operating and maintenance information for proportional valvesGS230E-BM-TEB digital driverGS240E-BM-TES digital driverGS330Z-BM-TEZ digital axis card	GS500 GS510 K800 P005	Programming tools Fieldbus Electric and electronic connectors Mounting surfaces for electrohydraulic valves
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atos 🛆

Digital servoproportional directional valves

direct, with on-board driver, LVDT transducer and zero spool overlap



(1) For possible combined options, see section $\boxed{17}$

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

3.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





3.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

4 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.



5 SMART TUNING

Smart tuning allows to adjust the valve dynamic response in order to match different performance requirements.

The valve is provided with 3 factory settings for the spool control:

- dynamic fast response time and high sensitivity for best dynamic performances. Default factory setting for directional valves
- balanced average response time and sensitivity suitable for major applications

- **smooth** attenuated response time and sensitivity to improve control stability in critical applications or in environments with electrical disturbances Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-RI-* and Quickstart, see section 2. For Response time and Bode diagrams see section 1.

6 IO-LINK - only for TEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

7 FIELDBUS - only for TES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

8 ALTERNATED p/Q CONTROLS - only for TES, see tech. table FS500

S* options add the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions. An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers

for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.

Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

9 AXIS CONTROLLER - see tech. table FS620

Digital servoproportional with on-board electronics **TEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. S* option add alternated p/Q control to the basic position ones. Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

10 SAFETY OPTIONS - only for TES

Atos range of proportional directional valves, provides functional safety options /U and /K , designed to accomplish a safety function, intended to reduce the risk in process control systems



They are TÜV certified in compliance to IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e

Safe double power supply, option /U: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table FY100

Safety function via on/off signals, option /K: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table FY200

Bluetooth or USB connection



11 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007					
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$					
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Vibration resistance	See technical table G004					
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

12 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model			DHZO		DKZOR		
Pressure limits	[bar]	ہ T = 210 (250	ports P , A , B = 350; T = 210 (250 with external drain /Y) Y = 10			ports P , A , B = 315 50 with external drain	; /Y) Y = 10
Spool type and	size	L3	L5	D5	L3	L5	D5
Nominal flow Δp	o P-T [l/min]						
(1)	∆p= 10 bar	18	28	28 (4)	45	75	75 (4)
	Δp= 30 bar	30	50	50 (4)	80	130	130 (4)
	$\Delta p = 70 \text{ bar}$	45	75	75 (4)	120	170	170 (4)
Max permissible flow (2)		50	80	80 (4)	130	180	180 (4)
Leakage	[cm³/min]	<500 (at p =	100 bar); <1500 (at	p = 350 bar)	<800 (at p =	100 bar); <2500 (a	t p = 315 bar)
Response time (3) [ms] ≤ 15					≤ 20		
Hysteresis		≤ 0,2 [% of max re			ax regulation]		
Repeatability		± 0,1 [% of max regulation]					
Thermal drift			zei	ro point displaceme	ent < 1% at $\Delta T = 40$	°С	

(1) For different Δp , the max flow is in accordance to the diagrams in section 15.2 (2) See detailed diagrams in section 15.3

(3) 0-100% step signal

(4) For spool type D5 the flow value is referred to single path P-A (A-T) at Δp/2 per control edge. The flow P-B (B-T) is 50% of P-A (A-T)

13 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	50 W					
Max. solenoid current	DHZO = 2,6 A	DHZO = 2,6 A DKZOR = 3 A				
Coil resistance R at 20°C	DHZO = $3 \div 3,3 \Omega$	DKZOR = 3	,8 ÷ 4,1 Ω			
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX tolera) mA	ant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$	2	
Monitor outputs	Output range:	voltage ±10 VDC current ±20 mA @	@ max 5 mA @ max 500 Ω load res	sistance		
Enable input	Range: 0 ÷ 5 VDC (O	FF state), 9 ÷ 24 VDC	(ON state), 5 ÷ 9 VDC	(not accepted); Input i	mpedance: Ri > 10 k Ω	
Fault output	Output range: 0 ÷ 2 external negative vo	24 VDC (ON state > [oltage not allowed (e.	power supply - 2 V] ; g. due to inductive lo	OFF state < 1 V) @ n ads)	nax 50 mA;	
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)					
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function					
Insulation class	H (180°) Due to the the European stand	occurring surface ter ards ISO 13732-1 an	nperatures of the sole d EN982 must be tak	enoid coils, en into account		
Protection degree to DIN EN60529	IP66 / IP67 with mat	ing connectors				
Duty factor	Continuous rating (E	D=100%)				
Tropicalization	Tropical coating on	electronics PCB				
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic (only for TES); spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply					
Communication interface	USB Atos ASCII coding	IO-Link Interface and System Specification 1.1.3	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT POWERLINK EtherNet/IP PROFINET IO RT/IRT IEC 61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	Fast Ethernet, insulated 100 Base TX				
Recommended wiring cable	LiYCY shielded cables, see section 24					

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

14 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$				
Recommended viscosity		20÷100 mm²/s - max allowed ra	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid normal operation		ISO4406 class 18/16/13 NAS1	see also filter section at			
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog			
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	100 10000		
Flame resistant with water		NBR, NBR low temp.	HFC	130 12922		

15 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C





Note:

Hydraulic configuration vs. reference signal for configurations 70 (standard and option /B) Reference signal $\begin{array}{c} 0 & \div & +10 \text{ V} \\ 12 & \div & 20 \text{ mA} \end{array}$ P \rightarrow A / B \rightarrow T Reference signal $\begin{array}{c} 0 & \div & -10 \text{ V} \\ 12 & \div & 4 \text{ mA} \end{array}$ P \rightarrow B / A \rightarrow T

15.2 Flow /∆p diagrams

stated at 100% of valve stroke

DHZO

1 = spool L3, **2** = spool L5, D5

DKZOR

3 = spool L3 **4** = spool L5, D5





15.3 Operating limits



15.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.





(*) Response time is represented only for 0-100% step; for intermediate steps, the response time increment of presets 2 (balanced) and 3 (smooth) with respect to the preset 1 (dynamic) is proportional to the step amplitude of the reference input signal

15.5 DHZO Bode diagrams

Stated at nominal hydraulic conditions

- ± 5% nominal stroke:
- $\mathbf{1}=\text{dynamic}$
- 2 = balanced
- $\mathbf{3} = \text{smooth}$
- ± 100% nominal stroke:
- $\mathbf{4} = dynamic$
- 5 = balanced
- $\mathbf{6} = \text{smooth}$





15.6 DKZOR Bode diagrams

Stated at nominal hydraulic conditions

- ± 5% nominal stroke:
- 1 = dynamic
- 2 = balanced
- 3 = smooth
- ± 100% nominal stroke:
- 4 = dynamic
- 5 = balanced
- 6 = smooth





16 HYDRAULIC OPTIONS

- B = Solenoid, on-board digital driver and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 15.1
- \mathbf{Y} = This option is mandatory if the pressure in port T exceeds 210 bar.

17 ELECTRONIC OPTIONS - not available for TEB-SN-IL

- **F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. see 20.9 for signal specifications.
- This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 20.7 for signal specifications.
- Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal see above option /F
 Enable input signal see above option /Q
 Repeat enable output signal only for TEB-SN-NP (see 20.8)
 Power supply for driver's logics and communication only for TES (see 20.2)
- **C** = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

18 POSSIBLE COMBINED OPTIONS

Standard versions for TEB-SN-NP and TES-SN:

/BF, /BFI, /BFIY, /BFY, /BI, /BIQ, /BIQY, /BIY, /BIYZ, /BIZ, /BQ, /BQY /BY, /BYZ, /BZ, /FI, /FIY, /FY, /IQ, /IQY, /IY, /IYZ, /IZ, /QY, /YZ

Standard versions for TEB-SN-IL:

/BY

Standard versions for TES-SP, SF, SL:

/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY, /CI, /CIY, /CY, /IY

Safety certified versions for TES-SN:

/BI/U, /BIY/U, /B/U, /BY/U, /I/U, /IY/U, /Y/U /BI/K, /BIY/K, /B/K, /BY/K, /I/K, /IY/K, /Y/K

Safety certified versions for TES-SP, SF, SL:

/BC/U, /BCI/U, /BCIY/U, /BCY/U, /BI/U, /BIY/U, /B/U, /BY/U, /C/U, /CI/U, /CIY/U, /CY/U, /I/U, /IY/U, /Y/U /BC/K, /BCI/K, /BCIY/K, /BCY/K, /BI/K, /BIY/K, /B/K, /BY/K, /C/K, /CI/K, /CIY/K, /CY/K, /I/K, /IY/K, /Y/K

Note: /T Bluetooth adapter option can be combined with all other options

19 SAFETY REST POSITION - configuration 70

In absence of electric power supply (+24 VDC), the valve spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.

This is specifically designed to avoid that in case of accidental interruption of the electrical power supply to the valve, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.

Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.

The spool moves to the closed loop control position (zero overlap) when the valve is fed with power supply +24 VDc and reference input = 0V (or 12 mA for option /I) is applied to the driver.



20 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **TEB-SN-IL** signals see section 21

For certified safety options: /U see tech. table FY100 and /K see tech. table FY200

20.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 20.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

20.2 Power supply for driver's logic and communication (VL+ and VL0) - only for TES with /Z option and for TES-SP, SF, SL with fieldbus The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

20.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

20.4 Pressure or force reference input signal (F_INPUT+) - only for TES-SP, SF, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**). Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

20.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

20.6 Pressure or force monitor output signal (F_MONITOR) - only for TES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

20.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

20.8 Repeat enable output signal (R_ENABLE) - only for TEB-SN-NP with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 20.7).

20.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

20.10 Remote pressure/force transducer input signal - only for TES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 22.5).

Analog input signal is factory preset according to selected valve code, defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vpc or ± 20 mA. Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

20.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for TES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 VDc or a 0 VDc on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION				
PIN	SET 1	SET 2	SET 3	SET 4	
9	0	24 Voc	0	24 VDC	
10	0	0	24 Vpc	24 Vpc	

21 IO-LINK SIGNALS SPECIFICATIONS - only for TEB-SN-IL

21.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDc power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

21.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

21.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

22 ELECTRONIC CONNECTIONS

For electronic connection of certified safety options /U see tech. table FY100 and /K see tech. table FY200

22.1	Main connector signals - 7 pin	(A1)	Standard, /Q and /F options
------	--------------------------------	------	-----------------------------

PIN	Standard /Q /F		/F	TECHNICAL SPECIFICATIONS	NOTES
Α	V+			Power supply 24 Vbc	Input - power supply
В	V0			Power supply 0 VDC	Gnd - power supply
6	AGND		AGND	Analog ground	Gnd - analog signal
	ENABLE			Enable (24 Vbc) or disable (0 Vbc) the valve, referred to V0	Input - on/off signal
				Flow reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
				Defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
E	E INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
	Q_MONITOR referred to:			Flow monitor output signal: ±10 Vpc / ±20 mA maximum range	Output - analog signal
F	AGND V0			Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /l option	Software selectable
	FAULT		FAULT	Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal
G	G EARTH		•	Internally connected to the driver housing	

22.2 Main connector signals - 12 pin (A2) /Z option and TES-SP, SF, SL

PIN	TEB-SN /Z TES-SN /Z TES-SP, SF, SL Fieldbus NP		, SF, SL NP	TECHNICAL SPECIFICATIONS	NOTES	
1	V+		-	Power supply 24 Vbc	Input - power supply	
2	V0				Power supply 0 Vbc	Gnd - power supply
3	3 ENABLE referred to: V0 VL0 VL0 V0		VO	Enable (24 Vpc) or disable (0 Vpc) the valve	Input - on/off signal	
4		-			Flow reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
4	Q_INPUT+				Defaults are ± 10 Vpc for standard and 4 \div 20 mA for /I option	Software selectable
5	INPUT-				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	Q_MONITOF	referred to:			Flow monitor output signal: ±10 Vpc / ±20 mA maximum range	Output - analog signal
0	AGND	VL0	VL0	VO	Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
	AGND				Analog ground	Gnd - analog signal
7	NC			Do not connect		
'	F_INPUT+			Pressure/Force reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal	
				Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable	
	R_ENABLE				Repeat enable, output repeater signal of enable input, referred to VO	Output - on/off signal
8		NC			Do not connect	
			F_MONITOR	referred to:	Pressure/Force monitor output signal: ±10 Vbc / ±20 mA maximum range	Output - analog signal
			VL0	VO	Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
	NC				Do not connect	
9		VL+			Power supply 24 Vpc for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
	NC			Do not connect		
10	10 VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply	
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	FAULT refer	red to: VL0	VLO	VO	Fault (0 Vpc) or normal working (24 Vpc)	Output - on/off signal
PE	EARTH				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

22.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for TEB-SN-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vpc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vpc for valve regulation, logics and diagnostics	Gnd - power supply
		·	

Note: L+, L- and P24, N24 are electrically isolated

22.4 Communications connectors $(\ensuremath{\mathsf{B}})$ - $(\ensuremath{\mathbb{C}})$

В	B USB connector - M12 - 5 pin always present					
PIN	SIGNAL TECHNICAL SPECIFICATION (1)					
1	+5V_USB	Power supply				
2	ID	D Identification				
3	3 GND_USB Signal zero data line					
4	D- Data line -					
5	D+	Data line +				

\bigcirc \bigcirc BP fieldbus execution, connector - M12 - 5 pin							
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)					
1	+5V	Termination supply signal					
2	LINE-A	Bus line (high)					
3	DGND	Data line and termination signal zero					
4	LINE-B	Bus line (low)					
5	SHIELD						

(1) Shield connection on connector's housing is recommended

C1 C2 BC fieldbus execution, connector - M12 - 5 pin						
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)				
1	CAN_SHLD	Shield				
2	not used	C1 - C2 pass-through connection (2)				
3	CAN_GND	Signal zero data line				
4	CAN_H	Bus line (high)				
5	CAN_L	Bus line (low)				

 C1
 C2
 EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin

 PIN
 SIGNAL
 TECHNICAL SPECIFICATION (1)

1	TX+	Transmitter
2	RX+	Receiver
3	тх-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(2) Pin 2 can be fed with external +5V supply of CAN interface

22.5 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	D1 SP, SL - Sing Voltage	gle transducer (1) Current	D2 SF - Double Voltage	e transducers (1) Current
1	VF +24V	Power supply +24Vbc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vpc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vpc / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

22.7 TEB-SN-IL connections layout



(1) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

22.9 Diagnostic LEDs - only for TES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1		VALVE STATUS	6	LINK/ACT				
L2	NETWORK STATUS		TWORK STATUS		NETWORK STATUS			
L3	SC	LENOID STAT	US	LINK/ACT				

23 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



24 CONNECTORS CHARACTERISTICS - to be ordered separately

24.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A1) ZM-7P	A3 ZH-7P
Туре	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Pecommonded cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)
Recommended cable	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

24.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	(A4) ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

24.3 IO-Link connector - only for TEB-SN-IL

CONNECTOR TYPE	IL IO-Link
CODE	A ZM-5PF
Туре	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

24.4 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFI	BUS DP (1)	EH Ether	rCAT, EW POWERLINK, Net/IP, EP PROFINET (2)
CODE	C1 ZM-5PF	© ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B – IEC 61076-2-101		M12 co	ding D – IEC 61076-2-101
Material	Me	tallic	Metallic			Metallic
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure r	nut - cable diameter 4÷8 mm
Cable	CANbus Stand	lard (DR 303-1)	PROFIBUS DP Standard		Ethe	ernet standard CAT-5
Connection type	screw terminal		screw terminal			terminal block
Protection (EN 60529)	IF	267	IP	67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table GS500

(2) Internally terminated

24.5 Remote pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers
CODE	D1 ZH-5PM/1.5	D1 ZH-5PM/5	D2 ZH-5PM-2/2
Туре	5 pin male st	raight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector mo 1,5 m length	ulded on cables 5 m length	Connector moulded on cables 2 m length
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP	67	IP 67

DHZO-TEB, DHZO-TES

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005) (for /Y surface 4401-03-03-0-05 without X port)



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DHZO-*-07	Α	B (1)	C (1)	D	E (air bleeding)	Mass [kg]
TEB - SN - IL	155	60	-	-		
TEB - SN - NP	155	100	-	-]	
TES - SN - NP, BC, BP, EH	155	100	58	8		3,5
TES - SN - EW, EI, EP	155	100	58	8] -	
TES - SP, SF, SL - *	155	100	58	8]	

(1) The indicated dimension refers to the longer connectors or Bluetooth adapter

For dimensions of connectors and Bluetooth adapter, see sections 22.6, 22.7 and 22.8 (2) Space required for connection cable and for connector removal

DKZOR-TEB, DKZOR-TES

ISO 4401: 2005

Mounting surface: 4401-05-04-0-05 (see table P005) (for /Y surface 4401-05-05-0-05 without X port)



DKZOR-*-17	Α	B (1)	C (1)	D	E (air bleeding)	Mass [kg]
TEB - SN - IL	165	60	-	-		
TEB - SN - NP	165	100	-	-		
TES - SN - NP, BC, BP, EH	165	100	58	8	or	5,4
TES - SN - EW, EI, EP	165	100	58	8	13	
TES - SP, SF, SL - *	165	100	58	8		

(1) The indicated dimension refers to the longer connectors or Bluetooth adapter For dimensions of connectors and Bluetooth adapter, see sections 22.6, 22.7 and 22.8

(2) Space required for connection cable and for connector removal

Note: for /B option the solenoid, the LVDT transducer and the on-board digital driver are at side of port A

26 FASTENING BOLTS AND SEALS

	DHZO	DKZOR
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
0	Seals: 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	Seals: 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

27 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric a	nd electronic connectors
FS500	Digital proportional valves with p/Q control	P005	Mounting	surfaces for electrohydraulic valves
FS620	Digital proportional valves with integral axis controller	QB300	Quickstar	t for TEB valves commissioning
FS900	Operating and maintenance information for proportional valves	QF300	Quickstar	t for TES valves commissioning
FY100	Safety proportional valves - option /U	Y010	Basics fo	r safety components
FY200	Safety proportional valves - option /K	E-MAN-	RI-LEB	TEB/LEB user manual
GS500	Programming tools	E-MAN-	RI-LES	TES/LES user manual
GS510	Fieldbus	E-MAN-	RI-LES-S	TES/LES with p/Q control user manual
GS520	IO-Link interface			·

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Servoproportional directional valves

direct, with LVDT transducer and zero spool overlap



2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TEB	E-BM-TES	Z-BM-TEZ
Туре	Digital	Digital	Digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position						
Subplate surface finishing to ISO 4401	Acceptable roughness index: R	Acceptable roughness index: Ra \leq 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	150 years, see technical table P007						
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$	/PE option = $-20^{\circ}C \div +60^{\circ}C$	/BT option = $-40^{\circ}C \div +60^{\circ}C$				
Storage temperature range	Standard = -20° C \div $+70^{\circ}$ C /PE option = -20° C \div $+70^{\circ}$ C /BT option = -40° C \div $+70^{\circ}$ C						
Surface protection	Zinc coating with black passivation						
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h						
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006						

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model			DHZO			DKZOR		
Pressure limi	ts [bar]	ہ T = 210 (250	ports \mathbf{P} , \mathbf{A} , \mathbf{B} = 350 0 with external drain	; n /Y) Y = 10	ports P , A , B = 315; T = 210 (250 with external drain /Y) Y = 10			
Spool type		L3	L5	D5	L3	L5	D5	
Nominal flow	Δp P-T [l/min]							
(1)	$\Delta p=10$ bar	18	28	28	45	75	75	
	$\Delta p = 30 \text{ bar}$	30	50	50	80	130	130	
	$\Delta p = 70 \text{ bar}$	45	75	75	120	170	170	
Max perm	nissible flow (2)	50	80	80	130	180	180	
Leakage	[cm³/min]	<500 (at p =	100 bar); <1500 (at	p = 350 bar)	<800 (at p = 100 bar); <2500 (at p = 315 bar)			
Response tin	ne (3) [ms]		≤ 15			≤ 20		
Hysteresis		≤ 0,2 [% of max regulation]						
Repeatibility		± 0,1 [% of max regulation]						
Thermal drift			zei	ro point displaceme	ent < 1% at $\Delta T = 40$	°C		

(1) For different Δp , the max flow is in accordance to the diagrams in section 7.2 (2) See detailed diagrams in section 7.3 (3) 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W			
Max. solenoid current	DHZO = 2,6 A	DKZOR = 3 A		
Coil resistance R at 20°C	DHZO = $3 \div 3,3 \Omega$	DKZOR = $3,8 \div 4,1 \Omega$		
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529 IP65 with mating connectors				
Duty factor	Continuous rating (ED=100%)			

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals recommended fluid temperature		NBR seals (standard) = -20° C ÷ $+80^{\circ}$ C, with HFC hydraulic fluids = -20° C ÷ $+50^{\circ}$ C EKM seals (/PE option) = -20° C ÷ $+80^{\circ}$ C				
	romporataro	HNBR seals (/BT option) = -40° C ÷ $+60^{\circ}$ C, with HFC hydraulic fluids = -40° C ÷ $+50^{\circ}$ C				
Recommended viscosity		20÷100 mm²/s - max allowed ra	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid normal operation		ISO4406 class 18/16/13 NAS1	see also filter section at			
contamination level	longer life	ISO4406 class 16/14/11 NAS1	638 class 5	www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	10000		
Flame resistant with water		NBR, HNBR	NBR, HNBR HFC ISO 12922			



Note:

Hydraulic configuration vs. reference signal for configurations 70 (standard and option /B) $\begin{array}{l} \text{Reference signal} \begin{array}{l} 0 & \div +10 \text{ V} \\ 12 & \div 20 \text{ mA} \end{array} \right\} P \rightarrow A \ / \ B \rightarrow T \qquad \text{Reference signal} \begin{array}{l} 0 & \div -10 \text{ V} \\ 12 & \div 4 \text{ mA} \end{array} \right\} P \rightarrow B \ / \ A \rightarrow T \\ \end{array}$

7.2 Flow /Ap diagrams

stated at 100% of valve stroke

DHZO

1 = spool L3, **2** = spool L5, D5

DKZOR

3 = spool L3 **4** = spool L5, D5





7.3 Operating limits

DHZO

1 = spool L3 **2** = spool L5, D5

DKZOR

- **3** = spool L3 **4** = spool L5, D5





7.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.





7.5 Bode diagrams

1 = 10% ↔ 90% nominal stroke

 $2 = 50\% \pm 5\%$ nominal stroke

DHZO DKZOR +2+2 Phase [degrees] Phase [degrees] 0 С Amplitude ratio [dB] Amplitude ratio [dB] -3 -3 12 2 90 90° 45° 45° 0 0 10 50 100 200 10 50 100 200 Frequency [Hz] Frequency [Hz]

8 HYDRAULIC OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 7.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

9 ELECTRICAL CONNECTION

9.1	Solenoid	connector -	supplied	with the	valve
-----	----------	-------------	----------	----------	-------

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

9.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	1 3
2	VT-	Power supply -15VDC	
3	VT+	Power supply +15VDC	
4	GND	Ground	4 2

10 SAFETY REST POSITION - configuration 70

In absence of power supply to the solenoids, the valve spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.

This is specifically designed to avoid that in case of accidental interruption of power supply to the valve solenoids, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.

Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/A-T connection.



11 FASTENING BOLTS AND SEALS

	DHZO	DKZOR	
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	
	Seals:	Seals:	
0	4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025	5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108	
	Diameter of port Y: $\emptyset = 3,2 \text{ mm}$ (only for /Y option)	Diameter of port Y: $\emptyset = 5 \text{ mm}$ (only for /Y option)	

12 INSTALLATION DIMENSIONS [mm]



Note: for option /B the solenoid and the LVDT transducer are at side of port A

13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
GS230	E-BM-TEB digital driver	K800	Electric and electronic connectors
GS240 GS330	E-BM-TES digital driver Z-BM-TEZ digital axis card	P005	Mounting surfaces for electrohydraulic valves

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Digital servoproportional directional valves

piloted, with on-board driver, two LVDT transducers and zero spool overlap



2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

3.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





3.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

4 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

5 SMART TUNING

Smart tuning allows to adjust the valve dynamic response in order to match different performance requirements.

The valve is provided with 3 factory settings for the spool control:

- dynamic fast response time and high sensitivity for best dynamic performances. Default factory setting for directional valves
- balanced average response time and sensitivity suitable for major applications

- **smooth** attenuated response time and sensitivity to improve control stability in critical applications or in environments with electrical disturbances Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-RI-* and Quickstart, see section 28. For Response time and Bode diagrams see section 15.

6 IO-LINK - only for LEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

7 FIELDBUS - only for LES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

8 ALTERNATED p/Q CONTROLS - only for LES, see tech. table FS500

S* options add the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions. An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions. Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

9 AXIS CONTROLLER - see tech. table FS630

Digital servoproportional with on-board electronics **LEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. S* option add alternated p/Q control to the basic position ones. Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

10 SAFETY OPTIONS - only for LES

Atos range of proportional directional valves, provides functional safety options /U and /K, designed to accomplish a safety function, intended to reduce the risk in process control systems



They are TÜV certified in compliance to IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e

Safe double power supply, option /U: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table FY100

Safety function via on/off signals, option /K: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table FY200

Bluetooth or USB connection



11 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007					
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$					
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Vibration resistance	See technical table G004					
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

12 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DPZO-*-1		DPZO-*-	2	DPZO-*-4	DPZO-*-4M	DPZO-*-6	DPZO-*-8
Pressure limits [bar]	ports P , A , B , X = 350; T = 250 (10 for option /D); Y = 10;							
Spool type and size	L5, DL5	L3	L5, DL5	T5	L5,	DL5	L	.5
Nominal flow ∆p P-T [l/min]								
(1) Δp= 10 bar	100	160	250	190	480	550	640	1200
Δp= 30 bar	160	270	430	330	830	950	1100	2000
Max permissible flow [I/min]	180	400	550	550	1000	1100	1600	3500
Piloting pressure [bar]	m	in. =	25; ma	ax = 3	850 (option /G advis	sable for pilot press	sure > 150 bar)	
Piloting volume [cm ³ /min]	1,4		3,7		9	11,3	21,6	39,8
Piloting flow (2) [I/min]	3,5		9		18	20	19	24
Leakage (3) Pilot [cm3/min]	100 / 300		150 / 450)	200 / 600	200 / 600	900 / 2800	900 / 2800
Main stage [l/min]	0,4 / 1,2		0,6 / 2,5		1,0 / 4,0	1,0 / 4,0	3,0 / 9,0	6,0 / 20
Response time (4) [ms]	≤ 25		≤ 25		≤ 30	≤ 35	≤ 80	≤ 100
Hysteresis	≤ 0,1 [%of max regulation]							
Repeatability	± 0,1 [%of max regulation]							
Thermal drift				ze	ro point displaceme	ent < 1% at $\Delta T = 40$	0°C	

(1) For different $\Delta p,$ the max flow is in accordance to the diagrams in section 15.2 (2) With step reference input signal 0 $\div100~\%$

(3) At p = 100/350 bar

13 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Bectified and filtered : VPNS = 20 ÷ 32 VMAY (ripple may 10 % VPP)								
Max power consumption	50 W	50 W							
Max. solenoid current	2,6 A	26A							
Coil resistance R at 20°C	3 ÷ 3,3 Ω								
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX tolera) mA	ant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$	2				
Monitor outputs	Output range:	voltage ±10 VDC current ±20 mA @	@ max 5 mA @ max 500 Ω load res	sistance					
Enable input	Range: 0 ÷ 5 VDC (O	FF state), 9 ÷ 24 VDC	(ON state), 5 ÷ 9 VDC	(not accepted); Input i	mpedance: Ri > 10 k Ω				
Fault output	Output range: 0 ÷ 2 external negative vo	24 VDC (ON state > [oltage not allowed (e.	power supply - 2 V] ; g. due to inductive lo	OFF state < 1 V) @ m ads)	nax 50 mA;				
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100	mA (E-ATR-8 see tec	h table GS465)						
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function								
Insulation class	H (180°) Due to the the European stand	occurring surface ter ards ISO 13732-1 an	nperatures of the sole d EN982 must be tak	enoid coils, en into account					
Protection degree to DIN EN60529	IP66 / IP67 with mat	ing connectors							
Duty factor	Continuous rating (E	D=100%)							
Tropicalization	Tropical coating on	electronics PCB							
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic (only for LES); spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply								
Communication interface	USB Atos ASCII coding	IO-Link Interface and System Specification 1.1.3	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT POWERLINK EtherNet/IP PROFINET IO RT/IRT IEC 61158				
Communication physical layer	not insulated USB 2.0 + USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX				
Recommended wiring cable	LiYCY shielded cables, see section 24								

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vpc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

^{(4) 0-100%} step signal, see detailed diagrams in section 15.3

14 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	100 10000	
Flame resistant with water		NBR, NBR low temp.	HFC	100 12922	





15.1 Regulation diagrams (values measure at Δp 10 bar P-T)

Stroke [% of max]

DPZO-6: 11 = L5 **DPZO-8:** 12 = L5

Stroke [% of max]

DPZO-4M: 9 = L5

 $\begin{array}{l} \textbf{10A} = \text{DL5} \ (\text{P} \rightarrow \text{A}, \ \text{A} \rightarrow \text{T}) \\ \textbf{10B} = \text{DL5} \ (\text{P} \rightarrow \text{B}, \ \text{B} \rightarrow \text{T}) \end{array}$



15.3 Response time

0 20

40 60

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.



80 100 0

1 = dynamic 2 = balanced (*) 3 = smooth (*)

Time [ms]





(*) Response time is represented only for 0-100% step; for intermediate steps, the response time increment of presets 2 (balanced) and 3 (smooth) with respect to the preset 1 (dynamic) is proportional to the step amplitude of the reference input signal

23

80 100

40 60

20



9 Spool stroke [%]

10

-60 -80

-100

20 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **TEB-SN-IL** signals see section 21

For certified safety options: /U see tech. table FY100 and /K see tech. table FY200

20.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 20.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

20.2 Power supply for driver's logic and communication (VL+ and VL0) - only for TES with /Z option and for TES-SP, SF, SL with fieldbus The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

20.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

20.4 Pressure or force reference input signal (F_INPUT+) - only for TES-SP, SF, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**). Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

20.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

20.6 Pressure or force monitor output signal (F_MONITOR) - only for TES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

20.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

20.8 Repeat enable output signal (R_ENABLE) - only for TEB-SN-NP with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 20.7).

20.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

20.10 Remote pressure/force transducer input signal - only for TES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 22.5).

Analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

20.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for TES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION					
PIN	SET 1	SET 2	SET 3	SET 4		
9	0	24 VDC	0	24 Vpc		
10	0	0	24 Vpc	24 Vpc		

20 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **LEB-SN-IL** signals see section 21

For certified safety options: /U see tech. table FY100 and /K see tech. table FY200

20.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 20.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

20.2 Power supply for driver's logic and communication (VL+ and VL0) - only for LES with /Z option and for LES-SP, SF, SL with fieldbus The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

/ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

20.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

20.4 Pressure or force reference input signal (F_INPUT+) - only for LES-SP, SF, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**). Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

20.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

20.6 Pressure or force monitor output signal (F_MONITOR) - only for LES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

20.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

20.8 Repeat enable output signal (R_ENABLE) - only for LEB-SN-NP with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 20.7).

20.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

20.10 Remote pressure/force transducer input signal - only for LES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 22.5).

Analog input signal is factory preset according to selected valve code, defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vpc or ± 20 mA. Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

20.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for LES-SP, SF, SL

ted by binary code table at side. Gray code can be selected by software.

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.). Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indica-

PID SET SELECTION PIN SET 1 SET 2 SET 3 SET 4 9 0 24 Vpc 0 24 Vpc 10 0 0 24 VDC 24 Vpc

21 IO-LINK SIGNALS SPECIFICATIONS - only for LEB-SN-IL

21.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDc power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

21.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

21.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

22 ELECTRONIC CONNECTIONS

For electronic connection of certified safety options /U see tech. table FY100 and /K see tech. table FY200

PIN	N Standard /Q /F		/F	TECHNICAL SPECIFICATIONS	NOTES
A	V+			Power supply 24 Voc	Input - power supply
В	V0			Power supply 0 VDC	Gnd - power supply
	AGND		AGND	Analog ground	Gnd - analog signal
	ENABLE			Enable (24 Vbc) or disable (0 Vbc) the valve, referred to V0	Input - on/off signal
				Flow reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
				Defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
E	E INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
	Q_MONITOR referred to:			Flow monitor output signal: ±10 Vpc / ±20 mA maximum range	Output - analog signal
F	F AGND V0			Defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
	FAULT		FAULT	Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal
G	G FARTH			Internally connected to the driver housing	

22.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

22.2 Main connector signals - 12 pin A2 /Z option and LES-SP, SF, SL

PIN	LEB-SN /Z	LES-SN /Z	LES-SP Fieldbus	, SF, SL NP	TECHNICAL SPECIFICATIONS	NOTES
1	V+				Power supply 24 Vbc	Input - power supply
2	V0				Power supply 0 Vbc	Gnd - power supply
3	ENABLE ref	erred to: VL0	VLO	VO	Enable (24 Vpc) or disable (0 Vpc) the valve $\label{eq:value}$	Input - on/off signal
4					Flow reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
4	Q_INPUT+				Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
5	INPUT-				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	Q_MONITOF	R referred to:			Flow monitor output signal: ±10 Vpc / ±20 mA maximum range	Output - analog signal
0	AGND	VL0	VLO	VO	Defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
	AGND			-	Analog ground	Gnd - analog signal
7	NC			Do not connect		
'	F_INPUT+			Pressure/Force reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal	
				Defaults are ± 10 Vpc for standard and 4 \div 20 mA for /I option	Software selectable	
	R_ENABLE				Repeat enable, output repeater signal of enable input, referred to V0	Output - on/off signal
8		NC			Do not connect	
		F_MONITOR referred to:		referred to:	Pressure/Force monitor output signal: ±10 Vbc / ±20 mA maximum range	Output - analog signal
			VLO	VO	Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
	NC				Do not connect	
9		VL+			Power supply 24 Vbc for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
	NC			Do not connect		
10	10 VL0			Power supply 0 VDc for driver's logic and communication	Gnd - power supply	
D_IN1		D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal		
11	FAULT refer	red to: VL0	VLO	VO	Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal
PE	EARTH				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

22.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for LEB-SN-IL

1 L+ Power supply 24 Vpc for IO-Link comm	unin-stine 1	
	unication	Input - power supply
2 P24 Power supply 24 Vbc for valve regulation	n, logics and diagnostics	Input - power supply
3 L- Power supply 0 Vbc for IO-Link commu	nication C	Gnd - power supply
4 C/Q IO-Link data line		Input / Output - signal
5 N24 Power supply 0 Vbc for valve regulation	, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

22.4 Communications connectors B - C

В	B USB connector - M12 - 5 pin always present					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)				
1	+5V_USB	Power supply				
2	ID	Identification				
3	GND_USB	Signal zero data line				
4	D-	Data line -				
5	D+	Data line +				

C1	C1 $C2$ BP fieldbus execution, connector - M12 - 5 pin				
PIN	VIN SIGNAL TECHNICAL SPECIFICATION (1)				
1	+5V	Termination supply signal			
2	LINE-A	Bus line (high)			
3	DGND	Data line and termination signal zero			
4	LINE-B	Bus line (low)			
5	SHIELD				

(1) Shield connection on connector's housing is recommended

C1) C2) BC fieldbus execution, connector - M12 - 5 pin PIN SIGNAL **TECHNICAL SPECIFICATION** (1) CAN_SHLD Shield 1 (c) - (c) pass-through connection (2) 2 not used 3 CAN_GND Signal zero data line 4 CAN_H Bus line (high) 5 CAN_L Bus line (low)

 C1
 C2
 EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin

 PIN
 SIGNAL
 TECHNICAL SPECIFICATION (1)

 4
 TV
 Tecensities

1	TX+	Transmitter
2	RX+	Receiver
3	тх-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(2) Pin 2 can be fed with external +5V supply of CAN interface

22.5 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	D1 SP, SL - Single transducer (1) Voltage Current		D2 SF - Double Voltage	e transducers (1) Current
1	VF +24V	Power supply +24Vbc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vpc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power Common gnd		Connect	/	Connect	/
4	TR2 2nd signal transducer: ±10 Vpc / ±20 mA maximum range Inp So		Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

22.6 LEB-SN-NP connections layout





(1) Pin layout always referred to driver's view



22.9 Diagnostic LEDs - only for LES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1		VALVE STATUS	6		LIN	<th></th> <th></th>		
L2	NETWORK STATUS		NETWORK STATUS					
L3	SC	LENOID STAT	US		LIN	<th></th> <th></th>		

23 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



24 CONNECTORS CHARACTERISTICS - to be ordered separately

24.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS	
CODE	A1) ZM-7P	A3 ZH-7P	
Туре	7pin female straight circular	7pin female straight circular	
Standard According to MIL-C-5015		According to MIL-C-5015	
Material	Metallic Plastic reinforced with fiber glass		
Cable gland	PG11	PG11	
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires	
Connection type	to solder	to solder	
Protection (EN 60529)	IP 67	IP 67	

24.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	(A2) ZM-12P	A4 ZH-12P		
Туре	12pin female straight circular	12pin female straight circular		
Standard	DIN 43651	DIN 43651		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG13,5	PG16		
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)		
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires		
Connection type to crimp		to crimp		
Protection (EN 60529)	IP 67	IP 67		

24.3 IO-Link connector - only for LEB-SN-IL

CONNECTOR TYPE	IL IO-Link		
CODE	A ZM-5PF		
Туре	5pin female straight circular		
Standard	M12 coding A – IEC 61076-2-101		
Material	Metallic		
Cable gland	Pressure nut - cable diameter 6÷8 mm		
Recommended cable	5 x 0,75 mm² max 20 m		
Connection type	screw terminal		
Protection (EN 60529)	IP 67		

24.4 Fieldbus communication connectors

CONNECTOR TYPE	BC CAN	open (1)	BP PROFI	BUS DP (1)	EH Ethe El Ether	rCAT, EW POWERLINK, Net/IP, EP PROFINET (2)
CODE	C1 ZM-5PF	C2 ZM-5PM	C1) ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B –	IEC 61076-2-101	M12 co	ding D – IEC 61076-2-101
Material	Me	tallic	Me	tallic		Metallic
Cable gland	Pressure nut - cab	e diameter 6÷8 mm	Pressure nut - cab	le diameter 6÷8 mm	Pressure r	nut - cable diameter 4÷8 mm
Cable	CANbus Stand	lard (DR 303-1)	PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal			terminal block
Protection (EN 60529)	IF	IP67		67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table GS500

(2) Internally terminated

24.5 Remote pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers
CODE	D1 ZH-5PM/1.5	D1 ZH-5PM/5	D2 ZH-5PM-2/2
Туре	5 pin male st	raight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector mot 1,5 m length	ulded on cables 5 m length	Connector moulded on cables 2 m length
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP	67	IP 67

25 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain.





DPZO-*-1	Α	B (1)	C (1)	E (air bleeding)	Mass [kg]
LEB - SN - IL	256	60	-		
LEB - SN - NP	256	100	-		
LES - SN - NP, BC, BP, EH	256	100	58		9,8
LES - SN - EW, EI, EP	271	100	58	1	
LES - SP, SF, SL - *	271	100	58	1	

 The indicated dimension refers to the longer connectors or Bluetooth adapter For dimensions of connectors and Bluetooth adapter, see sections 22.6, 22.7 and 22.8
 Space required for connection cable and for connector removal



ISO 4401: 2005 Mounting surface: 4401-07-07-0-05 (see table P005)





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DPZO-*-2	Α	B (1)	C (1)	E (air bleeding)	Mass [kg]
LEB - SN - IL	237	60	-		
LEB - SN - NP	237	100	-		
LES - SN - NP, BC, BP, EH	237	100	58		14,4
LES - SN - EW, EI, EP	252	100	58		
LES - SP, SF, SL - *	252	100	58		
Option /G	+30		-		+0,9

 The indicated dimension refers to the longer connectors or Bluetooth adapter For dimensions of connectors and Bluetooth adapter, see sections 22.6, 22.7 and 22.8
 Space required for connection cable and for connector removal

Note: for /B option the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage



 The indicated dimension refers to the longer connectors or Bluetooth adapter For dimensions of connectors and Bluetooth adapter, see sections 22.6, 22.7 and 22.8
 Space required for connection cable and for connector removal

Note: for /B option the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage



Note: for /B option the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

27 FASTENING BOLTS AND SEALS

Туре	Size	Fastening bolts	Seals
	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050 Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 - 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm	4 OR 130 Diameter of ports A, B, P, T: Ø 20 mm (max)
	2 = 10	2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	2 OR 2043 Diameter of ports X, Y: $\emptyset = 7 \text{ mm} (\text{max})$
0070	4 = 25 6 socket head screws M12x60 o Tightening torque = 125 Nm	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112 Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
DP2O	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137 Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	4 OR 144 Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	8 = 35	6 socket head screws M20x100 class 12.9 Tightening torque = 600 Nm	4 OR 156 Diameter of ports A, B, P, T: Ø 50 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 9 mm (max)

28 RELATED DOCUMENTATION

FS001	01 Basics for digital electrohydraulics		Electric a	nd electronic connectors	
FS500	Digital proportional valves with p/Q control	P005	Mounting	surfaces for electrohydraulic valves	
FS630	Digital proportional valves with integral axis controller	kis controller QB320		Quickstart for LEB valves commissioning	
FS900	Operating and maintenance information for proportional valves	QF320	Quicksta	rt for LES valves commissioning	
FY100	Safety proportional valves - option /U	Y010	Basics fo	r safety components	
FY200	Safety proportional valves - option /K	E-MAN-	RI-LEB	TEB/LEB user manual	
GS500	Programming tools	E-MAN-	RI-LES	TES/LES user manual	
GS510	Fieldbus	E-MAN-	RI-LES-S	TES/LES with p/Q control user manual	
GS520	IO-Link interface				

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Servoproportional directional valves

piloted, with two LVDT transducers and zero spool overlap



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2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LEB	E-BM-LES	Z-BM-LEZ
Туре	Digital	Digital	Digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra \leq 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	75 years, for futher details see technical table P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$	/PE option = $-20^{\circ}C \div +60^{\circ}C$	/BT option = $-40^{\circ}C \div +60^{\circ}C$		
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$	/PE option = $-20^{\circ}C \div +70^{\circ}C$	/BT option = $-40^{\circ}C \div +70^{\circ}C$		
Surface protection	Zinc coating with black passivation				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004				
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DPZO-L-1		DPZO-L-2	2	DPZO-L-4	DPZO-L-4M	DPZO-L-6
Pressure limits [bar]		por	ts P, A, B	, X = 3	50; T = 250 (10 for o	ption /D); Y = 10;	
Spool type	L5, DL5	L3	L5, DL5	T5	L5,	DL5	L5
Nominal flow ∆p P-T [I/min]							
(1) ∆p= 10 bar	100	160	250	190	480	550	640
Δp= 30 bar	160	270	430	330	830	950	1100
Max permissible flow [I/min]	180	400	550	550	1000	1100	1600
Piloting pressure [bar]	mir	n. = 25;	max =	350 (o	ption /G advisable for	pilot pressure > 150 b	ar)
Piloting volume [cm ³ /min]	1,4		3,7		9	11,3	21,6
Piloting flow (2) [I/min]	3,5		9		18	20	19
Leakage (3) Pilot [cm3/min]	100 / 300		150 / 450		200 / 600	200 / 600	900 / 2800
Main stage [l/min]	0,4 / 1,2		0,6 / 2,5		1,0 / 4,0	1,0 / 4,0	3,0 / 9,0
Response time (4) [ms]	≤ 25		≤ 25		≤ 30	≤ 35	≤ 80
Hysteresis		≤ 0,1 [%of max regulation]					
Repeatability	± 0,1 [%of max regulation]						
Thermal drift			zero	point d	isplacement < 1% at 2	$\Delta T = 40^{\circ}C$	

(1) For different Δp , the max flow is in accordance to the diagrams in section 7.2 (2) With step reference input signal 0 \div 100 %

(3) At p = 100/350 bar(4) 0-100% step signal, see detailed diagrams in section 7.3

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	$3 \div 3,3 \Omega$
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

		NBB seals (standard) = -20° C $\div +60^{\circ}$ C, with HEC by draulic fluids = -20° C $\div +50^{\circ}$ C				
Seals, recommended fluid temperature		$ \text{EKM seals}(/\text{PE option}) = -20^{\circ}\text{C} \div +80^{\circ}\text{C}$				
	i tomp or at a ro	HNBR seals (/BT option) = -40° C ÷ $+60^{\circ}$ C, with HFC hydraulic fluids = -20° C ÷ $+50^{\circ}$ C				
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s				
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	638 class 7	see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	100 10000		
Flame resistant with water		NBR, NBR low temp.	HFC	- 130 12922		



7.2 Flow /∆p diagram - stated at 100% of spool stroke

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)





P→A B→T

 $\begin{array}{l} \text{Reference signal } \begin{array}{l} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{array} \right\} \text{ P} \rightarrow \text{A / B} \rightarrow \text{T} \\ \text{Reference signal } \begin{array}{l} 0 \div -10 \text{ V} \\ 4 \div 12 \text{ mA} \end{array} \right\} \text{ P} \rightarrow \text{B / A} \rightarrow \text{T} \end{array}$

7.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.





7.4 Bode diagrams

Stated at nominal hydraulic conditions.





7.5 Pressure gain





4 6

8 HYDRAULIC OPTIONS

- **B** = Solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 7.1
- \mathbf{D} = Internal drain (through port T). Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12 The valve's standard configuration provides internal pilot and external drain.
- \mathbf{E} = External pilot (through port X). Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12 The valve's standard configuration provides internal pilot and external drain.
- G = Pressure reducing valve (3) with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

DPZO-1, DPZO-2, DPZO-4(M) and DPZO-6 = 40 bar

It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

Pressure reducing valve (3) is standard for DPZO-1, for other sizes add /G option.

9 ELECTRICAL CONNECTION - connectors supplied with the valve

9.1 Pilot valve solenoid connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

9.3 LVDT main stage transducer connector



10 SAFETY REST POSITION - configuration 70

In absence of power supply to the solenoids, the valve main spool is moved by the springs force to the safety rest position characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration. This is specifically designed to avoid that in case of accidental interruption of power supply to the valve solenoids, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.

Thanks to the safety rest position the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.

11 FASTENING BOLTS AND SEALS

Functional Scheme - example of configuration 70



1) Pilot valve 2 Main stage

(3) Pressure reducing valve

(4) Plug to be added for external pilot trough port X (5) Plug to be removed for internal drain through port T

9.2 LVDT pilot transducer connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	1 3
2	VT-	Power supply -15VDC	
3	VT+	Power supply +15VDC	
4	GND	Ground	4 2



Туре	Size	Fastening bolts	Seals
DPZO	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

12 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain.





Notes: the overall height is increased by 30 mm for /G option (0,9 kg); for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage



Notes: the overall height is increased by 40 mm for /G option (0,9 kg); for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

14 RELATED DOCUMENTATION

FS001 FS900	Basics for digital electrohydraulics Operating and maintenance information for proportional valves	GS500 GS510 K800	Programming tools Fieldbus
GS240 GS330	E-BM-LES digital driver Z-BM-LEZ digital axis card	P005	Mounting surfaces for electrohydraulic valves

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Digital servoproportional 3-way cartridges

piloted, with on-board driver and two LVDT transducers



(1) For possible combined options, see section 16
2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage. In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver (option /Q or /Z). A safety fuse 2,5 A installed on 24VDc power supply of each valve is always recommended, see also power supply note at sections 18.

The loss of the pilot pressure causes the undefined position of the main spool.

The sudden interruption of the power supply during the valve operation causes the immediate main spool opening $A \rightarrow T$ or $P \rightarrow A$ (for option /A). This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

3 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

3.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





LES E-C-SB-USB/M12 cable E-A-SB-USB/OPT isolator

Bluetooth or USB connection

3.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

4 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

5 SMART TUNING

Smart tuning allows to adjust the cartridge dynamic response in order to match different performance requirements.

The cartridge is provided with 3 factory settings for the spool control:

- dynamic fast response time and high sensitivity for best dynamic performances. Default factory setting for cartridges

- balanced average response time and sensitivity suitable for major applications

- smooth attenuated response time and sensitivity to improve control stability in critical applications or in environments with electrical disturbances

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-RI-* and Quickstart, see section 28. For Response time and Bode diagrams see section 19.

6 IO-LINK - only for LEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

7 FIELDBUS - only for LES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

8 ALTERNATED p/Q CONTROLS - only for LES, see tech. table FS500

S* options add the closed loop control of pressure (SP) or force (SL) to the basic functions of proportional directional valves flow regulation.

A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.

An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.

Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

9 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$				
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004				
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size	25	32	40	50	63	80
Nominal flow Δp P-A or A-T [I/min]						
$\Delta p = 5 bar$	185	330	420	780	1250	2100
$\Delta p = 10 \text{ bar}$	260	470	590	1100	1750	3000
Max permissible flow	500	850	1050	2000	3100	5000
Max pressure [bar]		Ports	P, A, T = 420	X = 350	$Y \le 10$	
Nominal flow of pilot valve at $\Delta p = 70$ bar [l/min]	4	8	28	40	100	100
Leakage of pilot valve at P = 100 bar [I/min]	0,2	0,2	0,5	0,7	0,7	0,7
Piloting pressure [bar]	min:	40% of system	pressure ma	ax 350 recor	nmended 140 ÷	160
Piloting volume [cm ³]	2,16	7,2	8,9	17,7	33,8	42,7
Piloting flow (1) [I/min]	6,5	20	25	43	68	76
Response time 0 ÷ 100% step signal (2) [ms]	21	22	22	25	30	34
Hysteresis [% of the max regulation]			≤ (),1		
Repeatability [% of the max regulation]			±	0,1		
Thermal drift	zero point displacement < 1% at $\Delta T = 40^{\circ}C$					

(1) With step reference input 0÷100%

(2) With pilot pressure = 140 bar, see datailed diagrams in section 13.2

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	50 W	50 W				
Max. solenoid current	2,6 A					
Coil resistance R at 20°C	3 ÷ 3,3 Ω					
Analog input signals	Voltage: range ±10 Current: range ±20	0 VDC (24 VMAX toler 0 mA	ant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$	2	
Monitor outputs	Output range:	voltage ±10 VDC current ±20 mA	@ max 5 mA @ max 500 Ω load res	sistance		
Enable input	Range: 0 ÷ 5 VDC (O	FF state), 9 ÷ 24 VDC	(ON state), 5 ÷ 9 VDC	(not accepted); Input i	mpedance: Ri > 10 k Ω	
Fault output	Output range: 0 ÷ 2 external negative vo	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V]; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)				
Pressure/Force transducer power supply (only for SP, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)					
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function					
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors					
Duty factor	Continuous rating (ED=100%)					
Tropicalization	Tropical coating on electronics PCB					
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic (only for LES); spool position control (SN) or pressure/force control (SP, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply				ES); lenoid switching;	
Communication interface	USB Atos ASCII coding	IO-Link Interface and System Specification 1.1.3	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT POWERLINK EtherNet/IP PROFINET IO RT/IRT IEC 61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX	
Recommended wiring cable	LiYCY shielded cables, see section 22					

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

12 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$				
Recommended viscosity		20÷100 mm²/s - max allowed ra	nge 15 ÷ 380 mm²/s			
Max fluid normal operation		ISO4406 class 18/16/13 NAS1	see also filter section at			
contamination level	longer life	ISO4406 class 16/14/11 NAS1	638 class 5	www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	100 10000		
Flame resistant with water		NBR, NBR low temp.	HFC	- 100 12922		

[13] DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

13.1 Regulation diagrams, see note

1 = LIQZP

Hydraulic configuration vs. reference signal:

 $\begin{array}{c} \text{standard option /A}\\ \text{Reference signal } 0 \div + 10 \text{ V}\\ 12 \div 20 \text{ mA} \end{array} \} \text{P} \rightarrow \text{A} \qquad \text{A} \rightarrow \text{T}\\ \text{Reference signal } 0 \div - 10 \text{ V}\\ 4 \div 12 \text{ mA} \end{array} \} \text{ A} \rightarrow \text{T} \qquad \text{P} \rightarrow \text{A} \end{array}$



13.2 Pressure gain diagram





13.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.

75

50

25

0







Step signal [%]

0-100

0-75

0-50

0-25

Time [ms]

12 24 36 48 60

2 3

1

36 48 60 0

1

12 24

LIQZP-50

(*) Response time is represented only for 0-100% step; for intermediate steps, the response time increment of presets 2 (balanced) and 3 (smooth) with respect to the preset 1 (dynamic) is proportional to the step amplitude of the reference input signal





1 = dynamic 2 = balanced (*) 3 = smooth (*)

Stated at nominal hydraulic conditions Phase [degree] 0 Amplitude ratio [dB] ± 5% nominal stroke: 1 = dynamic -3 2 = balanced 2 ġ. $\mathbf{3} = \text{smooth}$ 2 ± 100% nominal stroke: 90 4 = dynamic



13.4 Bode diagrams LIQZP-L*-253L4

6 = smooth





13.5 Bode diagrams LIQZP-L*-323L4 Stated at nominal hydraulic conditions

- ±5% nominal stroke:
- 1 = dynamic
- 2 = balanced 3 = smooth
- ± 100% nominal stroke:
- $\mathbf{4} = dynamic$
- 5 = balanced
- 6 = smooth



+2 [degree] 0 Amplitude ratio [dB] Phase [-3 6 5 4 5 6 90 45° Щ 0° 100 50 Frequency [Hz]



14 HYDRAULIC OPTIONS

A = The standard valve version provides the hydraulic configuration A-T of main spool in absence of electric power supply to the valve.

The option /A provides the reverse configuration P-A of main spool in absence of electric power supply to the valve.

This execution is particularly requested in vertical presses for safety reasons, because in case of electric power breakdown the P-A configuration of the main spool prevents the uncontrolled and dangerous downstroke of the press ram.



15 ELECTRONIC OPTIONS - not available for LEB-SN-IL

- **F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /l, spool position transducer broken, etc. see 18.9 for signal specifications.
- This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 18.7 for signal specifications.
- Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal see above option /F
 Enable input signal see above option /Q
 Repeat enable output signal only for LEB-SN-NP (see 18.8)
 Power supply for driver's logics and communication only for LES (see 18.9)
- **C** = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

16 POSSIBLE COMBINED OPTIONS

LEB-SN-NP, LES-SN

/AF, /AI, /AQ, /AZ, /FI, /IQ, /IZ, /AFI, /AIQ, /AIZ LES-SP, SL /AC, /CI, /ACI

Note: /T Bluetooth adapter option can be combined with all other options

17 AIR BLEEDING



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **LEB-SN-IL** signals see section 19

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for LES with /Z option and for LES-SP, SL with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

18.4 Pressure or force reference input signal (F_INPUT+) - only for LES-SP, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**). Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

18.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

18.6 Pressure or force monitor output signal (F_MONITOR) - only for LES-SP, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference). Monitor output signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDC for standard and $4 \div 20$ mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

18.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

18.8 Repeat enable output signal (R_ENABLE) - only for LEB-SN-NP with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 18.7).

18.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

18.10 Remote pressure/force transducer input signal - only for LES-SP, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 20.5). Analog input signal is factory preset according to selected valve code, defaults are ±10 VDc for standard and 4 ÷ 20 mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDc or ± 20 mA. Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

18.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for LES-SP, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.). Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	I	PID SET S	ELECTION	1
PIN	SET 1	SET 2	SET 3	SET 4
9	0	24 Vpc	0	24 Vpc
10	0	0	24 Vpc	24 Vpc

19 IO-LINK SIGNALS SPECIFICATIONS - only for LEB-SN-IL

19.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

19.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

19.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard /Q /F		/F	TECHNICAL SPECIFICATIONS	NOTES
Α	V+			Power supply 24 Vbc	Input - power supply
В	V0			Power supply 0 VDC	Gnd - power supply
<u> </u>	AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
				Flow reference input signal: ±10 Vbc / ±20 mA maximum range	Input - analog signal
	Q_INPUT+			Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /l option	Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
	Q_MONITOF	R referred to:		Flow monitor output signal: ±10 Vbc / ±20 mA maximum range	Output - analog signal
F	AGND	VO		Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
			FAULT	Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

20.2 Main connector signals - 12 pin A2 /Z option and LES-SP, SL

PIN	LEB-SN /Z	LES-SN /Z	LES-S	SP, SL	TECHNICAL SPECIFICATIONS	NOTES
1	V+		i leiubus	INF	Power supply 24 Vbc	Input - power supply
2	VO				Power supply 0 VDc	Gnd - power supply
3	ENABLE ref	erred to: VL0	VLO	VO	Enable (24 Vpc) or disable (0 Vpc) the valve	Input - on/off signal
4	Q_INPUT+	1		1	Flow reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /l option	Input - analog signal Software selectable
5	INPUT-				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	Q_MONITOF	R referred to:			Flow monitor output signal: ±10 Vbc / ±20 mA maximum range	Output - analog signal
0	AGND	VL0	VL0	VO	Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
	AGND				Analog ground	Gnd - analog signal
7		NC			Do not connect	
l '					Pressure/Force reference input signal: ±10 Vbc / ±20 mA maximum range	Input - analog signal
			F_INPUT+		Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Software selectable
	R_ENABLE				Repeat enable, output repeater signal of enable input, referred to V0	Output - on/off signal
0		NC			Do not connect	
0			F_MONITOF	R referred to:	Pressure/Force monitor output signal: ±10 VDc / ±20 mA maximum range	Output - analog signal
			VLO	VO	Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
	NC		•		Do not connect	
9		VL+			Power supply 24 Vbc for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
	NC				Do not connect	
10		VL0			Power supply 0 VDC for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
11	FAULT refer	red to: VL0	VLO	V0	Fault (0 Vpc) or normal working (24 Vpc)	Output - on/off signal
PE	EARTH				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for LEB-SN-IL

1 L+ Power supply 24 Vpc for IO-Link communication Input - p 2 P24 Power supply 24 Vpc for valve regulation, logics and diagnostics Input - p	power supply
2 P24 Power supply 24 Vbc for valve regulation, logics and diagnostics Input - p	
	power supply
3 L- Power supply 0 Vbc for IO-Link communication Gra - po	ower supply
4 C/Q IO-Link data line Input / C	Output - signal
5 N24 Power supply 0 Vpc for valve regulation, logics and diagnostics Gnd - pc	ower supply

Note: L+, L- and P24, N24 are electrically isolated

20.4 Communications connectors B - C

B USB connector - M12 - 5 pin always present			
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)	
1	+5V_USB	Power supply	
2	ID	Identification	
3	GND_USB	Signal zero data line	
4	D-	Data line -	
5	D+	Data line +	

(C1)	C1 $C2$ BP fieldbus execution, connector - M12 - 5 pin				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	+5V	Termination supply signal			
2	LINE-A	Bus line (high)			
3	DGND	Data line and termination signal zero			
4	LINE-B	Bus line (low)			
5	SHIELD				

(1) Shield connection on connector's housing is recommended

C1 C2 BC fieldbus execution, connector - M12 - 5 pin			
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)	
1	CAN_SHLD	Shield	
2	not used	©1 - ©2 pass-through connection (2)	
3	CAN_GND	Signal zero data line	
4	CAN_H	Bus line (high)	
5	CAN_L	Bus line (low)	

C1 C2 EH, EW, EI, EP fieldbus execution, connector - M12 - 4 p				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)		
1	TX+	Transmitter		
2	RX+	Receiver		
3	тх-	Transmitter		
4	RX-	Receiver		
Housing	SHIELD			

(2) Pin 2 can be fed with external +5V supply of CAN interface

20.5 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	VF +24V	Power supply +24Vbc	Connect	Connect
2	TR	Signal transducer ± 10 Vpc / ± 20 mA maximum range, software selectable Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /C option	Connect	Connect
3	AGND	Common GND for transducer power and signals	Connect	/
4	NC	Not Connect	/	/
5	NC	Not Connect	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

20.6 LEB-SN-NP connections layout



20.7 LEB-SN-IL connections layout



(1) Pin layout always referred to driver's view



19.9 Diagnostic LEDs - only for LES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NE	NETWORK STATUS			NETWORK STATUS			
L3	SC	SOLENOID STATUS			LINK/ACT			

21 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table GS500).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



22 CONNECTORS CHARACTERISTICS - to be ordered separately

22.1 Main connectors - 7 pin

CONNECTOR TYPE POWER SUPPLY AND SIGNALS		POWER SUPPLY AND SIGNALS
CODE (A1) ZM-7P		A3 ZH-7P
Туре	7pin female straight circular	7pin female straight circular
Standard According to MIL-C-5015		According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland PG11		PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size up to 1 mm ² - available for 7 wires		up to 1 mm ² - available for 7 wires
Connection type to solder		to solder
Protection (EN 60529)	IP 67	IP 67

22.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	A4 ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

22.3 IO-Link connector - only for LEB-SN-IL

CONNECTOR TYPE	IL IO-Link
CODE	A ZM-5PF
Туре	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

22.4 Fieldbus communication connectors

CONNECTOR TYPE BC CANopen (1)		BP PROFI	BUS DP (1)	EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)		
CODE	C1 ZM-5PF	©2 ZM-5PM	C1 ZM-5PF/BP	©2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Me	tallic	Metallic			Metallic
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure r	nut - cable diameter 4÷8 mm
Cable	CANbus Stand	dard (DR 303-1)	PROFIBUS DP Standard		Ethe	ernet standard CAT-5
Connection type screw terminal		screw terminal			terminal block	
Protection (EN 60529) IP67		IP 67			IP 67	
(1) E-TRM-** terminators can be ordered separately - see tech table GS500 (2) Internally terminated						

22.5 Remote pressure/Force transducer connectors - only for SP, SL

CONNECTOR TYPE	SP, SL - Single transducer				
CODE	D ZH-5PM/1.5	D ZH-5PM/5			
Туре	5 pin male s	raight circular			
Standard	M12 coding A – IEC 61076-2-101				
Material	Plastic				
Coble gland	Connector moulded on cables				
Cable glanu	1,5 m length	5 m length			
Cable	5 x 0,25 mm ²				
Connection type	molded cable				
Protection (EN 60529)	IP 67				

23 FASTENING BOLTS AND VALVE MASS

Туре	Size	Fastening bolts (1)	Mass [kg]	
	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,8	
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	11,2	
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	17,3	
LIQZP	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	24,6	
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,6	
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	72,2	

(1) Fastening bolts supplied with the valve

24 MAIN CONNECTORS INSTALLATION DIMENSIONS



B = Clearance between main connector to valve's mounting surface. See the below table to verify eventual interferences, depending to the valve size and connector type

 $\ensuremath{\textbf{C}}$ = Max manifold dimension to avoid interference with the main connector, see below table

Poforonce dimension	Main	Valve size					
Reference dimension	code	25	32	40	50	63	80
	ZM-7P	32	32	32	45	68	68
B	ZH-7P	(1)	(1)	(1)	29	52	52
	ZM-12P	(1)	(1)	(1)	(1)	35	35
	ZH-12P	(1)	(1)	(1)	(1)	(1)	(2)
C (max) for standard valve	-	134	141	154	161	192	222
C (max) for /A option	-	114	121	134	141	172	202
D for standard valve	-	154	161	174	181	212	242
D for /A option	-	134	141	154	161	192	222

Above dimenions refer to the main connector fully screwed to driver's connector. The space **A** = 15 mm to remove the connector must be considered (1) The connector installation can be performed only if the valve's driver protrudes from the edge of the relevant mounting manifold as rapresented in above "Installation 2"

(2) The connector installation may be critic, depending to the cable size and bending radius

25 INSTALLATION DIMENSIONS [mm]



(1) The indicated dimension refers to the main connector ZM-7P. See section 4 for main connectors installation dimensions (2) The indicated dimension refers to the longer connectors or Bluetooth adapter

For dimensions of connectors and Bluetooth adapter, see sections 20.6, 20.7 and 20.8

(3) Space required for connection cable and for connector removal



26 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	P006	Mounting	surfaces and cavities for cartridge valves
FS500	Digital proportional valves with p/Q control	QB340	Quicksta	rt for LEB valves commissioning
FS900	Operating and maintenance information for proportional valves	QF340	Quicksta	rt for LES valves commissioning
GS500	Programming tools	E-MAN-	RI-LEB	TEB/LEB user manual
GS510	Fieldbus	E-MAN-	RI-LES	TES/LES user manual
GS520	IO-Link interface	E-MAN-	RI-LES-S	TES/LES with p/Q control user manual
K800	Electric and electronic connectors			

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Servoproportional 3-way cartridges

piloted, with two LVDT transducers, sizes from 25 to 80



2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LEB	E-BM-LES		
Туре	digital	digital		
Format	DIN-rail panel	DIN-rail panel		
Tech table	GS230	GS240		

WARNING

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage. In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver.

3 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	75 years, for futher details see technical table P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$				
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004				
CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3 Compliance RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size	25	32	40	50	63	80
Nominal flow $\Delta p P-A$ or A-T [I/min]						
$\Delta p = 5 bar$	185	330	420	780	1250	2100
$\Delta p = 10 \text{ bar}$	260	470	590	1100	1750	3000
Max permissible flow	500	850	1050	2000	3100	5000
Max pressure [bar]		Ports	P, A, T = 420	X = 350	$Y \le 10$	
Nominal flow of pilot valve at $\Delta p = 70$ bar [l/min]	4	8	28	40	100	100
Leakage of pilot valve at P = 100 bar [l/min]	0,2	0,2	0,5	0,7	0,7	0,7
Piloting pressure [bar]	min:	40% of system	pressure ma	ax 350 recor	nmended 140 ÷	160
Piloting volume [cm ³]	2,16	7,2	8,9	17,7	33,8	42,7
Piloting flow (1) [l/min]	6,5	20	25	43	68	76
Response time 0 ÷ 100% step signal (2) [ms]	21	22	22	25	30	34
Hysteresis [% of the max regulation] ≤ 0,1						
Repeatability [% of the max regulation]	± 0,1					
Thermal drift	zero point displacement < 1% at $\Delta T = 40^{\circ}C$					

(1) With step reference input 0÷100%
(2) With pilot pressure = 140 bar, see datailed diagrams in section 7.2

WARNING

The loss of the pilot pressure causes the undefined position of the main spool.

The sudden interruption of the power supply during the valve operation causes the immediate main spool opening $A \rightarrow T$ or $P \rightarrow A$ (for option /A). This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	$3 \div 3,3 \Omega$
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	l temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$				
Recommended viscosity		20÷100 mm²/s - max allowed ra	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	see also filter section at			
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog			
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	100 10000		
Flame resistant with water		NBR, NBR low temp.	HFC	- 130 12922		

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

10.1 Regulation diagrams, see note

1 = LIQZP (all sizes)

Hydraulic configuration vs. reference signal:

standard option /A Reference signal 0 ÷+10 V - ... IU V 12÷20 mA}P $\rightarrow A$ $A \rightarrow T$ Reference signal 0 ÷-10 V 4÷12 mA } $A \rightarrow T$ $P \rightarrow A$





7.2 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.









7.3 Pressure gain diagram





7.4 Bode diagrams



9 = LIQZP-L-633L4: ± 90% 10 = LIQZP-L-633L4: ± 5%

- 11 = LIQZP-L-803L4: ± 90%
- **12** = LIQZP-L-803L4: ± 5%

8 HYDRAULIC OPTIONS

A = The standard valve version provides the hydraulic configuration A-T of main spool in absence of electric power supply to the valve.

The option /A provides the reverse configuration P-A of main spool in absence of electric power supply to the valve.

This execution is particularly requested in vertical presses for safety reasons, because in case of electric power breakdown the P-A configuration of the main spool prevents the uncontrolled and dangerous downstroke of the press ram.



9 ELECTRICAL CONNECTION - connectors supplied with the valve

9.1 Solenoid connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

9.3 LVDT main stage transducer connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code
1	PROG	Do not connect	ZBE-08
2	VT+	Power supply +15VDC	
3	AGND	Ground	4(6%)2)
4	TR	Output signal	
5	VT-	Power supply -15VDC	

9.2 LVDT pilot transducer connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	1 3
2	VT-	Power supply -15VDC	
3	VT+	Power supply +15VDC	
4	GND	Ground	4 2

10 AIR BLEEDING



11 FASTENING BOLTS AND VALVE MASS

Туре	Size	Fastening bolts (1)	Mass [kg]		
LIQZP	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,8		
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	11,2		
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	17,3		
	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	24,6		
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,6		
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	72,2		

(1) Fastening bolts supplied with the valve





Note: for mounting surface and cavity dimensions, see table $\ensuremath{\mathsf{P006}}$

13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
GS230	E-BM-LEB digital driver	K800	Electric and electronic connectors
GS240	E-BM-LES digital driver	P006	Mounting surfaces and cavities for cartridge valves

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Digital proportional directional valves high performance

direct, with on-board driver, LVDT transducer and positive spool overlap



(1) For P/Q control select configuration 73 with spools L,S,D, or specific spools Q5, V9, see section 2
 (2) Only for DKZOR-*-S5, see 15.8
 (3) For possible combined options, see section 18

2 SPOOLS SPECIFIC FOR ALTERNATED p/Q CONTROL - for valve model code and options, see section 1



3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

4.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.







Bluetooth or USB connection



4.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

5 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500

T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

6 SMART TUNING

Smart tuning allows to adjust the valve dynamic response in order to match different performance requirements.

The valve is provided with 3 factory settings for the spool control:

- dynamic fast response time and high sensitivity for best dynamic performances. Default factory setting for directional valves

- balanced average response time and sensitivity suitable for major applications

- smooth attenuated response time and sensitivity to improve control stability in critical applications or in environments with electrical disturbances

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-RI-* and Quickstart, see section 26. For Response time and Bode diagrams see section 15.

7 IO-LINK - only for TEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

8 FIELDBUS - only for TES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 ALTERNATED p/Q CONTROLS - only for TES, see tech. table FS500

 S^* options add the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions. An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions. Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

10 SAFETY OPTIONS - only for TES

Atos range of proportional directional valves, provides functional safety options /U and /K , designed to accomplish a safety function, intended to reduce the risk in process control systems.



They are TÜV certified in compliance to IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e

Safe double power supply, option /U: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table FY100

Safety function via on/off signals, option /K: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table FY200

11 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	150 years, for futher details see technical table P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$				
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004				
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

12 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DHZO					DKZOR				
Pressure limits	[bar]		ports P , A , B = 350; T = 210 (250 with external drain /Y) Y = 10				ports P , A , B = 315; T = 210 (250 with external drain /Y) Y =			Y = 10	
Configuration			5	1, 53, 71, 7	'3		73	51, 53	71, 73	72	73
Speel type and a	standard	L14	L1	S2	L3,S3,D3	L5,S5,D5		L3,S3,D3	L5,S5,D5	S5	
spool type and sizep/Q							Q5,V9				Q5,V9
Nominal flow	Δp = 10 bar	1	4,5	8	18 (4)	28 (4)	30	45 (4)	75 (4)	75	75
∆p P-T [l/min]	Δp = 30 bar	1,7	8	14	30 (4)	50 (4)	52	80 (4)	130 (4)	130	130
(1)	$\Delta p = 70 \text{ bar}$	2,6	12	21	45 (4)	75 (4)	80	120 (4)	170 (4)	170	170
Max permis	sible flow (2)	4	18	30	50 (4)	80 (4)	80	130 (4)	180 (4)	180	180
Leakage	[cm³/min]	<30 (at p = 100 bar); <135 (at p = 350 bar)					<80 (at p = 100 bar); <600 (at p = 315 bar)				
Response time	(3) [ms]	≤ 15						≤ 20	0		
Hysteresis		\leq 0,2 [% of max regulation]									
Repeatibility ± 0,1 [% of max regula				nax regulat	ion]						
Thermal drift					zero poin	t displacem	ent < 1% a	t $\Delta T = 40^{\circ}C$			

(1) For different Δp , the max flow is in accordance to the diagrams in section 15.2

(2) See detailed diagrams in section 15.3

(3) 0-100% step signal

(4) For spool type \overline{D}^* the flow value is referred to single path P-A (A-T) at $\Delta p/2$ per control edge. The flow P-B (B-T) is 50% of P-A (A-T)

13 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)						
Max power consumption	50 W						
Max. solenoid current	DHZO = 2,6 A	DKZOR = 3	A				
Coil resistance R at 20°C	DHZO = $3 \div 3,3 \Omega$	DHZO = $3 \div 3,3 \Omega$ DKZOR = $3,8 \div 4,1 \Omega$					
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX tolera) mA	ant) Input imp Input imp	bedance: Ri > 50 k Ω bedance: Ri = 500 Ω	2		
Monitor outputs	Output range:	voltage ±10 VDC current ±20 mA @	$^{@}$ max 5 mA $^{@}$ max 500 Ω load res	sistance			
Enable input	Range: 0 ÷ 5 VDC (O	FF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC	(not accepted); Input i	mpedance: Ri > 10 k Ω		
Fault output	Output range: 0 ÷ 2 external negative vo	24 VDC (ON state > [] ltage not allowed (e.g	oower supply - 2 V] ; g. due to inductive lo	OFF state < 1 V) @ m ads)	nax 50 mA;		
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100	mA (E-ATR-8 see tec	h table GS465)				
Alarms	Solenoid not conne valve spool transdu	cted/short circuit, ca cer malfunctions, alar	ole break with currer ms history storage fu	nt reference signal, or Inction	ver/under temperature,		
Insulation class	H (180°) Due to the the European stand	occurring surface ter ards ISO 13732-1 and	nperatures of the sole d EN982 must be take	enoid coils, en into account			
Protection degree to DIN EN60529	IP66 / IP67 with mat	ing connectors					
Duty factor	Continuous rating (E	D=100%)					
Tropicalization	Tropical coating on	electronics PCB					
Additional characteristics	Short circuit protect spool position contr protection against re	ion of solenoid's curre ol (SN) or pressure/fo everse polarity of pow	ent supply; 3 leds for rce control (SP, SF, S /er supply	diagnostic (only for T SL) by P.I.D. with rapid	ES); d solenoid switching;		
Communication interface	USB Atos ASCII coding	IO-Link Interface and System Specification 1.1.3	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT POWERLINK EtherNet/IP PROFINET IO RT/IRT IEC 61158		
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cab	les, see section 23			r		

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the driver energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

14 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$					
Seals, recommended fluid	l temperature	FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$					
		NBR low temp. seals (/BT option	NBR low temp. seals (/BT option) = -40°C \div +60°C, with HFC hydraulic fluids = -20°C \div +50°C				
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s					
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	see also filter section at				
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog				
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard			
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without wa	ater	FKM	HFDU, HFDR	190 12022			
Flame resistant with water		NBR, NBR low temp.	HFC	130 12922			







Hydraulic configuration vs. reference signal for configurations 71, 72 and 73 (standard and option /B)

 $\begin{array}{c} \text{Reference signal} & 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{array} \right\} \text{ P} \rightarrow \text{A} \text{ / B} \rightarrow \text{T} \\ \end{array} \\ \begin{array}{c} \text{Reference signal} & 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{array} \right\} \text{ P} \rightarrow \text{B} \text{ / A} \rightarrow \text{T} \\ \end{array}$

16 = linear spool Q5

Q5 spool type is specific for alternate P/Q controls in combination with S* option of digital on-board drivers (see tech table FS500). It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers

The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.

17 = differential - progressive spool V9

V9 spool type is specific for alternate P/Q controls in combination with S* option of digital on-board drivers (see tech table FS500). This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:

- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank



stated at 100% of valve stroke



DKZOR

6 = spool	S3, L3, D3
7 = spool	S5, L5, D5, V9

15.3 Operating limits

DHZO

1 = spool L14 $\mathbf{2} = spool$ L1 **3** = spool S2 **4** = spool L3, S3, D3 **5** = spool L5, S5, D5, V9 DKZOR



15.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.

32

48

DHZO

100

50

30

10

10

350

280

210

140

70

0

Valve pressure drop Δp [bar]

DHZO

30

2 3

16

70 100

Valve pressure drop Δp [bar]

Flow rate [I/min]





(*) Response time is represented only for 0-100% step; for intermediate steps, the response time increment of presets 2 (balanced) and 3 (smooth) with respect to the preset 1 (dynamic) is proportional to the step amplitude of the reference input signal



16

► T

100

2

200 300

64

80







15.8 Configuration 72

Only for DKZOR-*-S5 the spool overlapping type 2 provides the same characteristic of type 1, but in central position the internal leakages from P to A and B are drained to tank, avoiding the drift of cylinders with differential areas.

16 HYDRAULIC OPTIONS

- B = Solenoid, on-board digital driver and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 15.1
- Y = This option is mandatory if the pressure in port T exceeds 210 bar.

17 ELECTRONIC OPTIONS - not available for TEB-SN-IL

- F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 19.9 for signal specifications.
- I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vpc or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle - see 19.7 for signal specifications
- Z = This option provides, on the 12 pin main connector, the following additional features: Fault output signal - see above option /F Enable input signal - see above option /Q Repeat enable output signal - only for TEB-SN-NP (see 19.8) Power supply for driver's logics and communication - only for TES (see 19.2)
- C = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

18 POSSIBLE COMBINED OPTIONS

Standard versions for TEB-SN-NP and TES-SN: /BF, /BFI, /BFIY, /BFY, /BI, /BIQ, /BIQY, /BIY, /BIYZ, /BIZ, /BQ, /BQY /BY, /BYZ, /BZ, /FI, /FIY, /FY /IQ, /IQY, /IY, /IYZ, /IZ, /QY, /YZ Standard versions for TEB-SN-IL:

/RY

Standard versions for TES-SP, SF, SL /BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY, /CI, /CIY, /CY, /IY

Safety certified versions for TES-SN: /BI/U, /BIY/U, /B/U, /BY/U, /I/U, /IY/U, /Y/U /BI/K, /BIY/K, /B/K, /BY/K, /I/K, /IY/K, /Y/K

Safety certified versions for TES-SP, SF, SL:

/BC/U, /BCI/U, /BCIY/U, /BCY/U, /BI/U, /BIY/U, /B/U, /BY/U, /C/U, /CI/U, /CIY/U, /CY/U, /I/U, /IY/U, /Y/U /BC/K, /BCI/K, /BCIY/K, /BCY/K, /BI/K, /BIY/K, /B/K, /BY/K, /C/K, /CI/K, /CIY/K, /CY/K, /I/K, /IY/K, /Y/K

Note: /T Bluetooth adapter option can be combined with all other options

19 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **TEB-SN-IL** signals see section 20

For certified safety options: /U see tech. table FY100 and /K see tech. table FY200

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 19.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for driver's logic and communication (VL+ and VL0) - only for TES with /Z option and for TES-SP, SF, SL with fieldbus The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V

capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

/ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

19.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are ±10 VDc for standard and 4 ÷ 20 mA for /l option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

19.4 Pressure or force reference input signal (F_INPUT+) - only for TES-SP, SF, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**). Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 $\div 24$ VDC.

19.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

19.6 Pressure or force monitor output signal (F_MONITOR) - only for TES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

19.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

19.8 Repeat enable output signal (R_ENABLE) - only for TEB-SN-NP with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 19.7).

19.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

19.10 Remote pressure/force transducer input signal - only for TES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 21.5).

Analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

19.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for TES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION					
PIN	SET 1	SET 2	SET 3	SET 4		
9	0	24 Vpc	0	24 Vpc		
10	0	0	24 Vpc	24 Vpc		

20 IO-LINK SIGNALS SPECIFICATIONS - only for TEB-SN-IL

20.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDc power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

20.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

20.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

21 ELECTRONIC CONNECTIONS

For electronic connection of certified safety options /U see tech. table FY100 and /K see tech. table FY200

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES			
A	V+		1	Power supply 24 Vbc	Input - power supply			
В	V0			Power supply 0 Voc	Gnd - power supply			
_	AGND		AGND	Analog ground	Gnd - analog signal			
		ENABLE		Enable (24 Vbc) or disable (0 Vbc) the valve, referred to V0	Input - on/off signal			
				Flow reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal			
	Q_INPUT+			Defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable			
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal			
	Q_MONITOR	R referred to:		Flow monitor output signal: ±10 Vpc / ±20 mA maximum range	Output - analog signal			
F	AGND V0			Defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable			
	FAULT		FAULT	Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal			
G	EARTH			Internally connected to the driver housing				

21.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

21.2 Main connector signals - 12 pin (A2) /Z option and TES-SP, SF, SL

PIN	TEB-SN /Z	TES-SN /Z	TES-SP Fieldbus	, SF, SL NP	TECHNICAL SPECIFICATIONS	NOTES
1	V+			Power supply 24 Vbc	Input - power supply	
2	V0				Power supply 0 Vbc	Gnd - power supply
3	ENABLE ref	erred to: VL0	VLO	VO	Enable (24 Vpc) or disable (0 Vpc) the valve	Input - on/off signal
4					Flow reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
4	Q_INPUT+				Defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
5	INPUT-				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	Q_MONITOF	R referred to:			Flow monitor output signal: ±10 VDc / ±20 mA maximum range	Output - analog signal
0	AGND	VLO	VLO	VO	Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
	AGND				Analog ground	Gnd - analog signal
7	NC			Do not connect		
'	F_INPUT+			Pressure/Force reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal	
				Defaults are ± 10 Vpc for standard and 4 \div 20 mA for /I option	Software selectable	
	R_ENABLE				Repeat enable, output repeater signal of enable input, referred to V0	Output - on/off signal
8		NC			Do not connect	
			F_MONITOF	referred to:	Pressure/Force monitor output signal: ±10 Vbc / ±20 mA maximum range	Output - analog signal
			VL0	VO	Defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
	NC				Do not connect	
9		VL+			Power supply 24 Vbc for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
	NC			Do not connect		
10	10 VL0			Power supply 0 VDc for driver's logic and communication	Gnd - power supply	
		D_IN1		D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	FAULT referred to: V0 VL0 VL0 V0		VO	Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal	
PE	EARTH				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

21.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for TEB-SN-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vpc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vpc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vpc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

21.4 Communications connectors (B) - (C)

В	B USB connector - M12 - 5 pin always present					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)				
1	+5V_USB	Power supply				
2	ID	Identification				
3	GND_USB	Signal zero data line				
4	D-	Data line -				
5	D+	Data line +				

(C1)	C1 $C2$ BP fieldbus execution, connector - M12 - 5 pin				
PIN	SIGNAL TECHNICAL SPECIFICATION (1)				
1	+5V	Termination supply signal			
2	LINE-A	Bus line (high)			
3	DGND	Data line and termination signal zero			
4	LINE-B	Bus line (low)			
5	SHIELD				

(1) Shield connection on connector's housing is recommended

C1	C1 C2 BC fieldbus execution, connector - M12 - 5 pin					
PIN	SIGNAL TECHNICAL SPECIFICATION (1)					
1	CAN_SHLD	SHLD Shield				
2	not used	ed C1 - C2 pass-through connection (2)				
3	CAN_GND	AN_GND Signal zero data line				
4	CAN_H	N_H Bus line (high)				
5	CAN_L	CAN_L Bus line (low)				

C1 ($\fbox{(c1)}$ $\fbox{(c2)}$ EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin						
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)					
1	TX+	Transmitter					
2	RX+	Receiver					
3	тх-	Transmitter					
4	RX-	Receiver					
Housing	SHIELD						

(2) Pin 2 can be fed with external +5V supply of CAN interface

21.5 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION			gle transducer (1)	D2 SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	VF +24V	Power supply +24Vbc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vpc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vpc / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

21.6 TEB-SN-NP connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

21.7 TEB-SN-IL connections layout



(1) Pin layout always referred to driver's view



⁽¹⁾ Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

21.9 Diagnostic LEDs - only for TES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	El EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS		LINK/ACT					
L2	NETWORK STATUS		NETWORK STATUS					
L3	SOLENOID STATUS			LIN	K/ACT			

22 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



23 CONNECTORS CHARACTERISTICS - to be ordered separately

23.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A1 ZM-7P	A3 ZH-7P
Туре	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)
Recommended cable	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type to solder		to solder
Protection (EN 60529)	IP 67	IP 67

23.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS				
CODE	A2 ZM-12P	(A4) ZH-12P				
Туре	12pin female straight circular	12pin female straight circular				
Standard	DIN 43651	DIN 43651				
Material	Metallic	Plastic reinforced with fiber glass				
Cable gland	PG13,5	PG16				
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)				
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires				
Connection type	to crimp	to crimp				
Protection (EN 60529)	IP 67	IP 67				

23.3 IO-Link connector - only for TEB-SN-IL

CONNECTOR TYPE	IL IO-Link				
CODE	A ZM-5PF				
Туре	5pin female straight circular				
Standard	M12 coding A – IEC 61076-2-101				
Material	Metallic				
Cable gland	Pressure nut - cable diameter 6÷8 mm				
Recommended cable	5 x 0,75 mm² max 20 m				
Connection type	screw terminal				
Protection (EN 60529)	IP 67				

23.4 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFI	BUS DP (1)	EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)		
CODE	C1 ZM-5PF	©2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E	
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101		
Material	Metallic		Metallic		Metallic		
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm		
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5		
Connection type	screw terminal		screw terminal		terminal block		
Protection (EN 60529)	IP67		IP 67		IP 67		

(1) E-TRM-** terminators can be ordered separately - see tech table GS500

(2) Internally terminated

23.5 Remote pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	SP, SL - Sing	le transducer	SF - Double transducers				
CODE	D1 ZH-5PM/1.5	D1 ZH-5PM/5	D2 ZH-5PM-2/2				
Туре	5 pin male st	raight circular	4 pin male straight circular				
Standard	M12 coding A –	IEC 61076-2-101	M12 coding A – IEC 61076-2-101				
Material	Pla	istic	Plastic				
Cable gland Connect 1,5 m length		ulded on cables 5 m length	Connector moulded on cables 2 m length				
Cable	5 × 0,3	25 mm²	3 x 0,25 mm ² (both cables)				
Connection type	molde	d cable	splitting cable				
Protection (EN 60529)	IP	67	IP 67				

DHZO-TEB, DHZO-TES

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005) (for /Y surface 4401-03-03-0-05 without X port)



DHZO	A1	A2	B (1)	C (1)	D	E (air bleeding)	Mass [kg]	
TEB - SN - IL	140	155	60	-	-		DHZO-*-05	DHZO-*-07
TEB - SN - NP	140	155	100	-	-			
TES - SN - NP, BC, BP, EH	140	155	100	58	8		2,7	3,4
TES - SN - EW, EI, EP	155	155	100	58	8	-		
TES - SP, SF, SL - *	155	155	100	58	8			

(1) The indicated dimension refers to the longer connectors or Bluetooth adapter

For dimensions of connectors and Bluetooth adapter, see sections 21.6, 21.7 and 21.8 (2) Space required for connection cable and for connector removal

DKZOR-TEB, DKZOR-TES

ISO 4401: 2005

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(2)

Mounting surface: 4401-05-04-0-05 (see table P005) (for /Y surface 4401-05-05-0-05 without X port)





DKZOR-TEB-*-17 DKZOR-TES-*-17



DKZOR	A1	A2	B (1)	C (1)	D	E (air bleeding)	Mass [kg]	
TEB - SN - IL	150	165	60	-	-		DKZOR-*-15	DKZOR-*-17
TEB - SN - NP	150	165	100	-	-			
TES - SN - NP, BC, BP, EH	150	165	100	58	8	or	4,7	5,4
TES - SN - EW, EI, EP	165	165	100	58	8	13		
TES - SP, SF, SL - *	165	165	100	58	8			

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(1) The indicated dimension refers to the longer connectors or Bluetooth adapter

For dimensions of connectors and Bluetooth adapter, see sections 21.6, 21.7 and 21.8

(2) Space required for connection cable and for connector removal

Note: for /B option the solenoid, the LVDT transducer and the on-board digital driver are at side of port A
25 FASTENING BOLTS AND SEALS

	DHZO	DKZOR	
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	
0	Seals: 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	Seals: 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)	

26 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric and electronic connectors
FS500	Digital proportional valves with p/Q control	P005	Mounting surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	QB300	Quickstart for TEB valves commissioning
FY100	Safety proportional valves - option /U	QF300	Quickstart for TES valves commissioning
FY200	Safety proportional valves - option /K	Y010	Basics for safety components
GS500	Programming tools	E-MAN-	-RI-LEB TEB/LEB user manual
GS510	Fieldbus	E-MAN-	-RI-LES TES/LES user manual
GS520	IO-Link interface	E-MAN-	-RI-LES-S TES/LES with p/Q control user manual

06/24

atos 🛆

Digital proportional directional valves high performance

direct, with on-board driver, LVDT transducer and positive spool overlap



(1) Reference and monitor signals only via CANopen (analog signals not available)

(2) Possible combined options: /BI, /BJ (/T Bluetooth adapter option can be combined with all other options)

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

3.1 TID-NP

Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with

built-in Bluetooth. It does not support valves with p/Q control or axis controls.





E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

3.2 TID-BC

E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via CANopen connector. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.



Bluetooth or USB connection

CANopen connection



BLUETOOTH OPTION - only for TID-NP - see tech. table **GS500**

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

5 GENERAL CHARACTERISTICS

Assembly position	Any position		
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra \leq 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100		
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature range	Standard = -20° C ÷ $+60^{\circ}$ C /PE option = -20° C ÷ $+60^{\circ}$ C		
Storage temperature range	Standard = -20° C ÷ $+70^{\circ}$ C /PE option = -20° C ÷ $+70^{\circ}$ C		
Surface protection	Zinc coating with black passivation (body), tin plating (driver housing)		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Vibration resistance	See technical table G004		
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006		

6 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DHZE				DKZE								
Pressure limits	[bar]	p	orts P ,	A , B =	350; T = 2	10		ports P , A , B = 315; T = 210					
Spool type and s	size (1)	L3, S3	D	3	L5, S5	D	95	L3, S3	D	3	L5, S5	D	5
Nominal flow Δp (2)	P-T [l/min] Δp= 10 bar	18	Р-А А-Т 18	Р-В В-Т 9	28	Р-А А-Т 28	Р-В В-Т 14	45	Р-А А-Т 45	Р-В В-Т 22	75	Р-А А-Т 75	Р-В В-Т 37
	$\Delta p = 30 \text{ bar}$	30	30	15	50	50	25	80	80	40	130	130	65
	$\Delta p = 70 \text{ bar}$	45	45	22	75	75	37	120	120	60	170	170	85
	Max permissible flow	50	50	25	80	80	40	130	130	65	180	180	90
Leakage	[cm³/min]	<30 (at	p = 100) bar);	<135 (at p =	350 ba	ur)	<80 (at	p = 100) bar);	<600 (at p =	315 ba	r)
Response time (3) [ms]		≤ 15 ≤ 20											
Hysteresis		≤ 0,2 [% of n			% of m	ax regulatior	1]						
Repeatibility		± 0,1 [% of n			% of m	ax regulatior	ו]						
Thermal drift					zero poir	nt displ	aceme	ent < 1% at 2	T = 40)°C			

(1) For spool type D^* the flow value is referred to $\Delta p/2$ per control edge

(2) For different Δp , the max flow is in accordance to the diagrams in section 9.2 (3) 0-100% step signal

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	DHZE = 2,6 A DKZE = 3 A			
Coil resistance R at 20°C	DHZE = $3,1 \Omega$ DKZE = $3,2 \Omega$			
Analog input signals (1)	Voltage: range ± 10 VDC (24 VMAX tolerant)Input impedance: Ri > 50 k Ω Current: range ± 20 mAInput impedance: Ri = 500 Ω			
Monitor outputs (1)	Output range: voltage ±10 VDc @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal (1), over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Additional characteristics	Short circuit protection of solenoid's current supply; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB - Atos ASCII coding CANopen - EN50325-4 + DS408			
Communication physical layer	not insulated - USB 2.0 + USB OTG optical insulated - CAN ISO11898			
Recommended wiring cable	LiYCY shielded cables, see section 15			

(1) Available only for TID-NP

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

8 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult Atos Technical Office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C \div +60°C, with HFC hydraulic fluids = -20°C \div +50°C FKM seals (/PE option) = -20°C \div +80°C			
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid normal operation		ISO4406 class 18/16/13 NAS1638 class 7 s		see also filter section at	
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	100 10000	
Flame resistant with water		NBR	HFC	130 12922	





Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

Reference signal $\begin{array}{c} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{array}
ight\} P \rightarrow A \, / \, B \rightarrow T$ Reference signal $\begin{array}{c} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{array}$ P \rightarrow B / A \rightarrow T





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10 HYDRAULIC OPTIONS

B = Configurations 51, 53: solenoid, on-board digital driver connectors and LVDT transducer at side of port A. Configurations 71, 73: on-board digital driver connections and LVDT transducer at side of port A. For hydraulic configuration vs reference signal, see 9.1

11 ELECTRONIC OPTIONS - only for TID-NP

- This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- J = This option provides 4 ÷ 20 mA current reference and ±10 VDC voltage monitor signals. The valve functioning is disabled in case of reference signal cable breakage.

12 POSSIBLE COMBINED OPTIONS

/BI, /BJ

Note: /T Bluetooth adapter option can be combined with all other options

13 POWER SUPPLY AND SIGNALS SPECIFICATIONS

13.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

A safety fuse is required in series to the power supply: 2,5 A time lag fuse.

13.2 Flow reference input signal (Q_INPUT+) - only for TID-NP

The driver controls in closed loop the valve spool position proportionally to the external reference input signal. Standard (voltage reference input): default is ± 10 VDC and can be reconfigured via software, within a maximum range of ± 10 VDC. Options /I and /J (current reference input): default is $4 \div 20$ mA and can be reconfigured via software, within a maximum range of ± 20 mA.

13.3 Flow monitor output signal (Q_MONITOR) - only for TID-NP

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver.

Standard and option /J (voltage monitor output): default is ±10 VDC and can be reconfigured via software, within a maximum range of ±10 VDC. Option /I (current monitor output): default is 4 ÷ 20 mA and can be reconfigured via software, within a maximum range of ± 20 mA.

Note:

monitor output signal must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

14 ELECTRONIC CONNECTIONS

14.1 Main connector signals - 7 pin (A1) (A2)

PIN	TID-NP	TID-BC	TECHNICAL SPECIFICATIONS	NOTES
А	V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 Vbc	Gnd - power supply
С	AGND	(1)	Analog ground	Gnd - analog signal
D	Q_INPUT+	(1)	Flow reference input signal: ± 10 Vpc for standard, 4 \div 20 mA for /I and /J options	Input - analog signal
Е	INPUT-	(1)	Negative reference input signal for Q_INPUT+	Input - analog signal
F	Q_MONITOR	(1)	Flow monitor output signal: ± 10 Vpc for standard and /J option, 4 \div 20 mA for /I option, referred to AGND	Output - analog signal
G	EARTH		Internally connected to driver housing	

(1) Do not connect for TID-BC

14.2 USB connector - M12 5 pin (B) - only for TID-NP

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(1) Shield connection on connector housing is recommended

14.3 CANopen connector - M12 - 5 pin C - only for TID-BC

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	-
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(1) Shield connection on connector housing is recommended



(1) use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) pin layout always referred to driver's view

15 CONNECTORS CHARACTERISTICS - to be ordered separately

15.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A1 ZM-7P	(A2) ZH-7P
Туре	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

15.2 Fieldbus communication connector - only for TID-BC

CONNECTOR TYPE	CANopen
CODE	C ZM-5PF
Tupo	5 pin female
туре	straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Cable	CANbus Standard (DR 303-1)
Connection type	screw terminal
Protection (EN 60529)	IP67

16 FASTENING BOLTS AND SEALS

	DHZE	DKZE	
	Fastening bolts: 4 socket head screws M5x30 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	
0	Seals: 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm (max)	Seals: 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm (max)	



DHZE-*-07	Mass [kg]
all versions	3

(1) The indicated dimension refers to the longer connectors or Bluetooth adapter For dimensions of connectors and Bluetooth adapter, see section 14.4

165

, pl.

69

338 max

73



18 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting surfaces for electrohydraulic valves
GS500	Programming tools	QD300	Quickstart for TID valves commissioning
GS510	Fieldbus	E-MAN-	RI-TID TID user manual

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Table **F165-5/E**

Proportional directional valves high performance

direct, with LVDT transducer and positive spool overlap



(1) Only for DKZOR-*-S5 the spool overlapping type 2 provides the same characteristic of type 1, but in central position the internal leakages from P to A and B are drained to tank, avoiding the drift of cylinders with differential areas

(2) Possible combined options: /BY

(3) Spools for P/Q control, see section 2

2 MODEL CODE OF SPOOLS FOR ALTERNATED P/Q CONTROL - for valve model code and options, see section 1



3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TEB	E-BM-TES
Туре	digital	digital
Format	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: F	$Ra \leq 0.8$, recommended $Ra 0.4 -$	Flatness ratio 0,01/100			
MTTFd valves according to EN ISO 13849	150 years, see technical table F	P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$	/PE option = $-20^{\circ}C \div +60^{\circ}C$	/BT option = $-40^{\circ}C \div +60^{\circ}C$			
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$	/PE option = $-20^{\circ}C \div +70^{\circ}C$	/BT option = $-40^{\circ}C \div +70^{\circ}C$			
Surface protection	Zinc coating with black passivation					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model				DF	IZO			DKZOR			
Pressure limits	[bar]		ports P , A , B = 350; T = 210 (250 with external drain /Y) Y = 10				T = 210 (ports P , A , 250 with extern	B = 315; nal drain /Y)	Y = 10	
Configuration			5	1, 53, 71, 7	'3		73	51, 53,	71, 73	72	73
Speel type	standard	L14	L1	S2	L3,S3,D3	L5,S5,D5		L3,S3,D3	L5,S5,D5	S5	
Spool type	P/Q						Q5,V9				Q5,V9
Nominal flow	Δp = 10 bar	1	4,5	8	18	28	30	45	75	75	75
∆p P-T [l/min]	Δp = 30 bar	1,7	8	14	30	50	52	80	130	130	130
(1)	$\Delta p = 70 \text{ bar}$	2,6	12	21	45	75	80	120	170	170	170
Max permissible flow (2)		4	18	30	50	80	80	130	180	180	180
Leakage	[cm³/min]		<30 (at p	= 100 bar);	<135 (at p	= 350 bar)		<80 (at p	= 100 bar); <	:600 (at p =	315 bar)
Response time	(3) [ms]	3] ≤ 15 ≤ 20									
Hysteresis		≤ 0,2 [% of max regulation]									
Repeatibility		± 0,1 [% of max regulation]									
Thermal drift					zero poin	t displacem	ent < 1% a	t $\Delta T = 40^{\circ}C$			

(1) For different Δp , the max flow is in accordance to the diagrams in section 8.2

(2) See detailed diagrams in section 8.3

(3) 0-100% step signal

6 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W		
Max. solenoid current	DHZO = 2,6 A	DKZOR = 3 A	
Coil resistance R at 20°C	DHZO = $3 \div 3,3 \Omega$	DKZOR = $3,8 \div 4,1 \Omega$	
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors	3	
Duty factor	Continuous rating (ED=100%	б)	

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid normal operation		ISO4406 class 18/16/13 NAS1638 class 7 s		see also filter section at	
contamination level	longer life	ISO4406 class 16/14/11 NA	www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM HFDU, HFDR		100,10000	
Flame resistant with water		NBR, HNBR	HFC	1 130 12922	

B DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C





Note:

Hydraulic configuration vs. reference signal for configurations 71, 72 and 73 (standard and option /B)

 $\begin{array}{l} \text{Reference signal} & \begin{array}{c} 0 \ \div \ +10 \ V \\ 12 \ \div \ 20 \ \text{mA} \end{array} \right\} \ P \rightarrow A \ / \ B \rightarrow T \\ \text{Reference signal} & \begin{array}{c} 0 \ \div \ -10 \ V \\ 12 \ \div \ 4 \ \text{mA} \end{array} \right\} \ P \rightarrow B \ / \ A \rightarrow T \end{array}$

16 = linear spool Q5

Q5 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**). It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.

The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.

17 = differential - progressive spool V9

V9 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**). This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:

- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank





8.2 Flow /Ap diagrams

stated at 100% of valve stroke

DHZO

1	= spool	L14
2	- 0000	1.1

- 2 = spool L13 = spool S2
- **4** = spool L3, S3, D3
- **5** = spool L5, S5, D5, V9

DKZOR

6 = S	pool	S3,	L3,	D3	
7 = S	pool	S5,	L5,	D5,	V9





8.3 Operating limits

DHZO

1 = spool	L14
2 = spool	L1
3 - shool	S2

• - opoor	02
4 = spool	L3, S3, D3
5 = spool	15 S5 D5 V9

DKZOR

6 = spool S3, L3, D3 **7** = spool S5, L5, D5, V9





8.4 Response time

For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters. Step signal [%] Step signal [%] DHZO DKZOR 100 100 0 -100 0 -100 75 75 Spool stroke [%] Spool stroke [%] 0 -75 0 -75 50 50 0 -50 0 -50 25 25 0 -25 0 - 25 25 0 0 15 10 15 20 25 0 5 10 20 25 0 10 15 20 25 5 10 20 5 15 5 Time [ms] Time [ms]

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.

8.5 Bode diagrams

1 = 10% ↔ 90% nominal stroke

 $\mathbf{2} = 50\% \pm 5\%$ nominal stroke





8.6 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves: Pmax = 250 bar (option /Y advisable)



Max flow	SPOOL TYPE						
$\Delta p = 15 bar [l/min]$	L14	L1	S2	L3 S3	L5 S5		
DHZO	4	16	28	60	100		
DKZOR	-	-	-	160	260		

9 HYDRAULIC OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 8.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

10 ELECTRICAL CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	1 3
2	VT-	Power supply -15VDC	
3	VT+	Power supply +15VDC	
4	GND	Ground	4 2

11 FASTENING BOLTS AND SEALS

	DHZO	DKZOR
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	Seals:	Seals:
\cap	4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)
	1 OR 2025 Diameter of port Y: $\emptyset = 3,2$ mm (only for /Y option)	1 OR 108 Diameter of port Y: $\emptyset = 5$ mm (only for /Y option)

12 INSTALLATION DIMENSIONS [mm]



Note: for option /B the solenoid and the LVDT transducer are at side of port A

13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
GS230	E-BM-TEB digital driver	K800	Electric and electronic connectors
GS240	E-BM-TES digital driver	P005	Mounting surfaces for electrohydraulic valves

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Digital proportional directional valves high performance

piloted with on-board driver, two LVDT transducers and positive spool overlap



(1) For regenerative circuit select configuration 71 or 73 with specific spools D9 or L9, see section 2 For p/Q control select configuration 73 with spools L,S,D, or specific spools Q5, V9, see section 3

(2) Only for DPZO sizes 2, 4, 4M with spools L5, S5 or D5 see 16.4

(3) For possible combined options, see section 19

2 SPOOLS SPECIFIC FOR REGENERATIVE CIRCUIT - for valve model code and options, see section 1



3 SPOOLS SPECIFIC FOR ALTERNATED p/Q CONTROL - for valve model code and options, see section 1



4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

Bluetooth or USB connection



6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth® connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately

7 SMART TUNING

Smart tuning allows to adjust the valve dynamic response in order to match different performance requirements

The valve is provided with 3 factory settings for the spool control:

- dynamic fast response time and high sensitivity for best dynamic performances. Default factory setting for directional valves

 - balanced average response time and sensitivity suitable for major applications
 - smooth attenuated response time and sensitivity to improve control stability in critical applications or in environments with electrical disturbances Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-RI-* and Quickstart, see section 28 For Response time and Bode diagrams see section 16.

8 IO-LINK - only for LEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

9 FIELDBUS - only for LES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

10 ALTERNATED p/Q CONTROLS - only for LES, see tech. table FS500

S* options add the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.

An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions. Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

11 SAFETY OPTIONS - only for LES

Atos range of proportional directional valves, provides functional safety options /U and /K. designed to accomplish a safety function, intended to reduce the risk in process control systems.



Safe double power supply, option /U: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table FY100

Safety function via on/off signals, option /K: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table FY200

AFFT

12 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$				
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004				
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

13 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZO-*-1	DPZO-*-2		DPZO-*-4	DPZO-*-4M	DPZO-*-6	DPZO-*-8	
Pressure limits	[bar]	ports P , A , B , X = 350; T = 250 (10 for option /D); Y = 10;							
Spool type	Spool type standard		L3, S3, D3	.3, S3, D3 L5, DL5, S5, D5		L5, S5, D5			
and size reger	nerative or P/Q	D9, V9, Q5		D9, L9, V9, Q5	D9, V	9, Q5	١	/9	
Nominal flow Δ	p P-T [l/min]								
(1)	Δp = 10 bar	100	160	250	480	550	640	1200	
	Δp = 30 bar	160	270	430	830	950	1100	2000	
Max per	missible flow	180	400	550	1000	1100	1600	3500	
Piloting pressur	e [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 150 bar)							
Piloting volume	e [cm ³]	1,4		3,7	9,0	11,3	21,6	39,8	
Piloting flow (2	2) [l/min]	1,7		3,7	6,8	8	14,4	20	
Leakage (3) P	'ilot [cm³/min]	100 / 300	100) / 300	200 / 500	200 / 600	900 / 2800	900 / 2800	
Main	stage [l/min]	0,15 / 0,5	0,2	2 / 0,6	0,3 / 1,0	0,3 / 1,0	1,0 / 3,0	1,2/3,6	
Response time	(4) [ms]	≤ 50	-	≤ 60	≤ 80	≤ 85	≤ 90	≤ 120	
Hysteresis		≤ 0,1 [% of max regulation]							
Repeatability		± 0,1 [% of max regulation]							
Thermal drift		zero point displacement < 1% at $\Delta T = 40^{\circ}C$							

(1) For different Δp , the max flow is in accordance to the diagrams in section 16.2 (2) With step reference input signal 0 \div 100 %

(3) At p = 100/350 bar

(4) 0-100% step signal see detailed diagrams in section 16.3

14 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)							
Max power consumption	50 W							
Max. solenoid current	2,6 A							
Coil resistance R at 20°C	3 ÷ 3,3 Ω							
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX tolera) mA	ant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$	2			
Monitor outputs	Output range:	voltage ±10 VDC current ±20 mA @	@ max 5 mA $@$ max 500 Ω load res	istance				
Enable input	Range: 0 ÷ 5 VDC (O	FF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC	(not accepted); Input i	mpedance: Ri > 10 k Ω			
Fault output	Output range: 0 ÷ 2 external negative vo	24 VDC (ON state > [oltage not allowed (e.	oower supply - 2 V] ; g. due to inductive lo	OFF state < 1 V) @ m ads)	nax 50 mA;			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100	mA (E-ATR-8 see tec	h table GS465)					
Alarms	Solenoid not conne valve spool transdue	cted/short circuit, ca cer malfunctions, alar	ble break with currer ms history storage fu	nt reference signal, or Inction	ver/under temperature,			
Insulation class	H (180°) Due to the the European stand	occurring surface ter ards ISO 13732-1 and	nperatures of the sole d EN982 must be take	enoid coils, en into account				
Protection degree to DIN EN60529	IP66 / IP67 with mat	ing connectors						
Duty factor	Continuous rating (E	D=100%)						
Tropicalization	Tropical coating on	electronics PCB						
Additional characteristics	Short circuit protect spool position contri- protection against re	ion of solenoid's curre ol (SN) or pressure/fo everse polarity of pov	ent supply; 3 leds for rce control (SP, SF, S ver supply	diagnostic (only for L SL) by P.I.D. with rapic	ES); d solenoid switching;			
Communication interface	USB Atos ASCII coding	IO-Link Interface and System Specification 1.1.3	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT POWERLINK EtherNet/IP PROFINET IO RT/IRT IEC 61158			
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX			
Recommended wiring cable	LiYCY shielded cables, see section 24							

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the driver energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

15 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$				
Recommended viscosity	ecommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS	1638 class 7	see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS	1638 class 5	www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without wa	iter	FKM	HFDU, HFDR	100 10000		
Flame resistant with water		NBR, NBR low temp.	HFC	100 12922		

16.1 Regulation diagrams (values measure at Δp 10 bar P-T)



25 = D5

26 = differential - regenerative spool **D9** (not available for valve size 32 and 35)

D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.



27 = linear - internal regenerative spool L9 (available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.







(not available for valve size 32 and 35)

Q5 spool type is specific for alternate P/Q controls in combination with /S* option of digital on-board drivers, (see tech. table **FS500**).

It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.

The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.



29 = differential - progressive spool V9

V9 spool type is specific for alternate P/Q controls in combination with S^* option of digital on-board drivers, (see tech. table **FS500**).

This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:

- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank



16.2 Operating diagrams

Flow /△p diagram stated at 100% of spool stroke





DPZO-1: 1 = spools L5, S5, D5, DL5, D9, V9, Q5 DPZO-2: 2 = spools L3, S3, D3 3 = spools L5, S5, D5, DL5, D9, L9, V9, Q5 DPZO-4: 4 = spools L5, S5, D5, DL5, D9, V9, Q5 DPZO-4M: 5 = spools L5, S5, D5,DL5, D9, V9, Q5 DPZO-6: 6 = L5, S5, D5, V9 DPZO-8:

7 = L5, S5, D5, V9

16.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.



(*) Response time is represented only for 0-100% step; for intermediate steps, the response time increment of presets 2 (balanced) and 3 (smooth) with respect to the preset 1 (dynamic) is proportional to the step amplitude of the reference input signal

16.4 Configuration 72

Only for DPZO sizes 2, 4, 4M with spools L5 or S5: in central position the leakages P-A and P-B are drained to tank, avoiding the drift of cylinders with differential areas.

17 HYDRAULIC OPTIONS

- **B** = Solenoid, on-board digital driver and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 16.1
- D = Internal drain (through port T).
 Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section ²⁵
 The valve's standard configuration provides internal pilot and external drain.
- E = External pilot (through port X).
 Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section ²⁵
 The valve's standard configuration provides internal pilot and external drain.
- **G** = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

DPZO-1, DPZO-2, DPZO-4(M), DPZO-6 and DPZO-8 = 40 bar

It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

Functional Scheme - example of configuration 71



Pilot valve

Main stage

③ Pressure reducing valve

④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

18 ELECTRONIC OPTIONS - not available for LEB-SN-IL

- **F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. see 20.9 for signal specifications.
- This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 20.7 for signal specifications.
- Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal see above option /F
 Enable input signal see above option /Q
 Repeat enable output signal only for LEB-SN-NP (see 20.8)
 Power supply for driver's logics and communication only for LES (see 20.2)
- **C** = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDc. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ±20 mA.

19 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

Electronic options - Standard versions:						
LEB-SN, LES-SN	LES-SP, SF, SL					
/FI, /IQ, /IZ	/CI					

 Electronic options - Safety certified versions:

 LES-SN
 LES-SP, SF, SL

 ///U, //I/K
 /C/U, //U, /CI/U, /C/K, /I/K, /CI/K

Note: /T Bluetooth adapter option can be combined with all other options

20 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For LEB-SN-IL signals see section 21

For certified safety options: /U see tech. table FY100 and /K see tech. table FY200

20.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 20.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

20.2 Power supply for driver's logic and communication (VL+ and VL0) - only for LES with /Z option and for LES-SP, SF, SL with fieldbus The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

20.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

20.4 Pressure or force reference input signal (F_INPUT+) - only for LES-SP, SF, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**). Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDc or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 $\div 24$ VDc.

20.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

20.6 Pressure or force monitor output signal (F_MONITOR) - only for LES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

20.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

20.8 Repeat enable output signal (R_ENABLE) - only for LEB-SN-NP with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 20.7).

20.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

20.10 Remote pressure/force transducer input signal - only for LES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 22.5).

Analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

20.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for LES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION						
PIN	N SET 1 SET 2		SET 3	SET 4			
9	0	24 VDC	0	24 VDC			
10	0	0	24 Vdc	24 Voc			

21 IO-LINK SIGNALS SPECIFICATIONS - only for LEB-SN-IL

21.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

21.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

21.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

22 ELECTRONIC CONNECTIONS

For electronic connection of certified safety options /U see tech. table FY100 and /K see tech. table FY200

22.1 Main connector signals - 7 pin (A) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
Α	V+			Power supply 24 Voc	Input - power supply
В	V0			Power supply 0 Voc	Gnd - power supply
<u> </u>	AGND AGND Analog ground		Analog ground	Gnd - analog signal	
		ENABLE		Enable (24 Vbc) or disable (0 Vbc) the valve, referred to V0	Input - on/off signal
				Flow reference input signal: ±10 VDc / ±20 mA maximum range	Input - analog signal
	Q_INPUT+			Defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
	Q_MONITOF	R referred to:		Flow monitor output signal: ±10 Vpc / ±20 mA maximum range	Output - analog signal
F	AGND	AGND V0		Defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
			FAULT	Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

22.2 Main connector signals - 12 pin A2 /Z option and LES-SP, SF, SL

PIN	LEB-SN /Z	LES-SN /Z	LES-SP Fieldbus	, SF, SL NP	TECHNICAL SPECIFICATIONS	NOTES
1	V+				Power supply 24 Vbc	Input - power supply
2	VO				Power supply 0 Vbc	Gnd - power supply
3	ENABLE referred to: V0 VL0 VL0		VO	Enable (24 Vpc) or disable (0 Vpc) the valve	Input - on/off signal	
4					Flow reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
4	Q_INPUT+				Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /l option	Software selectable
5	INPUT-				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	Q_MONITOF	referred to:			Flow monitor output signal: ±10 VDc / ±20 mA maximum range	Output - analog signal
0	AGND	VL0	VL0	VO	Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
	AGND			Analog ground	Gnd - analog signal	
7	NC			Do not connect		
<i>'</i>					Pressure/Force reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
	F_INPUT+				Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
	R_ENABLE				Repeat enable, output repeater signal of enable input, referred to VO	Output - on/off signal
Q		NC			Do not connect	
			F_MONITOR	referred to:	Pressure/Force monitor output signal: ±10 Vbc / ±20 mA maximum range	Output - analog signal
			VL0	VO	Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
	NC				Do not connect	
9		VL+			Power supply 24 Vpc for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
	NC			Do not connect		
10	10 VL0			Power supply 0 VDc for driver's logic and communication	Gnd - power supply	
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	FAULT referred to: V0 VL0 V0		VO	Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal	
PE	EARTH				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

22.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for LEB-SN-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vpc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

22.4 Communications connectors (B) - (C)

В	B USB connector - M12 - 5 pin always present					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)				
1	+5V_USB	Power supply				
2	ID	Identification				
3	GND_USB	Signal zero data line				
4	D-	Data line -				
5	D+	Data line +				

C1	C1 C2 BP fieldbus execution, connector - M12 - 5 pin			
PIN	IN SIGNAL TECHNICAL SPECIFICATION (1)			
1	+5V	Termination supply signal		
2	LINE-A	Bus line (high)		
3	DGND	Data line and termination signal zero		
4	LINE-B	Bus line (low)		
5	SHIELD			

(1) Shield connection on connector's housing is recommended

C1	©1 ©2 BC fieldbus execution, connector - M12 - 5 pin				
PIN	SIGNAL TECHNICAL SPECIFICATION (1)				
1	CAN_SHLD	Shield			
2	not used	(c) - (c₂) pass-through connection (2)			
3	CAN_GND	Signal zero data line			
4	CAN_H	Bus line (high)			
5	CAN_L	Bus line (low)			

C1 (C1 $C2$ EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin					
PIN	SIGNAL	SIGNAL TECHNICAL SPECIFICATION (1)				
1	TX+	Transmitter				
2	RX+	Receiver				
3	тх-	Transmitter				
4	RX-	Receiver				
Housing	SHIELD					

(2) Pin 2 can be fed with external +5V supply of CAN interface

22.5 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	D1 SP, SL - Sing	gle transducer (1)	D2 SF - Double transducers (1)		
				Voltage	Current	Voltage	Current	
1	VF +24V	Power supply +24Vbc	Output - power supply	Connect	Connect	Connect	Connect	
2	TR1	1st signal transducer: ±10 Vpc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect	
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/	
4	TR22nd signal transducer: ±10 Vbc / ±20 mA maximum range		Input - analog signal Software selectable	/	/	Connect	Connect	
5	NC	Not connect		/	/	/	/	

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

22.6 LEB-SN-NP connections layout





(1) Pin layout always referred to driver's view



22.9 Diagnostic LEDs - only for LES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS		NETWORK STATUS				() ()	
L3	SC	DLENOID STAT	US		LIN	K/ACT		000

23 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



24 CONNECTORS CHARACTERISTICS - to be ordered separately

24.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	(A1) ZM-7P	A3 ZH-7P		
Туре	7pin female straight circular	7pin female straight circular		
Standard	According to MIL-C-5015	According to MIL-C-5015		
Material	Metallic Plastic reinforced with fiber gla:			
Cable gland	PG11	PG11		
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)		
necommended cable	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)		
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires		
Connection type	to solder	to solder		
Protection (EN 60529)	IP 67	IP 67		

24.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	(A2) ZM-12P	A4 ZH-12P		
Туре	12pin female straight circular	12pin female straight circular		
Standard	DIN 43651	DIN 43651		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG13,5	PG16		
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)		
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires		
Connection type	to crimp	to crimp		
Protection (EN 60529)	IP 67	IP 67		

24.3 IO-Link connector - only for LEB-SN-IL

CONNECTOR TYPE	IL IO-Link			
CODE	A ZM-5PF			
Туре	5pin female straight circular			
Standard	M12 coding A – IEC 61076-2-101			
Material	Metallic			
Cable gland	Pressure nut - cable diameter 6÷8 mm			
Recommended cable	5 x 0,75 mm² max 20 m			
Connection type	screw terminal			
Protection (EN 60529)	IP 67			

24.4 Fieldbus communication connectors

CONNECTOR TYPE	BC CAN	open (1)	BP PROFI	BUS DP (1)	EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)		
CODE	C1 ZM-5PF	©2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E	
Tupo	5 pin female	5 pin male	5 pin female	5 pin male		4 pin male	
туре	straight circular	straight circular	straight circular	straight circular		straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101		
Material	Metallic		Metallic		Metallic		
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6+8 mm		Pressure nut - cable diameter 4÷8 mm		
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5		
Connection type	screw terminal		screw terminal		terminal block		
Protection (EN 60529)	IF	°67	IP 67		IP 67		

(1) E-TRM-** terminators can be ordered separately - see tech table GS500

(2) Internally terminated

24.5 Remote pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers		
CODE	D1 ZH-5PM/1.5	D1 ZH-5PM/5	D2 ZH-5PM-2/2		
Туре	5 pin male straight circular		4 pin male straight circular		
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101		
Material	Plastic		Plastic		
Cable gland	Connector moulded on cables 1,5 m length 5 m length		Connector moulded on cables 2 m length		
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)		
Connection type	molde	d cable	splitting cable		
Protection (EN 60529)	IP	67	IP 67		

25 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain.





 \triangleleft

DPZO-*-1	Α	B (1)	C (1)	E (air bleeding)	Mass [kg]
LEB - SN - IL	256	60	-		
LEB - SN - NP	256	100	-		
LES - SN - NP, BC, BP, EH	256	100	58		9,8
LES - SN - EW, EI, EP	271	100	58	-	
LES - SP, SF, SL - *	271	100	58		

(1) The indicated dimension refers to the longer connectors or Bluetooth adapter

For dimensions of connectors and Bluetooth adapter, see sections 22.6, 22.7 and 22.8 (2) Space required for connection cable and for connector removal



ISO 4401: 2005 Mounting surface: 4401-07-07-0-05 (see table P005)



DPZO-*-2	Α	B (1)	C (1)	E (air bleeding)	Mass [kg]
LEB - SN - IL	237	60	-		
LEB - SN - NP	237	100	-		
LES - SN - NP, BC, BP, EH	237	100	58	3	14,4
LES - SN - EW, EI, EP	252	100	58		
LES - SP, SF, SL - *	252	100	58		
Option /G	+30	30 -			+0,9

 The indicated dimension refers to the longer connectors or Bluetooth adapter For dimensions of connectors and Bluetooth adapter, see sections 22.6, 22.7 and 22.8
 Space required for connection cable and for connector removal

Note: for /B option the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

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					0,		
LEB - SN - IL	308	60	-				
LEB - SN - NP	308	100	-				
LES - SN - NP, BC, BP, EH	323	100	58		3	43,4	
LES - SN - EW, EI, EP	323	100	58	1			
LES - SP, SF, SL - *	323	100	58	1			
Option /G	+40	40 -			+0,9		

 The indicated dimension refers to the longer connectors or Bluetooth adapter For dimensions of connectors and Bluetooth adapter, see sections 22.6, 22.7 and 22.8
 Space required for connection cable and for connector removal

Note: for /B option the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage



Note: for /B option the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

27 FASTENING BOLTS AND SEALS

Туре	Size	Fastening bolts	Seals		
	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050 Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)		
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130 Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)		
0070	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112 Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)		
DP2O	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137 Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)		
	6 = 32	6 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	4 OR 144 Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)		
	8 = 35	6 socket head screws M20x100 class 12.9 Tightening torque = 600 Nm	4 OR 156 Diameter of ports A, B, P, T: Ø 50 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 9 mm (max)		

28 RELATED DOCUMENTATION

FS001 FS500 FS900	Basics for digital electrohydraulics Digital proportional valves with p/Q control Operating and maintenance information for proportional valves	K800 P005 OB320	Electric and Mounting	nd electronic connectors surfaces for electrohydraulic valves t for LEB valves commissioning
FY100	Safety proportional valves - option /U	QF320	Quickstar	t for LES valves commissioning
FY200	Safety proportional valves - option /K	Y010	Basics for	r safety components
GS500	Programming tools	E-MAN-	RI-LEB	TEB/LEB user manual
GS510	Fieldbus	E-MAN-	RI-LES	TES/LES user manual
GS520	IO-Link interface	E-MAN-	RI-LES-S	TES/LES with p/Q control user manual

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Proportional directional valves high performance

piloted, with two LVDT transducers and positive spool overlap




3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LEB	E-BM-LES	
Туре	digital	digital	
Format	DIN-rail panel	DIN-rail panel	
Tech table	GS230	GS240	

4 GENERAL CHARACTERISTICS

Assembly position	Any position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra	$a \le 0.8$, recommended Ra 0.4 –	Flatness ratio 0,01/100			
MTTFd valves according to EN ISO 13849	75 years, for futher details see te	echnical table P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$					
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$	/PE option = $-20^{\circ}C \div +70^{\circ}C$	/BT option = $-40^{\circ}C \div +70^{\circ}C$			
Surface protection	Zinc coating with black passivation					
Corrosion resistance	Salt spray test (EN ISO 9227) > 2	200 h				
Vibration resistance	See technical table G004					
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZO-L-1	DPZ	0-L-2	DPZO-L-4	DPZO-L-4M	DPZO-L-6
Pressure limits	[bar]		ports P, A,	B , X = 350; T = 2	250 (10 for option /E	D); Y = 10;	
Spool type	standard	L5, DL5, S5, D5	L3, S3, D3	L5, DL5, S5, D5 L5,			L5, S5, D5
regen	erative or P/Q	D9, V9, Q5		D9, L9, V9, Q5	D9, V	9, Q5	V9
Nominal flow Δ	p P-T [l/min]						
(1)	Δp = 10 bar	100	160	250	480	550	640
	Δp = 30 bar	160	270	430	830	950	1100
Max permissible flow [I/min]		180	400	550	1000	1100	1600
Piloting pressur	e [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 150 bar)					
Piloting volume	e [cm ³]	1,4	3,7		9,0	11,3	21,6
Piloting flow (2	.) [l/min]	1,7	3,7		6,8	8	14,4
Leakage (3) Pi	ilot [cm³/min]	100 / 300	100 / 300		200 / 500	200 / 600	900 / 2800
Main	stage [l/min]	0,15 / 0,5	0,2	/ 0,6	0,3 / 1,0	0,3 / 1,0	1,0 / 3,0
Response time (4) [ms]		≤ 50	≤	60	≤ 80	≤ 85	≤ 90
Hysteresis		≤ 0,1 [% of max regulation]					
Repeatability		± 0,1 [% of max regulation]					
Thermal drift			zero point displacement < 1% at $\Delta T = 40^{\circ}C$				

(1) For different $\Delta p,$ the max flow is in accordance to the diagrams in section 8.2 (2) With step reference input signal 0 ÷100 %

(3) At p = 100/350 bar (4) 0-100% step signal see detailed diagrams in section 8.3

6 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	$3 \div 3,3 \Omega$
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1638 class 7 see also filter s		see also filter section at	
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	190 12022	
Flame resistant with water		NBR, NBR low temp.	HFC	130 12922	

8.1 Regulation diagrams (values measure at Δp 10 bar P-T)



Note:

Hydraulic configuration vs. reference signal (standard and option /B)

 $\begin{array}{l} \text{Reference signal} & \begin{array}{c} 0 & \div +10 \ V \\ 12 & \div & 20 \ \text{mA} \end{array} \right\} & P \rightarrow A \ / \ B \rightarrow T \\ \text{Reference signal} & \begin{array}{c} 0 & \div & -10 \ V \\ 12 & \div & 4 \ \text{mA} \end{array} \right\} & P \rightarrow B \ / \ A \rightarrow T \end{array}$

23 = differential - regenerative spool **D9** (not available for valve size 32 and 35)

D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.



24 = linear - internal regenerative spool L9 (available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.



(not available for valve size 32 and 35)

Q5 spool type is specific for alternate P/Q controls in combination with /S* option of digital integral drivers, (see tech. table **FS500**).

It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.

The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.







26 = differential - progressive spool V9

V9 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**).

This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:

- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank



8.2 Operating diagrams

Flow /△p diagram stated at 100% of spool stroke





DPZO-1:
1 = spools L5, S5, D5, DL5, D9, V9, Q5
DPZO-2:
2 = spools L3, S3, D3
3 = spools L5, S5, D5, DL5, D9, L9, V9, Q5
DPZO-4:
4 = spools L5, S5, D5, DL5, D9, V9, Q5
DPZO-4M:
5 = spools L5, S5, D5, DL5, D9, V9, Q5
DPZO-6:
6 = L5, S5, D5, V9

8.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



9 HYDRAULIC OPTIONS

- **B** = Solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 8.1
- D = Internal drain (through port T).
 Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12
 The valve's standard configuration provides internal pilot and external drain.
- E = External pilot (through port X).
 Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section ¹²
 The valve's standard configuration provides internal pilot and external drain.
- **G** = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

DPZO-1, DPZO-2, DPZO-4(M) and DPZO-6 = 40 bar

It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

Functional Scheme - example of configuration 71



1) Pilot valve

Main stage

③ Pressure reducing valve

④ Plug to be added for external pilot trough port X

(5) Plug to be removed for internal drain through port T

10 ELECTRICAL CONNECTION - connectors supplied with the valve

10.1 Pilot valve solenoid connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666	
1	COIL	Power supply		
2	COIL	Power supply		
3	GND	Ground		

10.3 LVDT main stage transducer connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code
1 PROG		Do not connect	2BE-08
2	VT+	Power supply +15VDC	
3	AGND	Ground	
4	TR	Output signal	
5	VT-	Power supply -15VDC	

11 FASTENING BOLTS AND SEALS

Туро	Sizo	Eastening bolts	Seals		
туре	Size		Seals		
	1 - 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max)		
	1 = 10		2 OR 108 Diameter of ports X, Y: $\emptyset = 5 \text{ mm} (\text{max})$		
	2 – 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max)		
0070	2 = 10	2 - 10	2 socke Tighteni	2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 - 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max)		
5120	4 - 20		2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)		
	4 M - 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max)		
			2 OR 3056 Diameter of ports X, Y: $\emptyset = 7 \text{ mm} (\text{max})$		
	6 = 32	6 socket head screws M20x80 class 12.9	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max)		
	0 - 52	Tightening torque = 600 Nm	2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)		

10.2 LVDT pilot transducer connector

PIN	SIGNAL TECHNICAL SPECIFICATION		Connector code 345
1	TR	Output signal	1 3
2	VT-	Power supply -15VDC	
3	VT+	Power supply +15VDC	
4	GND	Ground	4 2

12 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain.





Notes: the overall height is increased by 30 mm for /G option (0,9 kg);

for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

DPZO-L-4

ISO 4401: 2005 Mounting surface: 4401-08-08-0-05(see table P005)

DPZO-L-4M

ISO 4401: 2005 Mounting surface: 4401-08-08-0-05(see table P005) ports A, B, P, T Ø 32mm



Mass [kg]

17,5

DPZO-L-4

Notes: the overall height is increased by 40 mm for /G option (0,9 kg); for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

14 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
GS230	E-BM-LEB digital driver	K800	Electric and electronic connectors
GS240	E-BM-LES digital driver	P005	Mounting surfaces for electrohydraulic valves

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Digital proportional directional valves high performance

piloted, with on-board driver, LVDT transducer and positive spool overlap



(1) For regenerative circuit select configuration 71 or 73 with specific spools D9 or L9, see section 2 (2) Only for DPZO sizes 2, 4 with spools L5, S5 or D5, see 13.5

(3) For possible combined option, see section 16

2 SPOOLS SPECIFIC FOR REGENERATIVE CIRCUIT - for valve model code and options, see section 1



3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

4.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.







4.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

5 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500** T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

6 IO-LINK - only for TEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

7 FIELDBUS - only for TES, see tech. table GS510

signal only when the valve is in safe condition, see tech table FY200

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

8 SAFETY OPTIONS - only for TES

Atos range of proportional directional valves, provides functional safety options /U and /K, designed to accomplish a safety function, intended to reduce the risk in process control systems.





Safe double power supply, option /U: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table FY100 Safety function via on/off signals, option /K: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement

Bluetooth or USB connection



9 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007					
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$					
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Vibration resistance	See technical table G004					
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZO-*-1	DPZO-*-2		DPZO-*-4	DPZO-*-6	
Pressure limits [bar]			ports P , A , B , X = 350; T = 250 (10 for option /D); Y = 10;				
Speel type and size	standard	L5, DL5, S5, D5	L3, S3, D3	L5, DL5	i, S5, D5	L5, S5, D5	
Spool type and size	regenerative	D9		D9, L9	D9		
Nominal flow ∆p P-T	[l/min]						
(1)	∆p= 10 bar	100	160	250	480	640	
	∆p= 30 bar	160	270	430	830	1100	
Max permissible flow		180	400	550	1000	1600	
Piloting pressure	[bar]	min. = 25; max = 350					
Piloting volume	[cm ³]	1,4	3,7		9,0	21,6	
Piloting flow (2)	[l/min]	1,7	3,7		6,8	14,4	
	Pilot [cm³]	100 / 300	100 / 300		200 / 500	900 / 2800	
Main	n stage [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	1,0 / 3,0	
Response time (4) [ms]		≤ 60	≤ 75		≤ 90	≤ 120	
Hysteresis		≤ 1 [% of max regulation]					
Repeatability		± 0,5 [% of max regulation]					
Thermal drift			zero point o	displacement < 1% a	$t \Delta T = 40^{\circ}C$		

(1) For different $\Delta p,$ the max flow is in accordance to the diagrams in section 13.2 (2) With step reference input signal 0 $\div100~\%$

(3) At p = 100/350 bar

(4) 0-100% step signal see detailed diagrams in section 13.3

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC						
	Rectified and filtered	d : VRMS = 20 ÷ 32 '	VMAX (ripple max 10 °	% Vpp)			
Max power consumption	50 W	50 W					
Max. solenoid current	2,6 A						
Coil resistance R at 20°C	3 ÷ 3,3 Ω						
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX toler) mA	ant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$	2		
Monitor outputs	Output range:	voltage ±10 VDC current ±20 mA @	@ max 5 mA @ max 500 Ω load res	sistance			
Enable input	Range: 0 ÷ 5 VDC (O	FF state), 9 ÷ 24 VDC	(ON state), 5 ÷ 9 VDC	(not accepted); Input in	mpedance: $Ri > 10 k\Omega$		
Fault output	Output range: 0 ÷ 2 external negative vo	Output range: 0 - 24 VDC (ON state > [power supply - 2 V]; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)					
Alarms	Solenoid not connervalve spool transdu	cted/short circuit, ca cer malfunctions, ala	ble break with current ms history storage fu	nt reference signal, or Inction	ver/under temperature,		
Insulation class	H (180°) Due to the the European stand	occurring surface ter ards ISO 13732-1 an	mperatures of the sole d EN982 must be tak	enoid coils, en into account			
Protection degree to DIN EN60529	IP66 / IP67 with mat	ing connectors					
Duty factor	Continuous rating (E	D=100%)					
Tropicalization	Tropical coating on	electronics PCB					
Additional characteristics	Short circuit protect control by P.I.D. with	ion of solenoid's curr h rapid solenoid swite	ent supply; 3 leds for ching; protection aga	diagnostic (only for T inst reverse polarity of	ES); spool position power supply		
Communication interface	USB	IO-Link Interface and System		PROFIBUS DP	EtherCAT POWERLINK EtherNet/IP PROFINET IO RT/IRT		
			EINOU320-4 + DS408	ENDUT/U-2/IEC61158			
Communication physical layer	USB 2.0 + USB OTG	class port B	CAN ISO11898	RS485	100 Base TX		
Recommended wiring cable	LiYCY shielded cables, see section 20						

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the driver energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

12 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	I temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$					
Recommended viscosity		20÷100 mm²/s - max allowed ra	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s				
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1	638 class 7	see also filter section at			
	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog				
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard			
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without water		FKM	HFDU, HFDR	100 10000			
Flame resistant with water		NBR, NBR low temp.	HFC	100 12922			

13 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)





 $\mathbf{1} = L5$ $\mathbf{2A} = DL5 (P \rightarrow A, A \rightarrow T)$ $\mathbf{4A} = D5 (P \rightarrow A, A \rightarrow T)$ $\mathbf{3} = S5$ $\mathbf{2B} = DL5 (P \rightarrow B, B \rightarrow T)$ $\mathbf{4B} = D5 (P \rightarrow B, B \rightarrow T)$









Note:

Hydraulic configuration vs. reference signal (standard and option /B) Reference signal $\begin{array}{c} 0 & \div +10 \text{ V} \\ 12 & \div 20 \text{ mA} \end{array}$ $P \rightarrow A \ / B \rightarrow T$

Reference signal $\begin{array}{c} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{array} \right\} \text{ P} \rightarrow \text{B} / \text{A} \rightarrow \text{T}$

 19 = differential - regenerative spool D9 (not available for valve size 32)
 D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.



20 = linear - internal regenerative spool **L9** (available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.





13.2 Operating diagrams

Flow /Ap diagram stated at 100% of spool stroke







13.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.

For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.





13.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves: Pmax = 250 bar



DPZO-*-	151-L5	251-L5	451-L5	651-L5
Max flow [l/min]	320	860	1600	2200
$\Delta p = 15 \text{ bar}$	320	000	1000	2200

13.5 Configuration 72

Only for **DPZO** sizes **2**, **4** with spools **L5** or **S5**: in central position the leakages P-A and P-B are drained to tank, avoiding the drift of cylinders with differential areas.

14 HYDRAULIC OPTIONS

- **B** = Solenoid, on-board digital driver and LVDT transducer at side of port A of the main stage (side B of pilot valve). For hydraulic configuration vs reference signal, see 13.1
- \mathbf{D} = Internal drain (through port T).

Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section [22] The valve's standard configuration provides internal pilot and external drain.

 \mathbf{E} = External pilot (through port X).

Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 22 The valve's standard configuration provides internal pilot and external drain.

 Pilot valve 	③ Pressure reducing valve
 Main stage 	④ Plug to be added for external pilot trough port X
	(5) Plug to be removed for internal drain through port T

Functional Scheme - example of configuration 71



15 ELECTRONIC OPTIONS - not available for TEB-SN-IL

- **F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. see 17.7 for signal specifications.
- This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 17.5 for signal specifications.
- Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal see above option /F
 Enable input signal see above option /Q
 Repeat enable output signal only for TEB-SN-NP (see 17.6)
 Power supply for driver's logics and communication only for TES (see 17.2)

16 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

TEB-SN, TES-SN

/FI, /IQ, /IZ

Electronic options - Standard versions:

Electronic options - Safety certified versions: TES-SN /I/U, /I/K

Note: /T Bluetooth adapter option can be combined with all other options

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **TEB-SN-IL** signals see section 18

For certified safety options: /U see tech. table FY100 and /K see tech. table FY200

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for TES with /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

🔨 A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

17.4 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDc for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDc or ± 20 mA.

17.5 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

17.6 Repeat enable output signal (R_ENABLE) - only for TEB-SN-NP with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 17.5).

17.7 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

18 IO-LINK SIGNALS SPECIFICATIONS - only for TEB-SN-IL

18.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

18.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

18.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

19 ELECTRONIC CONNECTIONS AND LEDS

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
Α	V+			Power supply 24 Vbc	Input - power supply
В	VO			Power supply 0 VDC	Gnd - power supply
C	AGND AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
	D Q_INPUT+			Flow reference input signal: ±10 Vbc / ±20 mA maximum range	Input - analog signal
				Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
	Q_MONITO	R referred to:		Flow monitor output signal: ±10 Vbc / ±20 mA maximum range	Output - analog signal
F	AGND V0			Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Software selectable
	FAULT			Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

19.1 Main connector signals - 7 pin - standard, /F and /Q options A

19.2 Main connector signal - 12 pin - /Z option (A2)

PIN	TEB /Z	TES /Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 Vbc	Input - power supply
2	V0		Power supply 0 Vbc	Gnd - power supply
3	ENABLE ref	erred to: VL0	Enable (24 VDC) or disable (0 VDC) the valve	Input - on/off signal
1		-	Flow reference input signal: ±10 Vbc / ±20 mA maximum range	Input - analog signal
-	Q_INPUT+		Defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
5	INPUT-		Negative reference input signal for Q_INPUT+	Input - analog signal
6	Q_MONITOR referred to:		Flow monitor output signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
0	AGND	VL0	Defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
7	AGND		Analog ground	Output - analog signal
'	NC		Do not connect	Gnd - analog signal
Q	R_ENABLE		Repeat enable, output repeater signal of enable input, referred to V0	Output - on/off signal
		NC	Do not connect	
0	NC		Do not connect	
3	VL+		Power supply 24 Vpc for driver's logic and communication	Input - power supply
10	NC	Do not connect		
10		VL0	Power supply 0 Vbc for driver's logic and communication	Gnd - power supply
11	FAULT refer	red to: VL0	Fault (0 Vpc) or normal working (24 Vpc)	Output - on/off signal
PE	EARTH		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

19.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for TEB-SN-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vpc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vbc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vpc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

19.4 Communications connectors (B) - (C)

	B USB connector - M12 - 5 pin always present						
PIN	SIGNAL	FECHNICAL SPECIFICATION (1)					
1	+5V_USB	Power supply					
2	ID	Identification					
3	GND_USB	Signal zero data line					
4	D-	Data line -					
5	D+	Data line +					

\bigcirc \bigcirc BP fieldbus execution, connector - M12 - 5 pin					
PIN	SIGNAL TECHNICAL SPECIFICATION (1)				
1	+5V	Termination supply signal			
2	LINE-A	Bus line (high)			
3	DGND	Data line and termination signal zero			
4	LINE-B	Bus line (low)			
5	SHIELD				

C1 (C1 $C2$ BC fieldbus execution, connector - M12 - 5 pin				
PIN	I SIGNAL TECHNICAL SPECIFICATION (1)				
1	CAN_SHLD	Shield			
2	not used	©1 - ©2 pass-through connection (2)			
3	CAN_GND	Signal zero data line			
4	CAN_H	Bus line (high)			
5	CAN_L	Bus line (low)			

C1 (©1 ©2 EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin							
PIN	SIGNAL	SIGNAL TECHNICAL SPECIFICATION (1)						
1	TX+	Transmitter						
2	RX+	Receiver						
3	ТХ-	Transmitter						
4	RX-	Receiver						
Housing	SHIELD							

(1) shield connection on connector's housing is recommended

(2) Pin 2 can be fed with external +5V supply of CAN interface

19.5 TEB-SN-NP connections layout





(1) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

19.8 Diagnostic LEDs - only for TES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	El EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS				LIN	K/ACT		

20 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A1 ZM-7P	A3 ZH-7P
Туре	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

21.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2) ZM-12P	A4 ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

21.3 IO-Link connector - only for TEB-SN-IL

CONNECTOR TYPE	IL IO-Link
CODE	A ZM-5PF
Туре	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

21.4 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)		
CODE	C1) ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E	
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular	
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B –	IEC 61076-2-101	M12 co	ding D – IEC 61076-2-101	
Material	Me	tallic	Metallic			Metallic	
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cab	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Stand	lard (DR 303-1)	PROFIBUS DP Standard		PROFIBUS DP Standard Ethernet standar		ernet standard CAT-5
Connection type	screw	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IF	267	IF	° 67		IP 67	

(1) E-TRM-** terminators can be ordered separately - see tech table GS500

(2) Internally terminated

22 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain



23 FASTENING BOLTS AND SEALS

Туре	Size	Fastening bolts	Seals
	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050 Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
DPZO	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130 Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112 Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	4 OR 144 Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

ISO 4401: 2005

Mounting surface: 4401-05-05-0-05 (see table P005)



For dimensions of connectors and Bluetooth adapter, see sections 19.5, 19.6 and 19.7

(2) Space required for connection cable and for connector removal

Note: for /B option the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage

ISO 4401: 2005 Mounting surface: 4401-07-07-0-05

(see table P005)



(2) Space required for connection cable and for connector removal

Note: for /B option the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage

ISO 4401: 2005 Mounting surface: 4401-08-08-0-05

(see table P005)



(2) Space required for connection cable and for connector removal

Note: for /B option the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage

ISO 4401: 2005 Mounting surface: 4401-10-09-0-05 (see table P005)







DPZO-*-6	A1	A2	B (1)	C (1)	E (air bleeding)	Mass	s [kg]
TEB - SN - IL	308	323	60	-		DP70_*-65	DP70_*-67
TEB - SN - NP	308	323	100	-	3	DI 2000	DI 2007
TES - SN - NP, BC, BP, EH	308	323	100	58		40.4	44.1
TES - SN - EW, EI, EP	323	323	100	58		43,4	44,1

(1) The indicated dimension refers to the longer connectors or Bluetooth adapter

For dimensions of connectors and Bluetooth adapter, see sections 19.5, 19.6 and 19.7

(2) Space required for connection cable and for connector removal

Note: for /B option the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage

25 RELATED DOCUMENTATION

FS001 FS900 FY100 FY200	Basics for digital electrohydraulics Operating and maintenance information for proportional valves Safety proportional valves - option /U Safety proportional valves - option /K	K800 P005 QB320 QF320	Electric a Mounting Quicksta Quicksta	and electronic connectors g surfaces for electrohydraulic valves rt for TEB valves commissioning rt for TES valves commissioning
GS500	Programming tools	Y010	Basics fo	or safety components
GS510	Fieldbus	E-MAN-	RI-LEB	TEB/LEB user manual
GS520	IO-Link interface	E-MAN-	RI-LES	TES/LES user manual

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Digital proportional directional valves high performance

piloted, with on-board driver, LVDT transducer and positive spool overlap



(1) Reference and monitor signals only via CANopen (analog signals not available)

(2) Only for DPZE sizes 2, 4, with spools L5, S5 or D5 see 10.4

(3) For possible combined options, see section 13

(4) Pilot and Drain configuration: standard configuration is internal pilot and external drain, other configurations on request

(5) For regenerative circuit select configuration 71 or 73 with specific spools D9 or L9, see section 2

2 SPOOLS SPECIFIC FOR REGENERATIVE CIRCUIT - for valve model code and options, see section 1



3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

4.1 TID-NP

Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

4.2 TID-BC

E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via CANopen connector. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.





CANopen connection



5 BLUETOOTH OPTION - only for TID-NP - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500** T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

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6 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra \leq 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007				
Ambient temperature range	Standard = -20° C \div $+60^{\circ}$ C /PE option = -20° C \div $+60^{\circ}$ C				
Storage temperature range	Standard = -20° C \div $+70^{\circ}$ C /PE option = -20° C \div $+70^{\circ}$ C				
Surface protection	Zinc coating with black passivation (body), tin plating (driver housing)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004				
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZ	E-*-2	DPZE-*-4	DPZE-*-6		
Pressure limits	[bar]	por	ports P , A , B , X = 350; T = 250 (10 for option /D); Y = 10;				
Speel type and size (standard	L3, S3, D3	L5, DL5	i, S5, D5	L5, S5, D5		
	regenerative		D9, L9	D9			
Nominal flow $\Delta p P-T$	[l/min]						
(2)	Δp = 10 bar	160	250	480	640		
	$\Delta p = 30 \text{ bar}$	270	430	830	1100		
Max permissible flow		400	550	1000	1600		
Piloting pressure	[bar]		min. = 25;	max = 350			
Piloting volume	[cm ³]	3	,7	9,0	21,6		
Piloting flow (3)	[l/min]	3	,7	6,8	14,4		
	Pilot [cm³]	100 ,	/ 300	200 / 500	900 / 2800		
Mai	n stage [l/min]	0,2	/ 0,6	0,3 / 1,0	1,0 / 3,0		
Response time (5)	[ms]	\leq	75	≤ 90	≤ 120		
Hysteresis ≤ 1 [% of max regulation]							
Repeatability			± 0,5 [% of m	ax regulation]			
Thermal drift		zero point displacement < 1% at $\Delta T = 40^{\circ}C$					

(1) For spool type **D** and **DL** the flow value is referred to single path P-A (A-T) at $\Delta p/2$ per control edge. The flow P-B (B-T) is 50% of P-A (A-T)

(3) With step reference input signal 0 ÷100 %

(4) At p = 100/350 bar

(2) For different Δp , the max flow is in accordance to the diagrams in section 10.2

(5) 0-100% step signal see detailed diagrams in section 10.3

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	50 W					
Max. solenoid current	2,6 A					
Coil resistance R at 20°C	3,1 Ω					
Analog input signals (1)	Voltage: range ±10 VDC (24 VMAX tolerant) Current: range ±20 mA	$\begin{array}{llllllllllllllllllllllllllllllllllll$				
Monitor outputs (1)	Output range: voltage ±10 VDc @ max 5 mA current ±20 mA @ max 500 Ω load resistance					
Alarms	Solenoid not connected/short circuit, cable break with current reference signal (1), over/under temperature, valve spool transducer malfunctions, alarms history storage function					
Insulation class	H (180°) Due to the occurring surface temperative European standards ISO 13732-1 and ENS	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account				
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors	IP66 / IP67 with mating connectors				
Duty factor	Continuous rating (ED=100%)					
Additional characteristics	Short circuit protection of solenoid's current supply; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply					
Communication interface	USB - Atos ASCII coding	CANopen - EN50325-4 + DS408				
Communication physical layer	not insulated - USB 2.0 + USB OTG optical insulated - CAN ISO11898					
Recommended wiring cable	LiYCY shielded cables, see section 16					

(1) Available only for TID-NP

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	l temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$			
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS	O4406 class 18/16/13 NAS1638 class 7		
contamination level longe		ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM	HL, HLP, HLPD, HVLP, HVL	PD DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	150 12022	
Flame resistant with water		NBR HFC ISO 129			

10 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)















Note:

Hydraulic configuration vs. reference signal (standard and option /B)

TID-NP

TID-BC

Reference signal $\begin{array}{c} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{array}$	$\Big\} P \to A / B \to T$	Positi
Reference signal $\begin{array}{c} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{array}$	$\Big\} \ P \to B / A \to T$	Nega

Positive reference signal	$P \to A / B \to T$
Negative reference signal	$P \rightarrow B / A \rightarrow T$

19 = differential - regenerative spool **D9** (not available for valve size 32)

D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.



20 = linear - internal regenerative spool **L9** (available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.





10.2 Operating diagrams

Flow / Ap diagram stated at 100% of spool stroke



1 = spools L3, S3, D3 2 = spools L5, S5, D5, DL5, D9, L9





10.3 Response time

DPZE-4

100

75

50

25

0

Spool stroke [%]

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.

For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

Step signal [%]

-100

0 -75

0 -50

0 - 25

80 100 0

Time [ms]

20 40 60

60



10.4 Configuration 72

20 40

Only for DPZE sizes 2 and 4 with spools L5, S5 or D5: in central position the leakages P-A and P-B are drained to tank, avoiding the drift of cylinders with differential areas.

80 100

11 HYDRAULIC OPTIONS

- B = Configurations 71, 73: on-board digital driver connectors and LVDT transducer at side of port A of the main stage (side B of pilot valve).
 For hydraulic configuration vs reference signal, see 9.1
- **D** = Internal drain.

Pilot and drain configuration can be modified as shown in section 17. The valve's standard configuration provides internal pilot and external drain.

\mathbf{E} = External pilot (through port X).

Pilot and drain configuration can be modified as shown in section 17. The valve's standard configuration provides internal pilot and external drain.

① Pilot valve
 ③ Pressure reducing valve
 ③ Main stage
 ④ Plug to be added for external pilot trough port X
 ⑤ Plug to be removed for internal drain through port T

Functional Scheme - example of configuration 71



12 ELECTRONIC OPTIONS - only for TID-NP

- I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- **J** = This option provides 4 ÷ 20 mA current reference and ±10 VDC voltage monitor signals. The valve functioning is disabled in case of reference signal cable breakage.

13 POSSIBLE COMBINED OPTIONS

for **TID-NP**: /BD, /BE, /BI, /BJ, /BDE, /BDI, /BDJ, /BEI, /BEJ, /BDEI, /BDEJ, /DE, /DI, /DJ, /DEI, /DEJ, /EI, /EJ for **TID-BC**: /BD, /BE, /DE, BDE,

Note: /T Bluetooth adapter option can be combined with all other options

14 POWER SUPPLY AND SIGNALS SPECIFICATIONS

14.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

A safety fuse is required in series to the power supply: 2,5 A time lag fuse.

14.2 Flow reference input signal (Q_INPUT+) - only for TID-NP

The driver controls in closed loop the valve spool position proportionally to the external reference input signal. Standard (voltage reference input): default is ± 10 VDC and can be reconfigured via software, within a maximum range of ± 10 VDC. Options /l and /J (current reference input): default is $4 \div 20$ mA and can be reconfigured via software, within a maximum range of ± 20 mA.

14.3 Flow monitor output signal (Q_MONITOR) - only for TID-NP

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver.

Standard and option // (voltage monitor output): default is ± 10 VDC and can be reconfigured via software, within a maximum range of ± 10 VDC. Options /l and /J (current monitor output): default is $4 \div 20$ mA and can be reconfigured via software, within a maximum range of ± 20 mA.

Note:

monitor output signal must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

15 ELECTRONIC CONNECTIONS

15.1 Main connector signals - 7 pin (A1) (A2)

-				
PIN	TID-NP	TID-BC	TECHNICAL SPECIFICATIONS	NOTES
А	A V+		Power supply 24 VDC	Input - power supply
В	В V0		Power supply 0 Vbc	Gnd - power supply
С	AGND	(1)	Analog ground	Gnd - analog signal
D	Q_INPUT+	(1)	Flow reference input signal: ± 10 Vpc for standard, 4 \div 20 mA for /I and /J options	Input - analog signal
Е	INPUT-	(1)	Negative reference input signal for Q_INPUT+	Input - analog signal
F	Q_MONITOR	(1)	Flow monitor output signal: ± 10 Vpc for standard and /J option, 4 \div 20 mA for /I option, referred to AGND	Output - analog signal
G	EARTH		Internally connected to driver housing	

(1) Do not connect for TID-BC

15.2 USB connector - M12 5 pin (B) - only for TID-NP

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)	
1	+5V_USB	Power supply	
2	ID	Identification	
3	GND_USB	Signal zero data line	
4	D-	Data line -	
5	D+	Data line +	

(1) Shield connection on connector housing is recommended

15.4 Connections layout

15.3 CANopen connector - M12 - 5 pin (C) - only for TID-BC

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)	
1	CAN_SHLD	Shield	
2	not used	-	
3	CAN_GND	GND Signal zero data line	
4	CAN_H	Bus line (high)	
5	CAN_L	Bus line (low)	

(1) Shield connection on connector housing is recommended



(1) use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) pin layout always referred to driver's view

16 CONNECTORS CHARACTERISTICS - to be ordered separately

16.1 Main connectors - 7 pin

CONNECTOR TYPE POWER SUPPLY		POWER SUPPLY	
CODE	A1 ZM-7P	(A2) ZH-7P	
Туре	7pin female straight circular	7pin female straight circular	
Standard	According to MIL-C-5015	According to MIL-C-5015	
Material	Metallic	Plastic reinforced with fiber glass	
Cable gland	PG11	PG11	
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires	
Connection type	to solder	to solder	
Protection (EN 60529) IP 67		IP 67	

16.2 Fieldbus communication connector - only for TID-BC

CONNECTOR TYPE	CANopen		
CODE	C ZM-5PF		
Туре	5 pin female straight circular		
Standard	M12 coding A – IEC 61076-2-101		
Material	Metallic		
Cable gland	Pressure nut - cable diameter 6÷8 mm		
Cable	CANbus Standard (DR 303-1)		
Connection type	screw terminal		
Protection (EN 60529)	IP67		

17 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain







19 FASTENING BOLTS AND SEALS

Туре	Size	Fastening bolts	Seals
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max)
		2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
DP7E	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max)
DFZE			2 OR 3056 Diameter of ports X, Y: $\emptyset = 7 \text{ mm} (\text{max})$
	6 = 32	6 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max)
			2 OR 3056 Diameter of ports X, Y: $\emptyset = 7 \text{ mm} (\text{max})$

20 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting surfaces for electrohydraulic valves
GS500	Programming tools	QD320	Quickstart for TID valves commissioning
GS510	Fieldbus	E-MAN-	RI-TID TID user manual

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Proportional directional valves

piloted, with LVDT transducer and positive spool overlap



(1) Only for DPZO sizes 2 and 4 with spools L5, S5 or D5: in central position the leakages P-A and P-B are drained to tank, avoiding the drift of cylinders with differential areas

(2) Spools for regenerative circuit, see section 2(3) All combination possible
2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT - for valve model code and options, see section 1



3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TEB	E-BM-TES
Туре	digital	digital
Format	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	75 years, for futher details see t	echnical table P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$	/PE option = $-20^{\circ}C \div +60^{\circ}C$	/BT option = $-40^{\circ}C \div +60^{\circ}C$			
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$	/PE option = $-20^{\circ}C \div +70^{\circ}C$	/BT option = $-40^{\circ}C \div +70^{\circ}C$			
Surface protection	Zinc coating with black passivation					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Vibration resistance	See technical table G004					
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZO-T-1	DPZO-T-2		DPZO-T-4	DPZO-T-6
Pressure limits [bar]		ports P , A , B , X = 350; T = 250 (10 for option /D); Y = 10;				
Spool type	standard	L5, DL5, S5, D5	L3, S3, D3 L5, DL5,		5, S5, D5	L5, S5, D5
opool type	regenerative	D9		D9, L9	D9	
Nominal flow Δp	P-T [l/min]					
(1)	$\Delta p=$ 10 bar	100	160	250	480	640
_	$\Delta p = 30 \text{ bar}$	160	270	430	830	1100
Max permissible flow		180	400	550	1000	1600
Piloting pressure [bar]		min. = 25; max = 350				
Piloting volume	[cm ³]	1,4	3,7		9,0	21,6
Piloting flow (2)	[l/min]	1,7	3,7		6,8	14,4
	Pilot [cm³]	100 / 300	100 / 300		200 / 500	900 / 2800
Leanage (3)	Main stage [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	1,0 / 3,0
Response time (4) [ms]		≤ 60	≤ 75		≤ 90	≤ 120
Hysteresis		≤ 1 [% of max regulation]				
Repeatability		± 0,5 [% of max regulation]				
Thermal drift		zero point displacement < 1% at $\Delta T = 40^{\circ}C$				

(1) For different Δp , the max flow is in accordance to the diagrams in section 8.2 (2) With step reference input signal 0 \div 100 %

(3) At p = 100/350 bar(4) 0-100% step signal see detailed diagrams in section 8.3

6 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	$3 \div 3,3 \Omega$
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	I temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid normal operation		ISO4406 class 18/16/13 NAS1638 class 7 s		see also filter section at	
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type		Classification	Ref. Standard
Mineral oils		NBR, FKM, HNBR	Н	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM		HFDU, HFDR	100 10000
Flame resistant with water		NBR, HNBR		HFC	130 12922

B DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)





Note

Hydraulic configuration vs. reference signal (standard and option /B) Reference signal $\begin{array}{c} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{array}$ P \rightarrow A / B \rightarrow T

Reference signal $\begin{array}{c} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{array} \right\} \text{ P} \rightarrow \text{B} / \text{A} \rightarrow \text{T}$

19 = differential - regenerative spool **D9**

(not available for valve size 32)

D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.



20 = linear - internal regenerative spool **L9** (available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.



8.2 Operating diagrams

Flow / Ap diagram stated at 100% of spool stroke





2 = spools L3, S3, D3

3 = spools L5, S5, D5, DL5, D9, L9







8.3 Response time

DPZO-4

100

75

50

25

0

20 40

Pmax = 250 bar

8.4 Operation as throttle valve

Spool stroke [%]

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.

For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

Step signal [%]

-100

0 - 75

0 -50

0 - 25

80 100 0

Time [ms]

60

Single solenoid valves (*51) can be used as simple throttle valves:



DPZO-*-	151-L5	251-L5	451-L5	651-L5
Max flow [l/min] $\Delta p = 15 \text{ bar}$	320	860	1600	2200

9 HYDRAULIC OPTIONS

B = Solenoid and LVDT transducer at side of port A of the main stage (side B of pilot valve). For hydraulic configuration vs reference signal, see 8.1

20

40 60

80 100

D = Internal drain (through port T).
 Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 1
 The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
 Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 11
 The valve's standard configuration provides internal pilot and external drain.

Functional Scheme - example of configuration 71



Pilot valve
 Main stage

③ Pressure reducing valve

④ Plug to be added for external pilot trough port X

⑤ Plug to be removed for internal drain through port T

10 ELECTRICAL CONNECTION - connectors supplied with the valve

10.1 Pilot valve solenoid connector

PIN	N SIGNAL TECHNICAL SPECIFICATION		Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

10.2 LVDT main stage transducer connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code
1	PROG	Do not connect	ZBE-08
2	VT+	Power supply +15VDC	
3	AGND	Ground	
4	TR	Output signal	
5	VT-	Power supply -15VDC	

11 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain



12 FASTENING BOLTS AND SEALS

Туре	Size	Fastening bolts	Seals
	1 – 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050 Diameter of ports A, B, P, T: Ø 11 mm (max)
	1 = 10		2 OR 108 Diameter of ports X, Y: $\emptyset = 5 \text{ mm} (\text{max})$
	2 = 16 4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max)
DPZO		2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
DF20	4 - 25	e = 25 6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112 Diameter of ports A, B, P, T: Ø 24 mm (max)
	4 = 20		2 OR 3056 Diameter of ports X, Y: $\emptyset = 7 \text{ mm} (\text{max})$
	6 - 32	6 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	4 OR 144 Diameter of ports A, B, P, T: Ø 34 mm (max)
	u = 32		2 OR 3056 Diameter of ports X, Y: $\emptyset = 7 \text{ mm} (\text{max})$

DPZO-T-1 (dotted line = double solenoid version) ISO 4401: 2005 Mounting surface: 4401-05-05-0-05 (see table P005) 666 666 1 a P 8 ZBE-08 Ð Æ p P 🛓 30 130 125 30 285 3 (1) = Air bleeding

Mass	s [kg]
DPZO-T-15	8,5
DPZO-T-17	9,4



DPZO-T-2 (dotted line = double solenoid version) ISO 4401: 2005 Mounting surface: 4401-07-07-0-05 (see table P005)





Mass [kg]				
DPZO-T-25 13,5				
DPZO-T-27	14,4			



Notes: For option /B the proportional solenoid and the LVDT transducer are at side of port A of the main stage



Notes: For option /B the proportional solenoid and the LVDT transducer are at side of port A of the main stage

14 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
GS230	E-BM-TEB digital driver	K800	Electric and electronic connectors
GS240	E-BM-TES digital driver	P005	Mounting surfaces for electrohydraulic valves

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Digital proportional 2-way cartridges high performance

piloted, with on-board driver and two LVDT transducers



(1) Possible combined options: /FI, /IQ, /IZ (/T Bluetooth adapter option can be combined with all other options)

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive) Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table FS900 and in the user manuals included in the E-SW-SETUP programming software.

WARNING

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage. In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver (option /Q or /Z). A safety fuse 2,5 A installed on 24VDc power supply of each valve is always recommended, see also power supply note at sections 16.

WARNING

The loss of the pilot pressure causes the undefined position of the main poppet. The sudden interruption of the power supply during the valve operation causes the immediate shut-off of the main poppet. This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

3 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

3.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





E-A-BTH adapter mobile App PC software 3 E-C-SB-USB/M12 cable E-A-SB-USB/OPT isolator

Bluetooth or USB connection

LEB

3.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MvAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

4 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

5 SMART TUNING

Smart tuning allows to adjust the cartridge dynamic response in order to match different performance requirements.

The cartridge is provided with 3 factory settings for the spool control:

- dynamic fast response time and high sensitivity for best dynamic performances. Default factory setting for cartridges

- balanced average response time and sensitivity suitable for major applications

attenuated response time and sensitivity to improve control stability in critical applications or in environments with electrical disturbances - smooth

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-RI-* and Quickstart, see section [24]. For Response time and Bode diagrams see section 12.

6 IO-LINK - only for LEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

7 FIELDBUS - only for LES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

8 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007					
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ / PE option = $-20^{\circ}C \div +60^{\circ}C$ / BT option = $-40^{\circ}C \div +60^{\circ}C$					
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Vibration resistance	See technical table G004					
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size	16	25	32	40	50	63	80	100	125
Nominal flow Δp A-B [I/min]									
$\Delta p = 5 \text{ bar}$	250	500	800	1200	2000	3000	4500	7200	9350
$\Delta p = 10 \text{ bar}$	350	700	1100	1700	2800	4250	6350	10200	13200
Max permissible flow	600	1200	1800	2500	4000	6000	10000	16000	22000
Max pressure [bar]			Ports	A, B = 420) X =	350 N	′ ≤ 10		
Nominal flow of pilot valve at $\Delta p = 70$ bar [I/min]	4	8	20	40	40	100	100	100	100
Leakage of pilot valve at P = 100 bar [I/min]	0,2	0,2	0,3	0,7	0,7	1	1	1	1
Piloting pressure [bar]		min: 40%	of system	n pressure	max 3	50 recor	nmended	140 ÷ 160	
Piloting volume [cm ³]	1,6	2,2	7,0	9,4	17,7	32,5	39,5	49,5	124,9
Piloting flow (1) [I/min]	4	5,3	14	19	35,5	56	60	60	88,1
Response time 0 ÷ 100% step signal (2) [ms]	24	25	28	30	30	35	40	50	90
Hysteresis [% of the max regulation]					≤ 0,1				
Repeatability [% of the max regulation]					± 0,1				
Thermal drift	zero point displacement < 1% at $\Delta T = 40^{\circ}C$								
(4)) / (1) /	(O)) (())		1.10						

(1) With step reference input 0÷100%

(2) With pilot pressure = 140 bar, see datailed diagrams in section 12.2

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal Rectified and filtered	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)							
Max power consumption	50 W	50 W							
Max. solenoid current	2,6 A	,6 A							
Coil resistance R at 20°C	3 ÷ 3,3 Ω								
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX tolera) mA	ant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$	2				
Monitor outputs	Output range:	voltage ±10 VDC current ±20 mA @	@ max 5 mA @ max 500 Ω load res	sistance					
Enable input	Range: 0 ÷ 5 VDC (O	FF state), 9 ÷ 24 VDC ((ON state), 5 ÷ 9 VDC	(not accepted); Input in	mpedance: Ri > 10 k Ω				
Fault output	Output range: 0 ÷ 2 external negative vo	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V]; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)							
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function								
Insulation class	H (180°) Due to the the European stand	occurring surface ter ards ISO 13732-1 an	nperatures of the sol d EN982 must be tak	enoid coils, en into account					
Protection degree to DIN EN60529	IP66 / IP67 with mat	ing connectors							
Duty factor	Continuous rating (E	D=100%)							
Tropicalization	Tropical coating on	electronics PCB							
Additional characteristics	Short circuit protect control by P.I.D. with	ion of solenoid's curr h rapid solenoid swite	ent supply; 3 leds for ching; protection aga	diagnostic (only for L inst reverse polarity of	ES); poppet position				
Communication interface	USB Atos ASCII coding	IO-Link Interface and System Specification 1.1.3	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT POWERLINK EtherNet/IP PROFINET IO RT/IRT IEC 61158				
	not insulated	SDCI	optical insulated	optical insulated	Fast Ethernet, insulated				
	USB 2.0+USB OTG	class port B	CAN ISO11898	RS485	100 Base TX				
Recommended wiring cable	LiYCY shielded cab	les, see section 20							

Note: a maximum time of 800 ms (1000 ms just for size 125), depending on communication type, has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without wa	iter	FKM	HFDU, HFDR	- ISO 12922	
Flame resistant with water		NBR, NBR low temp.	HFC		

12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)















12.2 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.









1 = dynamic 2 = balanced (*) 3 = smooth (*)

(*) Response time is represented only for 0-100% step; for intermediate steps, the response time increment of presets 2 (balanced) and 3 (smooth) with respect to the preset 1 (dynamic) is proportional to the step amplitude of the reference input signal





13 ELECTRONIC OPTIONS - not available for LEB-SN-IL

- **F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, poppet position transducer broken, etc. see 16.7 for signal specifications.
- I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's poppet moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal - see above option /F
 Enable input signal - see above option /Q
 Repeat enable output signal - only for LEB-SN-NP (see 16.6)
 Power supply for driver's logics and communication - only for LES (see 16.2)

14 POSSIBLE COMBINED OPTIONS

/FI, /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

15 AIR BLEEDING



16 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **LEB-SN-IL** signals see section 16

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

16.4 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position). Monitor output signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDc for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ± 20 mA.

16.5 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

16.6 Repeat enable output signal (R_ENABLE) - only for LEB-SN-NP with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 16.5).

16.7 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17 IO-LINK SIGNALS SPECIFICATIONS - only for LEB-SN-IL

17.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

17.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

17.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

18 ELECTRONIC CONNECTIONS AND LEDS

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
Α	V+			Power supply 24 Vbc	Input - power supply
В	V0			Power supply 0 VDC	Gnd - power supply
0	AGND		AGND	Analog ground	Gnd - analog signal
C		ENABLE		Enable (24 VDC) or disable (0 VDC) the valve, referred to V0	Input - on/off signal
	D Q_INPUT+			Flow reference input signal: ±10 Vbc / ±20 mA maximum range	Input - analog signal
D				Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
	Q_MONITOR referred to:			Flow monitor output signal: ±10 Vbc / ±20 mA maximum range	Output - analog signal
F	AGND V0			Defaults are 0 ÷ 10 Vbc for standard and 4 ÷ 20 mA for /I option	Software selectable
	FAULT		FAULT	Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal
G	G EARTH			Internally connected to the driver housing	

18.1 Main connector signals - 7 pin - standard, /F and /Q options A

18.2 Main connector signal - 12 pin - /Z option (A2)

PIN	LEB /Z	LES /Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 Vbc	Input - power supply
2	VO		Power supply 0 Vbc	Gnd - power supply
3	ENABLE ref	erred to: VL0	Enable (24 Vbc) or disable (0 Vbc) the valve	Input - on/off signal
4			Flow reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
4	Q_INPUT+		Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
5	INPUT-		Negative reference input signal for Q_INPUT+	Input - analog signal
6	Q_MONITOR referred to:		Flow monitor output signal: ±10 Vbc / ±20 mA maximum range	Input - analog signal
0	AGND	VLO	Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
_	AGND		Analog ground	Output - analog signal
'	/ NC		Do not connect	Gnd - analog signal
0	R_ENABLE		Repeat enable, output repeater signal of enable input, referred to V0	Output - on/off signal
0		NC	Do not connect	
0	NC		Do not connect	
9		VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply
	NC		Do not connect	
10		VL0 Power supply 0 Vbc for driver's logic and communication		Gnd - power supply
11	FAULT refer	red to: VL0	Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal
PE	EARTH		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for LEB-SN-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vbc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

18.4 Communications connectors B - C

	B USB connector - M12 - 5 pin always present						
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)					
1	+5V_USB	Power supply					
2	ID	Identification					
3	GND_USB	Signal zero data line					
4	D-	Data line -					
5	D+	Data line +					

C1 (©1 ©2 BP fieldbus execution, connector - M12 - 5 pin					
PIN	SIGNAL TECHNICAL SPECIFICATION (1)					
1	+5V	Termination supply signal				
2	LINE-A	Bus line (high)				
3	DGND	Data line and termination signal zero				
4	LINE-B	Bus line (low)				
5	SHIELD					

©1 (C1 $C2$ BC fieldbus execution, connector - M12 - 5 pin				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	CAN_SHLD	Shield			
2	not used	©1 - ©2 pass-through connection (2)			
3	CAN_GND	Signal zero data line			
4	CAN_H	Bus line (high)			
5	CAN_L	Bus line (low)			

©1 (C1 C2 EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin						
PIN	SIGNAL TECHNICAL SPECIFICATION (1)						
1	TX+	Transmitter					
2	RX+	Receiver					
3	TX-	Transmitter					
4	RX-	Receiver					
	SHIELD						

(1) shield connection on connector's housing is recommended

(2) Pin 2 can be fed with external +5V supply of CAN interface

18.5 LEB-SN-NP connections layout





(1) Pin layout always referred to driver's view

FS330



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18.8 Diagnostic LEDs - only for LES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1	VALVE STATUS							
L2	NETWORK STATUS			NETWORK STATUS				
L3	SC	LENOID STAT	US		LIN	K/ACT		

19 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	A1) ZM-7P	A3 ZH-7P		
Туре	7pin female straight circular	7pin female straight circular		
Standard	According to MIL-C-5015	According to MIL-C-5015		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG11	PG11		
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)		
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires		
Connection type	to solder	to solder		
Protection (EN 60529)	IP 67	IP 67		

20.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	(A4) ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.3 IO-Link connector - only for LEB-SN-IL

CONNECTOR TYPE	IL IO-Link
CODE	A ZM-5PF
Туре	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

20.4 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFI	BUS DP (1)	EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)		
CODE	C1) ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP C2 ZM-5PM/BP		C1 C2	ZM-4PM/E	
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular	
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101		
Material	Me	tallic	Metallic		Metallic		
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cab	le diameter 6÷8 mm	Pressure r	nut - cable diameter 4÷8 mm	
Cable	CANbus Stand	dard (DR 303-1)	PROFIBUS DP Standard		PROFIBUS DP Standard Ethernet standar		ernet standard CAT-5
Connection type	screw	terminal	screw terminal		terminal block		
Protection (EN 60529)	IF	P67	IP 67 IP 67		IP 67		

(1) E-TRM-** terminators can be ordered separately - see tech table GS500

(2) Internally terminated

21 FASTENING BOLTS AND VALVE MASS

Туре	Size	Fastening bolts (1)	Mass [kg]
	16	4 socket head screws M8x90 class 12.9 Tightening torque = 35 Nm	5,6
	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,2
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	10,9
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	16,7
LIQZP	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	23,9
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,0
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	71,6
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	122,5
	125	8 socket head screws M36x260 class 12.9 Tightening torque = 3600 Nm	375

(1) Fastening bolts supplied with the valve

22 MAIN CONNECTORS INSTALLATION DIMENSIONS



A = 15 mm space to remove the 7 or 12 pin main connectors

 B = Clearance between main connector to valve's mounting surface. See the below table to verify eventual interferences, depending to the valve size and connector type



C = Max manifold dimension to avoid interference with the main connector, see below table

Reference	Main	Valve size								
dimension	code	16	25	32	40	50	63	80	100	125
	ZM-7P	32	32	32	40	45	68	68	80	142
В	ZH-7P	(1)	(1)	(1)	(1)	29	52	52	64	125
	ZM-12P	(1)	(1)	(1)	(1)	(1)	35	35	47	108
	ZH-12P	(1)	(1)	(1)	(1)	(1)	(1)	(2)	40	101
C (max)	-	104	114	121	134	141	172	202	229	271
D	-	124	134	141	154	161	192	222	249	291

Above dimenions refer to the main connector fully screwed to driver's connector. The space A = 15 mm to remove the connector must be considered
 (1) The connector installation can be performed only if the valve's driver protrudes from the edge of the relevant mounting manifold as rapresented in above "Installation 2"

(2) The connector installation may be critic, depending to the cable size and bending radius



(3) Space required for connection cable and for connector removal





Note: for mounting surface and cavity dimensions, see table P006

24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	P006	Mounting	g surfaces and cavities for cartridge valves
FS900	Operating and maintenance information for proportional valves	QB340 Quickstart for LEB valves		art for LEB valves commissioning
GS500	Programming tools	QF340	Quicksta	art for LES valves commissioning
GS510	Fieldbus	E-MAN-	RI-LEB	TEB/LEB user manual
GS520	IO-Link interface	E-MAN-	RI-LES	TES/LES user manual
K800	Electric and electronic connectors			

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Proportional 2-way cartridges high performance

piloted, with two LVDT transducers, ISO 7368 sizes from 16 to 125



F330

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LEB	E-BM-LES
Туре	digital	digital
Format	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS240

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage. In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver.

3 GENERAL CHARACTERISTICS

Assembly position	Any position						
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100						
MTTFd valves according to EN ISO 13849	75 years, for futher details see technical table P007						
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$						
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$						
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)						
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h						
Vibration resistance	See technical table G004						
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006						

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size		16	25	32	40	50	63	80	100	125
Nominal flow Δp A-B	[l/min]									
	$\Delta p = 5 \text{ bar}$	250	500	800	1200	2000	3000	4500	7200	9350
	$\Delta p = 10 \text{ bar}$	350	700	1100	1700	2800	4250	6350	10200	13200
Max	permissible flow	600	1200	1800	2500	4000	6000	10000	16000	22000
Max pressure	[bar]			Ports	A, B = 420) X =	350 Y	′ ≤ 10		
Nominal flow of pilot valve at Δp	= 70 bar [l/min]	4	8	20	40	40	100	100	100	100
Leakage of pilot valve at P = 1	00 bar [l/min]	0,2	0,2	0,3	0,7	0,7	1	1	1	1
Piloting pressure	[bar]		min: 40%	of system	n pressure	max 35	50 recor	nmended	140 ÷ 160	
Piloting volume	[cm ³]	1,6	2,2	7,0	9,4	17,7	32,5	39,5	49,5	124,9
Piloting flow (1)	[l/min]	4	5,3	14	19	35,5	56	60	60	88,1
Response time 0 ÷ 100% step	signal (2) [ms]	24	25	28	30	30	35	40	50	90
Hysteresis [% of the	e max regulation]					≤ 0,1				
Repeatability [% of the	e max regulation]					± 0,1				
Thermal drift				zero	point displa	acement <	1% at ΔT	= 40°C		

(1) With step reference input 0÷100%

(2) With pilot pressure = 140 bar, see datailed diagrams in section 7.2

The loss of the pilot pressure causes the undefined position of the main spool.

The sudden interruption of the power supply during the valve operation causes the immediate shut-off of the main poppet. This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	$3 \div 3,3 \Omega$
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$					
Recommended viscosity		20÷100 mm²/s - max allowed ra	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s				
Max fluid	normal operation	638 class 7	see also filter section at				
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog				
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard			
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without water		FKM	HFDU, HFDR	100 10000			
Flame resistant with water		NBR, NBR low temp.	HFC	100 12922			





7.1 Regulation diagrams (values measured at Dp 5 bar)



Stroke [% of max]

8 = LIQZP-L-1002L4









7.2 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.













9 = LIQZP-L-1252L4: 50% ± 5%

8 ELECTRICAL CONNECTION - connectors supplied with the valve

8.1 Solenoid connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

8.2 LVDT pilot transducer connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	1 3
2	VT-	Power supply -15VDC	
3	VT+	Power supply +15VDC	
4	GND	Ground	4 2

8.3 LVDT main stage transducer connector - for size $16 \div 100$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code					
1	PROG	Do not connect	2BE-08					
2	VT+	Power supply +15VDC						
3	AGND	Ground	4(6%)2)					
4	TR	Output signal						
5	VT-	Power supply -15VDC						

8.4 LVDT main stage transducer connector - for size 125

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code
1	TR	Output signal	STCO9131-6-PG9
2	AGND	Ground	4 5
3	NC	Do not connect	
4	NC	Do not connect	600
5	VT+	Power supply 24VDC	2 1
6	VT-	Power supply 0VDC	

9 AIR BLEEDING



Туре	Size	Fastening bolts (1)	Mass [kg]	
	16	4 socket head screws M8x90 class 12.9 Tightening torque = 35 Nm	5,6	
	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,2	
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	10,9	
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	16,7	
LIQZP	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	23,9	
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,0	
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	71,6	
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	122,5	
	125	8 socket head screws M36x260 class 12.9 Tightening torque = 3600 Nm	375	

10 FASTENING BOLTS AND VALVE MASS

(1) Fastening bolts supplied with the valve

11 INSTALLATION DIMENSIONS [mm]



LIQZP-L-252



LIQZP-L-402



LIQZP-L-632



Note: for mounting surface and cavity dimensions, see table P006



 $\ensuremath{\text{Note:}}$ for mounting surface and cavity dimensions, see table P006

12 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
GS230	E-BM-LEB digital driver	K800	Electric and electronic connectors
GS240	E-BM-LES digital driver	P006	Mounting surfaces and cavities for cartridge valves

atos 🛆

Digital servoproportional 2-way cartridges high response

piloted, with on-board driver and two LVDT transducers



(1) Possible combined options: /FI, /IQ, /IZ (/T Bluetooth adapter option can be combined with all other options)

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage. In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver (option /Q or /Z). A safety fuse 2,5 A installed on 24VDc power supply of each valve is always recommended, see also power supply note at sections 15.

The loss of the pilot pressure causes the undefined position of the main poppet. The sudden interruption of the power supply during the valve operation causes the immediate shut-off of the main poppet. This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

3 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table **GS500**

3.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





3.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

EtaB E-A-BTH adapter



4 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

5 IO-LINK - only for LEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

6 FIELDBUS - only for LES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$				
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004				
CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3 Compliance RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size	32	40	50	63	80	100
Max regulated flow [I/min]						
$\Delta p A-B$ at $\Delta p = 5$ bar at $\Delta p = 10$ bar	800 1100	1200 1700	2000 2800	3000 4250	4500 6350	7200 10200
Max permissible flow	1800	2500	4000	6000	10000	16000
Max pressure [bar]		Ports	A, B = 420	X = 350 Y	≤ 10	
Nominal flow of pilot valve at $\Delta p = 70$ bar [l/min]	20	40	40	100	100	100
Leakage of pilot valve at P = 100 bar [l/min]	0,3	0,7	0,7	1	1	1
Piloting pressure [bar]	min	: 40% of systen	n pressure n	nax 350 recon	nmended 140 ÷	160
Piloting volume [cm ³]	3,31	5,34	7,42	10,28	19,55	22,53
Piloting flow (1) [l/min]	13,2	17,8	22,3	31	39	45
Response time 0 ÷ 100% step signal (2) [ms]	15	18	20	24	30	37
Hysteresis [% of the max regulation]			≤	0,1		
Repeatability [% of the max regulation]			±	0,1		
Thermal drift		zero	point displacem	ient < 1% at ΔT :	= 40°C	

(1) With step reference input $0 \div 100\%$

(2) With pilot pressure = 140 bar, see datailed diagrams in section 11.2

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal	: +24 VDC	(h.t.) (dia a la manuel 10 (
	Reclined and intered : VRMS = $20 \div 32$ VMAX (hpple max 10 % VPP)						
Max power consumption	50 W	50 W					
Max. solenoid current	2,6 A						
Coil resistance R at 20°C	3 ÷ 3,3 Ω						
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX tolera) mA	ant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$			
Monitor outputs	Output range:	voltage ±10 VDC current ±20 mA @	@ max 5 mA @ max 500 Ω load res	sistance			
Enable input	Range: 0 ÷ 5 VDC (O	FF state), 9 ÷ 24 VDC	ON state), 5 ÷ 9 VDC	(not accepted); Input i	mpedance: Ri > 10 k Ω		
Fault output	Output range: 0 ÷ 2 external negative vo	24 VDC (ON state > [oltage not allowed (e.	oower supply - 2 V] ; g. due to inductive lo	OFF state < 1 V) @ m ads)	nax 50 mA;		
Alarms	Solenoid not conne valve spool transdu	cted/short circuit, ca cer malfunctions, ala	ble break with current ms history storage fu	nt reference signal, or Inction	ver/under temperature,		
Insulation class	H (180°) Due to the the European stand	occurring surface ter ards ISO 13732-1 an	nperatures of the sole d EN982 must be tak	enoid coils, en into account			
Protection degree to DIN EN60529	IP66 / IP67 with mat	ing connectors					
Duty factor	Continuous rating (E	D=100%)					
Tropicalization	Tropical coating on	electronics PCB					
Additional characteristics	Short circuit protect control by P.I.D. with	ion of solenoid's current of solenoid switch	ent supply; 3 leds for ching; protection aga	diagnostic (only for L inst reverse polarity of	ES); poppet position power supply		
Communication interface	USB Atos ASCII coding	IO-Link Interface and System Specification 1.1.3	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT POWERLINK EtherNet/IP PROFINET IO RT/IRT IEC 61158		
Communication physical layer	not insulated SDCI optical insulated optical insulated Fast Ethernet, insulated USB 2.0 + USB OTG class port B CAN ISO11898 RS485 100 Base TX						
Recommended wiring cable	mmended wiring cable LiYCY shielded cables, see section 19						

Recommended wiring cable LiYCY shielded cables, see section 19

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	100 10000	
Flame resistant with water		NBR, NBR low temp. HFC ISO 12922			

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)









5 = LIQZH-L*-80* **6** = LIQZH-L*-100*






11.2 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.







11.3 Bode diagrams - stated at nominal hydraulic conditions





 $5 = LIQZH-L^*-50^*: 10\% \leftrightarrow 90\%$ $7 = LIQZH-L^*-63^*: 10\% \leftrightarrow 90\%$
 $6 = LIQZH-L^*-50^*: 50\% \pm 5\%$ $8 = LIQZH-L^*-63^*: 50\% \pm 5\%$



Frequency [Hz]

10

45° 0°

100

50

12 ELECTRONIC OPTIONS - not available for LEB-SN-IL

- **F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, poppet position transducer broken, etc. see 15.7 for signal specifications.
- I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's poppet moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 15.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal - see above option /F
 Enable input signal - see above option /Q
 Repeat enable output signal - only for LEB-SN-NP (see 15.6)
 Power supply for driver's logics and communication - only for LES (see 15.2)

13 POSSIBLE COMBINED OPTIONS

/FI, /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

14 AIR BLEEDING



Port	LIQZH Size						
TOIL	32	40	50	63	80	100	
(1)	G1	/4"		G1	/2"		
Air suction	C	H 6		CH	■ + 10		
(2)			G1	/4"			
Air bleeding			C	■ H 6			
(3)	G3/8"			G1/2"			
External pilot	СН 8 СН 10						



15 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **LEB-SN-IL** signals see section 16

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

15.4 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position). Monitor output signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDc for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ± 20 mA.

15.5 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

15.6 Repeat enable output signal (R_ENABLE) - only for LEB-SN-NP with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 15.5).

15.7 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16 IO-LINK SIGNALS SPECIFICATIONS - only for LEB-SN-IL

16.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDc power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

16.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

16.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

17 ELECTRONIC CONNECTIONS AND LEDS

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
А	V+			Power supply 24 Vbc	Input - power supply
В	V0			Power supply 0 VDC	Gnd - power supply
0	AGND		AGND	Analog ground	Gnd - analog signal
C		ENABLE		Enable (24 VDc) or disable (0 VDc) the valve, referred to V0	Input - on/off signal
D	D Q_INPUT+			Flow reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
D				Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
	Q_MONITO	R referred to:		Flow monitor output signal: ±10 Vpc / ±20 mA maximum range	Output - analog signal
F	AGND	VO		Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
			FAULT	Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

17.1 Main connector signals - 7 pin - standard, /F and /Q options $\widehat{\mbox{A1}}$

17.2 Main connector signal - 12 pin - /Z option (A2)

PIN	LEB /Z	LES /Z	TECHNICAL SPECIFICATIONS	NOTES
	V+		Power supply 24 Vbc	Input - power supply
1	V0		Power supply 0 Vbc	Gnd - power supply
2 3	ENABLE ref	erred to: VL0	Enable (24 Vpc) or disable (0 Vpc) the valve	Input - on/off signal
1			Flow reference input signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
4	Q_INPUT+		Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
5	INPUT-		Negative reference input signal for Q_INPUT+	Input - analog signal
6	Q_MONITOR referred to:		Flow monitor output signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
	AGND	VLO	Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Software selectable
7	AGND		Analog ground	Output - analog signal
		NC	Do not connect	Gnd - analog signal
8	。 R_ENABLE		Repeat enable, output repeater signal of enable input, referred to VO	Output - on/off signal
		NC	Do not connect	
a	NC		Do not connect	
		VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	NC		Do not connect	
		VL0	Power supply 0 Vpc for driver's logic and communication	Gnd - power supply
11 PE	FAULT refer	red to: VL0	Fault (0 Vpc) or normal working (24 Vpc)	Output - on/off signal
	EARTH		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for LEB-SN-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vpc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vbc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

17.4 Communications connectors (B) - (C)

	B USB connector - M12 - 5 pin always present					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)				
1	+5V_USB	Power supply				
2	ID	Identification				
3	GND_USB	Signal zero data line				
4	D-	Data line -				
5	D+	Data line +				

C1 (©1 ©2 BP fieldbus execution, connector - M12 - 5 pin				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	+5V	Termination supply signal			
2	LINE-A	Bus line (high)			
3	DGND	Data line and termination signal zero			
4	LINE-B	Bus line (low)			
5	SHIELD				

©1 (©1 ©2 BC fieldbus execution, connector - M12 - 5 pin				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	CAN_SHLD	Shield			
2	not used	©1 - ©2 pass-through connection (2)			
3	CAN_GND	Signal zero data line			
4	CAN_H	Bus line (high)			
5	CAN_L	Bus line (low)			

C1 C2 EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	TX+	Transmitter			
2	RX+	Receiver			
3	TX-	Transmitter			
4	RX-	Receiver			
	SHIELD				

(1) shield connection on connector's housing is recommended

17.5 LEB-SN-NP connections layout



17.6 LEB-SN-IL connections layout



(1) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

ents (2) Pin layout always referred to driver's view

17.8 Diagnostic LEDs - only for LES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1		VALVE STATUS	S		LIN	<th></th> <th></th>		
L2	NETWORK STATUS		NETWORK STATUS					
L3	SC	DLENOID STAT	US		LIN	K/ACT		

18 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.





19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS	
CODE	A1 ZM-7P	A3 ZH-7P	
Туре	7pin female straight circular	7pin female straight circular	
Standard	According to MIL-C-5015	According to MIL-C-5015	
Material	Metallic	Plastic reinforced with fiber glass	
Cable gland	PG11	PG11	
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires	
Connection type	to solder	to solder	
Protection (EN 60529)	IP 67	IP 67	

19.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2) ZM-12P	A4 ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.3 IO-Link connector - only for LEB-SN-IL

CONNECTOR TYPE	IL IO-Link
CODE	A ZM-5PF
Туре	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

19.4 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFI	BUS DP (1)	EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)	
CODE	C1 ZM-5PF	©2) ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Me	tallic	Metallic			Metallic
Cable gland	Pressure nut - cab	Pressure nut - cable diameter 6÷8 mm		le diameter 6÷8 mm	Pressure r	nut - cable diameter 4÷8 mm
Cable	CANbus Stand	lard (DR 303-1)	PROFIBUS	DP Standard	Ethernet standard CAT-5	
Connection type	screw	terminal	screw	screw terminal		terminal block
Protection (EN 60529)	IF	267	IF	67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table GS500

(2) Internally terminated

20 FASTENING BOLTS AND VALVE MASS

Туре	Size	Fastening bolts (1)	Mass [kg]		
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	12,4		
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	18,0		
	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	26,0		
LIGZII	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	46,9		
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	75,0		
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	128,4		

(1) Fastening bolts supplied with the valve

21 MAIN CONNECTORS INSTALLATION DIMENSIONS



- \mathbf{A} = 15 mm space to remove the 7 or 12 pin main connectors
- B = Clearance between main connector to valve's mounting surface.
 See the below table to verify eventual interferences, depending to the valve size and connector type



Reference	Main	Valve size							
dimension	connector code	32	40	50	63	80	100		
	ZM-7P	35	35	45	65	65	80		
в	ZH-7P	(1)	(1)	29	52	52	67		
В	ZM-12P	(1)	(1)	(1)	32	32	47		
	ZH-12P	(1)	(1)	(1)	(1)	(2)	40		
C (max)	-	121	134	141	172	202	229		
D	-	141	154	161	192	222	249		

Above dimenions refer to the main connector fully screwed to driver's connector. The space **A** = 15 mm to remove the connector must be considered (1) The connector installation can be performed only if the valve's driver protrudes from the edge of the relevant mounting manifold as rapresented in above "Installation 2"

(2) The connector installation may be critic, depending to the cable size and bending radius

22 INSTALLATION DIMENSIONS [mm]



(3) Space required for connection cable and for connector removal

....

 $\ensuremath{\textbf{Note:}}$ for mounting surface and cavity dimensions, see table P006



(3) Space required for connection cable and for connector removal

Note: for mounting surface and cavity dimensions, see table P006



Note: for mounting surface and cavity dimensions, see table P006

23 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	P006	Mounting surfaces and cavities for cartridge valves
GS500	Programming tools	E-MAN-	RI-LEB TEB/LEB user manual
GS510	Fieldbus	E-MAN-	RI-LES TES/LES user manual
GS520	IO-Link interface		

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Digital proportional directional valves

direct, without transducer, with positive spool overlap



 $\ensuremath{\textbf{(1)}}\xspace{\ensuremath{\textbf{(1)}}}\xspace{\$

(2) For possible combined options, see section 15 (3) /I, /Q, /Z options not available for AEB-IL

2 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-A	AC-01F	E-MI-AS-IR		E-BM-AS-PS		E-BM-AES	
Туре	Ana	alog	Digital					
Voltage supply (VDC)	12	24	12	24	12	24	24	
Valve coil option	/6	std	/6	std	/6	std	std	
Format		plug-in to solenoid				DIN-rail panel		
Tech table	GC	010	G020		G030		GS050	

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

4.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





AEB E-A-BTH adapter mobile App AES AES PC software E-C-SB-USB/M12 cable E-A-SB-USB/OPT isolator

4.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

5 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

6 IO-LINK - only for AEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

7 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

8 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007					
Ambient temperature range	A: Standard = -20° C ÷ $+70^{\circ}$ C /PE option = -20° C ÷ $+70^{\circ}$ C /BT option = -40° C ÷ $+60^{\circ}$ C					
1 0	AEB, AES: Standard = $-20^{\circ}\text{C} \div +60^{\circ}\text{C}$ /PE option = $-20^{\circ}\text{C} \div +60^{\circ}\text{C}$ /BT option = $-40^{\circ}\text{C} \div +60^{\circ}\text{C}$					
Storage temperature range	A: Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
otorage temperature range	AEB, AES: Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Vibration resistance	See technical table G004 (for AEB and AES)					
	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)					
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU					
	REACH Regulation (EC) n°1907/2006					

Bluetooth or USB connection

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DHZO					DKZOR	
Pressure limits [bar]		ports P , A , B = 350; T = 210 (250 with external drain /Y) Y = 10					ports P , A , B = 315; T = 210 (250 with external drain /Y) Y = 10	
Spool type and	d size	L14	L1	S2	L3, S3, D3	L5, S5, D5	L3, S3, D3	L5, S5, D5
Nominal flow A	∆p P-T [l/min]							
(1)	$\Delta p=10$ bar	1	4,5	8	18	28	45	60
	Δp = 30 bar	1,7	8	14	30	50	80	105
	$\Delta p = 70 \text{ bar}$	2,6	12	21	45	70	120	160
Max permis	ssible flow (2)	4	18	30	50	70	120	160
Leakage	[cm³/min]	<	30 (at p = 100) bar); <135	(at p = 350 ba	ar)	<80 (at p = 100 bar);	<600 (at p = 315 bar)
Response time (3) [ms]		≤ 30					≤	40
Hysteresis		≤ 5 [% of max regulation]						
Repeatibility					± 1 [% of	max regulatio	n]	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2

(1) For different Δp , the max flow is in accordance to the diagrams in section 12.2

(2) See detailed diagrams in section 12.3

(3) 0-100% step signal, see detailed diagrams in section 12.4

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal: +24 VDCRectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)						
			DKZOR				
	A = 30 W	AEB, AE	S = 50 W	A = 35 W		LEB , AES = 50 W	
Coil voltage code	standard	option /6	option /18	standard	option /	6 option /18	
Max. solenoid current	2,2 A	2,75 A	1 A	2,6 A	3,25 A	1,2 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	3,8 ÷ 4,1 Ω	2,2 ÷ 2,4	Ω 12 ÷ 12,5 Ω	
Analog input signals	Voltage: range ±1 Current: range ±2	0 VDC (24 VMAX tol 0 mA	erant) Inpu Inpu	ut impedance: ut impedance:	Ri > 50 kΩ Ri = 500 Ω	2	
Monitor output	Output range:	voltage ±5 VDC	@ max 5 mA				
Enable input	Range: 0 ÷ 9 VDC (O	FF state), 15 ÷ 24 Vt	oc (ON state), 9 ÷ 1	5 VDC (not acce	epted); Input	impedance: Ri > 87 k Ω	
Fault output	Output range : 0 ÷ external negative vo	24 VDC (ON state oltage not allowed (≅ VL+ [logic pow e.g. due to induct	ver supply] ; OF ive loads)	F state ≅ 0	V) @ max 50 mA;	
Pressure transducer power supply (only for /W option)	+24VDC @ max 100	mA (E-ATR-8 see t	ech table GS465)				
Alarms	Solenoid not conne current control mon	cted/short circuit, c itoring, power supp	able break with cu lies level, pressur	urrent reference e transducer fa	e signal, ove ailure (/W opt	r/under temperature, tion)	
Insulation class	H (180°) Due to the the European stand	occurring surface lards ISO 13732-1	emperatures of th and EN982 must b	e solenoid coil e taken into ac	s, count		
Protection degree to DIN EN60529	A = IP65; AEB, AE	S = IP66 / IP67 with	mating connecto	rs			
Duty factor	Continuous rating (E	ED=100%)					
Tropicalization	Tropical coating on	electronics PCB					
Additional characteristics	Short circuit protect protection against r	tion of solenoid's cu everse polarity of p	irrent supply; curr ower supply	ent control by F	P.I.D. with ra	pid solenoid switching;	
	USB	IO-Link	CANopen	PROFIBU	IS DP	EtherCAT	
Communication interface	Atos ASCII coding	Specification 1.1.3	EN50325-4 + D	S408 EN50170	-2/IEC61158	IEC 61158	
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	d optical in: RS485	sulated	Fast Ethernet, insulated 100 Base TX	
Recommended wiring cable	LiYCY shielded cab	oles, see section 20				·	

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluic	temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for A), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$				
Recommended viscosity 20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s						
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	see also filter section at			
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog			
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	120 12022		
Flame resistant with water		NBR, NBR low temp.	HFC	100 12922		





Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

Reference signal $\begin{array}{c} 0 \ \div +10 \ V \\ 12 \ \div \ 20 \ mA \end{array} \Big\} P \rightarrow A \ / \ B \rightarrow T$

Reference signal $\begin{array}{c} 0 \div -10 \ V \\ 12 \div 4 \ mA \end{array}
ight\} P \rightarrow B / A \rightarrow T$

12.2 Flow /Ap diagrams - stated at 100% of valve stroke

DKZOR DHZO DHZO 100 **1** = spool L14 300 $\mathbf{2} = spool L1$ S2 **3** = spool 200 4 =spool L3, S3, D3 7 4 50 Flow rate [I/min] 5 = spool L5, S5, D5 Flow rate [I/min] 100 DKZOR 3 30 6 = spool S3, L3, D3 2 50 7 = spool S5, L5, D5 10 30 1 1 10-10 30 70100 200 300 10 30 200 300 70100 Valve pressure drop Δp [bar] Valve pressure drop Δp [bar] 12.3 Operating limits DHZO DKZOR DHZO 350 350 **1** = spool L14 **2** = spool L1 **3** = spool L3, S3, D3 **5** = spool L5, S5, D5 280 280 210 210 DKZOR 6 7 2 3 4 5

6 = spool S3, L3, D3 **7** = spool S5, L5, D5



12.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.





12.5 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves: Pmax = 250 bar (option /Y advisable)



Max flow	Spool type and size						
Δp = 15 bar [l/min]	L14	L1	S2	L3 S3	L5 S5		
DHZO	4	16	28	60	100		
DKZOR	-	-	-	160	200		

160

200

13 HYDRAULIC OPTIONS

- B = DHZO-05 and DKZOR-15 = solenoid and on-board digital driver at side of port A. DHZO-07 and DKZOR-17 = on-board digital driver at side of port A.
- Y = External drain advisable when the valve is used in double flow path, see section 12.5. This option is mandatory if the pressure in port T exceeds 210 bar.

Hand lever option - only for DHZO-A with spool type S3, S5, D3, D5, L3, L5.

It allows to operate the valve in absence of electrical power supply. For detailed description of DHZO-A with hand lever option see tech. table E138.

- **MO** = Horizontal hand lever
- BMO = Horizontal hand lever installed at side of port A
- **MV** = Vertical hand lever
- BMV = Vertical hand lever installed at side of port A



- N = Manual micrometric adjustment
- NV = As option /N plus handwheel





14 ELECTRONIC OPTIONS - only for AEB and AES

- I = This option provides $4 \div 20$ mA current reference, instead of the standard ± 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage Note: /I option not available for AEB-IL
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle - see 17.5 for signal specifications. Note: /Q option not available for AEB-IL

Z = This option provides, on the 12 pin main connector, the following additional features: Fault output signal - see 17.6 Enable input signal - see above option /Q Power supply for driver's logics and communication - see 17.2 Note: /Z option not available for AEB-IL

C = Only in combination with option /W This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

- W = Only for valves coupled with pressure compensator, see tech table D150
 - It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR.

When the actual requested hydraulic power pxQ (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

PowerLimit [sw setting] Flow regulation = Min (Flow Reference [INPUT+]) Transducer Pressure [TR]

Notes: for AEB-IL the drive receives the flow reference signal directly by IO-Link interface for AES the drive can receive the flow reference signal directly by fieldbus interface



(1) with power limitation

(2) without power limitation

p1 x Q1 = max power limit

Hydraulic Power Limitation - only for option /W

15 POSSIBLE COMBINED OPTIONS

For AEB-NP and AES

Hydraulic options: /BY

Electronic options: /IQ, /IZ, /IW, /CW, /CWI

For AEB-IL Hydraulic options: /BY Electronic options: /CW

Note: /T Bluetooth adapter option can be combined with all other options

16 COIL VOLTAGE OPTIONS - only for A

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDc and with max current limited to 1A.

pressure

feedback

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **AEB-IL** see section 18 for IO-Link signals specifications and see 17.7 for presssure trasducer signal for /W option.

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z and /W options

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are ± 10 V_{DC} for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{DC} or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ V_{DC}.

17.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, default settings is ±5 Vpc (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of ± 5 Vpc.

Option /W

The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.

The output maximum range is ± 5 Vpc; default setting is 0 \div 5 Vpc.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for /Z and /W options

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 Vbc, normal working corresponds to 24 Vbc. Fault status is not affected by the Enable input signal.

17.7 Remote pressure transducer input signal (TR) - only for /W option

Analog pressure transducers can be directly connected to the driver (see 19.5).

Analog input signal is factory preset according to selected driver code, defaults are $0 \div 10$ Vbc for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vbc or ± 20 mA. Note: transducer feedback can be read as a digital information through fieldbus and IO-Link communication - software selectable.

18 IO-LINK SIGNALS SPECIFICATIONS - only for AEB-IL

18.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

18.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

18.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

19 ELECTRONIC CONNECTIONS

19.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB-NP and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
Α	V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 VDc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDc) or disable (0 VDc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR re AGND	eferred to: V0	Monitor output signal: ±5 Vpc maximum range Default is ± 5 Vpc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

19.2 Main connector signals - 12 pin (A2) /Z and /W options - for AEB-NP and AES

PIN	/Z	/W	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 VDC	Input - power supply
2	VO		Power supply 0 Vbc	Gnd - power supply
3	ENABLE		Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	INPUT+		Reference input signal: $\pm 10 \text{ Vpc}$ / $\pm 20 \text{ mA}$ maximum range Defaults are $\pm 10 \text{ Vpc}$ for standard and $4 \div 20 \text{ mA}$ for /I option	Input - analog signal Software selectable
5	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR		Monitor output signal: ± 5 Vpc maximum range, referred to VL0 Default is ± 5 Vpc (1V = 1A)	Output - analog signal Software selectable
7	NC		Do not connect	
8	NC		Do not connect	
0		MONITOR2	2nd monitor output signal: ±5 Vpc maximum range, referred to VL0. Default is 0 ÷ 5 Vpc	Output - analog signal
9	VL+		Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	VL0		Power supply 0 Vpc for driver's logic and communication	Gnd - power supply
11	FAULT		Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal
PE	EARTH		Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

19.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for AEB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vpc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vpc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

19.4 Communication connectors - for AEB B and AES B - C

B USB connector - M12 - 5 pin always present				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)		
1	+5V_USB	Power supply		
2	ID	Identification		
3	GND_USB	Signal zero data line		
4	D-	Data line -		
5	D+	Data line +		

©2 BP fieldbus execution, connector - M12 - 5 pin (2)				
PIN	SIGNAL TECHNICAL SPECIFICATION (1)			
1	+5V Termination supply signal			
2	LINE-A Bus line (high)			
3	DGND Data line and termination signal zero			
4	LINE-B Bus line (low)			
5	SHIELD			

(1) Shield connection on connector's housing is recommended

C1 BC fieldbus execution, connector - M12 - 5 pin (2)				
PIN	SIGNAL TECHNICAL SPECIFICATION (1)			
1	CAN_SHLD Shield			
2	NC do not connect			
3	CAN_GND Signal zero data line			
4	CAN_H Bus line (high)			
5	CAN_L Bus line (low)			

<u>C</u> 3	C3 C4 EH fieldbus execution, connector - M12 - 4 pin (2)			
PIN	SIGNAL TECHNICAL SPECIFICATION (1)			
1	TX+	Transmitter		
2	RX+	Receiver		
3	тх-	Transmitter		
4	RX-	Receiver		
Housing	SHIELD			

(2) Only for AES execution

19.5 Remote pressure transducer connector - M12 - 5 pin - only for /W option - for AEB and AES (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	VF +24V	Power supply +24Vbc	Connect	Connect
2	TR	Signal transducer maximum range ± 10 Vpc / ± 20 mA, software selectable Defaults are 0 $\div 10$ Vpc for standard and 4 $\div 20$ mA for /C option	Connect	Connect
3	AGND	Common GND for transducer power and signals	Connect	/
4	NC	Not Connect	/	/
5	NC	Not Connect	/	/

Remote pressure transducer connection - example



Note: connectors front view

19.6 Solenoid connection - only for ${\bf A}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	



19.8 AEB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	A1) ZM-7P	A3 ZH-7P		
Туре	7pin female straight circular	7pin female straight circular		
Standard	According to MIL-C-5015	According to MIL-C-5015		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG11	PG11		
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)		
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires		
Connection type	to solder	to solder		
Protection (EN 60529)	IP 67	IP 67		

20.2 Main connectors - 12 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	(A4) ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.3 IO-Link connector - only for AEB-IL

CONNECTOR TYPE	IL IO-Link	
CODE	A ZM-5PF	
Туре	5pin female straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm	
Recommended cable	5 x 0,75 mm² max 20 m	
Connection type	screw terminal	
Protection (EN 60529)	IP 67	

20.4 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CAN	open (1)	BP PROFI	BUS DP (1)		EH EtherCAT (2)
CODE	C1 ZM-5PF	©2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female	5 pin male	5 pin female	5 pin male		4 pin male
туре	straight circular	straight circular	straight circular	straight circular		straight circular
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B –	IEC 61076-2-101	M12 co	ding D – IEC 61076-2-101
Material	Metallic		Metallic			Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure i	nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Eth	ernet standard CAT-5
Connection type	e screw terminal		screw terminal			terminal block
Protection (EN 60529)	rotection (EN 60529) IP67		IP 67			IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\text{GS500}}$

20.5 Remote pressure transducer connectors - only for /W option

CONNECTOR TYPE	TRANSDUCER			
CODE	D1 ZH-5PM/1.5	D1 ZH-5PM/5		
Туре	5 pin male straight circular			
Standard	M12 coding A – IEC 61076-2-101			
Material	Plastic			
Cable gland	Connector moulded on cables			
Cable glaild	1,5 m length 5 m length			
Cable	5 x 0,25 mm ²			
Connection type	molded cable			
Protection (EN 60529)	IP 67			

(2) Internally terminated



Note: for /B option the solenoid and the on-board digital driver are at side of port A



Note: for /B option the solenoid and the on-board digital driver are at side of port A

23 FASTENING BOLTS AND SEALS

	DHZO	DKZOR
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
0	Seals: 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø 3,2 mm (only for /Y option)	Seals: 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø 5 mm (only for /Y option)

24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric a	nd electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting	surfaces for electrohydraulic valves
G010	E-MI-AC analog driver	QB100	Quicksta	rt for AEB valves commissioning
G020	E-MI-AS-IR digital driver	QF100	Quicksta	rt for AES valves commissioning
G030	E-BM-AS digital driver	E-MAN-	MI-AS	E-MI-AS-IR user manual (off-board)
GS050	E-BM-AES digital driver	E-MAN-	BM-AS	E-BM-AS user manual (off-board)
GS500	Programming tools	E-MAN-	BM-AES	E-BM-AES user manual (off-board)
GS510	Fieldbus	E-MAN-	RI-AEB	AEB user manual
GS520	IO-Link interface	E-MAN-	RI-AES	AES user manual

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Proportional directional valves

direct, without transducer



(1) Only for DHZE with spool type S3, S5, D3, D5, L3, L5

2 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-A	\C-01F	E-MI-AS-IR E-BM-AS-PS E-BM-A			E-BM-AES	
Туре	Ana	alog		Digital			
Voltage supply (VDC)	12	24	12	24	12 24 24		
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid			DIN-rail panel			
Tech table	GC)10	G020 G030		GS050		

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevent components.

4 GENERAL CHARACTERISTICS

Assembly position	Any position						
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra \leq 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100						
MTTFd valves according to EN ISO 13849	150 years, see technical table P007						
Ambient temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$	/PE option = $-20^{\circ}C \div +70^{\circ}C$	/BT option = $-40^{\circ}C \div +60^{\circ}C$				
Storage temperature range	Standard = $-20^{\circ}C \div +80^{\circ}C$	/PE option = $-20^{\circ}C \div +80^{\circ}C$	/BT option = $-40^{\circ}C \div +70^{\circ}C$				
Surface protection	Zinc coating with black passiva	ation					
Corrosion resistance	Salt spray test (EN ISO 9227) >	> 200 h					
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006						

5 HYDRAULIC CHARACTERISTICS

Valve model		DHZE			DKZE			
Pressure limits [bar]		ports P, A, B = 350; T = 210					ports P, A, B = 315; T = 210	
Spool type and size	L14	L14 L1 S3, L3, D3 S5, L5, D5 L9				S3, L3, D3	S5, L5, D5	
Nominal flow (1) [I/min]								
at Δp = 10 bar (P-T)	1	4,5	18	28	45	45	60	
at $\Delta p = 30$ bar (P-T)	1,7	8	30	50	65	80	105	
max permissible flow			see op	erating limits, sec	ction 8.2			
Response time (2) [ms]		≤ 30 ≤				40		
Hysteresis [%]		5 [% of max regulation]						
Repeatability [%]			± 1	[% of max regula	ation]			

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2; the flow regulated by the directional proportional valves is not pressure compensated, thus it is affected by the load variations;

to keep costant the regulated flow under different load conditions, modular pressure compensators are available - see tech. table D150 (1) For different Δp , the max flow is in accordance to the diagrams in sections 8.2 and 9.2

(2) 0-100% step signal

6 ELECTRICAL CHARACTERISTICS

Valve model	DHZE			DKZE			
Coil voltage code	standard	option /6	option /18	standard	option /6	option /18	
Max. solenoid current	2,7 A	3 A	1,2 A	2,2 A	2,65 A	1 A	
Coil resistance R at 20°C	3,1 Ω	2,1 Ω	13,1 Ω	3,2 Ω	2,1 Ω	13,7 Ω	
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account						
Protection degree to DIN EN60529	IP65 with mating	IP65 with mating connectors					
Duty factor	Continuous rating (ED=100%)						
Certification	cURus North Am	cURus North American Standard					

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20 ÷ 100 mm²/s - max allowed r	ange 15 ÷ 380 mm²/s		
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	100 10000	
Flame resistant with water		NBR, HNBR	HFC	- 100 12922	

8 **DIAGRAMS FOR DHZE** (based on mineral oil ISO VG 46 at 50 °C)

8.1 Regulation diagrams



Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

Reference signal $\begin{array}{c} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{array} \right\} P \rightarrow A \, / \, B \rightarrow T$

Reference signal $\begin{array}{c} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{array}
ight\} P \rightarrow B / A \rightarrow T$

8.2 Operating limits



9 HYDRAULIC OPTIONS

B = DHZE-05 and DKZE-15 = solenoid at side of port A of the main stage. DHZO-07 and DKZE-17 = E-MI-AS-IR electronics at side of port A of the main stage.

Hand lever option - only for DHZE with spool type S3, S5, D3, D5, L3, L5.

It allows to operate the valve in absence of electrical power supply. For detailed description of DHZE with hand lever option see tech. table **E138**.

MO = Horizontal hand lever

- BMO = Horizontal hand lever installed at side of port A
- **MV** = Vertical hand lever
- BMV = Vertical hand lever installed at side of port A



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10 COIL VOLTAGE OPTIONS

- 6 = Optional coil to be used with Atos drivers with power supply 12 VDC.
- 18 = Optional coil to be used with electronic drivers not supplied by Atos.

IIIOPERATION AS THROTTLE VALVESingle solenoid valves

DHZE-A-051 and DKZE-A-151 can be used as simple throttle valves: Pmax = 210 bar

Max flow	SPOOL TYPE					
Δp = 15bar [l/min]	L14	L1	L3	S3	L5	S5
DHZE	4	16	60		100	
DKZE	-	-	160		200	



12 COILS WITH SPECIAL CONNECTORS

J option Coil type COZEJ (DHZE) Coil type CAZEJ (DKZE) AMP Junior Timer connector Protection degree IP67



K option Coil type COZEK (DHZE) Coil type CAZEK (DKZE) Deutsch connector, DT-04-2P male Protection degree IP67



S option

Coil type COZES (DHZE) Coil type CAZES (DKZE) Lead Wire connection Cable lenght = 180 mm



13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

14 FASTENING BOLTS AND SEALS

	DHZE	DKZE
	Fastening bolts: 4 socket head screws M5x30 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
0	Seals: 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm (max)	Seals: 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm (max)

15 INSTALLATION DIMENSIONS FOR DHZE [mm]



Note: for option /B the solenoid is at side of port A (only for DHZE-A-05 and DKZE-A-15)



17 RELATED DOCUMENTATION								
FS001	Basics for digital electrohydraulics	GS500	Programming tools					
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus					
G010	E-MI-AC analog driver	K800	Electric and electronic connectors					
G020	E-MI-AS-IR digital driver	P005	Mounting surfaces for electrohydraulic valves					
G030	E-BM-AS digital driver							
GS050	E-BM-AES digital driver							

Digital proportional directional valves

piloted, without transducer, with positive spool overlap



(1) Hydraulic symbols are represented with on-board digital driver

(3) /I, /Q, /Z options not available for AEB-IL

2 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-A	E-MI-AC-01F E-MI-AS-IR			E-BM-	AS-PS	E-BM-AES
Туре	Analog				Digital		
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid			DIN-rail panel			
Tech table	GC)10	G020 G030		GS050		

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

4.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





AEB E-A-BTH adapter mobile App AES AES PC software E-C-SB-USB/M12 cable E-A-SB-USB/OPT isolator

4.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

5 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

6 IO-LINK - only for AEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

7 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

8 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007				
Ambient temperature range	A:Standard = -20° C $\div +70^{\circ}$ C/PE option = -20° C $\div +70^{\circ}$ C/BT option = -40° C $\div +60^{\circ}$ CAEB, AES:Standard = -20° C $\div +60^{\circ}$ C/PE option = -20° C $\div +60^{\circ}$ C/BT option = -40° C $\div +60^{\circ}$ C				
Storage temperature range	A:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$ AEB, AES:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004 (for AEB and AES)				
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

Bluetooth or USB connection

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZO-*-1	DPZ	0-*-2	.*-2 DPZO-*-4 DPZO-*-6		
Pressure limits	[bar]		ports P , A , B , X = 350; T = 250 (10 with internal drain /D) Y = 10				
Spool type and	d size	L5, S5, D5	L3, S3, D3		L5, S5, D5		
Nominal flow Δ	p P-T [l/min]						
(1)	Δp = 10 bar	100	160	250	480	640	
	Δp = 30 bar	160	270	430	830	1100	
Max permissible flow		180	400	550	900	1500	
Piloting pressu	ressure [bar] min = 25; max = 350 (option /G advisable for pilot pressure > 150 bar)			r)			
Piloting volume	e [cm³]	1,4	3,7		9,0	21,6	
Piloting flow (2)) [l/min]	1,7	3,7		6,8	14,4	
Leakage (3)	[l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	1,0 / 3,0	
Response time	e (4) [ms]	≤ 80	≤ 100		≤ 120	≤ 180	
Hysteresis			≤ 5 [% of max regulation]				
Repeatibility		± 1 [% of max regulation]					

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2

(1) For different Δp , the max flow is in accordance to the diagrams in section 12.2 (2) With step reference input signal 0 ÷ 100 %

(3) At p = 100/350 bar (4) 0-100% step signal

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)				
Max power consumption	A = 30 W AEB , AES = 50 W				
Coil voltage code	standard		option /6		option /18
Max. solenoid current	2,2 A		2,75 A		1 A
Coil resistance R at 20°C	3 ÷ 3,3	Ω	2 ÷ 2,2 Ω		13 ÷ 13,4 Ω
Analog input signals	Voltage: range ± 10 VDC (24 VMAX tolerant)Input impedance:Ri > 50 k\OmegaCurrent: range ± 20 mAInput impedance:Ri = 500 Ω				
Monitor output	Output range:	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (Ol	Range: 0 ÷ 9 VDc (OFF state), 15 ÷ 24 VDc (ON state), 9 ÷ 15 VDc (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : $0 \div 24$ VDC (ON state \cong VL+ [logic power supply] ; OFF state \cong 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)				
Pressure transducer power supply (only for /W option)	+24Vbc @ max 100 mA (E-ATR-8 see tech table GS465)				
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)				
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account				
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors				
Duty factor	Continuous rating (ED=100%)				
Tropicalization	Tropical coating on electronics PCB				
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply				
Communication interface	USB	IO-Link	CANopen	PROFIBUS DP	EtherCAT
	Atos ASCII coding	Interface and System Specification 1.1.3	EN50325-4 + DS408	EN50170-2/IEC6115	3 IEC 61158
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20				

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for A), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at	
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922	
Flame resistant with water		NBR, NBR low temp.	HFC		





Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

 $\begin{array}{c} \text{Reference signal} & 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{array} \Big\} \text{ P} \rightarrow \text{A} / \text{B} \rightarrow \text{T} \\ \end{array} \\ \begin{array}{c} \text{Reference signal} & 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{array} \Big\} \text{ P} \rightarrow \text{B} / \text{A} \rightarrow \text{T} \\ \end{array}$
12.2 Flow /Ap diagram

stated at 100% of spool stroke

DPZO-1:

1 = spools L5, S5, D5

DPZO-2:

2 = spools L3, S3, D3 3 = spools L5, S5, D5

DPZO-4:

4 = spools L5, S5, D5

DPZO-6:

5 = spools L5, S5, D5



Valve pressure drop ∆p [bar]



Valve pressure drop Δp [bar]

12.3 Response time (measured at pilot pressure = 100 bar)

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.







12.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves: Pmax = 250 barFor this application, the use of valve -TEB or -TES (see tab. FS172) is advisable (consult our technical office)



	DPZO-*-	151-L5	251-L5	451-L5	651-L5
Ма: ∆р	x flow [l/min] = 15 bar	320	860	1600	2200

13 HYDRAULIC OPTIONS

- **B** = DPZO-*-*5 = solenoid and on-board digital driver at side B of the main stage (side A of pilot valve). DPZO-*-*7 = on-board digital driver at side of port B of the main stage (side A of pilot valve).
- D = Internal drain.
 Pilot and drain configuration can be modified as shown in section [21].
 The valve's standard configuration provides internal pilot and external drain.
- E = External pilot (through port X).
 Pilot and drain configuration can be modified as shown in section 21.
 The valve's standard configuration provides internal pilot and external drain.
- G = Pressure reducing valve installed between pilot valve and main body with fixed setting: DPZO-1 and DPZO-2 = 30 bar
 DPZO-4 and DPZO-6 = 100 bar
 It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

14 ELECTRONIC OPTIONS - only for AEB and AES

 This option provides 4 ÷ 20 mA current reference, instead of the standard ±10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Note: /I option not available for AEB-IL

 Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications. Note: /Q option not available for AEB-IL

Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal - see 17.6
 Enable input signal - see above option /Q
 Power supply for driver's logics and communication - see 17.2
 Note: /Z option not available for AEB-IL

 C = Only in combination with option /W This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

 $\label{eq:W} \textbf{W} = \text{Only for valves coupled with pressure compensator, see tech table$ **D150**. It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR. When the actual requested hydraulic power**p**x**Q**(TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

Flow regulation = Min (________ ; Flow Reference [INPUT+])

Transducer Pressure [TR]

Notes: for **AEB-IL** the drive receives the flow reference signal directly by IO-Link interface for **AES** the drive can receive the flow reference signal directly by fieldbus interface



Main stage

- ③ Pressure reducing valve
- ④ Plug to be added for external pilot trough port X
- (5) Plug to be removed for internal drain through port T

Hydraulic Power Limitation



15 POSSIBLE COMBINED OPTIONS

For AEB-NP and AES

Hydraulic options: all combinations possible Electronic options: /IQ, /IZ, /IW, /CW, /CWI

For AEB-IL Hydraulic options: all combinations possible Electronic options: /CW

Note: /T Bluetooth adapter option can be combined with all other options

16 COIL VOLTAGE OPTIONS - only for A

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDc and with max current limited to 1A.

Functional Scheme

(2)

Example of configuration 7* 3 positions, spring centered

: * * M

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **AEB-IL** see section ¹⁸ for IO-Link signals specifications and see 17.7 for presssure trasducer signal for *IW* option.

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z and /W options

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vpc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vpc.

17.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, default settings is ± 5 Vpc (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of ± 5 Vpc.

Option /W

The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure. The output maximum range is ± 5 Vpc; default setting is $0 \div 5$ Vpc.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for /Z and /W options

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 Vpc, normal working corresponds to 24 Vpc. Fault status is not affected by the Enable input signal.

17.7 Remote pressure transducer input signal (TR) - only for /W option

Analog pressure transducers can be directly connected to the driver (see 19.5). Analog input signal is factory preset according to selected driver code, defaults are $0 \div 10$ V_{DC} for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V_{DC} or ± 20 mA. Note: transducer feedback can be read as a digital information through fieldbus and IO-Link communication - software selectable.

18 IO-LINK SIGNALS SPECIFICATIONS - only for AEB-IL

18.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDc power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

18.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

18.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

19 ELECTRONIC CONNECTIONS

19.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB-NP and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
Α	A V+		Power supply 24 Vbc	Input - power supply
В	В V0		Power supply 0 Vbc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDc) or disable (0 VDc) the driver, referred to V0	Input - on/off signal
D	D INPUT+		Reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /l option	Input - analog signal Software selectable
Е	E INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	F MONITOR referred to: AGND V0		Monitor output signal: ±5 Vpc maximum range Default is ± 5 Vpc (1V = 1A)	Output - analog signal Software selectable
G	G EARTH		Internally connected to driver housing	

19.2 Main connector signals - 12 pin A2 /Z and /W options - for AEB-NP and AES

PIN	/Z	/W	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 Vbc	Input - power supply
2	V0		Power supply 0 Vbc	Gnd - power supply
3	ENABLE		Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
4	INPUT+		Reference input signal: $\pm 10 \text{ Vpc}$ / $\pm 20 \text{ mA}$ maximum range Defaults are $\pm 10 \text{ Vpc}$ for standard and $4 \div 20 \text{ mA}$ for /l option	Input - analog signal Software selectable
5	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR		Monitor output signal: ± 5 Vpc maximum range, referred to VL0 Default is ± 5 Vpc (1V = 1A)	Output - analog signal Software selectable
7	NC		Do not connect	
8	NC		Do not connect	
0		MONITOR2	2nd monitor output signal: ±5 Vpc maximum range, referred to VL0. Default is 0 ÷ 5 Vpc	Output - analog signal
9	VL+		Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	VL0		Power supply 0 Vpc for driver's logic and communication	Gnd - power supply
11	11 FAULT		Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal
PE	EARTH		Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

19.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for AEB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vpc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vpc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vbc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vpc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

19.4 Communication connectors - for AEB B and AES B - C

B USB connector - M12 - 5 pin always present			
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)	
1	+5V_USB	Power supply	
2	ID	Identification	
3	GND_USB	Signal zero data line	
4	D-	Data line -	
5	D+	Data line +	

C2	©2 BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	N SIGNAL TECHNICAL SPECIFICATION (1)		
1	+5V	Termination supply signal	
2	LINE-A Bus line (high)		
3	DGND Data line and termination signal zero		
4	LINE-B Bus line (low)		
5	SHIELD		

(1) Shield connection on connector's housing is recommended

C1	C1 BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL TECHNICAL SPECIFICATION (1)		
1	CAN_SHLD	Shield	
2	NC	do not connect	
3	CAN_GND	Signal zero data line	
4	CAN_H	Bus line (high)	
5	CAN_L	Bus line (low)	

C3	©3 ©4 EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	PIN SIGNAL TECHNICAL SPECIFICATION (1)		
1	TX+	Transmitter	
2	RX+	Receiver	
3	ТХ-	Transmitter	
4	RX-	Receiver	
Housing	SHIELD		

(2) Only for AES execution

19.5 Remote pressure transducer connector - M12 - 5 pin - only for /W option - for AEB and AES (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	VF +24V	Power supply +24VDC	Connect	Connect
2	TR	Signal transducer maximum range ± 10 Vpc / ± 20 mA, software selectable Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /C option	Connect	Connect
3	AGND	Common GND for transducer power and signals	Connect	/
4	NC	Not Connect	/	/
5	NC	Not Connect	/	/

Remote pressure transducer connection - example



Note: connectors front view

19.6 Solenoid connection - only for ${\boldsymbol{\mathsf{A}}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	



19.8 AEB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A1) ZM-7P	A3 ZH-7P
Туре	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

20.2 Main connectors - 12 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	(A4) ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.3 IO-Link connector - only for AEB-IL

CONNECTOR TYPE	IL IO-Link
CODE	A ZM-5PF
Туре	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

20.4 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CAN	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B -	IEC 61076-2-101	M12 co	ding D – IEC 61076-2-101
Material	Me	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cab	le diameter 6÷8 mm	Pressure r	nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS	DP Standard	Ethe	ernet standard CAT-5
Connection type	screw	screw terminal		terminal		terminal block
Protection (EN 60529)	IF	°67	IP 67			IP 67
(1) E-TRM-** terminators can be ordered separately - see tech table GS500 (2) Internally terminated						

20.5 Remote pressure transducer connectors - only for $\ensuremath{\textit{/W}}$ option

CONNECTOR TYPE	TRANSDUCER					
CODE	D1 ZH-5PM/1.5	D1 ZH-5PM/5				
Туре	5 pin male straight circular					
Standard	M12 coding A – IEC 61076-2-101					
Material	Plastic					
Cable gland	Connector moulded on cables					
Cable glaild	1,5 m length 5 m length					
Cable	5 x 0,25 mm ²					
Connection type	molded cable					
Protection (EN 60529)	IP 67					

21 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain



22 FASTENING BOLTS AND SEALS

Туре	Size	Fastening bolts	Seals		
	1 10	4 socket head screws M6x40 class 12.9	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max)		
	1 = 10	Tightening torque = 15 Nm	2 OR 108 Diameter of ports X, Y: $\emptyset = 5 \text{ mm} (\text{max})$		
• 10	2 – 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max)		
DBZO	2 = 10	2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	2 OR 2043 Diameter of ports X, Y: \emptyset = 7 mm (max)		
4 = 25 6 = 32	4 - 25	6 socket head screws M12x60 class 12.9	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max)		
	4 = 20	Tightening torque = 125 Nm	2 OR 3056 Diameter of ports X, Y: $\emptyset = 7 \text{ mm} (\text{max})$		
	6 - 22	6 socket head screws M20x80 class 12.9	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max)		
	U = 32	Tightening torque = 600 Nm	2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)		

ISO 4401: 2005			Mass [kg]	
Mounting surface: 4401-05-05-0-05 (see table P005)		Α	AEB, AES	AES-EH
	DPZO-*-15	7,7	8,1	8,2
	DPZO-*-17	8,6	9	9,1
	Option /G		+0,9	







DPZO-AEB-NP-1 DPZO-AEB-IL-1





DPZO-AES-BC-1 DPZO-AES-BP-1



option /G



Dotted line = double solenoid version

(1) = Air bleeding 3

 $(\mathbf{2})$ = Space required for connection cable and for connector removal

(3) = The dimensions of connectors and Bluetooth adapter must be considered, see section 19.7, 19.8 and 19.9

Note: for /B option the solenoid and the on-board digital driver are at side of port B of the main stage

24 INSTALLATION DIMENSIONS FOR DPZO-2 [mm]

ISO 4401: 2005

Mounting surface: 4401-07-07-0-05 (see table P005)

		Mass [kg]	
	Α	AEB, AES	AES-EH
DPZO-*-25	11,9	12,3	12,4
DPZO-*-27	12,8	13,2	13,3
Option /G		+0,9	

DPZO-A-2





DPZO-AEB-NP-2 DPZO-AEB-IL-2





DPZO-AES-BC-2

DPZO-AES-BP-2



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(3) = The dimensions of connectors and Bluetooth adapter must be considered, see section 19.7, 19.8 and 19.9

Note: for /B option the solenoid and the on-board digital driver are at side of port B of the main stage $\ensuremath{\mathsf{N}}$

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25 INSTALLATION DIMENSIONS FOR DPZO-4 [mm]

ISO 4401: 2005

Mounting surface: 4401-08-08-0-05 (see table P005)

		Mass [kg]	
	Α	AEB, AES	AES-EH
DPZO-*-45	17,1	18	18,1
DPZO-*-47	18	18,9	19
Option /G		+0,9	







option /G

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DPZO-AEB-NP-4 DPZO-AEB-IL-4





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(3) = The dimensions of connectors and Bluetooth adapter must be considered, see section 19.7, 19.8 and 19.9

Note: for /B option the solenoid and the on-board digital driver are at side of port B of the main stage



Mounting surface: 4401-10-09-0-05 (see table P005)







DPZO-AES-BC-6 DPZO-AES-BP-6







(3) = The dimensions of connectors and Bluetooth adapter must be considered, see section 19.7, 19.8 and 19.9

Note: for /B option the solenoid and the on-board digital driver are at side of port B of the main stage

27 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric a	nd electronic connectors
C010	E MLAC appled driver	P005 OB120	Quicketa	t for AEB valves commissioning
G020	E-MI-AS-IR digital driver	QF120	Quickstar	t for AES valves commissioning
G030	E-BM-AS digital driver	E-MAN-I	MI-AS	E-MI-AS-IR user manual (off-board)
GS050	E-BM-AES digital driver	E-MAN-I	BM-AS	E-BM-AS user manual (off-board)
GS500	Programming tools	E-MAN-I	BM-AES	E-BM-AES user manual (off-board)
GS510	Fieldbus	E-MAN-I	RI-AEB	AEB user manual
GS520	IO-Link interface	E-MAN-I	RI-AES	AES user manual

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Proportional directional valves

piloted, without transducer, with positive spool overlap



(1) In standard configuration the solenoid (config. 51 and 53) is at side A of the main stage (side B of pilot valve)

(2) Select valve's coil voltage /18 in case of electronic drivers not supplied by Atos, with power supply 24V_{bc} and with max current limited to 1A.

2 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-A	\C-01F	E-MI-AS-IR E-BM-AS-PS E-BM-AES				
Туре	Ana	alog	Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format		plug-in to solenoid			o solenoid DIN-rail panel		
Tech table	GC)10	G020 G030		GS050		

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supplied with relevent components.

4 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	75 years, see technical table P007					
Ambient temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$					
Storage temperature range	Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Surface protection	Zinc coating with black passivation					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)					
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU					
	REACH Regulation (EC) n°1907/2006					

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DPZE-*-1	DPZE	-*-2	DPZE-*-4	DPZE-*-6	
Pressure limits	[bar]		ports P , A , B , X = 350; T = 250 (10 with internal drain /D) Y = 10				
Spool type		L5, S5, D5	L3, S3, D3		L5, S5, D5		
Nominal flow Δ	p P-T [l/min]						
(1)	$\Delta p=10$ bar	100	160	250	480	640	
-	Δp = 30 bar	160	270	430	830	1100	
Max permissible flow		180	400	550	900	1500	
Piloting pressur	re [bar]	min = 25; max = 350 (option /G advisable for pilot pressure > 150 bar)					
Piloting volume	[cm ³]	1,4	3,7	,	9,0	21,6	
Piloting flow (2)	[l/min]	1,7	3,7	,	6,8	14,4	
Leakage (3)	[l/min]	0,15 / 0,5	0,2/	0,2 / 0,6		1,0 / 3,0	
Response time	e (4) [ms]	≤ 80	≤ 100		≤ 120	≤ 180	
Hysteresis			≤ 5 [% of max regulation]				
Repeatibility			± ·	1 [% of max regulatio	n]		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2

(1) For different Δp , the max flow is in accordance to the diagrams in section 8.2 (2) With step reference input signal 0 ÷100 %

(3) At P = 100/350 bar (4) 0-100% step signal

6 ELECTRICAL CHARACTERISTICS

Coil voltage code	Standard standard coil to be used with Atos drivers with power supply 24Vbc	option /6 optional coil to be used with Atos drivers with power supply 12 Voc	option /18 optional coil to be used with elec- tronic drivers not supplied by Atos, with power supply 24 Vbc and max current limited to 1A			
Max. solenoid current	2,5 A	3 A	1,2 A			
Coil resistance R at 20°C	3,1 Ω 2,1 Ω		13,1 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	IP 65 (with connectors 666 correctly assembled)					
Duty factor	Continuous rating (ED=100%)					
Certification	cURus North American Standards					

7 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM HFDU, HFDR		100 10000	
Flame resistant with water		NBR, HNBR	NBR, HNBR HFC ISO 12922		







Reference signal $\begin{array}{c} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{array} \right\} \text{ P} \rightarrow \text{A / B} \rightarrow \text{T}$

Reference signal $\begin{array}{c} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{array} P \rightarrow B / A \rightarrow T$

6A

12A

8.2 Flow /Ap diagram

stated at 100% of spool stroke **DPZE-1:**

1 = spools L5, S5, D5

DPZE-2:

2 = spools L3, S3, D3 **3** = spools L5, S5, D5

DPZE-4:

4 = spools L5, S5, D5

DPZE-6:

5 = spools L5, S5, D5



8.3 Response time (measured at pilot pressure = 100 bar)

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.







8.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves: Pmax = 250 bar



DPZE-A-	151-L5	251-L5	451-L5	651-L5
Max flow [I/min] $\Delta p = 15 \text{ bar}$	320	860	1600	2200

9 HYDRAULIC OPTIONS

- **B** = solenoid at side B of the main stage (side A of pilot valve).
- **D** = Internal drain. Pilot and drain configuration can be modified as shown in section 12. The valve's standard configuration provides internal pilot and external drain.
- **E** = External pilot (through port X). Pilot and drain configuration can be modified as shown in section 12. The valve's standard configuration provides internal pilot and external drain.

G = Pressure reducing valve installed between pilot valve and main body with fixed setting: DPZE-1 and DPZE-2 = 30 bar DPZE-4 and DPZE-6 = 40 bar

It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

Functional Scheme

Example of configuration 7* 3 positions, spring centered



- 1) Pilot valve
- Main stage
- ③ Pressure reducing valve
- ④ Plug to be added for external pilot trough port X
- (5) Plug to be removed for internal drain through port T

10 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

11 COILS WITH SPECIAL CONNECTORS

Options -J

Coil type COZEJ





Coil type COZEK Deutsch connector, DT-04-2P male Protection degree IP67



Options -S

Coil type COZES Lead Wire connection Cable lenght = 180 mm



12 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain



13 FASTENING BOLTS AND SEALS

Туре	Size	Fastening bolts	Seals
	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 7 mm (max)
DDZE	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 9 mm (max)
DFZE	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 25 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 11.5 mm (max)
	6 = 32	6 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

14 INSTALLATION DIMENSIONS [mm]

DPZE-1*

ISO 4401: 2005 Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]				
	Α			
DPZE-*-25*	6,9			
DPZE-*-27*	7,3			
Option /G	+0,9			

option /G







DPZE-2*

ISO 4401: 2005

Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]

	Α
DPZE-*-25*	11,9
DPZE-*-27*	12,8
Option /G	+0,9

Option /G







DPZE-4*

ISO 4401: 2005 Mounting surface: 4401-08-08-0-05 (see table P005) Mass [kg]

	Α
DPZE-*-45*	17,1
DPZE-*-47*	18
Option /G	+0,9



Dotted line = double solenoid version





DPZE-6* ISO 4401: 2005 Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]

	Α
DPZE-*-65*	44
DPZE-*-67*	44,5
Option /G	+1







Dotted line = double solenoid version

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Safety proportional valves with on-off signals

directional valves with on-board driver and LVDT transducer

IEC 61508 Safety Integrity Level and ISO 13849 Performance Level - certified by 📟



1 GENERAL DESCRIPTION

Safety proportional valves with on-off signals are identified by option /K and are intended for use in hydraulic circuits of machines which must comply with safety requirements of Machine Directive 2006/42/EC.

They are designed to perform **Safety Functions**, in addition to the standard control of direction, speed, pressure/force or position of hydraulic actuators, depending to the valve features.

The Safety Function is operated to reduce the potential dangerous risks which may happen in a specific phase of the machine cycle. It is activated by the machine central unit (PLC) which inhibits the regulation of proportional valve /K via on-off enable signals in case of emergency or for specific requirements along the working cycle.

Upon valve's disable command input, the valve driver generates on-off output signals as soon the spool has reached the safety position, confirming that hydraulic regulation has been inhibited. The machine central unit (PLC) manages this information as "safe condition".

Safety proportional valves with option /K are certified by TÜV in compliance with IEC 61508 and ISO 13849

2 CERTIFICATION

IEC 61508, IEC 61511, IEC 62061	max SIL 2 for non-redundant safety architecture max SIL 3 for redundant safety architecture	See techinical table Y010 for details about		
ISO 13849	category 1, PL c for non-redundant safety architecture category 4, PL e for redundant safety architecture	SIL, PL and safety architetures		

3 VALVES RANGE

Option /K is available for high performance proportional directional valves and servoproportional valves with TES/LES on-board digital driver or TEZ/LEZ axis controller.

It adds the safety functions to standard control of direction, speed, pressure/force (for SP, SF, SL version) and position (for TEZ, LEZ versions). Valve's performance characteristics and overall dimensions remains unchanged as per standard valve models, refer to specific FS** technical tables.

High perfomance proportionals:

DHZO-TES, DKZOR-TES - direct, positive spool overlap - technical table FS165 DPZO-TES - piloted, positive spool overlap - technical table FS172 DPZO-LES - piloted, positive spool overlap - technical table FS175

Servoproportionals:

DHZO-TES, DKZOR-TES - direct, zero spool overlap - technical tables FS168 DPZO-LES - piloted, zero spool overlap - technical table FS178 DLHZO-TES, DLKZOR-TES - direct, zero spool overlap - technical tables FS180

Servoproportionals with TEZ/LEZ axis controller:

DHZO-TEZ, DKZOR-TEZ - direct, zero spool overlap - technical tables FS620 DPZO-LEZ - piloted, zero spool overlap - technical tables FS630 DLHZO-TEZ, DLKZOR-TEZ - direct, zero spool overlap - technical tables FS610

4 FUNCTIONAL DESCRIPTION

Valves with option /K are designed to receive on-off enable signals from the machine central unit in order to inhibit the valve's regulation.

When this enable signal is switched OFF, the current to the valve's solenoid is safely cut-off, while the valve's diagnostics and communication remain active to continuously exchange its status with the machine central unit.

In consequence of the solenoid current cut-off, the valve's spool is moved by the spring towards the safe rest position and then the valve regulation is consequently inhibited.

When the spool has reached the safe position, the valve's driver generates an on-off output signal confirming to the machine central unit that the valve is in SAFE condition.

The time required by the valve's spool to reach the safe position is detailed in section 5

Safe enable input signal - SAFE_ENABLE

The SAFE_ENABLE is the command signal to cut-off the current to the solenoids in order to inhibit the valve's regulation:

- inhibited regulation: SAFE_ENABLE = **0 VDC**
- permitted regulation: SAFE_ENABLE = 24 VDC

Double solenoids valves are equipped with two independent enable circuits SAFE_ENABLE 1 and SAFE_ENABLE 2 permitting to:

- a) cut-off the current to both solenoids when the valve regulation must be inhibited in both directions
- b) cut-off the current to one solenoid when only one side of the valve regulation must be inhibited. This condition permits to intercept the actuator movement in one direction, permitting the actuator movement in the opposite direction (typical in motion/non-motion controls)

Safe enable acknowledge output signal - SAFE_ENABLE_ACK

The SAFE_ENABLE_ACK is the output signal generated by the driver to confirm that the valve has effectively reached the safe position in consequence of SAFE_ENABLE command switch-off.

SAFE_ENABLE_ACK is switched ON (24 Vbc) when the internal diagnostics verifies that solenoid current has been cut-off and the spool, monitored by the LVDT transducer, has reached the safe position.

Fault output signal – FAULT

Fault signal is a diagnostic output which states faults or warning according to the valve's status

This signal must be monitored by the machine central unit in addition to the SAFE_ENABLE_ACK signal, to intercept failures which may compromise the valve safety function.

The FAULT signal is switched OFF (0 Vbc) when the internal diagnostics detects valve failures or incorrect behavior (e.g. : spool sticking, solenoid short circuits, missing coils connection, reference signal cable broken for 4 ÷ 20 mA input, etc)

For piloted valves the FAULT signal = 0 Vpc indicates also the absence of pilot pressure.

5 SWITCH-OFF TIME

The valve switch-off time is the time between the SAFE_ENABLE signal = 0 VDc and the SAFE_ENABLE ACK signal = 24 VDc. It is influenced by the working conditions like flow, pressure and fluid viscosity.

The switch-off times shown in the table are considered in the following conditions:

- max flow and max pressure values as per specific technical table of each valve model
- fluid viscosity 46 mm²/s
- fluid contamination level: ISO4406 CLASS 18/16/13

The following switch-off times can be considered as the longest ones.

For different working conditions, consult Atos technical office.

Valve model	DHZO	DKZOR	DLHZO	DLKZOR	DPZO-1	DPZO-2	DPZO-4 DPZO-4M	DPZO-6	DPZO-8
Switch-off time [ms]	50	80	40	60	180	250	300	350	400

6 FUNCTIONAL EXAMPLES

The following examples show the condition of a double solenoid valve and of the controlled actuator depending to the SAFE_ENABLE status.

Valve normal operation

Input signals [VDC]		Output signals [VDC]		
SAFE_ENABLE 1	SAFE_ENABLE 2	SAFE_ENABLE 1_ACK	SAFE_ENABLE 2_ACK	
24	24	0	0	



Valve safe operation with P-A/B-T regulation inhibited to prevent the actuator forward movement

Input sigr	nals [VDC]	Output sig	nals [VDC]
SAFE_ENABLE 1	SAFE_ENABLE 2	SAFE_ENABLE 1_ACK	SAFE_ENABLE 2_ACK
0	24	24	0



Valve safe operation with P-B/A-T regulation inhibited to prevent the actuator backward movement

Input sigr	nals [VDC]	Output signals [VDC]		
SAFE_ENABLE 1	SAFE_ENABLE 2	SAFE_ENABLE 1_ACK	SAFE_ENABLE 2_ACK	
24	0	0	24	



Valve safe operation with regulation completely inhibited

Input sigr	nals [VDC]	Output signals [VDC]		
SAFE_ENABLE 1	SAFE_ENABLE 2	SAFE_ENABLE 1_ACK	SAFE_ENABLE 2_ACK	
0	0	24	24	



INHIBITED SPOOL POSITION SAFE_ENABLE = **0VDC** PERMITTED SPOOL POSITION SAFE_ENABLE = **24VDC**



7 INHIBITED / PERMITTED SPOOL POSITION

The below tables show the inhibited / permitted spool position depending to the SAFE_ENABLE status for all models of safety proportional valves.

Note: the inhibition of the actuator direction may be affected by other valves present in the circuit, then the whole hydraulic system where the valve /K is applied must be considered.

7.1 High performance proportionals

INHIBITED SPOOL POSITION

PERMITTED SPOOL POSITION

DHZO-TES, DKZOR-TES - direct operate	ed, positive spool overlap - technical table FS165
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Inp sigi	out nals	Ou	tput nals	Config 51,	uration 53	Config 71, 7	uration 2 2, 73
[Ŭi	DC]	Ŭ]	DC]	standard	option /B	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 2	SAFE ENABLE 1_ACK	SAFE ENABLE 2_ACK				
24		0					
0		24					
24	24	0	0	1	\bigcirc		
0	24	24	0				
24	0	0	24				
0	0	24	24				
							1

DPZO-TES - pilot operated	, positive spool overlap	- technical table FS172
---------------------------	--------------------------	-------------------------

lnı sigi	out nals	Ou sig	tput nals	Config 51,	uration , 53	Config 71, 7	uration 2, 73
[Vi	DC]	[V]	DC]	standard	option /B	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 2	SAFE ENABLE 1_ACK	SAFE ENABLE 2_ACK				
24		0					
0		24		$\begin{array}{c} \bot \ \bot \ \blacktriangle \\ T \ T \ \end{array} \\ \begin{array}{c} \intercal \\ \intercal \end{array} \\ \begin{array}{c} \bullet \\ \bullet \\ \intercal \end{array} \\ \begin{array}{c} \bullet \\ \bullet \\ \bullet \\ \bullet \end{array} \\ \begin{array}{c} \bullet \\ \bullet $			
24	24	0	0	1	\bigcirc		
0	24	24	0				
24	0	0	24				
0	0	24	24				
						\bigcirc	\bigcirc

DPZO-LES - pilot operated, positive spool overlap - technical table FS175

Input signals [VDC]	Output signals [VDC]	Config 71, 7 standard	uration 2, 73 option /B
SAFE ENABLE 1	SAFE ENABLE 1_ACK		
24	0		
0	24		
<u> </u>		\bigcirc	\bigcirc

7.2 Servoproportionals

INHIBITED SPOOL POSITION

PERMITTED SPOOL POSITION

DHZO-TES/TEZ, DKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables FS168, FS620

Inp sigr	out nals	Ou sig	tput nals	Configuration 70	
[Vi	DC]	[V	DC]	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 2	SAFE ENABLE 1_ACK	SAFE ENABLE 2_ACK		
24	24	0	0		
0	24	24	0		
24	0	0	24		
0	0	24	24		
				2	2

DPZO-LES, DPZO-LEZ - pilot operated, zero spool overlap - technical table FS178, FS630

Input signals	Output signals	Config 6	uration 0	Config 7	uration '0
[VDC]	[VDC]	standard	option /B	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 1_ACK				
24	0				
0	24				
				2	2

DLHZO-TES/TEZ, DLKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables FS180, FS610

Input signals	Output signals	Config 40 with fail	uration safe 1 or 3	Configuration 60 without fail safe		
[VDC]	[VDC]	standard	option /B	standard	option /B	
SAFE ENABLE 1	SAFE ENABLE 1_ACK					
24	0					
0	24					
		1	1	1	1	

1 = Spool safety rest position

(2) = Spool safety rest position for valves with zero spool overlap, configuration 70 - see 7.3

7.3 Safety rest position - for valves with zero spool overlap, configuration 70

In absence of solenoid power supply (SAFE_ENABLE1 = 0 and SAFE_ENABLE2 = 0), the valve spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.

This is specifically designed to avoid that in case of interruption of solenoid power supply, the actuator moves towards an undefined direction (due to the tolerances of the zero spool overlap), with potential risk of damages or personnel injury.

Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



8 ELECTRONIC CONNECTIONS

PIN	TES TEZ LES LEZ		TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 Vpc	Input - power supply
2	V0		Power supply 0 Vbc	Gnd - power supply
3	SAFE_ENABL	.E1	Enable (24 Vpc) or disable (0 Vpc) the solenoid at side of the driver and position transducer, referred to V0 $$	Input - on/off signal
4	Q_INPUT+		Flow (spool position) reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /l option	Input - analog signal
4	P_INPUT+		Position reference input signal: ±10 Vpc / ±20 mA maximum range	Software selectable
5	5 INPUT-		Negative reference input signal for Q_INPUT+, F_INPUT+ and P_INPUT+	Input - analog signal
6	Q_MONITOR		Flow (spool position) monitor output signal: ± 10 Vpc / ± 20 mA maximum range, referred to V0. Defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /I option	Output - analog signal
0	P_MONITOR		Position monitor output signal: ±10 Vpc / ±20 mA maximum range, referred to V0	Software selectable
7	F_INPUT+	(1)	Pressure/force reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /l option	Input - analog signal Software selectable
8	SAFE_ENABLE1_ACK		Safe condition acknowledged (24 Vpc) or unacknowledged (0 Vpc) for solenoid at side of the driver and position transducer, referred to V0	Output - on/off signal
9	SAFE_ENABLE2_ACK (2)		Safe condition acknowledged (24 Vbc) or unacknowledged (0 Vbc) for solenoid at the opposite side of the driver and position transducer, referred to V0	Output - on/off signal
10	10 SAFE_ENABLE2 (2)		Enable (24 Vpc) or disable (0 Vpc) the solenoid at the opposite side of the driver and position transducer, referred to V0	Input - on/off signal
11	FAULT		Fault (0 Vpc) or normal working (24 Vpc), referred to V0	Output - on/off signal
PE	EARTH		Internally connected to driver housing	

8.1 Main connector signals - 12 pin - options /K

(1) Connection NOT available for TES/LES in SN execution

(2) Connections available only for double solenoid valves

9 ELECTRICAL CHARACTERISTICS

SIGNALS	SPECIFICATIONS	NOTES
SAFE_ENABLE1 SAFE_ENABLE2	Input range: -3 \div 5 Vpc (OFF state), 15 \div 30 Vpc (ON state), 5 \div 15 Vpc (not accepted) Input impedance: Ri > 10 k Ω	Input - on/off signal
SAFE_ENABLE1_ACK SAFE_ENABLE2_ACK FAULT	ON state depends on input power supply V+: ON state > V+ - 2V @ max 50 mA e.g. in case of V+ = 24V, the ON state > 22V OFF state < 1 V; External negative voltage not allowed (e.g. due to inductive loads)	Output - on/off signal

Note: for the electrical characteristic of all other signals, refer to the technical table of each valve model - see section 3

9.1 Connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

For fieldbus and/or transducers connections, refer to specific technical tables of each valve model - see section 3

10 BLOCK DIAGRAMS

10.1 Single solenoid valves



10.2 Double solenoid valves



11 RELATED DOCUMENTATION

General ta	ables:
Y010 FS001 FS500 FS900 GS500 GS510 K800 P005	Basics for safety components Basics for digital electrohydraulics Digital proportional valves with p/Q control Operating and maintenance information for proportional valves Programming tools Fieldbus Electric and electronic connectors Mounting surfaces for electrohydraulic valves
FS165 FS172 FS175 FS168 FS180 FS180 FS178 FS610 FS620 FS630	DHZO-TES, DKZOR-TES, direct operated DPZO-TES, pilot operated DPZO-LES, pilot operated DHZO-TES, DKZOR-TES, direct operated, zero spool overlap DLHZO-TES, DLKZOR-TES, direct operated, sleeve execution DPZO-LES, pilot operated, zero spool overlap DLHZO-TEZ, DLKZOR-TEZ digital proportional valves with on-board axis card DHZO-TEZ, DKZOR-TEZ digital proportional valves with on-board axis card DHZO-TEZ, DKZOR-TEZ digital proportional valves with on-board axis card DPZO-LEZ digital proportional valves with on-board axis card
Commiss QF300 QF320	ioning and troubleshooting tables: Quickstart for TES direct operated proportional valves (supplied with the valve) Quickstart for TES/LES pilot operated proportional valves (supplied with the valve)
Operating E-MAN-RI E-MAN-RI E-MAN-S- E-MAN-S- E-MAN-S- E-MAN-S- E-MAN-S- E-MAN-S-	and fieldbus manuals for TES and LES: I-LES - TES and LES drivers user manual I-LES-S - TES and LES drivers with p/Q control user manual -BC - CANopen protocol programming manual -BP - PROFIBUS DP protocol programming manual -EH - EtherCAT protocol programming manual -EW - POWERLINK protocol programming manual -EI - EtherNet/IP protocol programming manual -EI - EtherNet/IP protocol programming manual -EP - PROFINET IRT protocol programming manual
Operating Z-MAN-RI Z-MAN-S- Z-MAN-S- Z-MAN-S- Z-MAN-S- Z-MAN-S- Z-MAN-S- Z-MAN-S-	and fieldbus manuals for TEZ and LEZ: -LEZ - TEZ and LEZ controllers user manual -LEZ-S - TEZ and LEZ controllers with p/Q control user manual BC - CANopen protocol programming manual BP - PROFIBUS DP protocol programming manual EH - EtherCAT protocol programming manual EW - POWERLINK protocol programming manual EU - EtherNet/IP protocol programming manual EP - PROFINET IRT protocol programming manual EP - PROFINET IRT protocol programming manual
SIL safety TT366 TT367 TT368	/ manuals for operating, installation and maintenance (on request): DHZO-TES/TEZ, DKZOR-TES/TEZ DLHZO-TES/TEZ, DLKZOR-TES/TEZ DPZO-TES/LES/LEZ
TÜV certii TUV IT 22 TUV IT 22	ficates (on request): SIL 0092 Safety proportional valves, direct operated SIL 0091 Safety proportional valves, piloted operated

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Safety proportional valves with double power supply

directional valves with on-board driver and LVDT transducer

IEC 61508 Safety Integrity Level and ISO 13849 Performance Level - certified by 🛞



1 GENERAL DESCRIPTION

Safety proportional valves with double power supply are identified by option /U and are intended for use in hydraulic circuits of machines which must comply with safety requirements of Machine Directive 2006/42/EC.

They are designed to perform **Safety Functions**, in addition to the standard control of direction, speed, pressure/force or position of hydraulic actuators, depending to the valve features.

The Safety Function is operated to reduce the potential dangerous risks which may happen in a specific phase of the machine cycle. It is activated by the machine central unit (PLC) which inhibits the regulation of proportional valve /U by removing the safe power supply to the valve solenoids in case of emergency or for specific requirements along the working cycle.

Upon solenoid power supply interruption, the valve driver remains active thanks to the separated power supply for logics, thus providing fault signal and communication to the machine central unit (PLC) which manages these information as diagnostic signals.

Safety proportional valves with option /U are certified by TÜV in compliance with IEC 61508 and ISO 13849

2 CERTIFICATION

IEC 61508, IEC 61511, IEC 62061	max SIL 2 for non-redundant safety architecture max SIL 3 for redundant safety architecture	See techinical table Y010 for details about
ISO 13849	category 1, PL c for non-redundant safety architecture category 4, PL e for redundant safety architecture	SIL, PL and safety architetures

3 VALVES RANGE

Option /U is available for high performance proportional directional valves and servoproportional valves with TES/LES on-board digital driver or TEZ/LEZ axis controller.

It adds the safety functions to standard control of direction, speed, pressure/force (for SP, SF, SL version) and position (for TEZ, LEZ versions). Valve's performance characteristics and overall dimensions remains unchanged as per standard valve models, refer to specific FS** technical tables.

High perfomance proportionals:

DHZO-TES, DKZOR-TES - direct, positive spool overlap - technical table FS165 DPZO-TES - piloted, positive spool overlap - technical table FS172 DPZO-LES - piloted, positive spool overlap - technical table FS175

Servoproportionals:

DHZO-TES, DKZOR-TES - direct, zero spool overlap - technical tables FS168 DPZO-LES - piloted, zero spool overlap - technical table FS178 DLHZO-TES, DLKZOR-TES - direct, zero spool overlap - technical tables FS180

Servoproportionals with TEZ/LEZ axis controller:

DHZO-TEZ, DKZOR-TEZ - direct, zero spool overlap - technical tables FS620 DPZO-LEZ - piloted, zero spool overlap - technical tables FS630 DLHZO-TEZ, DLKZOR-TEZ - direct, zero spool overlap - technical tables FS610

4 FUNCTIONAL DESCRIPTION

Valves with option /U are designed to receive separated power supplies for logic VL+ and solenoids SAFE_V+.

When the solenoid power supply SAFE_V+ is removed, the valve's spool is moved by the spring towards the safe rest position and then the valve regulation is consequently inhibited.

The valve's diagnostics and communication remain active thanks to the logic power supply VL+ and then the valve can continuously exchange spool position and status with the machine central unit.

The time required by the valve's spool to reach the safe position is detailed in section 5

Safe power supply - SAFE_V+

- The SAFE_V+ feeds only the valve solenoids. It can be removed to cut-off the current to the solenoids in order to inhibit the valve's regulation:
- inhibited regulation: SAFE_V+ = **0 VDC**
- permitted regulation: SAFE_V+ = 24 VDC

For double solenoids valves the power supply SAFE_V+ feeds both solenoids, then when it is removed the valve regulation is completely inhibited.

Power supply - VL+

The VL + feeds the logic and communication functions. It must always be kept ON = 24VDC to allow the real-time diagnostics of the valve status and spool position.

Fault output signal - FAULT

Fault signal is a diagnostic output which states faults or warning according to the valve status. This signal must be monitored by the machine central unit to intercept failures which may compromise the valve safety function. The FAULT signal is switched OFF (0 VDc) when the internal diagnostics detects valve failures or incorrect behaviour (e.g. : spool sticking, solenoid short circuits, missing coils connection, reference signal cable broken for $4 \div 20$ mA input, etc). For piloted valves the FAULT signal = 0 VDc indicates also the absence of pilot pressure.

5 SWITCH-OFF TIME

The switch-off time is the time between the power supply SAFE_V+ interruption and the achievement of the spool safety rest position. It is influenced by the working conditions like flow, pressure and fluid viscosity.

The switch-off times shown in the table are considered in the following conditions:

- max flow and max pressure values as per specific technical table of each valve model
- fluid viscosity 46 mm²/s
- fluid contamination level: ISO4406 CLASS 18/16/13

The following switch-off times can be considered as the longest ones.

For different working conditions, consult Atos technical office.

Valve model	DHZO	DKZOR	DLHZO	DLKZOR	DPZO-1	DPZO-2	DPZO-4 DPZO-4M	DPZO-6	DPZO-8
Switch-off time [ms]	50	80	40	60	180	250	300	350	400

6 FUNCTIONAL EXAMPLES

The following examples show the condition of a double solenoid valve and of the controlled actuator depending to the SAFE_ENABLE status.

Valve normal operation

Safe Power Supply [VDC]	Power Supply [VDC]
SAFE_V+	VL+
24	24

Valve safe operation with regulation completely inhibited

Safe Power Supply [VDC]	Power Supply [VDC]
SAFE_V+	VL+
0	24





INHIBITED SPOOL POSITION SAFE_V+ = **0VDC** PERMITTED SPOOL POSITION SAFE V+ = 24VDC

FY100





7 INHIBITED / PERMITTED SPOOL POSITION

The below tables show the inhibited / permitted spool position depending to the SAFE_V+ status for all models of safety proportional valves. **Note:** the inhibition of the actuator direction may be affected by other valves present in the circuit, then the whole hydraulic system where the valve /U is applied must be considered.

7.1 High performance proportionals

INHIBITED SPOOL POSITION

PERMITTED SPOOL POSITION

$\textbf{DHZO-TES, DKZOR-TES} \ \text{-} \ \text{direct operated, positive spool overlap - technical table } \textbf{FS165}$

Safe Power Supply	Power Supply	Configuration 51, 53		Configuration 71, 72, 73	
[VDC]	[VDC]	standard	option /B	standard	option /B
SAFE_V+	VL+				
24	24				
0	24				
		1	(1)	1	\bigcirc

DPZO-TES - pilot operated, positive spool overlap - technical table FS172

Safe Power Supply [Vpc]	Power Supply	Configuration 51, 53 standard option /B		Configuration 71, 72, 73 standard option /B	
SAFE_V+	VL+				
24	24				
0	24				
		1	1	(1)	1

DPZO-LES - pilot operated, positive spool overlap - technical table FS175

Safe Power Supply	Power Supply	Config 71, 7	uration 2. 73
[VDC]	[VDC]	standard	option /B
SAFE_V+	VL+		
24	24		
0	24		
		\square	

7.2 Servoproportionals

INHIBITED SPOOL POSITION

PERMITTED SPOOL POSITION

Safe Power Supply	Power Supply	Config 7	uration 0
[VDC]	[VDC]	standard	option /B
SAFE_V+	VL+		
24	24		
0	24		
		2	

DHZO-TES/TEZ, DKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables FS168, FS620

DPZO-LES, DPZO-LEZ - pilot operated, zero spool overlap - technical table FS178, FS630

Safe Power Supply	Power Supply	Config 6	uration 0	Config 7	uration 0
[VDC]	[VDC]	standard	option /B	standard	option /B
SAFE_V+	VL+				
24	24				
0	24				
				2	2

DLHZO-TES/TEZ, DLKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables FS180, FS610

Safe Power Supply	Power Supply	Configuration 40 with fail safe 1 or 3		Configuration 60 without fail safe	
[VDC]	[VDC]	standard	option /B	standard	option /B
SAFE_V+	VL+				
24	24				
0	24				
		1	1	1	1

(1) = Spool safety rest position

(2) = Spool safety rest position for valves with zero spool overlap, configuration 70 - see 7.3

7.3 Safety rest position - for valves with zero spool overlap, configuration 70

In absence of solenoid power supply (SAFE_V+ = 0), the valve spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.

This is specifically designed to avoid that in case of interruption of solenoid power supply, the actuator moves towards an undefined direction (due to the tolerances of the zero spool overlap), with potential risk of damages or personnel injury.

Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



8 ELECTRONIC CONNECTIONS

PIN	TES LES	TEZ LEZ	TECHNICAL SPECIFICATIONS	NOTES	
1	SAFE_V+		Safe power supply 24 Vbc for solenoid	Input - power supply	
2	SAFE_V0		Safe power supply 0 Vbc for solenoid	Gnd - power supply	
3	ENABLE		Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal	
4	Q_INPUT+		Flow (spool position) reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Input - analog signal Software selectable	
		P_INPUT+	Position reference input signal: ±10 Vbc / ±20 mA maximum range		
5	INPUT-		Negative reference input signal for Q_INPUT+, F_INPUT+ and P_INPUT+	Input - analog signal	
6	Q_MONITOR		Flow (spool position) monitor output signal: ± 10 Vpc / ± 20 mA maximum range, referred to VL0. Defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /l option	Output - analog signal	
		P_MONITOR	Position monitor output signal: ±10 Vpc / ±20 mA maximum range, referred to VL0	Software selectable	
7	F_INPUT+	(1)	Pressure/force reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /l option	Input - analog signal Software selectable	
8	F_MONITOR	(1)	Pressure/force monitor output signal: ± 10 Vbc / ± 20 mA maximum range, referred to VL0 Defaults are ± 10 Vbc for standard and $4 \div 20$ mA for /l option	Output - analog signal Software selectable	
9	VL+		Power supply 24 Vpc for driver's logic and communication	Input - power supply	
10	VL0		Power supply 0 Vbc for driver's logic and communication	Gnd - power supply	
11	FAULT		Fault (0 Vpc) or normal working (24 Vpc), referred to VL0	Output - on/off signal	
PE	EARTH		Internally connected to driver housing		

8.1 Main connector signals - 12 pin - options /U

(1) Connection NOT available for TES/LES in SN execution

9 ELECTRICAL CHARACTERISTICS

SIGNALS	SPECIFICATIONS	NOTES
SAFE_V+ VL+	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	Input - power supply
FAULT	ON state depends on input power supply VL+: ON state > VL+ - 2V @ max 50 mA e.g. in case of VL+ = 24V, the ON state > 22V OFF state < 1 V; External negative voltage not allowed (e.g. due to inductive loads)	Output - on/off signal

Note: for the electrical characteristic of all other signals, refer to the technical table of each valve model - see section 3

9.1 Connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

For fieldbus and/or transducers connections, refer to specific technical tables of each valve model - see section 3
10 RELATED DOCUMENTATION

General t	ables:
Y010	Basics for safety components
FS001	Basics for digital electrohydraulics
FS500	Digital proportional valves with p/Q control
FS900	Operating and maintenance information for proportional valves
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electronydraulic valves
Valves te	chnical tables:
	DUZO TES DUZOD TES direct apareted
F3103	DRZO-TES, DRZOR-TES, direct operated
FS175	DPZO-LES, pilot operated
FS168	DHZO-TES, DKZOR-TES, direct operated, zero spool overlap
FS180	DLHZO-TES, DLKZOR-TES, direct operated, sleeve execution
FS178	DPZO-LES, pilot operated, zero spool overlap
FS610	DLHZO-TEZ, DLKZOR-TEZ digital proportional valves with on-board axis card
FS620	DHZO-TEZ, DKZOR-TEZ digital proportional valves with on-board axis card
FS630	DPZO-LEZ digital proportional valves with on-board axis card
Commiss	ioning and troubleshooting tables:
QF300	Quickstart for TES direct operated proportional valves (supplied with the valve)
QF320	Quickstart for TES/LES pilot operated proportional valves (supplied with the valve)
Operating	g and fieldbus manuals for TES and LES:
E-MAN-R	I-LES - TES and LES drivers user manual
E-MAN-R	I-LES-S - TES and LES drivers with p/Q control user manual
E-MAN-S	-BC - CANopen protocol programming manual
E-MAN-S	-BP - PROFIBUS DP protocol programming manual
E-MAN-S	-EH - EtherCAI protocol programming manual
E-MAN-S	-EW - POWERLINK protocol programming manual
E-MAN-S	-EI - EtherNet/IP protocol programming manual
E-MAN-5	-EP - PROFINET IRT protocol programming manual
Operating	and fieldbus manuals for TE7 and LE7
	LET TEZ and LEZ controllars upor manual
	FLEZ - TEZ and LEZ controllers user manual $LI E7_S$ TEZ and LEZ controllers with p/Q control user manual
7-ΜΔΝ-S	- CANopen protocol programming manual
Z-MAN-S-	BP - PROFIBLIS DP protocol programming manual
Z-MAN-S-	EH - EtherCAT protocol programming manual
Z-MAN-S-	EW - POWERLINK protocol programming manual
Z-MAN-S-	El - EtherNet/IP protocol programming manual
Z-MAN-S-	EP - PROFINET IRT protocol programming manual
SIL safety	y manuals for operating, installation and maintenance (on request):
TT366	DHZO-TES/TEZ, DKZOR-TES/TEZ
TT367	DLHZO-TES/TEZ, DLKZOR-TES/TEZ
TT368	DPZO-TES/LES/LEZ
T ÜM	
TUV certi	Ticates (on request):
TUV IT 22	SIL 0068 Safety proportional valves, direct operated
10111 22	Salety proportional valves, piloted operated

atos 🛆

Digital proportional relief valves high performance

direct, with on-board pressure transducer



(1) Possible combined options: IQ, IZ (/T Bluetooth adapter option can be combined with all other options)

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES	
Туре	Digital	
Format	DIN rail panel format	
Tech table	GS203	

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

7 SMART TUNING

Smart tuning allows to adjust the valve dynamic response in order to match different hydraulic conditions and performance requirements.

The valve is provided with 3 factory settings for the pressure control:

- dynamic fast response time for best dynamic performances. Default factory setting for pressure valves

- balanced average response time suitable for major applications

- smooth attenuated response time for slow regulation without overshoots

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-* and Quickstart, see section 44. Below indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume.



8 IO-LINK - only for REB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

9 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

Bluetooth or USB connection



10 GENERAL CHARACTERISTICS

Assembly position	Any position			
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100			
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007			
Ambient temperature range	R:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$			
Storage temperature range	R:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$			
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)			
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h			
Vibration resistance	See technical table G004 (for REB and RES)			
	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU			
	REACH Regulation (EC) n°1907/2006			

11 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		RZMO-*-010	
Max regulated pressure	[bar]	100; 210; 315; 350	
Max pressure at port P	[bar]	350	
Max pressure at port T	[bar]	210	
Min regulated pressure	[bar]	see min. pressure / flow diagram at section 14	
Max flow	[l/min]	4	
Response time 0-100% step signal (depending on installation) (1) [ms]		≤ 55	
Hysteresis		≤ 0,3 [% of max pressure]	
Linearity		≤ 1,0 [% of max pressure]	
Repeatability		≤ 0,2 [% of max pressure]	
Thermal drift		zero point displacement < 1% at $\Delta T = 40^{\circ}C$	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 7

12 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal Rectified and filtere [,]	: +24 VDC d : VRMS = 20 ÷ 32 V	/MAX (ripple max 10 s	% Vpp)	
Max power consumption	R = 30 W	REB , RES = 50 V	1		
Max. solenoid current	3 A				
Coil resistance R at 20°C	3 ÷ 3,3 Ω				
Analog input signals	Voltage: range ±10 Current: range ±20	0 VDC (24 VMAX tolera 0 mA	ant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$	2
Monitor output	Voltage: maximum Current: maximum	range 0 ÷ 10 VDC range 0 ÷ 20 mA	@ max 5 mA @ max 500 Ω load r	esistance	
Enable input	Range: 0 ÷ 9 VDC (O	FF state), 15 ÷ 24 VDC	(ON state), 9 ÷ 15 VDC	(not accepted); Input	impedance: Ri > 87 k Ω
Fault output	Output range : 0 ÷ external negative vc	24 VDC (ON state \cong bltage not allowed (e.	VL+ [logic power su g. due to inductive lo	pply] ; OFF state ≅ 0 ads)	V) @ max 50 mA;
Pressure transducer (1)	E-ATR-8/*/I Outp	ut signal: 4 ÷ 20 mA	(see tech table GS4	165)	
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure				
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account				
Protection degree to DIN EN60529	R = IP65; REB, RES	S = IP66 / IP67 with m	ating connectors		
Duty factor	Continuous rating (E	D=100%)			
Tropicalization	Tropical coating on	electronics PCB			
Additional characteristics	Additional characteristics Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid swit protection against reverse polarity of power supply			pid solenoid switching;	
	USB	IO-Link	CANopen	PROFIBUS DP	EtherCAT
Communication interface	Atos ASCII coding	Interface and System Specification 1.1.3	EN50325-4 + DS408	EN50170-2/IEC61158	IEC 61158
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cab	les, see section 21			

(1) In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW-SETUP software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
 - automatically switch the pressure control from closed loop (dynamic, balanced, smooth) to open loop, to let the valve to temporarily operate with reduced regulation accuracy

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

13 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	l temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for R), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1638 class 7 se		see also filter section at	
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5 w		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	FKM HFDU, HFDR		
Flame resistant with water		NBR, NBR low temp.	HFC	100 12922	

14 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)



15 ELECTRONIC OPTIONS - only for REB-NP and RES

- This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 18.5 for signal specifications.
- Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal see 18.6
 Enable input signal see above option /Q
 Power supply for driver's logics and communication see 18.2

16 POSSIBLE COMBINED OPTIONS

Electronic options: /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

17 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for REB-NP and RES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **REB-IL** signals see section 19

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 \div 24 VDC.

18.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

19 IO-LINK SIGNALS SPECIFICATIONS - only for REB-IL

19.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDc power supply for IO-Link communication. Maximum power consumption: 2 W

Internal electrical isolation of power L+, L- from P24, N24

19.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics.

Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

19.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB-NP and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
А	V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 VDc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDc) or disable (0 VDc) the driver, referred to V0	Input - on/off signal
D	P_INPUT+		Pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	E INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	P_MONITOF Agnd	R referred to: V0	Pressure monitor output signal: 0 \div 10 Vpc / 0 \div 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
G	G EARTH		Internally connected to driver housing	

20.2 Main connector signals - 12 pin \bigcirc /Z option - for REB-NP and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vbc	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to VL0	Input - on/off signal
4	P_INPUT+	Pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /l option	Input - analog signal Software selectable
5	INPUT- Negative reference input signal for INPUT+		Input - analog signal
6	P_MONITOR	Pressure monitor output signal: 0 ÷ 10 Vpc / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	VL0 Power supply 0 Vpc for driver's logic and communication		Gnd - power supply
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for REB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vpc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vpc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vpc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

20.4 Communication connectors - for REB $(\ensuremath{\mathsf{B}})$ and RES $(\ensuremath{\mathsf{B}})$ - $(\ensuremath{\mathsf{C}})$

В	B USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)	
1	+5V_USB	Power supply	
2	ID	Identification	
3	GND_USB	Signal zero data line	
4	D-	Data line -	
5	D+	Data line +	

C2	2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL TECHNICAL SPECIFICATION (1)		
1	+5V	Termination supply signal	
2	LINE-A	Bus line (high)	
3	DGND Data line and termination signal zero		
4	LINE-B	Bus line (low)	
5	SHIELD		

(1) Shield connection on connector's housing is recommended

20.5 Solenoid connection - only for $\ensuremath{\mathsf{R}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

©1)	BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL TECHNICAL SPECIFICATION (1)		
1	CAN_SHLD	Shield	
2	NC	do not connect	
3	CAN_GND	Signal zero data line	
4	CAN_H	Bus line (high)	
5	CAN_L	Bus line (low)	

\bigcirc \bigcirc EH fieldbus execution, connector - M12 - 4 pin (2)				
PIN	SIGNAL TECHNICAL SPECIFICATION (1)			
1	TX+	Transmitter		
2	RX+	Receiver		
3	тх-	Transmitter		
4	RX-	Receiver		
Housing	SHIELD			

(2) Only for RES execution

20.6 Pressure transducer connection - only for $\ensuremath{\mathsf{R}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	V+	Power supply	
2	NC	Not connected	200
3	TR	Output signal 4 ÷ 20 mA	
4	NC	Not connected	3 4 4
5	NC	Not connected	5



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

20.8 REB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2)

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2)

(2) Pin layout always referred to driver's view

21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin - for REB-NP and RES

CONNECTOR TYPE POWER SUPPLY AND SIGNALS		POWER SUPPLY AND SIGNALS		
CODE	A1 ZM-7P	A3 ZH-7P		
Туре	7pin female straight circular	7pin female straight circular		
Standard	According to MIL-C-5015	According to MIL-C-5015		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG11	PG11		
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)		
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires		
Connection type	to solder	to solder		
Protection (EN 60529)	IP 67	IP 67		

21.2 Main connectors - 12 pin - for REB-NP and RES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	(A4) ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

21.3 IO-Link connector - only for REB-IL

CONNECTOR TYPE	IL IO-Link		
CODE	A ZM-5PF		
Туре	5pin female straight circular		
Standard	M12 coding A – IEC 61076-2-101		
Material	Metallic		
Cable gland	Pressure nut - cable diameter 6÷8 mm		
Recommended cable	5 x 0,75 mm² max 20 m		
Connection type	screw terminal		
Protection (EN 60529)	IP 67		

21.4 Fieldbus communication connectors - only for RES

CONNECTOR TYPE BC CANopen (1)		BP PROFI	BUS DP (1)	EH EtherCAT (2)		
CODE	C1) ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 co	ding D – IEC 61076-2-101
Material	Metallic		Metallic			Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure r	nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethe	ernet standard CAT-5
Connection type	be screw terminal		screw terminal			terminal block
Protection (EN 60529)	IP67		IP 67			IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\text{GS500}}$

(2) Internally terminated

22 FASTENING BOLTS AND SEALS

	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
0	Seals: 2 OR 108 Diameter of ports P, T: Ø 5 mm

23 INSTALLATION DIMENSIONS [mm]



24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	P005	Mounting	surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	QB400	Quicksta	rt for REB valves commissioning
GS203	E-BM-RES digital driver	QF400	Quicksta	rt for RES valves commissioning
GS500	Programming tools	E-MAN-	BM-RES	E-BM-RES user manual (off-board)
GS510	Fieldbus	E-MAN-	RI-REB	REB user manual
GS520	IO-Link interface	E-MAN-	RI-RES	RES user manual
K800	Electric and electronic connectors			

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Digital proportional relief valves high performance

piloted, with on-board pressure transducer



(1) Possible combined options: IQ, IZ (/T Bluetooth adapter option can be combined with all other options)

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Туре	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with

Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or wit built-in Bluetooth. It does not support valves with p/Q control or axis controls.





5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500** T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

7 SMART TUNING

Smart tuning allows to adjust the valve dynamic response in order to match different hydraulic conditions and performance requirements.

The valve is provided with 3 factory settings for the pressure control:

- dynamic fast response time for best dynamic performances. Default factory setting for pressure valves

- **balanced** average response time suitable for major applications

- smooth attenuated response time for slow regulation without overshoots

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-* and Quickstart, see section 24. Below indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume.



8 IO-LINK - only for REB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

9 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

Bluetooth or USB connection



10 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007				
Ambient temperature range	R:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$				
Storage temperature range	R:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004 (for REB and RES)				
	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)				
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

11 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		RZMO-*-030
Max regulated pressure	[bar]	100; 210; 315; 350
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure	[bar]	see min. pressure / flow diagram at section 14
Min ÷ Max flow	[l/min]	2,5 ÷ 40
Response time 0-100% step signal (depending on installation) (1) [ms]		≤ 45
Hysteresis		≤ 0,5 [% of max pressure]
Linearity		≤ 1,0 [% of max pressure]
Repeatability		≤ 0,2 [% of max pressure]
Thermal drift		zero point displacement < 1% at $\Delta T = 40^{\circ}C$

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 7

12 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal Rectified and filtered	: +24 VDC d : VRMS = 20 ÷ 32 '	/MAX (ripple max 10 s	% Vpp)	
Max power consumption	R = 30 W	REB , RES = 50 V	/		
Max. solenoid current	3 A				
Coil resistance R at 20°C	3 ÷ 3,3 Ω				
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX tolera) mA	ant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$	2
Monitor output	Voltage: maximum Current: maximum	range 0 ÷ 10 VDC range 0 ÷ 20 mA	@ max 5 mA @ max 500 Ω load r	esistance	
Enable input	Range: 0 ÷ 9 VDC (O	FF state), 15 ÷ 24 VDC	(ON state), 9 ÷ 15 VDC	(not accepted); Input	impedance: Ri > 87 k Ω
Fault output	Output range : 0 ÷ 24 Vbc (ON state = VL+ [logic power supply] ; OFF state = 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)				
Pressure transducer (1)	E-ATR-8/*/I Outp	ut signal: 4 ÷ 20 mA	(see tech table GS4	165)	
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure				
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account				
Protection degree to DIN EN60529	R = IP65; REB, RES	S = IP66 / IP67 with m	nating connectors		
Duty factor	Continuous rating (E	D=100%)			
Tropicalization	Tropical coating on	electronics PCB			
Additional characteristics	Short circuit protect protection against re	ion of solenoid's curr everse polarity of pov	ent supply; current co ver supply	ontrol by P.I.D. with ra	pid solenoid switching;
	USB	IO-Link	CANopen	PROFIBUS DP	EtherCAT
Communication interface	Atos ASCII coding	Interface and System Specification 1.1.3	EN50325-4 + DS408	EN50170-2/IEC61158	IEC 61158
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 21				

(1) In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW-SETUP software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)

- automatically switch the pressure control from closed loop (dynamic, balanced, smooth) to open loop, to let the valve to temporarily operate with reduced regulation accuracy

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

13 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for R), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	O4406 class 18/16/13 NAS1638 class 7 see a		
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	120 12022	
Flame resistant with water		NBR, NBR low temp.	HFC	100 12922	

14 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)



15 ELECTRONIC OPTIONS - only for REB-NP and RES

- I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle - see 18.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features: Fault output signal - see 18.6 Enable input signal - see above option /Q Power supply for driver's logics and communication - see 18.2

16 POSSIBLE COMBINED OPTIONS

Electronic options: /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

17 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for REB-NP and RES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **REB-IL** signals see section 19

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

18.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 VDc, normal working corresponds to 24 VDc. Fault status is not affected by the Enable input signal.

19 IO-LINK SIGNALS SPECIFICATIONS - only for REB-IL

19.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDc power supply for IO-Link communication. Maximum power consumption: 2 W

Internal electrical isolation of power L+, L- from P24, N24

19.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics.

Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

19.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 7 pin (A) Standard and /Q option - for REB-NP and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
Α	V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 VDc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDc) or disable (0 VDc) the driver, referred to V0	Input - on/off signal
D	P_INPUT+		Pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	E INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	F P_MONITOR referred to: AGND V0		Pressure monitor output signal: 0 \div 10 Vpc / 0 \div 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /l option	Output - analog signal Software selectable
G	G EARTH		Internally connected to driver housing	

20.2 Main connector signals - 12 pin A2 /Z option - for REB-NP and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 VDC	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to VL0	Input - on/off signal
4	P_INPUT+	Pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /l option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	P_MONITOR	Pressure monitor output signal: 0 ÷ 10 Vpc / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	VL0	.0 Power supply 0 Vpc for driver's logic and communication Gnd - power sup	
11	FAULT	AULT Fault (0 Vbc) or normal working (24 Vbc), referred to VL0 Output - on/off sig	
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for REB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vbc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

20.4 Communication connectors - for REB (B) and RES (B) - (C)

B USB connector - M12 - 5 pin always present			
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)	
1	+5V_USB	Power supply	
2	ID	Identification	
3	GND_USB	Signal zero data line	
4	D-	Data line -	
5	D+	Data line +	

C2	C2 BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL TECHNICAL SPECIFICATION (1)		
1	+5V	Termination supply signal	
2	LINE-A	Bus line (high)	
3	DGND	Data line and termination signal zero	
4	LINE-B	E-B Bus line (low)	
5	SHIELD		

(1) Shield connection on connector's housing is recommended

20.5 Solenoid connection - only for $\ensuremath{\mathsf{R}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

©1)	C1 BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL TECHNICAL SPECIFICATION (1)		
1	CAN_SHLD	Shield	
2	NC	do not connect	
3	CAN_GND	Signal zero data line	
4	CAN_H	Bus line (high)	
5	CAN_L	Bus line (low)	

C3 (© 3 © 4 EH fieldbus execution, connector - M12 - 4 pin (2)			
PIN	PIN SIGNAL TECHNICAL SPECIFICATION (1)			
1	TX+	Transmitter		
2	RX+	Receiver		
3	тх-	Transmitter		
4	RX-	Receiver		
Housing	SHIELD			

(2) Only for RES execution

20.6 Pressure transducer connection - only for $\ensuremath{\mathsf{R}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	V+	Power supply	
2	NC	Not connected	200
3	TR	Output signal 4 ÷ 20 mA	
4	NC	Not connected	3 4 4
5	NC	Not connected	5



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

20.8 REB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2)

(2) Pin layout always referred to driver's view

21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin - for REB-NP and RES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	(A1) ZM-7P	A3 ZH-7P
Туре	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

21.2 Main connectors - 12 pin - for REB-NP and RES

CONNECTOR TYPE	PE POWER SUPPLY AND SIGNALS POWER SUPPLY AND SIGNALS	
CODE	A2 ZM-12P	A4 ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

21.3 IO-Link connector - only for REB-IL

CONNECTOR TYPE	IL IO-Link		
CODE	A ZM-5PF		
Туре	5pin female straight circular		
Standard	M12 coding A – IEC 61076-2-101		
Material	Metallic		
Cable gland	Pressure nut - cable diameter 6÷8 mm		
Recommended cable	5 x 0,75 mm² max 20 m		
Connection type	screw terminal		
Protection (EN 60529)	IP 67		

21.4 Fieldbus communication connectors - only for RES

CONNECTOR TYPE	E BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)		
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E	
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101		
Material	Me	tallic	Metallic			Metallic	
Cable gland	Pressure nut - cabl	e diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm		
Cable	CANbus Standard (DR 303-1)		PROFIBUS	DP Standard	Ethe	ernet standard CAT-5	
Connection type	screw	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IF	67	IP 67			IP 67	
(1) E-TRM-** terminators can be ordered separately - see tech table GS500 (2) Internally terminated							

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\mathsf{GS500}}$

EASTENING BOI TS AND SEALS

22 F/	ASTENING BOL	ING BOLTS AND SEALS				
		Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm				
	0	Seals: 2 OR 108 Diameter of ports P, T: Ø 7,5 mm Ports A, B connected to port T				



24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	P005	Mounting	surfaces for electrohydraulic valves	
FS900	Operating and maintenance information for proportional valves	QB400 Quickstart		t for REB valves commissioning	
GS203	E-BM-RES digital driver	QF400 Quickstart		rt for RES valves commissioning	
GS500	Programming tools	E-MAN-	BM-RES	E-BM-RES user manual (off-board)	
GS510	Fieldbus	E-MAN-	RI-REB	REB user manual	
GS520	IO-Link interface	E-MAN-	RI-RES	RES user manual	
K800	Electric and electronic connectors				

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Digital proportional relief valves high performance

piloted, with on-board pressure transducer



(1) For possible combined options, see section 17

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Туре	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

7 SMART TUNING

Smart tuning allows to adjust the valve dynamic response in order to match different hydraulic conditions and performance requirements.

The valve is provided with 3 factory settings for the pressure control:

- dynamic fast response time for best dynamic performances. Default factory setting for pressure valves

- **balanced** average response time suitable for major applications

- smooth attenuated response time for slow regulation without overshoots

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-* and Quickstart, see section 27. Below indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume.



8 IO-LINK - only for REB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

9 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

Bluetooth or USB connection

E-C-SB-USB/M12 cable

E-A-BTH adapter

mobile App

PC software

E-A-SB-USB/OPT isolato

REB

RES

311

10 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007				
Ambient temperature range	R:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$				
Storage temperature range	R:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004 (for REB and RES)				
	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)				
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

11 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		AGMZO-*-10	AGMZO-*-20	AGMZO-*-32	
Max regulated pressure [bar]		100; 210; 315; 350			
Max pressure at port P	[bar]	350			
Max pressure at port T	[bar]	210			
Min regulated pressure	[bar]	see mi	n. pressure / flow diagrams at sec	tion 14	
Max flow	[l/min]	200	400	600	
Response time 0-100% step signal (depending on installation) (1) [ms]		≤ 80	≤ 100	≤ 115	
Hysteresis			≤0,5 [% of max pressure]		
Linearity		≤ 1,0 [% of max pressure]			
Repeatability		\leq 0,2 [% of max pressure]			
Thermal drift		zero point displacement < 1% at $\Delta T = 40^{\circ}C$			

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected

by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 7

12 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal Rectified and filtere	: +24 VDC d : VRMS = 20 ÷ 32 V	/MAX (ripple max 10 s	% Vpp)	
Max power consumption	R = 30 W	REB , RES = 50 V	/	,	
Max. solenoid current	3 A				
Coil resistance R at 20°C	3 ÷ 3,3 Ω				
Analog input signals	Voltage: range ±10 Current: range ±20	0 VDC (24 VMAX tolera 0 mA	ant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$	2
Monitor output	Voltage: maximum Current: maximum	range 0 ÷ 10 VDC range 0 ÷ 20 mA	@ max 5 mA @ max 500 Ω load r	esistance	
Enable input	Range: 0 ÷ 9 VDC (O	FF state), 15 ÷ 24 VDC	(ON state), 9 ÷ 15 VDC	(not accepted); Input	impedance: Ri > 87 k Ω
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)				
Pressure transducer (1)	E-ATR-8/*/I Outp	ut signal: 4 ÷ 20 mA	(see tech table GS4	l65)	
Alarms	Solenoid not connec current control mon	cted/short circuit, cab itoring, power supplie	le break with current s level, pressure trar	reference signal, ove Isducer failure	r/under temperature,
Insulation class	H (180°) Due to the the European stand	occurring surface ter ards ISO 13732-1 and	nperatures of the sole d EN982 must be tak	enoid coils, en into account	
Protection degree to DIN EN60529	R = IP65; REB, RES	$\mathbf{S} = IP66 / IP67$ with m	ating connectors		
Duty factor	Continuous rating (E	D=100%)			
Tropicalization	Tropical coating on	electronics PCB			
Additional characteristics	Short circuit protect protection against r	ion of solenoid's curre everse polarity of pov	ent supply; current co ver supply	ontrol by P.I.D. with ra	pid solenoid switching;
	USB	IO-Link	CANopen	PROFIBUS DP	EtherCAT
Communication interface	Atos ASCII coding	Interface and System Specification 1.1.3	EN50325-4 + DS408	EN50170-2/IEC61158	IEC 61158
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable LiYCY shielded cables, see section 24					

(1) In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW-SETUP software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)

- automatically switch the pressure control from closed loop (dynamic, balanced, smooth) to open loop, to let the value to temporarily operate with reduced regulation accuracy

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

13 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for R), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1638 class 7 se		see also filter section at	
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	100,10000	
Flame resistant with water		NBR, NBR low temp.	HFC	130 12922	

14 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)









3-8 = Min. pressure/flow diagrams

with zero reference signal

- **3** = AGMZO-*-10/100, 210, 315 **4** = AGMZO-*-10/350 **5** = AGMZO-*-20/100, 210, 315

- **5** = AGMZO- -20/100, 210, 315 **6** = AGMZO-*-20/350 **7** = AGMZO-*-32/100, 210, 315 **8** = AGMZO-*-32/350





15 HYDRAULIC OPTIONS

E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.

With option E the internal connection between port P and X of the valve is plugged. The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").

- Y = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
 - The Y drain port has a threaded connection G 1/4" available on the pilot stage body.





16 ELECTRONIC OPTIONS - only for REB-NP and RES

- I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is permethy used is a software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
- It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 21.5 for signal specifications.
- Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal see 21.6
 Enable input signal see above option /Q
 Power supply for driver's logics and communication see 21.2

17 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible Electronic options: /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

18 MECHANICAL PRESSURE LIMITER

The AGMZO are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.

For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



19 REMOTE PRESSURE UNLOADING

The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve).

This function can be used in emergency to unload the system pressure by-passing the proportional control.



20 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing.

The presence of air may cause pressure instability and vibrations.



21 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for REB-NP and RES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **REB-IL** signals see section 22

21.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 21.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

21.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

21.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

21.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

21.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

21.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 VDc, normal working corresponds to 24 VDc. Fault status is not affected by the Enable input signal.

22 IO-LINK SIGNALS SPECIFICATIONS - only for REB-IL

22.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W

Internal electrical isolation of power L+, L- from P24, N24

22.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics.

Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

22.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

23 ELECTRONIC CONNECTIONS

23.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB-NP and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
А	V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 VDc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDc) or disable (0 VDc) the driver, referred to V0	Input - on/off signal
D	P_INPUT+		Pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	P_MONITOR referred to: AGND V0		Pressure monitor output signal: 0 \div 10 Vpc / 0 \div 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

23.2 Main connector signals - 12 pin A2 /Z option - for REB-NP and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vbc	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 Vpc) or disable (0 Vpc) the driver, referred to VL0	Input - on/off signal
4	P_INPUT+	Pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /l option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	P_MONITOR	Pressure monitor output signal: 0 ÷ 10 Vpc / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vbc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vpc) or normal working (24 Vpc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

23.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B A only for REB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vpc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

23.4 Communication connectors - for REB $(\ensuremath{\mathsf{B}})$ and RES $(\ensuremath{\mathsf{B}})$ - $(\ensuremath{\mathsf{C}})$

B USB connector - M12 - 5 pin always present					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	+5V_USB	Power supply			
2	ID	Identification			
3	GND_USB Signal zero data line				
4	D-	Data line -			
5	D+	Data line +			

C2	BP field	bus execution, connector - M12 - 5 pin (2)			
PIN	SIGNAL TECHNICAL SPECIFICATION (1)				
1	+5V	+5V Termination supply signal			
2	LINE-A Bus line (high)				
3	DGND Data line and termination signal zero				
4	LINE-B Bus line (low)				
5	SHIELD				

(1) Shield connection on connector's housing is recommended

23.5 Solenoid connection - only for $\ensuremath{\textbf{R}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

C1 BC fieldbus execution, connector - M12 - 5 pin				
PIN	SIGNAL TECHNICAL SPECIFICATION (1)			
1	CAN_SHLD Shield			
2	NC do not connect			
3	CAN_GND Signal zero data line			
4	CAN_H Bus line (high)			
5	CAN_L	Bus line (low)		

<u>C</u> 3	C3 C4 EH fieldbus execution, connector - M12 - 4 pin (2)				
PIN	N SIGNAL TECHNICAL SPECIFICATION (1)				
1	TX+	Transmitter			
2	RX+ Receiver				
3	TX-	Transmitter			
4	RX- Receiver				
Housing	SHIELD				

(2) Only for RES execution

23.6 Pressure transducer connection - only for R

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	V+	Power supply	
2	NC	Not connected	200
3	TR	Output signal 4 ÷ 20 mA	
4	NC	Not connected	
5	NC	Not connected	5



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

23.8 REB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (

(2) Pin layout always referred to driver's view

24 CONNECTORS CHARACTERISTICS - to be ordered separately

24.1 Main connectors - 7 pin - for REB-NP and RES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	A1) ZM-7P	A3 ZH-7P		
Туре	7pin female straight circular	7pin female straight circular		
Standard According to MIL-C-5015		According to MIL-C-5015		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG11	PG11		
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)		
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires		
Connection type	to solder	to solder		
Protection (EN 60529)	IP 67	IP 67		

24.2 Main connectors - 12 pin - for REB-NP and RES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	(A2) ZM-12P	A4 ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

24.3 IO-Link connector - only for REB-IL

CONNECTOR TYPE	IL IO-Link		
CODE	A ZM-5PF		
Туре	5pin female straight circular		
Standard	M12 coding A – IEC 61076-2-101		
Material	Metallic		
Cable gland	Pressure nut - cable diameter 6÷8 mm		
Recommended cable	5 x 0,75 mm² max 20 m		
Connection type	screw terminal		
Protection (EN 60529)	IP 67		

24.4 Fieldbus communication connectors - only for RES

CONNECTOR TYPE BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)		
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	©2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Type	5 pin female	5 pin male	5 pin female	5 pin male		4 pin male
Type	straight circular	straight circular	straight circular	straight circular		straight circular
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B –	IEC 61076-2-101	M12 cc	oding D – IEC 61076-2-101
Material	Metallic		Me	tallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cab	le diameter 6÷8 mm	Pressure i	nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Eth	ernet standard CAT-5
Connection type screw terminal		screw terminal			terminal block	
Protection (EN 60529)	IP67		IP 67			IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\mathsf{GS500}}$

(2) Internally terminated

25 FASTENING BOLTS AND SEALS

	AGMZO-*-10	AGMZO-*-20	AGMZO-*-32
Ø	Fastening bolts:	Fastening bolts:	Fastening bolts:
I A	4 socket head screws M12x35 class 12.9	4 socket head screws M16x50 class 12.9	4 socket head screws M20x60 class 12.9
	Tightening torque = 125 Nm	Tightening torque = 300 Nm	Tightening torque = 600 Nm
U			
	Seals:	Seals:	Seals:
\frown	2 OR 123	2 OR 4112	2 OR 4131
()	Diameter of ports P, T: Ø 14 mm	Diameter of ports P, T: Ø 24 mm	Diameter of ports P, T: Ø 28 mm
	1 OR 109/70	1 OR 109/70	1 OR 109/70
	Diameter of port X: Ø 3,2 mm	Diameter of port X: Ø 3,2 mm	Diameter of port X: Ø 3,2 mm





27 RELATED DOCUMENTATION

FS001 FS900 GS203	Basics for digital electrohydraulics Operating and maintenance information for proportional valves E-BM-BES digital driver	P005 QB400 QE400	Mounting Quickstar	surfaces for electrohydraulic valves t for REB valves commissioning t for RES valves commissioning
GS500 GS510 GS520 K800	Programming tools Fieldbus IO-Link interface Electric and electronic connectors	E-MAN- E-MAN- E-MAN-	BM-RES RI-REB RI-RES	E-BM-RES user manual (off-board) REB user manual RES user manual

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Digital proportional reducing valves high performance

direct, with on-board pressure transducer



(1) Possible combined options: IQ, IZ (/T Bluetooth adapter option can be combined with all other options)

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES		
Туре	Digital		
Format	DIN rail panel format		
Tech table	GS203		

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with

built-in Bluetooth. It does not support valves with p/Q control or axis controls.





5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

7 SMART TUNING

Smart tuning allows to adjust the valve dynamic response in order to match different hydraulic conditions and performance requirements.

The valve is provided with 3 factory settings for the pressure control:

- dynamic fast response time for best dynamic performances. Default factory setting for pressure valves

- **balanced** average response time suitable for major applications

- smooth attenuated response time for slow regulation without overshoots

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-* and Quickstart, see section 24. Below indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume.



8 IO-LINK - only for REB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

9 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

Bluetooth or USB connection



10 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007					
Ambient temperature range	R:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$					
Storage temperature range	R:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Vibration resistance	See technical table G004 (for REB and RES)					
Compliance CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000 RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006						

11 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		RZGO-*-010		
Max regulated pressure [bar]		32; 100; 210		
Max pressure at port P [bar]		350		
Max pressure at port T [bar]		210		
Min regulated pressure (1) [bar]		0,8		
Max flow [l/min]		12		
Response time 0-100% step signal (depending on installation) (2) [ms]		≤ 40		
Hysteresis		≤ 0,3 [% of max pressure]		
Linearity		≤ 1,0 [% of max pressure]		
Repeatability		≤ 0,2 [% of max pressure]		
Thermal drift		zero point displacement < 1% at $\Delta T = 40^{\circ}C$		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure

(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 7

12 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VBMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)						
Max power consumption	$\mathbf{R} = 30 \text{ W}$ REB. RES = 50 W						
Max. solenoid current	3 A						
Coil resistance R at 20°C	$3 \div 3,3 \Omega$						
Analog input signals	Voltage: range ± 10 VDC (24 VMAX tolerant) Input impedance: Ri > 50 kΩ Current: range ± 20 mA Input impedance: Ri = 500 Ω						
Monitor output	Voltage:maximum range 0 ÷ 10 Vbc@ max 5 mACurrent:maximum range 0 ÷ 20 mA@ max 500 Ω load resistance						
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 ks						
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)						
Pressure transducer (1)	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table GS465)						
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure						
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account						
Protection degree to DIN EN60529	R = IP65; REB, RES = IP66 / IP67 with mating connectors						
Duty factor	Continuous rating (ED=100%)						
Tropicalization	Tropical coating on electronics PCB						
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply						
Communication interface	USB	IO-Link	CANopen	PROFIBUS DP	EtherCAT		
Communication interface	Atos ASCII coding	Specification 1.1.3	EN50325-4 + DS408	EN50170-2/IEC61158	IEC 61158		
Communication physical layer	not insulated USB 2.0 + USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cables, see section 21						

(1) In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW-SETUP software to:

 cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
 automatically switch the pressure control from closed loop (dynamic, balanced, smooth) to open loop, to let the valve to temporarily operate with reduced regulation accuracy

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.
13 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for R), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	04406 class 18/16/13 NAS1638 class 7 see also f		
contamination level longer life		ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	100 10000	
Flame resistant with water		NBR, NBR low temp.	HFC	100 12922	

14 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)



15 ELECTRONIC OPTIONS - only for REB-NP and RES

This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 18.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal - see 18.6
 Enable input signal - see above option /Q
 Power supply for driver's logics and communication - see 18.2

16 POSSIBLE COMBINED OPTIONS

Electronic options: /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

17 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for REB-NP and RES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **REB-IL** signals see section 19

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 \div 24 VDC.

18.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are $0 \div 10$ VDC for standard and $4 \div 20$ mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of $0 \div 10$ VDC or $0 \div 20$ mA.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

19 IO-LINK SIGNALS SPECIFICATIONS - only for REB-IL

19.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W

Internal electrical isolation of power L+, L- from P24, N24

19.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics.

Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

19.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 7 pin (A) Standard and /Q option - for REB-NP and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 VDc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDc) or disable (0 VDc) the driver, referred to V0	Input - on/off signal
D	P_INPUT+		Pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	P_MONITOF Agnd	R referred to: V0	Pressure monitor output signal: 0 \div 10 Vpc / 0 \div 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

20.2 Main connector signals - 12 pin $\textcircled{\text{A2}}$ /Z option - for REB-NP and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vbc	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to VL0	Input - on/off signal
4	P_INPUT+ Pressure reference input signal: ±10 Vbc / ±20 mA maximum range Defaults are 0 ÷ 10 Vbc for standard and 4 ÷ 20 mA for /l option		Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	P_MONITOR	Pressure monitor output signal: 0 ÷ 10 Vpc / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vbc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for REB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vbc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

20.4 Communication connectors - for REB B and RES B - C

B USB connector - M12 - 5 pin always present			
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)	
1	+5V_USB	Power supply	
2	ID	Identification	
3	GND_USB	Signal zero data line	
4	D-	Data line -	
5	D+	Data line +	

C2	2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL TECHNICAL SPECIFICATION (1)		
1	+5V	Termination supply signal	
2	LINE-A	Bus line (high)	
3	DGND	Data line and termination signal zero	
4	LINE-B Bus line (low)		
5	SHIELD		

(1) Shield connection on connector's housing is recommended

20.5 Solenoid connection - only for $\ensuremath{\mathsf{R}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

©1	BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL TECHNICAL SPECIFICATION (1)		
1	CAN_SHLD	Shield	
2	NC do not connect		
3	CAN_GND Signal zero data line		
4	CAN_H	Bus line (high)	
5	CAN_L	Bus line (low)	

C3 (C3 C4 EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	I SIGNAL TECHNICAL SPECIFICATION (1)		
1	TX+	Transmitter	
2	RX+	Receiver	
3	тх-	Transmitter	
4	RX-	Receiver	
Housing	SHIELD		

(2) Only for RES execution

20.6 Pressure transducer connection - only for $\ensuremath{\mathsf{R}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	V+	Power supply	
2	NC	Not connected	200
3	TR	Output signal 4 ÷ 20 mA	
4	NC	Not connected	3 4 4
5	NC	Not connected	5



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

20.8 REB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2

(2) Pin layout always referred to driver's view

21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin - for REB-NP and RES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A1) ZM-7P	A3 ZH-7P
Туре	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

21.2 Main connectors - 12 pin - for REB-NP and RES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	A4) ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

21.3 IO-Link connector - only for REB-IL

CONNECTOR TYPE	IL IO-Link
CODE	A ZM-5PF
Туре	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

21.4 Fieldbus communication connectors - only for RES

CONNECTOR TYPE	CONNECTOR TYPE BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)		
CODE	C1 ZM-5PF	©2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2 ZM-4PM/E		
Tupo	5 pin female	5 pin male	5 pin female	5 pin male		4 pin male	
туре	straight circular	straight circular	straight circular	straight circular		straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101		
Material	Me	tallic	Me	tallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure	nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Eth	ernet standard CAT-5	
Connection type	screw terminal		screw terminal			terminal block	
Protection (EN 60529)	IF	267	IP 67 IP 67		IP 67		

(1) E-TRM-** terminators can be ordered separately - see tech table ${f GS500}$

(2) Internally terminated

22 FASTENING BOLTS AND SEALS

	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
0	Seals: 4 OR 108 Diameter of ports P, A, T: Ø 5 mm Port B not used

23 INSTALLATION DIMENSIONS [mm]



FS001	Basics for digital electrohydraulics	P005	Mounting	surfaces for electrohydraulic valves	
FS900	Operating and maintenance information for proportional valves	QB400 Quickstart		rt for REB valves commissioning	
GS203	E-BM-RES digital driver	QF400 Quickstart		t for RES valves commissioning	
GS500	Programming tools	E-MAN-	BM-RES	E-BM-RES user manual (off-board)	
GS510	Fieldbus	E-MAN-	RI-REB	REB user manual	
GS520	IO-Link interface	E-MAN-	RI-RES	RES user manual	
K800	Electric and electronic connectors				

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Proportional reducing valves high performance

piloted, with on-board pressure transducer



(1) Possible combined options: IQ, IZ (/T Bluetooth adapter option can be combined with all other options)

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Туре	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with

Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or wit built-in Bluetooth. It does not support valves with p/Q control or axis controls.





5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500** T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

7 SMART TUNING

Smart tuning allows to adjust the valve dynamic response in order to match different hydraulic conditions and performance requirements.

The valve is provided with 3 factory settings for the pressure control:

- dynamic fast response time for best dynamic performances. Default factory setting for pressure valves

- **balanced** average response time suitable for major applications

- smooth attenuated response time for slow regulation without overshoots

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-* and Quickstart, see section 24. Below indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume.



8 IO-LINK - only for REB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

9 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

Bluetooth or USB connection



10 GENERAL CHARACTERISTICS

Assembly position	Any position			
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra \leq 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100			
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007			
Ambient temperature range	R:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$			
Storage temperature range	R:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$			
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)			
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h			
Vibration resistance	See technical table G004 (for REB and RES)			
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006			

11 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		RZGO-*-033
Max regulated pressure	[bar]	100; 210; 315; 350
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure	[bar]	see min. pressure / flow diagrams at section 14
Min ÷ Max flow	[l/min]	2,5 ÷ 40
Response time 0-100% step s (depending on installation) (1)	ignal [ms]	≤ 35
Hysteresis		≤ 0,5 [% of max pressure]
Linearity		\leq 1,0 [% of max pressure]
Repeatability		\leq 0,5 [% of max pressure]
Thermal drift		zero point displacement < 1% at $\Delta T = 40^{\circ}C$

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 7

12 ELECTRICAL CHARACTERISTICS

	Nominal	04 \/po			
Power supplies	Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)				
Max power consumption	R = 30 W	R = 30 W REB , RES = 50 W			
Max. solenoid current	3 A				
Coil resistance R at 20°C	3 ÷ 3,3 Ω				
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX tolera) mA	ant) Input imp Input imp	bedance: Ri > 50 k Ω bedance: Ri = 500 Ω	2
Monitor output	Voltage: maximum Current: maximum	range 0 ÷ 10 VDC range 0 ÷ 20 mA	@ max 5 mA @ max 500 Ω load r	esistance	
Enable input	Range: 0 ÷ 9 VDC (Of	FF state), 15 ÷ 24 VDC	(ON state), 9 ÷ 15 VDC	(not accepted); Input	impedance: Ri > 87 k Ω
Fault output	Output range : 0 ÷ external negative vc	Output range : $0 \div 24$ VDc (ON state \cong VL+ [logic power supply] ; OFF state \cong 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer (1)	E-ATR-8/*/I Outp	ut signal: 4 ÷ 20 mA	(see tech table GS4	165)	
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure				
Insulation class	H (180°) Due to the the European stand	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	R = IP65; REB, RES	S = IP66 / IP67 with m	nating connectors		
Duty factor	Continuous rating (E	D=100%)			
Tropicalization	Tropical coating on	electronics PCB			
Additional characteristics	Short circuit protection against re	ion of solenoid's curre everse polarity of pov	ent supply; current co ver supply	ontrol by P.I.D. with ra	pid solenoid switching;
	USB	IO-Link	CANopen	PROFIBUS DP	EtherCAT
Communication interface	Atos ASCII coding	Interface and System Specification 1.1.3	EN50325-4 + DS408	EN50170-2/IEC61158	IEC 61158
Communication physical layer not insulated USB 2.0 + USB OTG SDCI class port B optical insulated CAN ISO11898 optical insulated RS485 Fast Et 100 Ba			Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cables, see section 21				

(1) In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW-SETUP software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)

- automatically switch the pressure control from closed loop (dynamic, balanced, smooth) to open loop, to let the valve to temporarily operate with reduced regulation accuracy

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

13 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	I temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for R), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20 ÷ 100 mm²/s - max allowed r	ange 15 ÷ 380 mm²/s		
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	SO4406 class 18/16/13 NAS1638 class 7 see also		
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5 w		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	100 10000	
Flame resistant with water		NBR, NBR low temp. HFC ISO 12922			

14 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

Regulation diagrams 1 with flow rate Q = 10 l/min 100 Reduced pressure [% of max] 80 1 60

40

20

40

20

0

2 Pressure/flow diagrams with reference signal set at Q = 10 l/min



3-4 Min. pressure/flow diagrams with zero reference signal





15 ELECTRONIC OPTIONS - only for REB-NP and RES

60

Reference signal [% of max]

80

100

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle - see 18.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features: Fault output signal - see 18.6 Enable input signal - see above option /Q Power supply for driver's logics and communication - see 18.2

16 POSSIBLE COMBINED OPTIONS

Electronic options: /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

17 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for REB-NP and RES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **REB-IL** signals see section 19

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

18.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are $0 \div 10$ VDc for standard and $4 \div 20$ mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of $0 \div 10$ VDc or $0 \div 20$ mA.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

19 IO-LINK SIGNALS SPECIFICATIONS - only for REB-IL

19.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W

Internal electrical isolation of power L+, L- from P24, N24

19.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics.

Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

19.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB-NP and RES

PIN	Standard /Q TECHNICAL SPECIFICATIONS		NOTES	
A	V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 VDc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDc) or disable (0 VDc) the driver, referred to V0	Input - on/off signal
D	P_INPUT+		Pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	P_MONITOR referred to: AGND V0		Pressure monitor output signal: 0 \div 10 Vpc / 0 \div 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

20.2 Main connector signals - 12 pin $\textcircled{\text{A2}}$ /Z option - for REB-NP and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vbc	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to VL0	Input - on/off signal
4	P_INPUT+	Pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /l option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	P_MONITOR	Pressure monitor output signal: 0 ÷ 10 Vpc / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vbc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for REB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vpc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vpc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

20.4 Communication connectors - for REB B and RES B - C

	B USB connector - M12 - 5 pin always present				
	PIN	SIGNAL	TECHNICAL SPECIFICATION (1)		
	1	+5V_USB Power supply			
	2	ID	Identification		
3 GND_USB		GND_USB	Signal zero data line		
4 D- Data line -		Data line -			
	5	D+	Data line +		

Image: BP fieldbus execution, connector - M12 - 5 pin		
PIN	PIN SIGNAL TECHNICAL SPECIFICATION (1)	
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(1) Shield connection on connector's housing is recommended

20.5 Solenoid connection - only for $\ensuremath{\mathsf{R}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

C1	BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	PIN SIGNAL TECHNICAL SPECIFICATION (1)		
1	CAN_SHLD	Shield	
2	NC	do not connect	
3	CAN_GND	Signal zero data line	
4	CAN_H	Bus line (high)	
5	CAN_L Bus line (low)		

© 3 © 4 EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(2) Only for RES execution

20.6 Pressure transducer connection - only for $\ensuremath{\mathsf{R}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	V+	Power supply	
2	NC	Not connected	200
3	TR	Output signal 4 ÷ 20 mA	
4	NC	Not connected	3 4 4
5	NC	Not connected	5



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

20.8 REB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2)

(2) Pin layout always referred to driver's view

21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin - for REB-NP and RES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS	
CODE	A1) ZM-7P	A3 ZH-7P	
Туре	7pin female straight circular	7pin female straight circular	
Standard	According to MIL-C-5015	According to MIL-C-5015	
Material	Metallic	Plastic reinforced with fiber glass	
Cable gland	PG11	PG11	
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)	
Recommended cable	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires	
Connection type	to solder	to solder	
Protection (EN 60529)	IP 67	IP 67	

21.2 Main connectors - 12 pin - for REB-NP and RES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	A4 ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type to crimp		to crimp
Protection (EN 60529) IP 67		IP 67

21.3 IO-Link connector - only for REB-IL

CONNECTOR TYPE	IL IO-Link
CODE	A ZM-5PF
Туре	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

21.4 Fieldbus communication connectors - only for RES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic			Metallic
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cab	le diameter 6÷8 mm	Pressure r	nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS	DP Standard	Ethe	ernet standard CAT-5
Connection type	screw terminal		screw terminal			terminal block
Protection (EN 60529)	IF	267	IP 67			IP 67
(1) E-TRM-** terminators can be ordered separately - see tech table GS500 (2) Internally terminated						

22 FASTENING BOL	OLTS AND SEALS		
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm		
0	Seals: 4 OR 108 Diameter of ports P, A, T: Ø 7,5 mm Port B not used		

23 INSTALLATION DIMENSIONS [mm]



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Proportional reducing valves high performance

piloted, with on-board pressure transducer



(1) For possible combined options, see section 17

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Туре	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500** T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

7 SMART TUNING

Smart tuning allows to adjust the valve dynamic response in order to match different hydraulic conditions and performance requirements.

The valve is provided with 3 factory settings for the pressure control:

- dynamic fast response time for best dynamic performances. Default factory setting for pressure valves

- **balanced** average response time suitable for major applications

- smooth attenuated response time for slow regulation without overshoots

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-* and Quickstart, see section 27. Below indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume.



8 IO-LINK - only for REB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

9 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

Bluetooth or USB connection



10 GENERAL CHARACTERISTICS

Assembly position	Any position		
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100		
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007		
Ambient temperature range	R:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$		
Storage temperature range	R:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$		
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Vibration resistance	See technical table G004 (for REB and RES)		
	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006		

11 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		AGRCZO-*-10	AGRCZO-*-20
Max regulated pressure	[bar]	100; 210; 315; 350	
Min regulated pressure	[bar]	1; 3 (only	r for /350)
Max pressure at port A or B	[bar]	35	50
Max pressure at port Y	[bar]	pilot drain always external, to be direc	tly connected to tank at zero pressure
Max flow	[l/min]	160	300
Response time 0-100% step signal (depending on installation) (1) [ms]		≤ 45	≤ 50
Hysteresis		≤ 0,5 [% of m	nax pressure]
Linearity		≤ 1,0 [% of max pressure]	
Repeatability		≤ 0,2 [% of max pressure]	
Thermal drift		zero point displaceme	ent < 1% at $\Delta T = 40^{\circ}C$

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 7

12 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal Rectified and filtere	: +24 VDC d : VRMS = 20 ÷ 32 V	/MAX (ripple max 10 °	% Vpp)	
Max power consumption	R = 30 W	REB , RES = 50 V	/		
Max. solenoid current	3 A				
Coil resistance R at 20°C	3 ÷ 3,3 Ω				
Analog input signals	Voltage: range ±10 Current: range ±20	0 VDC (24 VMAX tolera 0 mA	ant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$	2
Monitor output	Voltage: maximum Current: maximum	range 0 ÷ 10 VDC range 0 ÷ 20 mA	@ max 5 mA @ max 500 Ω load r	esistance	
Enable input	Range: 0 ÷ 9 VDC (O	FF state), 15 ÷ 24 VDC	(ON state), 9 ÷ 15 VDC	(not accepted); Input	impedance: Ri > 87 k Ω
Fault output	Output range : 0 ÷ external negative vo	24 VDC (ON state ≅ Ditage not allowed (e.	VL+ [logic power su g. due to inductive lo	pply]; OFF state \cong 0 ads)	V) @ max 50 mA;
Pressure transducer (1)	E-ATR-8/*/I Outp	ut signal: 4 ÷ 20 mA	(see tech table GS4	465)	
Alarms	Solenoid not connec current control mon	cted/short circuit, cab itoring, power supplie	le break with current s level, pressure trar	reference signal, ove nsducer failure	r/under temperature,
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account				
Protection degree to DIN EN60529	R = IP65; REB, RES	S = IP66 / IP67 with m	ating connectors		
Duty factor	Continuous rating (E	D=100%)			
Tropicalization	Tropical coating on	electronics PCB			
Additional characteristics	Short circuit protect protection against re	ion of solenoid's curre everse polarity of pov	ent supply; current co ver supply	ontrol by P.I.D. with ra	pid solenoid switching;
	USB	IO-Link	CANopen	PROFIBUS DP	EtherCAT
Communication interface	Atos ASCII coding	Interface and System Specification 1.1.3	EN50325-4 + DS408	EN50170-2/IEC61158	IEC 61158
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cab	les, see section 22			

(1) In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW-SETUP software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting) - automatically switch the pressure control from closed loop (dynamic, balanced, smooth) to open loop, to let the valve to temporarily operate with reduced regulation accuracy

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

13 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for R), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	638 class 7	see also filter section at
contamination level	longer life	ISO4406 class 16/14/11 NAS1	638 class 5	www.atos.com or KTF catalog
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	190 12022
Flame resistant with water		NBR, NBR low temp.	HFC	100 12922

14 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)











3-6 Pressure drop/flow diagrams

with zero reference signal

Differential pressure $B \rightarrow A$ **3** = AGRCZO-*-10 20

$$\mathbf{4} = \mathsf{AGRCZO}^{*}-2$$

Differential pressure $A \rightarrow B$ (through check valve) 5 = AGRCZO-*-10/*/R

6 = AGRCZO-*-20/*/R





15 HYDRAULIC OPTIONS

= This option provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).

At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.

For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw () until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working





\mathbf{R} = This option provides a integral check valve for free reverse flow $A \rightarrow B$

Check valve - cracking pressure = 0,5 bar

2 Plug

16 ELECTRONIC OPTIONS - only for REB-NP and RES

- This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 19.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal - see 19.6
 Enable input signal - see above option /Q
 Power supply for driver's logics and communication - see 19.2

17 POSSIBLE COMBINED OPTIONS

for R: /PR

for REB and RES: /IP, /IQ, /IR, /IZ, /PQ, /PR, /PZ, /QR, /RZ, /IPQ, /IPR, /IPZ, /IQR, /IRZ, /PQR, /PRZ, /IPQR, /IPRZ

Note: /T Bluetooth adapter option can be combined with all other options

18 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



19 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for REB-NP and RES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **REB-IL** signals see section 20

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 19.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

19.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

19.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

19.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

19.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

20 IO-LINK SIGNALS SPECIFICATIONS - only for REB-IL

20.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDc power supply for IO-Link communication. Maximum power consumption: 2 W

Internal electrical isolation of power L+, L- from P24, N24

20.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics.

Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

20.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

21 ELECTRONIC CONNECTIONS

21.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB-NP and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
Α	V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 Vbc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to V0	Input - on/off signal
D	P_INPUT+		Pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	E INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	F P_MONITOR referred to: AGND V0		Pressure monitor output signal: 0 \div 10 Vpc / 0 \div 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
G	G EARTH		Internally connected to driver housing	

21.2 Main connector signals - 12 pin $\textcircled{\text{A2}}$ /Z option - for REB-NP and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vbc	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 VDc) or disable (0 VDc) the driver, referred to VL0	Input - on/off signal
4	P_INPUT+	Pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	P_MONITOR	Pressure monitor output signal: 0 ÷ 10 Vpc / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vbc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

21.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for REB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vpc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

21.4 Communication connectors - for REB $(B)\,$ and RES $(B)\,$ - $(C)\,$

B USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

© BP fieldbus execution, connector - M12 - 5 pin (bus execution, connector - M12 - 5 pin (2)
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(1) Shield connection on connector's housing is recommended

21.5 Solenoid connection - only for $\ensuremath{\textbf{R}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

C1 BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

©3 ©4 EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(2) Only for RES execution

21.6 Pressure transducer connection - only for ${\bf R}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	V+	Power supply	
2	NC	Not connected	200
3	TR	Output signal 4 ÷ 20 mA	
4	NC	Not connected	
5	NC	Not connected	5



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

21.8 REB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2)

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2

22 CONNECTORS CHARACTERISTICS - to be ordered separately

22.1 Main connectors - 7 pin - for REB-NP and RES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	(A1) ZM-7P	A3 ZH-7P
Туре	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

22.2 Main connectors - 12 pin - for REB-NP and RES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	A4 ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

22.3 IO-Link connector - only for REB-IL

CONNECTOR TYPE	IL IO-Link
CODE	A ZM-5PF
Туре	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

22.4 Fieldbus communication connectors - only for RES

CONNECTOR TYPE	BC CAN	open (1)	BP PROFI	BUS DP (1)	EH EtherCAT (2)				
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E			
Type	5 pin female	5 pin male	5 pin female	5 pin male		4 pin male			
Type	straight circular	straight circular	straight circular	straight circular		straight circular			
Standard	andard M12 coding A – IEC 61076-2-101		M12 coding B –	IEC 61076-2-101	M12 coding D – IEC 61076-2-101				
Material	Me	tallic	Metallic		Metallic				
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cable diameter 4÷8 mm				
Cable	CANbus Stand	lard (DR 303-1)	PROFIBUS	DP Standard	Ethernet standard CAT-5				
Connection type	screw	terminal	screw	terminal	terminal block				
Protection (EN 60529)	IF	267	IF	° 67	IP 67				

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\mathsf{GS500}}$

(2) Internally terminated

23 FASTENING BOLTS AND SEALS

	AGRCZO-*-10	AGRCZO-*-20
Ø	Fastening bolts:	Fastening bolts:
H H	4 socket head screws M10x45 class 12.9	4 socket head screws M10x45 class 12.9
	Tightening torque = 70 Nm	Tightening torque = 70 Nm
	Seals:	Seals:
\frown	2 OR 3068	2 OR 4100
()	Diameter of ports A, B: Ø 14 mm	Diameter of ports A, B: Ø 22 mm
	2 OR 109/70 Diameter of part X, Xi, Q E mm	2 OR 109/70 Diameter of part X, Vi. (0.5 mm
	Diameter of port X, Y: Ø 5 mm	





25 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	P005	Mounting	surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	QB400	Quickstar	t for REB valves commissioning
GS203	E-BM-RES digital driver	QF400	Quickstar	t for RES valves commissioning
GS500	Programming tools	E-MAN-	BM-RES	E-BM-RES user manual (off-board)
GS510	Fieldbus	E-MAN-	RI-REB	REB user manual
GS520	IO-Link interface	E-MAN-	RI-RES	RES user manual
K800	Electric and electronic connectors			

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Digital proportional pressure cartridges high performance

piloted, with on-board pressure transducer - compensator, relief, reducing functions



PROPORTIONAL VALVES 355

FS305



Type of poppet:

31 = for LIMZO and LICZO 36 = for LICZO

37 = for LIRZO

	Series number	Seals material, se - = NBR PE = FKM BT = NBR low ten
Spring cracking 2 = 1,5 bar for pop 3 = 3 bar for pop	pressure: oppet 31 pet 31 and 36	6 = 6 bar for popp 7 = 7 bar for popp

- 2 = 3 3 = 3 **4** = 4 bar only for poppet 37
- et 31 and 36 oet 37 (only for size 16, 25, 32, 40)

4 TYPE OF POPPET

Type of poppet	31	36	37
Functional sketch (Hydraulic symbol)			
Typical section			
Area ratio A: AP	1:1	1:1	1:1

5 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Туре	Digital
Format	DIN rail panel format
Tech table	GS203

6 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

7 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

7.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with

Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or wit built-in Bluetooth. It does not support valves with p/Q control or axis controls.





7.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

8 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500** T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

9 SMART TUNING

Smart tuning allows to adjust the valve dynamic response in order to match different hydraulic conditions and performance requirements.

The valve is provided with 3 factory settings for the pressure control:

- dynamic fast response time for best dynamic performances. Default factory setting for pressure valves

- **balanced** average response time suitable for major applications

- smooth attenuated response time for slow regulation without overshoots

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-* and Quickstart, see section 28. Below indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume.



10 IO-LINK - only for **REB**, see tech. table **GS520**

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

11 FIELDBUS - only for **RES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

Bluetooth or USB connection

E-C-SB-USB/M12 cable

E-A-BTH adapter

(ر (ر mobile App

PC software

E-A-SB-USB/OPT isolato

REB

RES

12 GENERAL CHARACTERISTICS

Assembly position	Any position								
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100								
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007								
Ambient temperature range	R:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$								
Storage temperature range	R:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$ REB, RES:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$								
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)								
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h								
Vibration resistance	See technical table G004 (for REB and RES)								
	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)								
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU								
	REACH Regulation (EC) n°1907/2006								

13 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		LICZO				LIMZO							LIRZO				
valve size	1	2	3	4	5	1	2	3	4	5	6	8	1	2	3	4	
Max flow [I/min]		400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800	
Min regulated pres. at port A [bar]		8,5	8	13	15	7 7 7 10,5 12 12 12 7				7							
Min regulated pres. at port A for /350 [bar]		10	10	13	16	10	10	9	12	13	13	16	5 12				
Max regulated pres. at port A [bar]	100; 210; 315; 350			100; 210; 315; 350							100; 210; 315; 350					
Response time 0-100% step signal [ms] (depending on installation) (1)		80 ÷ 300 80 ÷ 350 80 ÷ 200															
Hysteresis [% of the regulated max flow								≤(0,5								
Linearity [% of the regulated max flow]				≤ 1,0													
Repeatability [% of the regulated max flow		≤ 0,2															
Thermal drift		zero point displacement < 1% at $\Delta T = 40^{\circ}C$															

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 5

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the value is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 9

14 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal Rectified and filtere	: +24 VDC d : VRMS = 20 ÷ 32 '	VMAX (ripple max 10 °	% Vpp)		
Max power consumption	R = 30 W	REB , RES = 50 V	V			
Max. solenoid current	3 A					
Coil resistance R at 20°C	$3 \div 3,3 \Omega$					
Analog input signals	Voltage: range ± 10 VDc (24 VMAX tolerant)Input impedance:Ri > 50 k\OmegaCurrent: range ± 20 mAInput impedance:Ri = 500 Ω					
Monitor output	Voltage:maximum range 0 \div 10 VDC@ max 5 mACurrent:maximum range 0 \div 20 mA@ max 500 Ω load resistance					
Enable input	Range: 0 ÷ 9 VDc (OFF state), 15 ÷ 24 VDc (ON state), 9 ÷ 15 VDc (not accepted); Input impedance: Ri > 87 k Ω					
Fault output	Output range : $0 \div 24$ VDC (ON state \cong VL+ [logic power supply] ; OFF state \cong 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)					
Pressure transducer (1)	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table GS465)					
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure					
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	R = IP65; REB, RES = IP66 / IP67 with mating connectors					
Duty factor	Continuous rating (ED=100%)					
Tropicalization	Tropical coating on electronics PCB					
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply					
Communication interface	USB	IO-Link	CANopen	PROFIBUS DP	EtherCAT	
	Atos ASCII coding	Interface and System Specification 1.1.3	EN50325-4 + DS408	EN50170-2/IEC61158	IEC 61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX	
Recommended wiring cable	LiYCY shielded cables, see section 24					

 (1) In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW-SETUP software to:

 cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
 automatically switch the pressure control from closed loop (dynamic, balanced, smooth) to open loop, to let the valve to temporarily operate

 with reduced regulation accuracy

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

15 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for R), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at	
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922	
Flame resistant with water		NBR, NBR low temp.	HFC		

[16] DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

- **Regulation diagrams LIMZO** 1 2 **Regulation diagrams LICZO**
- Pressure/flow diagrams LICZO, LIMZO 3





4-14 Min. pressure/flow diagrams

with zero reference signal

4	= LIMZO-*-1	11 = LICZO-*-1
5	= LIMZO-*-2	12 = LICZO-*-2
6	= LIMZO-*-3	13 = LICZO-*-3
7	= LIMZO-*-4	14 = LICZO-*-4
8	= LIMZO-*-5	15 = LICZO-*-5
9	= LIMZO-*-6	
10) = LIMZO-*-8	



15 10 0

900



1800 2700

Flow [l/min]

3600 4500

Regulation diagrams LIRZO

15= LIRZO-A

16-19 Min. pressure/flow diagrams with reference signal "null"

= LIRZO-*-1 = LIRZO-*-2 = LIRZO-*-3 = LIRZO-*-4

Pressure/flow diagrams

20 = LIRZO-A





Flow [% of the max]

17 HYDRAULIC OPTIONS

= This option (standard for size 1, 2 and 3) provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).

At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.

For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw (1) until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working



18 ELECTRONIC OPTIONS - only for REB-NP and RES

- This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 21.5 for signal specifications.
- Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal see 21.6
 Enable input signal see above option /Q
 Power supply for driver's logics and communication see 21.2

19 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible Electronic options: /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

20 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.


21 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for REB-NP and RES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **REB-IL** signals see section 22

21.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 21.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

21.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

21.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

21.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 VDC for standard and 4 ÷ 20 mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 VDC or 0 ÷ 20 mA.

21.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

21.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for $4 \div 20$ mA input, etc.). Fault presence corresponds to 0 VDc, normal working corresponds to 24 VDc. Fault status is not affected by the Enable input signal.

22 IO-LINK SIGNALS SPECIFICATIONS - only for REB-IL

22.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDc power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

Internal electrical isolation of power L+, L- Iron P24, N24

22.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics.

Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

22.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

23 ELECTRONIC CONNECTIONS

23.1 Main connector signals - 7 pin (A) Standard and /Q option - for REB-NP and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
А	A V+		Power supply 24 Vbc	Input - power supply
В	3 VO		Power supply 0 VDc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to V0	Input - on/off signal
D	D P_INPUT+		Pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
Е	E INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	F P_MONITOR referred to: AGND V0		Pressure monitor output signal: 0 \div 10 Vpc / 0 \div 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
G	G EARTH		Internally connected to driver housing	

23.2 Main connector signals - 12 pin $\textcircled{\text{A2}}$ /Z option - for REB-NP and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vbc	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to VL0	Input - on/off signal
4	P_INPUT+	Pressure reference input signal: ±10 Vbc / ±20 mA maximum range Defaults are 0 ÷ 10 Vbc for standard and 4 ÷ 20 mA for /l option	
5	INPUT-	Negative reference input signal for INPUT+	
6	P_MONITOR	Pressure monitor output signal: 0 ÷ 10 Vpc / 0 ÷ 20 mA maximum range, referred to VL0 Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vbc for driver's logic and communication Gnd - pow	
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

23.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for REB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vpc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vpc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vpc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

23.4 Communication connectors - for REB $(\ensuremath{\mathsf{B}})$ and RES $(\ensuremath{\mathsf{B}})$ - $(\ensuremath{\mathsf{C}})$

B	B USB connector - M12 - 5 pin always present				
PIN	SIGNAL TECHNICAL SPECIFICATION (1)				
1	+5V_USB	Power supply			
2	ID	Identification			
3	GND_USB Signal zero data line				
4	D-	Data line -			
5	D+	Data line +			

C2 BP fieldbus execution, connector - M12 - 5 pin			
PIN	SIGNAL TECHNICAL SPECIFICATION (1)		
1	+5V	Termination supply signal	
2	LINE-A	Bus line (high)	
3	DGND	Data line and termination signal zero	
4	LINE-B	Bus line (low)	
5	SHIELD		

(1) Shield connection on connector's housing is recommended

23.5 Solenoid connection - only for $\ensuremath{\mathsf{R}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

C1	BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)	
1	CAN_SHLD	Shield	
2	NC	do not connect	
3	CAN_GND	Signal zero data line	
4	CAN_H	Bus line (high)	
5	CAN_L	Bus line (low)	

©3 ©4 EH fieldbus execution, connector - M12 - 4 pin (2)				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)		
1	TX+	Transmitter		
2	RX+	Receiver		
3	TX-	Transmitter		
4	RX-	Receiver		
Housing	SHIELD			

(2) Only for RES execution

23.6 Pressure transducer connection - only for ${\ensuremath{\mathsf{R}}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	V+	Power supply	
2	NC	Not connected	200
3	TR	Output signal 4 ÷ 20 mA	
4	NC	Not connected	3 4 4
5	NC	Not connected	5



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

23.8 REB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layer

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2)

(2) Pin layout always referred to driver's view

24 CONNECTORS CHARACTERISTICS - to be ordered separately

24.1 Main connectors - 7 pin - for REB-NP and RES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A1) ZM-7P	A3 ZH-7P
Туре	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

24.2 Main connectors - 12 pin - for REB-NP and RES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	A4 ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

24.3 IO-Link connector - only for REB-IL

CONNECTOR TYPE	IL IO-Link	
CODE	A ZM-5PF	
Туре	5pin female straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm	
Recommended cable	5 x 0,75 mm² max 20 m	
Connection type	screw terminal	
Protection (EN 60529)	IP 67	

24.4 Fieldbus communication connectors - only for RES

CONNECTOR TYPE BC CANopen (1)		BP PROFI	BUS DP (1)	EH EtherCAT (2)		
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	©2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Me	tallic	Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure i	nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Eth	ernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IF	° 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\mathsf{GS500}}$

(2) Internally terminated

Туре	Size	Fastening bolts	Seals
	1 = 16	4 socket head screws M8x45 class 12.9 Tightening torque = 35 Nm	2 OR 108
	2 = 25	4 socket head screws M12x45 class 12.9 Tightening torque = 125 Nm	2 OR 108
LIRZO	3 = 32	4 socket head screws M16x55 class 12.9 Tightening torque = 300 Nm	2 OR 2043
	4 = 40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZO LICZO	5 = 50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIM70	6 = 63	4 socket head screws M30x90 class 12.9 Tightening torque = 2100 Nm	2 OR 3050
2	8 = 80	8 socket head screws M24x90 class 12.9 Tightening torque = 1000 Nm	2 OR 4075

25 FASTENING BOLTS AND SEALS

26 COVERS DIMENSIONS [mm]

Size	AxA	ØB	С	D	Port Pp - Dr	
1 = 16	65x80	3	4	40	-	
2 = 25	85x85	5	6	40	-	
3 = 32	100×100	5	6	50	-	
4 = 40	125x125	5	6	60	G 1/4"	
5 = 50	140x140	6	4	70	G 1/4"	3.5 AxA 3.5
6 = 63	180x180	6	4	80	G 3/8"	Notes:
8 = 80	ø250	8	6	80	G 3/8"	size 8 cover is not squared but circular, dimension Ø250

27 INSTALLATION DIMENSIONS [mm]



103			1
	Dr	The second secon	

LIMZO-R-8



Mass [kg]						
LICZO, LIMZO, LIRZO Cartridge						
Size	Standard	Option /P	SC LI			
1 = 16	3,8	-	0,2			
2 = 25	4,3	-	0,5			
3 = 32	5,6	-	0,9			
4 = 40	11,0	12,0	1,7			
5 = 50	14,5	15,5	2,9			
6 = 63	24,0	25,0	6,7			
8 = 80	32,6	33,6	13,1			



LIMZO-R-4/P LIRZO-R-4/P LIMZO-R-5/P LIMZO-R-6/P



LIMZO-R-8/P





Note: for mounting surface and cavity dimensions, see tech. table P006



28 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	P006	Mounting	surfaces and cavities for cartridge valves
FS900	Operating and maintenance information for proportional valves	QB420	Quickstar	t for REB valves commissioning
GS203	E-BM-RES digital driver	QF420	Quickstar	t for RES valves commissioning
GS500	Programming tools	E-MAN-	BM-RES	E-BM-RES user manual (off-board)
GS510	Fieldbus	E-MAN-	RI-REB	REB user manual
GS520	IO-Link interface	E-MAN-	RI-RES	RES user manual
K800	Electric and electronic connectors			

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Digital proportional relief valves

direct, without transducer



Possible combined options: IQ, IZ (/T Bluetooth adapter option can be combined with all other options)
 Special execution with max regulated pressure 500 bar available on request

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES	
Туре	Ana	alog	Digital					
Voltage supply (VDC)	12	24	12	24	12	24	24	
Valve coil option	/6	std	/6	std	/6	std	std	
Format		plug-in to solenoid DIN-rail panel			panel			
Tech table	GC)10	G020 G030		GS050			

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





AEB E-A-BTH adapter mobile App AES PC software E-C-SB-USB/M12 cable E-A-SB-USB/OPT isolator

5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MvAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.



7 IO-LINK - only for AEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

8 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007				
Ambient temperature range	A: Standard = -20° C ÷ $+70^{\circ}$ C /PE option = -20° C ÷ $+70^{\circ}$ C /BT option = -40° C ÷ $+60^{\circ}$ C /PE option = -20° C ÷ $+60^{\circ}$ C /BT option = -40° C ÷ $+60^{\circ}$ C				
Storage temperature range	A:Standard = -20° C $\div +80^{\circ}$ C/PE option = -20° C $\div +80^{\circ}$ C/PE option = -40° C $\div +70^{\circ}$ CAEB, AES:Standard = -20° C $\div +70^{\circ}$ C/PE option = -20° C $\div +70^{\circ}$ C/PE option = -40° C $\div +70^{\circ}$ C				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004 (for AEB and AES)				
CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6 ompliance RoHS Directive 2011/65/EU as last update by 2015/863/EU BEACH Regulation (EC) n° 1907/2006					

Bluetooth or USB connection

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		RZMO-*-010
Max regulated pressure	[bar]	50; 100; 210; 315; 350
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure	[bar]	see min. pressure / flow diagram at section 13
Max flow	[l/min]	4
Response time 0-100% step sig (depending on installation) (1)	nal [ms]	≤ 70
Hysteresis		≤ 1,5 [% of max pressure]
Linearity		≤ 3,0 [% of max pressure]
Repeatability		≤ 2,0 [% of max pressure]

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal Rectified and filtere	: +24 VDC d : VRMS = 20 ÷ 32 V	/MAX (ripple max 10 S	% Vpp)	
Max power consumption	A = 30 W	AEB , AES = 50 V	/		
Coil voltage code	standa	ırd	option /6		option /18
Max. solenoid current	2,6 A	λ	3,25 A		1,5 A
Coil resistance R at 20°C	3 ÷ 3,3	SΩ	2 ÷ 2,2 Ω		13 ÷ 13,4 Ω
Analog input signals	Voltage: range ±10 Current: range ±20	0 VDC (24 VMAX tolera 0 mA	ant) Input imp Input imp	bedance: $Ri > 50 k$	2
Monitor output	Output range:	voltage ±5 VDC @	max 5 mA		
Enable input	Range: 0 ÷ 9 VDC (O	FF state), 15 ÷ 24 VDC	(ON state), 9 ÷ 15 VDC	(not accepted); Input	impedance: Ri > 87 k Ω
Fault output	Output range : 0 ÷ external negative vo	24 VDC (ON state \cong bltage not allowed (e.	VL+ [logic power su g. due to inductive lo	pply] ; OFF state ≅ 0 ads)	V) @ max 50 mA;
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level				
Insulation class	H (180°) Due to the the European stand	occurring surface ter ards ISO 13732-1 an	nperatures of the sole d EN982 must be take	enoid coils, en into account	
Protection degree to DIN EN60529	A = IP65; AEB, AES	S = IP66 / IP67 with m	nating connectors		
Duty factor	Continuous rating (E	D=100%)			
Tropicalization	Tropical coating on	electronics PCB			
Additional characteristics	Short circuit protect protection against re	ion of solenoid's curre everse polarity of pov	ent supply; current co ver supply	ontrol by P.I.D. with ra	pid solenoid switching;
Communication interface	USB	IO-Link Interface and System	CANopen	PROFIBUS DP	EtherCAT
	Atos ASCII coding	Specification 1.1.3	EN50325-4 + DS408	EN50170-2/IEC61158	IEC 61158
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cab	les, see section 21			

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for A), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$				
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s				
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog			
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	100 10000		
Flame resistant with water	-	NBR, NBR low temp.	HFC	- 130 12922		

13 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)



Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

14 ELECTRONIC OPTIONS - only for AEB-NP and AES

- I = This option provides $4 \div 20$ mA current reference, instead of the standard $0 \div 10$ VDC.
- Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 18.5 for signal specifications.
- Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal see 18.6
 Enable input signal see above option /Q
 Power supply for driver's logics and communication see 18.2
- 15 POSSIBLE COMBINED OPTIONS

Electronic options: /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

16 COIL VOLTAGE OPTIONS - only for A

- 6 = Optional coil to be used with Atos drivers with power supply 12 VDC.
- 18 = Optional coil to be used with electronic drivers not supplied by Atos.

17 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB-NP and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **AEB-IL** signals see section

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ Vbc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vbc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vbc.

18.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference). Monitor output signal is factory preset according to selected valve code, default settings is $0 \div 5$ Vpc (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of ± 5 Vpc.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for $4 \div 20$ mA input, etc.). Fault presence corresponds to 0 Vpc, normal working corresponds to 24 Vpc. Fault status is not affected by the Enable input signal.

19 IO-LINK SIGNALS SPECIFICATIONS - only for AEB-IL

19.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W

Internal electrical isolation of power L+, L- from P24, N24

19.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

19.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB-NP and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
Α	V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 Vbc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
	ENABLE		Enable (24 Vpc) or disable (0 Vpc) the driver, referred to V0	Input - on/off signal
D	D INPUT+		Reference input signal: $\pm 10 \text{ VDC}$ / $\pm 20 \text{ mA}$ maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	E INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	F MONITOR referred to: AGND V0		Monitor output signal: ±5 Vpc maximum range Default is 0 ÷ 5 Vpc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

20.2 Main connector signals - 12 pin $\textcircled{\text{A2}}$ /Z option - for AEB-NP and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vbc	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: ±10 Vpc / ±20 mA maximum range Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR	Monitor output signal: ± 5 Vpc maximum range, referred to VL0 Default is 0 $\div 5$ Vpc (1V = 1A)	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vbc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B A only for AEB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vpc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vpc for valve regulation, logics and diagnostics	Gnd - power supply

20.4 Communication connectors - for AEB B and AES B - C

B USB connector - M12 - 5 pin always present			
PIN	SIGNAL TECHNICAL SPECIFICATION (1)		
1	+5V_USB	Power supply	
2	ID	Identification	
3	GND_USB	Signal zero data line	
4	D-	Data line -	
5	D+	Data line +	

C2 BP field		bus execution, connector - M12 - 5 pin (2)
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(1) Shield connection on connector's housing is recommended

20.5 Solenoid connection - only for A

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

C1	BC field	bus execution, connector - M12 - 5 pin (2)
PIN	N SIGNAL TECHNICAL SPECIFICATION (1)	
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

C3 (C3 C4 EH fieldbus execution, connector - M12 - 4 pin (2)			
PIN	IN SIGNAL TECHNICAL SPECIFICATION (1)			
1	TX+	Transmitter		
2	RX+	Receiver		
3	тх-	Transmitter		
4	RX-	Receiver		
Housing	SHIELD			

(2) Only for AES execution



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

20.7 AEB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2)

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2)

(2) Pin layout always referred to driver's view

21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	A1) ZM-7P	A3 ZH-7P		
Туре	7pin female straight circular	7pin female straight circular		
Standard	According to MIL-C-5015	According to MIL-C-5015		
Material	Metallic Plastic reinforced with fiber glass			
Cable gland	PG11	PG11		
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)		
Recommended cable	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)		
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires		
Connection type	to solder to solder			
Protection (EN 60529)	IP 67	IP 67		

21.2 Main connectors - 12 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	A2 ZM-12P	(A4) ZH-12P		
Туре	12pin female straight circular	12pin female straight circular		
Standard	DIN 43651	DIN 43651		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG13,5	PG16		
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)		
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires		
Connection type	to crimp	to crimp		
Protection (EN 60529) IP 67		IP 67		

CONNECTOR TYPE	IL IO-Link
CODE	A ZM-5PF
Туре	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

21.4 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Me	tallic		Metallic
Cable gland	Pressure nut - cabl	e diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure r	nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethe	ernet standard CAT-5
Connection type	screw terminal		screw terminal			terminal block
Protection (EN 60529)	IF	67	IP 67			IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\mathsf{GS500}}$

(2) Internally terminated

22 FASTENING BOLTS AND SEALS

	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
0	Seals: 2 OR 108 Diameter of ports P, T: Ø 5 mm

23 INSTALLATION DIMENSIONS [mm]



24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric ar	nd electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting	surfaces for electrohydraulic valves
G010	E-MI-AC analog driver	QB200	Quickstar	t for AEB valves commissioning
G020	E-MI-AS-IR digital driver	QF200	Quickstar	t for AES valves commissioning
G030	E-BM-AS digital driver	E-MAN-	·MI-AS	E-MI-AS-IR user manual (off-board)
GS050	E-BM-AES digital driver	E-MAN-	BM-AS	E-BM-AS user manual (off-board)
GS500	Programming tools	E-MAN-	BM-AES	E-BM-AES user manual (off-board)
GS510	Fieldbus	E-MAN-	RI-AEB	AEB user manual
GS520	IO-Link interface	E-MAN-	RI-AES	AES user manual

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Table **F005-6/E**

Proportional relief valves

direct, without transducer



(1) Select valve's coil voltage /18 in case of electronic drivers not supplied by Atos, with power supply 24 VDc and with max current limited to 1A

2 HYDRAULIC SYMBOL



3 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F (1)		E-MI-AS-IR (1)		E-BM-AS-PS		E-BM-AES		
Туре	Analog			Digital					
Voltage supply (VDC)	12 24		12	24	12	24	24		
Valve coil option	/6	std	/6	std	/6	std	std		
Format		plug-in to	solenoid		DIN-rail panel		il panel		
Tech table	G010		G020		G030		GS050		

(1) For CART RZME the electronic driver may interfere with the manifold surface. Please check the installation dimensions at section ^[15]

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevant components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position						
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra \leq 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100						
MTTFd valves according to EN ISO 13849	150 years, see technical table P007						
Ambient temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$						
Storage temperature range	Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +$						
Surface protection	Zinc coating with black passivation						
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h						
	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)						
Conformity RoHS Directive 2011/65/EU as last update by 2015/863/EU							
	REACH Regulation (EC) n°190	7/2006					

6 HYDRAULIC CHARACTERISTICS

Valve model		RZME-A-010
Max regulated pressure		50; 100; 210; 315; 420;
Min. regulated pre	essure [bar]	see min. pressure / flow diagrams at section 9
Max. pressure at port P [bar]		420
Max. pressure at port T [bar]		210
Max. flow [l/min]		4
Response time 0-100% step signal (1) [ms] (depending on installation)		≤70
Hysteresis	[% of the max pressure]	≤3
Linearity	[% of the max pressure]	±3
Repeatability	[% of the max pressure]	≤2

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time values; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

Coil voltage code	Standard standard coil to be used with Atos drivers with power supply 24Vbc	option /6 optional coil to be used with Atos drivers with power supply 12 Vbc	option /18 optional coil to be used with elect tronic drivers not supplied by Atos with power supply 24 Vbc and ma current limited to 1A		
Max. solenoid current	2,3 A	2,7 A	1,1 A		
Coil resistance R at 20°C 3,1 Ω		2,1 Ω	13,1 Ω		
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account				
Protection degree to DIN EN60529	IP 65 (with connectors 666 correctly assembled)				
Duty factor	Continuous rating (ED=100%)				
Certification	cURus North American Standards				

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

		NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$					
Seals, recommended fluid	l temperature	FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$					
		HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$					
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s					
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at			
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog				
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard			
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without wa	iter	FKM HFDU, HFDR		100 10000			
Flame resistant with water		NBR, HNBR	HFC	100 12922			

9 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

Regulation diagrams - with flow rate Q = 1 l/min

- 1 = regulation characteristic linearized with Atos digital divers E-MI-AS-IR, E-BM-AS, E-BM-AES using Atos E-SW-SETUP software
- 2 = regulation characteristic without linearization
- Note: the presence of counter pressure at port T can affect the effective pressure regulation



with reference signal set at Q = 1 l/min

4-7 = Min. pressure/flow diagrams with zero reference signal

- **4** = pressure range: 50 **5** = pressure range: 100
- **6** = pressure range: 210
- **7** = pressure range: 315
- **8** = pressure range: 420

10 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

11 COILS WITH SPECIAL CONNECTORS



12 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

13 FASTENING BOLTS AND SEALS FOR RZME







16 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS050	E-BM-AES digital driver
FS900	Operating and maintenance information for proportional valves	GS500	Programming tools
G010 G020 G030	E-MI-AC analog driver E-MI-AS-IR digital driver E-BM-AS digital driver	K800 P005	Electric and electronic connectors Mounting surfaces for electrohydraulic valves

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Digital proportional relief valves

piloted, without transducer, subplate or modular mounting



(1) Possible combined options: IQ, IZ (/T Bluetooth adapter option can be combined with all other options)

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES		
Туре	Analog			Digital					
Voltage supply (VDC)	12 24		12	24	12	24	24		
Valve coil option	/6	std	/6	std	/6	std	std		
Format		plug-in to	o solenoid			DIN-rail panel			
Tech table	G010		G020		G030		GS050		

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





AEB AES AES PC software E-C-SB-USB/M12 cable E-A-SB-USB/OPT isolator

5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500** T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

7 IO-LINK - only for AEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

8 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position						
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra \leq 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100						
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007						
Ambient temperature range	A:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$ AEB, AES:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$						
Storage temperature range	A:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$ AEB, AES:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$						
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)						
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h						
Vibration resistance	See technical table G004 (for AEB and AES)						
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006						

Bluetooth or USB connection

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	RZMO-*-030, HZMO-A-30
Max regulated pressure [ba	50; 100; 210; 315; 350
Max pressure at port P [ba	350
Max pressure at port T [ba	210
Min regulated pressure [ba] see min. pressure / flow diagram at section 13
Min ÷ Max flow [l/mi] 2,5 ÷ 40
Response time 0-100% step signal (depending on installation) (1)] ≤ 60
Hysteresis	≤2 [% of max pressure]
Linearity	≤3 [% of max pressure]
Repeatability	≤2 [% of max pressure]

Note: above performance data refer to valves coupled with Atos electronic drivers, see section $\fbox{3}$

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

11 ELECTRICAL CHARACTERISTICS

Power supplies	r supplies Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)						
Max power consumption	A = 30 W	AEB , AES = 50 V	1				
Coil voltage code	standa	rd	option /6		option /18		
Max. solenoid current	2,6 A	1	3,25 A		1,5 A		
Coil resistance R at 20°C	3 ÷ 3,3	Ω	2 ÷ 2,2 Ω		13 ÷ 13,4 Ω		
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX tolera) mA	ant) Input imp Input imp	bedance: $Ri > 50 k$	2		
Monitor output	Output range:	voltage ±5 VDC @	max 5 mA				
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ						
Fault output	Output range : $0 \div 24$ Vbc (ON state \cong VL+ [logic power supply] ; OFF state \cong 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)						
Alarms	Solenoid not connect current control mon	cted/short circuit, cab itoring, power supplie	le break with current s level	reference signal, ove	er/under temperature,		
Insulation class	H (180°) Due to the the European stand	occurring surface ter ards ISO 13732-1 an	nperatures of the sole d EN982 must be tak	enoid coils, en into account			
Protection degree to DIN EN60529	A = IP65; AEB, AES	S = IP66 / IP67 with m	ating connectors				
Duty factor	Continuous rating (E	D=100%)					
Tropicalization	Tropical coating on	electronics PCB					
Additional characteristics	Short circuit protect protection against re	ion of solenoid's curre everse polarity of pov	ent supply; current co ver supply	ontrol by P.I.D. with ra	apid solenoid switching;		
Communication interface	USB	IO-Link Interface and System	CANopen	PROFIBUS DP	EtherCAT		
	Atos ASCII coding	Specification 1.1.3	EN50325-4 + DS408	EN50170-2/IEC61158	IEC 61158		
Communication physical layer	not insulated USB 2.0 + USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cables, see section 21						

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for A), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20 ÷ 100 mm²/s - max allowed r	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	638 class 7	see also filter section at	
contamination level	longer life	ISO4406 class 16/14/11 NAS1	638 class 5	www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	10022	
Flame resistant with water		NBR, NBR low temp.	HFC	100 12922	

13 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)



Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

14 ELECTRONIC OPTIONS - only for AEB-NP and AES

- This option provides 4 ÷ 20 mA current reference, instead of the standard 0 ÷ 10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 18.5 for signal specifications.
- Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal see 18.6
 Enable input signal see above option /Q
 Power supply for driver's logics and communication see 18.2

15 POSSIBLE COMBINED OPTIONS

Electronic options: /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

16 COIL VOLTAGE OPTIONS - only for A

- 6 = Optional coil to be used with Atos drivers with power supply 12 VDC.
- 18 = Optional coil to be used with electronic drivers not supplied by Atos.

17 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB-NP and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **AEB-IL** signals see section 19

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active

the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ Vbc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vbc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vbc.

18.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference). Monitor output signal is factory preset according to selected valve code, default settings is $0 \div 5 \text{ Vpc} (1V = 1A)$. Output signal can be reconfigured via software, within a maximum range of $\pm 5 \text{ Vpc}$.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 Vpc, normal working corresponds to 24 Vpc. Fault status is not affected by the Enable input signal.

19 IO-LINK SIGNALS SPECIFICATIONS - only for AEB-IL

19.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDc power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

19.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

19.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 7 pin (A) Standard and /Q option - for AEB-NP and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
Α	V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 Vbc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR re AGND	eferred to: V0	Monitor output signal: ±5 Vpc maximum range Default is 0 ÷ 5 Vpc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

20.2 Main connector signals - 12 pin A2 /Z option - for AEB-NP and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vbc	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: ±10 Vpc / ±20 mA maximum range Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR	Monitor output signal: ±5 Vbc maximum range, referred to VL0 Output - analog Default is 0 ÷ 5 Vbc (1V = 1A) Software select	
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vbc for driver's logic and communication Gnd - power supply	
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0 Output - on/off signal	
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for AEB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vbc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

20.4 Communication connectors - for AEB (B) and AES (B) - (C)

В	B USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)	
1	+5V_USB	Power supply	
2	ID	Identification	
3	GND_USB	Signal zero data line	
4	D-	Data line -	
5	D+	Data line +	

C2	BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL TECHNICAL SPECIFICATION (1)		
1	+5V	Termination supply signal	
2	LINE-A	Bus line (high)	
3	DGND	Data line and termination signal zero	
4	LINE-B	LINE-B Bus line (low)	
5	SHIELD		

(1) Shield connection on connector's housing is recommended

20.5 Solenoid connection - only for A

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

©1	C1 BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	PIN SIGNAL TECHNICAL SPECIFICATION (1)		
1	CAN_SHLD	Shield	
2	NC	do not connect	
3	CAN_GND	Signal zero data line	
4	CAN_H	Bus line (high)	
5	CAN_L	Bus line (low)	

C3 (C3 C4 EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL TECHNICAL SPECIFICATION (1)		
1	TX+	Transmitter	
2	RX+	Receiver	
3	тх-	Transmitter	
4	RX-	Receiver	
Housing	SHIELD		

(2) Only for AES execution



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

20.7 AEB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2)

(2) Pin layout always referred to driver's view

21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A1) ZM-7P	A3 ZH-7P
Туре	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material Metallic Plastic reinforced with fiber gla		Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)
Recommended cable	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size up to 1 mm ² - available for 7 wires up to 1 mm ² - available		up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

21.2 Main connectors - 12 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	(A4) ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

21.3 IO-Link connector - only for AEB-IL

CONNECTOR TYPE	IL IO-Link
CODE	A ZM-5PF
Туре	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

21.4 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B –	IEC 61076-2-101	M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic			Metallic
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal			terminal block
Protection (EN 60529)	tection (EN 60529) IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\mathsf{GS500}}$

(2) Internally terminated

22 FASTENING BOLTS AND SEALS

	RZMO	НΖМО		
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: Not available		
0	Seals: 4 OR 108 Diameter of ports P, T: Ø 7,5 mm Ports A, B connected to port T	Seals: 4 OR 108 Diameter of ports P, T, A, B: Ø 6,5 mm		



24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric a	and electronic connectors	
F5900	FS900 Operating and maintenance information for proportional valves		Mounting surfaces for electronydraulic valves		
G010	10 E-MI-AC analog driver		Quickstart for AEB valves commissioning		
G020	E-MI-AS-IR digital driver	QF200	Quicksta	rt for AES valves commissioning	
G030	E-BM-AS digital driver	E-MAN-	MI-AS	E-MI-AS-IR user manual (off-board)	
GS050	E-BM-AES digital driver	E-MAN-	BM-AS	E-BM-AS user manual (off-board)	
GS500	Programming tools	E-MAN-	BM-AES	E-BM-AES user manual (off-board)	
GS510	Fieldbus	E-MAN-	RI-AEB	AEB user manual	
GS520	IO-Link interface	E-MAN-	RI-AES	AES user manual	

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Digital proportional relief valves

piloted, without transducer



2 HYDRAULIC SYMBOLS


3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES	
Туре	Analog			Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24	
Valve coil option	/6	std	/6	std	/6	std	std	
Format plug-in to		o solenoid		DIN-rail panel		panel		
Tech table	G010		G020		G030		GS050	

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





AEB E-A-BTH adapter mobile App AES PC software E-C-SB-USB/M12 cable E-A-SB-USB/OPT isolator

5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

7 IO-LINK - only for AEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

8 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007				
Ambient temperature range	A:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$ AEB, AES:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$				
Storage temperature range	A:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$ AEB, AES:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004 (for AEB and AES)				
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

Bluetooth or USB connection

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		AGMZO-*-10	AGMZO-*-20	AGMZO-*-32		
Max regulated pressure	[bar]	50; 100; 210; 315; 350				
Max pressure at port P	[bar]	350				
Max pressure at port T	[bar]	210				
Min regulated pressure [bar]		see min. pressure / flow diagrams at section 13				
Max flow [I/min]		200	400	600		
Response time 0-100% step signal (depending on installation) (1) [ms]		≤ 120	≤ 135	≤ 150		
Hysteresis		≤ 2 [% of max pressure]				
Linearity		≤ 3 [% of max pressure]				
Repeatability		≤ 2 [% of max pressure]				

Note: above performance data refer to valves coupled with Atos electronic drivers, see section $\fbox{3}$

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response.

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal Rectified and filtere	: +24 VDC d : VRMS = 20 ÷ 32 V	/MAX (ripple max 10 s	% Vpp)		
Max power consumption	A = 30 W	AEB , AES = 50 V	/			
Coil voltage code	standa	rd	option /6		option /18	
Max. solenoid current	2,6 A	1	3,25 A		1,5 A	
Coil resistance R at 20°C	3 ÷ 3,3	Ω	2 ÷ 2,2 Ω		13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX tolera) mA	ant) Input imp Input imp	bedance: Ri > 50 k bedance: Ri = 500 s	Ω Ω	
Monitor output	Output range:	voltage ±5 VDC @	max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (O	FF state), 15 ÷ 24 VDC	(ON state), 9 ÷ 15 VDC	c (not accepted); Inpu	t impedance: Ri > 87 k Ω	
Fault output	Output range : 0 ÷ external negative vo	Output range : $0 \div 24$ VDC (ON state \cong VL+ [logic power supply] ; OFF state \cong 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)				
Alarms	Solenoid not connec current control mon	cted/short circuit, cat itoring, power supplie	ele break with current es level	reference signal, ov	er/under temperature,	
Insulation class	H (180°) Due to the occurring surface the European standards ISO 13732-1		temperatures of the solenoid coils, and EN982 must be taken into account			
Protection degree to DIN EN60529	A = IP65; AEB, AES	S = IP66 / IP67 with m	nating connectors			
Duty factor	Continuous rating (E	D=100%)				
Tropicalization	Tropical coating on	electronics PCB				
Additional characteristics Short circuit protection of solenoid's current supply; current control by P.I.D. with rap protection against reverse polarity of power supply		apid solenoid switching;				
Communication interface	USB Atos ASCII coding	IO-Link Interface and System Specification 1.1.3	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC 61158	
Communication physical layer not insulated SDCI USB 2.0+USB OTG class port B		SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX	
Recommended wiring cable	LiYCY shielded cab	les, see section 24				

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluic	temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for A), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$				
		NBR low temp. seals (/BT option)	$ = -40^{\circ}C \div +60^{\circ}C, $ with HFC hydra	aulic fluids = $-20^{\circ}C \div +50^{\circ}C$		
Recommended viscosity		$20 \div 100 \text{ mm}^2/\text{s}$ - max allowed r	20 \div 100 mm ² /s - max allowed range 15 \div 380 mm ² /s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	638 class 7	see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	100 10000		
Flame resistant with water		NBR, NBR low temp.	HFC	130 12922		



14 HYDRAULIC OPTIONS

E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.

With option E the internal connection between port P and X of the valve is plugged. The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G 1/4").

Y = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.

The Y drain port has a threaded connection G 1/4" available on the pilot stage body.

15 ELECTRONIC OPTIONS - only for AEB-NP and AES

I = This option provides 4 \div 20 mA current reference, instead of the standard 0 \div 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of \pm 10 VDC or \pm 20 mA.

It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 21.5 for signal specifications.
- Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal see 21.6
 Enable input signal see above option /Q
 Power supply for driver's logics and communication see 21.2

16 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible Electronic options: /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

- 17 COIL VOLTAGE OPTIONS only for A
- 6 = Optional coil to be used with Atos drivers with power supply 12 VDC.
- 18 = Optional coil to be used with electronic drivers not supplied by Atos.

18 MECHANICAL PRESSURE LIMITER

The AGMZO are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.

For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw () until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve).

This function can be used in emergency to unload the system pressure by-passing the proportional control.

20 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.









1

21 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB-NP and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **AEB-IL** signals see section 22

21.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 21.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

21.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

21.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ Vbc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vbc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vbc.

21.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference). Monitor output signal is factory preset according to selected valve code, default settings is $0 \div 5$ Vpc (1V = 1A). Output signal can be reconfigured via software, within a maximum range of ± 5 Vpc.

21.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

21.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 Vpc, normal working corresponds to 24 Vpc. Fault status is not affected by the Enable input signal.

22 IO-LINK SIGNALS SPECIFICATIONS - only for AEB-IL

22.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDc power supply for IO-Link communication. Maximum power consumption: 2 W

Internal electrical isolation of power L+, L- from P24, N24

22.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

22.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

23 ELECTRONIC CONNECTIONS

23.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB-NP and AES

PIN	Standard /Q TECHNICAL SPECIFICATIONS		NOTES	
Α	V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 Vbc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
	ENABLE		Enable (24 Vbc) or disable (0 Vbc) the driver, referred to V0	Input - on/off signal
D	D INPUT+		Reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	E INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	FMONITOR referred to: AGNDV0		Monitor output signal: ±5 Vpc maximum range Default is 0 ÷ 5 Vpc (1V = 1A)	Output - analog signal Software selectable
G	G EARTH		Internally connected to driver housing	

23.2 Main connector signals - 12 pin A2 /Z option - for AEB-NP and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vbc	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 Vpc) or disable (0 Vpc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: ±10 Vpc / ±20 mA maximum range Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+ Input - analog	
6	MONITOR	Monitor output signal: ±5 Vpc maximum range, referred to VL0 Output - an Software s	
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vbc for driver's logic and communication Input - power sup	
10	VL0	Power supply 0 Vpc for driver's logic and communication Gnd - power suppl	
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0 Output - on/off signa	
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

23.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B $\stackrel{}{(\ensuremath{\mathsf{A}})}$ only for AEB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vbc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vpc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

23.4 Communication connectors - for AEB B and AES B - C

В	B USB connector - M12 - 5 pin always present				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	+5V_USB	Power supply			
2	ID	Identification			
3	GND_USB	Signal zero data line			
4	D-	Data line -			
5	D+	Data line +			

C2	BP fieldbus execution, connector - M12 - 5 pin (2)			
PIN	SIGNAL	SIGNAL TECHNICAL SPECIFICATION (1)		
1	+5V	Termination supply signal		
2	LINE-A	Bus line (high)		
3	DGND	Data line and termination signal zero		
4	LINE-B	Bus line (low)		
5	SHIELD			

(1) Shield connection on connector's housing is recommended

23.5 Solenoid connection - only for $\ensuremath{\textbf{A}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

©1)	BC fieldbus execution, connector - M12 - 5 pin (2)				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	CAN_SHLD	Shield			
2	NC	do not connect			
3	CAN_GND	Signal zero data line			
4	CAN_H	Bus line (high)			
5	CAN_L	Bus line (low)			

C 3	C3 C4 EH fieldbus execution, connector - M12 - 4 pin (2)					
PIN	SIGNAL TECHNICAL SPECIFICATION (1)					
1	TX+	Transmitter				
2	RX+	Receiver				
3	ТХ-	Transmitter				
4	RX- Receiver					
Housing	SHIELD					

(2) Only for AES execution



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

23.7 AEB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) F

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2)

(2) Pin layout always referred to driver's view

24 CONNECTORS CHARACTERISTICS - to be ordered separately

24.1 Main connectors - 7 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS	
CODE	A1) ZM-7P	A3 ZH-7P	
Туре	7pin female straight circular	7pin female straight circular	
Standard According to MIL-C-5015 According to MIL-C-5015		According to MIL-C-5015	
Material	Metallic	Plastic reinforced with fiber glass	
Cable gland	PG11	PG11	
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)	
necommended cable	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	
Conductor size up to 1 mm ² - available for 7 wires		up to 1 mm ² - available for 7 wires	
Connection type	to solder	to solder	
Protection (EN 60529)	IP 67	IP 67	

24.2 Main connectors - 12 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	(A4) ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

24.3 IO-Link connector - only for AEB-IL

CONNECTOR TYPE	IL IO-Link
CODE	A ZM-5PF
Туре	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material Metallic	
Cable gland Pressure nut - cable diameter 6÷8 mn	
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

24.4 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	YPE BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	©2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A –	IEC 61076-2-101	2-101 M12 coding B – IEC 6107		M12 coding D – IEC 61076-2-101	
Material	Me	tallic	Metallic			Metallic
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure	nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Eth	ernet standard CAT-5
Connection type screw terminal		screw terminal			terminal block	
Protection (EN 60529)	IF	267	IP 67			IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\mathsf{GS500}}$

(2) Internally terminated

25 FASTENING BOLTS AND SEALS

	AGMZO-*-10	AGMZO-*-20	AGMZO-*-32
	Fastening bolts:	Fastening bolts:	Fastening bolts:
	4 socket head screws M12x35 class 12.9	4 socket head screws M16x50 class 12.9	4 socket head screws M20x60 class 12.9
	Tightening torque = 125 Nm	Tightening torque = 300 Nm	Tightening torque = 600 Nm
0	Seals:	Seals:	Seals:
	2 OR 123	2 OR 4112	2 OR 4131
	Diameter of ports P, T: Ø 14 mm	Diameter of ports P, T: Ø 24 mm	Diameter of ports P, T: Ø 28 mm
	1 OR 109/70	1 OR 109/70	1 OR 109/70
	Diameter of port X: Ø 3,2 mm	Diameter of port X: Ø 3,2 mm	Diameter of port X: Ø 3,2 mm





27 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric a	nd electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting	surfaces for electrohydraulic valves
G010	E-MI-AC analog driver	QB200	Quickstar	t for AEB valves commissioning
G020	E-MI-AS-IR digital driver	QF200	Quickstar	t for AES valves commissioning
G030	E-BM-AS digital driver	E-MAN-	MI-AS	E-MI-AS-IR user manual (off-board)
GS050	E-BM-AES digital driver	E-MAN-	BM-AS	E-BM-AS user manual (off-board)
GS500	Programming tools	E-MAN-	BM-AES	E-BM-AES user manual (off-board)
GS510	Fieldbus	E-MAN-	RI-AEB	AEB user manual
GS520	IO-Link interface	E-MAN-	RI-AES	AES user manual

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Table **F030-4/E**

Proportional relief valves

piloted, without transducer



(1) Possible combined options: /EY

(2) Select valve's coil voltage /18 in case of electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A

2 HYDRAULIC SYMBOL



3 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Туре	Ana	alog	Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format		plug-in to	solenoid			DIN-ra	il panel
Tech table	G010		GC)20	GC)30	GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevant components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	75 years, see technical table P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$				
Storage temperature range	Standard = $-20^{\circ}C \div +80^{\circ}C$	/PE option = $-20^{\circ}C \div +80^{\circ}C$	/BT option = $-40^{\circ}C \div +70^{\circ}C$		
Surface protection	Surface protection Zinc coating with black passivation				
Corrosion resistance	Corrosion resistance Salt spray test (EN ISO 9227) > 200 h				
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

6 HYDRAULIC CHARACTERISTICS

Valve model		AGMZE-A-10	AGMZE-A-20	AGMZE-A-32	
Max regulated pressure	[bar]	50; 100; 210; 315; 350			
Max pressure at port P	[bar]		350		
Max pressure at port T	[bar]	210			
Min regulated pressure	[bar]	see min. pressure / flow diagrams at section 11			
Max flow	[l/min]	200	400	600	
Response time 0-100% step signal (depending on installation) (1) [ms]		≤ 120	≤ 135	≤ 150	
Hysteresis		≤ 2 [% of max pressure]			
Linearity		≤ 3 [% of max pressure]			
Repeatability		≤2 [% of max pressure]			

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time values; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

Power supplies Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)				
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,5 A	3 A	1,2 A	
Coil resistance R at 20°C	3,1 Ω	2,1 Ω	13,1 Ω	
Insulation class	H (180°) Due to the occuring surfact the European standards ISO 13732	e temperatures of the solenoid coils -1 and EN982 must be taken into ac	count	
Protection degree to DIN EN60529	29 IP65 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Certification	cURus North American Standard			

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	l temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at	
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	10022	
Flame resistant with water		NBR, HNBR	HFC	130 12922	



10 HYDRAULIC OPTIONS

E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.

With option E the internal connection between port P and X of the valve is plugged. The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G $\frac{1}{4}$ ").







11 POSSIBLE COMBINED OPTIONS

/EY

12 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

13 MECHANICAL PRESSURE LIMITER

The AGMZE are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.

For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw (1) until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw (1) of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.

14 REMOTE PRESSURE UNLOADING

The P main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve).

This function can be used in emergency to unload the system pressure by-passing the proportional control.





15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



16 COILS WITH SPECIAL CONNECTORS



Coil type COZEK Deutsch connector, DT-04-2P male Protection degree IP67



S option Coil type COZES Lead Wire connection Cable lenght = 180 mm



17 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

18 FASTENING BOLTS AND SEALS

	AGMZE-A-10	AGMZE-A-20	AGMZE-A-32
Ø	Fastening bolts:	Fastening bolts:	Fastening bolts:
Ħ	4 socket head screws M12x35 class 12.9	4 socket head screws M16x50 class 12.9	4 socket head screws M20x60 class 12.9
	Tightening torque = 125 Nm	Tightening torque = 300 Nm	Tightening torque = 600 Nm
	Seals:	Seals:	Seals:
\bigcirc	2 OR 123 Diameter of ports P, T: Ø 14 mm	2 OR 4112 Diameter of ports P, T: Ø 24 mm	2 OR 4131 Diameter of ports P, T: Ø 28 mm
\bigcirc	1 OR 109/70 Diameter of port X: Ø 3,2 mm	1 OR 109/70 Diameter of port X: Ø 3,2 mm	1 OR 109/70 Diameter of port X: Ø 3,2 mm



20 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS050	E-BM-AES digital driver
FS900	Operating and maintenance information for proportional valves	GS500	Programming tools
G010	E-MI-AC analog driver	K800	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	P005	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver		

Digital proportional reducing valves

direct, without transducer



(1) Possible combined options: IQ, IZ (/T Bluetooth adapter option can be combined with all other options)



3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Туре	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solen		solenoid		DIN-rail panel		panel
Tech table G010		G020 G030		GS050			

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





AEB E-A-BTH adapter mobile App AES PC software E-C-SB-USB/M12 cable E-A-SB-USB/OPT isolator

5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MvAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

7 IO-LINK - only for AEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

8 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007				
Ambient temperature range	A:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$ AEB, AES:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$				
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004 (for AEB and AES)				
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

Bluetooth or USB connection

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		RZGO-*-010
Max regulated pressure	[bar]	32; 100; 210
Max pressure at port P	[bar]	350
Max pressure at port T	[bar]	210
Min regulated pressure (1)	[bar]	0,8
Max flow	[l/min]	12
Response time 0-100% step sign (depending on installation) (2)	al [ms]	≤ 45
Hysteresis		≤ 1,5 [% of max pressure]
Linearity		≤ 3,0 [% of max pressure]
Repeatability		≤ 2,0 [% of max pressure]

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure

(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal Rectified and filtered	: +24 VDC d : VRMS = 20 ÷ 32	2 VMAX (ripple max 10 s	% Vpp)			
Max power consumption	A = 30 W	AEB , AES = 50	W				
Coil voltage code	standa	rd	option /6		option /18		
Max. solenoid current	2,4 A 1,8 A for /32 - max p	oressure 32 bar 2,2	3 A 25 A for /32 - max pressu	re 32 bar 0,8 A for /3	1 A 2 - max pressure 32 bar		
Coil resistance R at 20°C	3 ÷ 3,3	Ω	2 ÷ 2,2 Ω		13 ÷ 13,4 Ω		
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX tole) mA	erant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$	2		
Monitor output	Output range:	voltage ±5 VDC	@ max 5 mA				
Enable input	Range: 0 ÷ 9 VDC (OI	FF state), 15 ÷ 24 Vc	c (ON state), 9 ÷ 15 VDC	c (not accepted); Input	impedance: Ri > 87 k Ω		
Fault output	Output range : 0 ÷ external negative vo	24 VDC (ON state oltage not allowed (≅ VL+ [logic power su e.g. due to inductive logen	pply] ; OFF state ≅ 0 ads)	V) @ max 50 mA;		
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level						
Insulation class	H (180°) Due to the the European stand	occurring surface t ards ISO 13732-1 a	emperatures of the sole and EN982 must be take	enoid coils, en into account			
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors						
Duty factor	Continuous rating (E	D=100%)					
Tropicalization	Tropical coating on	electronics PCB					
Additional characteristics	Additional characteristics Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid soleno protection against reverse polarity of power supply		pid solenoid switching;				
	USB	IO-Link	CANopen	PROFIBUS DP	EtherCAT		
Communication interface	Atos ASCII coding	Interface and Syste Specification 1.1.3	m EN50325-4 + DS408	EN50170-2/IEC61158	IEC 61158		
Communication physical layer	not insulated USB 2.0 + USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cab	les, see section 21	LiYCY shielded cables, see section 21				

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluic	temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for A), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at	
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	100 10000	
Flame resistant with water		NBR, NBR low temp.	NBR, NBR low temp. HFC ISO 12922		

13 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

Pressure/flow diagrams 1 **Regulation diagrams** 2 3-4 Min. pressure/flow diagrams with flow rate Q = 1 l/min with reference signal set at Q = 1 l/min 100 18 2 1 Regulated pressure at port A [% of the max] Differential pressure P-A - A-T [bar] 100 15 Pressure at port A [% of the max] 80 80 12 60 60 9 40 40 6 20 20 0 0 40 100 20 60 80 12 8 4 0 8 12 0 2 4 [P→A] [A→T] Reference signal [% of the max] Flow [l/min]





14 ELECTRONIC OPTIONS - only for AEB-NP and AES

- I = This option provides 4 ÷ 20 mA current reference, instead of the standard 0 ÷ 10 VDC.
- Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle - see 18.5 for signal specifications
- Z = This option provides, on the 12 pin main connector, the following additional features: Fault output signal - see 18.6 Enable input signal - see above option /Q Power supply for driver's logics and communication - see 18.2

15 POSSIBLE COMBINED OPTIONS

Electronic options: /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

16 COIL VOLTAGE OPTIONS - only for A

- 6 = Optional coil to be used with Atos drivers with power supply 12 VDC.
- 18 = Optional coil to be used with electronic drivers not supplied by Atos.

17 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB-NP and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **AEB-IL** signals see section 19

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ Vbc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vbc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vbc.

18.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference). Monitor output signal is factory preset according to selected valve code, default settings is $0 \div 5$ Vpc (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of ± 5 Vpc.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 Vpc, normal working corresponds to 24 Vpc. Fault status is not affected by the Enable input signal.

19 IO-LINK SIGNALS SPECIFICATIONS - only for AEB-IL

19.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W

Internal electrical isolation of power L+, L- from P24, N24

19.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

19.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 7 pin (A) Standard and /Q option - for AEB-NP and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
А	V+		Power supply 24 VDc	Input - power supply
В	V0		Power supply 0 Vbc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to V0	Input - on/off signal
D	D INPUT+		Reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	F MONITOR referred to: AGND V0		Monitor output signal: ±5 Vpc maximum range Default is 0 ÷ 5 Vpc (1V = 1A)	Output - analog signal Software selectable
G	G EARTH		Internally connected to driver housing	

20.2 Main connector signals - 12 pin A2 /Z option - for AEB-NP and AES

PIN	/Z	TECHNICAL SPECIFICATIONS NOTES		
1	V+	Power supply 24 Vbc	Input - power supply	
2	V0	Power supply 0 Vbc	Gnd - power supply	
3	ENABLE	Enable (24 VDc) or disable (0 VDc) the driver, referred to VL0	Input - on/off signal	
4	INPUT+	Reference input signal: ±10 Vpc / ±20 mA maximum range Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable	
5	INPUT-	Negative reference input signal for INPUT+ Input - analog si		
6	MONITOR	Monitor output signal: ±5 Vpc maximum range, referred to VL0 Output Default is 0 ÷ 5 Vpc (1V = 1A) Softwa		
7	NC	Do not connect		
8	NC	Do not connect		
9	VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply	
10	VL0	LO Power supply 0 Vbc for driver's logic and communication Gnd - power supp		
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0 Output - on/off signal		
PE	EARTH	Internally connected to driver housing		

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B $\stackrel{}{(\ensuremath{\mathsf{A}})}$ only for AEB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vpc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vpc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

20.4 Communication connectors - for AEB B and AES B - C

B USB connector - M12 - 5 pin always present					
PIN	SIGNAL TECHNICAL SPECIFICATION (1)				
1	+5V_USB	Power supply			
2	ID	Identification			
3	GND_USB	Signal zero data line			
4	D-	Data line -			
5	D+	Data line +			

C2	BP fieldbus execution, connector - M12 - 5 pin (2)				
PIN	SIGNAL TECHNICAL SPECIFICATION (1)				
1	+5V	Termination supply signal			
2	LINE-A	Bus line (high)			
3	DGND	Data line and termination signal zero			
4	LINE-B	Bus line (low)			
5	SHIELD				

(1) Shield connection on connector's housing is recommended

20.5 Solenoid connection - only for $\boldsymbol{\mathsf{A}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

C1 BC fieldbus execution, connector - M12 - 5 pin (2)					
PIN	SIGNAL TECHNICAL SPECIFICATION (1)				
1	CAN_SHLD	Shield			
2	NC	do not connect			
3	CAN_GND	Signal zero data line			
4	CAN_H	Bus line (high)			
5	CAN_L	Bus line (low)			

© 3 © 4 EH fieldbus execution, connector - M12 - 4 pin (2)					
PIN	SIGNAL TECHNICAL SPECIFICATION (1)				
1	TX+	Transmitter			
2	RX+	Receiver			
3	ТХ-	Transmitter			
4	RX-	Receiver			
Housing	SHIELD				

(2) Only for AES execution



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

20.7 AEB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layou

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2)

(2) Pin layout always referred to driver's view

21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	A1) ZM-7P	A3 ZH-7P		
Туре	7pin female straight circular	7pin female straight circular		
Standard	According to MIL-C-5015	According to MIL-C-5015		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG11	PG11		
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)		
necommended cable	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)		
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires		
Connection type	to solder	to solder		
Protection (EN 60529)	IP 67	IP 67		

21.2 Main connectors - 12 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS	
CODE	A2 ZM-12P	(A4) ZH-12P	
Туре	12pin female straight circular	12pin female straight circular	
Standard	DIN 43651	DIN 43651	
Material	Metallic	Plastic reinforced with fiber glass	
Cable gland	PG13,5	PG16	
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)	
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires	
Connection type	to crimp	to crimp	
Protection (EN 60529) IP 67		IP 67	

21.3 IO-Link connector - only for AEB-IL

CONNECTOR TYPE	IL IO-Link
CODE	A ZM-5PF
Туре	5pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Recommended cable	5 x 0,75 mm² max 20 m
Connection type	screw terminal
Protection (EN 60529)	IP 67

21.4 Fieldbus communication connectors - only for AES

CONNECTOR TYPE BC CANopen (1)		BP PROFI	BUS DP (1)	EH EtherCAT (2)		
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Tupo	5 pin female	5 pin male	5 pin female	5 pin male		4 pin male
туре	straight circular	straight circular	straight circular	straight circular		straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 cc	ding D – IEC 61076-2-101
Material	Me	tallic	Metallic			Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure	nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Eth	ernet standard CAT-5
Connection type	screw terminal		screw terminal			terminal block
Protection (EN 60529)	IP67		IP 67			IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table GS500

(2) Internally terminated

22 FASTENING BOLTS AND SEALS

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Fastening bolts:4 socket head screws M5x50 class 12.9Tightening torque = 8 Nm

Seals:

4 OR 108 Diameter of ports P, A, T: Ø 5 mm Port B not used

23 INSTALLATION DIMENSIONS [mm]



24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric an	d electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting	surfaces for electronydraulic valves
G010	E-MI-AC analog driver	QB200	Quickstart	for AEB valves commissioning
G020	E-MI-AS-IR digital driver	QF200	Quickstart	for AES valves commissioning
G030	E-BM-AS digital driver	E-MAN-	MI-AS	E-MI-AS-IR user manual (off-board)
GS050	E-BM-AES digital driver	E-MAN-	BM-AS	E-BM-AS user manual (off-board)
GS500	Programming tools	E-MAN-	BM-AES	E-BM-AES user manual (off-board)
GS510	Fieldbus	E-MAN-	RI-AEB	AEB user manual
GS520	IO-Link interface	E-MAN-	RI-AES	AES user manual

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direct. without transducer



(1) Select valve's coil voltage /18 in case of electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1,2A

2 HYDRAULIC SYMBOL



3 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F (1)		E-MI-AS-IR (1)		E-BM-AS-PS		E-BM-AES	
Туре	Analog			Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24	
Valve coil option	/6	std	/6	std	/6	std	std	
Format plu		plug-in to solenoid		DIN-rail panel				
Tech table	G010		G020		G030		GS050	

(1) For CART RZGE the electronic driver may interfere with the manifold surface. Please check the installation dimensions at section 16

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevant components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra \leq 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	150 years, see technical table	P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$	/PE option = $-20^{\circ}C \div +70^{\circ}C$	/BT option = $-40^{\circ}C \div +60^{\circ}C$			
Storage temperature range	Standard = $-20^{\circ}C \div +80^{\circ}C$	/PE option = $-20^{\circ}C \div +80^{\circ}C$	/BT option = $-40^{\circ}C \div +70^{\circ}C$			
Surface protection	Zinc coating with black passivation					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
	CE according to EMC directive	e 2014/30/EU (Immunity: EN 61000	D-6-2; Emission: EN 61000-6-3)			
Compliance	RoHS Directive 2011/65/EU as	last update by 2015/863/EU				
	REACH Regulation (EC) n°190	07/2006				

6 HYDRAULIC CHARACTERISTICS

Valve model	RZGE-A-010		
Max regulated pressure	32; 100; 210		
Min. regulated pressure [bar]	0,8 (or actual value at T port)		
Max. pressure at port P [bar]	315		
Max. pressure at port T [bar]	210		
Max. flow [I/min]	12		
Internal leakage [cm³/min]	50 bar = 320; 100 bar =340; 210 bar =550		
Response time 0-100% step signal (1) (depending on installation) [bar]	≤70		
Hysteresis [% of the max pressure]	≤ 1,5		
Linearity [% of the max pressure]	≤5		
Repeatability [% of the max pressure]	≤2		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time values; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

Coil voltage code	Standard standard coil to be used with Atos drivers with power supply 24Vbc	option /6 optional coil to be used with Atos drivers with power supply 12 Vbc	option /18 optional coil to be used with elec- tronic drivers not supplied by Atos, with power supply 24 Vbc and max current limited to 1,2 A		
Max. solenoid current	2,5 A	3 A	1,2 A		
Coil resistance R at 20°C	3,1 Ω	2,1 Ω	13,1 Ω		
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account				
Protection degree to DIN EN60529	IP 65 (with connectors 666 correctly assembled)				
Duty factor	Continuous rating (ED=100%)				
Coil certification	cURus North American Standards				

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended f	luid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$			
Recommended viscosi	ty	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS163	see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS163	4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	10022	
Flame resistant with water		NBR, HNBR	HFC	130 12922	

9 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams

with flow rate Q = 1 l/min

Note: the presence of counter pressure at port T can affect the effective pressure regulation







3-4 = Min. pressure/flow diagrams

with zero reference signal

3 = Pressure drops vs. flow P-A **4** = Pressure drops vs. flow A-T





10 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

11 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



12 COILS WITH SPECIAL CONNECTORS



13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

14 FASTENING BOLTS AND SEALS FOR RZGE



15 INSTALLATION DIMENSIONS FOR RZGE [mm]





17 RELATED DOCUMENTATION

FS001Basics for digital electrohydraulicsGFS900Operating and maintenance information for proportional valvesGG010E-MI-AC analog driverKG020E-MI-AS-IR digital driverPG030E-BM-AS digital driverP	 S050 E-BM-AES digital driver S500 Programming tools 800 Electric and electronic connectors Mounting surfaces for electrohydraulic valves
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Digital proportional reducing valves

piloted, without transducer, subplate or modular mounting



(1) Possible combined options: IQ, IZ (/T Bluetooth adapter option can be combined with all other options)

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Туре	Analog			Digital			
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid			DIN-rail panel			
Tech table	GC	010	G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





AEB E-A-BTH adapter mobile App MES AES PC software E-C-SB-USB/M12 cable E-A-SB-USB/OPT isolator

5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

7 IO-LINK - only for AEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

8 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra \leq 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007				
Ambient temperature range	A:Standard = -20° C $\div +70^{\circ}$ C/PE option = -20° C $\div +70^{\circ}$ C/BT option = -40° C $\div +60^{\circ}$ CAEB, AES:Standard = -20° C $\div +60^{\circ}$ C/PE option = -20° C $\div +60^{\circ}$ C/BT option = -40° C $\div +60^{\circ}$ C				
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004 (for AEB and AES)				
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

Bluetooth or USB connection

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		RZGO, HZGO	KZGO		
Max regulated pressure	[bar]	50; 100; 210; 315; 350	100; 210; 315; 350		
Max pressure at port P	[bar]	350			
Max pressure at port T	[bar]	210			
Min regulated pressure (1)	[bar]	1,0; 3,0 (only for /350)			
Min flow	[l/min]	2,5	3		
Max flow	[l/min]	40	100		
Response time 0-100% step sig (depending on installation) (2)	nal [ms]	≤ 50	≤80		
Hysteresis		≤ 2 [% of max pressure]			
Linearity		≤3 [% of max pressure]			
Repeatability		≤2 [% of max pressure]			

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure

(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)						
Max power consumption	A = 30 W	A = 30 W AEB , AES = 50 W					
Coil voltage code	standa	standard option /6 option /18					
Max. solenoid current	2,6 A	\	3,25 A		1,5 A		
Coil resistance R at 20°C	3 ÷ 3,3	Ω	2 ÷ 2,2 Ω		13 ÷ 13,4 Ω		
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX toler) mA	ant) Input imp Input imp	bedance: Ri > 5 bedance: Ri = 5	Ο ΚΩ ΟΟ Ω		
Monitor output	Output range:	voltage ±5 VDC @	9 max 5 mA				
Enable input	Range: 0 ÷ 9 VDC (O	FF state), 15 ÷ 24 VDC	(ON state), 9 ÷ 15 VD0	c (not accepted); Ir	nput impedance: Ri > 87 k Ω		
Fault output	Output range : 0 ÷ external negative vo	Output range : $0 \div 24$ VDc (ON state \cong VL+ [logic power supply] ; OFF state \cong 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)					
Alarms	Solenoid not connec current control mon	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level					
Insulation class	H (180°) Due to the the European stand	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	A = IP65; AEB, AES	A = IP65; AEB, AES = IP66 / IP67 with mating connectors					
Duty factor	Continuous rating (E	D=100%)					
Tropicalization	Tropical coating on	electronics PCB					
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply						
Communication interface	USB Atos ASCII coding	IO-Link Interface and System Specification 1.1.3	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61	EtherCAT 158 IEC 61158		
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cables, see section 21						

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for A), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$				
Recommended viscosity 20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s						
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	see also filter section at			
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog			
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	ISO 12022		
Flame resistant with water	r	NBR, NBR low temp.	HFC	130 12922		

[13] DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)



Flow [l/min]


14 ELECTRONIC OPTIONS - only for AEB-NP and AES

- This option provides 4 ÷ 20 mA current reference, instead of the standard 0 ÷ 10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 18.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal - see 18.6
 Enable input signal - see above option /Q

Power supply for driver's logics and communication - see 18.2

15 POSSIBLE COMBINED OPTIONS Electronic options: /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

16 COIL VOLTAGE OPTIONS - only for A

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

17 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB-NP and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **AEB-IL** signals see section 19

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active

the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ Vbc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vbc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vbc.

18.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference). Monitor output signal is factory preset according to selected valve code, default settings is $0 \div 5 \text{ Vpc} (1V = 1A)$. Output signal can be reconfigured via software, within a maximum range of $\pm 5 \text{ Vpc}$.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 Vpc, normal working corresponds to 24 Vpc. Fault status is not affected by the Enable input signal.

19 IO-LINK SIGNALS SPECIFICATIONS - only for AEB-IL

19.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

19.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

19.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB-NP and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
Α	V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 Vbc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR re AGND	eferred to: V0	Monitor output signal: ±5 Vpc maximum range Default is 0 ÷ 5 Vpc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

20.2 Main connector signals - 12 pin A2 /Z option - for AEB-NP and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vbc	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: $\pm 10 \text{ Vpc} / \pm 20 \text{ mA}$ maximum range Defaults are 0 $\div 10 \text{ Vpc}$ for standard and 4 $\div 20 \text{ mA}$ for /l option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR	Monitor output signal: ± 5 Vpc maximum range, referred to VL0 Default is 0 \div 5 Vpc (1V = 1A)	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vbc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for AEB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vbc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

20.4 Communication connectors - for AEB B and AES B - C

B USB connector - M12 - 5 pin always present						
PIN	PIN SIGNAL TECHNICAL SPECIFICATION (1)					
1	+5V_USB Power supply					
2	ID Identification					
3	GND_USB Signal zero data line					
4	D- Data line -					
5	D+ Data line +					

C2	BP field	bus execution, connector - M12 - 5 pin (2)	
PIN SIGNAL TECHNICAL SPECIFICATION (1)			
1	+5V Termination supply signal		
2	LINE-A Bus line (high)		
3	DGND Data line and termination signal zero		
4	LINE-B Bus line (low)		
5	SHIELD		

(1) Shield connection on connector's housing is recommended

20.5 Solenoid connection - only for A

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

©1)	BC field	bus execution, connector - M12 - 5 pin (2)
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(3)	C3 C4 EH fieldbus execution, connector - M12 - 4 pin (2)			
PIN	N SIGNAL TECHNICAL SPECIFICATION (1)			
1	TX+	Transmitter		
2	RX+	Receiver		
3	TX-	Transmitter		
4 RX-		Receiver		
Housing	SHIELD			

(2) Only for AES execution



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

20.7 AEB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2

(2) Pin layout always referred to driver's view

21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	(A1) ZM-7P	A3 ZH-7P		
Туре	7pin female straight circular	7pin female straight circular		
Standard	According to MIL-C-5015	According to MIL-C-5015		
Material	Metallic Plastic reinforced with fiber glass			
Cable gland	PG11	PG11		
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply) LiYCY 7 x 1 mm ² max 40 m (logic and power supply)			
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires		
Connection type	to solder to solder			
Protection (EN 60529)	IP 67	IP 67		

21.2 Main connectors - 12 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	A2 ZM-12P	(A4) ZH-12P		
Туре	12pin female straight circular	12pin female straight circular		
Standard	DIN 43651	DIN 43651		
Material	Metallic Plastic reinforced with fiber gl			
Cable gland	PG13,5	PG16		
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)		
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires		
Connection type	to crimp	to crimp		
Protection (EN 60529)	IP 67	IP 67		

21.3 IO-Link connector - only for AEB-IL

CONNECTOR TYPE	IL IO-Link	
CODE	A ZM-5PF	
Туре	5pin female straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm	
Recommended cable	5 x 0,75 mm² max 20 m	
Connection type	screw terminal	
Protection (EN 60529)	IP 67	

21.4 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)		
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E	
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular	
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B –	IEC 61076-2-101	M12 coding D – IEC 61076-2-101		
Material	Metallic		Me	tallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6+8 mm		Pressure i	Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5		
Connection type	screw terminal		screw terminal		terminal block		
Protection (EN 60529)	IP67		IP 67		IP 67		

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\mathsf{GS500}}$

(2) Internally terminated

22 FASTENING BOLTS AND SEALS

	RZGO	HZGO	KZGO
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: M5 class 12.9 Tightening torque = 8 Nm	Fastening bolts: M6 class 12.9 Tightening torque = 15 Nm
0	Seals: 4 OR 108 Diameter of ports P, A, T: Ø 7,5 mm Port B not used	Seals: 4 OR 108 Diameter of ports P, A, B, T: Ø 6,5 mm	Seals: 5 OR 2050; 1 OR 108 Diameter of ports P, A, B, T: Ø 10,5 mm (max)



(4) = Pressure gauge port = G1/4"

24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric a	and electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting	surfaces for electrohydraulic valves
G010	E-MI-AC analog driver	QB200	Quicksta	rt for AEB valves commissioning
G020	E-MI-AS-IR digital driver	QF200	Quicksta	rt for AES valves commissioning
G030	E-BM-AS digital driver	E-MAN-	MI-AS	E-MI-AS-IR user manual (off-board)
GS050	E-BM-AES digital driver	E-MAN-	BM-AS	E-BM-AS user manual (off-board)
GS500	Programming tools	E-MAN-	BM-AES	E-BM-AES user manual (off-board)
GS510	Fieldbus	E-MAN-	RI-AEB	AEB user manual
GS520	IO-Link interface	E-MAN-	RI-AES	AES user manual

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Digital proportional reducing valves

piloted, without transducer



3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Туре	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format plug-in to		solenoid			DIN-rail	panel	
Tech table	ch table G010		GC)20	GC)30	GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





AEB E-A-BTH adapter mobile App AES PC software E-C-SB-USB/M12 cable E-A-SB-USB/OPT isolator

5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MvAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500 T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

7 IO-LINK - only for AEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

8 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007					
Ambient temperature range	A:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$ AEB, AES:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-40^{\circ}C \div +60^{\circ}C$					
Storage temperature range	A:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$ AEB, AES:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Vibration resistance	See technical table G004 (for AEB and AES)					
Ormaliana	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)					
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

Bluetooth or USB connection

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		AGRCZO-*-10	AGRCZO-*-20	
Max regulated pressure	[bar]	50; 100; 21	0; 315; 350	
Min regulated pressure (1)	[bar]	1; 3 (only	r for /350)	
Max pressure at port A or B	[bar]	35	50	
Max pressure at port Y	[bar]	pilot drain always external, to be direc	tly connected to tank at zero pressure	
Max flow	[l/min]	160	300	
Response time 0-100% step sig (depending on installation) (2)	nal [ms]	≤ 45	≤ 50	
Hysteresis		≤ 2,0 [% of max pressure]		
Linearity		≤ 3,0 [% of max pressure]		
Repeatability		≤ 2,0 [% of max pressure]		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure

(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	A = 30 W	A = 30 W AEB , AES = 50 W				
Coil voltage code	standa	ırd	option /6		option /18	
Max. solenoid current	2,6 A	λ	3,25 A		1,5 A	
Coil resistance R at 20°C	3 ÷ 3,3	3Ω	2 ÷ 2,2 Ω		13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 Current: range ±20	0 VDC (24 VMAX toler 0 mA	ant) Input imp Input imp	bedance: $Ri > 50 k$ bedance: $Ri = 500 k$	Ω Ω	
Monitor output	Output range:	voltage ±5 VDC @	max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (O	FF state), 15 ÷ 24 VDC	(ON state), 9 ÷ 15 VDC	(not accepted); Inpu	t impedance: Ri > 87 k Ω	
Fault output	Output range : $0 \div 24$ VDC (ON state \cong VL+ [logic power supply] ; OFF state \cong 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)					
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level					
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors					
Duty factor	Continuous rating (ED=100%)					
Tropicalization	Tropical coating on electronics PCB					
Additional characteristics	Short circuit protect protection against re	ion of solenoid's curr everse polarity of pov	ent supply; current co ver supply	ontrol by P.I.D. with ra	apid solenoid switching;	
Communication interfere	USB	IO-Link	CANopen	PROFIBUS DP	EtherCAT	
Communication interface	Atos ASCII coding	Specification 1.1.3	EN50325-4 + DS408	EN50170-2/IEC61158	B IEC 61158	
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX	
Recommended wiring cable	LiYCY shielded cables, see section 22					

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for A), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$				
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s				
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1638 class 7 s		see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	100 10000		
Flame resistant with water		NBR, NBR low temp.	HFC	100 12922		



14 HYDRAULIC OPTIONS

P = This option provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).

At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.

For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw () until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working
- **R** = This option provides a integral check valve for free reverse flow $A \rightarrow B$

① Check valve - cracking pressure = 0,5 bar

2 Plug





15 ELECTRONIC OPTIONS - only for AEB-NP and AES

- This option provides 4 ÷ 20 mA current reference, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 19.5 for signal specifications.
- Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal see 19.6
 Enable input signal see above option /Q
 Power supply for driver's logics and communication see 19.2

16 POSSIBLE COMBINED OPTIONS

for A: /PR

for AEB and AES: /IP, /IQ, /IR, /IZ, /PQ, /PR, /PZ, /QR, /RZ, /IPQ, /IPR, /IPZ, /IQR, /IRZ, /PQR, /PRZ, /IPQR, /IPRZ

Note: /T Bluetooth adapter option can be combined with all other options

17 COIL VOLTAGE OPTIONS - only for A

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

18 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



19 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB-NP and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For AEB-IL signals see section 20

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 19.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

19.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ Vbc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vbc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vbc.

19.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference). Monitor output signal is factory preset according to selected valve code, default settings is $0 \div 5 \text{ Vpc} (1V = 1A)$. Output signal can be reconfigured via software, within a maximum range of $\pm 5 \text{ Vpc}$.

19.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

19.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 Vbc, normal working corresponds to 24 Vbc. Fault status is not affected by the Enable input signal.

20 IO-LINK SIGNALS SPECIFICATIONS - only for AEB-IL

20.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W

Internal electrical isolation of power L+, L- from P24, N24

20.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

20.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

21 ELECTRONIC CONNECTIONS

21.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB-NP and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
Α	V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 VDc	Gnd - power supply
6	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 VDc) or disable (0 VDc) the driver, referred to V0	Input - on/off signal
D	D INPUT+		Reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	F MONITOR referred to: AGND V0		Monitor output signal: ±5 Vpc maximum range Default is 0 ÷ 5 Vpc (1V = 1A)	Output - analog signal Software selectable
G	G EARTH		Internally connected to driver housing	

21.2 Main connector signals - 12 pin A2 /Z option - for AEB-NP and AES

PIN	/Z	TECHNICAL SPECIFICATIONS NOTES		
1	V+	Power supply 24 Vbc	Input - power supply	
2	V0	Power supply 0 Vbc	Gnd - power supply	
3	ENABLE	Enable (24 VDc) or disable (0 VDc) the driver, referred to VL0	Input - on/off signal	
4	INPUT+	Reference input signal: ±10 Vpc / ±20 mA maximum range Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable	
5	INPUT-	Negative reference input signal for INPUT+ Input - an		
6	MONITOR Monitor output signal: ±5 Vpc maximum range, referred to VL0 O Default is 0 ÷ 5 Vpc (1V = 1A) S		Output - analog signal Software selectable	
7	NC	Do not connect		
8	NC	Do not connect		
9	VL+ Power supply 24 Vbc for driver's logic and communication Input - power sup		Input - power supply	
10	VL0 Power supply 0 Vbc for driver's logic and communication Gnd - power sup		Gnd - power supply	
11	FAULT	.T Fault (0 Vpc) or normal working (24 Vpc), referred to VL0 Output - on/off sign		
PE	EARTH	Internally connected to driver housing		

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

21.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B $\stackrel{}{(\ensuremath{\mathsf{A}})}$ only for AEB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vpc for IO-Link communication	
2	P24 Power supply 24 Vbc for valve regulation, logics and diagnostics Input - power s		Input - power supply
3	3 L- Power supply 0 Vpc for IO-Link communication Gnd -		Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vpc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

21.4 Communication connectors - for AEB $(\ensuremath{\mathsf{B}})$ and AES $(\ensuremath{\mathsf{B}})$ - $(\ensuremath{\mathsf{C}})$

B	B USB connector - M12 - 5 pin always present				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	+5V_USB	Power supply			
2	ID	Identification			
3	GND_USB	Signal zero data line			
4	D-	Data line -			
5	D+	Data line +			

C2	©2 BP fieldbus execution, connector - M12 - 5 pin (2)				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	+5V	Termination supply signal			
2	LINE-A	Bus line (high)			
3	DGND	Data line and termination signal zero			
4	LINE-B	Bus line (low)			
5	SHIELD				

(1) Shield connection on connector's housing is recommended

21.5 Solenoid connection - only for $\boldsymbol{\mathsf{A}}$

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

©1)	BC fieldbus execution, connector - M12 - 5 pin (2)					
PIN	SIGNAL TECHNICAL SPECIFICATION (1)					
1	CAN_SHLD	Shield				
2	NC	do not connect				
3	CAN_GND	Signal zero data line				
4	CAN_H	Bus line (high)				
5	CAN_L	Bus line (low)				

©3	C3 C4 EH fieldbus execution, connector - M12 - 4 pin (2)						
PIN	SIGNAL	SIGNAL TECHNICAL SPECIFICATION (1)					
1	TX+	Transmitter					
2	RX+	Receiver					
3	ТХ-	Transmitter					
4	RX-	RX- Receiver					
Housing	SHIELD						

(2) Only for AES execution



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

21.7 AEB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2)

(2) Pin layout always referred to driver's view

22 CONNECTORS CHARACTERISTICS - to be ordered separately

22.1 Main connectors - 7 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	A1) ZM-7P	A3 ZH-7P		
Туре	7pin female straight circular	7pin female straight circular		
Standard According to MIL-C-5015		According to MIL-C-5015		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG11	PG11		
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)		
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires		
Connection type	to solder	to solder		
Protection (EN 60529)	IP 67	IP 67		

22.2 Main connectors - 12 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS			
CODE	A2 ZM-12P	(A4) ZH-12P			
Туре	12pin female straight circular	12pin female straight circular			
Standard	DIN 43651	DIN 43651			
Material Metallic		Plastic reinforced with fiber glass			
Cable gland	PG13,5	PG16			
Recommended cable LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)		LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)			
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires			
Connection type to crimp		to crimp			
Protection (EN 60529)	IP 67	IP 67			

22.3 IO-Link connector - only for AEB-IL

CONNECTOR TYPE	IL IO-Link		
CODE	A ZM-5PF		
Туре	5pin female straight circular		
Standard	M12 coding A – IEC 61076-2-101		
Material	Metallic		
Cable gland	Pressure nut - cable diameter 6÷8 mm		
Recommended cable	5 x 0,75 mm² max 20 m		
Connection type	screw terminal		
Protection (EN 60529)	IP 67		

22.4 Fieldbus communication connectors - only for AES

CONNECTOR TYPE BC CANopen (1)		open (1)	BP PROFI	BUS DP (1)	EH EtherCAT (2)		
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E	
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular	
Standard	Standard M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101		
Material	Me	tallic	Metallic		Metallic		
Cable gland	Cable gland Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm		
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5		
Connection type	screw terminal		screw terminal		terminal block		
Protection (EN 60529)	IP67		IP 67		IP 67		

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\mathsf{GS500}}$

(2) Internally terminated

23 FASTENING BOLTS AND SEALS

	AGRCZO-*-10	AGRCZO-*-20
Q	Fastening bolts:	Fastening bolts:
H	4 socket head screws M10x45 class 12.9	4 socket head screws M10x45 class 12.9
	Tightening torque = 70 Nm	Tightening torque = 70 Nm
U		
	Seals:	Seals:
\frown	2 OR 3068	2 OR 4100
	Diameter of ports A, B: Ø 14 mm	Diameter of ports A, B: Ø 22 mm
$\mathbf{\circ}$	2 OR 109/70	2 OR 109/70
	Diameter of port X, Y: Ø 5 mm	Diameter of port X, Y: Ø 5 mm

SIZE 10

ISO 5781: 2000

Mounting surface: 5781-06-07-0-00 (see table P005)

	Mass [kg]					
	Α	AEB, AES	AES-EH			
AGRCZO-*-10	5,0	5,6	5,7			
Option /P		+0,5				



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(2)

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P

P

36.5

Film

Ρ

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36.5

50 (2)



50

(2)

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AGRCZO-AES-BC-10 AGRCZO-AES-BP-10

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Option /P

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standard and /R

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3 Π

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240

AGRCZO-A-10 standard and /R

1 = Air bleeding, see section 18

 $(\mathbf{2})$ = Space required for connection cable and for connector removal

(3) = The dimensions of connectors and Bluetooth adapter must be considered, see section 21.6, 21.7 and 21.8

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AGRCZO-AEB-NP-10 AGRCZO-AEB-IL-10

F

141

AGRCZO-AES-EH-10 standard and /R

standard and /R

3

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160

8

3

184

80

1

264

240





25 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric a	and electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting	surfaces for electrohydraulic valves
G010	E-MI-AC analog driver	QB200	Quicksta	rt for AEB valves commissioning
G020	E-MI-AS-IR digital driver	QF200	Quicksta	rt for AES valves commissioning
G030	E-BM-AS digital driver	E-MAN-	MI-AS	E-MI-AS-IR user manual (off-board)
GS050	E-BM-AES digital driver	E-MAN-	BM-AS	E-BM-AS user manual (off-board)
GS500	Programming tools	E-MAN-	BM-AES	E-BM-AES user manual (off-board)
GS510	Fieldbus	E-MAN-	RI-AEB	AEB user manual
GS520	IO-Link interface	E-MAN-	RI-AES	AES user manual

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Digital proportional pressure cartridges

piloted, without transducer - compensator, relief, reducing functions



(1) For possible combined options, see section 18



- 36 = for LICZO
- 37 = for LIRZO

6 = 6 bar for poppet 31 and 36 **7** = 7 bar for poppet 37 4 = 4 bar only for poppet 37 (only for size 16, 25, 32, 40)

4 TYPE OF POPPET

Type of poppet	31	36	37
Functional sketch (Hydraulic symbol)			
Typical section			
Area ratio A: Ap	1:1	1:1	1:1

5 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES	
Туре	Analog			Digital				
Voltage supply (VDC) 12 24		12	24	12	24	24		
Valve coil option	/6	std	/6	std	/6	std	std	
Format plug-in to		solenoid			DIN-rail panel			
Tech table	G010		G020		G030		GS050	

6 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

7 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

7.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





AEB E-A-BTH adapter mobile App AES PC software E-C-SB-USB/M12 cable E-A-SB-USB/OPT isolator

7.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

8 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500** T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

9 IO-LINK - only for AEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

10 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

11 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007					
Ambient temperature range	A:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$ AEB, AES:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-40^{\circ}C \div +60^{\circ}C$					
Storage temperature range	A:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$ AEB, AES:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Vibration resistance	See technical table G004 (for AEB and AES)					
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) p°1007/2006					
Compliance	REACH Regulation (EC) n°1907/2006					

Bluetooth or USB connection

12 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		LICZO				LIMZO						LIRZO				
valve size	1	2	3	4	5	1	2	3	4	5	6	8	1	2	3	4
Max flow [l/mi	n] 200	400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800
Min regulated pres. at port A [ba	r] 9	8,5	8	13	15	7	7	7	10,5	12	12	(2)		7	7	
Min regulated pres. at port A for /350 [ba	r] 11	10	10	13	16	10	10	9	12	13	13	16	6 12			
Max regulated pres. at port A [ba	r] 5	50; 100; 210; 315; 350				50; 100; 210; 315; 350					50; 100; 210; 315; 350					
Response time 0-100% step signal (depending on installation) (1) [m:	;]	100 ÷ 400					100 ÷ 450						100 ÷ 350			
Hysteresis [% of the regulated max flow	[% of the regulated max flow] ≤ 2			≤ 1,5						≤2						
Linearity [% of the regulated max flow	/]	≤3			≤3					≤ 3						
Repeatability [% of the regulated max flow	v]		≤2			≤2						≤2				

Note: above performance data refer to valves coupled with Atos electronic drivers, see section [5]

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response.

(2) Consult our techincal office.

13 ELECTRICAL CHARACTERISTICS

Power supplies	wer supplies Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	A = 30 W	AEB , AES = 50 V	1			
Coil voltage code	standa	rd	option /6			option /18
Max. solenoid current	2,6 A	\	3,25 A			1,5 A
Coil resistance R at 20°C	3 ÷ 3,3	Ω	$2 \div 2,2 \Omega$		-	13 ÷ 13,4 Ω
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX tolera) mA	ant) Input imp Input imp	edance: Ri edance: Ri	> 50 kΩ = 500 Ω	
Monitor output	Output range:	voltage ±5 VDC @	max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (O	FF state), 15 ÷ 24 VDC	(ON state), 9 ÷ 15 VDC	(not accepted	d); Input i	impedance: Ri > 87 k Ω
Fault output	Output range : 0 ÷ external negative vo	24 VDC (ON state ≅	VL+ [logic power su g. due to inductive lo	pply] ; OFF sta ads)	ate ≅ 0	V) @ max 50 mA;
Alarms	Solenoid not connec current control mon	cted/short circuit, cab itoring, power supplie	le break with current s level	reference sigr	inal, over	r/under temperature,
Insulation class	H (180°) Due to the the European stand	occurring surface ter ards ISO 13732-1 an	nperatures of the sole d EN982 must be tak	enoid coils, en into accour	nt	
Protection degree to DIN EN60529	A = IP65; AEB, AES	S = IP66 / IP67 with m	ating connectors			
Duty factor	Continuous rating (E	D=100%)				
Tropicalization	Tropical coating on	electronics PCB				
Additional characteristics	Short circuit protect protection against re	ion of solenoid's curre everse polarity of pov	ent supply; current co ver supply	ontrol by P.I.D.	. with rap	oid solenoid switching;
Communication interface	USB	IO-Link	CANopen	PROFIBUS DF	P	EtherCAT
	Atos ASCII coding	Specification 1.1.3	EN50325-4 + DS408	EN50170-2/IE0	C61158	IEC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulate RS485	ted	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cab	les, see section 24				

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

14 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	d temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+ $80^{\circ}C$ for A), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$					
Recommended viscosity		20 ÷ 100 mm²/s - max allowed r	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s				
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	638 class 7	see also filter section at			
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog				
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard			
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without wa	ater	FKM HFDU, HFDR		100 10000			
Flame resistant with water	r	NBR, NBR low temp.	HFC	100 12922			

15 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)



Flow [% of the max]

16 HYDRAULIC OPTIONS

P = This option (standard for size 1, 2 and 3) provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).

At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.

For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw () until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw (1) of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working



17 ELECTRONIC OPTIONS - only for AEB-NP and AES

- This option provides 4 ÷ 20 mA current reference, instead of the standard 0 ÷ 10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle see 21.5 for signal specifications.
- Z = This option provides, on the 12 pin main connector, the following additional features:
 Fault output signal see 21.6
 Enable input signal see above option /Q
 Power supply for driver's logics and communication see 21.2

18 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible Electronic options: /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

19 COIL VOLTAGE OPTIONS - only for A

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

20 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



21 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB-NP and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For AEB-IL signals see section 22

21.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 21.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

21.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active

the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

21.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ Vbc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vbc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vbc.

21.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference). Monitor output signal is factory preset according to selected valve code, default settings is $0 \div 5 \text{ Vpc} (1V = 1A)$. Output signal can be reconfigured via software, within a maximum range of $\pm 5 \text{ Vpc}$.

21.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

21.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 Vbc, normal working corresponds to 24 Vbc. Fault status is not affected by the Enable input signal.

22 IO-LINK SIGNALS SPECIFICATIONS - only for AEB-IL

22.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W

Internal electrical isolation of power L+, L- from P24, N24

22.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

22.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

23 ELECTRONIC CONNECTIONS

23.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB-NP and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
Α	A V+		Power supply 24 Vbc	Input - power supply
В	В V0		Power supply 0 Vbc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
0		ENABLE	Enable (24 VDc) or disable (0 VDc) the driver, referred to V0	Input - on/off signal
D	D INPUT+		Reference input signal: $\pm 10 \text{ Vpc} / \pm 20 \text{ mA}$ maximum range Defaults are 0 $\div 10 \text{ Vpc}$ for standard and 4 $\div 20 \text{ mA}$ for /I option	Input - analog signal Software selectable
Е	E INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	F MONITOR referred to: AGND V0		Monitor output signal: ±5 Vpc maximum range Default is 0 ÷ 5 Vpc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

23.2 Main connector signals - 12 pin A2 /Z option - for AEB-NP and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vbc	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: ±10 Vpc / ±20 mA maximum range Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR	Monitor output signal: ± 5 Vpc maximum range, referred to VL0 Default is 0 \div 5 Vpc (1V = 1A)	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vbc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vbc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

23.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for AEB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vpc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

23.4 Communication connectors - for AEB (B) and AES (B) - (C)

В	B USB connector - M12 - 5 pin always present				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	+5V_USB	Power supply			
2	ID	Identification			
3	GND_USB	Signal zero data line			
4	D-	Data line -			
5	D+	Data line +			

C2	BP field	bus execution, connector - M12 - 5 pin (2)
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(1) Shield connection on connector's housing is recommended

23.5 Solenoid connection - only for A

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

C1 BC fieldbus execution, connector - M12 - 5 pin (2)					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	CAN_SHLD	Shield			
2	NC	do not connect			
3	CAN_GND	Signal zero data line			
4	CAN_H	Bus line (high)			
5	CAN_L	Bus line (low)			

C3 (C3 C4 EH fieldbus execution, connector - M12 - 4 pin (2)					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)				
1	TX+	Transmitter				
2	RX+	Receiver				
3	TX-	Transmitter				
4	RX-	Receiver				
Housing	SHIELD					

(2) Only for AES execution



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

23.7 AEB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) P

(2) Pin layout always referred to driver's view

23.8 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

24 CONNECTORS CHARACTERISTICS - to be ordered separately

24.1 Main connectors - 7 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS			
CODE	A1) ZM-7P	A3 ZH-7P			
Туре	7pin female straight circular	7pin female straight circular			
Standard According to MIL-C-5015		According to MIL-C-5015			
Material	Metallic	Plastic reinforced with fiber glass			
Cable gland	PG11	PG11			
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)			
necommended cable	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)			
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires			
Connection type	to solder	to solder			
Protection (EN 60529)	IP 67	IP 67			

24.2 Main connectors - 12 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS			
CODE	A2 ZM-12P	A4 ZH-12P			
Туре	12pin female straight circular	12pin female straight circular			
Standard	DIN 43651	DIN 43651			
Material	Metallic	Plastic reinforced with fiber glass			
Cable gland	PG13,5	PG16			
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)			
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires			
Connection type	to crimp	to crimp			
Protection (EN 60529)	IP 67	IP 67			

24.3 IO-Link connector - only for AEB-IL

CONNECTOR TYPE	IL IO-Link				
CODE	A ZM-5PF				
Туре	5pin female straight circular				
Standard	M12 coding A – IEC 61076-2-101				
Material	Metallic				
Cable gland	Pressure nut - cable diameter 6÷8 mm				
Recommended cable	5 x 0,75 mm ² max 20 m				
Connection type	screw terminal				
Protection (EN 60529)	IP 67				

24.4 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFI	BUS DP (1)	EH EtherCAT (2)	
CODE	C1 ZM-5PF	©2 ZM-5PM	C1) ZM-5PF/BP	© ZM-5PM/BP	C1 C2	ZM-4PM/E
Tupo	5 pin female	5 pin male	5 pin female	5 pin male		4 pin male
туре	straight circular	straight circular	straight circular	straight circular		straight circular
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Me	tallic	Metallic			Metallic
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure i	nut - cable diameter 4÷8 mm
Cable	CANbus Stand	dard (DR 303-1)	PROFIBUS DP Standard		Eth	ernet standard CAT-5
Connection type	screw	terminal	screw terminal			terminal block
Protection (EN 60529)	IF	267	IP 67			IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\mathsf{GS500}}$

(2) Internally terminated

Туре Size **Fastening bolts** Seals 4 socket head screws M8x45 class 12.9 2 OR 108 **1** = 16 Tightening torque = 35 Nm 4 socket head screws M12x45 class 12.9 2 OR 108 LIMZO **2** = 25 Tightening torque = 125 Nm LICZO 4 socket head screws M16x55 class 12.9 LIRZO **3** = 32 2 OR 2043 Tightening torque = 300 Nm 4 socket head screws M20x70 class 12.9 2 OR 3043 **4** = 40 Tightening torque = 600 Nm LIMZO 4 socket head screws M20x80 class 12.9 2 OR 3043 **5** = 50 Tightening torque = 600 Nm LICZO 4 socket head screws M30x90 class 12.9 Tightening torque = 2100 Nm **6** = 63 2 OR 3050 LIMZO 8 socket head screws M24x90 class 12.9 Tightening torque = 1000 Nm 2 OR 4075 **8** = 80

25 FASTENING BOLTS AND SEALS

26 COVERS DIMENSIONS [mm]

Size	AxA	ØB	С	D	Port Pp - Dr			
1 = 16	65x80	3	4	40	-			
2 = 25	85x85	5	6	40	-			
3 = 32	100x100	5	6	50	-			
4 = 40	125x125	5	6	60	G 1/4"			
5 = 50	140x140	6	4	70	G 1/4"	3.5 AxA 3.5		
6 = 63	180x180	6	4	80	G 3/8"	Notes: size 1 cover is not squared but retangular, dimensions 65x80		
8 = 80	ø250	8	6	80	G 3/8"	size 8 cover is not squared but circular, dimension ø250		

27 INSTALLATION DIMENSIONS [mm]



Mass [kg]					
	Cartridge				
Size	Standard	Option /P	SC LI		
1 = 16	3,3	-	0,2		
2 = 25	4,0	-	0,5		
3 = 32	5,3	-	0,9		
4 = 40	10,7	11,7	1,7		
5 = 50	14,2	15,2	2,9		
6 = 63	23,7	24,7	6,7		
8 = 80	32,3	33,3	13,1		

LICZO-A-4/P LICZO-A-5/P

LIMZO-A-4/P LIRZO-A-4/P LIMZO-A-5/P



LIMZO-A-8/P



Note: for mounting surface and cavity dimensions, see tech. table P006



Note: for mounting surface and cavity dimensions, see tech. table P006



Note: for mounting surface and cavity dimensions, see tech. table P006

28 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric a	nd electronic connectors
FS900	Operating and maintenance information for proportional valves	P006	Mounting	surfaces and cavities for cartridge valves
G010	E-MI-AC analog driver	QB220	Quickstar	rt for AEB valves commissioning
G020	E-MI-AS-IR digital driver	QF220	Quickstar	rt for AES valves commissioning
G030	E-BM-AS digital driver	E-MAN-	MI-AS	E-MI-AS-IR user manual (off-board)
GS050	E-BM-AES digital driver	E-MAN-	BM-AS	E-BM-AS user manual (off-board)
GS500	Programming tools	E-MAN-	BM-AES	E-BM-AES user manual (off-board)
GS510	Fieldbus	E-MAN-	RI-AEB	AEB user manual
GS520	IO-Link interface	E-MAN-	RI-AES	AES user manual

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Digital proportional reducing valves

3-way, direct, without transducer



Hydraulic symbols are represented with on-board digital driver
3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-	E-MI-AS-IR E-BM-AS-		AS-PS	E-BM-AES
Туре	Analog			Digital			
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format		plug-in to	solenoid		DIN-rail panel		panel
Tech table G010		GC)20	GC)30	GS050	

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





AEB E-A-BTH adapter mobile App Methods AES PC software E-C-SB-USB/M12 cable E-A-SB-USB/OPT isolator

5.2 E-SW PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500** T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

7 IO-LINK - only for AEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

8 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007				
Ambient temperature range	A: Standard = -20° C ÷ $+70^{\circ}$ C /PE option = -20° C ÷ $+70^{\circ}$ C /BT option = -40° C ÷ $+60^{\circ}$ C /BE option = -20° C ÷ $+60^{\circ}$ C /PE option = -20° C ÷ $+60^{\circ}$ C /BT option = -40° C ÷ $+60^{\circ}$ C				
Storage temperature range	A:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$ AEB, AES:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004 (for AEB and AES)				
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

Bluetooth or USB connection

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DHRZO	
Max regulated pressure	[bar]	25	
Max pressure at port P	[bar]	350	
Max pressure at port T	[bar]	210	
Min regulated pressure (1)	[bar]	3	
Max flow	[l/min]	24	
Response time 0-100% step signal (depending on installation) (2) [ms]		≤ 45	
Hysteresis		≤ 1,5 [% of max pressure]	
Linearity		≤ 3,0 [% of max pressure]	
Repeatability		\leq 2,0 [% of max pressure]	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure

(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal	: +24 VDC				
	Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	A = 30 W	A = 30 W AEB , AES = 50 W				
Coil voltage code	standa	ırd	option /6		option /18	
Max. solenoid current	2,2 A	\	2,75 A		1 A	
Coil resistance R at 20°C	3 ÷ 3,3	Ω	2 ÷ 2,2 Ω		13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX toler) mA	ant) Input imp Input imp	bedance: $Ri > 50 k$	2	
Monitor output	Output range:	voltage ±5 VDC @) max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OI	FF state), 15 ÷ 24 VDC	(ON state), 9 ÷ 15 VDC	(not accepted); Input	impedance: Ri > 87 k Ω	
Fault output	Output range : $0 \div 24$ VDC (ON state \cong VL+ [logic power supply]; OFF state \cong 0 V) @ max 50 mA;					
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temp current control monitoring, power supplies level			er/under temperature,		
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	A = IP65; AEB, AES	S = IP66 / IP67 with n	nating connectors			
Duty factor	Continuous rating (E	D=100%)				
Tropicalization	Tropical coating on	electronics PCB				
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching protection against reverse polarity of power supply			pid solenoid switching;		
	USB	IO-Link	CANopen	PROFIBUS DP	EtherCAT	
Communication interface	Atos ASCII coding	Interface and System Specification 1.1.3	EN50325-4 + DS408	EN50170-2/IEC61158	IEC 61158	
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX	
Recommended wiring cable	LiYCY shielded cab	les, see section 21	1	1	1	

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

12 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for A), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$				
Recommended viscosity		20 ÷ 100 mm²/s - max allowed r	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	638 class 7	see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	100 10000		
Flame resistant with water		NBR, NBR low temp.	HFC	150 12922		



14 HYDRAULIC OPTIONS

For configuration 010:

B = reduced pressure on port B, solenoid at side of port A

For configuration 012:

B = solenoid with on-board digital driver at side of port A (only for AEB and AES version)

15 ELECTRONIC OPTIONS - only for AEB-NP and AES

This option provides 4 ÷ 20 mA current reference, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 18.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 18.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 18.2

16 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible Electronic options: /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

17 COIL VOLTAGE OPTIONS - only for A

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB-NP and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For AEB-IL signals see section 18

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are ± 10 V_{DC} for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{DC} or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ V_{DC}.

18.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference). Monitor output signal is factory preset according to selected valve code, default settings is ± 5 Vpc (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of ± 5 Vpc.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 Vpc, normal working corresponds to 24 Vpc. Fault status is not affected by the Enable input signal.

19 IO-LINK SIGNALS SPECIFICATIONS - only for AEB-IL

19.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDc power supply for IO-Link communication. Maximum power consumption: 2 W

Internal electrical isolation of power L+, L- from P24, N24

19.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

19.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 7 pin (A) Standard and /Q option - for AEB-NP and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
Α	A V+		Power supply 24 Vbc	Input - power supply
В	V0		Power supply 0 VDc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
C	ENABLE		Enable (24 Vbc) or disable (0 Vbc) the driver, referred to V0	Input - on/off signal
D	D INPUT+		Reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
E	E INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	F MONITOR referred to: AGND V0		Monitor output signal: ± 5 Vpc maximum range Default is ± 5 Vpc (1V = 1A)	Output - analog signal Software selectable
G	G EARTH		Internally connected to driver housing	

20.2 Main connector signals - 12 pin A2 /Z option - for AEB-NP and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vbc	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: $\pm 10 \text{ Vpc} / \pm 20 \text{ mA}$ maximum range Defaults are $\pm 10 \text{ Vpc}$ for standard and $4 \div 20 \text{ mA}$ for /l option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+ Input - an	
6	MONITOR	Monitor output signal: ± 5 Vpc maximum range, referred to VL0 Default is ± 5 Vpc (1V = 1A)	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vpc for driver's logic and communication Input - power su	
10	VL0	Power supply 0 Vbc for driver's logic and communication Gnd - power su	
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0 Output - on/off sig	
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for AEB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vbc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vbc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vbc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vpc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

20.4 Communication connectors - for AEB (B) and AES (B) - (C)

В	B USB connector - M12 - 5 pin always present				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	+5V_USB	Power supply			
2	ID	Identification			
3	GND_USB	Signal zero data line			
4	D-	Data line -			
5	D+	Data line +			

C2	BP fieldbus execution, connector - M12 - 5 pin (2)				
PIN	SIGNAL	SIGNAL TECHNICAL SPECIFICATION (1)			
1	+5V	Termination supply signal			
2	LINE-A	Bus line (high)			
3	DGND	Data line and termination signal zero			
4	LINE-B	Bus line (low)			
5	SHIELD				

(1) Shield connection on connector's housing is recommended

20.5 Solenoid connection - only for A

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

©1)	C1 BC fieldbus execution, connector - M12 - 5 pin (2)				
PIN	SIGNAL TECHNICAL SPECIFICATION (1)				
1	CAN_SHLD	Shield			
2	NC	do not connect			
3	CAN_GND Signal zero data line				
4	CAN_H	Bus line (high)			
5	CAN_L	Bus line (low)			

©3	C3 C4 EH fieldbus execution, connector - M12 - 4 pin (2)					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)				
1	TX+	Transmitter				
2	RX+	Receiver				
3	TX-	Transmitter				
4	RX-	Receiver				
Housing	SHIELD					

(2) Only for AES execution



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

20.7 AEB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) P

(2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2)

(2) Pin layout always referred to driver's view

21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin - for AEB-NP and AES

CONNECTOR TYPE POWER SUPPLY AND SIGNALS		POWER SUPPLY AND SIGNALS		
CODE	A1) ZM-7P	A3 ZH-7P		
Туре	7pin female straight circular	7pin female straight circular		
Standard According to MIL-C-5015 According to MIL-C-5		According to MIL-C-5015		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG11	PG11		
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)		
necommended cable	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)		
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires		
Connection type	to solder	to solder		
Protection (EN 60529)	IP 67	IP 67		

21.2 Main connectors - 12 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	A2 ZM-12P	A4 ZH-12P		
Туре	12pin female straight circular	12pin female straight circular		
Standard	DIN 43651	DIN 43651		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG13,5	PG16		
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)		
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires		
Connection type	to crimp	to crimp		
Protection (EN 60529)	IP 67	IP 67		

21.3 IO-Link connector - only for AEB-IL

CONNECTOR TYPE	IL IO-Link		
CODE	A ZM-5PF		
Туре	5pin female straight circular		
Standard	M12 coding A – IEC 61076-2-101		
Material	Metallic		
Cable gland	Pressure nut - cable diameter 6÷8 mm		
Recommended cable	5 x 0,75 mm² max 20 m		
Connection type	screw terminal		
Protection (EN 60529)	IP 67		

21.4 Fieldbus communication connectors - only for AES

CONNECTOR TYPE B		open (1)	BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	C1 ZM-5PF	C2 ZM-5PM	C1) ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B – IEC 61076-2-101		M12 co	ding D – IEC 61076-2-101
Material	Me	tallic	Metallic			Metallic
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure r	nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethe	ernet standard CAT-5
Connection type	screw terminal		screw terminal			terminal block
Protection (EN 60529)	IF	267	IP 67			IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\text{GS500}}$

(2) Internally terminated

22 FASTENING BOLTS AND SEALS

	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
0	Seals: 4 OR 108 Diameter of ports P, A, T: Ø 7,5 mm



24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric a	nd electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting	surfaces for electrohydraulic valves
G010	E-MI-AC analog driver	QB240	Quickstar	t for AEB valves commissioning
G020	E-MI-AS-IR digital driver	QF240	Quickstar	t for AES valves commissioning
G030	E-BM-AS digital driver	E-MAN-	MI-AS	E-MI-AS-IR user manual (off-board)
GS050	E-BM-AES digital driver	E-MAN-	BM-AS	E-BM-AS user manual (off-board)
GS500	Programming tools	E-MAN-	BM-AES	E-BM-AES user manual (off-board)
GS510	Fieldbus	E-MAN-	RI-AEB	AEB user manual
GS520	IO-Link interface	E-MAN-	RI-AES	AES user manual

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Proportional reducing valves

3-way, direct, without transducer





3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-MI-A	AC-01F	E-MI-AS-IR		E-BM-AS-PS		E-BM-AES	
Туре	Analog				Digital			
Voltage supply (VDC)	12	24	12	24	12	24	24	
Valve coil option	/6	std	/6	std	/6	std	std	
Format	plug-in to		o solenoid		DIN-rail panel		panel	
Tech table	GC)10	G020		G030		GS050	

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevent components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	150 years, see technical table P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$	/PE option = $-20^{\circ}C \div +70^{\circ}C$	/BT option = $-40^{\circ}C \div +60^{\circ}C$		
Storage temperature range	Standard = $-20^{\circ}C \div +80^{\circ}C$	/PE option = $-20^{\circ}C \div +80^{\circ}C$	/BT option = $-40^{\circ}C \div +70^{\circ}C$		
Surface protection	Zinc coating with black passivation				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)				
Conformity	RoHS Directive 2011/65/EU as last update by 2015/863/EU				
	REACH Regulation (EC) n°1907/2006				

6 HYDRAULIC CHARACTERISTICS

Valve model		DHRZE
Max regulated pres	ssure (Q=1 l/min) [bar]	25
Min. regulated pres	ssure (Q=1 I/min) (1) [bar]	3
Max. pressure at p	ort P [bar]	315
Max. pressure at p	ort T [bar]	210
Max. flow	[l/min]	24
Response time 0-100% step signal (2) [ms] (depending on installation)		≤ 45
Hysteresis	[% of the max pressure]	≤ 1,5
Linearity	[% of the max pressure]	≤ 3,0
Repeatability	[% of the max pressure]	≤ 2,0

Notes: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure

(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)				
Coil voltage code	standard	option /6	option /18		
Max. solenoid current	2,5 A	3 A	1,2 A		
Coil resistance R at 20°C	3,1 Ω	2,1 Ω	13,1 Ω		
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account				
Protection degree to DIN EN60529	IP65 with mating connectors				
Duty factor	Continuous rating (ED=100%)				
Certification	cURus North American Standard				

8 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$				
Recommended viscosity	20÷100 mm²/s - max allowed ran	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, in line filters of 10 μm (β10 ≥75 recommended)				
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard		
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water	FKM	HFDU, HFDR	100 10000		
Flame resistant with water	NBR, HNBR	HFC	150 12922		

9 DIAGRAMS based on mineral oil ISO VG 46 at 50°C

1 = Regulation diagrams

with flow rate Q = 1 l/min

- **Note:** the presence of counter pressure at port T can affect the effective pressure regulation
- 2 = Pressure/flow diagrams reference signal set at Q = 1 l/min





10 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

11 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



12 COILS WITH SPECIAL CONNECTORS



13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

14 FASTENING BOLTS AND SEALS FOR DHRZE



15 INSTALLATION DIMENSIONS FOR DHRZE [mm]



16 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS050	E-BM-AES digital driver
FS900	Operating and maintenance information for proportional valves	GS500	Programming tools
G010	E-MI-AC analog driver	K800	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	P005	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver		

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Digital proportional flow valves

direct, pressure compensated, with on-board driver and LVDT transducer



(1) Possible combined options: /FI, /IQ, /IZ (/T Bluetooth adapter option can be combined with all other options)

2 HYDRAULIC SYMBOLS





2 way connection

3 way connection

The valves can be used in 2 or 3 way connection, depending to the application requirements.

In 2 way the P port must not be connected (blocked)

In **3 way** the P port has to be connected to tank or to other user lines The port T must be always not connected (blocked)

For application examples of 2 and 3 way connections, see section 14

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table FS900 and in the user manuals included in the E-SW-SETUP programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

built-in Bluetooth. It does not support valves with p/Q control or axis controls.

4.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows guick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with

App Store



4.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

Bluetooth or USB connection



5 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth® connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.



WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500

T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

6 SMART TUNING

Smart tuning allows to adjust the valve dynamic response in order to match different performance requirements.

The valve is provided with 3 factory settings for the spool control:

- dynamic fast response time and high sensitivity for best dynamic performances. Default factory setting for directional valves
- balanced average response time and sensitivity suitable for major applications

attenuated response time and sensitivity to improve control stability in critical applications or in environments with electrical disturbances - smooth

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter. For details consult related manuals E-MAN-RI-* and Quickstart, see section 24.

7 IO-LINK - only for TEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

8 FIELDBUS - only for TES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Vibration resistance	See technical table G004
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	QVHZO				QVKZOR			
Max regulated flow	[l/min]	3,5	12	18	35	45	65	90
Min regulated flow	[cm³/min]	15	20	30	50	60	85	100
Regulating ∆p [bar]		4 - 6 10 - 12			15	6 - 8	10 - 12	
Max flow on port A [l/min]		50				60	70	100
Max pressure [bar]		210				2.	10	
Response time 0÷100% step	p signal [ms]	25				3	5	
Hysteresis [% of the regulated max flow]		0,5			0	,5		
Linearity [% of the regulated max flow]		0,5				0,5		
Repeatability [% of the regulated max flow]		0,1			0	,1		
Thermal drift		zero point displacement < 1% at $\Delta T = 40^{\circ}C$						

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal: +24 VDCRectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)				
Max power consumption	50 W	50 W			
Max. solenoid current	QVHZO = 2,6 A	QVKZOR =	3 A		
Coil resistance R at 20°C	QVHZO = 3 ÷ 3,3 W	QVKZOR =	3,8 ÷ 4,1 W		
Analog input signals	Voltage: range ±10 Current: range ±20) VDC (24 VMAX toler) mA	ant) Input imp Input imp	bedance: $Ri > 50 k\Omega$ bedance: $Ri = 500 \Omega$	2
Monitor outputs	Output range:	voltage ±10 VDC current ±20 mA @	@ max 5 mA @ max 500 Ω load res	sistance	
Enable input	Range: 0 ÷ 5 VDC (O	FF state), 9 ÷ 24 VDC	(ON state), 5 ÷ 9 VDC	(not accepted); Input i	mpedance: Ri > 10 k Ω
Fault output	Output range: 0 ÷ 2 external negative vo	24 VDC (ON state > [oltage not allowed (e.	power supply - 2 V] ; g. due to inductive lo	OFF state < 1 V) @ n ads)	nax 50 mA;
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100	mA (E-ATR-8 see tec	h table GS465)		
Alarms	Solenoid not conne valve spool transdu	cted/short circuit, ca cer malfunctions, ala	ble break with current ms history storage fu	nt reference signal, o Inction	ver/under temperature,
Insulation class	H (180°) Due to the the European stand	occurring surface ter ards ISO 13732-1 an	nperatures of the sole d EN982 must be tak	enoid coils, en into account	
Protection degree to DIN EN60529	IP66 / IP67 with mat	ing connectors			
Duty factor	Continuous rating (E	D=100%)			
Tropicalization	Tropical coating on	electronics PCB			
Additional characteristics	Short circuit protect control by P.I.D. with	ion of solenoid's curr h rapid solenoid swite	ent supply; 3 leds for ching; protection aga	diagnostic (only for T inst reverse polarity of	ES); spool position f power supply
Communication interface	USB Atos ASCII coding	IO-Link Interface and System Specification 1.1.3	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT POWERLINK EtherNet/IP PROFINET IO RT/IRT IEC 61158
Communication physical layer	not insulated USB 2.0+USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cab	les, see section 21			

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

12 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$			
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at	
contamination level	longer life	ISO4406 class 16/14/11 NAS1	638 class 5	www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	HFDU, HFDR	100 10000	
Flame resistant with water		NBR, NBR low temp.	HFC	100 12922	



14 APPLICATIONS AND CONNECTIONS



2 way connection

The 2 way connection is normally used to control the flow in one part of the hydraulic circuit or to regulate the speed of a specific actuator. The metered flow in the controlled line is kept constant, independently to the load variations If the valve is directly installed on the pump main line, the exceeding flow is returned to tank though the pressure relief valve.

3 way connection

The 3 way connection is normally used when the valve directly controls the pump flow (main line) The metered flow in the controlled line is kept constant, independently to the load variations

The exceeding flow (not metered by the valve) it is returned to tank trough the valve P port = T line (3rd way)

Priority connection

The priority connection guarantees the pressure compensated flow supply to the primary circuit. The exceeding flow (not required by the primary circuit) is bypassed through the valve P port, to secondary circuit operating at lower pressure and not requiring compensated flow regulations.

15 ELECTRONIC OPTIONS - not available for TEB-SN-IL

- **F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. see 17.9 for signal specifications.
- I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDc.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option /F
Enable input signal - see above option /Q
Repeat enable output signal - only for TEB-SN-NP (see 17.6)
Power supply for driver's logics and communication - only for TES (see 17.2)

16 POSSIBLE COMBINED OPTIONS - not available for TEB-SN-IL

/FI, /IQ, /IZ

Note: /T Bluetooth adapter option can be combined with all other options

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For **TEB-SN-IL** signals see section 18

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for TES with /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ Vpc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vpc or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vpc.

17.4 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position). Monitor output signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDC for standard and $4 \div 20$ mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

17.5 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

17.6 Repeat enable output signal (R_ENABLE) - only for TEB-SN-NP with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 17.5).

17.7 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

18 IO-LINK SIGNALS SPECIFICATIONS - only for TEB-SN-IL

18.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

18.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDc power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

18.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

19 ELECTRONIC CONNECTIONS AND LEDS

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
Α	V+			Power supply 24 Vbc	Input - power supply
В	V0			Power supply 0 VDC	Gnd - power supply
0	AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 Vpc) or disable (0 Vpc) the valve, referred to V0	Input - on/off signal
				Flow reference input signal: ±10 Vbc / ±20 mA maximum range	Input - analog signal
	Q_INPUT+			Defaults are 0 ÷ 10 Vpc for standard and 4 ÷ 20 mA for /I option	Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
	Q_MONITO	R referred to:		Flow monitor output signal: ±10 Vbc / ±20 mA maximum range	Output - analog signal
F	AGND	VO		Defaults are 0 ÷ 10 Vbc for standard and 4 ÷ 20 mA for /I option	Software selectable
			FAULT	Fault (0 Vbc) or normal working (24 Vbc)	Output - on/off signal
G	EARTH		-	Internally connected to the driver housing	

19.1 Main connector signals - 7 pin - standard, /F and /Q options A

19.2 Main connector signal - 12 pin - /Z option (A2)

PIN	TEB-SN /Z	TES-SN /Z	TECHNICAL SPECIFICATIONS	NOTES
	V+		Power supply 24 VDC	Input - power supply
1	V0		Power supply 0 VDC	Gnd - power supply
2 3	ENABLE ref	erred to: VL0	Enable (24 Vbc) or disable (0 Vbc) the valve	Input - on/off signal
4			Flow reference input signal: ±10 Vbc / ±20 mA maximum range	Input - analog signal
4	Q_INPUT+		Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /l option	Software selectable
5	INPUT-		Negative reference input signal for Q_INPUT+	Input - analog signal
6	Q_MONITOR	referred to:	Flow monitor output signal: ±10 Vpc / ±20 mA maximum range	Input - analog signal
	AGND	VL0	Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /l option	Software selectable
7	AGND		Analog ground	Output - analog signal
		NC	Do not connect	Gnd - analog signal
Q	R_ENABLE		Repeat enable, output repeater signal of enable input, referred to V0	Output - on/off signal
		NC	Do not connect	
a	NC		Do not connect	
3		VL+	Power supply 24 Vpc for driver's logic and communication	Input - power supply
10	NC		Do not connect	
		VL0	Power supply 0 Vpc for driver's logic and communication	Gnd - power supply
11 PE	FAULT refer	red to: VL0	Fault (0 Vpc) or normal working (24 Vpc)	Output - on/off signal
	EARTH		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

19.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for TEB-SN-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vpc for IO-Link communication	
2	P24	P24 Power supply 24 Vbc for valve regulation, logics and diagnostics	
3	L- Power supply 0 Vbc for IO-Link communication		Gnd - power supply
4	C/Q IO-Link data line		Input / Output - signal
5	N24	Power supply 0 Vbc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

19.4 Communications connectors B - C

	B USB connector - M12 - 5 pin always present				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	+5V_USB	Power supply			
2	ID	Identification			
3	GND_USB	Signal zero data line			
4	D-	Data line -			
5	D+	Data line +			

©1 (©1 ©2 BP fieldbus execution, connector - M12 - 5 pin			
PIN	SIGNAL TECHNICAL SPECIFICATION (1)			
1	+5V	Termination supply signal		
2	LINE-A	Bus line (high)		
3	DGND	Data line and termination signal zero		
4	LINE-B	Bus line (low)		
5	SHIELD			

©1 (C1 $C2$ BC fieldbus execution, connector - M12 - 5 pin				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	CAN_SHLD	Shield			
2	not used	©1 - ©2 pass-through connection (2)			
3	CAN_GND	Signal zero data line			
4	CAN_H	Bus line (high)			
5	CAN_L	Bus line (low)			

©1 (© © EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin						
PIN	PIN SIGNAL TECHNICAL SPECIFICATION (1)						
1	TX+	Transmitter					
2	RX+	Receiver					
3	TX-	Transmitter					
4	RX-	Receiver					
	SHIELD						

(1) shield connection on connector's housing is recommended

(2) Pin 2 can be fed with external +5V supply of CAN interface



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

19.6 TEB-SN-IL connections layout



(1) Pin layout always referred to driver's view



19.8 Diagnostic LEDs - only for TES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1		VALVE STATUS	6	LINK/ACT				
L2	NE	TWORK STAT	US	NETWORK STATUS				
L3	SC	LENOID STAT	US		LINK/ACT			

20 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**). For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin

CONNECTOR TYPE POWER SUPPLY AND SIGNALS		POWER SUPPLY AND SIGNALS		
CODE	A1 ZM-7P	A3 ZH-7P		
Туре	7pin female straight circular	7pin female straight circular		
Standard	According to MIL-C-5015	According to MIL-C-5015		
Material Metallic		Plastic reinforced with fiber glass		
Cable gland	PG11	PG11		
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)		
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires		
Connection type to solder		to solder		
Protection (EN 60529)	IP 67	IP 67		

21.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A2 ZM-12P	(A4) ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

21.3 IO-Link connector - only for TEB-SN-IL

CONNECTOR TYPE	IL IO-Link				
CODE	A ZM-5PF				
Туре	5pin female straight circular				
Standard	M12 coding A – IEC 61076-2-101				
Material	Metallic				
Cable gland	Pressure nut - cable diameter 6÷8 mm				
Recommended cable	5 x 0,75 mm² max 20 m				
Connection type	screw terminal				
Protection (EN 60529)	IP 67				

21.4 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)	
CODE	C1) ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B – IEC 61076-2-101		M12 co	ding D – IEC 61076-2-101
Material	Me	tallic	Metallic			Metallic
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure r	nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethe	ernet standard CAT-5
Connection type	screw terminal		screw terminal			terminal block
Protection (EN 60529)	IF	°67	IP 67			IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table GS500

(2) Internally terminated

22 FASTENING BOLTS AND SEALS

	QVHZO	QVKZOR
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
0	Seals: 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm (max)	Seals: 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm (max)

QVHZO-TEB, QVHZO-TES

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see tab. P005)





QVHZO	Α	B (1)	C (1)	D	Mass [kg]
TEB - SN - IL	140	60	-	-	
TEB - SN - NP	140	100	-	-	27
TES - SN - NP, BC, BP, EH	140	100	58	8	2,1
TES - SN - EW, EI, EP	155	100	58	8	

 (1) The indicated dimension refers to the longer connectors or Bluetooth adapter For dimensions of connectors and Bluetooth adapter, see sections 19.5, 19.6 and 19.7
(2) Space required for connection cable and for connector removal

QVKZOR-TEB, QVKZOR-TES

ISO 4401: 2005

Mounting surface: 4401-05-04-0-05 (see tab. P005)





QVKZOR	Α	B (1)	C (1)	D	Mass [kg]
TEB - SN - IL	150	60	-	-	
TEB - SN - NP	150	100	-	-	47
TES - SN - NP, BC, BP, EH	150	100	58	8	4,7
TES - SN - EW, EI, EP	165	100	58	8	

(1) The indicated dimension refers to the longer connectors or Bluetooth adapter

For dimensions of connectors and Bluetooth adapter, see sections 19.5, 19.6 and 19.7

(2) Space required for connection cable and for connector removal

24 RELATED DOCUMENTATION

FS001 FS900	Basics for digital electrohydraulics Operating and maintenance information for proportional valves	P005 QB300	Mounting Quickstar	surfaces for electrohydraulic valves
GS500	Programming tools	QF300	Quickstar	t for TES valves commissioning
GS510	Fieldbus	E-MAN-	RI-LEB	TEB/LEB user manual
GS520	IO-Link interface	E-MAN-	RI-LES	TES/LES user manual
K800	Electric and electronic connectors			

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Proportional flow valves

direct, pressure compensated, with LVDT transducer



2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TEB	E-BM-TES
Туре	digital	digital
Format	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	150 years, see technical table F	P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$					
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Surface protection	Zinc coating with black passivation					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		QVHZO					QVKZOR	
Max regulated flow	[l/min]	3,5	12	18	35	45	65	90
Min regulated flow	[cm³/min]	15	20	30	50	60	85	100
Regulating ∆p [bar]		4 - 6 10 - 12			- 12	15	6 - 8	10 - 12
Max flow on port A [l/min]			5	60	70	100		
Max pressure	[bar]	210					2.	10
Response time 0÷100% st	ep signal [ms]	25					3	5
Hysteresis [% of the re	egulated max flow]			0,5			0	,5
Linearity [% of the re	egulated max flow]	0,5					0,5	
Repeatability [% of the re	egulated max flow]	0,1				0	,1	
Thermal drift		zero point displacement < 1% at $\Delta T = 40^{\circ}C$						

6 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W	
Max. solenoid current	QVHZO = 2,6 A	QVKZOR = 3 A
Coil resistance R at 20°C	QVHZO = 3 ÷ 3,3 Ω	QVKZOR = $3,8 \div 4,1 \Omega$
Insulation class	H (180°) Due to the occuring the European standards ISC	g surface temperatures of the solenoid coils, D 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors	3
Duty factor	Continuous rating (ED=100%	6)

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20° C ÷ $+80^{\circ}$ C, with HFC hydraulic fluids = -20° C ÷ $+50^{\circ}$ C FKM seals (/PE option) = -20° C ÷ $+80^{\circ}$ C				
Recommended viscosity		$20 \div 100 \text{ mm}^2/\text{s} - \text{max}$ allowed range $15 \div 380 \text{ mm}^2/\text{s}$				
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	638 class 7	see also filter section at		
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog			
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	100 10000		
Flame resistant with water		NBR, HNBR	HFC	- 130 12922		





2 way connection

The 2 way connection is normally used to control the flow in one part of the hydraulic circuit or to regulate the speed of a specific actuator. The metered flow in the controlled line is kept constant, independently to the load variations. If the valve is directly installed on the pump main line, the exceeding flow is returned to tank though the pressure relief valve.

3 way connection

The 3 way connection is normally used when the valve directly controls the pump flow (main line) The metered flow in the controlled line is kept constant, independently to the load variations

The exceeding flow (not metered by the valve) it is returned to tank trough the valve P port = T line (3rd way)

Priority connection

The priority connection guarantees the pressure compensated flow supply to the primary circuit.

The exceeding flow (not required by the primary circuit) is bypassed through the valve P port, to secondary circuit operating at lower pressure and not requiring compensated flow regulations.

10 ELECTRICAL CONNECTION

10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	1 3
2	VT-	Power supply -15VDC	
3	VT+	Power supply +15VDC	
4	GND	Ground	4 2

11 FASTENING BOLTS AND SEALS

	QVHZO	QVKZOR		
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm		
U				
0	Seals: 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	Seals: 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)		

12 INSTALLATION DIMENSIONS [mm]



13 RELATED DOCUMENTATION

FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
GS230	E-BM-TEB digital driver	K800	Electric and electronic connectors
GS240	E-BM-TES digital driver	P005	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		

14 FASTENING BOLTS AND SEALS FOR RZGE



15 INSTALLATION DIMENSIONS FOR RZGE [mm]





17 RELATED DOCUMENTATION

FS001 FS900 G010 G020 G030	Basics for digital electrohydraulics Operating and maintenance information for proportional valves E-MI-AC analog driver E-MI-AS-IR digital driver E-BM-AS digital driver	GS050 GS500 K800 P005	E-BM-AES digital driver Programming tools Electric and electronic connectors Mounting surfaces for electrohydraulic valves	
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Digital proportional flow valves

direct, pressure compensated, without transducer



In **2 way** the P port must not be connected (blocked) In **3 way** the P port has to be connected to tank or to other user lines The port T must be always not connected (blocked) For application examples of 2 and 3 way connections, see section **14**

Note: hydraulic symbols are rapresented with on-board digital driver

2 way connection

3 way connection

3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-A	AC-01F	E-MI-	AS-IR	E-BM-AS-PS		E-BM-AES	
Туре	Ana	alog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24	
Valve coil option	/6	std	/6	std	/6	std	std	
Format		plug-in to	solenoid		DIN-rail panel			
Tech table	GC)10	GC)20	GC	GS050		

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





AEB E-A-BTH adapter mobile App AES PC software E-C-SB-USB/M12 cable E-A-SB-USB/OPT isolator

Bluetooth or USB connection

5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

6 BLUETOOTH OPTION - see tech. table GS500

T option adds Bluetooth[®] connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.

Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500** T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

7 IO-LINK - only for AEB, see tech. table GS520

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

8 FIELDBUS - only for AES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra \leq 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature range	A:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$ AEB, AES:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Vibration resistance	See technical table G004 (for AEB and AES)
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model			QVHZO				QVKZOR	
Max regulated flow	[l/min]	3,5	12	18	35	45	65	90
Min regulated flow	[cm³/min]	15	20	30	50	60	85	100
Regulating ∆p	[bar]	4 - 6 1		10 -	- 12	15	6 - 8	10 - 12
Max flow on port A	[l/min]	40			50	55	70	100
Max pressure	[bar]				210			
Response time 0-100% ste	ep signal [ms]	≤ 30 ≤ 45					45	
Hysteresis				≤5 [% of	the regulated	max flow]		
Linearity		≤ 3 [% of the regulated max flow]						
Repeatability				≤ 1 [% of	the regulated	max flow]		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal: +24 VDCRectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)						
Max power consumption			QVKZOR				
	A = 30 W AEB , AES		= 50 W	A = 35 W		AEB , AES = 50 W	
Coil voltage code	standard	option /6	option /18 s	tandard	option /	6 option /18	
Max. solenoid current	2,2 A	2,75 A	1,2 A	2,6 A	3,25 A	1,2 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	3 ÷ 13,4 Ω 3,	3 ÷ 4,1 Ω	2,2 ÷ 2,4	4Ω 12 ÷ 12,5 Ω	
Analog input signals	Voltage: range ±1 Current: range ±2	0 VDC (24 VMAX tole 0 mA	rant) Input Input	mpedance: mpedance:	Ri > 50 kΩ Ri = 500 Ω	2	
Monitor output	Output range:	voltage ±5 VDC	@ max 5 mA				
Enable input	Range: 0 ÷ 9 VDC (O	FF state), 15 ÷ 24 Vd	C (ON state), 9 ÷ 15	/DC (not acc	epted); Input	impedance: Ri > 87 k	
Fault output	Output range : 0 ÷ external negative vo	24 VDC (ON state oltage not allowed (e	≤ VL+ [logic power e.g. due to inductive	supply] ; OF loads)	F state ≅ 0	V) @ max 50 mA;	
Pressure transducer power supply (only for /W option)	+24VDC @ max 100	mA (E-ATR-8 see te	ch table GS465)				
Alarms	Solenoid not conne current control mon	cted/short circuit, ca itoring, power supp	ble break with curr ies level, pressure	ent reference ransducer fa	e signal, ove ailure (/W op	r/under temperature, tion)	
Insulation class	H (180°) Due to the the European stand	occurring surface t ards ISO 13732-1 a	emperatures of the nd EN982 must be	solenoid coil aken into ac	s, count		
Protection degree to DIN EN60529	A = IP65; AEB, AE	S = IP66 / IP67 with	mating connectors				
Duty factor	Continuous rating (E	D=100%)					
Tropicalization	Tropical coating on	electronics PCB					
Additional characteristics	Short circuit protect protection against r	ion of solenoid's cu everse polarity of po	rent supply; curren wer supply	control by F	P.I.D. with ra	pid solenoid switching	
Communication interface	USB	IO-Link Interface and System	CANopen	PROFIBU	IS DP	EtherCAT	
	Atos ASCII coding	Specification 1.1.3	EN50325-4 + DS2	08 EN50170	-2/IEC61158	IEC 61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	SDCI class port B	optical insulated CAN ISO11898	optical in RS485	sulated	Fast Ethernet, insulate 100 Base TX	
Recommended wiring cable	LiYCY shielded cab	les, see section 22					

Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

12 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ (+80°C for A), with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1	638 class 7	see also filter section at
contamination level	longer life	ISO4406 class 16/14/11 NAS1	04406 class 16/14/11 NAS1638 class 5 www.atos.com	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	100 10000
Flame resistant with water		NBR, NBR low temp.	HFC	100 12922





2 way connection

The 2 way connection is normally used to control the flow in one part of the hydraulic circuit or to regulate the speed of a specific actuator. The metered flow in the controlled line is kept constant, independently to the load variations.

If the valve is directly installed on the pump main line, the exceeding flow is returned to tank though the pressure relief valve.

3 way connection

The 3 way connection is normally used when the valve directly controls the pump flow (main line).

The metered flow in the controlled line is kept constant, independently to the load variations.

The exceeding flow (not metered by the valve) it is returned to tank trough the valve P port = T line (3rd way).

Priority connection

The priority connection guarantees the pressure compensated flow supply to the primary circuit. The exceeding flow (not required by the primary circuit) is bypassed through the valve P port, to secondary circuit operating at lower pressure and not requiring compensated flow regulations.

15 HYDRAULIC OPTIONS

 ${\bf D}$ = This option provides a quick venting of the use port B when the valve is closed or de-energized.

The valve must be connected in 3 way, with P port connected to tank. When the proportional throttle is fully closed, the valve's port B is internally connected to port P (tank), permitting a quickly decompression of the pressure in the use line.

In the diagram aside are represented the venting times of **QVHZO** and **QVKZOR** with option /D respect to standard versions:

- 1 = standard version
- $\mathbf{2} = \text{option} / D$

Hand lever option - only for QVHZO-A

= Manual micrometric adjustment

NV = As option /N plus handwheel

It allows to operate the valve in absence of electrical power supply. For detailed description of QVHZO-A with hand lever option see tech. table **E138**.

- MO = Horizontal hand lever
- **MV** = Vertical hand lever

Ν





2,5



16 ELECTRONIC OPTIONS - only for AEB and AES

standard solenoid manual override, see tech. table TK150

I = This option provides 4 ÷ 20 mA current reference, instead of the standard 0 ÷ 10 VDC.

The following supplementary options allow to operate QVHZO-A and QVKZOR-A in

absence of electrical power supply by means of a micrometric screw replacing the

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage. Note: **/I** option not available for **AEB-IL**

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 19.5 for signal specifications.

Note: /Q option not available for AEB-IL

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 19.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 19.2
Note: /Z option not available for AEB-IL

C = Only in combination with option /W This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

W = Only for valves coupled with pressure compensator, see tech table D150.

It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR. When the actual requested by draulic power $P_{\rm eff} = P_{\rm eff} (T_{\rm eff}) + P_{\rm eff} (T_{\rm eff}$

When the actual requested hydraulic power pxQ (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:



Notes: for **AEB-IL** the drive receives the flow reference signal directly by IO-Link interface for **AES** the drive can receive the flow reference signal directly by fieldbus interface

17 POSSIBLE COMBINED OPTIONS

For **AEB-NP** and **AES**

Hydraulic options: all combination possible Electronic options: /IQ, /IZ, /IW, /CW, /CWI For AEB-IL Hydraulic options: all combination possible Electronic options: /CW

Note: /T Bluetooth adapter option can be combined with all other options

18 COIL VOLTAGE OPTIONS - only for A

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.





19 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For AEB-IL see section 2 for IO-Link signals specifications and see 16.7 for pressure trasducer signal for /W option.

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 19.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z and /W options

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

19.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ Vbc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vbc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vbc.

19.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, default settings is 0 ÷ 5 Vbc (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of ±5 Vbc.

Option /W

The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure. The output maximum range is ± 5 Vpc; default setting is $0 \div 5$ Vpc.

19.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vbc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

19.6 Fault output signal (FAULT) - only for /Z and /W options

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 Vpc, normal working corresponds to 24 Vpc. Fault status is not affected by the Enable input signal.

19.7 Remote pressure transducer input signal (TR) - only for /W option

Analog pressure transducers can be directly connected to the driver (see 18.5). Analog input signal is factory preset according to selected driver code, defaults are $0 \div 10$ V_{DC} for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V_{DC} or ± 20 mA. Note: transducer feedback can be read as a digital information through fieldbus and IO-Link communication - software selectable.

20 IO-LINK SIGNALS SPECIFICATIONS - only for AEB-IL

20.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDc power supply for IO-Link communication. Maximum power consumption: 2 W Internal electrical isolation of power L+, L- from P24, N24

20.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics. Maximum power consumption: 50 W Internal electrical isolation of power P24, N24 from L+, L-

20.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

21 ELECTRONIC CONNECTIONS

21.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB-NP and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
Α	A V+		Power supply 24 VDc	Input - power supply
В V0			Power supply 0 Vbc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E INPUT-			Negative reference input signal for INPUT+	Input - analog signal
F	F MONITOR referred to: AGND V0		Monitor output signal: ± 5 Vpc maximum range Default is 0 \div 5 Vpc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

21.2 Main connector signals - 12 pin A2 /Z and /W options - for AEB-NP and AES

PIN	/Z	/W	TECHNICAL SPECIFICATIONS	NOTES
1	1 V+		Power supply 24 Vbc	Input - power supply
2	V0		Power supply 0 VDc	Gnd - power supply
3	ENABLE		Enable (24 Vbc) or disable (0 Vbc) the driver, referred to VL0	Input - on/off signal
4	4 INPUT+ Ref		Reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
6	6 MONITOR		Monitor output signal: ± 5 Vpc maximum range, referred to VL0 Default is 0 \div 5 Vpc (1V = 1A)	Output - analog signal Software selectable
7	7 NC		Do not connect	
8	NC		Do not connect	
0	MONITOR2		2nd monitor output signal: ±5 Vpc maximum range, referred to VL0. Default is 0 ÷ 5 Vpc	Output - analog signal
9 VL+ Power supply 24 Vpc for driver's logic and communication		Power supply 24 Vbc for driver's logic and communication	Input - power supply	
10 VL0 Power supply 0 Vbc for driver's logic and communication		Power supply 0 Vpc for driver's logic and communication	Gnd - power supply	
11 FAULT Fault (0 Vbc) or normal working (24 Vbc), referred to VL0		Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal	
PE	EARTH		Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

21.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for AEB-IL

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	L+	Power supply 24 Vpc for IO-Link communication	Input - power supply
2	P24	Power supply 24 Vpc for valve regulation, logics and diagnostics	Input - power supply
3	L-	Power supply 0 Vbc for IO-Link communication	Gnd - power supply
4	C/Q	IO-Link data line	Input / Output - signal
5	N24	Power supply 0 Vpc for valve regulation, logics and diagnostics	Gnd - power supply

Note: L+, L- and P24, N24 are electrically isolated

21.4 Communication connectors - for AEB B and AES B - C

B USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

C2	© BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL TECHNICAL SPECIFICATION (1)		
1	+5V	Termination supply signal	
2	LINE-A	Bus line (high)	
3	DGND	Data line and termination signal zero	
4	LINE-B	Bus line (low)	
5	SHIELD		

(1) Shield connection on connector's housing is recommended

©1)	BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)	
1	CAN_SHLD	Shield	
2	NC	do not connect	
3	CAN_GND	Signal zero data line	
4	CAN_H	Bus line (high)	
5	CAN_L	Bus line (low)	

C3 (©3 ©4 EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)	
1	TX+	Transmitter	
2	RX+	Receiver	
3	TX-	Transmitter	
4	RX-	Receiver	
Housing	SHIELD		

(2) Only for AES execution
21.5 Remote pressure transducer connector - M12 - 5 pin - only for /W option - for AEB and AES (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	VF +24V	Power supply +24Vbc	Connect	Connect
2	TR	Signal transducer maximum range ± 10 Vpc / ± 20 mA, software selectable Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /C option	Connect	Connect
3	AGND	Common GND for transducer power and signals	Connect	/
4	NC	Not Connect	/	/
5	NC	Not Connect	/	/

Remote pressure transducer connection - example



Note: connectors front view

21.6 Solenoid connection - only for A

PIN SIGNAL TECHNICAL SPECIFICATION Connector code 666

1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	



21.8 AEB-IL connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

22 CONNECTORS CHARACTERISTICS - to be ordered separately

22.1 Main connectors - 7 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	A1 ZM-7P	A3 ZH-7P		
Туре	7pin female straight circular	7pin female straight circular		
Standard	According to MIL-C-5015	According to MIL-C-5015		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG11	PG11		
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply)		
necommended cable	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)		
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires		
Connection type	to solder	to solder		
Protection (EN 60529)	IP 67	IP 67		

22.2 Main connectors - 12 pin - for AEB-NP and AES

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS			
CODE	A2 ZM-12P	(A4) ZH-12P			
Туре	12pin female straight circular	12pin female straight circular			
Standard	DIN 43651	DIN 43651			
Material	Metallic	Plastic reinforced with fiber glass			
Cable gland	PG13,5	PG16			
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)			
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires			
Connection type	to crimp	to crimp			
Protection (EN 60529) IP 67		IP 67			

22.3 IO-Link connector - only for AEB-IL

CONNECTOR TYPE	IL IO-Link		
CODE	A ZM-5PF		
Туре	5pin female straight circular		
Standard	M12 coding A – IEC 61076-2-101		
Material	Metallic		
Cable gland	Pressure nut - cable diameter 6+8 mm		
Recommended cable	5 x 0,75 mm² max 20 m		
Connection type	screw terminal		
Protection (EN 60529)	IP 67		

22.4 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	C1 ZM-5PF	C2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland Pressure nut - cable diameter		le diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IF	267	IP 67			IP 67
(1) E-TRM-** terminators can be ordered separately - see tech table GS500 (2) Internally terminated						

(1) E-TRM-** terminators can be ordered separately - see tech table $\ensuremath{\text{GS500}}$

22.5 Remote pressure transducer connectors - only for $\ensuremath{\textit{/W}}$ option

CONNECTOR TYPE	TRANSDUCER				
CODE	D1 ZH-5PM/1.5	D1 ZH-5PM/5			
Туре	5 pin male s	traight circular			
Standard	M12 coding A – IEC 61076-2-101				
Material	Plastic				
Coble gland	Connector moulded on cables				
Cable gland	1,5 m length	5 m length			
Cable	5 x 0,25 mm ²				
Connection type	molded cable				
Protection (EN 60529)	IP 67				

23 INSTALLATION DIMENSIONS FOR QVHZO [mm]

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]						
Α	AEB, AES	AES-EH				
2,3	2,8	2,9				

46

85

46



QVHZO-AEB-NP QVHZO-AEB-IL



QVHZO-AES-BC QVHZO-AES-BP











(1) = Space required for connection cable and for connector removal

(2) = The dimensions of connectors and Bluetooth adapter must be considered, see section 21.7, 21.8 and 21.9

24 INSTALLATION DIMENSIONS FOR QVHZOR [mm]

ISO 4401: 2005

Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]						
Α	AEB, AES	AES-EH				
3,8	4,3	4,4				













(1) = Space required for connection cable and for connector removal

(2) = The dimensions of connectors and Bluetooth adapter must be considered, see section 21.7, 21.8 and 21.9

25 FASTENING BOLTS AND SEALS

	QVHZO	QVKZOR
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
0	Seals: 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm	Seals: 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm

26 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric a	nd electronic connectors	
FS900	Operating and maintenance information for proportional valves	P005 Mounting		g surfaces for electrohydraulic valves	
G010	E-MI-AC analog driver	QB100	Quicksta	t for AEB valves commissioning	
G020	E-MI-AS-IR digital driver	QF100	Quicksta	t for AES valves commissioning	
G030	E-BM-AS digital driver	E-MAN-	MI-AS	E-MI-AS-IR user manual (off-board)	
GS050	E-BM-AES digital driver	E-MAN-	BM-AS	E-BM-AS user manual (off-board)	
GS500	Programming tools	E-MAN-	BM-AES	E-BM-AES user manual (off-board)	
GS510	Fieldbus	E-MAN-	RI-AEB	AEB user manual	
GS520	IO-Link interface	E-MAN-	RI-AES	AES user manual	

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Proportional flow valves

direct, pressure compensated, without transducer



2 HYDRAULIC SYMBOLS





2 way connection

In **3 way** the P port has to be connected to tank or to other user lines The port T must be always not connected (blocked)

F400

For application examples of 2 and 3 way connections, see section 10

In 2 way the P port must not be connected (blocked)

The valves can be used in 2 or 3 way connection, depending to the

application requirements.

3 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-A	E-MI-AC-01F E		AS-IR	E-BM-AS-PS		E-BM-AES
Туре	Analog			Digital			
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid			DIN-rail panel			
Tech table	GC)10	GC)20	G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	150 years, see technical table P007					
Ambient temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$					
Storage temperature range	Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

6 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model				QVKZE				
		3	12	18	35	45	65	90
Max regulated flow	[l/min]	3,5	12	18	35	45	65	90
Min regulated flow	[cm³/min]	15	20	30	50	60	85	100
Max flow on port A	[l/min]		40		50	55	70	100
Max pressure	[bar]				210			
Response time 0-100% st	ep signal [ms]	≤ 30 ≤ 45					45	
Hysteresis		≤ 5 [% of the regulated max flow]						
Linearity		\leq 3 [% of the regulated max flow]						
Repeatability		± 1 [% of the regulated max flow]						

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

7 ELECTRICAL CHARACTERISTICS

Valve model	QVHZE			QVHZE QVKZE			
Coil voltage code	standard	option /6	option /18	standard	option /6	option /18	
Max. solenoid current	2,2 A	2,7 A	1,1 A	2,2 A	2,7 A	1,1 A	
Coil resistance R at 20°C	3,1 Ω	2,1 Ω	13,1 Ω	3,2 Ω	2,1 Ω	13,7 Ω	
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account						
Protection degree to DIN EN60529	IP65 with mating connectors						
Duty factor	Continuous rating (ED=100%)						
Certification	cURus North American Standard						

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended f	luid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$					
Recommended viscosi	ty	20 ÷ 100 mm²/s - max allowed rang	20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s				
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1638	3 class 7	see also filter section at			
contamination level	longer life	ISO4406 class 16/14/11 NAS1638	3 class 5	www.atos.com or KTF catalog			
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard			
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without water		FKM HFDU, HFDR		120 10000			
Flame resistant with wa	ater	NBR, NBR low temp.	HFC	130 12922			

9 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

9.1 Regulation diagrams

- 1 = QVHZE-*-06/3 2 way
- 2 = QVHZE-*-06/3 3 way







3 = QVHZE-*-06**/12** 2 way **4** = QVHZE-*-06**/12** 3 way

5 = QVHZE-*-06**/18** 2 way **6** = QVHZE-*-06**/18** 3 way





Regulated flow [l/min] (reg $\Delta p)$

Regulated flow [l/min] (reg $\Delta p)$



Regulated flow [l/min] (reg Δp) Reference signal [% of max.]

9 = QVHZE-*-06/45 2 way 10 = QVHZE-*-06/45 3 way

11 = QVKZE-*-10/65 2 way 12 = QVKZE-*-10/65 3 way

 = QVKZE-*-10**/90** 2 way 14 = QVKZE-*-10/90 3 way

9.2 Regulated flow/outlet pressure diagrams

with inlet pressure = 210 bar

- 1 = QVHZE
- 2 = QVKZE

Dotted line for 3-way versions



9.3 Flow $A \rightarrow P/\Delta p$ diagrams

3-way configuration

Values in above diagrams are measured without pressure on port B. If port B is pressurized, the values in the diagrams must be increased by the same value

- 1 = QVHZE-A-06**/3** QVHZE-A-06**/12** QVHZE-A-06**/18**
- 2 = QVHZE-A-06**/36** QVHZE-A-06**/45**

 $\begin{bmatrix} 13 \\ 12 \\ 9 \\ 6 \\ 3 \\ 0 \\ 15 \\ 30 \\ 45 \\ 60 \\ 75 \\ Flow A \rightarrow P [l/min]$

3 = QVKZE-A-10**/65 4** = QVKZE-A-10**/90**



15

10 APPLICATIONS AND CONNECTIONS



2 way connection

The 2 way connection is normally used to control the flow in one part of the hydraulic circuit or to regulate the speed of a specific actuator. The metered flow in the controlled line is kept constant, independently to the load variations. If the valve is directly installed on the pump main line, the exceeding flow is returned to tank though the pressure relief valve.

3 way connection

The 3 way connection is normally used when the valve directly controls the pump flow (main line).

The metered flow in the controlled line is kept constant, independently to the load variations.

The exceeding flow (not metered by the valve) it is returned to tank trough the valve P port = T line (3rd way).

Priority connection

The priority connection guarantees the pressure compensated flow supply to the primary circuit (B port). The exceeding flow (not required by the primary circuit) is bypassed through the valve P port, to secondary circuit operating at lower pressure and not requiring compensated flow regulations.

11 HYDRAULIC OPTIONS

D = This option provides a quick venting of the use port B when the valve is closed or de-energized.

The valve must be connected in 3 way, with P port connected to tank. When the proportional throttle is fully closed, the valve's port B is internally connected to port P (tank), permitting a quickly decompression of the pressure in the use line.

In the diagram aside are represented the venting times of **QVHZE** and **QVKZE** with option /D respect to standard versions:

1 = standard version 2 = option /D



12 HAND LEVER OPTION - only for QVHZE

It allows to operate the valve in absence of electrical power supply. MO = Horizontal hand lever MV = Vertical hand lever

13 COIL VOLTAGE OPTIONS

- 6 = Optional coil to be used with Atos drivers with power supply 12 VDC.
- 18 = Optional coil to be used with electronic drivers not supplied by Atos.

14 COILS WITH SPECIAL CONNECTORS



15 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

16 FASTENING BOLTS AND SEALS

	QVHZE	QVKZE
Ø	Fastening bolts:	Fastening bolts:
H H	4 socket head screws M5x30 class 12.9	4 socket head screws M6x40 class 12.9
	Tightening torque = 8 Nm	Tightening torque = 15 Nm
\cap	Seals:	Seals:
	Diameter of ports A, B, P, T: Ø7,5 mm	Diameter of ports A, B, P, T: Ø 11,2 mm
Ŭ		

17 INSTALLATION DIMENSIONS FOR QVHZE [mm]





19 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS050	E-BM-AES digital driver
FS900	Operating and maintenance information for proportional valves	GS500	Programming tools
G010	E-MI-AC analog driver	GS510	Fieldbus
G020	E-MI-AS-IR digital driver	K800	Electric and electronic connectors
G030	E-BM-AS digital driver	P005	Mounting surfaces for electrohydraulic valves

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Digital E-BM-TES/LES drivers

DIN-rail format, for proportional valves with one or two LVDT transducers



E-BM-TES/LES

Digital drivers control in closed loop the position of the spool or poppet of direct and pilot operated proportional valves, according to the electronic reference input signal.

TES execution controls direct operated directional/flow valves with one LVDT transducer.

LES execution controls pilot operated directional valves with two LVDT transducers. Option S adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation (see section 4). Bluetooth/USB connection is always present for valve settings via mobile App and Atos PC software.

General Features:

- up to 9 fast plug-in connectors
- Mini USB connector for Bluetooth/USB connection always present
- DB9 connector for CANopen and PROFIBUS DP
- RJ45 connectors input/output for EtherCAT, POWERLINK, EtherNet/IP, PROFINET
- 8 leds for diagnostics (see 9.1)
- Electrical protection against reverse
- polarity of power supply
 Ambient temperature range: -20 ÷ +50 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulationSetting of PID gains
- Selection of analog IN / OUT range
- Complete diagnostic of driver status
- Internal oscilloscope function
- In field firmware update through USB

MODEL CODE 1 E-BM TES Ν NP 01H * Set code Off-board electronic driver (see section 10) in DIN rail format Series number TES = digital full driver, for valves with one LVDT transducer Options, see section 11: = digital full driver, for valves with LES A=max current limitation for Ex-proof valves two LVDT transducers C=current feedback 4 ÷ 20 mÅ for remote transducers (only for option S) and LVDT transducers (only for option A) Alternated P/Q control: I = current reference input and monitor 4 ÷ 20 mA N = none S = closed loop pressure/force (see tech table FS500) omit for direct valves and for pilot operated valves with two LVDT transducers **P** = for pilot operated valves with one LVDT transducer (only for **TES-N**) Fieldbus interface: NP = Not Present BC = CANopen **EW** = POWERLINK **BP** = PROFIBUS DP EI = EtherNet/IP 01H = for single solenoid proportional valves = PROFINET RT/IRT FP EH = EtherCAT 05H = for double solenoid proportional valves (only for TES)

2 BLOCK DIAGRAM EXAMPLE



3 VALVES RANGE

Valves		Directional		Flow	Directional	Cartridge
Industrial	DHZO-T, DKZOR-T	DLHZO-T, DLKZOR-T	DPZO-T	QVHZO-T, QVKZOR-T	DPZO-L	LIQZP-L
Tech table	F165, F168	F180	F172	F412	F175, F178	F330, F340
Ex-proof	DHZA-T, DKZA-T	DLHZA-T, DLKZA-T	DPZA-T	QVHZA-T, QVKZA-T	DPZA-L	LIQZA-L
Tech table	FX120	FX140	FX220	FX420	FX232, FX237	FX350, FX370
Driver model		E-BM-1	E-I	BM-LES		

Option S not available

4 ALTERNATED p/Q CONTROL - only for S option

S option on digital drivers adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation. The alternated p/Q control operates according to the two electronic reference signals by a dedicated algorithm that automatically selects which control will be active time by time.

The dynamics of the switching between the two control will be active time by time. specific software setting, in order to avoid instability or vibrations.

Flow regulation is active when the actual system pressure/force is lower than the relevant input reference signal - the valve works normally to regulate the flow by controlling in closed-loop the spool/poppet position through the integral LVDT transducer. Pressure/force control is activated when the actual system pressure/force, measured by remote transducers, grows up to the relevant input reference signal - the driver

reduces the valve's flow regulation in order to keep steady the system pressure/force. If the pressure/force tends to decrease under its input reference signal, the flow control returns active.

The dynamic response of pressure/force control can be adapted to different system's characteristics, by setting the internal PID parameters using Atos PC software. Up to 4 different PIDs are selectable to optimize the system dynamic response according to different hydraulic working conditions.



Alternated control configurations - software selectable



SP - flow/pressure control

Adds pressure control to standard flow control and permits to limit the max force in one direction controlling in closed loop the pressure acting on one side of the hydraulic actuator. A single pressure transducer has to be installed on hydraulic line to be controlled.

SF - flow/force control

Adds force control to standard flow control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.

SL - flow/force control

Adds force control to standard flow control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault see tech table EY105
- for additional information about alternated P/Q controls configuration please refer to tech table FS500
- Atos technical service is available for additional evaluations related to specific applications usage

5 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW-* programming software.

6 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

6.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with

Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.





6.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.



WARNING: drivers USB port is not isolated! For E-C-SB-USB/BM cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500

7 FIELDBUS - see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

8 MAIN CHARACTERISTICS

Power supplies	Nominal Rectified and filtered	: +24 Vdc : Vrms = 20 ÷ 32 Vma	x (ripple max 10 % VPP)			
Max power consumption	50 W					
Current supplied to solenoids	$I_{MAX} = 3.0 \text{ A for standa}$ $I_{MAX} = 2.5 \text{ A for ex-pro}$	MAX = 3.0 A for standard driver MAX = 2.5 A for ex-proof driver (/A option)				
Analog input signals	Voltage: range ±10 V Current: range ±20 n					
Monitor outputs	Output range:	voltage ±10 Vbc @ r current ±20 mA @ r	max 5 mA max 500 Ω load resistan	се		
Enable input Digital inputs	Range: 0 ÷ 5 Vpc (OFF state), 9 ÷ 24 Vpc (ON state), 5 ÷ 9 Vpc (not accepted); Input impedance: Ri > 10 k Ω					
Fault output	Output range: 0 ÷ 24 Vpc (ON state > [power supply - 2 V]; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			te < 1 V) @ max 50 mA;		
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function					
Pressure/Force transducers power supply (only for S option)	+24Vbc @ max 100 n	nA (E-ATR-8 see tech	table GS465)			
Format	Plastic box ; IP20 prot	ection degree ; L 35 - H	17,5 mm DIN-rail mount	ting as per EN60715		
Ambient temperature range	-20 ÷ +50 °C (storage	∋ -25 ÷ +85 °C)				
Mass	Approx. 400 g					
Additional characteristics	8 leds for diagnostic;	protection against rever	rse polarity of power sup	pply		
Compliance	CE according to EMC RoHS Directive 2011/6 REACH Regulation (E0	directive 2014/30/EU (I 65/EU as last update by C) n°1907/2006	mmunity: EN 61000-6-2 v 2015/863/EU	; Emission: EN 61000-6-3)		
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158		
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cables: 0,5 mm ² max 50 m for logic - 1,5 mm ² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet					
Max conductor size (see section 14)	2,5 mm²	2,5 mm ²				

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

Bluetooth or USB connection



9 CONNECTIONS AND LEDS



(1) D connector is available only for TES-N versions 01HP / 05HP and LES-* (2) E connector is available only for TES-* versions 01H / 05H and LES-*

(3) I , J and K connectors are available only for TES-S and LES-S

(4) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector: DG909MF1 - the connector will be oriented upwards DG909MF3 - the connector will be oriented downwards

9.1 Diagnostic LEDs (L)

Eight leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	PW L1 L2 L3
L1	VALVE STATUS				LINK	/ACT		
L2	NETWORK STATUS		NETWORK STATUS					
L3	SOLENOID STATUS		LINK/ACT					
PW	OFF = Power supply OFF ON = Pow		er supply ON					
ST	OFF = Fault pr	resent	ON = No f	ault				ST

CONNECTOR	PIN	ALTERNATED N none	P/Q CONTROL S pressure/force	TECHNICAL SPECIFICATIONS	NOTES
	A1	V+		Power supply 24 Voc	Input - power supply
Λ	A2	VO		Power supply 0 Vbc	Gnd - power supply
	A3	VL+		Power supply 24 Vpc for driver's logic and communication	Input - power supply
	A4	VL0		Power supply 0 Vpc for driver's logic and communication	Gnd - power supply
	B1	Q_INPUT+		Flow reference input signal: ± 10 Vpc / ± 20 mA maximum range Default are ± 10 Vpc for standard and 4 $\div 20$ mA for /l option	Input - analog signal Software selectable
	B2	INPUT-		Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
B		NC		Do not connect	
	В3		F_INPUT+	Pressure/Force reference input signal ± 10 Vpc / ± 20 mA maximum range Default are ± 10 Vpc for standard and 4 $\div 20$ mA for /I option	Input - analog signal Software selectable
	B4	EARTH		Connect to system ground	
	C1	Q_MONITOR		Flow monitor output signal: ± 10 Vpc / ± 20 mA maximum range, referred to AGND. Default are ± 10 Vpc for standard and 4 $\div 20$ mA for /l option	Output - analog signal Software selectable
	C2	ENABLE		Enable (24 Vpc) or disable (0 Vpc) the controller, referred to VL0	Input - on/off signal
С		NC		Do not connect	
	C3		F_MONITOR	Pressure/Force monitor output signal: ± 10 Vpc / ± 20 mA maximum range, referred to AGND Default are ± 10 Vpc for standard and 4 $\div 20$ mA for /l option	Output - analog signal Software selectable
	C4	FAULT		Fault (0 Vpc) or normal working (24 Vpc), referred to VL0	Output - on/off signal
	D1	LVDT_L		Main stage valve position transducer signal	Input - analog signal
	D2	-15V		Main stage valve position transducer power supply -15V	Output power supply
	D3	+15V		Main stage valve position transducer power supply +15V	Output power supply
	D4	AGND		Common gnd for transducer power and monitor outputs	Common gnd
	E1	LVDT_T		VDT_T Direct valve or pilot valve position transducer signal	
F	E2	-15V	Direct valve or pilot valve position transducer power supply -15V		Output power supply
L (2)	E3	+15V		Direct valve or pilot valve position transducer power supply +15V	Output power supply
	E4	AGND		Common gnd for transducer power and monitor outputs	Common gnd
	F1	SOL_S1-		OL_S1- Negative current to solenoid S1	
F	F2	SOL_S1+	+ Positive current to solenoid S1		Output - power PWM
•	F3	SOL_S2-		Negative current to solenoid S2	Output - power PWM
	F4	SOL_S2+		Positive current to solenoid S2	
	11		NC	Do not connect	
I	12		D_IN0	NP execution: multiple pressure/force PID selection, referred to VL0 Fieldbus execution: general purpose digital input 0 ÷ 24Vbc, referred to VL0	Input - on/off signal
	13		NC	Do not connect	
	14		NC	Do not connect	
	J1		VF +24V	Power supply: +24Vbc or OFF (default OFF)	Output - power supply Software selectable
J	J2		F_TR1	1st signal pressure/force transducer: ±10 Vpc / ±20 mA maximum range	Input - analog signal Software selectable
	JЗ		AGND	Common gnd for transducer power and signals	Common gnd
	J4		NC	Do not connect	
	K1		VF +24V	Power supply: +24Vbc or OFF (default OFF)	Output - power supply Software selectable
			F_TR2 (3)	2nd signal pressure transducer: ±10 Vpc / ±20 mA maximum range	Input - analog signal Software selectable
K	K2		D_IN1 (4)	NP execution: multiple pressure/force PID selection, referred to VL0 Fieldbus execution: general purpose digital input 0 ÷ 24Vbc, referred to VL0	Input - on/off signal
	K3		AGND	Common gnd for transducer power and signals	Common gnd
	K4		NC	Do not connect	

(1) D connector is available only for TES-N versions 01HP / 05HP and LES-* (2) E connector is available only for TES-* versions 01H / 05H and LES-*

(3) Only for SF control(4) Only for SP or SL control

9.3 Pressure/force transducers connection - example - only for S option



BC field
 BIGNAL

2

3

5

7

PIN

1 TX+

2

CAN L

CAN H

SIGNAL

RX+

3 TX-

6 RX-

CAN_GND

CAN_SHLD Shield

BC fieldbus execution, connector - DB9 - 9 pin

Signal zero data line

6 7 EH, EW, EI, EP fieldbus execution, connector - RJ45 - 8 pin

TECHNICAL SPECIFICATION (1)

white/orange

white/green

orange

green

Bus line (low)

Bus line (high)

Transmitter

Transmitter

Receiver

Receiver

TECHNICAL SPECIFICATION (1)

9.4 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

3	USB connector - Mini USB type B always present					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)				
1	+5V_USB	Power supply				
2	D-	Data line -				
3	D+	Data line +				
4	ID	Identification				
5	GND_USB	Signal zero data line				

5	(5) BP fieldbus execution, connector - DB9 - 9 pin					
PIN	SIGNAL TECHNICAL SPECIFICATION (1)					
1	SHIELD					
3	LINE-B	Bus line (low)				
5	DGND	Data line and termination signal zero				
6	+5V	Termination supply signal				
8	LINE-A	Bus line (high)				

(1) shield connection on connector's housing is recommended

10 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

11 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

11.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

11.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply (pin A3 and A4) for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. The separate power supply for driver's logic, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

🔨 A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

11.3 Flow reference input signals (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin B1) for the valve's spool position.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 Vbc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vbc or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vbc.

11.4 Pressure or force reference input signal (F_INPUT+) - only for S option

Functionality of pressure or force input reference signal (pin B3), is used as reference for the driver pressure/force closed loop, see section [4]. Reference input signal is factory preset according to selected valve code, defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vpc or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 $\div 24$ Vpc.

11.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin C1) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, valve spool position). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDc or ± 20 mA.

11.6 Pressure or force monitor output signal (F_MONITOR) - only for S option

The driver generates an analog output signal (C3) proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vpc or ± 20 mA

11.7 Enable input signal (ENABLE)

To enable the driver, supply 24 Vbc on pin C2: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as digital input by software selection.

11.8 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 Vbc, normal working corresponds to 24 Vbc. Fault status is not affected by the status of the Enable input signal. Fault output signal can be used as digital output by software selection.

11.9 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ± 15 Vpc supply output available at pin D2, D3 and pin E2, E3.

Note: transducer input signals working range is ± 10 Vpc for standard or $4 \div 20$ mA for /AC option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

11.10 Remote pressure/force transducer input signals (F_TR1 and F_TR2) - only for S option

Analog remote pressure transducers or load cell can be directly connected to the driver. Analog input signal is factory preset according to selected driver code, defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vpc or ± 20 mA. Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**). Note: F_TR2 (pin K2) analog input signal is available only SF control.

11.11 Multiple PID selection or digital input signals (D_IN0 and D_IN1) - only for S option

Note: D_IN1 (pin K2) on-off input signal is available only for SP or SL control.

Two on-off input signals are available on the connectors I and K. For NP executions pin I2 and/or pin K2 are used to select one of the four pressure (force) PID parameters setting, stored into the driver. Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.). Supply a 24 Vbc or a 0 Vbc on pin I2 and/or pin K2, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software. For fieldbus executions pin I2 and/or K2 can be used as generic purpose on-off input signals.

	PID SET SELECTION							
PIN	SET 1	SET 2	SET 3	SET 4				
12	0	24 Vpc	0	24 VDC				
K2	0	0	24 Vpc	24 VDC				

11.12 Possible combined options: /AC, /AI, /ACI, /CI - combined options /CI is available only for E-BM-TES/LES-S.

12 MAIN SOFTWARE PARAMETER SETTINGS

For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW-SETUP programming software:

E-MAN-BM-LES - user manual for E-BM-TES-N and E-BM-LES-N digital drivers

E-MAN-BM-LES-S - user manual for E-BM-TES-S and E-BM-LES-S digital drivers

13 OVERALL DIMENSIONS [mm]



(1) D connector is available only for TES-N versions 01HP / 05HP and LES-* (2) E connector is available only for TES-* versions 01H / 05H and LES-*

(3) I, J and K connectors are available only for TES-S and LES-S

14 INSTALLATION



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot. (e.g. connector A can not be inserted into connector slot of B,C,D,E,F,I,J,K)

06/24

atos 🛆

Digital E-BM-TEB/LEB drivers

DIN-rail format, for proportional valves with one or two LVDT transducers





GS230

2 BLOCK DIAGRAM EXAMPLE



3 VALVES RANGE

Valves		Directional		Flow	Directional	Cartridge
Industrial	DHZO-T, DKZOR-T	DLHZO-T, DLKZOR-T	DPZO-T	QVHZO-T, QVKZOR-T	DPZO-L	LIQZP-L
Tech table	F165, F168	F180	F172	F412	F175, F178	F330, F340
Ex-proof	DHZA-T, DKZA-T	DLHZA-T, DLKZA-T	DPZA-T	QVHZA-T, QVKZA-T	DPZA-L	LIQZA-L
Tech table	FX120	FX140	FX220	FX420	FX232, FX237	FX350, FX370
Driver model		E-BM-T	E-E	BM-LEB		

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

5.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.







5.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/BM cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

 \sum WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500

Bluetooth or USB connection



6 FIELDBUS - see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 MAIN CHARACTERISTICS

Power supply	(see 7.1)	Nominal: +24 VDCRectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)						
Max power consumption		50 W						
Current supplied to soler	noids	Imax = 3.0 A for standard driver Imax = 2.5 A for ex-proof driver (/A option)						
Analog input signal	(see 7.2)	$ \begin{array}{llllllllllllllllllllllllllllllllllll$						
Monitor output	(see 7.3)	Output range: voltage ±10 Vpc @ max 5 mA current ±20 mA @ max 500 Ω load resistance						
Enable input	(see 7.4)	Range: 0 ÷ 5 Vpc (OFF state), 9 ÷ 24 Vpc (ON state), 5 ÷ 9 Vpc (not accepted); Input impedance: Ri > 10 kΩ						
Fault output	(see 7.5)	Output range: 0 ÷ 24 Vbc (ON state > [power supply - 2 V]; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)						
Alarms		Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function						
Format		Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715						
Operating temperature		-20 ÷ +60 °C (storage -25 ÷ +85 °C)						
Mass		Approx. 300 g						
Additional characteristic	S	2 leds for diagnostic; protection against reverse polarity of power supply						
Compliance		CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006						
Communication interface	9	USB Atos ASCII coding						
Communication physical	layer	USB 2.0 + USB OTG not insulated						
Recommended wiring cable		LiYCY shielded cables: 0,5 mm ² max 50 m for logic - 1,5 mm ² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet						
Max conductor size	(see 11)	2,5 mm ²						

Note: a maximum time of 400 ms have be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

8 CONNECTIONS AND LEDS



8.1 Diagnostic LEDs (L)

Two leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LEDS	DESCRIPTION		
PW	OFF = Power supply OFF	ON = Power supply ON	O PW
ST	OFF = Fault present	ON = No fault	O ST

CONNECTOR	PIN	SIGNALS	TECHNICAL SPECIFICATIONS	NOTES
	A1	V+	Power supply 24 Vbc	Input - power supply
A	A2	V0	Power supply 0 Vpc	Gnd - power supply
	A3	ENABLE	Enable (24 Vpc) or disable (0 Vpc) the controller, referred to V0	Input - on/off signal
	A4	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to V0	Output - on/off signal
	B1	SOL_S1-	Negative current to solenoid S1	Output - power PWM
B	B2	SOL_S1+	Positive current to solenoid S1	Output - power PWM
D	B3	SOL_S2-	Negative current to solenoid S2	Output - power PWM
	B4	SOL_S2+	Positive current to solenoid S2	Output - power PWM
	D1	Q_INPUT+	Flow reference input signal: ± 10 Vpc / ± 20 mA maximum range Default are ± 10 Vpc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
П	D2	INPUT-	Negative reference input signal for Q_INPUT+	Input - analog signal
D	D3	Q_MONITOR	Flow monitor output signal: ± 10 Vbc / ± 20 mA maximum range, referred to AGND Default are ± 10 Vbc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
	D4	AGND	Common gnd for monitor output	Common gnd
	E1	LVDT_T	Direct valve or pilot valve position transducer signal	Input - analog signal
F	E2	-15V	Direct valve or pilot valve stage position transducer power supply -15V	Output power supply
Ŀ	E3	+15V	Direct valve or pilot valve tage position transducer power supply +15V	Output power supply
	E4	AGND	Common gnd for transducer power	Common gnd
	F1	LVDT_L	Main stage valve position transducer signal	Input - analog signal
F	F2	-15V	Main stage valve position transducer power supply -15V	Output power supply
■ (1)	F3	+15V	Main stage valve position transducer power supply +15V	Output power supply
-	F4	AGND	Common gnd for transducer power	Common gnd

(1) F connector is available only for LEB

8.3 Communication connector ③

3	③ USB connector - Mini USB type B always present					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)				
1	+5V_USB	Power supply				
2	D-	Data line -				
3	D+	Data line +				
4	ID	Identification				
5	GND_USB	Signal zero data line				

9 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

10 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

10.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

10.2 Flow reference input signal (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin D1) for the valve's spool position.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 V_{Dc} for standard and $4 \div 20$ mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{Dc} or ± 20 mA.

10.3 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin D3) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, valve spool position).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 V_{DC} for standard and $4 \div 20$ mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{DC} or ± 20 mA.

10.4 Enable input signal (ENABLE)

To enable the driver, supply 24 VDC on pin A3: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

10.5 Fault output signal (FAULT)

Fault output signal (pin A4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the status of the Enable input signal.

10.6 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin F1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ±15 VDC supply output available at pin F2, F3 and pin E2, E3.

Note: transducer input signals working range is ±10 VDC for standard or 4 ÷ 20 mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

10.7 Possible combined options: /AC, /AI, /ACI

11 MAIN SOFTWARE PARAMETER SETTINGS

For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW-SETUP programming software:

E-MAN-BM-LEB - user manual for E-BM-TEB and E-BM-LEB digital drivers

12 OVERALL DIMENSIONS [mm]



(1) F connector is available only for LEB





Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot. (e.g. connector A can not be inserted into connector slot of B,D,E,F)

atos 🛆

Digital electronic E-BM-RES drivers

DIN-rail format, for proportional valves with integral pressure transducer



1 MODEL CODE

E-BM	- RES	- NP	-	01H /	*	*	*
Off-board electronic driver in DIN rail format							Set code (see section 5)
RES = digital full driver, for valves with pressure transduce	er				Ontions	Series numbe	er
Fieldbus interface - USB port always present: NP = Not Present					A = max current I = current refe (omit for vo	t limitation for Exercise to the second s Itage reference	k-proof valves d monitor 4 ÷ 20 mA and monitor input 0 ÷10 Vbc)
BP = PROFIBUS DP EH = EtherCAT				01H = for	single solenoid p	roportional valv	es

2 VALVES RANGE

Valves		Relief			Compensator		
Industrial	RZMO	AGMZO	LIMZO	RZGO	AGRCZO	LIRZO	LICZO
Tech table	FS010, FS067	FS040	FS305	FS020, FS075	FS055	FS305	FS305
Ex-proof	RZMA	AGMZA	LIMZA	RZGA	AGRCZA	LIRZA	LICZA
Tech table	FX035	FX035	FX325	FX065	FX065	FX325	FX325

E-BM-RES

Digital drivers ① control, in closed loop, the regulated pressure of direct and pilot operated proportional valves according to the electronic reference input signal.

E-BM-RES operate direct and pilot operated relief/reducing control valves with integral pressure transducer.

Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 7 fast plug-in connectors (2)
- Mini USB port (3) always present
 DB9 CANopen (4) and PROFIBUS DP (5) communication connector
- RJ45 EtherCAT communication connectors
 (a) output and (7) input
- 3 leds for diagnostics (8) (see 4.1)
- Pressure transducer input signal 4 ÷ 20 mA
 ±5 Vpc output supply for external reference potentiometer
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
 Plastic box with IP20 protection degree
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither, PID gains
- 4 factory pre-set dynamic response setting to match different hydraulic conditions (see 8.1)
- Linearization function for hydraulic regulation
- Complete diagnostics of driver status
- Internal oscilloscope function
- In field firmware update through USB port

Fieldbus Features:

- Valve direct communication with machine control unit for digital reference, diagnostics and settings
- Fieldbus execution allow to operate the valves via fieldbus or via analog signals available on the connectors (see 4.2)

3 MAIN CHARACTERISTICS

Power supply (see 6.1, 6.4)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)						
Max power consumption	50 W						
Current supplied to solenoids	$I_{MAX} = 2.7 \text{ A with } +24 \text{ MAX} = 2.5 \text{ A with } +24 \text{ With } +24 \text{ MAX} = 2.5 \text{ A with } +2.5 \text{ A with } +2.$	/bc power supply to drive sta /bc power supply to drive ex-	ndard proportional valves (3,2 Ω proof proportional valves (3,2 Ω	solenoid) solenoid) for /A option			
Analog input signals (see 6.2)	Voltage: maximum rar Current: maximum rar	nge ±10 Vbc Input impedance nge ±20 mA Input impedance	e: Ri > 50 k Ω e: Ri = 500 Ω				
Monitor output (see 6.3)	Voltage: maximum rar Current: maximum rar	nge 0 ÷ 10 Vbc @ max nge 0 ÷ 20 mA @ max	t 5 mA t 500 Ω load resistance				
Enable input (see 6.5)	Range: 0 ÷ 9 Vbc (OF	F state), 15 ÷ 24 Vpc (ON sta	te), 9 ÷ 15 Vpc (not accepted); 1	nput impedance: Ri > 87 k Ω			
Output supply (see 6.8)	±5 Vpc @ max 10 mA	output supply for external po	otentiometer				
Fault output (see 6.6)	Output range : 0 ÷ 24 external negative volta	VDC (ON state \cong VL+ [logic lige not allowed (e.g. due to in	power supply]; OFF state \cong 0 V ductive loads)	') @ max 50 mA;			
Pressure transducer power supply	+24VDC @ max 100 r	nA (E-ATR-8 see tech table	GS465; E-ATRA-7 for ex-proof	f, see tech table GX800)			
Alarms	Solenoid not connecte power supplies level, p	d/short circuit, cable break w pressure transducer failure, al	ith current reference signal, over/ larms history storage function	/under temperature,			
Format	Plastic box ; IP20 prote	ection degree ; L 35 - H 7,5 m	m DIN-rail mounting as per EN6	0715			
Operating temperature	-20 ÷ +60 °C (storage	e -25 ÷ +85 °C)					
Mass	Approx. 330 g						
Additional characteristics	Short circuit protection protection against reve	n of solenoid current supply; c erse polarity of power supply	urrent control by P.I.D. with rapic	solenoid switching;			
Compliance	CE according to EMC RoHS Directive 2011/6 REACH Regulation (EC	directive 2014/30/EU (Immun 55/EU as last update by 2015/ C) n°1907/2006	ity: EN 61000-6-2; Emission: EN 6 '863/EU	61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC61158			
Communication physical layer	nmunication physical layer not insulated USB 2.0 + USB OTG CAN ISO11898 RS485 Fast Ethernet 100 Base TX						
Recommended wiring cable	LiYCY shielded cables	LiYCY shielded cables: 0,5 mm ² max 50 m for logic - 1,5 mm ² max 50 m for power supply and solenoids					
Max conductor size (see 10)	2,5 mm ²						

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vpc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

4 CONNECTIONS AND LEDS



4.1 Diagnostic LEDs (L)

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION	
L1	OREEN	DW/	OFF	Power supply OFF	
	GREEN		ON	Power supply ON	st O L2
L2	GREEN	ст	OFF	Fault present	USB S1 O L3 S2 O mot used
		51	ON	No fault	
1.2	VELLOW/	01	OFF	PWM command OFF	000000000
L3	TELLOW	31	ON	PWM command ON	

4.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
	A1	V+	Power supply 24 Vbc (see 6.1)	Input - power supply
A	A2	V0	Power supply 0 VDc (see 6.1)	Gnd - power supply
	A3	VL+	Power supply 24 Vpc for driver's logic and communication (see 6.4)	Input - power supply
	A4	VL0	Power supply 0 VDc for driver's logic and communication (see 6.4)	Gnd - power supply
	B1	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the driver, referred to VL0 (see 6.5)	Input - on/off signal
R	B2	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0 (see 6.6)	Output - on/off signal
D	B3	VL0	Ground for ENABLE and FAULT	Gnd - digital signals
	B4	EARTH	Connect to system ground	
	C1	SOL_S1-	Negative current to solenoid S1	Output - power PWM
C	C2	SOL_S1+	Positive current to solenoid S1	Output - power PWM
U	C3	NC	Do not connect	
	C4	NC	Do not connect	
	E1	VF +24V	Power supply +24 Vbc	Output - power supply
E	E2	TR+	Positive pressure transducer input signal: ±20 mA maximum range (see 6.7) Default is 4 ÷ 20 mA	Input - analog signal Software selectable
_	E3	NC	Do not connect	
	E4	AGND	Common gnd for signals and external potentiometer	
	F1	+5V_REF	External potentiometer power supply +5 Vbc @ 10mA (see 6.8)	Output - power supply
F	F2	P_INPUT+	Positive pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range (see 6.2) Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
	F3	INPUT-	Negative pressure reference input signal for P_INPUT+	Input - analog signal
	F4	-5V_REF	External potentiometer power supply -5 VDC @ 10mA (see 6.8)	Output - power supply
	G1	EARTH	Connect to system ground	
	G2	AGND	Analog ground for monitor and external potentiometer	Gnd - analog signal
G	G3	NC	Do not connect	
	G4	P_MONITOR	Pressure monitor output signal: $0 \div 10 \text{ Vbc} / 0 \div 20 \text{ mA}$ maximum range (see 6.3) Default are $0 \div 10 \text{ Vbc}$ for standard and $4 \div 20 \text{ mA}$ for /l option	Output - analog signal Software selectable
	H1	VL0	Power supply 0 Vbc for digital input (see 6.4)	Gnd - power supply
н	H2	D_IN1	Pressure PID selection, referred to VL0 (see 6.9)	Input - on/off signal
	H3	D_IN0	Pressure PID selection, referred to VL0 (see 6.9)	Input - on/off signal
	H4	VL+	Power supply 24 Vbc for digital input (see 6.4)	Output - power supply

Pressure transducer connections



4.3 Communication connectors (3 - (4) - (5) - (6) - (7)

3	USB connector - Mini USB type B always present										
PIN	SIGNAL	AL TECHNICAL SPECIFICATION (1)									
1	+5V_USB	Power supply									
2	D-	Data line -									
3	D+	Data line +									
4	ID	Identification									
5	GND_USB	Signal zero data line									
5	BP fieldbus	execution, connector - DB9 - 9 pin									
⑤ PIN	BP fieldbus SIGNAL	execution, connector - DB9 - 9 pin TECHNICAL SPECIFICATION (1)									
⑤ PIN 1	BP fieldbus SIGNAL SHIELD	execution, connector - DB9 - 9 pin TECHNICAL SPECIFICATION (1)									
5 PIN 1 3	BP fieldbus SIGNAL SHIELD LINE-B	execution, connector - DB9 - 9 pin TECHNICAL SPECIFICATION (1) Bus line (low)									
 (5) PIN 1 3 5 	BP fieldbus SIGNAL SHIELD LINE-B DGND	execution, connector - DB9 - 9 pin TECHNICAL SPECIFICATION (1) Bus line (low) Data line and termination signal zero									
 (5) PIN 1 3 5 6 	BP fieldbus SIGNAL SHIELD LINE-B DGND +5V	execution, connector - DB9 - 9 pin TECHNICAL SPECIFICATION (1) Bus line (low) Data line and termination signal zero Termination supply signal									

Coil connection



Potentiometer connection



(1) As alternative the AGND on pin E4 can be used

4	BC fieldbus execution, connector - DB9 - 9 pin								
PIN	SIGNAL	L TECHNICAL SPECIFICATION (1)							
2	CAN_L	Bus line (low)							
3	CAN_GND	Signal zero data line							
5	CAN_SHLD	Shield							
7	CAN_H	Bus line (high)							

67	⑥ ⑦ EH fieldbus execution, connector - RJ45 - 8 pin												
PIN	SIGNAL	TECHNICAL	FECHNICAL SPECIFICATION (1)										
1	TX+	Transmitter	-	white/orange									
2	RX+	Receiver	-	white/green									
3	тх-	Transmitter	-	orange									
6	RX-	Receiver	-	green									

(1) shield connection on connector's housing is recommended

5 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

6 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in the user manuals included in the E-SW-SETUP programming software. Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

6.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of double power supply see 6.4. A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

6.2 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ Vpc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vpc or ± 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24Vbc.

6.3 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference). Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷10 Vpc for standard and 4 ÷ 20 mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷10 Vpc or 0 ÷ 20 mA.

6.4 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin A3 and A4, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

6.5 Enable input signal (ENABLE)

To enable the driver, supply 24 Vpc on pin B1: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

6.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 + 20 mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 Vbc. Fault status is not affected by the Enable input signal.

6.7 Pressure transducer integrated to the valve, input signal (TR+)

Analog pressure transducer integrated to the valve, has to be directly connected to the driver. Analog input signal is factory preset according to selected driver code, default is 4 ÷ 20 mA. Input signal can be reconfigured via software, within a maximum range of \pm 20 mA.

6.8 Output supply for external potentiometer (±5V_REF) - not available for EH version

The reference analog signal can be generated by one external potentiometer directly connected to the driver, using the ±5 Vpc supply output available at pin F1 and F4.

Note: using an external potentiometer, the reference input signal must be set via software at 0 ÷ 5 Vbc (default 0 ÷10 Vbc, see 6.2) 6.9 PID selection (D_IN0 and D_IN1) PID SET SELECTION

- - Two on-off input signals are available on the pin H2 and H3 to select one of the four pressure FID parameters setting, stored into the driver. Supply a 24 Vpc or a 0 Vpc on pin H2 and/or pin H3, to select one of the PID settings as indica-

ted by binary code table at side. Gray code can be selected by software. Refer to dynamic response for function description (see 8.1).

6.10 Possible combined options: /AI



7 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital drivers via USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/BM cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

Note: Bluetooth connection is not available for E-BM-RES drivers

USB connection

PIN

H2

НЗ

SET 1

0

0

SET 2

24 Vpc

0

SET 3

0

24 Vpc

SET 4

24 Vpc

24 Vpc



8 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW-SETUP programming software:

E-MAN-BM-RES - user manual for E-BM-RES

8.1 Smart tuning

Smart tuning allows to adjust the valve dynamic response in order to match different hydraulic conditions and performance requirements. The valve is provided with 3 factory settings for the pressure control:

- **dynamic** fast response time for best dynamic performances. Default factory setting for pressure valves

- **balanced** average response time suitable for major applications
- **smooth** attenuated response time for slow regulation without overshoots

Smart tuning setting can be switched from Dynamic (default) to Balanced or Smooth via software or fieldbus; if requested, performances can be further customized directly tuning each single control parameter.

Below indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume.





8.2 Pressure transducer failure

This function is available only for pressure transducer input configured in current as 4 ÷ 20 mA.

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW-SETUP software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)

- automatically switch the pressure control from closed loop (dynamic, balaced, smooth) to open loop, to let the valve to temporarily operate with reduced regulation accuracy

8.3 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max pressure valve regulation, at maximum reference signal value.

This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the pressure proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.

8.4 Bias and Threshold

Pressure proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.

This dead band discontinuity in the pressure valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (analog or fieldbus external input).

The Bias function is activated when the reference signal overcomes the Threshold value, preset into the driver.

The Bias setting allows to calibrate the Bias current to the specific pressure proportional valve to which the driver is coupled.

The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence. If fieldbus reference signal is active (see 6.2), threshold should be set to zero.

Refer to the programming manuals for a detailed description of other software selectable Bias functions.

8.5 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.

Different ramp mode can be set:

- single ramp for any reference variation

- two ramps for increasing and for decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.

If the pressure proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting).

8.6 Linearization - E-SW-SETUP level 2 functionality

Linearization function allows to set the relation between the reference input signal and the controlled valve's pressure regulation. Linearization is useful for applications where it is required to linearize the valve's pressure regulation in a defined working condition.

8.3, 8.4 - Scale, Bias & Threshold







8.6 - Linearization



9 OVERALL DIMENSIONS [mm]



10 INSTALLATION



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot (eg. connector A can not be inserted into connector slot of B, C, E, F, G, H)

06/24

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Digital electronic E-BM-AES drivers

DIN-rail format, for proportional valves without transducer



E-BM-AES

Digital drivers ① control the current to the solenoid of Atos proportional valves without transducer, according to the electronic reference input signal.

E-BM-AES operate direct and pilot operated proportional valves ZO-A without transducer.

Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 7 fast plug-in connectors (2)
- Mini USB port (3) always present
- DB9 CANopen ④ and PROFIBUS DP ⑤ communication connector
- RJ45 EtherCAT communication connectors (a) output and (7) input
- 4 leds for diagnostics (8) (see 4.1)
- ±5 Vpc output supply for external reference potentiometer
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
 Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither, PID gains
- Linearization function for hydraulic regulation
- /W option max power limitation function
- Complete diagnostics of driver status
- Internal oscilloscope function
- In field firmware update through USB port

Fieldbus Features:

- Valve direct communication with machine control unit for digital reference, diagnostics and settings
- Fieldbus execution allow to operate the valves via fieldbus or via analog signals available on the connectors (see 4.2)

E-BM	- [AES	-	NP] -	01H	1	*	*
Off-board electronic driver								Ontioner	Series number
								Options:	
AES = digital full driver, for valves without transducer								A = max current limita C = current feedback transducer, only i	4 ÷ 20 mA for remote n combination with option W
Fieldbus interface - USB port always present: NP = Not Present								 I = current reference (omit for standard W= power limitation f 	Input 4 ÷ 20 mA d voltage reference input ±10 Vbc) function
BC = CANopen BP = PROFIBUS DP EH = EtherCAT						01H = f 05H = f	or sir	ngle solenoid proportio	onal valves ional valves

2 VALVES RANGE

Valves	Pressure									Directional			Cartridge	Flo	W
Industrial	rzmo Hmzo	RZME CART RZME	RZGO HZGO KZGO	RZGE CART RZGE	AGMZO	AGMZE	AGRCZO	DHRZO	DHRZE	DHZO DKZOR	DHZE DKZE	DPZO DPZE	LIMZO LIRZO LICZO	QVHZO QVKZOR	QVHZE QVKZE
Tech table	FS007 FS065	F005	FS015 FS070	F012	FS035	F030	FS050	FS025	F022	FS160	F150	FS170 F171	FS300	FS410	F400
Ex-proof	RZMA HZMA	-	RZGA HZGA KZGA	-		-	AGRCZA	DHRZA	-		-	DPZA	LIMZA LIRZA LICZA	QVHZA QVKZA	-
3 MAIN CHARACTERISTICS

Power supply (see 5.1, 5.2)	Nominal : +24 VDc Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	50 W					
Current supplied to solenoids	$I_{MAX} = 2.7 \text{ A with } +24 \text{ MAX} = 2.5 \text{ A with } +24 \text{ With } +24 \text{ MAX} = 2.5 \text{ A with } +2.5 $	VDC power supply to drive sta VDC power supply to drive ex-	andard proportional valves (3,2 proof proportional valves (3,2	2 solenoid) 2 solenoid) for /A option		
Analog input signals (see 5.3)	Voltage: maximum rai Current: maximum rai	nge ±10 Vbc Input impedant nge ±20 mA Input impedant	ce: $Ri > 50 k\Omega$ ce: $Ri = 500 \Omega$			
Monitor output (see 5.4)	Voltage: maximum rai	nge ±5 Vpc @max 5 mA				
Enable input (see 5.5)	Range: 0 ÷ 9 Vpc (OF	FF state), 15 ÷ 24 Vpc (ON sta	ate), 9 ÷ 15 Vpc (not accepted);	Input impedance: Ri > 87 k Ω		
Output supply (see 5.8)	±5 Vpc @ max 10 mA	: output supply for external po	otentiometer			
Fault output (see 5.6)	Output range : 0 ÷ 24 Vbc (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)					
Pressure transducer power supply (only for /W option)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465; E-ATRA-7 for ex-proof, see tech table GX800)					
Alarms	Solenoid not connecte power supplies level, j	d/short circuit, cable break w pressure transducer failure	vith current reference signal, ove	er/under temperature,		
Format	Plastic box ; IP20 prote	ection degree ; L 35 - H 7,5 m	nm DIN-rail mounting as per EN	60715		
Operating temperature	-20 ÷ +60 °C (storage	e -25 ÷ +85 °C)				
Mass	Approx. 330 g	Approx. 330 g				
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply					
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC61158		
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet 100 Base TX		
Recommended wiring cable	LiYCY shielded cables: 0,5 mm ² max 50 m for logic - 1,5 mm ² max 50 m for power supply and solenoids					
Max conductor size (see 9)	2,5 mm ²					

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

4 CONNECTIONS AND LEDS



4.1 Diagnostic LEDs L

Four leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION	
1.1	GREEN	D\M/	OFF	Power supply OFF	
	GREEN	ΓVV	ON	Power supply ON	st O L1
1.0	OREEN	ст	OFF	Fault present	
LZ	GREEN	51	ON	No fault	20
12 and 14	VELLOW/	S1 and S2	OFF	PWM command OFF	0000000000
LS and L4	TELLOW	51 anu 52	ON	PWM command ON	

4.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
	A1	V+	Power supply 24 Vpc (see 5.1)	Input - power supply
•	A2	VO	Power supply 0 Vpc (see 5.1)	Gnd - power supply
A	A3	VL+	Power supply 24 Vpc for driver's logic and communication (see 5.2)	Input - power supply
	A4	VL0	Power supply 0 Vbc for driver's logic and communication (see 5.2)	Gnd - power supply
B1 ENABL			Enable (24 Vbc) or disable (0 Vbc) the driver, referred to VL0 (see 5.5)	Input - on/off signal
D	B2	FAULT	Fault (0 Vpc) or normal working (24 Vpc), referred to VL0 (see 5.6)	Output - on/off signal
D	B3	VL0	Ground for ENABLE and FAULT	Gnd - digital signals
	B4	EARTH	Connect to system ground	
	C1	SOL_S1-	Negative current to solenoid S1	Output - power PWM
	C2	SOL_S1+	Positive current to solenoid S1	Output - power PWM
	C3	SOL_S2-	Negative current to solenoid S2	Output - power PWM
	C4	SOL_S2+	Positive current to solenoid S2	Output - power PWM
	E1	VF +24V	Power supply +24 Vbc	Output - power supply
F	E2	TR+	Positive pressure transducer input signal: ± 10 Vbc / ± 20 mA maximum range (see 5.7) Default are 0 \div 10 Vbc for standard and 4 \div 20 mA for /C option	Input - analog signal Software selectable
	E3	NC	Do not connect	
for /W option	E4	AGND	Common gnd for transducer power, signals and external potentiometer	
	F1	+5V_REF	External potentiometer power supply +5 Vbc @ 10mA (see 5.8)	Output - power supply
F	F2	INPUT+	Positive reference input signal: ±10 Vpc / ±20 mA maximum range (see 5.3) Default are ±10 Vpc for standard and 4 ÷ 20 mA for /l option	Input - analog signal Software selectable
•	F3	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
	F4	-5V_REF	External potentiometer power supply -5 VDc @ 10mA (see 5.8)	Output - power supply
	G1	EARTH	Connect to system ground	
	G2	AGND	Analog ground for monitor and external potentiometer	Gnd - analog signal
G	G3	MONITOR2	Only for /W option, 2nd monitor output signal: ±5 Vpc maximum range (see 5.4) Default is 0 ÷ 5 Vpc	Output - analog signal Software selectable
	G4	MONITOR	Monitor output signal: ±5 Vpc maximum range (see 5.4) Default is ±5 Vpc (1V = 1A)	Output - analog signal Software selectable
	H1	VL0	Power supply 0 Vbc for digital input (see 5.2)	Gnd - power supply
Ы	H2	D_IN1	Digital input 0 ÷ 24Vbc, referred to VL0	Input - on/off signal
	H3	D_IN0	Digital input 0 ÷ 24Vpc, referred to VL0	Input - on/off signal
	H4	VL+	Power supply 24 Vbc for digital input (see 5.2)	Output - power supply

Pressure transducer connections - only for /W option



Coils connection



4.3 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

3	USB connec	ctor - Mini USB type B always present				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)				
1	+5V_USB	Power supply				
2	D-	Data line -				
3	D+	Data line +				
4	ID	Identification				
5	GND_USB	Signal zero data line				

(5)	BP fieldbus execution, connector - DB9 - 9 pin				
PIN	SIGNAL	- TECHNICAL SPECIFICATION (1)			
1	SHIELD				
3	LINE-B	Bus line (low)			
5	DGND	D Data line and termination signal zero			
6	+5V	Termination supply signal			
8	LINE-A	Bus line (high)			

Potentiometer connection



(1) As alternative the AGND on pin E4 can be used (only /W option)

4	BC fieldbus execution, connector - DB9 - 9 pin				
PIN	SIGNAL	IGNAL TECHNICAL SPECIFICATION (1)			
2	CAN_L	Bus line (low)			
3	CAN_GND	GND Signal zero data line			
5	CAN_SHLD	Shield			
7	CAN_H	Bus line (high)			

67	6 7 EH fieldbus execution, connector - RJ45 - 8 pin							
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)						
1	TX+	Transmitter	-	white/orange				
2	RX+	Receiver	-	white/green				
3	TX-	Transmitter	-	orange				
6	RX-	Receiver	-	green				

(1) shield connection on connector's housing is recommended

5 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in the user manuals included in the E-SW-SETUP programming software.

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and componentshydraulics, ISO 4413).

5.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

In case of double power supply see 5.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

5.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. The separate power supply for driver's logic on pin A3 and A4, allow to remove solenoid power supply from pin A1 and A2 maintaining

active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

5.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are ± 10 Vpc for standard and $4 \div 20$ mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vpc or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDc.

5.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference). Monitor output signal is factory preset according to selected valve code, default settings is ± 5 Vpc (1V = 1A). Output signal can be reconfigured via software, within a maximum range of ± 5 Vpc.

Option /W

The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure. The output maximum range is ±5 Vpc; default setting is 0 ÷ 5 Vpc.

5.5 Enable input signal (ENABLE)

To enable the driver, supply 24 Vbc on pin B1: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

5.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 Vbc, normal working corresponds to 24 Vbc. Fault status is not affected by the Enable input signal

5.7 Remote pressure transducer input signal (TR+) - only for /W option

Analog pressure transducers can be directly connected to the driver.

Analog pression and a status of the directly connected when the direct of the direct status of the direct of the Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

5.8 Output supply for external potentiometer (±5V_REF) - not available for EH version

The reference analog signal can be generated by one external potentiometer directly connected to the driver, using the ±5 V_{DC} supply output available at pin F1 and F4.

Note: using an external potentiometer, the reference input signal must be set via software at ±5 Vbc (default ±10 Vbc, see 5.3)

5.9 Possible combined options: /AI, /AW, /IW, /AIW, /ACW, /CIW, /ACIW, /CW

6 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital drivers via USB service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers USB port is not isolated! For E-C-SB-USB/BM cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

Note: Bluetooth connection is not available for E-BM-AES drivers

USB connection



7 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW-SETUP programming software:

E-MAN-BM-AES - user manual for E-BM-AES

7.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value.

This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.

Two different Scale regulations are available for double solenoid valves: ScaleA for positive reference signal and ScaleB for negative reference signal.

7.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.

This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (analog or fieldbus external input).

The Bias function is activated when the reference signal overcomes the Threshold value, preset into the driver.

The Bias setting allows to calibrate the Bias current to the specific proportional valve to which the driver is coupled.

The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.

If fieldbus reference signal is active (see 5.3), threshold should be set to zero.

Two different Bias regulations are available for double solenoid valves: positive reference signals activate BiasA and negative reference signals activate BiasB.

Refer to the programming manuals for a detailed description of other software selectable Bias functions.

7.3 Offset

Proportional valves may be provided with zero overlapping in the hydraulic regulation corresponding to zero reference input signal (valve's central spool position).

The Offset function allows to calibrate the Offset current, required to obtain valve's spool central position, to the specific hydraulic system setup (e.g. valve applied to cylinder with differential areas).

7.4 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.

Different ramp mode can be set:

- single ramp for any reference variation

- two ramps for increasing and for decreasing reference variations

- four ramps for positive/negative signal values and increasing/decreasing reference variations Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.

If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting).

7.5 Linearization - E-SW-SETUP level 2 functionality

Linearization function allows to set the relation between the reference input signal and the controlled valve's regulation.

Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition.

7.6 Variable Dither

The dither is the frequency modulation of the current supplied to the solenoid. To reduce the hysteresis should be selected a lower value of frequency, despite a lower regulation stability, because a small vibration in the valve regulating parts considerably reduces static friction effects.

To improve the regulation stability, should be selected a high value of frequency, despite a higher hysteresis. This solution in some application can lead to vibration and noise. Normally, the right setting is a compromise and depends on system setup.

E-BM-AES drivers allow to realize a variable dither frequency that linearly depends on the demanded current: variable dither frequency allows an higher degree to optimize the valve hysteresis.

7.7 Hydraulic Power Limitation - only for /W option

Digital E-BM-AES drivers with /W option electronically perform hydraulic power limitation on:

- direct and pilot operated flow control valves
- direct and pilot operated directional control valves + mechanical pressure compensator

- variable displacement pumps with proportional flow regulator (e.g. PVPC-*-LQZ, tech table $\ensuremath{\textbf{AS170}}\xspace$

The driver receives the flow reference signal by the analog external input INPUT+ (see 5.3) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR (see 5.7).

When the actual requested hydraulic power pxQ (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

Flow regulation = Min (<u>PowerLimit [sw setting]</u>; Flow Reference [INPUT+]) Transducer Pressure [TR]

7.1, 7.2 - Scale, Bias & Threshold











7.5 - Linearization



7.6 - Variable Dither



7.7 - Hydraulic Power Limitation



8 OVERALL DIMENSIONS [mm]



9 INSTALLATION



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot (eg. connector A can not be inserted into connector slot of B, C, E, F, G, H)

atos 🛆

Digital electronic E-BM-AS drivers

DIN-rail format, for proportional valves without transducer



1 MODEL CODE



(see 7.7)

E-BM-AS

Digital drivers control the current to the solenoid of Atos proportional valves without transducer, according to the electronic reference input signal.

The solenoid proportionally transforms the current into a force, acting on the valve spool or poppet, against a reacting spring, thus providing the hydraulic regulation. E-BM-AS can drive up to two single or one double solenoid proportional valves.

Electrical Features:

- 4 fast plug-in connectors ①
- RJ45 connector (2) for RS232 Serial communication to program the driver with the Atos PC software
- 4 leds for diagnostics (3) (see section 10)
 ±5 Vpc output supply for external referen-
- ce potentiometers (/P option)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for the hydraulic regulation
- 2 selectable modes for electronic reference signal: external analog input or internal generation
- /W option max power limitation function
- Complete diagnostics of driver status

2 BLOCK DIAGRAM

proportional valves



3 MAIN CHARACTERISTICS

Power supply (see 4.1)	Standard option /12Nominal: +24 VDC Nominal: +12 VDCRectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)Rectified and filtered: VRMS = 10 ÷ 14 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W01H single solenoid valve and 05H double solenoid valve100 W05H two single solenoid valves			
Current supplied to solenoids	IMAX = 2.7 A with +24 VDC power supply for standard proportional valves (3,2 Ω solenoid) IMAX = 3.3 A with +12 VDC power supply for proportional valves with /6 option (2,1 Ω solenoid) IMAX = 2.5 A with +24 VDC power supply for ex-proof proportional valves (3,2 Ω solenoid) for /A option			
Analog input signal (see 4.2)	Voltage: range ± 10 VDCInput impedance:Ri > 50 k\OmegaCurrent: range ± 20 mAInput impedance:Ri = 500 Ω			
Enable input (see 4.5)	Range : 0 ÷ 24 VDC (OFF state: 0 ÷ 0,75 VDC ; ON state: 0,75 ÷ 24 VDC) Input impedance: Ri > 10 k Ω			
Optical insulated ON/OFF inputs (see 4.7)	$\begin{array}{ c c c c c c c c } \hline Range: 0 \div 24 \ \text{VDC} \ (\ \text{OFF state:} 0 \div 9,5 \ \text{VDC} \ ; \ \text{ON state:} 9,5 \div 24 \ \text{VDC} \) \\ \hline Input \ impedance: Ri > 10 \ k\Omega \end{array}$			
Output supply (see 4.4)	±5 VDC @ max 10 mA : output supply for external potentiometers (only for /P option)			
Status output (see 4.6)	Output range : 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 1,4 A			
Alarms	Solenoid not connected, short circuit and cable break with current reference signal			
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm rail mounting as per EN60715			
Operating temperature	$-20 \div +60 \degree$ C (-20 ÷ +40 °C for 05H version if drive two single solenoid proportional valves; storage -25 ÷ +85 °C)			
Mass	130 g			
Additional characteristics	Short circuit protection of current output to solenoids; protection against reverse polarity of power supply			
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-4) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006			
Communication interface	RS232 serial connection (not insulated), Atos protocol with ASCII coding (see section 9)			
Recommended wiring cable	LiYCY shielded cables: 0,5 mm ² for length up to 40 m [1,5 mm ² for power supply and solenoids]			
Max conductor size (see section 12)	2,5 mm ²			

4 POWER SUPPLY AND SIGNALS SPECIFICATIONS

4.1 Power supply

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse for 01H single solenoid valve and 05H double solenoid valve 5 A time lag fuse for 05H two single solenoid valves

Option /12

This driver execution is designed to receive a 12 VDC power supply and it is commonly used in mobile application. A safety fuse is required in series to each driver power supply:

/Ì	∖ A safety fuse is required in series to each power supply	4 A time lag fuse for 01H single solenoid valve and 05H double solenoid valve
	7	6,3 A time lag fuse for 05H two single solenoid valves

4.2 Reference Input Signals (pin B1 and B3, both referred to pin B2)

The driver proportionally transforms the external reference input signal into the current supplied to the solenoid. The driver is designed to receive one (01H) or two (05H) analog reference inputs (CMD1 on pin B1, CMD2 on pin B3); both signals are referred to a common electric ground (CMD- on pin B2). CMD1 has to be used in case of 05H version that drives one double solenoid valve. CMD2 has to be used in case of 05H version that drives two single solenoid valves or transducer input for /W option (see 4.3). The input range is software selectable among voltage ($0 \div \pm 10$ VDC) or current ($4 \div 20$ mA with cable break detection or $0 \div \pm 20$ mA). Defaults for standard: $0 \div 10$ VDC for two position valves; $0 \div \pm 10$ VDC for three position valves (see valve's tech. table). Default for /I option: $4 \div 20$ mA (see valve's tech. table) Other ranges can be set by software. Internal reference generation is software selectable (see 7.6).

Note: software selection of analog input range (voltage or current) is applied to both signals CMD1 and CMD2.

4.3 Pressure Input Signal (pin B3 referred to pin B2) only for, /W option)

When hydraulic power limitation is active (see 7.7), input signal CMD2 must be connected to an external pressure transducer installed on the hydraulic system; maximum input range 0 ÷ 10 VDC.

4.4 Output supply Signal for external reference potentiometers (/P option)

The reference analog signals can be generated by one (01H) or two (05H) external potentiometers directly connected to the driver, using the ±5 VDC supply output available at pin C3 and C4. Reference input signal can be set up via software to ±5 VDC, in order to match potentiometer output signal.



4.5 Enable Input Signal (pin D3 referred to pin D2)

Enable input signal allows to enable/disable the current supply to the solenoids, without removing the electrical power supply to the driver; it is used to maintain active the serial connection and the other driver functions when the valve must be disabled for safety reasons. To enable the driver, supply a 24 VDC for standard or 12 VDC for option /12 on pin D3 referred to pin D2.

4.6 Status Output Signal (pin D4 referred to pin D2)

Status output signal indicates fault conditions of the driver (short circuits, solenoids not connected, cable broken for 4 ÷ 20mA input) and is not affected by Enable input signal status: fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC for standard or 12 VDC for option /12. When hydraulic power limitation function is active (see 7.7), status output signal can be software configured to indicate power limitation status: not active (0 VDC) or active (24 VDC for standard or 12 VDC for option /12).

4.7 ON/OFF Input Signals (pin C1...C4 referred to DGND pin B4)

Analog Drivers Compatibility - default for series 12 or higher

The four ON/OFF digital input signals (DI) can be used to activate compatibility functionalities with E-BM-AC and E-ME-AC analog drivers (see section 5). If digital inputs are not connected, the driver behavior corresponds to an E-BM-AS series 11 or lower or

Internal Reference Generation - software selectable

When the driver is configured in internal reference generation mode (see 7.6), the 4 ON/OFF input signals (DI) are used to select the active reference signal, among the available stored values. If the 4 ON/OFF input signals (DI) are not active, the driver can be commanded by external analog reference. The polarity of the digital inputs can be customized: default active status = 24 Vbc (standard) or 12 Vbc (option /12). **Note:** for /P option DI3 and DI4 are not available

4.8 Possible combined options:

/12W, /12PW, /12CIW, /AW, /ACIW, /APW, /CIW, /PW only for 05H /12I, /12P, /AI, /AP for 01H and 05H

5 ANALOG DRIVERS COMPATIBILITY - only for E-BM-AS series 12 or higher

E-BM-AS digital inputs (DI1..DI4) activate compatibility functionalities with E-BM-AC and E-ME-AC analog drivers:

REFERENCE COMPATIBILITY

Digital Inp	uts Signals	Digital driver	Analog driver	24 VDC to DI1 (1)	0 VDC to DI1	
DI1	24 VDC (1)		E-BM-AC 01F	E-BM-AC 01F	01H	
DI2	0 Vdc	E-BM-AS 01H	E-BM-AC 05F	Current 4 ÷ 20 mA / 0 ÷ 100%	See section 4.2	
DI3	0 VDC	E-BM-AS 05H	E-ME-AC 01F	05H	566 Section 4.2	
DI4	0 VDC		E-ME-AC 05F	Current 4 ÷ 20 mA / 0 ÷ 100%		

Notes: set 0 VDC to DI1 and power-off/on the driver to restore latest settings; (1) 12 VDC for option/12

REFERENCE INVERSION

Digital Inp	uts Signals	Digital driver	Analog driver	24 VDC to DI2 (1)	0 Vpc to DI2
DI1	24 VDC (1)				
DI2	24 VDC (1)			Voltage 0 ÷ 5 VDC / 0 ÷ -100%	Voltage 0 ÷ 5 VDC / 0 ÷ 100%
DI3	0 VDC	L-DIVI-A3 0311	L-IVIL-AC USI	Current 4 ÷ 20 mA / 0 ÷ -100%	Current 4 ÷ 20 mA / 0 ÷ 100%
DI4	0 Vdc				

Notes: to enable reference inversion, set 24 Vbc (standard) or 12 Vbc (option /12) to DI1 before driver power-on; (1) 12 Vbc for option /12

RAMP SWITCH OFF

Digital Inp	uts Signals	Digital driver	Analog driver	24 VDC to DI3 (1)	0 VDC to DI3
DI1	24 VDC (1)				
DI2	0 VDC	E-BM-AS 01H	E-ME-AC 01F	Ramp evoluded	Pamp activated
DI3	24 VDC (1)	E-BM-AS 05H	E-ME-AC 05F	hamp excluded	namp activated
DI4	0 VDC				

Notes: to enable ramp switch off, set 24 VDc (standard) or 12 VDc (option /12) to DI1 before driver power-on; DI3 not available for /P option; (1) 12 VDc for option/12

011F CONFIGURATION

Digital Inp	nputs Signals Digital driver		Analog driver	24 VDC to DI4 (1)	0 VDC to DI4
DI1	(*)				
DI2	(*)			Driver configuration 011E	Driver configuration 05H
DI3	(*)	L-DIVI-A3 USIT	L-DIVI-AC UT II		
DI4	24 VDC (1)			(*) = don't care	(*) = don't care

Notes: set 0 VDc to DI4 and power-off/on the driver to restore latest settings; DI4 not available for /P option; (1) 12 VDc for option/12

6 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital drivers via RS232 service port. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

WARNING: drivers RS232 port is not isolated!





7 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW-SETUP programming software:

E-MAN-BM-AS - user manual for E-BM-AS

7.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value.

This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.

For double solenoid valves two different Scale regulations are available:

ScaleA for positive reference signal and ScaleB for negative reference signal

7.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.

This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (external input or internally generated).

The Bias function is activated when the reference signal overcome the Threshold value, preset into the driver.

The Bias setting allows to calibrate the Bias current supplied to the solenoid of the specific proportional valve to which the driver is coupled.

The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.

If internal reference generation is active (see 7.6), threshold should be set to 0.

For double solenoid valves two different Bias regulations are available: positive reference signal activates BiasA for solenoid S1 and negative reference signal activates BiasB for solenoid S2

7.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid. Different ramp mode can be set:

- single ramp for any reference variation

- two ramps for increasing and for decreasing reference variations

- four ramps for positive/negative signal values and increasing/decreasing reference variations Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.

If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting)

7.4 Dither

The dither is an high frequency modulation of the current supplied to the solenoid, to reduce the hysteresis of the valve's regulation: a small vibration in the valve's regulating parts considerably reduces static friction effects.

Dither frequency can be set in a range from 80 to 500 Hz (default value is 200Hz).

Lower dither setting reduces the hysteresis but also reduces the regulation stability. In some application this can lead to vibration and noise: right setting usually depends on system setup. Default dither is a valid setting for a wide range of hydraulic applications

7.5 Linearization

Linearization function allows to set the relation between the reference input signal and the current supplied to the solenoid.

Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition (e.g. maximum pressure control at defined working flow)

7.6 Internal Reference Generation

Internal generation of reference values is software selectable.

In this mode the 4 digital inputs of the driver (DI1..DI4) allow to activate the desired internal reference signal, among the different driver's stored values: external control unit can thus manage complex machine profile by simple switching the reference signal, by 4 digital inputs (see 4.7).

The digital inputs are software configurable into 2 different reference selection mode:

- Standard mode
- each digital input corresponds to a different value; up to 4 different internal values are available (2+2 with E-BM-AS-PS-05H driving two single solenoid valves)
- Binary mode

each digital input combination corresponds to a different value; up to 15 different internal values are available (3+3 with E-BM-AS-PS-05H when driving two single solenoid valves)

A dedicated ramp time value can be set by software for each available stored reference value.

Note: with all input signals (DI) set to zero, the driver can be commanded by external analog reference also if internal reference generation is selected (for more information please refer to the programming manual E-MAN-BM-AS).

7.1, 7.2 - Scale, Bias & Threshold



7.3 - Ramps







7.5 - Linearization



7.6 - Internal Reference Generation



7.7 Hydraulic Power Limitation (/W option, only for drivers E-BM-AS-PS-05H)

- E-BM-AS drivers with /W option electronically perform hydraulic power limitation on:
- direct and pilot operated flow control valves

- direct and pilot operated directional control valves + mechanical pressure compensator

- variable displacement pumps with proportional flow regulator

(e.g. PVPC-*-LQZ, tech. table AS170)

The driver receives the flow reference signal by the analog external input CMD1 (see 4.2) or by the internal generator (see 7.6) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input CMD2.

When the actual requested hydraulic power $\mathbf{p} \times \mathbf{Q}$ (CMD2xCMD1) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

Flow regulation = Min (PowerLimit [sw setting] Transducer Pressure [CMD2]; Flow Reference [CMD1])



8 CONNECTIONS

The 4 fast plug-in connectors (A,B,C,D), included in the supply, provide simple wirings, easy driver's replacement and the possibility to test the signals directly on the connectors.

CONNECTOR	PIN	SIGNAL	TECHNICAL	SPECIFICATIONS	NO	TES	
•	A1 A2	SOL S1	Current to solenoid S1			Output power PWM	
A	A3 A4	- SOL S2	Current to solenoid S2 (only for 05H version)				
	B1	CMD1	Reference analog input: ±10 VDc / ± 20 mA	Reference analog input: ± 10 Vpc / ± 20 mA maximum range software selectable (see 4.2)			
			Standard	/P option (see 4.4)			
В	B B2 CM	CMD-	Zero signal, ground for reference signals	Reference for ±5 Vpc output (AGND)	Input - analog signal		
	B3	CMD2 (1)	Reference analog input: ±10 Vpc / ± 20 mA maximum range software selectable (see 4.2)]	
	B4	DGND	Optical insulated ground for on/off inputs (DI1 ÷ DI4)				
			Standard	/P option (see 4.4)	Standard	Option /P	
	C1	DI1		Optical insulated on/off input 0 ÷ 24 Vbc (2)			
С	C2	DI2	Optical insulated on/off input $0 \div 24$ Vpc (2)	For analog driver compatibility see section 5	linput - on/	on signai	
	C3	DI3	For analog driver compatibility see section 5	+5 Vpc @ 10 mA output supply to pin B2 (AGND)	Input -	Output -	
	C4	DI4	•	-5 VDC @ 10 mA output supply to pin B2 (AGND)	on/off	analog	
	D1	V+	Power supply 24 Vpc for standard or 12 Vpc for option /12 (see 4.1)				
P	D2	VO	Power supply 0 Vbc			- Input - power supply	
U	D3	ENABLE	Enable (24 VDC for standard or 12 VDC for op	otion /12) or disable (0 Vbc) the driver (see 4.5)	Input - on/off signal		
	D4	STATUS	Fault (default) or software selected output (see 4.6)			n/off signal	

(1) Only for 05H version, when used to drive two single solenoid valves or transducer input for /W option; (2) 0 ÷ 12 Vbc for option/12 WARNING: if CMD2 is not used has to be connect to CMD- (ground)

9 RJ45 CONNECTOR

		RJ45 CONNECTOR
PIN	SIGNAL	DESCRIPTION
1	/	Not connected
2	/	Not connected
3	/	Not connected
4	GND	Signal zero data line
5	RX	Driver receiving data line
6	TX	Driver transmitting data line
7	/	Not connected
8	/	Not connected



7.7 - Hydraulic Power Limitation

p1 x Q1 = max power limit

10 DIAGNOSTIC LEDS

Four leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION	
L1	OREEN	POWER	OFF	Power supply OFF	
	GREEN		ON	Power supply ON	
L2		STATUS	OFF or ON	Fault conditions	
	GREEN		Slow blinking	Driver disabled	
			Fast blinking	Driver enabled	
L3 and L4	YELLOW	YELLOW S1 and S2	OFF	PWM command OFF	
			ON	PWM command ON	L3
			Slow blinking	Coil not connected	
			Fast blinking	Short circuit on the solenoid	

11 OVERALL DIMENSIONS [mm]



12 INSTALLATION



atos 🛆

Digital electronic E-MI-AS-IR drivers

DIN 43650 plug-in format, for proportional valves without transducer





(1) ZH-5P female connector must be ordered separately

2 BLOCK DIAGRAM



E-MI-AS-IR

Digital drivers are designed for mounting on the solenoid's DIN connector of proportional valves without transducer. They supply and control the current to the solenoid according to the electronic reference input signal. The solenoid proportionally transforms the current into a force, acting on the valve spool or poppet, against a reacting spring, thus providing the valve's hydraulic regulation.

E-MI-AS drivers can drive single or double solenoid proportional valve.

Electrical Features:

- Standard 5m cable connection ① or M12 connector (/M12 option)
- Infrared communication interface ② to program the driver with Atos PC software
- 2 leds for diagnostics (see 9)
- +5 Vbc output supply for external reference potentiometer (not available for /M12 option)
- Operating temperature range: -20° ÷ +50°
- Current reference input (/I option)
 Plastic box with IP65 protection degree
- Plastic box with IP65 protection degree and standard DIN43650 plug-in format with double earth connection to allow double-side orientation
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for the hydraulic regulation
- 2 selectable modes for electronic reference signal: external analog input or internal generation
- /W option max power limitation function (see 6.7)
- Complete diagnostics of driver status

3 MAIN CHARACTERISTICS

Power supply (see 4.1)	Nominal: +24 Vbc Nominal: +12 Vbc	Rectified and filtered Rectified and filtered	d: VRMS = 20 ÷ 27 VMAX (rip d: VRMS = 10 ÷ 14 VMAX (rip	ople max 10 % VPP) ople max 10 % VPP)	
Max power consumption	50 W				
Current supplied to solenoids	$\begin{array}{l} \text{Imax} = 2.7 \text{ A with } +2.1 \text{ A with } +2.1 \text{ A with } +1.1 $	4 Vbc power supply to 2 Vbc power supply to	o drive standard proportion	al valves (3,2 Ω soler with /6 option (2,1 Ω	noid) solenoid)
Reference input signal (1) (CMD1 - see 4.2)	Standard (voltage) /I option (current)	Input range: Input range:	0 ÷ 10 V _{DC} 4 ÷ 20 mA / 0 ÷ 20 mA	Input impedance: Input impedance:	$\begin{array}{l} {\sf Ri} > 50 \; {\sf k}\Omega \\ {\sf Ri} = 500 \; \Omega \end{array}$
Enble Input Signal (CMD2 - see 4.5) ON/OFF Input Signal (CMD1,CMD2 - see 4.6)		Input range: Input impedance:	0 \div 24 Vpc (OFF state: 0 Ri > 10 k Ω) ÷ 5 VDC; ON state: 9	÷ 24 Vpc)
Pressure transducer input (CMD2 - see 4.3)	/W option	Input range:	0 ÷ 10 VDC	Input impedance:	${ m Ri}$ > 50 k Ω
Output supply (see 4.4)	+5 V @ max 5 mA: o	utput supply for extern	nal potentiometer (not avail	able for /M12 option)
Alarms	Solenoid coil not con	nected, short circuit a	and cable break with curre	nt reference signal (/I	option)
Format	Plastic box ; IP65 pro	otection degree (when	fixed on solenoid); DIN43	3650 format	
Operating temperature	-20 ÷ +50 °C (storag	e -25 ÷ +85 °C)			
Mass	Standard version: 45	0 g; /M12 option: 70 g]		
Additional characteristics	Short circuit protection	on of current output to	solenoid		
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-4) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				
Communication interface	Infrared, Atos protocol with ASCII coding; E-A-PS-USB/IR adapter is required (see section 5)				
Wiring cable characteristics	2 poles x 0,5 mm ² pl	us 4 poles x 0,35 mm ²	² , external diameter 7,4 mr	n	

(1) Negative reference input signal not allowed

4 POWER SUPPLY AND SIGNALS SPECIFICATIONS

4.1 Power supply

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

According to power supply value, a safety fuse is required in series to each driver:

+24 VDC - 2,5 A time lag fuse +12 VDC - 4 A time lag fuse

4.2 Reference Input Signal (CMD1: yellow/pin 4, referred to AGND: white/pin 3)

The driver proportionally transforms the external reference signal input into the current supplied to the solenoid. The driver is designed to receive one analog reference input (CMD1 on yellow/pin 4) referred to the analog electric ground (AGND on white/pin3) and with a maximum range of 0 ÷ 10 Vpc . Internal reference generation is software selectable (see 6.6). Option /I (current reference input) The reference input signal maximum range is software selectable among current 4 ÷ 20 mA (with cable break detection) or 0 ÷ 20 mA.

4.3 Pressure Input Signal (CMD2: blue/pin 5) - only for /W option

When hydraulic power limitation is active (see 6.7), enable input (CMD2) is managed as an analog input and has to be connected to an external pressure transducer installed on the hydraulic system; maximum input range 0 ÷ 10 Vpc. 4.4 Output supply for external potentiometer - (OUTPUT SUPPLY: green, referred to AGND: white) - not available for /M12 option

- The reference analog signal can be generated by an external potentiometer directly connected to the driver, using the +5Vbc supply output available at green wire thus generating the desired reference signal.
- 4.5 Enable Input Signal (CMD2: blue/pin 5, referred to AGND: white/pin 3) Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to maintain active the infrared connection and the other driver functions when the valve must be disabled for safety reasons.

To enable the driver, supply a 24Vbc on CMD2 (blue/pin 5, referred to white/pin 3).

The polarity of the enable input can be customized and the enable function can be deactivated, see table at side.

- 4.6 ON/OFF Input Signals (CMD1: yellow/pin 4, CMD2: blue/pin 5) When the driver is configured in internal reference generation mode (see 6.6), both reference input (CMD1) and enable input (CMD2) are managed as ON/OFF input signals. In this mode they are used to select the active reference signal, among the available stored values.
- 4.7 Possible combined options: /IM12, /IM12W, /IW and /M12W

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital drivers via infrared adapter. Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at

www.atos.com in MyAtos area.





ENABLE CONFIGURATION					
Signal	default polarity	reverse polarity	deactiveted		
$9 \div 24 \text{ VDC}$	solenoid ON	solenoid OFF	solenoid ON		
0 ÷ 5 V	solenoid OFF	solenoid ON	solenoid ON		

Infrared connection



Adapter, to be ordered separately :

E-A-PS-USB/IR = adapter from USB connector (PC communication port) to driver infrared communication interface: plug the adapter on the driver to establish the infrared communication



6 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the

user manual included in the E-SW-SETUP programming software:

E-MAN-MI-AS - user manual for E-MI-AS-IR

6.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value.

This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also usefull to reduce the maximum valve regulation in front of maximum reference signal.

6.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.

This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (external input or internally generated).

The Bias function is activated when the reference signal overcome the Threshold value, preset into the driver.

The Bias setting allows to calibrate the Bias current supplied to the solenoid of the specific proportional valve to which the driver is coupled.

The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.

If internal reference generation is active (see 6.6), threshold should be set to 0.

6.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.

Different ramp mode can be set:

- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.

If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting)

6.4 Dither

The dither is an high frequency modulation of the current supplied to the solenoid, to reduce the hysteresis of the valve's regulation: a small vibration in the valve's regulating parts considerably reduces static friction effects.

Dither frequency can be set in a range from 80 to 500 Hz (default value is 200Hz).

Lower dither setting reduces the hysteresis but also reduces the regulation stability. In some application this can lead to vibration and noise: right setting usually depends on system setup. Default dither is a valid setting for a wide range of hydraulic applications

6.5 Linearization

Linearization function allows to set the relation between the reference input signal and the current supplied to the solenoid.

Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition (e.g. maximum pressure control at defined working flow)

6.6 Internal Reference Generation

Internal generation of reference values is software selectable.

In this mode the 2 driver inputs (see 4.6) allow to select the desired solenoid current reference signal, among the different internal stored values: external control unit can thus manage complex machine profile by simple switching of the reference signal, by 2 digital inputs (see 4.6).

Each digital input combination corresponds to a different reference value; up to 4 different internal values are available:

	Internal generated references					
	REF1 REF2 REF3 REF4					
CMD1	0	24 VDC	24 VDC	0		
CMD2	0	0	24 VDC	24 Vpc		

A different ramp time value can be set by software for each available stored reference value.

6.7 Hydraulic Power Limitation (/W option)

E-MI-AS drivers with /W option electronically perform hydraulic power limitation on single solenoid valves:

- flow control valves (direct and pilot operated)

- directional control valves (direct and pilot operated) + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator (e.g. PVPC-*-LQZ, tab. AS170)

The driver receives the flow reference signal by the analog external input CMD1 (see 4.2) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input CMD2 (see 4.3).

When the actual requested hydraulic power \mathbf{pxQ} (CMD2xCMD1) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure transducer feedback the lower is the valve's regulated flow:

Flow regulation = Min ($\frac{PowerLimit [sw setting]}{Transducer Pressure [CMD2]}$; Flow Reference [CMD1])

6.1, 6.2 - Scale, Bias & Threshold











6.5 - Linearization



6.6 - Internal Reference Generation



6.7 - Hydraulic Power Limitation



7 CONNECTIONS

Standard cable wire color	/M12 option pin	SIGNAL	TECHNICAL SPECIFICATIONS		NOTES
RED	1	V+	Power supply +24 Vbc or +12 Vbc (see 4.1)	Input	power supply
BLACK	2	VO	Power supply 0 Vbc	Input	- power suppry
WHITE	3	AGND (Signal zero)	Ground for CMD1,CMD2 and OUTPUT SUPPLY	Input	- analog signal
GREEN	N.A.	OUTPUT SUPPLY	+5 Vbc @ 5 mA output supply for external potentiometer (not available for option /M12) (see 4.4)	Output	- analog signal

The two input signals CMD1 and CMD2 can be managed as analog input or ON/OFF signals; their function depends on the selected software setting:

Standard cable	/M12 option		TECHNICAL SPE	CIFICATIONS (software	setting dependent)	
wire color	pin	SIGNAL	Default (see 4.2 : 4.5)	Internal Reference Generation (see 4.6 : 6.6)	Hyraulic Power Limitation (only for /W option - see 4.3 : 6.7)	NOTES
YELLOW	4	CMD 1	Reference analog input: 0 ÷ 10 Vpc (4 ÷ 20 mA; 0 ÷ 20 mA for /l option)	ON/OFF: 24 Vpc / 0 Vpc	Reference analog input: 0 ÷ 10 Vpc (4 ÷ 20 mA; 0 ÷ 20 mA for option /l)	Input applog or digital
BLUE	5	CMD 2	Enable/disable the driver: 24Vpc / 0Vpc	ON/OFF: 24 VDC / 0 VDC	Pressure transducer input: 0 ÷ 10 VDc	input - analog of digital

8 DOUBLE SOLENOID VALVES OPERATION

It is possible to use two E-MI-AS drivers to operate one double solenoid proportional valve supplying the same analog signal to both CMD1 inputs reference. The enable input signal is used to select which driver/solenoid has to be active.

To operate double solenoid valves it is required to:

- parallel wire the two drivers (see following scheme).
- select opposite polarity (default and reverse) for the two enable signals (see 4.5)
- manage from PLC or machine unit: 1 analog reference signal corresponding to desired valve's regulation and 1 ON/OFF signal to select the active solenoid.



Numbers inside brackets are referred to 5 poles connector (option /M12)

9 DIAGNOSTIC LEDS

It is possible to verify the actual status of solenoid command (yellow LED) and the driver status (green LED). The following table details the possible displayed conditions:

	COIL (YELLOW LED)			
Light signal displayed	Coil status			
Light Off	PWM command OFF			
Light On	PWM command ON			
Slow blinking	Solenoid not connected			
Fast blinking	Short circuit on the solenoid			
STATUS (GREEN LED)				
Light signal displayed	Driver status			
Light Off	Absence of power supply			
Light On	Malfunctioning			
Slow blinking	Driver disabled or Alarm present			
Fast blinking	Driver enabled			



10 OVERALL DIMENSIONS [mm] AND INSTALLATION



Analog electronic E-MI-AC drivers

DIN 43650 plug-in format, for proportional valves without transducer



MODEL CODE 1

* * E-MI AC 01F _ On-board electronic driver Set code (see 4.4) DIN 43650 plug-in format Series number AC = for proportional valve without transducer **Options:** = standard symmetrical ramps RR = adjustable dissimmetrical ramps, adjustable dither,

7

01F = for single solenoid proportional valve

2 BLOCK DIAGRAM



E-MI-AC

Analog drivers control the current to the solenoid of Atos proportional valves without pressure or LVDT position transducer, regulating the spool position, the flow or the pressure according to the electronic reference signal.

Features:

- · bias and scale regulations by potentiometers
- symmetrical (standard) or dissymmetrical (/RR option) rising and falling ramp generator
- factory pre-set
- alluminium box with IP65 protection degree
- · electronic filters on input and output lines
- CE mark according to EMC directive

Applications:

suitable also for current signal 0÷20 mA

= pre arranged for double solenoid valves control

Pressure, flow, position open or closedloop systems, according to the block diagram 2.

3 MAIN CHARACTERISTICS

Power supply (see 4.1)	Nominal: +24 VDCRectified and filtered: VRMS = 21 ÷ 33 VMAX (ripple max 10 % VPP)Nominal: +12 VDCRectified and filtered: VRMS = 10 ÷ 14 VMAX (ripple max 10 % VPP)
Max power consumption	50 W
Current supplied to solenoid	IMAX= 2,7 A type PWM square wave (with solenoid type ZO(R)-A with resistance 3,2 Ω)
Nominal reference signal (factory preset)	0 ÷ 10 VDC
Reference signal variation range (scale adjustment)	0 ÷ 10 VDC (0 ÷ 5 VMIN) – (0 ÷ 20 mA for current signal)
Input signal impedence	Voltage signal Ri > 50 k Ω – (Ri = 250 Ω for current signal)
Potentiometers supply	+5 V / 10 mA at contact 3
Ramp time	10 sec. max (0 ÷ 10 V of reference signal)
Format	Box equipped with DIN 43650-IP65 plug; VDE 0110 wired on solenoid
Operating temperature	0 ÷ +50 °C (storage -20 ÷ +70 °C)
Mass	190 g
Additional characteristics	Outputs to solenoids protected against accidental short circuits
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-4) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006
Connections	7 contacts – terminal strip
Recommended wiring cable	LiYCY shielded cables: 0,5 mm ² up to 1,0 mm ² (20 AWG - 18 AWG)

4 GENERAL SPECIFICATIONS

4.1 Power supply and wiring

The power supply must be appropriately stabilized or rectified and filtered. If the power supply is generated by a single phase rectifier use a 10000 μ F/40V capacitor; if pulse voltage is generated by a three phase rectifier, connect a 4700 μ F capacitor (see 1).

Connect the reference signal to the main electronic control by means of shielded and twisted cables. Pay attention: the negative and the positive poles must not be exchanged each other. Shield the wirings to avoid electromagnetic noise (EMC), connecting the shield to noiseless earth (TE), see [1]. It is suitable to keep the driver and its cables far from any electromagnetic radiation source (like cables where high currents flow, electric motors, transformers, relays, solenoids, portable radio-transmitter, etc.).

The 12 VDc electric voltage supply is allowed only after evaluation of the performances required from the proportional valves, and however after check with our technical office.

According to power supply value, a safety fuse is required in series to each driver: +24 VDC - 2,5 A time lag fuse +12 VDC - 4 A time lag fuse

4.2 Reference signal, see 5.

The electronic driver is designed to receive a voltage reference signal according to the following options:

- potentiometers mounted externally and wired according to the application diagrams.
- external reference signals generated by PLC, see 11.
- voltage from 0 to 10V
- current from 0 to 20 mA (only with /RR option).

4.3 Monitor signal

This voltage output signal allows to measure the current supplied to the coil, read by a voltmeter between the test point M and pin 2 (see 9).

Reading scale is 1 mV = 10 mA (eg.: if the voltage signal is 70 mV, coil current is 700 mA). To visualize the signals use voltmeters with impedance >10 K Ω .

4.4 Set code

Basic calibration of the electronic driver is factory pre-set, according to the proportional valve it has to be coupled with. These pre-calibrations are identified by a standard number in the model code as follows:

1 = RZGO (KZGO)	2 = RZMO, AG*ZO, LI*ZO
3 = DHZO, DKZOR	4 = DPZO-A-*5
$6 = QV^*ZO(R)$	8 = DHZE, DKZE

4.5 Calibrations available to the user, see 7, 8, 9, 11.

Scale

The relation between driving current and reference signal can be regulated with the Scale adjustment.

Bias (dead band)

Regulation of dead band adjusts the hydraulic zero of the valve (starting position adjustment) to the corresponding electrical zero. The electronic card is factory pre-set for the valve it is coupled with, according to the set code (see section 4.4). An output current is obtained when the input voltage is 100 mV or greater.

Ramps see 7, 9.

The internal ramp generator circuit converts a step input signal into a slowly increasing output signal (solenoid current).

The rise/fall time of the current is set via internal potentiometer P1 up to a max. time of 10 sec. for 0-10V of reference signal. The **/RR** option provides dissimmetrical ramps, ramp up is set via P1 potentiometer and ramp down is set via P2.

Dither

With the **/RR** option the dither frequency adjust is allowed from 100 Hz to 500 Hz.

5 EXTERNAL REFERENCE SIGNALS



6 INSTALLATION AND START-UP

It is advisable to perform calibration procedures in the order given below:

6.1 Warning

- Never insert or remove the driver while the electronic system is powered on.
- Refer to 9 to identify components mentioned in calibration procedures.
- The E-MI-AC electronic drivers are designed to work in open loop system, where the coupled proportional valve is not required to work at its limits.

6.2 Start-up

Factory pre-set adjustments might not meet the requirements desired for the specific application. Performances can be optimized by on-site re-adjustments of Bias, Scale and Ramps potentiometers, in sequence.

Remove the cover and connect the electronic driver according to the desired connection diagram, see 5.

For double solenoid valves two electronic drivers type E-MI-AC-01F/7 must be used connected as shown in 5.

Start-up instructions are the same for each driver.

On the first driver two cable clamps must be mounted, one for the external wirings and one to give power and signal to the second driver which is equipped with one cable clamp and one blind plug.

A differential voltage signal -10 V ÷ +10 V must be supplied to the first driver.

Note that the first driver will work with signal from 0 to 10V while the second driver will work with signal from 0 to -10 V.

 The current supplied to the coil can be measured by a voltmeter connected between pins M and 2 of the screw terminal. The reading range will be: I[mA]=10xV[mV] (for example reading 70 mV the current in the coil will be 700 mA).

Bias adjustment (dead band compensation) see 8, 9

- Supply electrical power to the driver; supply a reference signal voltage = 0,1 VDC. Gradually
- turn the P4 bias potentiometer until a movement of the controlled actuator is obtained.
- Turn in the opposite direction until the actuator is stopped.

Scale adjustment, see 8, 9.

Supply max. current reference signal; check if the current in the coil reaches the max. value desired, turning P3 clockwise (see the regulation curve of the employed valve used).

Ramps see 7, 9.

Turning the ramp potentiometer clockwise, acceleration and deceleration time can be increased to obtain the optimization of the complete system.

9 REGULATIONS LAYOUT



10 IMPORTANT INSTRUCTIONS

ELETTROMAGNETIC COMPATIBILITY

Actos electronic drivers and proportional valves are designed according to the 2014/30/UE Directive (Electromagnetic Compatibility) and according to EN 50081-2 (Emission) and EN 50082-2 (Immunity) standards. The electromagnetic compatibility of electronic drivers is valid only for wirings realized according to the typical electric connections shown in this technical table. The device must be verified on the machine because the magnetic field may be different from the test conditions. SAFETY The electrical signals (for example reference signals, feedback and enable signal) of electronic drivers must not be used to realize safety condi-

The electrical signals (for example reference signals, feedback and enable signal) of electronic drivers must not be used to realize safety conditions of the machine. This is in accordance with the provisions of European directives (Safety requirements of fluid technology systems and components-hydraulics, EN 982). Special attention must be payed to switch-on/switch-off of electronic drivers because they could produce uncontrolled movements of actuators operated by the proportional valves.



8 BIAS AND SCALE



11 WIRING BLOCK DIAGRAM



12 OVERALL DIMENSIONS [mm]



13 EARTH CONNECTIONS







	N	Size	Qmax [I/min]	Table	Pag			
Programming tools for valv	e drivers and axis controls			GS500	941			
Fieldbus features	Fieldbus features							
Younting surfaces for electrohudraulic valves								
Mounting surfaces and cav	ities for cartridge valves			P006	962			
AXIS CONTROLS								
servoproportional direction	als							
DLHZO-TEZ	direct, zero overlap, sleeve execution,	06 ÷ 10	70 ÷ 130	FS610	562			
DLKZOR-TEZ	on-board driver & axis card	00 · 10	70 - 130	1 3010	502			
DHZO-TEZ, DKZOR-TEZ	direct, zero overlap, on-board driver & axis card	06 ÷ 10	80 ÷ 180	FS620	578			
DPZO-LEZ	piloted, zero overlap, on-board driver & axis card	10 ÷ 35	180 ÷ 3500	FS630	593			
electronics, DIN-rail FN 60	715							
Z-BM-TEZ. Z-BM-LEZ	off-board driver & axis card for servoproportional direc	tionals		GS330	613			
Z-BM-KZ	off-board axis card for servoproportional directionals			GS340	625			
servoactuators								
AZC	servocylinder plus servoproportional directional with o	n-board driv	ver & axis card	FS700	637			
SERVOPUMPS								
SSP servopumps	high performance & energy saving p/Q servopumps			AS100	641			
For complete servopumps of	documentation see KTP catalog							
p/O CONTROLS								
servoproportional & high p	erformance directionals							
DLHZO-TES, DLKZOR-TES	direct, zero overlap, sleeve execution, on-board driver	06 ÷ 10	70 ÷ 130					
DHZO-TES, DKZOR-TES	direct, positive or zero overlap, on-board driver	06 ÷ 10	80 ÷ 180					
DPZO-LES	piloted, positive or zero overlap, on-board driver	10 ÷ 35	180 ÷ 3500	FS500	651			
LIQZP-LES	3 way cartridge, piloted, on-board driver	25 ÷ 80	500 ÷ 5000					
electronics, DIN-rail EN 60	715							
E-BM-TES, E-BM-LES	off-board driver for servoproportional & high performa	nce directio	nals, fieldbus	GS240	520			
variable displacement pum	as, axial piston							
PVPC proportional	flow, pressure or p/Q controls			AS170	655			
For complete pumps docum	nentation see KTP catalog							
ACCESSORIES								
E-ATR-8	pressure transducer with amplified analog output sign	al		GS465	912			
BA	single station subplates, mounting surfaces ISO 4401	6264 and ⁶	5781	K280	918			
	for transducers, pumps, on-off and proportional values	5		K800	926			
		-						
OPERATING INFORMATIO	N							
Operating and maintenanc	e information for proportional valves			FS900	968			

Supplementary components range available on www.atos.com

atos 🛆

Digital servoproportionals with on-board axis card

direct, single solenoid, sleeve execution, with LVDT transducer and zero spool overlap, autotuning



(1) Not available for configuration 60 (2) For possible combined options, see section 19

2 POSITION CONTROL

2.1 External reference signal

Axis card controls in closed loop the actuator position according to a position reference signal from the machine central unit.

Position profile can be managed in two ways (software selectable):

- Without trajectory generation (a): the axis card receives from the machine central unit the position reference signal and follows it at any given instant - With trajectory generation (b): the axis card receives from the machine central unit just the final target position and internally generates a
- With trajectory generation (D): the axis card receives from the machine central unit just the final target position and internally generates a position profile limiting acceleration, velocity and deceleration

The position reference signal can be software selected between Analog reference (c) and Fieldbus reference (d). Refer to the axis card user manual for further details on position control features.



2.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands (e) or Fieldbus commands (f). Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



3 ALTERNATED POSITION / FORCE CONTROL

SF and SL controls add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase 2) and 4) at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations



SF - position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on A and B hydraulic lines.

SL - position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on the hydraulic actuator.

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault
- Atos technical office is available for additional evaluations related to specific applications

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital axis controls via Bluetooth/USB service port. Atos Z-SW-SETUP PC software supports all Atos digital axis controls and it is available at www.atos.com in MyAtos area.



WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500**

Bluetooth or USB connection



6 SMART START-UP

The automatic procedure supports the user during the commissioning phases of the axis control with guided procedures:

General setting

It assists the user in system data setup, as like cylinder stroke, diameters, load mass, configure analog/digital signals and communication interface, position transducer setup.

System check

It automatically executes position open loop movements to set axis control parameters, position transducer calibration and verify cylinder stroke.

Position autotuning

It automatically determines the optimal PID parametrization of the position control adapting the dynamic response to guarantee control precision and axis stability. Once the procedure is started, the control performs few automatic position open loop movements of the actuator, during which control parameters are calculated and stored.

7 SMART TUNING

Once the Smart Start-up procedure has been completed, the Smart tuning feature allows to further refine the position control response by choosing from 3 different levels of performance in positioning:

- **dynamic** best dynamics and accuracy (default factory setting)

- **balanced** average dynamics and accuracy

- **smooth** attenuated dynamics and accuracy to improve control stability in critical applications or in environments with electrical disturbances Settings can be changed any time via Z-SW-SETUP software or fieldbus.

If required, control performance can be further customized by modifying PID parameter via Z-SW-SETUP software.



8 MULTIPLE SETS

Multiple PID sets allows to easily switch axis behaviour according to machine cycle, selecting between independent groups of parameters for:

- position control PID

- force control PID and p/Q logics switching criteria

Settings can be changed any time via Z-SW-SETUP software, fieldbus or digital input signals.

9 FIELDBUS - see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

10 SAFETY OPTIONS

Atos range of proportional directional valves, provides functional safety options /U and /K, designed to accomplish a safety function, intended to reduce the risk in process control systems.



They are TÜV certified in compliance to IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e

Safe double power supply, option /U: the axis card has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table FY100

Safety function via on/off signals, option /K: upon a disable command, the axis card checks the spool position and it provides on-off acknowledgement signal only when the valve is in safe condition, see tech table FY200

11 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	4401 Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007					
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$					
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Vibration resistance	See technical table G004					
	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)					
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU					
	REACH Regulation (EC) n°1907/2006					

12 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve n	nodel		DLHZO DLKZOR																	
Pressu	re limits [bar]		ports P , A , B = 350; T = 210 (250 with external drain /Y) Y = 10					T = 2	م 10 (25	orts P 0 with	, A , B externa	i = 315 al drair	5; n/Y) Y	= 10						
Spool t	ype and size	L0	L1	V1	L3	V3	L5	T5	L7	T7	V7	D7	DT7	L3	Т3	L7	T7	V7	D7	DT7
Nomina	al flow $\Delta p P-T$ [I/min]																			
(1)	Δp= 30 bar	2,5	4,5	8	9	13	1	8		26		26÷1	3 (4)	4	0		60		60÷3	33 (4)
	$\Delta p = 70 \text{ bar}$	4	7	12	14	20	2	8		40		40÷2	20 (4)	6	0		100		100÷	50 (4)
I	Max permissible flow	8	14	16	30	40	5	0		70		70÷4	0 (4)	1.	10		130		130÷	65 (4)
Leakag	e (2) [cm³/min]	<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Respor	nse time (3) [ms]						≤	10									≤ 15			
Hystere	esis	≤ 0,1 [% of max regulation]																		
Repeat	ibility								± 0,1	[% of	max r	egulat	ion]							
Therma	al drift						Z	ero po	pint dis	place	ment •	< 1% a	at ΔT =	= 40°C						

(1) For different Δp , the max flow is in accordance to the diagrams in section 15.2 (2) Referred to spool in neutral position and 50°C oil temperature (3) 0-100% step signal

(4) For spool type D7 and DT7 the flow value is referred to single path P-A (A-T) \div P-B (B-T) at $\Delta p/2$ per control edge

13 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal Rectified and filtered	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	50 W	0 W					
Max. solenoid current	DLHZO = 2,6 A	DLKZOR = 3	A				
Coil resistance R at 20°C	DLHZO = $3 \div 3,3 \Omega$	DLKZOR = 3,6	8 ÷ 4,1 Ω				
Analog input signals	Voltage: range ±10 V Current: range ±20 m	'DC (24 VMAX tolerant) nA	Input impedance Input impedance	e: $Ri > 50 k\Omega$ e: $Ri = 500 \Omega$			
Monitor outputs	Output range: vc cl	oltage ±10 VDC @ ma urrent ±20 mA @ ma	ix 5 mA x 500 Ω load resistance				
Enable input	Range: 0 ÷ 5 VDC (OFF	state), 9 ÷ 24 VDC (ON s	state), 5 ÷ 9 VDC (not acc	epted); Input impedance: $Ri > 10 k\Omega$			
Fault output	Output range: 0 ÷ 24 external negative volta	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V]; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)					
Position transducers power supply	+24 VDc @ max 100 mA and +5 VDc @ max 100 mA are software selectable; ±10 VDc @ max 14 mA minimum load resistance 700 Ω						
Pressure/Force transducer power supply (only for SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)						
Alarms	Solenoid not connected valve spool transduce	ed/short circuit, cable b r malfunctions, alarms h	reak with current refere	nce signal, over/under temperature,			
Insulation class	H (180°) Due to the oc the European standard	curring surface temperads ISO 13732-1 and EN	atures of the solenoid co 982 must be taken into a	oils, account			
Protection degree to DIN EN60529	IP66 / IP67 with mating	g connectors					
Duty factor	Continuous rating (ED=	=100%)					
Tropicalization	Tropical coating on ele	ectronics PCB					
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; protection against reverse polarity of power supply						
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158			
Communication physical layer	not insulated USB 2.0 + USB OTGoptical insulated CAN ISO11898optical insulated RS485Fast Ethernet, insulated 100 Base TX						
Recommended wiring cable	LiYCY shielded cables	s, see section 24					

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the axis card energizing with the 24 VDc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

14 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	temperature	NBR seals (standard) = -20°C ÷ FKM seals (/PE option) = -20°C NBR low temp. seals (/BT option	$+ +60^{\circ}$ C, with HFC hydraulic fluid: $\div +80^{\circ}$ C h) = -40^{\circ}C $\div +60^{\circ}$ C, with HFC hydraulic fluid:	s = -20° C ÷ $+50^{\circ}$ C draulic fluids = -20° C ÷ $+50^{\circ}$ C			
Recommended viscosity		20÷100 mm²/s - max allowed ra	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s				
Max fluid	normal operation ISO4406 class 18/16/13 NAS1638 class 7 see also filt		see also filter section at				
contamination level	longer life	ISO4406 class 16/14/11 NAS1	www.atos.com or KTF catalog				
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard			
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without water		FKM HFDU, HFDR		100 10000			
Flame resistant with water		NBR, NBR low temp.	HFC	130 12922			

15.1 Regulation diagrams

- 1 = Linear spools L
- 2 = Differential linear spool D7
- $\mathbf{3}$ = Differential non linear spool DT7
- 4 = Non linear spool T5 (only for DLHZO)
- 5 = Non linear spool T3 (only for DLHZO) and T7
- 6 = Progressive spool V

T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.

The non linear characteristics of the spool is compensated by the axis card, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2

Note:

Hydraulic configuration vs. reference signal:

Standard: Reference signal	$ \begin{array}{c} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{array} P \rightarrow \text{A} / \text{B} \rightarrow \text{T} \end{array} $	[%] v	
Reference signal	$ \left. \begin{array}{c} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{array} \right\} P \rightarrow B / A \rightarrow T $	gulated flov	-10
Reference signal	$ \begin{array}{c} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{array} P \rightarrow \text{B} / \text{A} \rightarrow \text{T} $	Re	
Reference signal	$\begin{array}{c} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{array} \left\{ P \rightarrow A / B \rightarrow T \right.$		



100%

80%

60%

40%

20%

20%

40%

60%

80%

100% Reference signal [Volt]

5

100%

80%

1





15.2 Flow /Ap diagrams

Stated at 100% of spool stroke

DLHZO:

- 1 = spool L7, T7, V7, D7, DT7
- 2 = spool L5, T5
- $\mathbf{3} = \text{spool V3}$
- 4 = spool L3 5 = spool L1, V1
- 6 = spool L0

DLKZOR: 7 = spool L7, T7, V7, D7, DT7







15.3 Pressure gain



15.4 Valve response time

The valve response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.





15.5 DLHZO Bode diagrams

Stated at nominal hydraulic conditions





15.6 DLKZOR Bode diagrams Stated at nominal hydraulic conditions





16 FAIL SAFE POSITION



Fail safe connections		$\mathbf{P} \rightarrow \mathbf{A}$	$\textbf{P} \rightarrow \textbf{B}$	$\textbf{A} \rightarrow \textbf{T}$	$\textbf{B} \rightarrow \textbf{T}$
Leakage [cm³/min]	Fail safe 1	50	70	70	50
at P = 100 bar (1)	Fail safe 3	50	70	-	-
DLHZO	Fail safa 3	-	-	15÷30	10÷20
DLKZOR	i ali sale s	-	-	40÷60	25÷40

(1) Referred to spool in fail safe position and 50°C oil temperature

(2) Referred to spool in fail safe position at $\Delta p = 35$ bar per edge

17 HYDRAULIC OPTIONS

- **B** = Solenoid, on-board digital driver + axis card and LVDT position transducer at side of port A. For hydraulic configuration vs reference signal, see 15.1
- **Y** = This option is mandatory if the pressure in port T exceeds 210 bar.

18 ELECTRONIC OPTIONS

- This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- **C** = This option is available to connect analog position transducer and pressure/force transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

19 POSSIBLE COMBINED OPTIONS

Standard versions for D-SN: /BI, /BIY, /BY, /IY

Safety certified versions for D-SN: /BI/U, /BIY/U, /B/U, /BY/U, /I/U, /I/U, /Y/U

/BI/K, /BIY/K, /B/K, /BY/K, /I/K, /IY/K, /Y/K

Standard versions for A-SN, A-SF, A-SL and D-SF, D-SL: /BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,

/CI, /CIY, /CY, /IY Safety certified versions for A-SN, A-SF, A-SL and D-SF, D-SL: /BC/U, /BCI/U, /BCIY/U, /BCY/U, /BI/U, /BIY/U, /B/U, /BY/U, /C/U, /CI/U, /CIY/U, /CY/U, /I/U, /IY/U, /Y/U /BC/K, /BCI/K, /BCIY/K, /BCY/K, /BI/K, /BIY/K, /B/K, /BY/K, /C/K, /CI/K, /CIY/K, /CY/K, /I/K, /IY/K, /Y/K

20 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For certified safety options: /U see tech. table FY100 and /K see tech. table FY200

20.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 20.2.

 Λ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

20.2 Power supply for axis card logic and communication (VL+ and VL0)

The power supply for axis card logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for axis card logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each axis card logic and communication power supply: 500 mA fast fuse.

20.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 4), depends on axis card reference mode, see section 2:

external analog reference (see 2.1): input is used as reference for control in closed loop the actuator position.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

external fieldbus reference (see 2.1) or automatic cycle (see 2.2): analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

20.4 Force reference input signal (F_INPUT+) - only for SF, SL

Functionality of F_INPUT+ signal (pin 7), depends on selected axis card reference mode and alternated control options, see section 3:

SL, SF controls and external analog reference selected : input is used as reference for the axis card force closed loop. Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA. *SN control or fieldbus reference selected*: analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

20.5 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position). Monitor output signal is factory preset according to selected valve code, defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vpc or ± 20 mA.

20.6 Force monitor output signal (F_MONITOR) - only for SF, SL

The axis card generates an analog output signal according to alternated force control option:

SN control: output signal is proportional to the actual valve spool position

SL, SF controls: output signal is proportional to the actual force applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).

The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA.

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

20.7 Enable input signal (ENABLE)

To enable the axis card, a 24VDC voltage has to be applied on pin 3.

When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:

- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

20.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

Fault output signal can be used as digital output by software selection.

20.9 Position transducer input signal

A position transducer must be always directly connected to the axis card. Select the correct axis card execution depending on the desired transducer interface: digital SSI or Encoder (D execution), potentiometer or a generic transducer with analog interface (A execution). Position digital input signal is factory preset to binary SSI, it can be reconfigured via software selecting between binary/gray SSI and Encoder. Position analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Refer to position transducer characteristics to select the transducer type according to specific application requirements (see 21.1).

20.10 Remote pressure/force transducer input signals - only for SF, SL

Analog remote pressure transducers or load cell can be directly connected to the axis card. Analog input signal is factory preset according to selected valve code, defaults are ± 10 VDc for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDc or ± 20 mA. Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see 21.2).

21 ACTUATOR'S TRANSDUCER CHARACTERISTICS

21.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution). Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances.

Transducers with analog interface grant simple and cost effective solutions.

21.2 Pressure/force transducers

The accuracy of the force control is strongly dependent to the selected pressure/force transducer, see section 3.

Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.

Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details).

Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control. The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain

the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

21.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

		Position						
Execution	Α		I	SF, SL				
Input type	Potentiometer	Analog	SSI (3)	Incremental Encoder	Analog			
Power supply (1)	10 ÷ 30 VDC	+24 VDC	+24 VDC	+5 VDC / +24 VDC	+24 VDC			
Axis card interface	0 ÷ 10 V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vpc 4 ÷ 20 mA			
Max speed	0,5 m/s	1 m/s	1 m/s	2 m/s	-			
Max resolution	< 0.4 % FS	< 0.2 % FS	5 µm	1 μm (@ 0.15 m/s)	< 0.4 % FS			
Linearity error (2)	± 0.1% FS	< ±0.02% FS	< ± 0.02 % FS	< ± 0.001 % FS	< ±0.25% FS			
Repeatability (2)	± 0.05% FS	< ± 0.005% FS	< ± 0.005 % FS	< ± 0.001 % FS	< ±0.1% FS			

(1) Power supply provided by Atos axis card (2) Percentage of total stroke (3) For Balluff BTL7 with SSI interface only special code SA433 is supported

22 ELECTRONIC CONNECTIONS

For electronic connection of certified safety options /U see tech. table FY100 and /K see tech. table FY200

22.1 Main connector - 12 pin (A)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	V+ Power supply 24 Vbc		Input - power supply
2	VO Power supply 0 Vbc		Gnd - power supply
3	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the axis card, referred to VL0	Input - on/off signal
4	P_INPUT+ Position reference input signal: ±10 Vpc / ±20 mA maximum range		Input - analog signal Software selectable
5	INPUT- Negative reference input signal for P_INPUT+ and F_INPUT+		Gnd - analog signal
6	P_MONITOR Position monitor output signal: ±10 Vbc / ±20 mA maximum range, referred to VL0		Output - analog signal Software selectable
7	F_INPUT+	Force reference input signal (SF, SL controls): ±10 Vbc / ±20 mA maximum range	Input - analog signal Software selectable
8	F_MONITOR	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ± 10 Vpc / ± 20 mA maximum range, referred to VL0	Output - analog signal Software selectable
9	VL+	Power supply 24 Vbc for axis card logic and communication	Input - power supply
10	VL0 (1) Power supply 0 Vpc for axis card logic and communication		Gnd - power supply
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to axis card housing	

(1) Do not disconnect VL0 before VL+ when the axis card is connected to PC USB port

22.2 Communication connectors (B) - (C)

B	B USB connector - M12 - 5 pin always present						
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)					
1	+5V_USB	Power supply					
2	ID	Identification					
3	GND_USB	Signal zero data line					
4	D-	Data line -					
5	D+	Data line +					

©1)	\bigcirc \bigcirc BP fieldbus execution, connector - M12 - 5 pin						
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)					
1	+5V	Termination supply signal					
2	LINE-A	Bus line (high)					
3	DGND	Data line and termination signal zero					
4	LINE-B	Bus line (low)					
5	SHIELD						

©1 (\bigcirc \bigcirc BC fieldbus execution, connector - M12 - 5 pin						
PIN SIGNAL TECHNICAL SPECIFICATION (1)							
1	1 CAN_SHLD Shield						
2	not used	(c) - (c₂) pass-through connection (2)					
3	CAN_GND	CAN_GND Signal zero data line					
4	CAN_H	Bus line (high)					
5	CAN_L	Bus line (low)					

©1 ©2 EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin							
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)					
1	TX+	Transmitter					
2	RX+	Receiver					
3	TX-	Transmitter					
4	RX-	Receiver					
Housing	SHIELD						

(1) Shield connection on connector's housing is recommended

(2) Pin 2 can be fed with external +5V supply of CAN interface

22.3 Remote pressure/force transducer connector - M12 - 5 pin - only for SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	D1 SL - Single t	transducer (1)	D2 SF - Double	transducers (1) Current
1	VF +24V	Power supply +24Vbc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vbc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vbc / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to axis card view

22.4 D execution - Digital position transducers connector - M12 - 8 pin (E1)

		SSI - default transducer (1)		Encoder (1)		
PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	SIGNAL	TECHNICAL SPECIFICATION	NOTES
1	CLOCK+	Serial syncronous clock (+)		R	Input channel R	
2	CLOCK-	Serial syncronous clock (-)	Input digital signal	/R	Input channel /R	
3	DATA+	Serial position data (+)	input - digital signal	Α	Input channel A	 Input - digital signal
4	DATA-	Serial position data (-)		/A	Input channel /A	input - uigitai signai
5	NC	Not connect	Do not connect	В	Input channel B	
6	NC	Not connect	Do not connect	/В	Input channel /B	
7	VP	Power supply: +24Vbc , +5Vbc or OFF (default OFF)	Output - power supply Software selectable	VP	Power supply: +24Vbc , +5Vbc or OFF (default OFF)	Output - power supply Software selectable
8	0 V	Common gnd for transducer power and signals	Common gnd	0 V	Common gnd for transducer power and signals	Common gnd

(1) Digital position transducer type is software selectable: Encoder or SSI, see 20.9

SSI connection - example



Note: pin layout referred to axis card view

Encoder connection - example

TEZ axis control			1			Encoder - HEIDENHAN Model LS 100, cable gland
	1	R	Red	R+		
ZH-8PM/5	2	/R	Black	R-	1×10^{-1}	
	3	A	Brown	A+		
(E1) □ □□□□□[□□□]	4	/A	Green	A-		
	5	В	Gray	B+] >	
1 2	6	/B	Pink	B-] _	
8-420-3	7	VP	Brown / Green	Up		
	8	OV	White / Green	0V		
65			Above conn	ections	are intended	d as generic example, for details please consult the transducer datasheet

Note: pin layout referred to axis card view

22.5 A execution - Analog position transducers connector - M12 - 5 pin (E2)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Potentiometer	Analog
1	VP +24V	Power supply: +24Vbc or OFF (default OFF)	Output - power supply Software selectable	/	Connect
2	VP +10V	Power supply reference +10Vbc (always present)	Output - power supply	Connect	/
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	Connect
4	TR	Signal transducer	Input - analog signal	Connect	Connect
5	VP -10V	Power supply reference -10Vpc (always present)	Output - power supply	Connect	/

Note: analog input range is software selectable, see 20.9



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

22.7 Diagnostic LEDs (L)

Three leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	El EtherNet/IP	EP PROFINET	L1 L2 L
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				

23 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital axis card executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table GS500).

For EH, EW, EI and EP execution the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection

L3 Ð



24 CONNECTORS CHARACTERISTICS - to be ordered separately

24.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS		
CODE	A1 ZM-12P	A2 ZH-12P		
Туре	12pin female straight circular	12pin female straight circular		
Standard	DIN 43651	DIN 43651		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG13,5	PG16		
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)		
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires		
Connection type to crimp		to crimp		
Protection (EN 60529)	IP 67	IP 67		

24.2 Fieldbus communication connectors

CONNECTOR TYPE	R TYPE BC CANopen (1)		BP PROFI	BUS DP (1)	EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	C1 ZM-5PF	©2 ZM-5PM	C1) ZM-5PF/BP	©2 ZM-5PM/BP	©1) ©2) ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Me	tallic	Metallic		Metallic
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable CANbus Standard (DR 30		dard (DR 303-1)	PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IF	267	IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately, see tech table GS500

(2) Internally terminated

24.3 Pressure/Force transducer connectors - only for SF, SL

CONNECTOR TYPE	SL - Single	transducer	SF - Double transducers	
CODE	D1 ZH-5PM/1.5	D1) ZH-5PM/5	D2 ZH-5PM-2/2	
Туре	5 pin male straight circular		4 pin male straight circular	
Standard	M12 coding A –	IEC 61076-2-101	M12 coding A – IEC 61076-2-101	
Material	Pla	stic	Plastic	
Cable gland	Connector moulded on cables 1,5 m length 5 m length		Connector moulded on cables 2 m length	
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)	
Connection type	molded cable		splitting cable	
Protection (EN 60529)	IP 67		IP 67	

24.4 Position transducer connectors

CONNECTOR TYPE	DIGITAL POSITION TRANSDUCER D execution - see 22.4	ANALOG POSITI A executio	ON TRANSDUCER n - see 22.5	
CODE	E1) ZH-8PM/5	E2 ZH-5PM/1.5	E2 ZH-5PM/5	
Туре	8 pin male straight circular	8 pin male straight circular 5 pin male straight circular		
Standard	M12 coding A – IEC 61076-2-101	M12 coding A – IEC 61076-2-101		
Material	Plastic		Plastic	
Cable gland	Connector moulded on cables 5 m length	Connector moulded on cables		
Cable glaild	Connector modided on cables 5 m length	1,5 m length	5 m length	
Cable	8 x 0,25 mm ²	5 x 0,25 mm ²		
Connection type molded cable		molded cable		
Protection (EN 60529)	IP 67	IP 67		

25 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW-SETUP programming software:

Z-MAN-RI-LEZ - user manual for TEZ and LEZ with SN

 $\ensuremath{\mathsf{Z}\text{-MAN-RI-LEZ-S}}$ - user manual for $\ensuremath{\mathsf{TEZ}}$ and $\ensuremath{\mathsf{LEZ}}$ with $\ensuremath{\mathsf{SF}}$, $\ensuremath{\mathsf{SL}}$

25.1 External reference and transducer parameters

- Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements: - *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- Limit parameters define maximum/minimum stroke and force to detect possible alarm conditions
- Homing parameters define the startup procedure to initialize incremental transducer (e.g. Encoder)

25.2 PID control dynamics parameters

Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:

- PID parameters each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

25.3 Monitoring parameters

- Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:
- Monitoring parameters maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 25.4)

25.4 Fault parameters

Allow to configure how the axis card detect and react to alarm conditions:

- Diagnostics parameters define different conditions, threshold and delay time to detect alarm conditions
 - define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

25.5 Valve characteristics compensation

Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- Valve parameters modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

25.6 Motion phases parameters

- Reaction parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

26 FASTENING BOLTS AND SEALS

	DLHZO	DLKZOR
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
0	Seals: 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	Seals: 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)
DLHZO-TEZ

ISO 4401: 2005 Mounting surface: 4401-03-02-0-05 (see table P005)

(for /Y surface 4401-03-03-0-05 without X port)





 The indicated dimension refers to the longer connectors or Bluetooth adapter For dimensions of connectors and Bluetooth adapter, see sections 22.6
 Space required for connection cable and for connector removal

DLKZOR-TEZ

ISO 4401: 2005 Mounting surface: 4401-05-04-0-05 (see table P005) (for /Y surface 4401-05-05-0-05 without X port)



Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port A

28 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric a	nd electronic connectors
FS900	Operating and maintenance information for proportional valves	P005 Mounting		surfaces for electrohydraulic valves
FY100	Safety proportional valves - option /U	Y010	Basics fo	or safety components
FY200	Safety proportional valves - option /K	Z-MAN-	RI-LEZ	TEZ/LEZ user manual
GS500	Programming tools	Z-MAN-	RI-LEZ-S	TEZ/LEZ with p/Q control user manual
GS510	Fieldbus			

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Digital servoproportionals with on-board axis card

direct, double solenoid, with LVDT transducer and zero spool overlap, autotuning



⁽¹⁾ For possible combined options, see section 18

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2 POSITION CONTROL

2.1 External reference signal

Axis card controls in closed loop the actuator position according to a position reference signal from the machine central unit.

Position profile can be managed in two ways (software selectable):

- Without trajectory generation (a): the axis card receives from the machine central unit the position reference signal and follows it at any given instant - With trajectory generation (b): the axis card receives from the machine central unit just the final target position and internally generates a
- position profile limiting acceleration, velocity and deceleration

The position reference signal can be software selected between Analog reference (c) and Fieldbus reference (d). Refer to the axis card user manual for further details on position control features.



2.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands (e) or Fieldbus commands (f).

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



3 ALTERNATED POSITION / FORCE CONTROL

SF and SL controls add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase 2) and 4) at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations



SF - position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on A and B hydraulic lines.

SL - position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on the hydraulic actuator.

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault
- Atos technical office is available for additional evaluations related to specific applications

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital axis controls via Bluetooth/USB service port. Atos Z-SW-SETUP PC software supports all Atos digital axis controls and it is available at www.atos.com in MyAtos area.



WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500**

Bluetooth or USB connection



6 SMART START-UP

The automatic procedure supports the user during the commissioning phases of the axis control with guided procedures:

General setting

It assists the user in system data setup, as like cylinder stroke, diameters, load mass, configure analog/digital signals and communication interface, position transducer setup.

System check

It automatically executes position open loop movements to set axis control parameters, position transducer calibration and verify cylinder stroke.

Position autotuning

It automatically determines the optimal PID parametrization of the position control adapting the dynamic response to guarantee control precision and axis stability. Once the procedure is started, the control performs few automatic position open loop movements of the actuator, during which control parameters are calculated and stored.

7 SMART TUNING

Once the Smart Start-up procedure has been completed, the Smart tuning feature allows to further refine the position control response by choosing from 3 different levels of performance in positioning:

- dynamic best dynamics and accuracy (default factory setting)

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- **balanced** average dynamics and accuracy

- **smooth** attenuated dynamics and accuracy to improve control stability in critical applications or in environments with electrical disturbances Settings can be changed any time via Z-SW-SETUP software or fieldbus.

If required, control performance can be further customized by modifying PID parameter via Z-SW-SETUP software.



8 MULTIPLE SETS

Multiple PID sets allows to easily switch axis behaviour according to machine cycle, selecting between independent groups of parameters for:

- position control PID

- force control PID and P/Q logics switching criteria

Settings can be changed any time via Z-SW-SETUP software, fieldbus or digital input signals.

9 FIELDBUS - see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

10 SAFETY OPTIONS

Atos range of proportional directional valves, provides functional safety options /U and /K, designed to accomplish a safety function, intended to reduce the risk in process control systems.



They are TÜV certified in compliance to IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e

Safe double power supply, option /U: the axis card has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table FY100

Safety function via on/off signals, option /K: upon a disable command, the axis card checks the spool position and it provides on-off acknowledgement signal only when the valve is in safe condition, see tech table FY200

11 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ / PE option = $-20^{\circ}C \div +60^{\circ}C$ / BT option = $-40^{\circ}C \div +60^{\circ}C$				
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004				
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

12 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		DHZO			DKZOR			
Pressure limits	[bar]	ہ T = 210 (250	ports P , A , B = 350; T = 210 (250 with external drain /Y) Y = 10		ports P , A , B = 315; T = 210 (250 with external drain /Y) Y = 10			
Spool type and	size	L3	L5	D5	L3	L5	D5	
Nominal flow $\Delta \mu$	o P-T [l/min]							
(1)	∆p= 10 bar	18	28	28 (4)	45	75	75 (4)	
	Δp= 30 bar	30	50	50 (4)	80	130	130 (4)	
	Δp= 70 bar	45	75	75 (4)	120	170	170 (4)	
Max permis	sible flow (2)	50	80	80 (4)	130	180	180 (4)	
Leakage	[cm³/min]	<500 (at p =	<500 (at p = 100 bar); <1500 (at p = 350 bar)			<800 (at p = 100 bar); <2500 (at p = 315 bar)		
Response time	(3) [ms]		≤ 15 ≤ 20					
Hysteresis ≤ 0,2 [% of m			max regulation]					
Repeatibility		± 0,1 [% of max regulation]						
Thermal drift		zero point displacement < 1% at $\Delta T = 40^{\circ}C$						

(1) For different Δp, the max flow is in accordance to the diagrams in section 15.2
(2) See detailed diagrams in section 15.3
(3) 0-100% step signal
(4) For spool type D5 the flow value is referred to single path P-A (A-T) at Δp/2 per control edge. The flow P-B (B-T) is 50% of P-A (A-T)

13 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal Rectified and filtered	: +24 VDC : VRMS = 20 ÷ 32 VMAX	(ripple max 10 % VPP)			
Max power consumption	50 W					
Max. solenoid current	DHZO = 2,6 A	DKZOR = 3 A				
Coil resistance R at 20°C	DHZO = $3 \div 3,3 \Omega$	DKZOR = 3,8	÷ 4,1 Ω			
Analog input signals	Voltage: range ±10 V Current: range ±20 m	/DC (24 VMAX tolerant) nA	Input impedance Input impedance	e: Ri > 50 kΩ e: Ri = 500 Ω		
Monitor outputs	Output range: vo	oltage ±10 VDC @ ma urrent ±20 mA @ ma	ax 5 mA x 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF	state), 9 ÷ 24 VDC (ON s	state), 5 ÷ 9 VDC (not acc	epted); Input impedance: Ri > 10 k Ω		
Fault output	Output range: 0 ÷ 24 external negative volta	VDC (ON state > [powe age not allowed (e.g. du	er supply - 2 V] ; OFF sta e to inductive loads)	te < 1 V) @ max 50 mA;		
Position transducers power supply	+24 VDC @ max 100 mA and +5 VDC @ max 100 mA are software selectable; ± 10 VDC @ max 14 mA minimum load resistance 700 Ω					
Pressure/Force transducer power supply (only for SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)					
Alarms	Solenoid not connecte valve spool transduce	ed/short circuit, cable b r malfunctions, alarms h	reak with current refere history storage function	nce signal, over/under temperature,		
Insulation class	H (180°) Due to the oc the European standard	curring surface temper ds ISO 13732-1 and EN	atures of the solenoid co 982 must be taken into a	oils, account		
Protection degree to DIN EN60529	IP66 / IP67 with mating	g connectors				
Duty factor	Continuous rating (ED=	=100%)				
Tropicalization	Tropical coating on ele	ectronics PCB				
Additional characteristics	Short circuit protection protection against reven	of solenoid's current sup rse polarity of power sup	ply; 3 leds for diagnostic; ply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158		
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cables, see section 23					

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the axis card energizing with the 24 VDc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

14 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	temperature	NBR seals (standard) = -20° C ÷ $+60^{\circ}$ C, with HFC hydraulic fluids = -20° C ÷ $+50^{\circ}$ C EKM seals (/PE option) = -20° C ÷ $+80^{\circ}$ C			
		NBR low temp. seals (/BT option) = -40° C ÷ $+60^{\circ}$ C, with HFC hydraulic fluids = -20° C ÷ $+50^{\circ}$ C			
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s			
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1638 class 7 see also filter section a			
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog	
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard	
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water		FKM	FKM HFDU, HFDR		
Flame resistant with water		NBR, NBR low temp.	HFC ISO 12922		





Note:

Hydraulic configuration vs. reference signal for configurations 70 (standard and option /B) $\begin{array}{l} \text{Reference signal} \begin{array}{l} 0 & \div & +10 \ \text{V} \\ 12 & \div & 20 \ \text{mA} \end{array} \right\} P \rightarrow A \ / \ B \rightarrow T \qquad \text{Reference signal} \begin{array}{l} 0 & \div & -10 \ \text{V} \\ 12 & \div & 4 \ \text{mA} \end{array} \right\} P \rightarrow B \ / \ A \rightarrow T$

15.2 Flow /Ap diagrams

stated at 100% of valve stroke

DHZO

1 = spool L3, **2** = spool L5, D5

DKZOR

3 = spool L3 **4** = spool L5, D5





15.3 Operating limits

DHZO

1 = spool L3 **2** = spool L5, D5

DKZOR

- **3** = spool L3 **4** = spool L5, D5





15.4 Valve response time

The valve response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.



16 HYDRAULIC OPTIONS

- **B** = Solenoid, on-board digital driver + axis card and LVDT position transducer at side of port A. For hydraulic configuration vs reference signal, see 15.1
- **Y** = This option is mandatory if the pressure in port T exceeds 210 bar.

17 ELECTRONIC OPTIONS

This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = This option is available to connect analog position transducer and pressure/force transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

18 POSSIBLE COMBINED OPTIONS

Standard versions for D-SN: /BI, /BIY, /BY, /IY

Standard versions for A-SN, A-SF, A-SL and D-SF, D-SL:

/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY, /CI, /CIY, /CY, /IY

Safety certified versions for D-SN:

/BI/U, /BIY/U, /B/U, /BY/U, /I/U, /IY/U, /Y/U /BI/K, /BIY/K, /B/K, /BY/K, /I/K, /IY/K, /Y/K

Safety certified versions for A-SN, A-SF, A-SL and D-SF, D-SL: /BC/U, /BCI/U, /BCIY/U, /BCY/U, /BI/U, /BIY/U, /B/U, /BY/U, /C/U, /CI/U, /CIY/U, /CY/U, /I/U, /IY/U, /Y/U /BC/K, /BCI/K, /BCIY/K, /BCY/K, /BI/K, /BIY/K, /B/K, /BY/K, /C/K, /CI/K, /CIY/K, /CY/K, /I/K, /IY/K, /Y/K

19 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For certified safety options: /U see tech. table FY100 and /K see tech. table FY200

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 19.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for axis card logic and communication (VL+ and VL0)

The power supply for axis card logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for axis card logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each axis card logic and communication power supply: 500 mA fast fuse.

19.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 4), depends on axis card reference mode, see section 2:

external analog reference (see 2.1): input is used as reference for control in closed loop the actuator position.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

external fieldbus reference (see 2.1) or automatic cycle (see 2.2): analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

19.4 Force reference input signal (F_INPUT+) - only for SF, SL

Functionality of F_INPUT+ signal (pin 7), depends on selected axis card reference mode and alternated control options, see section 3:

SL, SF controls and external analog reference selected : input is used as reference for the axis card force closed loop. Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDc or ± 20 mA. *SN control or fieldbus reference selected*: analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDc.

19.5 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position). Monitor output signal is factory preset according to selected valve code, defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vpc or ± 20 mA.

19.6 Force monitor output signal (F_MONITOR) - only for SF, SL

The axis card generates an analog output signal according to alternated force control option:

SN control: output signal is proportional to the actual valve spool position

SL, SF controls: output signal is proportional to the actual forcel applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).

The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA.

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 Vbc for standard and $4 \div 20$ mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vbc or ± 20 mA.

19.7 Enable input signal (ENABLE)

To enable the axis card, a 24VDC voltage has to be applied on pin 3.

- When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:
- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

19.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

Fault output signal can be used as digital output by software selection.

19.9 Position transducer input signal

A position transducer must be always directly connected to the axis card. Select the correct axis card execution depending on the desired transducer interface: digital SSI or Encoder (D execution), potentiometer or a generic transducer with analog interface (A execution). Position digital input signal is factory preset to binary SSI, it can be reconfigured via software selecting between binary/gray SSI and Encoder. Position analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Refer to position transducer characteristics to select the transducer type according to specific application requirements (see 20.1).

19.10 Remote pressure/force transducer input signals - only for SF, SL

Analog remote pressure transducers or load cell can be directly connected to the axis card. Analog input signal is factory preset according to selected valve code, defaults are ± 10 VDc for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDc or ± 20 mA. Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see 20.2).

20 ACTUATOR'S TRANSDUCER CHARACTERISTICS

20.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution). Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances.

Transducers with analog interface grant simple and cost effective solutions.

20.2 Pressure/force transducers

The accuracy of the force control is strongly dependent to the selected pressure/force transducer, see section 3

Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.

Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details).

Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115% + 120% of the maximum regulated pressure/force.

20.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

		Pressure/Force			
Execution	A		1	SF, SL	
Input type	Potentiometer	Analog	SSI (3)	Incremental Encoder	Analog
Power supply (1)	10 ÷ 30 VDC	+24 VDC	+24 VDC	+5 VDC / +24 VDC	+24 VDC
Axis card interface	0 ÷ 10 V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vpc 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	1 m/s	2 m/s	-
Max resolution	< 0.4 % FS	< 0.2 % FS	5 µm	1 μm (@ 0.15 m/s)	< 0.4 % FS
Linearity error (2)	± 0.1% FS	< ±0.02% FS	< ± 0.02 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability (2)	± 0.05% FS	< ± 0.005% FS	< ± 0.005 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) Power supply provided by Atos axis card (2) Percentage of total stroke (3) For Balluff BTL7 with SSI interface only special code SA433 is supported

21 ELECTRONIC CONNECTIONS

For electronic connection of certified safety options /U see tech. table FY100 and /K see tech. table FY200

21.1 Main connector - 12 pin (A)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vbc	Input - power supply
2	V0	Power supply 0 Vbc	Gnd - power supply
3	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the axis card, referred to VL0	Input - on/off signal
4	P_INPUT+	Position reference input signal: ±10 Vbc / ±20 mA maximum range	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for P_INPUT+ and F_INPUT+	Gnd - analog signal
6	P_MONITOR	Position monitor output signal: $\pm 10 \text{ Vpc}$ / $\pm 20 \text{ mA maximum range, referred to VL0}$	Output - analog signal Software selectable
7	F_INPUT+	Force reference input signal (SF, SL controls): ±10 Vbc / ±20 mA maximum range	Input - analog signal Software selectable
8	F_MONITOR	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ± 10 Vpc / ± 20 mA maximum range, referred to VL0	Output - analog signal Software selectable
9	VL+	Power supply 24 Vbc for axis card logic and communication	Input - power supply
10	VLO (1)	Power supply 0 Vbc for axis card logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to axis card housing	

(1) Do not disconnect VL0 before VL+ when the axis card is connected to PC USB port

21.2 Communication connectors (B) - (C)

B USB connector - M12 - 5 pin always present				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)		
1	+5V_USB	Power supply		
2	ID	Identification		
3	GND_USB	Signal zero data line		
4	D-	Data line -		
5	D+	Data line +		

C1)	\bigcirc \bigcirc BP fieldbus execution, connector - M12 - 5 pin				
PIN SIGNAL TECHNICAL SPECIFICATION (1)					
1	+5V	Termination supply signal			
2	LINE-A	Bus line (high)			
3	DGND	Data line and termination signal zero			
4	LINE-B	Bus line (low)			
5	SHIELD				

C1 (\bigcirc \bigcirc BC fieldbus execution, connector - M12 - 5 pin				
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)			
1	CAN_SHLD	Shield			
2	not used	©1 - ©2 pass-through connection (2)			
3	CAN_GND	Signal zero data line			
4	CAN_H	Bus line (high)			
5	CAN_L	Bus line (low)			

C1 (©1 ©2 EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin					
PIN SIGNAL TECHNICAL SPECIFICATION (1)						
1	TX+	Transmitter				
2	RX+	Receiver				
3	тх-	Transmitter				
4	RX-	Receiver				
Housing	SHIELD					

(1) Shield connection on connector's housing is recommended

(2) Pin 2 can be fed with external +5V supply of CAN interface

21.3 Remote pressure/force transducer connector - M12 - 5 pin - only for SF, SL (D)

PIN	SIGNAL	NAL TECHNICAL SPECIFICATION NOTES		D1 SL - Single transducer (1)		D2 SF - Double transducers (1)	
				Voltage	Current	voltage	Current
1	VF +24V	Power supply +24Vbc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vbc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vbc / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to axis card view

21.4 D execution - Digital position transducers connector - M12 - 8 pin (E1)

		SSI - default transducer (1)		Encoder (1)			
PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	SIGNAL	TECHNICAL SPECIFICATION	NOTES	
1	CLOCK+	Serial syncronous clock (+)		R	Input channel R		
2	CLOCK-	Serial syncronous clock (-)		/R	Input channel /R		
3	DATA+	Serial position data (+)	input - uigitai signai	Α	Input channel A	 Input - digital signal	
4	DATA-	Serial position data (-)		/A	Input channel /A	Input - digital signal	
5	NC	Not connect	Do not connect	В	Input channel B		
6	NC			/B	Input channel /B		
7	VP	Power supply: +24Vbc , +5Vbc or OFF (default OFF)	Output - power supply Software selectable	VP	Power supply: +24Vbc,+5Vbc or OFF (default OFF)	Output - power supply Software selectable	
8	0 V	Common gnd for transducer power and signals	Common gnd	0 V	Common gnd for transducer power and signals	Common gnd	

(1) Digital position transducer type is software selectable: Encoder or SSI, see 19.9

SSI connection - example



Note: pin layout referred to axis card view

Encoder connection - example

TEZ axis control			1		Enc	coder - HEIDENHAN Model LS 100, cable gland
	1	R	Red	R+	N	
ZH-8PM/5	2	/R	Black	R-		
	3	A	Brown	A+		
(E1) 🔲 📥 🗋 🖂 🗌	4	/A	Green	A-		
	5	В	Gray	B+	<u>`</u>	
12	6	/B	Pink	B-		
8-42-3	7	VP	Brown / Green	Up		
	8	VO	White / Green	0V		
65			Above conn	ections a	re intended as generic exa	mple, for details please consult the transducer datasheet

Note: pin layout referred to axis card view

21.5 A execution - Analog position transducers connector - M12 - 5 pin (E2)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Potentiometer	Analog
1	VP +24V	Power supply: +24Vbc or OFF (default OFF)	Output - power supply Software selectable	/	Connect
2	VP +10V	Power supply reference +10Vbc (always present)	Output - power supply	Connect	/
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	Connect
4	TR	Signal transducer	Input - analog signal	Connect	Connect
5	VP -10V	Power supply reference -10Vbc (always present)	Output - power supply	Connect	/

Note: analog input range is software selectable, see 19.9



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

21.7 Diagnostic LEDs (L)

Three leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SC	DLENOID STAT	US	LINK/ACT				

22 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital axis card executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP execution the external terminators are not required: each connector is internally terminated.

23 CONNECTORS CHARACTERISTICS - to be ordered separately

23.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS	
CODE	A1 ZM-12P	A2 ZH-12P	
Туре	12pin female straight circular	12pin female straight circular	
Standard	DIN 43651	DIN 43651	
Material	Metallic	Plastic reinforced with fiber glass	
Cable gland	PG13,5	PG16	
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)	
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires	
Connection type	to crimp	to crimp	
Protection (EN 60529)	IP 67	IP 67	

23.2 Fieldbus communication connectors

CONNECTOR TYPE	BC CAN	open (1)	BP PROFI	BUS DP (1)	EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)		
CODE	C1 ZM-5PF C2 ZM-5PM ()		C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E	
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular	
Standard	M12 coding A –	IEC 61076-2-101	M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101		
Material	Me	tallic	Metallic			Metallic	
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm		
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5		
Connection type screw terminal		screw terminal		terminal block			
Protection (EN 60529)	IF	267	IP 67		IP 67		

(1) E-TRM-** terminators can be ordered separately, see tech table GS500

(2) Internally terminated

23.3 Pressure/Force transducer connectors - only for SF, SL

CONNECTOR TYPE	SL - Single	transducer	SF - Double transducers		
CODE	D1 ZH-5PM/1.5	D1 ZH-5PM/5	D2 ZH-5PM-2/2		
Туре	5 pin male st	raight circular	4 pin male straight circular		
Standard	M12 coding A –	IEC 61076-2-101	M12 coding A – IEC 61076-2-101		
Material	Pla	stic	Plastic		
Cable gland	Connector mo	ulded on cables	Connector moulded on cables 2 m length		
	1,5 m length	5 m length			
Cable	5 × 0,2	25 mm²	3 x 0,25 mm ² (both cables)		
Connection type	molde	d cable	splitting cable		
Protection (EN 60529)	IP	67	IP 67		

23.4 Position transducer connectors

CONNECTOR TYPE	DIGITAL POSITION TRANSDUCER D execution - see 21.4	ANALOG POSITION TRANSDUCER A execution - see 21.5			
CODE	E1 ZH-8PM/5	E2 ZH-5PM/1.5	E2 ZH-5PM/5		
Туре	8 pin male straight circular	5 pin male st	raight circular		
Standard	M12 coding A – IEC 61076-2-101	M12 coding A – IEC 61076-2-101			
Material	Plastic	Plastic			
Cable gland	Connector moulded on cables 5 m length	Connector moulded on cables			
Cable gland	Connector modided on cables 5 milength	1,5 m length	5 m length		
Cable	8 x 0,25 mm ²	5 x 0,25 mm ²			
Connection type	molded cable	molded cable			
Protection (EN 60529)	IP 67	IP 67			

BC and BP pass-through connection

L3

))



24 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW-SETUP programming software:

Z-MAN-RI-LEZ - user manual for TEZ and LEZ with SN

Z-MAN-RI-LEZ-S - user manual for TEZ and LEZ with SF, SL

24.1 External reference and transducer parameters

- Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements: - Scaling parameters define the correspondence of these signals with the specific actuator stroke or force to be controlled - Limit parameters
 - define maximum/minimum stroke and force to detect possible alarm conditions
- define the startup procedure to initialize incremental transducer (e.g. Encoder) - Homing parameters

24.2 PID control dynamics parameters

Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:

- PID parameters each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

24.3 Monitoring parameters

- Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:
- Monitoring parameters maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 24.4)

24.4 Fault parameters

Allow to configure how the axis card detect and react to alarm conditions:

- Diagnostics parameters define different conditions, threshold and delay time to detect alarm conditions
- Reaction parameters define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

24.5 Valve characteristics compensation

Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- Valve parameters modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

24.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

25 FASTENING BOLTS AND SEALS

	DHZO	DKZOR
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
0	Seals: 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	Seals: 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

DHZO-TEZ

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005) (for /Y surface 4401-03-03-0-05 without X port)





(1) The indicated dimension refers to the longer connectors or Bluetooth adapter For dimensions of connectors and Bluetooth adapter, see sections 21.6 (2) Space required for connection cable and for connector removal

DKZOR-TEZ

ISO 4401: 2005 Mounting surface: 4401-05-04-0-05 (see table P005) (for /Y surface 4401-05-05-0-05 without X port)

I



(1) The indicated dimension refers to the longer connectors or Bluetooth adapter For dimensions of connectors and Bluetooth adapter, see sections 21.6 (2) Space required for connection cable and for connector removal

Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port A

28 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric a	nd electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting	surfaces for electrohydraulic valves
FY100	Safety proportional valves - option /U	Y010	Basics fo	r safety components
FY200	Safety proportional valves - option /K	Z-MAN-	-RI-LEZ	TEZ/LEZ user manual
GS500	Programming tools	Z-MAN-	-RI-LEZ-S	TEZ/LEZ with p/Q control user manual
GS510	Fieldbus			



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Digital servoproportionals with on-board axis card

piloted, single solenoid, with two LVDT transducers and zero spool overlap, autotuning



2 POSITION CONTROL

2.1 External reference signal

Axis card controls in closed loop the actuator position according to a position reference signal from the machine central unit.

Position profile can be managed in two ways (software selectable):

- Without trajectory generation (a): the axis card receives from the machine central unit the position reference signal and follows it at any given instant - With trajectory generation (b): the axis card receives from the machine central unit just the final target position and internally generates a
- position profile limiting acceleration, velocity and deceleration

The position reference signal can be software selected between Analog reference (c) and Fieldbus reference (d).

Refer to the axis card user manual for further details on position control features.



2.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands (e) or Fieldbus commands (f).

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



3 ALTERNATED POSITION / FORCE CONTROL

SF and SL controls add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase 2) and 4) at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations



SF - position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on A and B hydraulic lines.

SL - position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on the hydraulic actuator.

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault
- Atos technical office is available for additional evaluations related to specific applications

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW-SETUP programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital axis controls via Bluetooth/USB service port. Atos Z-SW-SETUP PC software supports all Atos digital axis controls and it is available at www.atos.com in MyAtos area



see tech, table GS500

WARNING: for the list of countries where the Bluetooth adapter has been approved,

Bluetooth or USB connection



6 SMART START-UP

The automatic procedure supports the user during the commissioning phases of the axis control with guided procedures:

General setting

It assists the user in system data setup, as like cylinder stroke, diameters, load mass, configure analog/digital signals and communication interface, position transducer setup.

System check

It automatically executes position open loop movements to set axis control parameters, position transducer calibration and verify cylinder stroke.

Position autotuning

It automatically determines the optimal PID parametrization of the position control adapting the dynamic response to guarantee control precision and axis stability. Once the procedure is started, the control performs few automatic position open loop movements of the actuator, during which control parameters are calculated and stored.

7 SMART TUNING

Once the Smart Start-up procedure has been completed, the Smart tuning feature allows to further refine the position control response by choosing from 3 different levels of performance in positioning:

- **dynamic** best dynamics and accuracy (default factory setting)
- **balanced** average dynamics and accuracy

- **smooth** attenuated dynamics and accuracy to improve control stability in critical applications or in environments with electrical disturbances Settings can be changed any time via Z-SW-SETUP software or fieldbus.

If required, control performance can be further customized by modifying PID parameter via Z-SW-SETUP software.



8 MULTIPLE SETS

Multiple PID sets allows to easily switch axis behaviour according to machine cycle, selecting between independent groups of parameters for: - **position control PID**

- position control PID

- force control PID and p/Q logics switching criteria

Settings can be changed any time via Z-SW-SETUP software, fieldbus or digital input signals.

9 FIELDBUS - see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

10 SAFETY OPTIONS

Atos range of proportional directional valves, provides functional safety options /U and /K , designed to accomplish a safety function, intended to reduce the risk in process control systems.



They are TÜV certified in compliance to IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e

Safe double power supply, option /U: the axis card has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table FY100

Safety function via on/off signals, option /K: upon a disable command, the axis card checks the spool position and it provides on-off acknowledgement signal only when the valve is in safe condition, see tech table FY200

11 GENERAL CHARACTERISTICS

Assembly position	Any position						
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100						
MTTFd valves according to EN ISO 13849	9 75 years, for futher details see technical table P007						
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ / PE option = $-20^{\circ}C \div +60^{\circ}C$ / BT option = $-40^{\circ}C \div +60^{\circ}C$						
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ / PE option = $-20^{\circ}C \div +70^{\circ}C$ / BT option = $-40^{\circ}C \div +70^{\circ}C$						
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)						
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h						
Vibration resistance	See technical table G004						
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006						

12 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DPZO-*-1		DPZO-*-	2	DPZO-*-4	DPZO-*-4M	DPZO-*-6	DPZO-*-8	
Pressure limits [bar]		ports P , A , B , X = 350; T = 250 (10 for option /D); Y = 10;							
Spool type and size	L5, DL5	L3	L5, DL5	T5	L5,	DL5	L5		
Nominal flow ∆p P-T [I/min]									
(1) Δp= 10 bar	100	160	250	190	480	550	640	1200	
Δp= 30 bar	160	270	430	330	830	950	1100	2000	
Max permissible flow [I/min]	180	400	550	550	1000	1100	1600	3500	
Piloting pressure [bar]	m	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)							
Piloting volume [cm ³ /min]	1,4		3,7		9	11,3	21,6	39,8	
Piloting flow (2) [I/min]	3,5		9		18	20	19	24	
Leakage (3) Pilot [cm3/min]	100 / 300		150 / 450)	200 / 600	200 / 600	900 / 2800	900 / 2800	
Main stage [l/min]	0,4 / 1,2		0,6/2,5		1,0 / 4,0	1,0 / 4,0	3,0 / 9,0	6,0 / 20	
Response time (4) [ms]	≤ 25		≤ 25		≤ 30	≤ 35	≤ 80	≤ 100	
Hysteresis	≤ 0,1 [%of max regulation]								
Repeatability	± 0,1 [%of max regulation]								
Thermal drift	zero point displacement < 1% at $\Delta T = 40^{\circ}C$								

(1) For different Δp , the max flow is in accordance to the diagrams in section 15.2

(2) With step reference input signal 0 ÷100 %

(3) At p = 100/350 bar

(4) 0-100% step signal, see detailed diagrams in section 15.3

13 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal: +24 VDCRectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)						
Max power consumption	50 W						
Max. solenoid current	2,6 A						
Coil resistance R at 20°C	$3 \div 3,3 \Omega$						
Analog input signals	Voltage: range ±10 V Current: range ±20 m	Voltage: range ± 10 VDc (24 VMAX tolerant) Input impedance: Ri > 50 k Ω Current: range ± 20 mA Input impedance: Ri = 500 Ω					
Monitor outputs	Output range: vo	oltage ±10 VDC @ ma urrent ±20 mA @ ma	ax 5 mA x 500 Ω load resistance				
Enable input	Range: 0 ÷ 5 VDC (OFF	state), 9 ÷ 24 VDC (ON s	state), 5 ÷ 9 VDC (not acc	epted); Input impedance: $Ri > 10 k\Omega$			
Fault output	Output range: 0 ÷ 24 external negative volta	VDC (ON state > [powe age not allowed (e.g. du	er supply - 2 V] ; OFF sta e to inductive loads)	ate < 1 V) @ max 50 mA;			
Position transducers power supply	+24 VDC @ max 100 mA and +5 VDC @ max 100 mA are software selectable; \pm 10 VDC @ max 14 mA minimum load resistance 700 Ω						
Pressure/Force transducer power supply (only for SF, SL)	+24Vbc @ max 100 mA (E-ATR-8 see tech table GS465)						
Alarms	Solenoid not connecte valve spool transduce	ed/short circuit, cable b r malfunctions, alarms h	reak with current refere history storage function	nce signal, over/under temperature,			
Insulation class	H (180°) Due to the oc the European standard	curring surface temper ds ISO 13732-1 and EN	atures of the solenoid co 982 must be taken into a	bils, account			
Protection degree to DIN EN60529	IP66 / IP67 with mating	g connectors					
Duty factor	Continuous rating (ED=	=100%)					
Tropicalization	Tropical coating on ele	ectronics PCB					
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control, force control (SF, SL) by axis P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply						
Communication interface	USBCANopenPROFIBUS DPEtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RTAtos ASCII codingEN50325-4 + DS408EN50170-2/IEC61158EC 61158						
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX			
Recommended wiring cable	LiYCY shielded cables	s, see section 22					

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the axis card energizing with the 24 VDc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

14 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$				
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s				
Max fluid normal operation		ISO4406 class 18/16/13 NAS1	see also filter section at			
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog		
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM	HFDU, HFDR	100 10000		
Flame resistant with water		NBR, NBR low temp.	HFC	150 12922		

15 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

15.1 Regulation diagrams (values measure at Δp 10 bar P-T)











P→A B→T





15.3 Valve response time

The valve response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.





16 HYDRAULIC OPTIONS

- **B** = Solenoid, on-board digital driver + axis card and LVDT position transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 15.1
- D = Internal drain (through port T).
 Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section ²⁵
 The valve's standard configuration provides internal pilot and external drain.
- E = External pilot (through port X).
 Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 25
 The valve's standard configuration provides internal pilot and external drain.
- **G** = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

DPZO-2 = 28 bar

DPZO-1, DPZO-2, DPZO-4(M), DPZO-6 and DPZO-8 = 40 bar

It is advisable for valves with internal pilot in case of system pressure higher than 200 bar.

Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

Functional Scheme - example of configuration 70



Pilot valve

Main stage

③ Pressure reducing valve

④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

17 ELECTRONIC OPTIONS

This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = This option is available to connect analog position transducer and pressure/force transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

18 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For certified safety options: /U see tech. table FY100 and /K see tech. table FY200

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for axis card logic and communication (VL+ and VL0)

The power supply for axis card logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for axis card logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each axis card logic and communication power supply: 500 mA fast fuse.

18.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 4), depends on axis card reference mode, see section 2:

external analog reference (see 2.1): input is used as reference for control in closed loop the actuator position.

Reference input signal is factory preset according to selected valve code, defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

external fieldbus reference (see 2.1) or automatic cycle (see 2.2): analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

18.4 Force reference input signal (F_INPUT+) - only for SF, SL

Functionality of F_INPUT+ signal (pin 7), depends on selected axis card reference mode and alternated control options, see section 3:

SL, SF controls and external analog reference selected : input is used as reference for the axis card force closed loop. Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDc for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDc or ± 20 mA. *SN control or fieldbus reference selected*: analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDc.

18.5 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position). Monitor output signal is factory preset according to selected valve code, defaults are ±10 Vpc for standard and 4 ÷ 20 mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vpc or ± 20 mA.

18.6 Force monitor output signal (F_MONITOR) - only for SF, SL

The axis card generates an analog output signal according to alternated force control option:

SN control: output signal is proportional to the actual valve spool position

SL, SF controls: output signal is proportional to the actual forcel applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).

The output range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA.

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 Vbc for standard and $4 \div 20$ mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vbc or ± 20 mA.

18.7 Enable input signal (ENABLE)

To enable the axis card, a 24VDC voltage has to be applied on pin 3.

When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:

- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

18.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

Fault output signal can be used as digital output by software selection.

18.9 Position transducer input signal

A position transducer must be always directly connected to the axis card. Select the correct axis card execution depending on the desired transducer interface: digital SSI or Encoder (D execution), potentiometer or a generic transducer with analog interface (A execution). Position digital input signal is factory preset to binary SSI, it can be reconfigured via software selecting between binary/gray SSI and Encoder. Position analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Refer to position transducer characteristics to select the transducer type according to specific application requirements (see 19.1).

18.10 Remote pressure/force transducer input signals - only for SF, SL

Analog remote pressure transducers or load cell can be directly connected to the axis card. Analog input signal is factory preset according to selected valve code, defaults are ± 10 VDc for standard and $4 \div 20$ mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDc or ± 20 mA. Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see 19.2).

19 ACTUATOR'S TRANSDUCER CHARACTERISTICS

19.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution). Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances.

Transducers with analog interface grant simple and cost effective solutions.

19.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer, see section 3. Alternated pressure/force controls require to install pressure transducers or load cell to measure the actual pressure/force values. Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

19.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

		Pressure/Force			
Execution	A		I	SF, SL	
Input type	Potentiometer Analog		SSI (3)	Incremental Encoder	Analog
Power supply (1)	10 ÷ 30 VDC	+24 VDC	+24 VDC	+5 VDC / +24 VDC	+24 VDC
Axis card interface	0 ÷ 10 V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vpc 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	1 m/s	2 m/s	-
Max resolution	< 0.4 % FS	< 0.2 % FS	5 µm	1 μm (@ 0.15 m/s)	< 0.4 % FS
Linearity error (2)	± 0.1% FS	< ±0.02% FS	< ± 0.02 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability (2)	± 0.05% FS	< ± 0.005% FS	< ± 0.005 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) Power supply provided by Atos axis card (2) Percentage of total stroke (3) For Balluff BTL7 with SSI interface only special code SA433 is supported

20 ELECTRONIC CONNECTIONS

For electronic connection of certified safety options /U see tech. table FY100 and /K see tech. table FY200

20.1 Main connector - 12 pin (A)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES		
1	V+	Power supply 24 Vbc I			
2	V0	Power supply 0 Vbc	Gnd - power supply		
3	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the axis card, referred to VL0	Input - on/off signal		
4	P_INPUT+ Position reference input signal: ±10 Vpc / ±20 mA maximum range		Input - analog signal Software selectable		
5	INPUT- Negative reference input signal for P_INPUT+ and F_INPUT+				
6	P_MONITOR Position monitor output signal: ±10 Vpc / ±20 mA maximum range, referred to VL0		Output - analog signal Software selectable		
7	F_INPUT+ Force reference input signal (SF, SL controls): ±10 Vpc / ±20 mA maximum range		Input - analog signal Software selectable		
8	F_MONITOR	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ± 10 Vpc / ± 20 mA maximum range, referred to VL0	Output - analog signal Software selectable		
9	VL+	Power supply 24 Vbc for axis card logic and communication	Input - power supply		
10	VLO (1)	Power supply 0 Vbc for axis card logic and communication	Gnd - power supply		
11	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal		
PE	EARTH	Internally connected to axis card housing			

(1) Do not disconnect VL0 before VL+ when the axis card is connected to PC USB port

20.2 Communication connectors (B) - (C)

В	USB connector - M12 - 5 pin always present					
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)				
1	+5V_USB	Power supply				
2	ID	Identification				
3	GND_USB	Signal zero data line				
4	D-	Data line -				
5	D+	Data line +				

C1	C1 C2 BP fieldbus execution, connector - M12 - 5 pin					
PIN	PIN SIGNAL TECHNICAL SPECIFICATION (1)					
1	+5V	Termination supply signal				
2	LINE-A	Bus line (high)				
3	DGND	Data line and termination signal zero				
4	LINE-B	Bus line (low)				
5	SHIELD					

©1 (C1 C2 BC fieldbus execution, connector - M12 - 5 pin				
PIN	PIN SIGNAL TECHNICAL SPECIFICATION (1)				
1	CAN_SHLD	Shield			
2	not used	(c) - (c₂) pass-through connection (2)			
3	CAN_GND	Signal zero data line			
4	CAN_H	Bus line (high)			
5	5 CAN_L Bus line (low)				

$\textcircled{C1} \ \textcircled{C2} \ \textbf{EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin}$						
PIN	N SIGNAL TECHNICAL SPECIFICATION (1)					
1	TX+	Transmitter				
2	RX+	Receiver				
3	TX-	Transmitter				
4	RX-	Receiver				
Housing	SHIELD					

(1) Shield connection on connector's housing is recommended

(2) Pin 2 can be fed with external +5V supply of CAN interface

20.3 Remote pressure/force transducer connector - M12 - 5 pin - only for SF, SL

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	D1 SL - Single t	ransducer (1)	D2 SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	VF +24V	Power supply +24Vbc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vbc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vbc / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to axis card view

20.4 D execution - Digital position transducers connector - M12 - 8 pin (E1)

	SSI - default transducer (1)				Encoder (1)		
PIN	SIGNAL	NAL TECHNICAL SPECIFICATION NOTES		SIGNAL	TECHNICAL SPECIFICATION	NOTES	
1	CLOCK+	Serial syncronous clock (+)		R	Input channel R		
2	CLOCK-	Serial syncronous clock (-)		/R	Input channel /R		
3	DATA+	Serial position data (+)	niput - digital signal	Α	Input channel A		
4	DATA-	Serial position data (-)]	/A	Input channel /A	input - digital signal	
5	NC	Not connect	Do not connect	В	Input channel B		
6	NC	Not connect	Do hot connect	/B	Input channel /B		
7	VP	Power supply: +24Vbc , +5Vbc or OFF (default OFF)	Output - power supply Software selectable	VP	Power supply: +24Vbc , +5Vbc or OFF (default OFF)	Output - power supply Software selectable	
8	0 V	Common gnd for transducer power and signals	Common gnd	0 V	Common gnd for transducer power and signals	Common gnd	

(1) Digital position transducer type is software selectable: Encoder or SSI, see 18.9

SSI connection - example



Note: pin layout referred to axis card view

Encoder connection - example

LEZ axis control				Encoder - HEIDENHAN Model LS 100, cable gland
	1 R	Red	R+	
ZH-8PM/5	2 /R	Black	R-	
	3 A	Brown	A+	
	4 /A	Green	A-	
	5 B	Gray	B+	
12	6 /B	Pink	B-	
8-12-3	7 VP	Brown / Green	Up	
	8 OV	White / Green	OV	
65		Above conn	ections	is are intended as generic example, for details please consult the transducer datasheet

Note: pin layout referred to axis card view

20.5 A execution - Analog position transducers connector - M12 - 5 pin (E2)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Potentiometer	Analog
1	VP +24V	Power supply: +24Vbc or OFF (default OFF)	Output - power supply Software selectable	/	Connect
2	VP +10V	Power supply reference +10Vbc (always present)	Output - power supply	Connect	/
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	Connect
4	TR	Signal transducer	Input - analog signal	Connect	Connect
5	VP -10V	Power supply reference -10Vbc (always present)	Output - power supply	Connect	/

Note: analog input range is software selectable, see 18.9



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

20.7 Diagnostic LEDs (L)

Three leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	El EtherNet/IP	EP PROFINET	
L1	VALVE STATUS				LINK/ACT			
L2	NETWORK STATUS				NETWOF	IK STATUS		
L3	SC	DLENOID STAT	US		LIN	<th></th> <th></th>		

21 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital axis card executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP execution the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



22 CONNECTORS CHARACTERISTICS - to be ordered separately

22.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY		
CODE (A1) ZM-12P		A2 ZH-12P		
Туре	12pin female straight circular	12pin female straight circular		
Standard	DIN 43651	DIN 43651		
Material	Metallic	Plastic reinforced with fiber glass		
Cable gland	PG13,5	PG16		
Recommended cable LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)		LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)		
Conductor size 0,5 mm ² to 1,5 mm ² - available for 12 wires		0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires		
Connection type	to crimp	to crimp		
Protection (EN 60529) IP 67		IP 67		

22.2 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFI	BUS DP (1)	EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	C1 ZM-5PF	C2 ZM-5PM	C1) ZM-5PF/BP	C2 ZM-5PM/BP	©1 ©2 ZM-4PM/E
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately, see tech table GS500

(2) Internally terminated

22.3 Pressure/Force transducer connectors - only for SF, SL

CONNECTOR TYPE	SL - Single transducer		SF - Double transducers	
CODE	D1 ZH-5PM/1.5	D1) ZH-5PM/5	D2) ZH-5PM-2/2	
Туре	5 pin male st	raight circular	4 pin male straight circular	
Standard	M12 coding A –	IEC 61076-2-101	M12 coding A – IEC 61076-2-101	
Material	Pla	stic	Plastic	
Cable gland	Connector moulded on cables 1,5 m lenght 5 m lenght		Connector moulded on cables 2 m lenght	
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)	
Connection type	molded cable		splitting cable	
Protection (EN 60529)	IP 67		IP 67	

22.4 Position transducer connectors

CONNECTOR TYPE	DIGITAL POSITION TRANSDUCER D execution - see 20.4	ANALOG POSITION TRANSDUCER A execution - see 20.5			
CODE	E1) ZH-8PM/5	E2 ZH-5PM/1.5	E2 ZH-5PM/5		
Туре	8 pin male straight circular	5 pin male st	5 pin male straight circular		
Standard M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101			
Material	Plastic	Plastic			
Cable gland	Connector moulded on cables 5 m lenght	Connector moulded on cables 1,5 m lenght 5 m lenght			
Cable	ole 8 x 0,25 mm ²		5 x 0,25 mm ²		
Connection type	molded cable	molded cable			
Protection (EN 60529) IP 67		IP 67			

23 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW-SETUP programming software:

Z-MAN-RI-LEZ - user manual for TEZ and LEZ with SN

Z-MAN-RI-LEZ-S - user manual for TEZ and LEZ with SF, SL

23.1 External reference and transducer parameters

- Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements:
- Scaling parameters define the correspondence of these signals with the specific actuator stroke or force to be controlled
- Limit parameters define maximum/minimum stroke and force to detect possible alarm conditions
- Homing parameters define the startup procedure to initialize incremental transducer (e.g. Encoder)

23.2 PID control dynamics parameters

Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:

- PID parameters each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

23.3 Monitoring parameters

- Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:
- Monitoring parameters maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 23.4)

23.4 Fault parameters

Allow to configure how the axis card detect and react to alarm conditions:

- Diagnostics parameters define different conditions, threshold and delay time to detect alarm conditions
- Reaction parameters define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

23.5 Valve characteristics compensation

Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- Valve parameters modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

23.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

Туре	Size	Fastening bolts	Seals
	1 = 10	4 socket head screws M6x40 class 12.9	5 OR 2050 Diameter of ports A, B, P, T: Ø 11 mm (max)
		Tightening torque = 15 Nm	2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	9 – 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm	4 OR 130 Diameter of ports A, B, P, T: Ø 20 mm (max)
	2 = 10	2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
DPZO -	4 - 25	6 socket head screws M12x60 class 12.9	4 OR 4112 Diameter of ports A, B, P, T: Ø 24 mm (max)
	4 = 23	Tightening torque = 125 Nm	2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9	4 OR 3137 Diameter of ports A, B, P, T: Ø 32 mm (max)
		Tightening torque = 125 Nm	2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x80 class 12.9	4 OR 144 Diameter of ports A, B, P, T: Ø 34 mm (max)
		Tightening torque = 600 Nm	2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	8 = 35	6 socket head screws M20x100 class 12.9	4 OR 156 Diameter of ports A, B, P, T: Ø 50 mm (max)
		Tightening torque = 600 Nm	2 OR 3056 Diameter of ports X, Y: Ø = 9 mm (max)

24 FASTENING BOLTS AND SEALS

25 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain.





Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port B of the main stage



Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port B of the main stage



Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port B of the main stage

27 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting surfaces for electrohydraulic valves
FY100	Safety proportional valves - option /U	Y010	Basics for safety components
FY200	Safety proportional valves - option /K	Z-MAN-	RI-LEZ TEZ/LEZ user manual
GS500	Programming tools	Z-MAN-	RI-LEZ-S TEZ/LEZ with p/Q control user manual
GS510	Fieldbus		
Digital Z-BM-TEZ/LEZ axis cards with driver functionality

DIN-rail format, for position and force controls, autotuning



Z-BM-TEZ/LEZ

Digital axis cards perform the driver functions for proportional valves plus the position closed loop control of the linear or rotative actuator to which the proportional valve is connected.

Z-BM-TEZ execution controls direct and pilot operated directional valves with one LVDT transducer.

Z-BM-LEZ execution controls directional pilot operated valves with two LVDT transducers.

The controlled actuator has to be equipped with position transducer (analog, potentiometer, SSI or Encoder) to read the axis position feedback.

Alternated p/Q control may be set by software and add the force limitation to position regulation, requiring pressure or force transducers installation.

Smart Start-up procedure makes the commissioning quicker and easier, thanks to the Autotuning and Smart Tuning functionalities. Multiple PID sets allows to easily switch axis behaviour according to machine cycle.

General Features:

- up to 11 fast plug-in connectors
- Mini USB connector for Bluetooth/USB connection always present
- DB9 connector for CANopen and PROFIBUS DP
- RJ45 connectors input/output for EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT/IRT
- 8 leds for diagnostics (see 14.1)
- Electrical protection against reverse polarity of power supply
- Ambient temperature range: $-20 \div +50$ °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Smart Start-up with autotuning
- Smart tuning
- Multiple sets
- Internal generation of motion cycle
- Complete diagnostics of axis status
- Internal oscilloscope function
- In field firmware update through USB

Z-BI	M	-	TEZ	-	NP	-	01H	/	*		*	1	*
Off-board electronic a in DIN rail format	xis card												Set code (see section 15)
TEZ = digital full driver one LVDT trans LEZ = digital full driver two LVDT trans	r + axis card, for va ducer r + axis card, for va ducers	alve: alve:	s with s with						Series number Options, see section 16 :				
Fieldbus interface: NP = Not Present BC = CANopen BP = PROFIBUS DP EH = EtherCAT	EW = POWERLI EI = EtherNet/ EP = PROFINE	INK IP T R1	ī/IRT				01H = 05H =	for s	$\begin{array}{l} \mathbf{A} = \max_{\substack{\mathbf{C} = \operatorname{cur}\\ \operatorname{only}}} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	x c rer y ir enc	urrent l nt feedk n combi nid prop	imita back inatio	ation for Ex-proof valves 4 ÷ 20 mA for LVDT transducers, on with option A onal valves (onal valves (only for TEZ)

2 BLOCK DIAGRAM EXAMPLE



3 VALVES RANGE

Valves	Directional							
Industrial	DHZO-T, DKZOR-T	DLHZO-T, DLKZOR-T	DPZO-L					
Tech table	F168	F180	F178					
Ex-proof		DLHZA-T, DLKZA-T						
Tech table	-	FX140	-					
Axis card model	Z-BN	1-TEZ	Z-BM-LEZ					

4 POSITION CONTROL

4.1 External reference signal

Axis card controls in closed loop the actuator position according to a position reference signal from the machine central unit.

- Position profile can be managed in two ways (software selectable):
 Without trajectory generation (a): the axis card receives from the machine central unit the position reference signal and follows it at
- any given instant
 With trajectory generation (b): the axis card receives from the machine central unit just the final target position and internally generates a position profile limiting acceleration, velocity and deceleration

The position reference signal can be software selected between Analog reference (c) and Fieldbus reference (d).

Refer to the axis card user manual for further details on position control features.



4.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands (e) or Fieldbus commands (f).

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



5 ALTERNATED POSITION / FORCE CONTROL

The alternated pressure or force closed loop control can be added to the actuator standard position control, requiring one or two remote transducers (pressure or force) that have to be installed on the actuator, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase (2) and (4) at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations - software selectable



SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.

SL - position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.

General Notes:

- servoproportional type DLHZO, DLKZOR and DPZO-L are strongly recommended for high accuracy applications see tech tables F180, F175
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault, see tech table EY105
- for additional information about alternated p/Q controls configuration please refer to tech table FS500
- Atos technical service is available for additional evaluations related to specific applications usage

6 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW-SETUP programming software.

7 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

Bluetooth or USB connection

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital axis controls via Bluetooth/USB service port. Atos Z-SW-SETUP PC software supports all Atos digital axis controls and it is available at www.atos.com in MyAtos area.



WARNING: axis card USB port is not isolated! For E-C-SB-USB/BM cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection





8 SMART START-UP

The automatic procedure supports the user during the commissioning phases of the axis control with guided procedures:

General setting

It assists the user in system data setup, as like cylinder stroke, diameters, load mass, configure analog/digital signals and communication interface, position transducer setup.

System check

It automatically executes position open loop movements to set axis control parameters, position transducer calibration and verify cylinder stroke.

Position autotuning

It automatically determines the optimal PID parametrization of the position control adapting the dynamic response to guarantee control precision and axis stability. Once the procedure is started, the control performs few automatic position open loop movements of the actuator, during which control parameters are calculated and stored.

9 SMART TUNING

Once the Smart Start-up procedure has been completed, the Smart tuning feature allows to further refine the position control response by choosing from 3 different levels of performance in positioning:

- dynamic best dynamics and accuracy (default factory setting)

- balanced average dynamics and accuracy

- **smooth** attenuated dynamics and accuracy to improve control stability in critical applications or in environments with electrical disturbances.

If required, control performance can be further customized by modifying PID parameter via Z-SW-SETUP software.



10 MULTIPLE SETS

Multiple PID sets allows to easily switch axis behaviour according to machine cycle, selecting between independent groups of parameters for:

- position control PID

- force control PID and p/Q logics switching criteria

Settings can be changed any time via Z-SW-SETUP software, fieldbus or digital input signals.

11 FIELDBUS - see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

12 APPLICATION EXAMPLES



Hydraulic steering wheel in marine applications

Rudder controls on motor yachts and sail boats requires smooth control for precise and reliable operations.

Z-BM-TEZ/LEZ axis cards perform the rudder position control system, ensuring accurate and repetitive regulations for a comfortable ride, thanks to:

- analog position reference mode for real time controls
- analog position transducer for simple and compact solution
- position PID control parameters to optimize the system response
- complete diagnostic information for advanced system monitoring











Wind turbines

The pitch control of the rotor blades is required to maximize the energy production. Accurate positioning, decentralized intelligence as well as long service life and reliability are required.

Z-BM-TEZ/LEZ axis cards perform high quality regulation of the blade pitch simplifying the system architecture, thanks to:

- SSI digital position transducer for high precision control
- complete remote system management with fieldbus interface
- position PID selection to adapt the position control to the different wind conditions

Process valves

Process valves motion regulation requires smooth and remote controls due to wide distributed applications.

Z-BM-TEZ/LEZ axis cards allow remote control, thanks to:

- internal reference generation with maximum speed and acceleration settings for standing alone axis control
- potentiometer position transducer for compact and cost effective solution
 fieldbus connection for easy parameterization and remote commands

Wood machinery

Hydraulic wood machines require configurable and repetitive motion profiles, accurate position controls, and digital signals for synchronization purpose.

Z-BM-TEZ/LEZ axis cards allow remote control, thanks to:

- internal reference generation with maximum speed and acceleration settings
- analog position transducer for simple and reliable solution
- pressure transducer for alternated pressure control
 fieldbus connection for remote parameterization, commands, and axis card state indication

Bending Machines

Machine tools for cold-forming flat sheets require complete, automatic, programmable and flexible machine control to produce sheet metal panels from punched blank.

Z-BM-TEZ/LEZ axis cards combine high level position regulation with accurate force control to provide in a single device a complete and dedicated solution, thanks to:

- internal reference generation to simplify the machine control cycle
- digital position sensor for high resolution measurement system
- two pressure transducers for alternated force control
 fieldbus interface for easy machine control integration
- auxiliary digital outputs for system status indication (target reached,
- force control active)

Die-casting machinery

Clamp movements in die-casting phases involve fast/slow motion cycle with accurate and repetitive alternated position/force controls for the mould safety functions.

Z-BM-TEZ/LEZ axis cards, with alternated position/force control, simplify the hydraulic + electronic system architecture, thanks to:

- internal reference generation for repetitive working cycles
- SSI digital position transducer for accurate axis control
- two pressure transducers for alternated force control
- auxiliary digital inputs/output to synchronize the machine functions
- fieldbus connection for machine remote control and advanced diagnostics

13 MAIN CHARACTERISTICS

Power supplies	Nominal Rectified and filtered	: +24 VDC : VRMS = 20 ÷ 32 VMA	x (ripple max 10 % VPP)					
Max power consumption	50 W	50 W						
Current supplied to solenoids	$I_{MAX} = 3.0 \text{ A for standa}$ $I_{MAX} = 2.5 \text{ A for ex-pro}$	ard axis card of axis card (/A option)					
Analog input signals	Voltage: range ±10 V Current: range ±20 n	/DC (24 VMAX tolerant) nA	Input impedance: Ri > Input impedance: Ri =	- 50 kΩ = 500 Ω				
Monitor outputs	Output range:	voltage ±10 Vbc @ current ±20 mA @ r	max 5 mA max 500 Ω load resistan	се				
Enable input	Range: 0 ÷ 5 Vbc (OFF	state), 9 ÷ 24 Vpc (ON	I state), 5 ÷ 9 Vpc (not ac	ccepted); Input impedance: $Ri > 10 k\Omega$				
Fault output	Output range: 0 ÷ 24 external negative volta	Dutput range: 0 ÷ 24 Vbc (ON state > [power supply - 2 V]; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)						
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, position control monitoring, valve spool transducer malfunctions, alarms history storage function							
Position transducers power supply	+24 Vbc @ max 100 mA or +5 Vbc @ max 100 mA are software selectable							
Pressure/Force transducers power supply	+24 Vpc @ max 100 mA							
Format	Plastic box ; IP20 prot	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715						
Ambient temperature range	-20 ÷ +50 °C (storage	e -25 ÷ +85 °C)						
Mass	Approx. 450 g							
Additional characteristics	8 leds for diagnostic;	protection against reve	rse polarity of power sup	pply				
Compliance	CE according to EMC RoHS Directive 2011/6 REACH Regulation (E0	directive 2014/30/EU (65/EU as last update by C) n°1907/2006	Immunity: EN 61000-6-2 / 2015/863/EU	; Emission: EN 61000-6-3)				
Communication interface	USB	CANopen	PROFIBUS DP	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT				
	Alos ASCII couling	EINOU320-4 + D5406	ENSUI7U-2/IECG1156					
Communication physical layer	USB 2.0 + USB OTG	CAN ISO11898	RS485	100 Base TX				
Recommended wiring cable	LiYCY shielded cables Note: for transducers	s: 0,5 mm ² max 50 m f wiring cable please cor	for logic - 1,5 mm ² ma	x 50 m for power supply tasheet				
Max conductor size (see section 20)	2,5 mm ²							

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the axis card energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

14 CONNECTIONS AND LEDS



(1) D connector is available only for Z-BM-LEZ-**-01H

(2) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector: DG909MF1 - the connector will be oriented upwards; DG909MF3 - the connector will be oriented downwards

14.1 Diagnostic LEDs L

Eight leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	PW L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SC	DLENOID STAT	US	LINK/ACT				
PW	OFF = Power s	supply OFF	ON = Pow	er supply ON				
ST	OFF = Fault pr	esent	ON = No fa	ault				ST

14.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES				
	A1	V+	Power supply 24 Vpc	Input - power supply				
•	A2	VO	Power supply 0 Vbc	Gnd - power supply				
A	A3	VL+	Power supply 24 Vbc for axis card logic and communication	Input - power supply				
	A4	VL0	Power supply 0 Vpc for axis card logic and communication	Gnd - power supply				
			Desition reference input signal, 10 Vpc / 20 mA maximum repres	Innut, angles signal				
	B1	P_INPUT+	default is ± 10 Vbc	Software selectable				
B	B2	INPUT-	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal				
	B3	F_INPUT+	+orce reference input signal (SF, SL controls): +10 Vpc / ±20 mA maximum range; default is ±10 Vpc	Input - analog signal Software selectable				
	B4	EARTH	Connect to system ground					
	01		Position monitor output signal: ±10 Vpc / ±20 mA maximum range.	Output - analog signal				
	0		referred to AGND; default is ±10 Vpc	Software selectable				
C	02	ENABLE	Enable (24 Vbc) or disable (0 Vbc) the axis card, referred to VL0	Input - on/off signal				
	C3	F_MONITOR	signal: ±10 Vpc / ±20 mA maximum range, referred to AGND; default is ±10 Vpc	Output - analog signal Software selectable				
	C4	FAULT	Fault (0 Vbc) or normal working (24 Vbc), referred to VL0	Output - on/off signal				
	D1	LVDT_L	Main stage valve LVDT position transducer signal	Input - analog signal				
	D2	-15V	Main stage valve LVDT position transducer power supply -15V	Output power supply				
D (1)	D3	+15V	Main stage valve LVDT position transducer power supply +15V	Output power supply				
	D4	AGND	Common gnd for transducer power supply and monitor outputs	Common gnd				
	E 1		Direct valve or pilot valve LVDT position trapeducer signal					
_	E2	-15V	Direct valve or pilot valve LVDT position transducer signal	Output - analog signal				
	E3	+15V	Direct valve or pilot valve LVDT position transducer power supply 15V	Output power supply				
	E4	AGND	Common gnd for transducer power supply and monitor outputs	Common and				
				0				
	F1	SOL_S1-	Negative current to solenoid S1	Output - power PWM				
F	F2	SOL_S1+	Positive current to solenoid S1	Output - power PWM				
•	F3	SOL_S2-	Negative current to solenoid S2	Output - power PWM				
	F4	SOL_S2+	Positive current to solenoid S2	Output - power PWM				
	G1							
G	G2		Digital position transducer SSI or Encoder is software selectable: - SSI connections see 14.3					
	G3		- Encoder connections see 14.4					
	G4							
	H1							
Ц	H2		Digital position transducer SSI or Encoder is software selectable:					
	H3							
	H4							
	1	VP	Power supply:	Output - power supply				
_			+24Vbc, +5Vbc or OFF (default OFF)	Software selectable				
	12	P_TR1	±10 Vpc / ±20 mA maximum range; default is ±10 Vpc	Software selectable				
	13	AGND	Common gnd for transducer power supply and signals	Common gnd				
	14	NC	Do not connect					
	J1	VF +24V	Power supply: +24Vbc or OFF (default OFF)	Output - power supply Software selectable				
	J2	F_TR1	1st signal pressure/force transducer: ±10 Vbc / ±20 mA maximum range: default is ±10 Vbc	Input - analog signal Software selectable				
0	J3	AGND	Common gnd for transducer power supply and signals	Common gnd				
	J4	NC	Do not connect					
	144			Output - power supply				
	К1	VF +24V	Power supply: +24Vbc or OFF (default OFF)	Software selectable				
K	K2	F_TR2	± 10 Signal pressure narisoucer (only for SF): ± 10 Vpc / ± 20 mA maximum range; default is ± 10 Vpc	Software selectable				
	K3	AGND	Common gnd for transducer power supply and signals	Common gnd				
	K4	NC	Do not connect					

(1) D connector is available only for Z-BM-LEZ-**-01H

14.3 SSI connectors signals - 4 pin

	G1	CLOCK+	Serial synchronous clock (+)	Output - on/off signal	
	G2 CLOCK-		Serial synchronous clock (-)	Output - on/off signal	
G	G3	VP	Power supply: +24Vbc , +5Vbc or OFF (default OFF)	Output - power supply Software selectable	
	G4	0V	Common gnd for transducer power and signals	Common gnd	
		I			
	H1	DATA+	Serial position data (+)	Input - on/off signal	
н	H2	DATA-	Serial position data (-)	Input - on/off signal	
	H3	NC	Do not connect		
	H4	NC	Do not connect		

Note: for Balluff BTL7 with SSI interface only special code SA433 is supported

SSI connection - example



14.4 Encoder connectors signals - 4 pin

	G1 R		Input channel R	Input - on/off signal	
	G2	/R	Input channel /R	Input - on/off signal	
G	G3	3 VP Power supply: +24Vbc,+5Vbc or OFF (default OFF)		Output - power supply Software selectable	
	G4 0V		Common gnd for transducer power and signals	Common gnd	
	H1	Α	Input channel A	Input - on/off signal	
ы	H2	/A	Input channel /A	Input - on/off signal	
	H3	В	Input channel B	Input - on/off signal	
	H4	/B	Input channel /B	Input - on/off signal	

Encoder connection - example



14.5 Pressure/force transducers connection - example



14.6 Communication connectors (3 - 4) - (5 - 6) - (7)

3	USB connector - Mini USB type B always present							
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)						
1	+5V_USB	Power supply						
2	D-	Data line -						
3	D+	Data line +						
4	ID	Identification						
5	GND_USB	Signal zero data line						
5	BP fieldbus	execution, connector - DB9 - 9 pin						
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)						
1	SHIELD							
3	LINE-B	Bus line (low)						
5	DGND	Data line and termination signal zero						
6	+5V	Termination supply signal						
0		Due line (high)						

(4)	④ BC fieldbus execution, connector - DB9 - 9 pin						
PIN	SIGNAL	SIGNAL TECHNICAL SPECIFICATION (1)					
2	CAN_L	Bus line (low)					
3	CAN_GND	Signal zero data line					
5	CAN_SHLD	Shield					
7	CAN_H	Bus line (high)					

60	(6) (7) EH, EW, EI, EP fieldbus execution, connector - RJ45 - 8 pin								
PIN	SIGNAL	TECHNICAL	FECHNICAL SPECIFICATION (1)						
1	TX+	Transmitter	-	white/orange					
2	TX-	Transmitter	-	orange					
3	RX+	Receiver	-	white/green					
6	RX-	Receiver	-	green					

(1) Shield connection on connector's housing is recommended

15 SET CODE

The basic calibration of axis card is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of axis card model code (see section 1). For correct set code selection, please include in the axis card order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for axis card logic and communication (VL+ and VL0)

The power supply (pin A3 and A4) for axis card logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. The separate power supply for axis card logic, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each axis card logic and communication power supply: 500 mA fast fuse.

16.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin B1), depends on axis card reference mode, see section 4:

external analog reference (see 4.1): input is used as reference for control in closed loop the actuator position.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vbc or ± 20 mA; default is ±10 Vbc

external fieldbus reference (see 4.1) or automatic cycle (see 4.2): analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vpc.

16.4 Force reference input signal (F_INPUT+)

Functionality of F_INPUT+ signal (pin B3), depends on selected axis card reference mode and alternated control options, see section 5: *SL, SF controls and external analog reference selected*: input is used as reference for the axis card pressure/force closed loop. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vpc or ± 20 mA; default is ±10 Vpc

SN control or fieldbus reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24Vpc

16.5 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal (pin C1) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position). The output range and polarity are software selectable within the maximum range ± 10 Vpc or ± 20 mA; default is ± 10 Vpc

16.6 Force monitor output signal (F_MONITOR)

The axis card generates an analog output signal (pin C3) according to alternated force control option: *SN control:* output signal is proportional to the actual valve spool position *SL, SF controls:* output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference). The output range and polarity are software selectable within the maximum range ±10 Vpc or ±20 mA; default is ±10 Vpc

16.7 Enable Input Signal (ENABLE)

To enable the axis card, a 24VDc voltage has to be applied on pin C2

- When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:
- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

16.8 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signalcable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 Vpc, normal working corresponds to 24 Vpc Fault status is not affected by the status of the Enable input signal.

Fault output signal can be used as digital output by software selection.

16.9 Position transducer input signals

A position transducer must be always directly connected to the axis card. Position digital input signals are factory preset to binary SSI, they can be reconfigured via software selecting between binary/gray SSI, Encoder or generic transducer with analog interface. Input signals can be reconfigured via software selecting between voltage and current, within a maximum range of $\pm 10 \text{ V}_{DC}$ or $\pm 20 \text{ mA}$; default is $\pm 10 \text{ V}_{DC}$

Refer to position transducer characteristics to select the transducer type according to specific application requirements, see section 17.

16.10 Remote pressure/force transducer input signals (F_TR1 and F_TR2) - SF, SL controls

Analog remote pressure transducers or load cell can be directly connected to the axis card.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vpc or ± 20 mA; default is ±10 Vpc

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements, see section 17.

16.11 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the axis card using ±15 Vpc supply output available at pin D2, D3 and pin E2, E3.

Note: transducer input signals working range is ± 10 Vpc for standard or $4 \div 20$ mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the axis card set code).

16.12 Possible combined options: /AC

17 ACTUATOR'S TRANSDUCER CHARACTERISTICS

17.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: analog signal (analog), SSI or Encoder (digital). Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances. Transducers with analog interface grant simple and cost effective solutions.

17.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer (see section 5).

Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.

Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115% ÷120% of the maximum regulated pressure/force.

17.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

		Pressure/Force		
Input type	Analog	SSI (3)	Incremental Encoder	Analog
Power supply (1)	+24 VDC	+24 VDC	+5 Vpc or +24 Vpc	+24 Vpc
Axis card interface	0 ÷ 10V or 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vpc or 4 ÷ 20 mA
Max speed	1 m/s	1 m/s	2 m/s	-
Max resolution	< 0.2 % FS	5 µm	1 μm (@ 0.15 m/s)	< 0.4 % FS
Linearity error (2)	< ±0.02% FS	< ± 0.02 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability (2)	< ± 0.005% FS	< ± 0.005 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) power supply provided by Atos axis card (2) percentage of total stroke (3) for Balluff BTL7 with SSI interface only special code SA433 is supported

18 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW-SETUP programming software:

Z-MAN-BM-LEZ - user manual for Z-BM-LEZ and Z-BM-TEZ

18.1 External reference and transducer parameters

Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements:

- Scaling parameters define the correspondence of these signals with the specific actuator stroke or force to be controlled
- Limit parameters define maximum/minimum stroke and force to detect possible alarm conditions
- Homing parameters define the startup procedure to initialize incremental transducer (e.g. Encoder)

18.2 PID control dynamics parameters

Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:

- PID parameters each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

18.3 Monitoring parameters

Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:

- Monitoring parameters maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 18.4)

18.4 Fault parameters

Allow to configure how the axis card detect and react to alarm conditions:

- Diagnostics parameters define different conditions, threshold and delay time to detect alarm conditions
- Reaction parameters define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

18.5 Valve characteristics compensation

Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- Valve parameters modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

18.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 4.2).

19 OVERALL DIMENSIONS [mm]



(1) D connector is available only for Z-BM-LEZ-**-01H

20 INSTALLATION



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot. (eg. connector A can not be inserted into connector slot of B,C,D,E,F,G,H,I,J,K)

21 WIRING EXAMPLES

21.1 Position control - analog reference - analog position transducer



(1) For valve electrical connections please refer to the specific technical table

(2) The analog position transducer connections are intended as generic example, for details please consult the transducer datasheet

21.2 Alternated position/force control - CANopen reference - SSI position transducer - 2 analog pressure transducers



(1) For valve electrical connections please refer to the specific technical table

(2) Pressure transducers connections are shown with voltage signal output; for connections with current signal output see 14.5

(3) The SSI position transducer connections are intended as generic example, for details please consult the transducer datasheet

21.3 Alternated position/force control - EtherNet/IP reference - Encoder position transducer - analog load cell



(1) For valve electrical connections please refer to the specific technical table

(2) Load cell connections is shown with voltage signal output; please consult the load cell datasheet for details about connections

(3) The Encoder position transducer connections are intended as generic example, for details please consult the transducer datasheet

atos 🛆

Digital Z-BM-KZ axis cards

DIN-rail format, for position and force controls, autotuning



Z-BM-KZ

Digital axis cards perform the position closed loop of linear or rotative hydraulic axes. The axis card generates a reference signal to the proportional valve which regulates the hydraulic flow to the actuator.

The controlled actuator has to be equipped with position transducer (analog, potentiometer, SSI or Encoder) to read the axis position feedback.

Alternated p/Q control may be set by software and add the force limitation to position regulation, requiring pressure or force transducers installation.

Smart Start-up procedure makes the commissioning quicker and easier, thanks to the Autotuning and Smart Tuning functionalities. Multiple PID sets allows to easily switch axis behaviour according to machine cycle.

General Features:

- 10 fast plug-in connectors
- Mini USB connector for Bluetooth/USB connection always present
- DB9 connector for CANopen and PROFIBUS DP
- RJ45 connectors input/output for EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT/IRT
- 8 leds for diagnostics (see 14.1)
- Electrical protection against reverse polarity of power supply
- Ambient temperature range: -20 ÷ +50 °C
- Plastic box with IP20 protection degree
 and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Smart Start-up with autotuning
- Smart tuning
- Multiple sets
- Internal generation of motion cycle
- · Complete diagnostics of axis status
- Internal oscilloscope function
- In field firmware update through USB



Note: block diagram example for alternated position/force control, with fieldbus interface

3 VALVES RANGE

Valves		Directional								
Industrial Tech table	DHZO-TEB, DKZOR-TEB FS168	DHZO-TES, DKZOR-TES FS168	DLHZO-TEB, DLKZOR-TEB FS180	DLHZO-TES, DLKZOR-TES FS180	DPZO-LEB FS178	DPZO-LES FS178				
Ex-proof Tech table	-	DHZA-TES, DKZA-TES FX135	-	DLHZA-TES, DLKZA-TES FX150	-	DPZA-LES FX235				

4 POSITION CONTROL

4.1 External reference signal

Axis card controls in closed loop the actuator position according to a position reference signal from the machine central unit.

Position profile can be managed in two ways (software selectable):

- Without trajectory generation (a): the axis card receives from the machine central unit the position reference signal and follows it at any given instant
- With trajectory generation (b): the axis card receives from the machine central unit just the final target position and internally generates a position profile limiting acceleration, velocity and deceleration

The position reference signal can be software selected between Analog reference (c) and Fieldbus reference (d).

Refer to the axis card user manual for further details on position control features.



4.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands (e) or Fieldbus commands (f).

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



5 ALTERNATED POSITION / FORCE CONTROL

The alternated force closed loop control can be added to the actuator standard position control, requiring one or two remote transducers (pressure or force) that have to be installed on the actuator, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time. The dynamics of the switching between the two controls can be regulated thanks to

specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase 2) and 4) at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations - software selectable



SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.

SL - position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.

General Notes:

- servoproportional type DLHZO, DLKZOR and DPZO-L are strongly recommended for high accuracy applications see tech tables F180, F175
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault, see tech table EY105
- for additional information about alternated p/Q controls configuration please refer to tech table FS500
- Atos technical service is available for additional evaluations related to specific applications usage

6 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW-SETUP programming software.

7 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital axis controls via Bluetooth/USB service port. Atos Z-SW-SETUP PC software supports all Atos digital axis controls and it is available at www.atos.com in MyAtos area.



WARNING: axis card USB port is not isolated! For E-C-SB-USB/BM cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500**

Bluetooth or USB connection



8 SMART START-UP

The automatic procedure supports the user during the commissioning phases of the axis control with guided procedures:

General setting

It assists the user in system data setup, as like cylinder stroke, diameters, load mass, configure analog/digital signals and communication interface, position transducer setup.

System check

It automatically executes position open loop movements to set axis control parameters, position transducer calibration and verify cylinder stroke.

Position autotuning

It automatically determines the optimal PID parametrization of the position control adapting the dynamic response to guarantee control precision and axis stability. Once the procedure is started, the control performs few automatic position open loop movements of the actuator, during which control parameters are calculated and stored.

9 SMART TUNING

Once the Smart Start-up procedure has been completed, the Smart tuning feature allows to further refine the position control response by choosing from 3 different levels of performance in positioning:

- dynamic best dynamics and accuracy (default factory setting)

- balanced average dynamics and accuracy

- **smooth** attenuated dynamics and accuracy to improve control stability in critical applications or in environments with electrical disturbances Settings can be changed any time via Z-SW-SETUP software or fieldbus.

If required, control performance can be further customized by modifying PID parameter via Z-SW-SETUP software.



10 MULTIPLE SETS

Multiple PID sets allows to easily switch axis behaviour according to machine cycle, selecting between independent groups of parameters for:

- position control PID

- force control PID and p/Q logics switching criteria

Settings can be changed any time via Z-SW-SETUP software, fieldbus or digital input signals.

11 FIELDBUS - see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

12 APPLICATION EXAMPLES











Hydraulic steering wheel in marine applications

Rudder axis card on motor vachts and sail boats requires smooth control for precise and reliable operations.

Z-BM-KZ axis cards perform the rudder position control system, ensuring accurate and repetitive regulations for a comfortable ride, thanks to:

- analog position reference mode for real time controls
- analog position transducer for simple and compact solution
 position PID control parameters to optimize the system response
- complete diagnostic information for advanced system monitoring

Wind turbines

The pitch control of the rotor blades is required to maximize the energy production. Accurate positioning, decentralized intelligence as well as long service life and reliability are required.

Z-BM-KZ axis cards perform high quality regulation of the blade pitch simplifying the system architecture, thanks to:

- SSI digital position transducer for high precision control
- complete remote system management with fieldbus interface - position PID selection to adapt the position control to the different wind conditions

Wood machinery

Hydraulic wood machines require configurable and repetitive motion profiles, accurate position controls, and digital signals for synchronization purpose.

- Z-BM-KZ axis cards allow remote control, thanks to:
- internal reference generation with maximum speed and acceleration settings
- analog position transducer for simple and reliable solution
- pressure transducer for alternated pressure control
- fieldbus connection for remote parameterization, commands, and axis card state indication

Bending Machines

Machine tools for cold-forming flat sheets require complete, automatic, programmable and flexible machine control to produce sheet metal panels from punched blank

Z-BM-KZ axis cards combine high level position regulation with accurate force control to provide in a single device a complete and dedicated solution, thanks to:

- internal reference generation to simplify the machine control cycle
- digital position sensor for high resolution measurement system
- two pressure transducers for alternated force control
- fieldbus interface for easy machine control integration
- auxiliary digital outputs for system status indication (target reached, force control active)

Die-casting machinery

Clamp movements in die-casting phases involve fast/slow motion cycle with accurate and repetitive alternated position/force controls for the mould safety functions.

Z-BM-KZ axis cards, with alternated position/force control, simplify the hydraulic + electronic system architecture, thanks to:

- internal reference generation for repetitive working cycles
- SSI digital position transducer for accurate axis control
- two pressure transducers for alternated force control
- auxiliary digital inputs/output to synchronize the machine functions
- fieldbus connection for machine remote control and advanced diagnostics

13 MAIN CHARACTERISTICS

Power supply	Nominal: +24 VbcRectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)								
Max power consumption	10 W								
Analog input signals	Voltage: range ±10 V Current: range ±20 m	Voltage: range ± 10 Vpc (24 VMAX tollerant) Input impedance: Ri > 50 k Ω Current: range ± 20 mA Input impedance: Ri = 500 Ω							
Monitor outputs Control output	Output range:	voltage ±10 Vpc @ current ±20 mA @ r	max 5 mA max 500 Ω load resistan	се					
Enable and digital inputs	Range: 0 ÷ 5 Vpc (OFF	= state), 9 ÷ 24 Vpc (ON	I state), 5 ÷ 9 Vpc (not ac	ccepted); Input impedance: Ri > 10 k Ω					
Fault output	Output range: 0 ÷ 24 external negative volta	VDC (ON state > [powe age not allowed (e.g. du	er supply - 2 V] ; OFF sta ue to inductive loads)	ate < 1 V) @ max 50 mA;					
Alarms	Cable break with curre	ent reference signal, ov	er/under temperature, p	osition control monitoring					
Position transducers power supply	+24 Vpc @ max 100 m	A or +5 VDc@ max 100	mA are software selecta	able					
Pressure/Force transducers power supply	+24 Vpc @ max 100 mA								
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715								
Ambient temperature range	-20 ÷ +50 °C (storage	e -25 ÷ +85 °C)							
Mass	Approx. 450 g								
Additional characteristics	8 leds for diagnostic;	protection against reve	rse polarity of power sup	pply					
Compliance	CE according to EMC RoHS Directive 2011/6 REACH Regulation (E0	directive 2014/30/EU (65/EU as last update by C) n°1907/2006	Immunity: EN 61000-6-2 / 2015/863/EU	; Emission: EN 61000-6-3)					
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158					
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX					
Recommended wiring cable	LiYCY shielded cables: 0,5 mm ² max 50 m for logic - 1,5 mm ² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet								
Max conductor size (see section 19)	2,5 mm ²								

14 CONNECTIONS AND LEDS



(1) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector: DG909MF1 - the connector will be oriented upwards; DG909MF3 - the connector will be oriented downwards

14.1 Diagnostic LEDs (L)

Eight leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	PW L1 L2 L3
L1	VALVE STATUS				LINK			
L2	NETWORK STATUS				NETWOR			
L3	ALARM STATUS				LINK			
PW	OFF = Power s	supply OFF	ON = Pow	er supply ON				
ST	OFF = Fault pr	esent	ON = No f	ault		51		

14.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES			
	A1	NC	Do not connect				
Λ	A2	NC	Do not connect				
A	A3	V+	Input - power supply				
	A4	V0	Power supply 0 Vbc	Gnd - power supply			
	B1	P_INPUT+	Position reference input signal: +10 Vpc / +20 mA maximum range: default is +10 Vpc	Input - analog signal			
Р	B2	INPUT-	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal			
D	B3	F_INPUT+	Force reference input signal (SF, SL controls): ±10 Vpc / ±20 mA maximum range; default is ±10 Vpc	Input - analog signal Software selectable			
	B4	EARTH	Connect to system ground				
	C1	P_MONITOR	Position monitor output signal: ± 10 Vpc / ± 20 mA maximum range, referred to AGND; default is ± 10 Vpc	Output - analog signal Software selectable			
	C2	ENABLE	Enable (24 Vpc) or disable (0 Vpc) the axis card, referred to V0	Input - on/off signal			
С	C3	F_MONITOR	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ± 10 Vpc / ± 20 mA maximum range, referred to AGND; default is ± 10 Vpc	Output - analog signal Software selectable			
		NC	For EW, EI, EP executions the F_MONITOR is not available: do not connect				
	C4	FAULT	Fault (0 Vpc) or normal working (24 Vpc), referred to V0	Output - on/off signal			
	D1	D_IN1	Digital input 0 ÷ 24Vbc, referred to AGND	Input - on/off signal			
	D2	NC	Do not connect				
D	D3	CTRL_OUT+	Control output signal for external valve driver, referred to AGND	Output - analog signal Software selectable			
	D4	AGND	Common gnd				
	E1	D_IN0	Digital input 0 ÷ 24Vbc, referred to AGND	Input - on/off signal			
F	E2	NC	Do not connect				
_	E3	NC	Do not connect				
	E4	AGND	Common gnd for digital input and monitor outputs	Common gnd			
G	G1 G2 G3 G4		Digital position transducer SSI or Encoder is software selectable: - SSI connections see 14.3 - Encoder connections see 14.4				
Н	H1 H2 H3 H4		Digital position transducer SSI or Encoder is software selectable: - SSI connections see 14.3 - Encoder connections see 14.4				
	11	VP	Power supply: +24Vbc, +5Vbc or OFF (default OFF)	Output - power supply Software selectable			
I	12	P_TR1	Analog position transducer input signal ± 10 Vpc / ± 20 mA maximum range; default is ± 10 Vpc	Input - analog signal Software selectable			
	13	AGND	Common gnd for transducer power supply and signals	Common gnd			
	14	NC	Do not connect				
	J1	VF +24V	Power supply: +24Vbc or OFF (default OFF)	Output - power supply Software selectable			
J	J2	F_TR1	1st signal pressure/force transducer: $\pm 10 \text{ Vpc} / \pm 20 \text{ mA maximum range; default is } \pm 10 \text{ Vpc}$	Input - analog signal Software selectable			
_	J3	AGND	Common gnd for transducer power supply and signals	Common gnd			
	J4	NC	Do not connect				
	K1	VF +24V	Power supply: +24Vbc or OFF (default OFF)	Output - power supply Software selectable			
K	K2	F_TR2	2nd signal pressure transducer (only for SF): ±10 Vbc / ±20 mA maximum range; default is ±10 Vbc	Input - analog signal Software selectable			
	K3	AGND	Common gnd for transducer power supply and signals	Common gnd			
	K4 NC Do not connect						

14.3 SSI connectors signals - 4 pin

	G1	CLOCK+	Serial synchronous clock (+)	Output - on/off signal
\sim	G2	CLOCK-	Serial synchronous clock (-)	Output - on/off signal
G	G3	VP	Power supply: +24Vbc , +5Vbc or OFF (default OFF)	Output - power supply Software selectable
	G4	0V	Common gnd for transducer power supply and signals	Common gnd
		1	1	
	H1	DATA+	Serial position data (+)	Input - on/off signal
н	H2	DATA-	Serial position data (-)	Input - on/off signal
	H3	NC	Do not connect	
	H4	NC	Do not connect	

Note: for Balluff BTL7 with SSI interface only special code SA433 is supported

SSI connection - example



14.4 Encoder connectors signals - 4 pin

	G1	R	Input channel R	Input - on/off signal
\sim	G2	/R	Input channel /R	Input - on/off signal
G	G3	VP	Power supply: +24Vbc , +5Vbc or OFF (default OFF)	Output - power supply Software selectable
	G4	0V	Common gnd for transducer power and signals	Common gnd
	H1	Α	Input channel A	Input - on/off signal
ы	H2	/A	Input channel /A	Input - on/off signal
	H3	В	Input channel B	Input - on/off signal
	H4	/B	Input channel /B	Input - on/off signal

Encoder connection - example



14.5 Pressure/force transducers connection - example



14.6 Communication connectors (3 - (4) - (5) - (6) - (7)

3	USB connector - Mini USB type B always present									
PIN	SIGNAL	L TECHNICAL SPECIFICATION (1)								
1	+5V_USB	Power supply								
2	D-	Data line -								
3	D+	Data line +								
4	ID	Identification								
5	GND_USB	Signal zero data line								
Ø	DD Galallana	outries consistent DD0 0 min								
5	BP fieldbus	execution, connector - DB9 - 9 pin								
⑤ PIN	BP fieldbus SIGNAL	execution, connector - DB9 - 9 pin TECHNICAL SPECIFICATION (1)								
⑤ PIN 1	BP fieldbus SIGNAL SHIELD	execution, connector - DB9 - 9 pin TECHNICAL SPECIFICATION (1)								
 (5) PIN 1 3 	BP fieldbus SIGNAL SHIELD LINE-B	execution, connector - DB9 - 9 pin TECHNICAL SPECIFICATION (1) Bus line (low)								
 (5) PIN 1 3 5 	BP fieldbus SIGNAL SHIELD LINE-B DGND	execution, connector - DB9 - 9 pin TECHNICAL SPECIFICATION (1) Bus line (low) Data line and termination signal zero								
 (5) PIN 1 3 5 6 	BP fieldbus SIGNAL SHIELD LINE-B DGND +5V	execution, connector - DB9 - 9 pin TECHNICAL SPECIFICATION (1) Bus line (low) Data line and termination signal zero Termination supply signal								

4	④ BC fieldbus execution, connector - DB9 - 9 pin							
PIN	SIGNAL TECHNICAL SPECIFICATION (1)							
2	CAN_L Bus line (low)							
3	CAN_GND	Signal zero data line						
5	CAN_SHLD	Shield						
7	CAN_H	Bus line (high)						

6 (7) EH, EW, EI, EP fieldbus execution, connector - RJ45 - 8 pin										
PIN	SIGNAL	TECHNICAL	TECHNICAL SPECIFICATION (1)							
1	TX+	Transmitter	-	white/orange						
2	RX+	Receiver	-	white/green						
3	TX-	Transmitter	-	orange						
6	RX-	Receiver	-	green						

(1) Shield connection on connector's housing is recommended

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

A safety fuse is required in series to each power supply: 500 mA fast fuse.

15.2 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin B1), depends on axis card reference mode, see section 4:

external analog reference (see 4.1): input is used as reference for control in closed loop the actuator position. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vpc or ± 20 mA; default is ± 10 Vpc

external fieldbus reference (see 4.1) or automatic cycle (see 4.2): analog reference input signal can be used as on-off commands with input range 0 ÷ 24 Vpc.

15.3 Force reference input signal (F_INPUT+)

Functionality of F_INPUT+ signal (pin B3), depends on selected axis card reference mode and alternated control options, see section 5: *SL, SF controls and external analog reference selected*: input is used as reference for the axis card pressure/force closed loop. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vpc or ± 20 mA; default is ±10 Vpc

SN control or fieldbus reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC

15.4 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal (pin C1) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position). The output range and polarity are software selectable within the maximum range ± 10 Vpc or ± 20 mA; default is ± 10 Vpc

15.5 Force monitor output signal (F_MONITOR)

The axis card generates an analog output signal (pin C3) according to alternated force control option:

SN control: output signal is proportional to the actual valve spool position

SL, SF controls: output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).

The output range and polarity are software selectable within the maximum range ±10 Vbc or ±20 mA; default is ±10 Vbc

15.6 Enable Input Signal (ENABLE)

To enable the axis card, a 24 VDC voltage has to be applied on pin C2.

When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:

- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)

- move forward or backward in open loop (only the valve's closed loop remain active)

15.7 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 Vbc, normal working corresponds to 24 Vbc Fault status is not affected by the status of the Enable input signal.

Fault output signal can be used as digital output by software selection.

15.8 Position transducer input signals

A position transducer must be always directly connected to the axis card. Position digital input signals are factory preset to binary SSI, they can be reconfigured via software selecting between binary/gray SSI, Encoder or generic transducer with analog interface. Input signals can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vpc or ± 20 mA;

default is ± 10 Vpc of ± 20 m/A,

Refer to position transducer characteristics to select the transducer type according to specific application requirements, see section 16.

15.9 Remote pressure/force transducer input signals (F_TR1 and F_TR2) -SF, SL controls

Analog remote pressure transducers or load cell can be directly connected to the axis card.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vpc or ± 20 mA; default is ± 10 Vpc

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements, see section 16.

15.10 Control output signal (CTRL_OUT+)

The error signal processed by the control algorithms generates the control output signal (pin D3) for the external driver of the proportional valve which operates the hydraulic flow to the actuator.

The output range and polarity are software selectable within ±10 Vpc (for voltage) or ± 20 mA (for current) maximum range referred to the analog ground AGND on pin D4; default setting is ±10 Vpc

15.11 Digital input signals (D_IN0 and D_IN1)

Two on-off input signals are available on the pin E1 and D1. For each input by the Z-SW-SETUP software, it is possible to set the polarity and to match a proper condition within the following:

- pressure/force PID selection (default)
- start/stop/switch-over command in case of internal reference generation (see 4.2)
- specific operative command for hydraulic axis mode (referencing mode, jog mode, automatic mode)
- jog command

- disable force alternated control

	PID SET SELECTION											
PIN	SET 1	SET 2	SET 3	SET 4								
E1	0	24 VDC	0	24 VDC								
D1	0	0	24 Vdc	24 Vdc								

16 ACTUATOR'S TRANSDUCER CHARACTERISTICS

16.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis card, depending to the system requirements: analog signal (analog), SSI or Encoder (digital).

Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances. Transducers with analog interface grant simple and cost effective solutions.

16.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer (see section 5).

Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.

Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115% ÷ 120% of the maximum regulated pressure/force.

16.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

		Pressure/Force		
Input type	Analog	SSI (3)	Incremental Encoder	Analog
Power supply (1)	+24 VDC	+24 VDC	+5 Vpc or +24 Vpc	+24 Vpc
Axis card interface	0 ÷ 10V or 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vpc or 4 ÷ 20 mA
Max speed	1 m/s	1 m/s	2 m/s	-
Max resolution	< 0.2 % FS	5 µm	1 μm (@ 0.15 m/s)	< 0.4 % FS
Linearity error (2)	< ±0.02% FS	< ± 0.02 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability (2)	< ± 0.005% FS	< ± 0.005 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) power supply provided by Atos axis card (2) percentage of total stroke (3) for Balluff BTL7 with SSI interface only special code SA433 is supported

17 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW-SETUP programming software:

Z-MAN-BM-KZ - user manual for Z-BM-KZ

17.1 External reference and transducer parameters

Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements:

- Scaling parameters define the correspondence of these signals with the specific actuator stroke or force to be controlled
- Limit parameters define maximum/minimum stroke and force to detect possible alarm conditions
- Homing parameters define the startup procedure to initialize incremental transducer (e.g. Encoder)

17.2 PID control dynamics parameters

Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:

- PID parameters each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

17.3 Monitoring parameters

Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:

- Monitoring parameters maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 17.4)

17.4 Fault parameters

Allow to configure how the axis card detect and react to alarm conditions:

- Diagnostics parameters define different conditions, threshold and delay time to detect alarm conditions
- Reaction parameters define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

17.5 Valve characteristics compensation

Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- Valve parameters modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

17.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 4.2).

18 OVERALL DIMENSIONS [mm]



19 INSTALLATION



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot (eg. connector A can not be inserted into connector slot of B,C,D,E,G,H,I,J,K)

AXIS & P/Q CONTROLS 635

20 WIRING EXAMPLES

20.1 Position control - analog reference - analog position transducer



(1) For valve driver electrical connections please refer to the specific technical table

(2) The analog position transducer connections are intended as generic example, for details please consult the transducer datasheet

20.2 Alternated position/force control - CANopen reference - SSI position transducer - 2 analog pressure transducers



(1) For valve driver electrical connections please refer to the specific technical table

(2) Pressure transducers connections are shown with voltage signal output; for connections with current signal output see 14.5

(3) The SSI position transducer connections are intended as generic example, for details please consult the transducer datasheet

20.3 Alternated position/force control - EtherNet/IP reference - Encoder position transducer - analog load cell



(1) For valve driver electrical connections please refer to the specific technical table

(2) Load cell connections is shown with voltage signal output; please consult the load cell datasheet for details about connections

(3) The Encoder position transducer connections are intended as generic example, for details please consult the transducer datasheet

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Digital electrohydraulic servoactuators

servocylinder plus servoproportional directional with on-board driver & axis card



AZC

Digital electrohydraulic servoactuators are stand-alone units performing closed loop position controls.

The complete motion control cycle can be operated by external signals (from machine PLC) or programmed internally to the controller.

Alternated p/Q control add the force limitation to position regulation, requiring pressure or force transducers installation.

The servoacuators are made by a servocylinder with position transducer, servoproportional valve with on-board driver plus axis card, factory assembled and tested.

They can be provided with optional fieldbus interfaces for functional parameters setting, reference signals and real time diagnostics.

Smart Start-up procedure makes the commissioning quicker and easier, thanks to the Autotuning and Smart Tuning functionalities. Multiple PID sets allows to easily switch axis behaviour according to machine cycle.

1 MODEL CODE

	_				ı —				_				1		
*** AZC	Μ	-	D	- SF	- EH	/ СК	Μ	200	1	100	D	0500	1	V0	40
Design number Digital electrohydraulic servoactuator for linear axis position control															 Servoproportional valve configuration, zero spool overlap: 40 = with fail safe, sleeve execution, direct (tech table FS610) 60 = without fail safe, sleeve execu-
Cycle Generation type: - = none I = injection M = mold P = notices															tion, direct (tech table FS610) or piloted (tech table FS630) 70 = spring central position, direct (tech table FS620) or piloted (tech table FS630)
 P = parison S = synchronism X = positioning 9 = customized 														Ser axis V0	voproportional valve size with controller : = direct, size 06
Position transducer type: A = Analog (standard, poter D = Digital (SSI, Encoder)	ntiom	eter))											V1 V2 V4	= direct or piloted, size 10 = piloted size 16 = piloted size 25 or size 27
												Stroke [mn	n]	
Alternated p/Q controls: SN = none SF = with 2 on-board press SL = with 1 on-board load XL = with 1 remote load ce	sure † cell	trans	sduc	ers							Roo S = D =	d : single roo double ro	d d		
					1				F	Rod di	iame	eter [mm]			
Fieldbus interfaces, USB pNP = Not presentBC = CANopenBP = PROFIBUS DPEI	oort a V = F = E	alway POW Ether	ys pr 'ERL 'Net/	esent: INK IP			Act	Bore	dian	neter tion tr	[mm] ansc	lucer tvp	e. :	see s	ection 9 :
EH = EtherCAT EF	• = P	PRO	FINE	T RT/IF	RT		Ana	alog (or	ily fo	or AZC	-A)		-,		Digital (only for AZC-D)
Servocylinder Type, tech t	able 0 bay	B31	0 :	ahla P '	180		P = F = N -	potenti analog	ome ma	eter, m igneto:	iax s sonic	troke 700 c, max stro	mn oke	n e 250 oke 30	M = SSI magnetosonic, max stroke 2500mm
$CK = ISO 6020^{-1}$, FIIAX 25 $CK = ISO 6020^{-2}$, Pmax 25 $CH = ISO 6020^{-3}$, Pmax 25 CC = ISO 6022, Pmax 32	0 bar 0 bar 0 bar 0bar	r - te r - te r - te - te	ech t ech t ech t	able B able B able B	137 160 241		T = L = V =	LVDT, LVDT, inducti	max max ve, I	k strok k strok max st	e 16 e 30 troke	mm mm 1000mm	500	JI\C J	Analog or Digital 9 = special X = remoted

2 MAIN CHARACTERISTICS

Assembly position		Any position				
Ambient temperature rang	ge	standard execution = $-20^{\circ}C \div +60^{\circ}C$				
Storage temperature rang	je	Standard execution = -20°C ÷ +70°C				
Protection degree to EN6	0529	IP66 / IP67				
Duty factor		Continuous rating (ED=100%)				
Recommended fluid temp	perature	$-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$				
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s				
Max fluid	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at			
contamination level	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog			
Hydraulic	fluid	Classification	Ref. Standard			
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without wa	ater	HEDU, HEDR				
Flame resistant with water	r	HFC	100 12922			

3 POSITION CONTROL

Digital servoproportionals direct or pilot operated include valve with on-board digital driver plus axis card to perform the position closed loop of hydraulic actuator. Axis controllers are operated by an external or internally generated reference position signal. For detailed information about integral axis controller see tech tables **FS610**, **FS620**, **FS630**.

4 ALTERNATED POSITION / FORCE CONTROL

SF and **SL** controls add the alternated force closed loop control to the actuator standard position control. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions. For detailed information about SF, SL controls, see tech table **FS500**.



5 SMART START-UP

The automatic procedure supports the user during the commissioning phases of the axis control with guided procedures:

· General setting

It assists the user in system data setup, as like cylinder stroke, diameters, load mass, configure analog/digital signals and communication interface, position transducer setup.

• System check

It automatically executes position open loop movements to set axis control parameters, position transducer calibration and verify cylinder stroke.

• Position autotuning

It automatically determines the optimal PID parametrization of the position control adapting the dynamic response to guarantee control precision and axis stability. Once the procedure is started, the control performs few automatic position open loop movements of the actuator, during which control parameters are calculated and stored.

6 SMART TUNING

Once the Smart Start-up procedure has been completed, the Smart tuning feature allows to further refine the position control response by choosing from 3 different levels of performance in positioning:

- **dynamic** best dynamics and accuracy (default factory setting)

- balanced average dynamics and accuracy

- smooth attenuated dynamics and accuracy to improve control stability in critical applications or in environments with electrical disturbances

Settings can be changed any time via Z-SW software or fieldbus.

If required, control performance can be further customized by modifying PID parameter via Z-SW software.



2 = generated position trajectory $\mathbf{3} = dvnamic$

4 = balanced

5 = smooth

7 MULTIPLE SETS

Multiple PID sets allows to easily switch axis behaviour according to machine cycle, selecting between independent groups of parameters for:

- position control PID

- force control PID and p/Q logics switching criteria

Settings can be changed any time via Z-SW software, fieldbus or digital input signals.

8 FIELDBUS - see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 ACTUATOR'S TRANSDUCER CHARACTERISTICS

9.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution). Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest

performances. Transducers with analog interface grant simple and cost effective solutions.

9.2 Pressure/force transducers

The accuracy of the force control is strongly dependent to the selected pressure/force transducer.

Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.

Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details).

Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115% ÷120% of the maximum regulated pressure/force.

9.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

		Pressure/Force						
Execution		4	ſ	D				
Input type	Potentiometer	Analog (3)	SSI (4) (5)	Incremental Encoder	Analog			
Power supply (1)	10 ÷ 30 VDC	+24 VDC	+24 VDC	+5 VDC / +24 VDC	+24 VDC			
Controller Interface	0 ÷ 10 V 0 ÷ 10V 4 ÷ 20 mA		Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vpc 4 ÷ 20 mA			
Max speed	0,5 m/s	1 m/s	1 m/s	2 m/s	-			
Max Resolution	< 0.4 % FS	< 0.2 % FS	5 µm	1 μm (@ 0.15 m/s)	< 0.4 % FS			
Linearity error (2)	± 0.1% FS	< ±0.02% FS	< ± 0.02 % FS	< ± 0.001 % FS	< ±0.25% FS			
Repeatability (2)	± 0.05% FS	< ± 0.005% FS	< ± 0.005 % FS	< ± 0.001 % FS	< ±0.1% FS			

(1) power supply provided by digital controller

(2) percentage of total stroke

(3) Output derived from 4 different types of transducers, see tech table B310

(4) Output derived from 2 different types of transducers, see tech table B310

(5) Balluff BTL7 with SSI interface is not supported

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Smart Servopump - SSP

high performance p/Q control and energy saving



SSP is available in single pump (sect. 1.1) or doube pump execution (sect. 1.2). SSP systems combine the typical advantages of hydraulic power transmission with the ease of control and adjustment of an electric drive while also ensuring maximum levels of energy efficiency.

Maximum flow:	350 l/min
Maximum rated power:	100 kW
Maximum continuous pressur cast iron pump aluminium pump	re: 330 bar 250 bar

They consist of a fixed displacement internal gear pump, driven by a permanent magnet synchronous servomotor controlled by an electronic drive. The latter controls the speed of the servomotor and therefore of the pump, to adjust the flow rate or pressure of the system based on the reference signals received from the PLC of the machine.

A dedicated algorithm optimizes the p/Q function by automatically selecting the activation of the flow or pressure control.

Compared to traditional systems, SSPs offer the following advantages:

significant reduction in energy consumption, as the pump operates at the speed strictly necessary to generate the required flow rate / pressure
high dynamics and precision of p/Q control thanks to a dedicated algorithm

reduction of the noise level, thanks to the design of the pump and the variable speed

maximum flexibility thanks to dedicated software

- Smart Maintenance allows to plan in advance the replacement of worn components, maximizing productivity and minimizing maintenance costs
- simplified commissioning thanks to the Smart start-up and Smart tuning functions

• possibility of customization up to 4 axes with Multiple axis function

For more details see technical table AS050

1 MODEL CODE

1.1 Single pump execution

For optimal sizing, download the sizing software from MyAtos area at www.atos.com

SSP - T-SP	- NP	-[2020L ·	- [1024	-	046	1	С	/	Т		*	1	PE
Smart servopump													Series number		Seals material PE = FKM
Control logic:										Р	ort or	ien	tation see	e se	ection 10
T-SP = alternated p/Q control with resolver										Т U	= sta , V = 0	nda opti	ard onal		
Fieldbus interface, serial port alwNP = Not presentBC = CANopenBP = PROFIBUS DPEP = PR	ays present: herCAT OFINET RT/IRT								Hydrauli C = integ sure D = as c	ic o grat e tra	ption ed blo nsduc	see ock cer lus	e section [with relies Smart Co	8 : ef v	alve and pres-
D									Electron	nic f	unctio	on s	see sectio	n	9
PGI. cast iron pump. Pmax 330 b	ar (1) - see table A	S30	00:						K = Driv	'e w	ith Saf	fe T	orque Off	- a	lways present
1011 = 10,8 cm³/rev 2040 = 39 1016 = 15,6 cm³/rev 2050 = 49 2020 = 20 cm³/rev 4050 = 50 2025 = 24,5 cm³/rev 3064 = 64 2032 = 31,6 cm³/rev 4064 = 64	30,5 cm³/rev 3080 30,5 cm³/rev 4080 30,5 cm³/rev 3100 31,0 cm³/rev 4100 4 cm³/rev 4100	= 8 = 8 = 1 = 1	30 cm ³ /rev 30 cm ³ /rev 00 cm ³ /rev 00 cm ³ /rev				Drive 022 = 032 = 046 =	D-N 22 32 46	MP - see t A A A	tabl 06 09 10	e AS50 0 = 57 0 = 87 0 = 10	00: 7,5 / 7 A	A A	140 165 210	= 140 A = 165 A = 210 A
PGIL, aluminium pump, Pmax 25	0 bar - see table As	S35	i0:		Motor F	РМ	IM - see	e ta	ble AS40	0:					
2020L = 20 cm³/rev 2040L = 4 2025L = 24,5 cm³/rev 2050L = 5 2032L = 32,1 cm³/rev 3064L = 6	10,1 cm ³ /rev 3080 50 cm ³ /rev 3100 54 cm ³ /rev 4125	L = L = L =	80 cm³/rev 100 cm³/rev 125 cm³/rev		1009 = 1015 = 1024 =	8,7 15 24	7 kW kW kW		1032 = 2042 = 2055 =	= 30 = 42 = 55) kW 2 kW 5 kW		2080 2100	= 8 = 1	0 kW 00 kW

(1) Pmax depends on the pump displacement

1.2 Double pump execution

Second pump must be selected with equal or smaller displacement than first pump Our specialists are available to give support in the sizing of SSP double pump executions

SSP - T-SP - NP - 2020) / 1011	- 1024	- 046 /	/ K /	/ Τ	*]/[PE
Smart servopump						Series number	r [Seals material PE = FKM
Control logic: T-SP = alternated p/Q control with resolver					Port T = S	orientatio	on se	ee section 10:
Fieldbus interface, serial port always present:NP = Not presentBC = CANopenBP = PROFIBUS DPEP = PROFINET RT/IRT				Elect K =	tronic f Drive w (always	function with Safe 1	see : Torqı)	section 9: ue Off
First pump PGI, cast iron pump, Pmax 330 bar (1) - see table AS320: 1011 = 10,8 cm³/rev 2025 = 24,5 cm³/rev 2050 = 49,5 cm³/r 1016 = 15,6 cm³/rev 2032 = 31,6 cm³/rev 2020 = 20 cm³/rev 2020 = 20 cm³/rev 2040 = 39,5 cm³/rev	rev		Drive D 022 = 2 032 = 3 046 = 4	0-MP - s 2 A 2 A 6 A	see tab 060 = 090 = 100 =	le AS500: = 57,5 A = 87 A = 100 A	:	140 = 140 A 165 = 165 A 210 = 210 A
Second pump PGI, cast iron pump, Pmax 330 bar - see table AS320: 1011 = 10,8 cm ³ /rev 1016 = 15,6 cm ³ /rev		Motor 1009 = 1015 =	PMM - see t = 8,7 kW = 15 kW	table A 1024 1032	S400: 4 = 24 2 = 30	kW kW	204 205	l2 = 42 kW 55 = 55 kW

(1) Pmax depends on the pump displacement

Typical double pump application

The double pump execution is particularly suitable for machine cycles in which phases with high flow rate and low pressure alternate with phases of high pressure and very low flow rate. This configuration allows, in fact, to limit the required shaft torque, reducing the size of the electrical motor and drive. When the machine cycle requires high pressure and low flow rate, the venting valve () must be activated.

The suction valve (2) is necessary to allow oil suction from the tank in case SSP revolves in opposite direction when in pressure control phase, while the venting valve is activated.

The image below represents an example of hydraulic scheme for double pump execution. The assembled manifold is on customer behalf.



Contact the Atos technical department for more details and support regarding the sizing of the SSP with a double pump execution.

2 FUNCTIONING DESCRIPTION

SSP servopumps are designed to efficiently and accurately generate and regulate hydraulic power at every stage of the machine cycle. The ability to modulate the required flow rate or pressure by varying the number of revolutions gives it a substantial advantage in terms of energy savings compared to traditional systems that operate at constant speed. Thanks to the high dynamics and dedicated algorithms, the SSP allow you to directly control the speed of movement and the force of the hydraulic actuators with optimal levels of precision and repeatability.

They consist of an internal gear pump, a permanent magnet servomotor and an electronic drive.

The drive is connected to an angular transducer which measures the rotation speed of the servomotor and to a pressure transducer. It manages the motor power supply, the operating logic and system diagnostics.

3 PROGRAMMING TOOLS

The functional parameters and configurations of the SSP servopumps can be easily set and optimized using the Atos S-SW-SETUP programming software by connecting the PC to the drive via the RS485 serial port.

The software allows the parameterization of the drive via the RS485 serial port even if the drive is connected to the machine central unit via fieldbus.

S-SW-SETUP support: NP (Serial) BC (CANopen) EH (EtherCAT) BP (PROFIBUS DP) EP (PROFINET)

Note: For detailed descriptions of settings, wiring and installation procedures, refer to the user manual included in S-SW-SETUP

4 FIELDBUS

Fieldbus allows direct communication between the Drive and the machine control unit for digital reference, extended diagnostics and servopump settings. However, the fieldbus versions allow the servopump to be controlled also through analog references.

5 GENERAL CHARACTERISTICS

Installation position Motor and pump: horizontal position Drive: wall mounting, vertical position						
Ambient temperature range	Motor and pump: -20°C ÷ 40°C Drive: -10°C ÷ 50°C	motor and drive derate in power for higher temperature				
Altitude	up to 2000 m, motor and drive derate in power for higher altitude					
Compliance	CE according to EMC directive 2014/30/EU and LVD 2014/35/EU Rohs directive 2011/65/EU as last update by 2015/863/EU					

6 HYDRAULIC CHARACTERISTICS

Hydraulic fluid		HL, HLP DIN 51524535, for other fluids contact Atos technical office					
Fluid temperature range		-20°C ÷ 80°C					
Recommended viscosity		10 ÷ 300 mm ² /s - cold start max 2000 mm ² /s					
Max fluid contamination level	normal operation	ISO4406 class 20/18/15 NAS1638 class 9	see also fiter section at				
	longer life	ISO4406 class 18/16/13 NAS1638 class 7	www.atos.com or KTF catalog				
Min/max inlet pressure (bar abs)		from 0.8 to 2 bar. Recommended ≥ 1					

7 DRIVE ELECTRICAL CHARACTERISTICS

Rated IN voltage	[V]	200 V -10% ÷ 480 400 V -10% ÷ 480	200 V -10% ÷ 480 V +10% @ 45 ÷ 65 Hz for drive 022 ÷ 060 100 V -10% ÷ 480 V +10% @ 45 ÷ 65 Hz for drive 090 ÷ 210							
DC Bus voltage	[V]	280 V -10% ÷ 600 280 V -10% ÷ 640	30 V -10% ÷ 600 V +10% for drive 022 ÷ 060 30 V -10% ÷ 640 V +10% for drive 090 ÷ 210							
24VDC input power supply		24 Vpc ±10% @ max 1,0 A for drives type 022, 090, 100, 140, 165, 210 24 Vpc ±10% @ max 1,3 A for drive type 032 24 Vpc ±10% @ max 1,8 A for drives type 046, 060								
24VDC output power suppl	У	24 Vpc ±10% @ ma	24 Vpc ±10% @ max 500 mA - only for drives type 090, 100, 140, 165, 210							
Digital inputs		24 Vpc ±10% @ max 10 mA								
Digital outputs		30 Vpc @ max 60 mA								
Analog inputs		\pm 10 V @ max 0,5 mA or 4 \div 20 mA (Dip-switch selectable - see user manual)								
Analog outputs		±10 V @ max 2 mA								
Protection degree to DIN E	N60529	Motor: IP54 (IP65 on request); Drive: IP20								
Communication interface		Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, PROFINET IO RT / IRT EC 61158					
Communication physical layer		insulated RS485	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX					





8 HYDRAULIC OPTION - not for double pump execution

- C = This option provides a hydraulic block mounted directly on the pump outlet, which integrates a mechanical pressure relief valve with safety function on the maximum system pressure and a pressure transducer for the feedback of the actual pressure on the delivery line.
 - Mechanical pressure relief valve; the valve is supplied with zero adjustment, and must be adjusted by the user at a pressure slightly higher than the maximum pressure required by the system.
 - (2) Pressure transducer E-ATR-8/400/I see technical table GS465
- **D** = This option allows to protect the pump from overheating when it is subjected to particularly heavy duty cycles, in particular in the prolonged phases of static pressure control.

This option includes a hydraulic block with relief valve and pressure transducer, as for the /C option, with also integrated:

③ Smart Cooling cartridge valve JO-DL-4-2/NC-X 24DC - see technical table E105

When a temperature considered critical is reached, the Smart Cooling valve opens (3) as to cause a small recirculation of oil through the pump which protects it from dangerous overheating.

The sizing software for SSP suggests the need for the /D option based on the machine cycle.



9 ELECTRONIC FUNCTION - always present

K = The drive implements the Safe Torque Off (STO) function as a prevention of unexpected starts according to 2006/42/EC Machinery Directive (MD) - standard EN 61800-5-2.

This function prevents the generation of a rotating magnetic field removing the power semiconductor control voltage allowing short-term operations (such as cleaning and / or maintenance work on parts of non-electrical devices of the machine) without disconnecting drive power supply or the connection between the drive and the servomotor.

For detailed descriptions, please refer to the S-MAN-HW installation manual.

Possible combined option - not for double pump execution /CK, /DK

1 CP

10 PORTS ORIENTATION

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The pump can be supplied with inlet and outlet ports oriented in different configurations, as shown in the figure (seen from the bottom of the pump)

IN

11 INSTALLATION DIMENSIONS - motor pump unit [mm] for drive dimensions see AS500



MODEL CODE	Α	В	С	E	F	G	М	N	Mass [Kg]
SSP-*- 3064*-1024 -*	004	055	830	000	312	000 F	10	10	94
SSP-*- 3064*-1032 -*	- 324	355	900	- 300	385	- 383.5	12	12	111
SSP-*- 3064*-2042 -*		435	930		275				149
SSP-*- 3064*-2055 -*	384	450	980	356	330	456.5	14	18	170
SSP-*- 3064*-2080 -*		430	112		476]			213
SSP-*- 3080*-1024 -*	324	355	840	300	312	305.5	12	10	97
SSP-*- 3080*-1032 -*	- 324	300	920	- 300	385	- 393.3	12	12	113
SSP-*- 3080*-2042 -*		435	940		275				151
SSP-*- 3080*-2055 -*	384		1000	356	330	168.5	1/	12	172
SSP-*- 3080*-2080 -*	504	450	1123		476	-	14	12	216
SSP-*- 3080-2100 -*			1200		583				257
SSP-*- 3100*-1024 -*	324	355	860	300	312	411.5	12	12	98
SSP-*- 3100*-1032 -*	524	355	930	500	385	411.5	12	12	115
SSP-*- 3100*-2042 -*		435	950		275				152
SSP-*- 3100*-2055 -*	384	450	1011	356	330	484.5	14	18	174
SSP-*- 3100*-2080 -*		-00	1140		476		17	10	217
SSP-*- 3100*-2100 -*		490	1210		583				258
SSP-*-4050-1015-*			810		240				108
SSP-*-4050-1024-*	324	355	870	300	312	427	12	12	122
SSP-*-4050-1032-*			950		385				138
SSP-*-4050-2042-*		435	950		275	/81			166
SSP-*- 4050-2055 -*	384	450	1011	356	330	401	14	18	187
SSP-*- 4050-2080 -*		400	1155		476	500]		239

AS100







MODEL CODE	Α	В	С	E	F	G	м	N	Mass [Kg]
SSP-*- 4064-1024 -*	00.4	055	860	000	312	400	10		124
SSP-*-4064-1032-*	- 324	355	960	300	385	438	12	12	140
SSP-*- 4064-2042 -*		445	48		275	400			168
SSP-*- 4064-2055 -*	384	450	1020	356	330	492	14	18	189
SSP-*- 4064-2080 -*	-	450	1166		476	511	1		241
SSP-*- 4080-1024 -*	204	255	890	200	312	447	10	10	126
SSP-*- 4080-1032 -*	- 324	300	970	- 300	385	447	12 12 14 18 12 12	142	
SSP-*- 4080-2042 -*		435	970		275	- 501 - 520			170
SSP-*- 4080-2055 -*	204		1032	356	330		14	10	191
SSP-*- 4080-2080 -*	- 304	450	1175		476		1 14	10	243
SSP-*- 4080-2100 -*			1250		583				284
SSP-*- 4100-1032 -*	324	355	980	300	385	460	12	12	145
SSP-*- 4100-2042 -*		435	980		275	514			173
SSP-*- 4100-2055 -*	201		1040	256	330	1 514	14	10	194
SSP-*- 4100-2080 -*		450	1188	- 350	476	500		18	246
SSP-*- 4100-2100 -*			1260		583	- 555			287
SSP-*- 4125L-2042 -*		435	980		275	500			162
SSP-*- 4125L-2055 -*	384	450	1032	356	330	- 528	14	18	183
SSP-*- 4125L-2080 -*		400	1150	300	476		- 14	18	229
SSP-*- 4125L-2100 -*	1	490	1183	1	583				234








					F		G		
			Ø	_					_
MODEL CODE	Α	В	с	E	F	G	м	N	Mass [Kg]
SSP-*-1011/1011-1009-*	204	335	757	200	168	451	10	10	61
SSP-*-1011/1011-1015-*	324	355	827	- 300	240	431	12	12	73
SSP-*-1016/1011-1009-*	324	335	767	300	168	461	12	12	61
SSP-*-1016/1011-1015-*	524	355	837	500	240	401	12	12	73
SSP-*- 2020/1011-1009 -*		335	817		168				67
SSP-*-2020/1011-1015-*	324		887	300	240	510	12	12	79
SSP-*-2020/1011-1024-*	524	355	957	300	312	510	12	12	95
SSP-*-2020/1011-1032-*			1027		385	-			110
SSP-*-2025/1011-1009-*		335	816		168				67
SSP-*-2025/1011-1015-*	324		886	- 300	240	499	12	12	80
SSP-*-2025/1011-1024-*	024	355	956		312		12	12	95
SSP-*-2025/1011-1032-*			1026		385				111
SSP-*-2032/1011-1009-*		335	816		168				68
SSP-*-2032/1011-1015-*	324	355	886	- 300	240	504	12	12	81
SSP-*-2032/1011-1024-*	024		956		312		12		96
SSP-*-2032/1011-1032-*			1026		385				112
SSP-*-2032/1011-2042-*	384	435	1026	356	275	553	14	18	150
SSP-*-2040/1011-1009-*			826	300	168				72
SSP-*-2040/1011-1015-*	324	355	896		240	517	12	12	84
SSP-*-2040/1011-1024-*	024	0000	966	300	312	017	12	12	99
SSP-*-2040/1011-1032-*			1036		385				115
SSP-*-2040/1011-2042-*	384	435	1036	356	275	566	14	18	153
SSP-*-2050/1011-1009-*			836	300	168				74
SSP-*-2050/1011-1015-*	324	355	906		240	531	12	12	86
SSP-*-2050/1011-1024-*	027		976	300	312		12		101
SSP-*-2050/1011-1032-*			1046		385	-			117
SSP-*-2050/1011-2042-*	384	435	1046	356	275	580	14	18	155
SSP-*-2050/1011-2055-*	001	450	1106	000	330	000			177

AS100









12 INSTALLATION DIMENSIONS - motor double pump unit [mm] for drive dimensions see AS500

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MODEL CODE	Α	В	с	Е	F	G	М	N	Mass [Kg]
SSP-*-1016/1016-1009-*	204	335	777	200	168	471	10	10	65
SSP-*-1016/1016-1015-*	324	355	847	300	240	4/1	12	12	74
SSP-*- 2020/1016-1009 -*		335	806		168				68
SSP-*- 2020/1016-1015 -*	204		876	300	240	510	10	10	80
SSP-*- 2020/1016-1024 -*	524	355	946	- 300	312	510	12	12	96
SSP-*- 2020/1016-1032 -*			1016		385				111
SSP-*- 2025/1016-1009 -*		335	799		168				68
SSP-*- 2025/1016-1015 -*	324		869	200	240	500	12	12	81
SSP-*- 2025/1016-1024 -*	524	355	939		312	500			96
SSP-*- 2025/1016-1032 -*			1009		385				111
SSP-*- 2032/1016-1009 -*		335	826		168				69
SSP-*- 2032/1016-1015 -*	324	355	896	300	240	505	10	12	82
SSP-*- 2032/1016-1024 -*	524		966		312	- 505	12	12	97
SSP-*-2032/1016-1032-*			1036		385				114
SSP-*-2032/1016-2042-*	384	435	1036	356	275	554	14	18	151
SSP-*-2040/1016-1009-*			836	300	168				73
SSP-*-2040/1016-1015-*	324	355	906		240	518	10	12	85
SSP-*- 2040/1016-1024 -*	324	555	976	300	312] 510	12	12	100
SSP-*-2040/1016-1032-*			1036		385				116
SSP-*-2040/1016-2042-*	384	435	1036	356	275	567	14	18	154
SSP-*-2050/1016-1009-*			846	300	168				75
SSP-*- 2050/1016-1015 -*	324	355	916		240	530	10	12	87
SSP-*-2050/1016-1024-*	024	000	986	300	312	002	12		102
SSP-*-2050/1016-1032-*			1056		385				118
SSP-*-2050/1016-2042-*	.384	435	1056	356	275	581	14	18	156
SSP-*-2050/1016-2055-*		450	1116	000	330				178

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13 RELATED DOCUMENTATION

- AS050 Basics for Smart Servopumps - SSP AS200
- Sizing criteria for servopumps
- AS300 PGI cast iron internal gear pumps, high pressure
- AS320 PGIX cast iron double internal gear pumps, high pressure

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- AS350 PGIL aluminium internal gear pumps
- PMM high performance synchronous servomotors AS400
- AS500 D-MP electronic drives

- Programming tools for pumps & servopumps AS800
- AS810 Accessories for servopumps
- AS910 Operating and maintenance information for servopumps

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- GS510 Fieldbus
 - S-MAN-HW Servopumps installation manual
 - S-MAN-SW Servopumps programming software manual
- AS100

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Digital proportional valves with p/Q control

directional valves with LVDT transducer and on-board driver



1 GENERAL DESCRIPTION

Proportional directional valves with p/Q control are identified by option SP, SF or SL and they are designed to perform the alternated regulation of speed/position/force of hydraulic actuators.

These options add the closed loop control of pressure (for SP) or force (for SF and SL) to the standard direction and flow regulation operated by the servoproportional and high performance proportional directional valves.

Note: for simplification, the following description always refers to the "force control", even if for the SP option the control is the "pressure".

The switching from the flow control to the force control is automatically performed by the valve thanks to a sophisticated algorithm. The advantage offered by this solution is the high accurate and high dynamic control of the machine actuator in terms of direction, speed, position and force, all performed by a single valve.

2 FUNCTIONAL DESCRIPTION

The alternated p/Q control is operated by means of two electronic reference signals sent from the machine central unit to the valve driver: one for flow regulation and one for regulation. The valve driver has to be interfaced to a remote pressure transducer or to a load cell for the measurement and feedback of the actual pressure or force.

The SP option controls the pressure on A user port and it has to be interfaced to a single pressure transducer.

The SF option controls the force by measuring the delta p across A and B user ports and it has to be interfaced to two pressure transducers.

The SL option directly controls the actuator force and it has to be interfaced to a load cell.

See section 4 for configuration examples.

A dedicated algorithm automatically selects which control (flow or force) will be active time by time. The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability or vibrations.

The flow regulation is active when the actual system force measured by the force transducer is lower than the relevant input reference signal.

The valve normally works to regulate the flow by controlling in closed-loop the spool position through the on-board LVDT transducer.

The force control is activated when the actual system force, measured by remote transducers, reaches the setpoint defined by the relevant force reference input signal and meets the regulation requirements defined within the control algorithm.

The flow regulation is consequently reduced to keep steady the closed loop regulation of the force.

If the force decreases below its input reference signal, the flow control returns active.

The dynamic response of the force control can be adapted to different system characteristics, by setting the internal PID parameters using Atos PC software. Up to 4 different PIDs are selectable to optimize the system dynamic response according to different hydraulic working conditions.

3 VALVES RANGE

Options SP, SF, SL are available for high performance proportional directional valves and servoproportional valves with TES/LES on-board digital driver or TEZ/LEZ on-board digital driver + axis card.

Valve's performance characteristics and overall dimensions remains unchanged as per standard valve models, refer to specific FS** technical tables.

Servoproportionals:

DLHZO-TES, DLKZOR-TES - direct, zero spool overlap, sleeve execution - technical tables FS180 DHZO-TES, DKZO-TES - direct, zero spool overlap - technical tables FS168 DPZO-LES - piloted, zero spool overlap - technical table FS178 LIQZP-LES - 3-way servocartridges - technical table FS340

Servoproportionals with TEZ/LEZ on-board digital driver + axis card:

DLHZO-TEZ, DLKZOR-TEZ - direct, zero spool overlap, sleeve execution - technical tables FS610

DHZO-TEZ, DKZOR-TEZ - direct, zero spool overlap - technical tables FS620

DPZO-LEZ - piloted, zero spool overlap - technical tables FS630

High perfomance proportionals:

DHZO-TES, DKZOR-TES - direct, positive spool overlap - technical table FS165 DPZO-LES - piloted, positive spool overlap - technical table FS175



5 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table FS900 and in the user manuals included in the E-SW-SETUP and Z-SW-SETUP programming software.

6 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table GS500

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers and axis controls via Bluetooth/USB service port.

Atos E-SW-SETUP and Z-SW-SETUP PC software supports all Atos digital valve drivers and axis controls and they are available at www.atos.com in MyAtos area.



WARNING: driver and axis card USB port is not isolated! For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table GS500

Bluetooth or USB connection

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7 FUNCTIONAL EXAMPLES

The following functional examples are just generic reference of the possible applications of with proportional directional valves with alternated p/Q control, **SP**, **SF**, **SL**.

Please contact Atos technical department for additional evaluations related to specific applications usage.

7.1 High-dynamic pressure reducing controls - only for SP

Directional proportional valves with zero spool overlap and SP control, are operated in 3-way hydraulic configuration to obtain high-dynamic pressure reducing control on the A (or B) user port:

- flow reference signal is used to limit the maximum flow during the pressure regulation
- pressure reference signal is used to regulate the pressure on the valve's A user port; the rapid/repeatable response of the pressure control is performed in high dynamics by the directional valve's closed loop regulation

Requirements:

- an remote pressure transducer has to be installed in the hydraulic system on the controlled user port (when using 4 way valves either A or B port can be used while the not controlled port must be plugged)
- · zero overlap valves without fail safe position are recommended;

I Positive overlap valves with PABT ports closed in central position are not suitable for this application

7.2 Single effect actuators with speed/pressure/force controls - only for SP or SL

Directional proportional valves with SP or SL control, are operated in 3-way hydraulic configuration to control speed/pressure (force) on single effect actuators:

- flow reference signal is used to regulate the actuator's forward and backward speed while pressure (force) reference signal is used to limit the maximum pushing pressure (force) to the actuator or
- pressure (force) reference signal is used to regulate the actuator pushing pressure (force) while flow reference signal is used to limit the maximum actuator speed

Requirements:

- for SP control a remote pressure transducer has to be installed in the hydraulic system on the actuator pushing port
- for SL control a remote force transducer has to be installed between the actuator and the controlled load
- zero overlap valves without fail safe position are recommended;

Positive overlap valves with PABT ports closed in central position are not suitable for this application

7.3 Double effect actuators with speed/pressure controls - only for SP

Directional proportional valves with SP control, regulate speed/pressure on double effect actuators:

- flow reference signal is used to regulate the actuator's forward and backward speed while pressure reference signal is used to limit the maximum pushing pressure of the actuator or
- pressure reference signal is used to regulate the actuator pushing pressure while flow reference signal is used to limit the maximum forward and backward actuator speed

Requirements:

- a remote pressure transducer has to be installed on the actuator's pushing port
- a dedicated Q5 spool with strong "meter-in" characteristic in central position has to be used; during pressure regulation, the not controlled port remains connected to T line to avoid any back pressure see section 7.4

Positive overlap valves with PABT ports closed are not suitable for this application

7.4 Q5 spool for 4 way connection with SP control

Spool type ${\bf Q5}$ allows fast direction reverse during motion phases (e.g. ejector motion with max strain limitation)

- (1) depressuring (pressure control active)
- (2) backward movements (flow control active)

(3) forward movements (flow or pressure control active)



High-dynamic - only for SP











7.5 Double effect actuators with force limit/regulation - only for SF or SL

4 way directional proportional valves with SF or SL control, regulate speed/force on double effect actuators:

- flow reference signal is used to regulate the actuator's forward and backward speed while force reference signal is used to limit the maximum pushing and pulling force of the actuator or
- force reference signal is used to regulate the actuator pushing and pulling force while flow reference signal is used to limit the maximum actuator speed

Requirements:

- for SF two remote pressure transducers have to be installed on the both actuator's ports
- for SL one push/pull load cell transducer has to be installed between the actuator and the controlled load
- zero overlap valves are recommended;

positive overlap valves with PABT ports closed in central position are not suitable for this application

Advantages:

- force control is possible in both push and pull directions
- SL allows a more precise force control despite of a more complex installation of the load cell transducer
- SF allows to add force control also into existing systems thanks to the simple installation of pressure transducers

Control modes:

- Flow priority: flow reference signal is used to move forward and backward the actuator while force is limited/regulated in both push and pull direction
- Force priority: force reference signal is used to control both push and pull forces while flow is limited/regulated in both direction

Note:

auxiliary check valves are recommended to intercept A and B lines in case of specific hydraulic configuration requirements in absence of power supply or fault

7.6 Flow priority



7.7 Force priority



8 PRESSURE/FORCE TRANSDUCER CHARACTERISTICS

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducers.

Pressure/force controls require to install remote pressure transducers or load cell to measure the actual pressure/force values:

• Pressure Transducers: allow easy system integration and cost effective solution for both pressure and force controls, see tech table GS465 for E-ATR-8 pressure transducer details

• Load Cell Transducers: allow the user to get high accuracy and precise regulations for force control, but it increases the complexity of the mechanical installation

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115÷120 % of the maximum regulated pressure/force.

Double effect - only for SF or SL



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Proportional controls for axial piston pumps

pressure, flow or p/Q controls



PVPC

Variable displacement axial piston pumps with swash plate design suited for high pressure open circuits, they are provided with advanced electrohydraulic proportional controls:

- CZ open loop pressure control
- LQZ open loop flow control (load sensing) • PES closed loop p/Q control

PES performs alternate closed loop controls of pressure, flow and max power limitation. It is also available with optional sequence module (PERS versions) that allows to reduce close to zero the pressure to the delivery line. SAE J744 mounting flange and shaft.

Max displacement	Max pressure working	Max pressure peak
(cm ³ /rev)	(bar)	(bar)
29, 46, 73, 140 88	280 250	350 315

For technical characteristics and features, see tech table A160.

1 MODEL CODE

PVPC	X2E	- PER	S-SP - E	BC	- 4046	/ *	1	1	D	/	*	*	1	*
Variable displacement axial piston pump														Seals material, see section 9 :
Option for pumps with throug XA = intermediate flange SAE XB = intermediate flange SAE XC = intermediate flange SAE (only for size 5073 and 50	n shaft (1) : A B C D90)										Coil	Series number	_ or (- = NBR PE = FKM CZ_LOZ - see section 18:
Additional suffix for double pur X2E = with a fixed displaceme type PFE (see tech table	nps: nt pump e A005)										18 = Elec	optional c	oil ion	for low current drivers s, for PES and PERS (4):
Type of control, see section 1 CZ = proportional pressure of LQZ = proportional flow control PES-SP = closed loop integr PERS-SP = as PES plus seque Fieldbus interfaces, USB port NP = Not present BC = CANopen BP = PROFIBUS DP EI = EH = EtherCAT EP =	and 14: ontrol (1) I (load sensi al digital p/C ence module always pres POWERLIN EtherNet/IP PROFINET I	ng) (1) d driver ent (2) : K RT/IRT									I = (X = (S = (4÷20 mA current re 4÷20 mA on-board p pre-configu (only for Pf with 2 on-c PID selecti power sup plus dedic pressure tr	fer res rec ERS off in opli cation	ence input and monitor sure transducer with pressure settings b) nputs for multiple pressure for NP execution or double y for fieldbus execution, ed connector for remote iducer
Size and max displacement (3029 = size 3 - displacement (4046 = size 4 - displacement (5073 = size 5 - displacement (5090 = size 5 - displacement (6140 = size 6 - displacement 1	 3): 29 cm³/rev 46 cm³/rev 73 cm³/rev 90 cm³/rev 40 cm³/rev 								Dir see D :	ec e s = c	tion ectio locky	of rotatior n 23: wise	ı, ∨i S =	ewed at the shaft end:
Pressure setting, only for PER	S: 200 = 200) bar 25	0 = 250 ba	ır	280 = 280) bar		Shaf 1 = k	t, SA eyed	ES	Stand 5	lard (5) : = splined		
(1) Not available for PVPC-*-61	40													

(2) Only for PES and PERS

(3) Optional intermediate displacements 35 and 53 cm³/rev are available on request

(4) For possible combined options, see section 17

(5) Pumps with ISO 3019/2 mounting flange and shaft (option /M) are available on request

2 OFF-BOARD ELECTRONIC DRIVERS - only for CZ, LQZ

Drivers model	E-MI-AC-01F		E-MI-	AS-IR	E-BM-	AS-PS	E-BM-AES		
Туре	Ana	alog	Digital						
Voltage supply (VDC)	12	24	12	24	12	24	24		
Valve coil option	/6	std	/6	std	/6	std	std		
Format	plug-in to solenoid				DIN-rail panel				
Tech table	GC)10	GC	20	GC)30	GS050		

3 GENERAL NOTES

Atos digital proportionals pumps are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-SETUP programming software.

5 PUMP SETTINGS AND PROGRAMMING TOOLS - see tech. table AS800

Free downloadable software for PC allows to set all pump functional parameters and to access complete diagnostic information of digital drivers via Bluetooth/USB service port. Atos E-SW-SETUP PC software supports all Atos digital pump drivers and it is available at www.atos.com in MyAtos area.



WARNING: for the list of countries where the Bluetooth adapter has been approved, see tech. table **AS800**





5 FIELDBUS - see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 GENERAL CHARACTERISTICS

Assembly position	Any position. The drain port must be on the top of the pump. Drain line must be separated and unrestricted to the reservoir and extended below the oil level as far from the inlet as possible. Suggested maximum line length is 3 m.						
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra \leq 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100						
MTTFd valves according to EN ISO 13849	150 years, for further details see technical table P007						
Ambient temperature range	CZ,LQZ:Standard = $-25^{\circ}C \div +60^{\circ}C$ /PE option = $-15^{\circ}C \div +80^{\circ}C$ PES, PERS:Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$						
Storage temperature range	CZ,LQZ:Standard = $-20^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ PES, PERS:Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$						
Surface protection (pump body)	Black painting RAL 9005						
Surface protection (pilot valve)	Zinc coating with black passivation, galvanic treatment (driver housing)						
Corrosion resistance (pilot valve)	Salt spray test (EN ISO 9227) > 200 h						
Vibration resistance	See technical table G004						
Compliance (proportional pilot valve)	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006)						

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

PVPC size		30	29	40	46	50	73	50	90	6140		
Max displacement	(cm ³ /rev)	29		46		7	73		88		140	
Theoretical max flow at 1450 rpm	(l/min)	4	42		66,7		105,8		127,6		03	
Max pressure working / peak	(bar)	280	/ 350	280 /	/ 350	280	/ 350	250	/ 315	280/3	350 (1)	
Min/Max inlet pressure	(bar abs.)	0,8	/ 25	0,8	/ 25	0,8	0,8 / 25		0,8 / 25		0,8 / 25	
Max pressure on drain port	(bar abs.)	1	,5	1,	,5	1	,5	1	1,5		,5	
Power consumption at 1450 rpm and at max pressure and displacer	nent (Kw)	19	9,9	31	,6	50),1	54	54,1		22	
Max torque on the first shaft	(Nm)	Type 1 210	Type 5 270	Type 1 350	Type 5 440	Type 1 670	Type 5 810	Type 1 670	Type 5 810	Type 1 1300	Type 5 1660	
Max torque at max working pressu	ıre (Nm)	1:	28	20)3	33	28	35	50	78	30	
Speed rating	(rpm)	500 ÷	- 3000	500 ÷	2600	500 ÷	2600	500 ÷	2200	500 ÷	2200	
Body volume	(I)	0	,7	0	,9	1	,5	1,5		2,8		

(1) The maximum pressure can be increased to 350 bar (working) and 420 bar (peak) after detailed analysis of the application and of the pump working cycle

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal Rectified and filtered	: +24 VDC : VRMS = 20 ÷ 32 VMAX	(ripple max 10 % VPP)						
Max power consumption	CZ , LQZ = 35 Watt;	PES , PERS = 50 Wat	t						
Max. solenoid current	2,6 A for standard 12	VDC coil; 1,5 A for st	andard 18 Vpc coil (only	for CZ, LQZ)					
Coil resistance B at 20°C	Size 3 : 3 ÷ 3,3 Ω t	for standard 12 Vpc coil	; $13 \div 13,4 \ \Omega$ for 18	VDC coil (only for version CZ, LQZ)					
	Size 4, 5: 3,8 ÷ 4,1 0	Ω for standard 12 Vpc c	pil; 12 ÷ 12,5 Ω for 18	VDC coil (only for version CZ, LQZ)					
Analog input signals	Voltage: range ±10 V Current: range ±20 m	DC (24 VMAX tolerant)	Input impedance Input impedance	e: $Ri > 50 k\Omega$ e: $Ri = 500 \Omega$					
Monitor outputs	Output range: vo	Dutput range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance							
Enable input	Range: 0 ÷ 5 VDC (OFF	state), 9 ÷ 24 VDC (ON s	state), 5 ÷ 9 VDC (not acc	epted); Input impedance: $Ri > 10 k\Omega$					
Fault output	Output range: 0 ÷ 24 external negative volta	butput range: 0 ÷ 24 VDC (ON state > [power supply - 2 V]; OFF state < 1 V) @ max 50 mA; xternal negative voltage not allowed (e.g. due to inductive loads)							
Pressure transducer power supply	+24VDC @ max 100 m.	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)							
Alarms	Solenoid not connected valve spool transduced	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function							
Insulation class	H (180°) Due to the oc the European standard	curring surface temperates ISO 13732-1 and EN	atures of the solenoid co 982 must be taken into a	oils, account					
Protection degree to DIN EN60529	CZ, LQZ = IP65; F	PES, PERS = IP66/67 w	ith mating connector						
Duty factor	Continuous rating (ED=	=100%)							
Tropicalization	Tropical coating on ele	ectronics PCB							
Additional characteristics	Short circuit protection with rapid solenoid sw	n of solenoid's current si itching; protection agai	upply; 3 leds for diagnos nst reverse polarity of po	stic; spool position control by P.I.D. ower supply					
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158					
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX					
Recommended wiring cable	LiYCY shielded cables	s, see section 22							

Note: a maximum time of 800 ms (depending on communication type) has to be considered between the driver energizing with the 24 Vbc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid	temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$						
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s							
Max fluid	normal operation	ISO4406 class 18/16/13 NAS	see also filter section at					
contamination level	longer life	ISO4406 class 16/14/11 NAS	www.atos.com or KTF catalog					
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard				
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524				
Flame resistant without wa	iter	FKM	HFDU, HFDR (1)	- ISO 12922				
Flame resistant with water		NBR, HNBR	HFC (1)					

(1) See section 10

10 PERFORMACE RESTRICTIONS WITH FLAME RESISTANT FLUIDS

10.1 HFDU and HFDR - Phosphate ester

PVPC size	3029 4046 5073 50				6140	
Max pressure working / peak	(bar)		200	/ 240		
Max speed	(1) (rpm @ VMAX)	2050	1850	1700	1550	(2)
Ambient temperature range	(°C)		(2)			
Bearing life (% of bearing life wit	h mineral oil) (%)		9	0		

(1) With an inlet pressure of 1 bar abs

(2) For information about size 6140, contact Atos technical office

10.2 HFC - Water-glycol (35 \div 55 % of water)

PVPC size		3029	4046	5073	5090	6140		
Max pressure working / peak	(bar)							
Max speed	(1) (rpm @ VMAX)	2050	1850	1700	1550	(2)		
Ambient temperature range	(°C)		-10 ÷ +60					
Bearing life (% of bearing life wit	h mineral oil) (%)		4	0				

(1) With an inlet pressure of 1 bar abs

(2) For information about size 6140, contact Atos technical office

11 MAX PERMESSIBLE LOAD ON DRIVE SHAFT

PVPC size			3029	4046	5073	5090	6140
Fax = axial load	Fax Fax	Ν	1000	1500	2000	2000	2000
Frad = radial load		N	1500	1500	3000	3000	3000

12 VARIATION OF MAX SPEED VS INLET PRESSURE

Inlet pressure			Displacement %			
bar abs.	65	70	80	90	100	
0,8	120	115	105	97	90	
0,9	120	120	110	103	95	
1,0	120	120	115	107	100	% variation
1,2	120	120	120	113	106	of the
1,4	120	120	120	120	112	max. speed
1,6	120	120	120	120	117	
2,0	120	120	120	120	120	

Example

Displacement: 80% - Inlet pressure: 1,0 bar - Speed: 115%

13 OPEN LOOP ELECTROHYDRAULIC CONTROLS





p/Q control integrates the alternate pressure and flow regulation with the electronic max power limitation. A remote pressure transducer must be installed on the system and its feedback

has to be interfaced to the pump on-board digital driver. Flow control is active when the actual system pressure is lower than the pressure reference input signal: the pump flow is regulated according to the flow reference input. Pressure control is activated when the actual pressure grows up to the pressure reference input signal: the pump flow is then reduced in order to regulate and limit the max system pressure (if the pressure tends to decrease under its command value, the flow control returns active). This option allows to realize accurate dynamic pressure profiles.

Following fieldbus interfaces are available:

- BC CANopen interface • BP - PROFIBUS DP interface • EH - EtherCAT interface
- EW POWRELINK interface
- El EtherNet/IP interface
- EP PROFINET RT/IRT interface

The pumps with BC, BP, EH, EW, EI and EP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit. The digital control ensures high performances as flow and pressure linearity (see diagram 1), better flow knee (see diagram 2), internal leakage compensation (controlled flow independent to the load variations).

PVPC-PES basic version, without sequence module and without pressure transducer, which has to be installed on the main line and wired to the 12 poles connector of the pump on-board digital driver.

version with sequence module RESC 2 which grant a minimum **PVPC-PERS** piloting pressure (18 bar) when the actual pressure falls below that value. Without pressure transducer.

PVPC-PERS/X as PERS version plus integral pressure transducer, with output signal 4-20 mA, factory wired to the pump on-board digital driver through a cable gland.







	d1	d2	d3	d4	d5	
i ype pullip	[ms]					
PVPC-PE(R)S-3029	30	60	90	30	60	
PVPC-PE(R)S-4046	40	80	120	40	80	
PVPC-PE(R)S-5073	50	100	150	50	100	
PVPC-PE(R)S-5090	60	120	170	60	120	
PVPC-PE(R)S-6140	90	180	200	90	180	

Time [ms]

Response time of displacement variation for a step change of the electronic reference signal.

15 PRESSURE TRANSDUCER SELECTION

The pressure transducer type E-ATR-8 must be ordered separately (see tech table GS465) For /X option the pressure transducer with output signal 4 ÷ 20 mA is on-board to the pump.

Pump code: PVPC-PE(R)S-*/200

PVPC-PE(R)S-*/250 PVPC-PE(R)S-*/280 PVPC-PE(R)S-*/200/*/C PVPC-PE(R)S-*/250/*/C PVPC-PE(R)S-*/280/*/C

Pressure transducer code:

E-ATR-8/250 E-ATR-8/400 E-ATR-8/400 E-ATR-8/250/I E-ATR-8/400/I E-ATR-8/400/I

16 ELECTRONIC OPTIONS - only for PES and PERS

- I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- C = This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
- X = This option providing the presence of the pressure transducer, with output signal 4÷20 mA, integral to the pump and factory wired to the PES electronics through a cable gland (see 19.10).
- S = Two on-off input signals are available on the main connector to select one of the four pressure PID parameters setting, stored into the driver (see 19.11).

17 POSSIBLE COMBINED OPTIONS

for **PES**: for **PERS**: /CI, /CS, /IS, /CIS /CI, /CS, /IS, /IX, /SX, /CIS, /ISX

18 COIL VOLTAGE OPTION - only for CZ and LQZ

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

19 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for PES and PERS

Generic electrical output signals of the pump (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 19.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /S and /SX options for fieldbus executions

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

19.3 Flow reference input signal (Q_INPUT+)

Functionality of Q_INPUT+ signal, is used as reference for the pump's flow.

Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

19.4 Pressure reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal, is used as reference for the driver pressure closed loop.

Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDC for standard and $4 \div 20$ mA for /l option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

19.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual pump swashplate position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).

Monitor output signal is factory preset according to selected pump code, defaults are 0 ÷ 10VDc for standard and 4 ÷ 20 mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDc or ± 20 mA.

19.6 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).

Monitor output signal is factory preset according to selected pump code, defaults are $0 \div 10$ VDC for standard and $4 \div 20$ mA for /l option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

19.7 Enable input signal (ENABLE) - only for /S and /SX options

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

19.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

19.9 Pressure transducer input signal

Analog pressure transducers can be directly connected to the driver.

Analog input signal is factory preset according to selected pump code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA. Refer to the pump technical table to transducer characteristics to select the transducer's maximum pressure. Standard:

Remote pressure transducer can be directly connected to the main connector on the driver (see 20.1) /S option

Remote pressure transducer can be directly connected to a dedicated M12 connector (see 20.4) /X and /SX options

Integral-to-pump transducer is directly connected with a dedicated M12 connector and no remote transducer is required; current input signal (4 - 20 mA) of the integral transducer allows cable break detection functionality



19.10 Logic Input Signal (D_IN) - only for standard and standard with /X option

D_IN on-off input signal can be software set to perform one of the following functions:

- enable and disable the driver functioning; apply 0 VDC to disable and 24 VDC to enable the driver see 19.7
- switch between two pressure PID settings; apply 0 VDc to select SET1 pressure PID and 24 VDc to select SET2 see 19.11
- enable and disable the power limitation function; default setting, apply 0V to disable and 24VDC to enable the power limitation see 19.13

19.11 Multiple PID selection (D_IN0 and D_IN1) - only for /S and /SX options in NP execution

Two on-off input signals are available on the main connector to select one of the four pressure PID parameters setting, stored into the driver Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 VDC or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

	PID SET SELECTION				
PIN	SET 1	SET 2	SET 3	SET 4	
9	0	24 Vpc	0	24 Vpc	
10	0	0	24 VDC	24 VDC	

19.13 - Hydraulic Power Limitation

Q

p1

regulation curve (1) with and

(2) without power limitation.

p1 x Q1 = max power limit

Q1

reference signal for pump flow

19.12 Multiple pressure PID (1)

Four sets for pressure PID parameters are stored into the driver: switching in real-time the active pressure PID parameters during machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.). The available commands to switch these PID pressure sets depend on the driver execution:

Fieldbus	Driver	Commands
NP	Standard and Standard with /X option	1 on-off input on main connector allow to switch the 2 PID parameters (SET1 and SET2, see 4.10)
I NI	/S and /SX options	2 on-off inputs allow to switch the 4 PID parameters set (SET1 SET4 - see 4.11)
BC, BP, EH, EW, EI, EP	All versions	real-time fieldbus communication can switch between the 4 PID parameters set (SET1 - SET4 - see driver manuals)

19.13 Hydraulic Power Limitation (1)

A limit to the maximum pump's hydraulic power can be software set into the driver thus limiting the electric power consumption of the motor coupled to the pump: when the actual requested hydraulic power $p \times Q$ (pressure transducer feeback x flow reference value) reaches the max power limit (p1xQ1), the driver automatically reduces the flow pump regulation. The higher is the pressure feedback the lower is the pumps's regulated flow:



The hydraulic power limitation, disabled as default, can be enabled using the Atos pc software or the fieldbus communication (fieldbus executions).

Standard and standard with /X option allow also to enable and disable this function during the machine cycle, using the D_IN on-off input available on the main connector (see 19.11).

(1) The sections 19.12 and 19.13 are a brief description of the settings and features of digital drivers with alternated p/Q control. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW-SETUP programming software:

E-MAN-RI-PES - user manual for PES-S digital drivers

2

1

p

pressure

. feedback

20 ELECTRONIC CONNECTIONS

PIN	Standard	/X	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 Vpc	Input - power supply
2	V0		Power supply 0 Vpc	Gnd - power supply
3	FAULT		Fault (0 Vbc) or normal working (24 Vbc), referred to V0	Output - on/off signal
4	INPUT-		Negative reference input signal for Q_INPUT+ and P_INPUT+	Gnd - analog signal
5	Q_INPUT+		Flow reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
6	6 Q_MONITOR		Flow monitor output signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option. Referred to V0	Output - analog signal Software selectable
7	7 P_INPUT+		Pressure reference input signal: $\pm 10 \text{ Vpc} / \pm 20 \text{ mA maximum range}$ Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
8	8 P_MONITOR		Pressure monitor output signal: ± 10 Vbc / ± 20 mA maximum range Defaults are 0 \div 10 Vbc for standard and 4 \div 20 mA for /I option. Referred to V0	Output - analog signal Software selectable
9	9 D_IN		Function software selectable between: power limitation enable (default), multiple pressure PID selection or pump enable (24 Vbc) / disable (0 Vbc). Referred to V0	Input - on/off signal
10	10 TR+		Remote pressure transducer input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /C option	Input - analog signal Software selectable
		NC	Do not connect	
11	TR-		Negative pressure transducer input signal for TR+	Input - analog signal
		NC	Do not connect	
PE	E EARTH Internally connected to driver housing			

20.1 Main connector signals - 12 pin (A) Standard and Standard with /X option - for PES and PERS

Note: these connections are the same of Rexroth A10VSO axial piston pumps, model SYDFEE and SYDFEC

Remote pressure transducer connections - only for Standard



20.2 Main connector signals - 12 pin ~~ (A ~~ /S and /SX option - for PES and PERS

DIN	/S and	d /SX		NOTES
	NP	Fieldbus		NOTES
1	V+		Power supply 24 Vbc	Input - power supply
2	V0		Power supply 0 Vbc	Gnd - power supply
3	ENABLE refe	erred to: VL0	Enable (24 Vpc) or disable (0 Vpc) the pump	Input - on/off signal
4	Q_INPUT+		Flow reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-		Negative reference input signal for Q_INPUT+ and P_INPUT+	Input - analog signal
6	Q_MONITOR V0	R referred to: VL0	Flow monitor output signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
7	P_INPUT+	-	Pressure reference input signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
8	P_MONITOF V0	referred to: VL0	Pressure monitor output signal: ± 10 Vpc / ± 20 mA maximum range Defaults are 0 \div 10 Vpc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
9	D_IN0		Function software selectable between: multiple pressure PID 0 selection (default) or power limitation enable. Referred to V0	Input - on/off signal
		VL+	Power supply 24 Vpc for driver's logic and communication	Input - power supply
10	D_IN1		Function software selectable between: multiple pressure PID 1 selection (default) or power limitation enable. Referred to V0	Input - on/off supply
		VL0	Power supply 0 Vbc for driver's logic and communication	Gnd - power supply
11	FAULT refer	red to: VL0	Fault (0 Vpc) or normal working (24 Vpc)	Output - on/off signal
PE	EARTH		Internally connected to driver housing	

Notes: these connections are the same of Moog radial piston pumps, model RKP-D; do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 Communications connectors - for PES and PERS (B) - (C)

В	B USB connector - M12 - 5 pin always present				
PIN	SIGNAL	GNAL TECHNICAL SPECIFICATION (1)			
1	+5V_USB	Power supply			
2	ID Identification				
3	GND_USB Signal zero data line				
4	D-	Data line -			
5	D+	Data line +			

C1	C₁ C₂ BP fieldbus execution, connector - M12 - 5 pin					
PIN	PIN SIGNAL TECHNICAL SPECIFICATION (1)					
1	+5V	Termination supply signal				
2	LINE-A	Bus line (high)				
3	DGND	Data line and termination signal zero				
4	LINE-B	Bus line (low)				
5	SHIELD					

(1) Shield connection on connector's housing is recommended

C1 (C1 C2 BC fieldbus execution, connector - M12 - 5 pin					
PIN	PIN SIGNAL TECHNICAL SPECIFICATION (1)					
1	CAN_SHLD	Shield				
2	not used	©1 - ©2 pass-through connection (2)				
3	3 CAN_GND Signal zero data line					
4	CAN_H	Bus line (high)				
5	CAN_L	Bus line (low)				

(C1) (C1 C2 EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin					
PIN	PIN SIGNAL TECHNICAL SPECIFICATION (1)					
1	TX+	Transmitter				
2	RX+	Receiver				
3	тх-	Transmitter				
4	RX-	Receiver				
Housing	SHIELD					

(2) Pin 2 can be fed with external +5V supply of CAN interface

20.4 Remote pressure/force transducer connector - M12 - 5 pin - for PES and PERS with for /S, /X, /SX options 0) - 02

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Voltage	Current
1	VF +24V	Power supply +24Vbc	Output - power supply	Connect	Connect
2	TR1	Signal transducer: ±10 Vpc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/
4	NC	Not connect		/	/
5	NC	Not connect		/	/

Remote pressure transducer connection - example



Note: connectors front view

20.5 Solenoid connection - for CZ and LQZ

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

20.7 Diagnostic LEDs (L)

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3	
L1	VALVE STATUS				LINK/ACT				
L2	NE	NETWORK STATUS							
L3	SC	SOLENOID STATUS			LIN	K/ACT			

21 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital driver executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table AS800).

For EH, EW, EI and EP execution the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



22 CONNECTORS CHARACTERISTICS - to be ordered separately

22.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY AND SIGNALS	POWER SUPPLY AND SIGNALS
CODE	A1 ZM-12P	A2 ZH-12P
Туре	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

22.2 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)		
CODE	C1 ZM-5PF	©2 ZM-5PM	C1 ZM-5PF/BP	C2 ZM-5PM/BP	C1 C2	ZM-4PM/E	
Туре	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular		4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101		
Material	Metallic		Metallic		Metallic		
Cable gland	Pressure nut - cab	le diameter 6÷8 mm	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm		
Cable	CANbus Stand	dard (DR 303-1)	PROFIBUS DP Standard		Ethernet standard CAT-5		
Connection type	screw	terminal	screw terminal		terminal block		
Protection (EN 60529)	IP67		IP 67		IP 67		
(1) E-TRM-** terminators can be ordered separately, see tech table AS800 (2) Internally terminated							

22.3 Remote pressure transducer connectors

CONNECTOR TYPE	PRESSURE TRANSDUCER		SF - Double transducers
CODE	D1 D2 ZH-5PM/1.5	D1 D2 ZH-5PM/5	D2 ZH-5PM-2/2
Туре	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector mo	oulded on cables	Connector moulded on cables 2 m length
Cable gland	1,5 m length	5 m length	Connector modided on cables 2 milengin
Cable	5 × 0	,25 mm²	3 x 0,25 mm ² (both cables)
Connection type	molde	ed cable	splitting cable
Protection (EN 60529)	IP 67		IP 67

23 DIRECTION OF ROTATION



PVPC-*-5073

PVPC-*-5090

cz

LQZ

190

166

111

111

24.1 Dimension of PVPC size 3, 4, 5 - version CZ, LQZ



36,9

44

3/4" BSPP

163

Flange SAE 3000 2"

328

Flange SAE 6000 1 1/4"

PES

PERS

PERS/X

PVPC-*-5073

PVPC-*-5090

190

190

190

103,5

103,5

103,5



36,6

46,7

47,1

190

230

230

337

337

Flange SAE 3000 2" Flange SAE 6000 1 1/4"

3/4" BSPP



(2) = Sequence module

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and consequently also the position of the control devices.

Pump type	Version	IN	OUT	D1, D2	Mass (kg)
PVPC-*-6140	PES				72,7
	PERS	Flange SAE 3000 2 1/2"	Flange SAE 6000 1 1/4"	1 1/16"-12UNF	82,8
	PERS/X				83,2

25 RELATED DOCUMENTATION

A900	Operating and maintenance information for pumps	G030	E-BM-AS digital driver
AS800	Programming tools	GS050	E-BM-AES digital driver
FS001	Basics for digital electrohydraulics	GS510	Fieldbus
FS500	Digital proportional valves with p/Q control	K800	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting surfaces for electrohydraulic valves
G010	E-MI-AC analog driver	E-MAN-	RI-PES PES user manual
G020	E-MI-AS-IR digital driver		





TECHNICAL INFORMATION	Size	Qmax [l/min]	Table	Pag
Basics for on-off solenoid directional valves			F001	934
Basics for safety components			Y010	936
Mounting surfaces for electrohydraulic valves			P005	958
Mounting surfaces and cavities for cartridge valves			P006	962

DIRECTIONAL VALVES

direct, spool type, subplate, AC or DC solenoids,		60	5010	674
compact execution	00	00	EUIO	0/4
direct, spool type, subplate, AC or DC solenoids	06	80	E015	680
direct, spool type, subplate, AC or DC solenoids, high pressure	06	80	E030	684
direct, spool type, subplate, AC or DC solenoids	10	150	E025	690
direct, spool type, subplate, AC or DC solenoids, high pressure	10	150	E035	694
piloted, spool type, subplate, AC or DC solenoids	10 ÷ 32	160 ÷ 1000	E100	700
piloted, spool type, subplate, AC or DC solenoids	10 ÷ 32	160 ÷ 1000	E085	710
	direct, spool type, subplate, AC or DC solenoids, compact execution direct, spool type, subplate, AC or DC solenoids direct, spool type, subplate, AC or DC solenoids, high pressure direct, spool type, subplate, AC or DC solenoids direct, spool type, subplate, AC or DC solenoids, high pressure piloted, spool type, subplate, AC or DC solenoids piloted, spool type, subplate, AC or DC solenoids	direct, spool type, subplate, AC or DC solenoids, compact execution06direct, spool type, subplate, AC or DC solenoids06direct, spool type, subplate, AC or DC solenoids, high pressure06direct, spool type, subplate, AC or DC solenoids10direct, spool type, subplate, AC or DC solenoids, high pressure10direct, spool type, subplate, AC or DC solenoids, high pressure10piloted, spool type, subplate, AC or DC solenoids10 ÷ 32piloted, spool type, subplate, AC or DC solenoids10 ÷ 32	direct, spool type, subplate, AC or DC solenoids, compact executionO660direct, spool type, subplate, AC or DC solenoids0680direct, spool type, subplate, AC or DC solenoids, high pressure0680direct, spool type, subplate, AC or DC solenoids, high pressure0680direct, spool type, subplate, AC or DC solenoids, high pressure10150direct, spool type, subplate, AC or DC solenoids, high pressure10150piloted, spool type, subplate, AC or DC solenoids10 ÷ 32160 ÷ 1000piloted, spool type, subplate, AC or DC solenoids10 ÷ 32160 ÷ 1000	direct, spool type, subplate, AC or DC solenoids, compact executionO660E018direct, spool type, subplate, AC or DC solenoids0680E015direct, spool type, subplate, AC or DC solenoids, high pressure0680E030direct, spool type, subplate, AC or DC solenoids, high pressure0680E030direct, spool type, subplate, AC or DC solenoids, high pressure10150E025direct, spool type, subplate, AC or DC solenoids, high pressure10150E035piloted, spool type, subplate, AC or DC solenoids10÷32160÷1000E100piloted, spool type, subplate, AC or DC solenoids10÷32160÷1000E085

leak free, solenoid operated

DLEH, DLEHM	direct, poppet type, subplate, AC or DC solenoids		12 . 70	FOAF	720
CART LEH, CART LEHM	direct, poppet type, screw-in cartridge, AC or DC s	olenoids M2O	12 ÷ 50	E045	720
	piloted, poppet type,		aa" 40 · 700	FIOF	724
JO-DL	eak free screw-in cartridge, DC solenoids UNF 3/4" ÷ 1 ⁵ /16" 40 ÷ 300 ET) EI05			

mechanical, hydraulic, pneumatic operated

DH, DK, DP mechanical	hand lever or cam operated, spool type, subplate	06 ÷ 25	50 ÷ 700	E150	728
DH, DK, DP hydraulic	spool type, subplate	06 ÷ 32	80 ÷ 1000	E225	734
DH, DK, DP pneumatic	spool type, subplate	06 ÷ 32	50 ÷ 1000	E255	739

PRESSURE VALVES

CART M, CART ARE	relief, direct, screw-in cartridge	G1/2" ÷ M35	2,5 ÷ 120	C010	743
ARE	relief, direct, in line	G1/4" ÷ G1/2"	40 ÷ 100	C020	748
ARAM	relief, piloted, in line, optional AC or DC solenoids	G3/4" ÷ G1 1/4"	350 ÷ 500	C045	751
AGAM	relief, piloted, subplate, optional AC or DC solenoids	10 ÷ 32	200 ÷ 600	C066	756
REM	relief, piloted, flanged, optional AC or DC solenoids	SAE 3/4" ÷11/4"	200 ÷ 600	C073	762
AGIR	reducing, piloted, subplate	10 ÷ 32	160 ÷ 400		
AGIS	sequence, piloted, subplate	10 ÷ 32	200 ÷ 600	C070	768
AGIU	unloading, piloted, subplate, optional AC or DC soleno	ids 10 ÷ 32	100 ÷ 300		

FLOW VALVES

QV	pressure compensated, 2 way, subplate	06	1,5 ÷ 24	C210	773
AQFR	throttle, in line	G3/8" ÷ 1 1/4"	30 ÷ 250	C280	775

		Size (Qmax [I/min]	Table	Pag
	direct corew in certridge	$C1/4" \div C1/2"$		C400	777
	direct, screw-in cartriage	$G1/4 \div G1/2$	25 ÷ 95	C400	770
	nileted in line	$C7/9" \div C11/4" = 70 \div 700$		C400	//9
	photed, in line		30 ÷ 300	C450	781
AGRL	piloted, subplate	10 ÷ 32	160 ÷ 500		
SAFETY VALVES					
directionals, machine dire	ctive 2006/42/EC				
DHE/FV, DKE/FV	divert eventure extendets AC ev DC estenside	00 + 10	00 · 150	EVOIO	705
DHE/FI, DKE/FI	airect, spool type, subplate, AC or DC solenolas	06 ÷ 10	80 ÷ 150	EYOIO	/85
HF/FV	direct, spool type, modular, AC or DC solenoids	06	60	EY050	795
DPHE/FV	piloted, spool type, subplate, AC or DC solenoids	10 ÷ 25	160 ÷ 700	EY030	799
	piloted, poppet type,				
JO-DL/FV	leak free screw-in cartridge, DC solenoids	NF 3/4" ÷ 1 5/16"	40 ÷ 300	EY105	809
LIFL LIDA/FL LIDA/FV	piloted, poppet tupe, ISO cartridae,				
LIDAS/FL LIDAS/FV	optional AC or DC solenoids	16 ÷ 100	120 ÷ 6300	EY120	812
pressure relief, PED 2014,	/68/UE				
CART M/PED	direct. screw-in cartridae	G1/2" ÷ M35	2.5 ÷ 150	CY010	826
CART ARE/PED		01/2 1100	2,0 100	01010	
ARE/PED	direct, in line	G1/4" ÷ G1/2"	60 ÷ 100	CY020	830
ARAM/PED	piloted, in line, optional AC or DC solenoids	G3/4" ÷ G1 1/4"	400 ÷ 600	CY045	834
AGAM/PED	piloted, subplate, optional AC or DC solenoids	10 ÷ 32	200 ÷ 600	CY066	839
MODULAR VALVES					
directionals					
HF	direct, spool type, AC or DC solenoids	06	60	D050	845
pressure					
HMP, HM, KM	relief, direct or piloted, poppet type	06 ÷ 10	35 ÷ 120	D120	849
HS, KS	sequence, direct or piloted, spool type	06 ÷ 10	40 ÷ 80	D130	853
HG, KG, JPG	reducing, direct or piloted, spool type, 3 or 2 way	06 ÷ 25	50 ÷ 300	D140	855
HC, KC, JPC	compensator, direct or piloted, spool type, 2 way	06 ÷ 16	50 ÷ 200	D150	859
flow					
	pressure compensated flow with bu-pass solonoid value	ve 06	40	סקום	861
	throttle, reverse free flow	06 ÷ 25	+0 80 ÷ 300	D160	965
ויע, גע, זרע		00 7 25	00 + 300	0010	005
check					
HR, KR, JPR	direct or piloted, poppet type	06 ÷ 25	60 ÷ 300	D180	869

		Size	Qmax [l/min]	Table	Pag
SC LI, SC LIR	2 way, slip-in, optional leak free execution	16 ÷ 100	270 ÷ 9000	H003	873
directionals					
LIDEW, LIDBH	functional covers, optional AC or DC solenoids	16 ÷ 100	270 ÷ 9000	H030	883
LIDAS, LIDASH	2 way, active piloting, optional AC or DC solenoids	16 ÷ 50	240 ÷ 2100	H050	889
pressure					
LIMM	relief, functional covers, optional AC or DC solenoids	16 ÷ 80	180 ÷ 4900		
LIRA	reducing, functional covers	16 ÷ 40	140 ÷ 750	H010	893
LIC	compensator, functional covers	16 ÷ 80	180 ÷ 4900		
flow					
LIDD	functional covers, throttle with stroke limiter	16 ÷ 63	270 ÷ 4000	H020	899
check					
LIDA	normally closed, functional covers	16 ÷ 100	270 ÷ 9000		
LIDO	normally open, functional covers	16 ÷ 50	160 ÷ 1800		
LIDB	normally closed, functional covers, shuttle valve	16 ÷ 63	270 ÷ 4000	H040	903
LIDR	normally closed, functional covers, check valve	16 ÷ 63	270 ÷ 4000		
ACCESSORIES					
E-ATR-8	pressure transducer with amplified analog output signal			GS465	912
E-DAP-2	electronic pressure switch with digital output signals and dis	play		GS470	914
МАР	manual pressure switch with fixed differential switching pres	sure		D250	916
BA	single station subplates, mounting surfaces ISO 4401, 6264	and 5781		K280	918
HAND LEVERS	for on-off and proportional valves			E138	922
HANDWHEELS & KNOBS	for on-off and proportional valves			K150	924

OPERATING INFORMATION

CONNECTORS

Operating and maintenance information for on-off valves	E900	976
Operating and maintenance information for safety PED pressure relief valves	CY900	982

K800

926

for transducers, pumps, on-off and proportional valves

Supplementary components range available on www.atos.com

atos 🛆

Solenoid directional valves type DHL

direct, spool type, compact execution



2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)



Note:

Spool type 6/7 is available only for configuration 61, not available for version /A

Spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank

Spools type 1, 4, 5 and 58 are also available as 1/1, 4/8, 5/1 and 58/1. They are properly shaped to reduce water-hammer shocks during the swiching Spools type 1, 1/2, 3, 8 are available as 1P, 1/2P, 3P, 8P to limit valve internal leakages.

3 GENERAL CHARACTERISTICS

Assembly position	Any position		
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100		
MTTFd valves according to EN ISO 13849	150 years, see technical table P007		
Ambient temperature rangeStandard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$			
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$		
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006		

4 HYDRAULIC CHARACTERISTICS

Operating pressure	Ports P,A,B: 350 bar; Port T 210 bar for DC version; 160 bar for AC version
Max flow	60 l/min, see Q/ Δp diagram at section \mathbb{B} and operating limits at section \mathbb{B}

5 ELECTRICAL CHARACTERISTICS

Insulation class	H (180°C) for DC coils; F (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See section 6
Supply voltage tolerance	± 10%

6 COIL VOLTAGE

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil DHL	
12 DC	12 DC			COL-12DC	
14 DC	14 DC			COL-14DC	
24 DC	24 DC	-	20\\/	COL-24DC	
28 DC	28 DC		2911	COL-28DC	
110 DC	110 DC	666		COL-110DC	
220 DC	220 DC	- or 667	667		COL-220DC
110/50 AC (1)	110/50/60 AC	-		COL-110/50/60AC	
115/60 AC	115/60 AC		58VA	COL-115/60AC	
230/50 AC (1)	230/50/60 AC	_	(3)	COL-230/50/60AC	
230/60 AC	230/60 AC			COL-230/60AC	
110/50 AC - 120/60 AC	110 DC	669	20///	COL-110DC	
230/50 AC - 230/60 AC	220 DC	009	2311	COL-220DC	

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA.

(2) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

7 OPTIONS

A = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.

MV, MO = auxiliary hand lever positioned vertically (MV) or horizontally (MO). For available configuration and dimensions see section **IB WP** = prolonged manual override protected by rubber cap.

Available for configuration: 61 - 63 - 71, spools: 0 - 0/2 - 1 - 1P - 1/2 - 1/2P - 3 - 3P - 4 - 7

7.1 Accessories

WPD/HL = (only for DHL-*DC) manual override with detent, to be ordered separatelly, see section 18

The manual override operation can be possible only if the pressure at T port is lower than 50 bar

8 Q/△P DIAGRAMS based on mineral oil ISO VG 46 at 50°C

Flow direction	DA	D.B	л.т	в.т	в.т
Spool type	F→A	ר⇒ם	A→I	וישם	r⇒ı
0	A	Α	С	С	D
1, 1P, 1/1	С	С	С		
3, 3P, 3/1	D	D	Α	Α	
4, 4/8, 5	F	F	G	С	E
0/2, 1/2, 1/2P	D	D	D	D	
6, 7, 16, 17	D	D	D	D	
8, 8P	A	Α	E	E	
2, 6/7	D	D			
2/2	F	F			
19, 91	E	E	D	D	
39, 93	F	F	G	G	



9 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. $P \rightarrow A$ and $B \rightarrow T$). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

Curve	DC version, spool type:		
Α	0, 0/2, 1/2, 1/2P, 8, 8P		
в	1, 1P, 1/1		
С	3, 3P, 3/1, 6, 7		
D	4, 4/8, 16, 17, 5, 19, 39, 58, 91, 93		
Е	2, 2/2, 6/7		



Curve	AC version, spool type:		
Α	0, 0/2, 1/2, 1/2P, 8, 8P		
В	1, 1P, 1/1		
с	3, 3P, 3/1, 6, 7		
D	4, 16, 17, 4/8, 5, 19, 39, 58, 91, 93		
Е	2, 2/2, 6/7		





10 SWITCHING TIMES (average values in msec)

- Test conditions: 20 l/min; 150 bar
 - nominal voltage
 - 2 bar of counter pressure on port T
 - mineral oil: ISO VG 46 at 50°C

The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

Inlet pressure [bar]

Valve	Switch-on	Switch-off	Switch-on	Switch-off
	AC	AC	DC	DC
DHL	10 - 25	20 - 40	30 - 50	15 - 25

11 SWITCHING FREQUENCY

Valve	AC (cycles/h)	DC (cycles/h)
DHL + 666/667	7200	15000

12 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A) **E-SD** = electronic connector which eliminates electric disturbances when solenoid valves are de-energized

13 COILS WITH SPECIAL CONNECTORS only for voltage supply 12, 14, 24, 28 VDC



Note: For the electric characteristics refer to standard coils features - see section 6

14 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, reccomended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$			
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s			
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog			
Hydraulic fluid	Suitable seals type Classification Ref. Standard			
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water	FKM	HFDU, HFDR		
Flame resistant with water	NBR	HFC	130 12922	

15 PLUG-IN RESTRICTOR (to be ordered separately)

The use of plug-in restrictors in valve's ports P or A or B may be necessary is case of particular conditions as long flexible hoses or the presence of accumulators which could cause at the valve switching instantaneous high flow peaks over the max valve's operating limits.





16 FASTENING BOLTS AND SEALS

Fastening bolts	Seals
4 socket head screws M5x30 class 12.9	4 OR 108;
Tightening torque = 8 Nm	Diameter of ports A, B, P, T: Ø 7,5 mm (max)

17 DIMENSIONS [mm]



E018

18 MANUAL OVERRIDE



19 RELATED DOCUMENTATION

E001 K150 K280 K800	Basics for solenoid directional valves Handweels for hydraulic controls Single and modular subplates Electric and electronic connectors	P005 E900	Mounting surfaces for electrohydraulic valves Operating and maintenance information
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Solenoid directional valves type DHE

direct, spool type, high flow



Note: see also section 4, note 3, for special shaped spools

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position				
Subplate surface finishing	Roughness index Ra 0,4 - flatness	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)			
MTTFd values according to EN ISO 13849	150 years, for further details see t	echnical table P007			
Ambient temperature	Standard = $-30^{\circ}C \div +70^{\circ}C$	/PE option = $-20^{\circ}C \div +70^{\circ}C$	/BT option = $-40^{\circ}C \div +70^{\circ}C$		
Storage temperature	Standard = $-30^{\circ}C \div +80^{\circ}C$	/PE option = $-20^{\circ}C \div +80^{\circ}C$	/BT option = $-40^{\circ}C \div +80^{\circ}C$		
Surface protection	Body: zinc coating with black p	assivation Coil: zinc nick plastic ir	el coating (DC version) acapsulation (AC version)		
Corrosion resistance	Salt spray test (EN ISO 9227) >	200 h			
Compliance	CE to Low Voltage Directive 20 RoHS Directive 2011/65/EU as REACH Regulation (EC) n°1907	14/35/EU last update by 2015/863/EU 7/2006			
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ 4 FKM seals (/PE option) = -20°C ÷ HNBR seals (/BT option) = -40°C	+80°C, with HFC hydraulic fluids = - +80°C ÷ +60°C, with HFC hydraulic fluids	20°C ÷ +50°C = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed rang	ge 2.8 ÷ 500 mm²/s			
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638	3 class 9, see also filter section at w	ww.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard		
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water	FKM	HFDU, HFDR			
Flame resistant with water	NBR, HNBR	HFC	ISO 12922		
Flow direction	As shown in the symbols of table	2			
Operating pressure	Ports P,A,B: 350 bar; Port T 210 bar for DC version; 160	bar for AC version			
Rated flow	See diagrams Q/Ap at section 6				
Maximum flow	80 l/min, see operating limits at s	ection 🛛			
3.1 Coils characteristics	·				
Insulation class	Insulation class H (180°C) for DC coils F (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account				
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 6	IP 65 (with connectors 666, 667, 669 correctly assembled)			
Relative duty factor	100%				
Supply voltage and frequency	See electric feature 5				
Supply voltage tolerance	± 10%				
Certification	cURus North American Standard				

4 NOTES

Options 1 A

= Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A. WP = prolonged manual override protected by rubber cap.

m
m
m M The manual override operation can be possible only if the pressure at T port is lower than 50 bar - see section 🕮

L1, L2, L3 = (only for DHE-DC) device for switching time control, installed in the valve solenoid, see section 9. For spools 4 and 4/8 only device L3 is available.

FI, FV = with proximity or inductive position switch for monitoring spool position: see tab. E110.

MV, MO = auxiliary hand lever positioned vertically (MV) or horizontally (MO). Available for configuration: 61 - 63 - 71, spools: 0 - 0/2 - 1 - 1P - 1/2 - 1/2P - 3 - 3P - 4 - 7.

2 Accessories

WPD/HE-DC = (only for DHE-DC) manual override with detent, to be ordered separately, see tab. K150

Special shaped spools

spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank.

- spools type 1, 4, 5 and 58 are also available as 1/1, 4/8, 5/1 and 58/1. They are properly shaped to reduce water-hammer shocks during the swiching. spools type 1, 1/2, 3, 8 are available as 1P, 1/2P, 3P, 8P to limit valve internal leakages.

spool type 1/9 has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.
 Other types of spools can be supplied on request.

5 ELECTRIC FEATURES

External supply	Voltage	Type of connector	Power	Code of spare coil		
nominal voltage ± 10%	code	Type of connector	consumption (2)	DHE		
12 DC	12 DC		COE-12DC			
14 DC	14 DC		30 W	COE-14DC		
24 DC	24 DC			COE-24DC		
28 DC	28 DC			COE-28DC		
48 DC	48 DC			COE-48DC		
110 DC	110 DC	666		COE-110DC		
125 DC	125 DC	000		COE-125DC		
220 DC	220 DC	667		COE-220DC		
24/50 AC	24/50/60 AC	007		COE-24/50/60AC (1)		
48/50 AC	48/50/60 AC		58 VA (3)	COE-48/50/60AC (1)		
110/50 AC	110/50/60 AC			COE-110/50/60AC (1)		
230/50 AC	230/50/60 AC			COE-230/50/60AC (1)		
115/50 AC	115/60 AC		80 VA	COE-115/60AC		
230/50 AC	230/60 AC		(3)	COE-230/60AC		
110/50 AC - 120/60 AC	110 RC	669	30 W	COE-110RC		
230/50 AC - 230/60 AC	230 RC	000	00 W	COE-230RC		

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷15% and the power consumption is 52 VA. (2) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

6 Q/AP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

Flow direction					
Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1	А	A	С	С	D
1, 1/1	D	С	С	С	
3, 3/1	D	D	А	A	
4, 4/8, 5, 5/1, 49, 58, 58/1, 94	F	F	G	С	E
1/2, 0/2	D	D	D	D	
6, 7, 16, 17	D	D	D	D	
8	А	А	E	E	
2	D	D			
2/2	F	F			
09, 19, 90, 91	E	E	D	D	
1/9, 39, 93	F	F	G	G	



7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P \rightarrow A and B \rightarrow T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

Curro	Spool type			
Cuive	AC	DC		
Α	1, 1/2, 8	0, 0/1, 1, 1/2, 3, 8		
в	0, 0/1, 0/2, 1/1, 1/9, 3	0/2, 1/1, 6, 7, 1/9, 19		
с	3, 3/1, 6, 7	3/1, 4, 4/8, 5, 5/1, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94		
D	4, 4/8, 5, 5/1, 16, 17, 19, 39, 58, 58/1, 09, 90, 91, 93, 94	2, 2/2		
Е	2, 2/2	-		





9 DEVICES FOR THE SWITCHING TIME CONTROL

1-1-

These devices are used to control the valve's switching time

(only for DC version) and therefore reduce the hammering shocks in the hydraulic circuit.

Options L1, L2, L3 control the switching time in both moving directions of the valve spool by means of calibrated restrictors installed in the solenoid anchor.

ø L'

L1 = Ø 1,1 mm

L2 = Ø 0,9 mm **L3** = Ø 0,7 mm

8 SWITCHING TIMES (average values in msec)

Test conditions: - 36 l/min; 150 bar

- nominal voltage
- 2 bar of counter pressure on port T

- mineral oil: ISO VG 46 at 50°C The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

Valve	Switch-on AC	Switch-off AC	Switch-on DC	Switch-off DC
DHE	10 - 25	20 - 40	30 - 50	15 - 25
DHE-*/L1	_	_	60	60
DHE-*/12			80	80

10 SWITCHING FREQUENCY

DHF-*/13

Valve	AC (cycles/h)	DC (cycles/h)
DHE + 666 / 667	7200	15000

11 COIL WITH SPECIAL CONNECTORS only for voltage supply 12, 14, 24, 28 VDC

150

150



Note: for the electric characteristics refer to standard coils features - see section 5

ON-OFF VALVES 682



Overall dimensions refer to valves with connector 666

13 PLUG-IN RESTRICTOR (to be ordered separately)

The use of plug-in restrictors in valve's ports P or A or B may be necessary is case of particular conditions as long flexible hoses or the presence of accumulators which could cause at the valve switching instantaneous high flow peaks over the max valve's operating limits.





14 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)

15 MOUNTING SUBPLATES

Model	Ports location	GAS Ports A-B-P-T	Ø Counterbore [mm] A-B-P-T	Mass [kg]
BA-202	Ports A, B, P, T underneath;	3/8"	-	1,2
BA-204	Ports P, T underneath; ports A, B on lateral side	3/8"	25,5	1,8
BA-302	Ports A, B, P, T underneath	1/2"	30	1,8

The subplates are supplied with 4 fastening bolts M5x50. Also available are multi-station subplates and modular subplates. For further details see table K280.

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Solenoid directional valves Pmax 420 bar

direct operated, ISO 4401 size 06






3 GENERAL CHARACTERISTICS

Assembly position	Any position			
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100			
MTTFd valves according to EN ISO 13849	150 years, see technical table P007			
Ambient temperature range	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$			
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +80^{\circ}C$			
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)			
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h			
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006			

4 HYDRAULIC CHARACTERISTICS

Operating pressure	Ports P,A,B: 420 bar; Port T 210 bar for DC version; 160 bar for AC version
Max flow	80 l/min, see Q/ Δp diagram at section \mathbb{B} and operating limits at section \mathbb{B}

5 ELECTRICAL CHARACTERISTICS

Insulation class	H (180°C) for DC coils; F (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 or E-SD correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See section 6
Supply voltage tolerance	± 10%

6 COIL VOLTAGE

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil
12 DC	12 DC			COE-12DC
14 DC	14 DC			COE-14DC
24 DC	24 DC			COE-24DC
28 DC	28 DC		20.W	COE-28DC
48 DC	48 DC	_	30 W	COE-48DC
110 DC	110 DC			COE-110DC
125 DC	125 DC	666	or	COE-125DC
220 DC	220 DC	667		COE-220DC
24/50 AC	24/50/60 AC			COE-24/50/60AC (1)
48/50 AC	48/50/60 AC		58 VA	COE-48/50/60AC (1)
110/50 AC	110/50/60 AC		(3)	COE-110/50/60AC (1)
230/50 AC	230/50/60 AC			COE-230/50/60AC (1)
115/50 AC	115/60 AC		80 VA	COE-115/60AC
230/50 AC	230/60 AC		(3)	COE-230/60AC
110/50 AC - 120/60 AC	110 RC	669	30 W/	COE-110RC
230/50 AC - 230/60 AC	230 RC	669	50 W	COE-230RC

Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷15% and the power consumption is 52 VA.
 Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.
 When solenoid is energized, the inrush current is approx 3 times the holding current.

7 NOTES FOR DHEP

1 Options

A = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.
 WP = prolonged manual override protected by rubber cap.

/ The manual override operation can be possible only if the pressure at T port is lower than 50 bar - see section 🗹

L1, L2, L3 = (only for DHEP-DC) device for switching time control, installed in the valve solenoid, see section 11. For spools 4 and 4/8 only device L3 is available.

MV, MO = auxiliary hand lever positioned vertically (MV) or horizontally (MO). For available configuration and dimensions see table E138.

2 Accessories

WPD/HE-DC = (only for DHEP-DC) manual override with detent, to be ordered separately, see tab. K150

3 Special shaped spools

- spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank.
- spools type 1, 4, 5 and 58 are also available as 1/1, 4/8, 5/1 and 58/1. They are properly shaped to reduce water-hammer shocks during the swiching. - spools type 1, 1/2, 3, 8 are available as 1P, 1/2P, 3P, 8P to limit valve internal leakages.
- Other types of spools can be supplied on request.

8 Q/AP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

Flow direction Spool type	P→A	P→B	A→T	В→Т	P→T
0, 0/1	А	A	С	С	D
1, 1/1	D	С	С	С	
3, 3/1	D	D	А	А	
4, 4/8, 5, 5/1, 58, 58/1 09, 90, 91, 93, 94	F	F	G	С	E
1/2, 0/2	D	D	D	D	
6, 7	D	D	D	D	
8	А	A	Е	E	
2	D	D			
2/2	F	F			



9 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P \rightarrow A and B \rightarrow T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

450





DHEP - DC

Curro	Spool type				
Curve	AC	DC			
A 1, 1/2, 8		0, 0/1, 1, 1/2, 3, 8			
в	0, 0/1, 0/2, 1/1	0/2, 1/1, 6, 7			
с	3, 3/1	3/1, 4, 4/8, 5, 5/1, 19, 39, 58, 90, 91, 93, 94			
D	4, 4/8, 5, 5/1, 6, 7, 19, 39, 58, 91, 93, 94	2, 2/2			
E	E 2, 2/2 -				

10 SWITCHING TIMES (average values in msec)

Test conditions: - 36 l/min; 150 bar

- nominal voltage
- 2 bar of counter pressure on port T
- mineral oil: ISO VG 46 at 50°C

The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

Valve	Switch-on AC	Switch-off AC	Switch-on DC	Switch-off DC
DHEP	10 - 25	20 - 40	30 - 50	15 - 25
DHEP-*/L1	_	_	60	60
DHEP-*/L2	—	—	80	80
DHEP-*/L3	_	_	150	150

12 SWITCHING FREQUENCY

Valve	AC (cycles/h)	DC (cycles/h)
DHE + 666 / 667	7200	15000

11 DEVICES FOR THE SWITCHING TIME CONTROL

These devices are used to control the valve's switching time (only for DC version) and therefore reduce the hammering shocks in the hydraulic circuit.

Options L1, L2, L3 control the switching time in both moving directions of the valve spool by means of calibrated restrictors installed in the solenoid anchor.



13 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K800)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)

E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized

14 COIL WITH SPECIAL CONNECTORS only for voltage supply 12, 14, 24, 28 VDC



Note: for the electric characteristics refer to standard coils features - see section 6

SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$						
Recommended viscosity	15÷100 mm²/s - max allowed ra	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s					
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog						
Hydraulic fluid	Suitable seals type Classification Ref. Standard						
Mineral oils	NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524				
Flame resistant without water	FKM	HFDU, HFDR	100 10000				
Flame resistant with water	NBR, NBR low temp.	NBR, NBR low temp. HFC ISO 12922					

16 FASTENING BOLTS AND SEALS

Fastening bolts	Seals
4 socket head screws M5x30 class 12.9	4 OR 108;
Tightening torque = 8 Nm	Diameter of ports A, B, P, T: Ø 7,5 mm (max)

17 INSTALLATION DIMENSIONS [mm]



E030

18 MANUAL OVERRIDE



19 RELATED DOCUMENTATION

E001 K150 K280 K800	Basics for solenoid directional valves Handweels for hydraulic controls Single and modular subplates Electric and electronic connectors	P005 E900	Mounting surfaces for electrohydraulic valves Operating and maintenance information
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Solenoid directional valves type DKE

direct, spool type





3 MAIN CHARACTERISTCS, SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position for all valves except for type - 170* (without springs) that must be installed with horizontal axis if operated by impulses				
Subplate surface finishing	Roughness index Ra 0,4 - flatne	ess ratio 0,01/100 (ISO 1101)			
MTTFd values according to EN ISO 13849	150 years, for further details see	e technical table P007			
Ambient temperature	Standard = $-30^{\circ}C \div +70^{\circ}C$	/PE option = $-20^{\circ}C \div +70^{\circ}C$	/BT option = $-40^{\circ}C \div +70^{\circ}C$		
Storage temperature	Standard = $-30^{\circ}C \div +80^{\circ}C$	/PE option = $-20^{\circ}C \div +80^{\circ}C$	/BT option = $-40^{\circ}C \div +80^{\circ}C$		
Surface protection	Body: zinc coating with black pa	assivation Coil: zinc nicl plastic ii	kel coating (DC version) ncapsulation (AC version)		
Corrosion resistance	Salt spray test (EN ISO 9227) >	200 h			
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				
Seals, recommended fluid temperature	NBR seals (standard) = -20° C ÷ $+80^{\circ}$ C, with HFC hydraulic fluids = -20° C ÷ $+50^{\circ}$ C FKM seals (/PE option) = -20° C ÷ $+80^{\circ}$ C HNBR seals (/BT option) = -40° C ÷ $+60^{\circ}$ C, with HFC hydraulic fluids = -40° C ÷ $+50^{\circ}$ C				
Recommended viscosity	15÷100 mm²/s - max allowed ra	nge 2.8 ÷ 500 mm²/s			
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638	class 9, see also filter section at w	ww.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard		
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water	FKM HFDU, HFDR				
Flame resistant with water	NBR, HNBR HFC ISO 12922				
Flow direction	As shown in the symbols of table 2				
Operating pressure	Ports P,A,B: 350 bar; Port T 210 bar for DC version (250 bar with option /Y); 160 bar for AC version				
Rated flow	See diagrams Q/Ap at section 6				
Maximum flow	150 I/min, see operating limits at section 7				

3.1 Coils characteristics

Insulation class	H (180°C) for DC coils F (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree DIN EN 60529	IP 65 (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 5
Supply voltage tolerance	± 10%
Certification	cURus North American Standard

4 NOTES

1 Options

 \mathbf{A} = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A. \mathbf{WP} = prolonged manual override protected by rubber cap - see section 12.

- L, L1, L2, L3, LR, L7, L8 see section 10 = device for switching time control (only for DC solenoids).
- L7 and L8 are available only for spool type 0/1, 1/1, 3/1, 4 and 5.
- FI, FV = versions with proximity switch for spool position monitoring: see tab. EY010.
- Y = external drain, only for DC version, to be selected if the pressure at T port is higher than the max allowed limits.

2 Accessories

WPD/KE-DC = (only for DC supply) manual override with detent, to be ordered separately, see tab. K150

3 Special shaped spools

- spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank.
- spool type 1 is also available as 1/1, properly shaped to reduce the water-hammer shocks during the switching.
- spool type 1/9 has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.

5 ELECTRIC FEATURES

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil
12 DC	12 DC			CAE-12DC
14 DC	14 DC			CAE-14DC
24 DC	24 DC			CAE-24DC
28 DC	28 DC		36 W	CAE-28DC
110 DC	110 DC	666		CAE-110DC
125 DC	125 DC	or		CAE-125 DC
220 DC	220 DC	667		CAE-220DC
110/50/60 AC	110/50/60 AC		100 VA	CAE-110/50/60AC (1)
230/50/60 AC	230/50/60 AC	1	(3)	CAE-230/50/60AC (1)
115/60 AC	115/60 AC		130 VA	CAE-115/60AC
230/60 AC	230/60 AC		(3)	CAE-230/60AC
110/50/60 AC	110 DC	000	00.144	CAE-110DC
230/50/60 AC	220 DC	669	36 VV	CAE-220DC

- (1) In case of 60 Hz voltage frequency the performances are reduced by 10÷15% and the power consumption is 90 VA
- (2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

6 Q/AP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

Flow direction Spool type	P→A	P→B	A→T	B→T	P→T	B→A
0, 0/1, 0/2, 2/2	A	А	В	В		
1, 1/1, 6, 8	A	А	D	С		
3, 3/1, 7	A	Α	С	D		
4	В	В	В	В	F	
5, 58	A	В	С	С	G	
1/2	В	С	С	В		
19, 91	F	F	G	G		Н
1/9, 39, 93	F	F	G	G		Н



7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (Vnom - 10%). The curves refer to application with symmetrical flow through the valve (i.e. $P \rightarrow A$ and $B \rightarrow T$). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.







Curve	AC Spoo	I type DC
Α	0/1	0, 0/1, 1, 1/1, 3, 3/1, 1/2, 0/2, 8
В	4, 5, 19, 91	6, 7
С	0, 1/1, 3, 3/1	19, 91
D	1, 1/2, 0/2	4, 5
E	6, 7, 8, 2/2	2/2
U	-	4, 5
Z	-	0/1, 1/1, 3/1

8 SWITCHING TIMES (average values in msec)

Valve	Switch-on AC	Switch-on DC	Switch-off AC	Switch-off DC
DKE + 666 / 667	40	60	25	35
DKE + 669	60		90	_
DKE-*/L*		75÷150		45÷150
DKE-*/L7 - DKE-*/L8		100÷150		100÷150

Test conditions:

- 50 l/min; 150 bar
- nominal supply voltage
- 2 bar of back pressure on port T
- mineral oil ISO VG 46 at 50°C

The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

9 SWITCHING FREQUENCY

Valve	AC (cycles/h)	DC (cycles/h)
DKE + 666 / 667	7200	15000

10 DEVICES FOR SWITCHING TIME CONTROL

These devices are only available for DC valve version (5 chambers body) and can control the switching time and therefore reduce the coil hammering in the hydraulic circuit. The different types are available shown in the figure.

- L: controls and regulates the switching time in both moving directions of the spool: regulation is carried out by screwing/unscrewing the element itself (regulating choke);
- L1/L2/L3: controls the switching time in both moving directions of the spool by means of fixed calibrated restrictor (gauged flow). The restrictor is positioned in the valve's body ØL1 = 1,25 mm; ØL2 = 1 mm; ØL3 = 0,75 mm;
- LR: controls and regulates the switching time in the B
 A direction of the spool movement.
 The device does not control the switching time (standard time) in the opposite direction
 A
 A b of the spool movement.
- L7/L8: controls the switching time in both moving directions of the spool by means of fixed calibrated restrictor (gauged flow). The restrictor is installed in the solenoid's anchor.
 For a correct operation of the switching time control, the passage in which the control device

For a correct operation of the switching time control, the passage in which the control devic is installed must be completely filled with oil.



11 COILS TYPE CAE WITH SPECIAL CONNECTORS (only for 12DC, 14DC, 24DC and 28DC)



13 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K800)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)

14 MOUNTING SUBPLATES

Model	Ports location	GAS Ports A-B-P-T (X-Y)	Ø Counterbore [mm] A-B-P-T (X-Y)	Mass [kg]
BA-308 (/Y)	Ports A, B, P, T (X, Y) underneath	1/2" (1/4")	30 (21,5)	2,5
BA-428 (/Y)	Ports A, B, P, T (X, Y) underneath	3/4" (1/4")	36,5 (21,5)	5,5
BA-434 (/Y)	Ports P, T, (X, Y) underneath; ports A, B on lateral side	3/4" (1/4")	36,5 (21,5)	8,5

The subplates are supplied with 4 fastening bolts M6x40. Also available are multi-station subplates and modular subplates. For further details see table K280.

atos 🛆

Solenoid directional valves Pmax 420 bar

direct operated, ISO 4401 size 10



3 GENERAL CHARACTERISTICS

Assembly position	Any position			
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra 0,8 recommended Ra 0,4 - flatness ratio 0,01/100			
MTTFd valves according to EN ISO 13849	150 years, see technical table P007			
Ambient temperature range	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +60^{\circ}C$			
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +80^{\circ}C$			
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)			
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h			
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006			

4 HYDRAULIC CHARACTERISTICS

Operating pressure	Ports P,A,B: 420 bar; Port T 210 bar for DC version; (350 bar for option /Y); 160 bar for AC version
Max flow	150 l/min , see Q/ Δp diagram at section 9 and operating limits at section 10

5 ELECTRICAL CHARACTERISTICS

Insulation class	H (180°C) for DC coils; F (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 or E-SD correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See section 6
Supply voltage tolerance	± 10%

6 COIL VOLTAGE

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil		
12 DC	12 DC			CAE-12DC		
14 DC	14 DC			CAE-14DC		
24 DC	24 DC	- 666 or 667				CAE-24DC
28 DC	28 DC		36 W	CAE-28DC		
110 DC	110 DC		666		CAE-110DC	
125 DC	125 DC			CAE-125DC		
220 DC	220 DC			CAE-220DC		
110/50/60 AC	110/50/60 AC			100 VA	CAE-110/50/60AC (1)	
230/50/60 AC	230/50/60 AC		(3)	CAE-230/50/60AC (1)		
115/50 AC	115/60 AC		130 VA	CAE-115/60AC		
230/50 AC	230/60 AC	1	(3)	CAE-230/60AC		
110/50/60 AC	110 DC	660	26.14	CAE-110DC		
230/50/60 AC	220 DC	009	30 W	CAE-220DC		

Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 90 VA.
 Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.
 When solenoid is energized, the inrush current is approx 3 times the holding current.

7 NOTES FOR DKEP

1 Options

Υ

= Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A. Α WP = prolonged manual override protected by rubber cap.

L7, L8 see section B = device for switching time control (only for DC solenoids), available only for spool type 0/1, 1/1, 3/1, 4 and 5. = external drain, only for DC version, to be selected if the pressure at T port is higher than the max allowed limits.

riangleq The manual override operation can be possible only if the pressure at T port is lower than 50 bar

WPD/KE-DC = manual override with detent, to be ordered separately, see tab. K150

2 Special spools

- spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank.
- spools type 1 is also available as 1/1, properly shaped to reduce the water-hammer shocks during the switching.
- spool type 1/9 has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.
- other types of spools can be supplied on request.

DEVICES FOR SWITCHING TIME CONTROL 8

These devices are only available for DC valve version (5 chambers body) and can control the switching time and therefore reduce the coil hammering in the hydraulic circuit.

- L7/L8: controls the switching time in both moving directions of the spool by means of fixed calibrated restrictor (gauged flow). The restrictor is installed in the solenoid's anchor.

For a correct operation of the switching time control, the passage in which the control device is installed must be completely filled with oil.



Q/ P DIAGRAMS based on mineral oil ISO VG 46 at 50°C 9

Flow direction						
Spool type	P→A	Р→В	A→I	B→I	P→I	В→А
0, 0/1, 0/2, 2/2	А	А	В	В		
1, 1/1, 1/3, 6, 8	А	A	D	С		
3, 3/1, 7	А	A	С	D		
4	В	В	В	В	F	
5	А	В	С	С	G	
1/2	В	С	С	В		
2/7	D			F		
5/7	В			А	E	
19	А	D	С			Н



10 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (Vnom - 10%). The curves refer to application with symmetrical flow through the valve (i.e. P-A and B-T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.





Curve	Spoo AC	l type DC
М	0/1, 5/7, 1/3	0, 0/1, 1, 1/1, 3, 3/1, 1/2, 0/2, 8
S	2/7, 4, 5, 19	1/3, 5/7, 6, 7
Y	1, 1/2, 0/2	4, 5, 2/7
V	6, 7, 8, 2/2	2/2
т	0, 1/1, 3, 3/1	19
U	-	4, 5
Z	-	0/1, 1/1, 3/1

11 SWITCHING TIMES (average values in msec)

Valve	Switch-on	Switch-on	Switch-off	Switch-off
	AC	DC	AC	DC
DKEP + 666 / 667	40	60	25	35

Test conditions:

- 50 l/min; 150 bar
- nominal supply voltage
- 2 bar of back pressure on port T - mineral oil ISO VG 46 at 50°C

The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

12 SWITCHING FREQUENCY

Valve	AC (cycles/h)	DC (cycles/h)	
DKEP + 666 / 667	7200	15000	

13 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K800)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)

14 COIL WITH SPECIAL CONNECTORS only for voltage supply 12, 14, 24, 28 VDC



Note: for the electric characteristics refer to standard coils features - see section 6

15 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$				
Recommended visco	sity	20÷100 mm²/s - max allowed ra	nge 15 ÷ 380 mm²/s			
Max fluid normal operation contamination level longer life		ISO4406 class 18/16/13 NAS16	see also filter section at			
		ISO4406 class 16/14/11 NAS16	www.atos.com or KTF catalog			
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard		
Mineral oils		NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water		FKM HFDU, HFDR		100 10000		
Flame resistant with water		NBR, NBR low temp. HFC		130 12922		

16 FASTENING BOLTS AND SEALS

Fastening bolts	Seals
4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; (1 OR 108 for Y optional port); Diameter of ports A, B, P, T: Ø 11.5mm (max); Y: Ø 5mm (optional port)

17 INSTALLATION DIMENSIONS [mm]



E035

18 MANUAL OVERRIDE



19 RELATED DOCUMENTATION

E001	Basics for solenoid directional valves
K150	Handweels for hydraulic controls
K280	Single and modular subplates
K800	Electric and electronic connectors

P005 E900 Mounting surfaces for electrohydraulic valves Operating and maintenance information

Solenoid directional valves type DPHL

piloted, spool type





2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
CE to Low Voltage Directive 2014/35/EU Compliance RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006	

4 HYDRAULIC CHARACTERISTICS

Flow direction	As shown in the symbols of table 2
Operating pressure	Ports P,A,B: 350 bar; Port T 210 bar for DC version; 160 bar for AC version
Rated flow	See Q/ Δp diagram at section \square and operating limits at section \square
Max flow	DPHL-1: 160 I/min; DPHL-2: 300 I/min; DPHL-4: 700 I/min; DPHL-6: 1000 I/min (see rated flow at section I and operating limits at section I)

5 ELECTRICAL CHARACTERISTICS

Insulation class	H (180°C) for DC coils; F (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account			
Protection degree to DIN EN 60529	IP 65 with connectors correctly assembled			
Relative duty factor	100%			
Supply voltage and frequency	See section 6			
Supply voltage tolerance	± 10%			

6 COIL VOLTAGE

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil -X
12 DC	12 DC			COL-12DC
14 DC	14 DC			COL-14DC
24 DC	24 DC		20\\/	COL-24DC
28 DC	28 DC		2900	COL-28DC
110 DC	110 DC 666			COL-110DC
220 DC	220 DC	667		COL-220DC
110/50 AC (1)	110/50/60 AC			COL-110/50/60AC
115/60 AC	115/60 AC		58VA	COL-115/60AC
230/50 AC (1)	230/50/60 AC		(3)	COL-230/50/60AC
230/60 AC	230/60 AC			COL-230/60AC
110/50 AC - 120/60 AC	110 DC	660	20///	COL-110DC
230/50 AC - 230/60 AC	220 DC	009	2300	COL-220DC

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

7 OPTIONS

- /A = Solenoid mounted at side of port A of main body (only for single solenoid valves).
- In standard version, solenoid is mounted at side of port B.
- **/D** = Internal drain (standard configuration is external drain)
- **/E** = External pilot pressure (standard configuration is internal pilot pressure).
- /R = Pilot pressure generator 4 bar on port P not for DPHL-1 see section 8
- **/S** = Main spool stroke adjustment not for DPHL-1.

/WP = Prolonged manual override protected by rubber cap.

The manual override operation can be possible only if the pressure at T port is lower than 50 bar



FUNCTIONAL SCHEME (config. 71)

Devices for main spool switching control and to reduce the hydraulic shocks at the valve operation

/H = Adjustable chokes (meter-out to the pilot chambers of the main valve).

/H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve).

/L1, /L2, /L3 = calibrated restrictors on A and B ports of the pilot valve: L1 =0,8mm, L2 =1mm, L3 =1,25mm) - not for DPHL-1.

/L9 = plug with calibrated restictor in P port of pilot valve - see section 12 - only for DPHL-2 and DPHL-4.

Suggested for pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

7.1 Shaped spools

- spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank.

- spools type 1, 4, 5, 58, 6 and 7 are also available as 1/1, 4/8, 5/1, 58/1, 6/1 and 7/1 that are properly shaped to reduce water-hammer shocks during the switching (to use with option /L*).

Shaped spool availability

Shaped spool type	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
Hydraulic symbol								A B T T P T
DPHL-1	•	•		٠				
DPHL-2, DPHL-4	•	•	•	٠	٠	•	•	٠
DPHL-6		•	•	•				

8 PILOT PRESSURE GENERATOR (OPTION /R)

The device /R generates an additional pressure drop, in order to ensure the minimum pilot pressure, for correct operation of the valves with internal pilot and fitted with spools type 0, 0/1, 4, 4/8, 5, 58, 09, 90, 94, 49. The device /R has to be fitted when the pressure drop in the valve, verified on flow versus pressure diagrams, is lower than the minimum pilot pressure value.









R/DP	-	*
Pilot pressure generator		Size: 2 for DPHL-2 4 for DPHL-4 6 for DPHL-6



9 FLOW VERSUS PRESSURE DIAGRAMS Based on mineral oil ISO VG 46 at 50°C

DPHL-1

0		Flow direction						
Spool type	P→A	P→B	A→T	B→T	P→T			
0/2, 1/2	D	Е	D	С	-			
0	D	Е	С	С	E			
1	A	В	D	С	-			
3, 6, 7	A	В	С	С	-			
4, 4/8	В	С	D	D	-			
5 58	Α	F	С	С	F			

DPHL-2

Caselhune	Flow direction					
Spool type	P→A	P→B	A→T	B→T	P→T	
0/2, 1, 3, 6, 7, 8	Α	Α	С	D	-	
1/1, 1/2, 7/1	В	В	D	E	-	
0	Α	Α	D	E	С	
0/1	A	Α	D	-	-	
2	Α	Α	-	-	-	
2/2	В	В	-	-	-	
3/1	Α	Α	D	D	-	
4	С	С	Н	Ι	F	
4/8	С	С	G	Ι	F	
5	Α	В	F	Н	G	
5/1	А	В	D	F	-	
6/1	В	В	С	E	-	
09	А	-	-	G	-	
16	Α	С	D	F	-	
17	С	Α	E	F	-	
19	С	-	-	G	-	
39	С	-	-	Н	-	
49	-	D	-	-	-	
58	В	Α	F	Н	Н	
58/1	В	A	D	F	-	
90	Α	Α	E	-	D	
91	С	С	E	-	-	
93	-	С	D	-	-	
94						

DPHL-4

On a al home	Flow direction						
Spool type	P→A	P→B	A→T	B→T	P→T		
1	В	В	В	D	-		
1/1	D	E	E	F	-		
1/2	E	D	В	С	-		
0	D	С	D	E	F		
0/1, 3/1, 5/1, 6, 7	D	D	D	F	-		
0/2	D	D	D	E	-		
2	В	В	-	-	-		
2/2	Е	D	-	-	-		
3	В	В	D	F	-		
4	С	С	Н	L	L		
5	Α	D	D	D	Н		
6/1	D	E	D	F	-		
7/1	D	E	F	F	-		
8	D	D	E	F	-		
09	D	-	-	F	F		
16	С	D	E	F	-		
17	E	D	E	F	-		
19	F	-	-	E	-		
39	G	F	-	F	-		
58	E	Α	В	F	Н		
58/1	E	D	D	F	-		
90	D	D	D	-	F		
91	F	F	D				
93	-	G	D	-	-		

DPHL-6

Speel type		Flow direction						
Shooi ràhe	P→A	P→B	A→T	B→T	P→T			
0, 0/2	Α	Α	В	В	В			
1, 1/2	Α	Α	Α	В	-			
3, 6, 7	Α	Α	Α	В	-			
4, 5, 58	Α	Α	С	С	С			







 OPERATING LIMITS
 For a correct value operation do not exceed the max recommended flow rates (I/min) shown in the below tables

 DPHL-1
 DPHL-2

	Inlet pressure [bar]					
Spool	70	160	210	350		
	Flow rate [l/min]					
0, 1, 3, 6, 7	160	160	160	145		
4, 4/8	160	160	135	100		
5, 58	160	160	145	110		
0/1, 0/2, 1/2	160	160	145	135		

	Inlet pressure [bar]					
Spool	70	140	210	350		
-	Flow rate [l/min]					
0, 1, 3, 6, 7, 8	300	300	300	300		
2, 4, 4/8	300	300	240	140		
5	260	220	180	100		
0/1, 0/2, 1/2	300	250	210	180		
16, 17, 56, *9, 9*	300	300	270	200		

DPHL-4

	Inlet pressure [bar]						
Spool	70	140	210	350			
-	Flow rate [l/min]						
1, 6, 7, 8	700	700	700	600			
2, 4, 4/8	500	500	450	400			
5, 0/1, 0/2, 1/2	600	520	400	300			
0, 3	700	700	600	540			
16, 17, 58, *9, 9*	500	500	500	450			

DPHL-6

	Inlet pressure [bar]					
Spool	70	140	210	350		
	Flow rate [l/min]					
1, 3, 6, 7, 8	1000	950	850	700		
0	950	900	800	650		
2, 4, 4/8, 5	850	800	700	450		
0/1, 58, 19, 91	950	850	650	450		

11 SWITCHING TIMES (average values in m sec)

			Piloting pressure					
			70 bar		140	bar	250	bar
Valve model	Configuration		Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
	71 61 67 61*/0 67*/0	Switch ON	35	50	30	45	20	35
	71, 01, 07, 01 /A, 07 /A	Switch OFF			50)		
DFHL-1	63 63*//	Switch ON	50	75	40	65	30	50
	03, 03 /A	Switch OFF			80)		
	71 61 67 61*// 67*//	Switch ON	40	55	30	50	20	40
	71, 01, 07, 01 /A, 07 /A	Switch OFF	60					
DPHL-2	63 63*//	Switch ON	55	80	45	70	35	55
	03, 03 /A	Switch OFF	95					
	71 61 67 61*// 67*//	Switch ON	60	80	45	60	30	45
	71, 01, 07, 01 /A, 07 /A	Switch OFF			80)		
DPHL-4	63 63*//	Switch ON	95	115	75	95	50	65
	03, 03 /A	Switch OFF			13	0		
	71 61 67 61*// 67*//	Switch ON	70	95	55	70	40	55
	71,01,07,01 /A,07 /A	Switch OFF			15	0		
DPHL-0	63 63*//	Switch ON	115	145	95	110	70	90
	00, 03 /A	Switch OFF			28	0		

Notes:

1) For configuration 75, times of switching ON and switching OFF are the same: this value is equal to time of switch ON of configuration 63.

2) TEST CONDITIONS

- Nominal voltage supply DC (direct) and AC (alternating) with connector type SP-666. The use of other connectors can affect the switching time;

- 2 bar of counter pressure on port T;

- mineral oil: ISO VG 46 at 50°C

3) The response time is affected by elasticity of the hydraulic circuit, by variation of hydraulic characteristics and temperature.

12 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain



13 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K800)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)

E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized

14 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, reccomended fluid temperature	JBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C					
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s					
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog					
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard			
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without water	FKM	HFDU, HFDR				
Flame resistant with water	NBR	HFC	130 12922			

15 FASTENING BOLTS AND SEALS

	DPHL-1	DPHL-2	DPHL-4	DPHL-6
	Fastening bolts:	Fastening bolts:	Fastening bolts:	Fastening bolts:
	4 socket head screws M6x40 class 12.9 Tightening torgue = 15 Nm	4 socket head screws M10x50 class 12.9 Tightening torgue = 70 Nm	6 socket head screws M12x60 class 12.9 Tightening torgue = 125 Nm	6 socket head screws M20x80 class 12.9 Tightening torgue = 600 Nm
		2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm		
	Seals:	Seals:	Seals:	Seals:
\bigcirc	5 OR 2050 Diameter of ports A, B, P, T: Ø 11 mm (max)	4 OR 130 Diameter of ports A, B, P, T: Ø 20 mm (max)	4 OR 4112 Diameter of ports A, B, P, T: Ø 24 mm (max)	4 OR 144 Diameter of ports A, B, P, T: Ø 34 mm (max)
	2 OR 108 Diameter of ports X, Y: Ø 5 mm (max)	2 OR 2043 Diameter of ports X, Y: Ø 7 mm (max)	2 OR 3056 Diameter of ports X, Y: Ø 7 mm (max)	2 OR 3056 Diameter of ports X, Y: Ø 7 mm (max)



Overall dimensions refer to valves DC voltage, with connectors type 666





17 MOUNTING SUBPLATES

Valve Subplate		Ports location	Ports		Ø Coun [m	Mass	
	moder		A, B, P, T	Х, Ү	A, B, P, T	Х, Ү	[149]
DPHL-1	BA-428	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	5,6
DPHL-1	BA-434	Ports P, T, X, Y underneath; ports A, B on lateral side	G 3/4"	G 1/4"	36,5	21,5	5,5
DPHL-2	BA-418	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	3,5
DPHL-2	BA-518	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	8
DPHL-2	BA-519	Ports P, T, X, Y underneath; ports A, B on lateral side	G 1"	G 1/4"	46	21,5	8
DPHL-4	BA-508	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	7
DPHL-4	BA-509	Ports P, T, X, Y underneath; ports A, B on lateral	G 1"	G 1/4"	46	21,5	12,5
DPHL-6	BA-708	Ports A, B, P, T, X, Y underneath;	G 1 1/2"	G 1/4"	63,5	21,5	17



Solenoid directional valves type DPHE

piloted, spool type





2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)

3 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra £0,8 recommended Ra 0,4 - flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	75 years, for further details see technical table P007				
Ambient temperature range	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +80^{\circ}C$				
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

4 HYDRAULIC CHARACTERISTICS

Flow direction	As shown in the symbols of table 2
Operating pressure	Ports P,A,B: 350 bar; Port T 210 bar for DC version; 160 bar for AC version
Rated flow	See Q/Dp diagram at section 9 and operating limits at section 10
Max flow	DPHE-1: 160 I/min; DPHE-2: 300 I/min; DPHE-4: 700 I/min; DPHE-6: 1000 I/min see rated flow at section (i) and operating limits at section (ii)

5 ELECTRICAL CHARACTERISTICS

Insulation class	H (180°C) for DC coils; F (155°C) for AC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 with connectors correctly assembled
Relative duty factor	100%
Supply voltage and frequency	See section 6
Supply voltage tolerance	± 10%

6 COIL VOLTAGE

Valve code	External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil DHE
	12 DC	12 DC			COE-12DC
	14 DC	14 DC			COE-14DC
	24 DC	24 DC			COE-24DC
	28 DC	28 DC		30 W - 666 - or - 667 -	COE-28DC
	48 DC 110 DC 125 DC	48 DC	- 666 - or 667		COE-48DC
		110 DC			COE-110DC
		125 DC			COE-125DC
	220 DC	220 DC			COE-220DC
	24/50 AC	24/50/60 AC			COE-24/50/60AC (1)
	48/50 AC	48/50/60 AC		58 VA (3)	COE-48/50/60AC (1)
	110/50 AC	110/50/60 AC			COE-110/50/60AC (1)
	230/50 AC	230/50/60 AC			COE-230/50/60AC (1)
	115/50 AC	115/60 AC		80 VA	COE-115/60AC
	230/50 AC	230/60 AC		(3)	COE-230/60AC
	110/50 AC - 120/60 AC	110 RC	660	30 W/	COE-110RC
	230/50 AC - 230/60 AC	230 RC	009	50 W	COE-230RC

Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷15% and the power consumption is 52 VA.
 Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.
 When solenoid is energized, the inrush current is approx 3 times the holding current.

7 OPTIONS

7.1 Options

- /A = Solenoid mounted at side of port A of main body (only for single solenoid valves).
- In standard version, solenoid is mounted at side of port B.
- **/D** = Internal drain (standard configuration is external drain)
- **/E** = External pilot pressure (standard configuration is internal pilot pressure).
- **/FV** = With proximity switch for spool position monitoring: see tab. EY030.
- $/\mathbf{R}$ = Pilot pressure generator (4 bar on port P not for DPHE-1, see section 8.
- **/S** = Main spool stroke adjustment (not for DPHE-1).
- **/WP** = Prolonged manual override protected by rubber cap.

ightarrow The manual override operation can be possible only if the pressure at T port is lower than 50 bar

Devices for main spool switching control and to reduce the hydraulic shocks at the valve operation

- **/H** = Adjustable chokes (meter-out to the pilot chambers of the main valve).
- /H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve).
- /L1, /L2, /L3 = calibrated restrictors on A and B ports of the pilot valve: L1 =0,8mm, L2 =1mm, L3 =1,25mm)
- /L9 = (only for DPHE-2 and DPHE-4) plug with calibrated restictor in P port of pilot valve see section 12

Suggested for pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

7.2 Special shaped spools

- spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank.
- spools type 1, 4, 5, 58, 6 and 7 are also available as 1/1, 4/8, 5/1, 58/1, 6/1 and 7/1 that are properly shaped to reduce water-hammer shocks during the switching (to use with option /L*).

Shaped spool availability

Shaped spool type	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
Hydraulic symbol								A B T T P T
DPHE-1	•	•		•				
DPHE-2, DPHE-4	•	•	•	•	٠	•	•	•
DPHE-6		•	•	•				

8 PILOT PRESSURE GENERATOR (OPTION /R)

The device /R generates an additional pressure drop, in order to ensure the minimum pilot pressure, for correct operation of the valves with internal pilot and fitted with spools type 0, 0/1, 4, 4/8, 5, 58, 09, 90, 94, 49. The device /R has to be fitted when the pressure drop in the valve, verified on flow versus pressure diagrams, is lower than the minimum pilot pressure value.







Ordering code of spare pilot pressure generator

Ρ

р

g

R/DP	-	*
ilot ressure enerator		Size: 2 for DPHE-2 4 for DPHE-4 6 for DPHE-6



example of switching control options

FUNCTIONAL SCHEME (config. 71)



9 FLOW VERSUS PRESSURE DIAGRAMS Based on mineral oil ISO VG 46 at 50°C

DPHE-1

Flow direction Spool type	P→A	P→B	A→T	B→T	P→T
0/2, 1/2	D	E	D	С	-
0	D	E	С	С	E
1	Α	В	D	С	-
3, 6, 7	Α	В	С	С	-
4, 4/8	В	С	D	D	-
5, 58	A	E	С	С	F

DPHE-2

Flow direction Spool type	P→A	P→B	A→T	B→T	P→T
0/2, 1, 3, 6, 7, 8	А	Α	С	D	-
1/1, 1/2, 7/1	В	В	D	E	-
0	Α	Α	D	E	С
0/1	Α	Α	D	-	-
2	А	Α	-	-	-
2/2	В	В	-	-	-
3/1	А	Α	D	D	-
4	С	С	Н		F
4/8	С	С	G		F
5	Α	В	F	Н	G
5/1	Α	В	D	F	-
6/1	В	В	С	E	-
09	А	-	-	G	-
16	Α	С	D	F	-
17	С	Α	E	F	-
19	С	-	-	G	-
39	С	-	-	Н	-
49	-	D	-	-	-
58	В	Α	F	Н	Н
58/1	В	Α	D	F	-
90	А	Α	E	-	D
91	С	С	E	-	-
93	-	С	D	-	-
94	D	-	-	-	-

DPHE-4

Flow direction Spool type	P→A	Р→В	A→T	B→T	P→T
1	В	В	В	D	-
1/1	D	E	E	F	-
1/2	E	D	В	С	-
0	D	С	D	E	F
0/1, 3/1, 5/1, 6, 7	D	D	D	F	-
0/2	D	D	D	E	-
2	В	В	-	-	-
2/2	E	D	-	-	-
3	В	В	D	F	-
4	С	С	Н	L	L
5	A	D	D	D	Н
6/1	D	E	D	F	-
7/1	D	E	F	F	-
8	D	D	E	F	-
09	D	-	-	F	F
16	С	D	E	F	-
17	E	D	E	F	-
19	F	-	-	E	-
39	G	F	-	F	-
58	E	Α	В	F	Н
58/1	E	D	D	F	-
90	D	D	D	-	F
91	F	F	D		
93	-	G	D	-	-

DPHE-6

Flow direction Spool type	P→A	P→B	A→T	B→T	P→T
0	A	Α	В	В	В
1	A	Α	A	В	-
3	A	-	A	В	-
4	A	Α	С	С	С



10 OPERATING LIMITS For a correct valve operation do not exceed the max recommended flow rates (I/min) shown in the below tables

DPHE-1

	Inlet pressure [bar]						
Spool	70	160	210	350			
-	Flow rate [l/min]						
0, 1, 3, 6, 7	160	160	160	145			
4, 4/8	160	160	135	100			
5, 58	160	160	145	110			
0/1, 0/2, 1/2	160	160	145	135			

DPHE-4

	Inlet pressure [bar]						
Spool	70	70 140 210		350			
	Flow rate [l/min]						
1, 6, 7, 8	700	700	700	600			
2, 4, 4/8	500	500	450	400			
5, 0/1, 0/2, 1/2	600	520	400	300			
0, 3	700	700	600	540			
16, 17, 58, *9, 9*	500	500	500	450			

DPHE-2

	Inlet pressure [bar]				
Spool	70	140	210	350	
	Flow rate [l/min]				
0, 1, 3, 6, 7, 8	300	300	300	300	
2, 4, 4/8	300	300	240	140	
5	260	220	180	100	
0/1, 0/2, 1/2	300	250	210	180	
16, 17, 56, *9, 9*	300	300	270	200	

DPHE-6

Inlet pressure [bar]				.r]	
Spool	70	140	210	350	
	Flow rate [l/min]				
1, 3, 6, 7, 8	1000	950	850	700	
0	950	900	800	650	
2, 4, 4/8, 5	850	800	700	450	
0/1, 58, 19, 91	950	850	650	450	

11 SWITCHING TIMES (average values in m sec)

		Piloting pressure						
		70 bar		140 bar		250 bar		
Valve model	Configuration		Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
	71 61 67 61*/4 67*/4	Switch ON	35	50	30	45	20	35
		Switch OFF	50					
DFRE-1	63 63*//	Switch ON	50	75	40	65	30	50
	00,007A	Switch OFF		80				
	71 61 67 61*// 67*//	Switch ON	40	55	30	50	20	40
			60					
DFRE-2	DPRE-2	Switch ON	55	80	45	70	35	55
	03, 03 /A	Switch OFF	95					
	71 61 67 61*// 67*//	Switch ON	60	80	45	60	30	45
		Switch OFF	80					
DFRE-4	63 63*/4	Switch ON	95	115	75	95	50	65
	00,007A	Switch OFF	130					
	71 61 67 61*// 67*//	Switch ON	70	95	55	70	40	55
		Switch OFF	150					
DFHE-0	63 63*/4	Switch ON	115	145	95	110	70	90
	Switch OFF	280						

Notes:

1) For configuration 75, times of switching ON and switching OFF are the same: this value is equal to time of switch ON of configuration 63.

2) TEST CONDITIONS

- Nominal voltage supply DC (direct) and AC (alternating) with connector type SP-666. The use of other connectors can affect the switching time;

- 2 bar of counter pressure on port T;

- mineral oil: ISO VG 46 at 50°C

3) The response time is affected by elasticity of the hydraulic circuit, by variation of hydraulic characteristics and temperature.

12 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain



13 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K800)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)

E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized

SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C				
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s				
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog				
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard		
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water	FKM	HFDU, HFDR	10022		
Flame resistant with water	NBR, HNBR	HFC	130 12922		

15 FASTENING BOLTS AND SEALS

	DPHE-1	DPHE-2	DPHE-4	DPHE-6
	Fastening bolts:	Fastening bolts:	Fastening bolts:	Fastening bolts:
	4 socket head screws M6x40 class 12.9 Tightening torgue = 15 Nm	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	6 socket head screws M20x80 class 12.9 Tightening torgue = 600 Nm
		2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm		
	Seals:	Seals:	Seals:	Seals:
\cap	5 OR 2050 Diameter of ports A, B, P, T: Ø 11 mm (max)	4 OR 130 Diameter of ports A, B, P, T: Ø 20 mm (max)	4 OR 4112 Diameter of ports A, B, P, T: Ø 24 mm (max)	4 OR 144 Diameter of ports A, B, P, T: Ø 34 mm (max)
	2 OR 108 Diameter of ports X, Y: Ø 5 mm (max)	2 OR 2043 Diameter of ports X, Y: Ø 7 mm (max)	2 OR 3056 Diameter of ports X, Y: Ø 7 mm (max)	2 OR 3056 Diameter of ports X, Y: Ø 7 mm (max)





E085



17 MOUNTING SUBPLATES

Valve	Subplate	Ports location	Ports		Ø Counterbore [mm]		Mass
	moder		A, B, P, T	Х, Ү	A, B, P, T	Х, Ү	[1,8]
DPHE-1	BA-428	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	5,6
DPHE-1	BA-434	Ports P, T, X, Y underneath; ports A, B on lateral side	G 3/4"	G 1/4"	36,5	21,5	5,5
DPHE-2	BA-418	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	3,5
DPHE-2	BA-518	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	8
DPHE-2	BA-519	Ports P, T, X, Y underneath; ports A, B on lateral side	G 1"	G 1/4"	46	21,5	8
DPHE-4	BA-508	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	7
DPHE-4	BA-509	Ports P, T, X, Y underneath; ports A, B on lateral	G 1"	G 1/4"	46	21,5	12,5
DPHE-6	BA-708	Ports A, B, P, T, X, Y underneath;	G 1 1/2"	G 1/4"	63,5	21,5	17

atos 🛆

Solenoid directional valves type DLEH and DLEHM

direct, poppet type, leak free



2 VALVE CONFIGURATION

DLEH-2A CART LEH-2A	DLEH-2A/R	DLEH-2C CART LEH-2C	DLEH-2C/R	DLEHM-3A CART LEHM-3A
CART LEH-3A	DLEH-3A/R	DLEH-3C CART LEH-3C	DLEH-3C/R	DLEHM-3C CART LEHM-3C
3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position					
Subplate surface finishing	Roughness index Ra 0,4 - flatness	s ratio 0,01/100 (ISO 1101)				
MTTFd values according to EN ISO 13849	150 years, for further details see t	150 years, for further details see technical table P007				
Compliance	CE to Low Voltage Directive 2014 RoHS Directive 2011/65/EU as las REACH Regulation (EC) n°1907/2	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				
Ambient temperature	Standard execution = $-30^{\circ}C \div +7$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$	0°C				
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ + FKM seals (/PE option) = -20°C ÷ HNBR seals (/BT option) = -40°C	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C				
Recommended viscosity	15÷100 mm²/s - max allowed rang	ge 2.8 ÷ 500 mm²/s				
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638	3 class 9, see also filter section at w	ww.atos.com or KTF catalog			
Hydraulic fluid	Suitable seals type	Suitable seals type Classification Ref. Standard				
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without water	FKM	HFDU, HFDR	100 10000			
Flame resistant with water	NBR, HNBR	HFC	150 12922			
Flow direction	As shown in the symbols of table	2				
Operating pressure	DLEH, LEH: Ports P, A, B 350 bar Port T 210 bar;	; DLEHM, LEHM: Ports P, A 315 ba	r;			
Rated flow	See diagrams Q/Δp at section 7					
Max flow	DLEH, LEH: 12 I/min, DLEHM, LE	EHM: 30 I/min , see operating limits a	t section 8			
Internal leakage	Less than 5 drops/min (≤ 0,36 cm	³ /min) at max working pressure				
3.1 Coils characteristics	1					
Insulation class	H (180°C) for DC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account					
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 6	669 correctly assembled)				
Relative duty factor	100%					
Supply voltage and frequency	See electric feature 5					
Supply voltage tolerance	± 10%					
Certification	cURus North American Standard					

4 NOTES

Options

WP = prolonged manual override protected by rubber cap

The manual override operation can be possible only if the pressure at T port is lower than 50 bar

 \mathbf{R} = (only for DLEH) with check valve on P port, see section 2.

S = (only for DLEH and CART LEH) poppet with positive overlapping in the intermediate position to reduce the internal leakage at the valve switching and without manual override pin for safety applications (blind locking ring)

5 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)

6 ELECTRIC FEATURES

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption	Code of spare coil
12 DC	12 DC			COE-12DC
14 DC	14 DC		30 W	COE-14DC
24 DC	24 DC			COE-24DC
28 DC	28 DC	666 Or		COE-28DC
48 DC	48 DC	667		COE-48DC
110 DC	110 DC			COE-110DC
125 DC	125 DC			COE-125DC
220 DC	220 DC			COE-220DC
110/50 AC - 120/60 AC	110 RC	000	-	COE-110RC
230/50 AC - 230/60 AC	230 RC	7 009		COE-230RC

7

∆p/Q DIAGRAM based on mineral oil ISO VG 46 at 50°C



(1) For two-way valves, pressure drop refers to PØT





8 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagram has been obtained with warm solenoids and power supply at lowest value (Vnom - 10%).

- A = DLEH-3A, DLEH-2C
- $\mathbf{B} = \mathsf{DLEH-2A}, \mathsf{DLEH-3C}$
- C = DLEHM-3A
- D = DLEHM-3C





9 SWITCHING TIMES (average values in msec)

Valve type	Connector	Switch-on AC	Switch-on DC	Switch-off	
DLEH(M)-* DC	666, 667	_	45	25	
DLEH(M)-* RC	669	30	-	75	

TEST CONDITIONS:

- 8 l/min; 150 bar

- nominal voltage
- 2 bar of counter pressure on port T
- based on mineral oil ISO VG 46 at 50°C

The response time is affected by elasticity of the hydraulic circuit, by variation of hydraulic characteristics and temperature

10 DIMENSIONS OF CARTRIDGE VERSIONS [mm] - for cavity dimensions see table P006





12 MOUNTING SUBPLATES - see table K280

Valve	Subplate model	Ports location	GAS ports A-B-P-T	Ø Counterbore [mm] A-B-P-T	Mass [Kg]
	BA-202	Ports A, B, P, T underneath;	3/8"	-	1,2
DLER- DI FHM-*	BA-204	Ports P, T underneath; ports A, B on lateral side	3/8"	25,5	1,8
DEETIW	BA-302	Ports A, B, P, T underneath;	1/2"	30	1,8

06/24

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Solenoid cartridge valves

screw-in, 2-way, poppet type, leak free





3 GENERAL CHARACTERISTICS

Installation position	Any position
Cavity	JO-DL-4 = SAE-08-2N; JO-DL-6 = SAE-10-2N; JO-DL-10 = SAE-16-2N
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	Standard execution = -20°C ÷ +50°C /PE option = -20°C ÷ +50°C /BT option = -40°C ÷ +50°C
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Model			JO-DL-4-2/NC	JO-DL-4-2/NO	JO-DL-6-2/NC	JO-DL-6-2/NO	JO-DL-10-2/NC	JO-DL-10-2/NO
Operating pressure [bar]				Ports A and B 350				
Max flow		[l/min]	40 75 300			00		
Response time:	energizing	[ms]	35	50	30	50	35	150
	de-energizing	[ms]	50	35	60	35	70	35
Internal leakage			less than 5 drops/min (≤ 0,36 cm³/min) max at 350 bar					

5 ELECTRIC CHARACTERISTICS

Relative duty factor	100%	
Supply voltage	See model code at section 1	
Supply voltage tolerance	±10%	
Max power	20 Watt	
Power connector	666 (plastic - black); 3 pins, cable clamp PG11, cable max ø 11 mm	to be ordered
Connectors features	DIN 43650 - ISO 4400; IP65 (DIN 40050); VDE 0110C	separately

6 INSTALLATION NOTES

1) The assembling of cartridges inside manifolds must be done tightening the valve exagonal ring (for tightening torque, see section 1). Excessive values can cause anomalous deformation and poppet sticking.

2) The CE certification is valid only with shielded electric cables and connector. Consult also tab. P004.

7 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult Atos Technical Office

Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option)= $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$					
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s					
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog					
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard			
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without water	FKM HFDU, HFDR		120 12022			
Flame resistant with water	NBR	HFC	130 12922			















9 INSTALLATION DIMENSIONS [mm]



10 CAVITY DIMENSIONS



E105

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Hand & mechanical directional valves

ISO 4401 sizes 06, 10, 16 and 25



	CI7E	VALVE CONFIGURATION								
VALVEITPE	SIZE	0	1	2	3	4	5	6	7	8
DH-00		•	•	•	•	•	•	•	•	•
DH-01	06	•	•	•	•	•	•	•	•	•
DH-02	_				•				•	•
DK-10		•	•	•	•	•	•	•	•	•
DK-11	10	•	•	•	•	٠	٠	•	•	•
DK-12					•				•	•
DP-20	10		•		•	٠	٠			
DP-21	16		•		•	•	•			
DP-40	05		•		•	•	•			
DP-41	25		•		•	•	•			

2 RANGE OF VALVE'S MODELS

DH-00*, DH-01* and DK-10*, DK-11* - mechanical and hand lever actuator



NOTE: configurations 2 and 3 are available only with spools type 0/2, 1/2, 2/2 (1) spools type 2 and 2/2 available only for DH

DP-20*, DP-21*, DP-40*, DP-41* - hand lever actuator



DH-02*, DK-12* - cam actuator



NOTE: spools type 0/2, 1/2, 2/2 are only used for valves type DH-023*/2 and DK 123*/2;

4 GENERAL CHARACTERISTICS

Assembly position	Any position except for configuration 0 (without spring) that must be installed with horizontal axis				
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	150 years, see technical table P007				
Ambient temperature range	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +80^{\circ}C$				
Flow direction	As shown in the symbols of tables 3				
Surface protection	Zinc coating with black passivation				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200h				
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				
Operating pressure DI	P, A, B = 350 bar T = 250 bar (160 bar for DH-02)				
DI	<pre>P, A, B = 315 bar T = 250 bar</pre>				
DI	 P, A, B, X = 350 bar T = 250 bar for external drain (standard); Ports Y = 0 bar 				
Maximum flow DH-00, DH-0 DH-0	1 80 l/min 2 50 l/min				
DK-10, DK-1 DK-1	1 150 l/min 2 140 l/min				
DP- DP-	2 300 l/min 4 700 l/min				
D Activation force	H DH-00*: 70 N; DH-004*: 40 N; DH-01*: 36 N; DH-014*: 21 N; DH-01*/C: 43 N; DH-014*/C: 25 N; DH-02*: 81 N;				
without pressure on port T D	DK-10* : 86 N; DK-104 : 41 N; DK-11* : 44 N; DK-114* : 21 N; DK-12* : 120 N				
(nominal values ± 10%)	DP-201*: 168 N; DP-203*: 73 N; DP-211*: 38 N; DP-213*: 16 N; DP-401*: 365 N; DP-403*: 132 N; DP-411*: 76 N; DP-413*: 28 N;				

5 SEALS AND HYDRAULIC FLUIDS - For other fluids not included in above table, consult our technical office

Seals, recommended fluid temperature	NBR seals = (standard) -30°C \div +80°C, with HFC hydraulic fluids = -20°C \div +50°C FKM seals = (/PE option) -20°C \div +80°C					
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s					
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog					
Hydraulic fluid	Suitable seals type Classification Ref. Standard					
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without water	FKM	HFDU, HFDR	ISO 12022			
Flame resistant with water	NBR	HFC 150 1292.				

6 **Q/ΔP DIAGRAMS** based on mineral oil ISO VG 46 at 50°C

DH-02

Flow direction Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/2	С	С	С	С	
1, 1/2	A	А	Α	Α	
2, 2/2, 3	A	А	С	С	
4, 5	D	D	D	D	Α
6, 7	A	А	С	А	
8	С	С	В	В	

DH-00, DH-01

Flow direction Spool type	P→A	Р→В	A→T	B→T	P→T
0, 0/1	Α	Α	В	В	С
1, 1/1	В	В	С	С	
3, 3/1	С	С	В	В	
4, 5	E	E	F	F	D
1/2, 0/2, 6, 7	С	С	D	D	
8	А	A	D	D	
2	D	D			
2/2	E	E			

DK-*

Flow direction Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1, 0/2	Α	Α	В	В	
1, 1/1, 6, 8	Α	Α	D	С	
3, 3/1, 7	А	А	С	D	
4	В	В	В	В	E
5	А	В	С	С	F
1/2	В	С	С	В	

DP-2*

Flow direction Spool type	P→A	P→B	A→T	B→T	P→T
1, 3	A	А	В	С	
0	A	А	С	D	В
2	A	А			
4	В	В	F	G	Е

DP-4*

P→A	P→B	A→T	B→T	₽→⊺
A	А	Α	С	
С	В	С	D	Е
A	А			
A	Α	С	E	
В	В	F	G	G
	P→A A C A A B	P→A P→B A A C B A A A A A B B	$\begin{array}{c c} \mathbf{P} \rightarrow \mathbf{A} & \mathbf{P} \rightarrow \mathbf{B} & \mathbf{A} \rightarrow \mathbf{T} \\ \hline A & A & A \\ \hline C & B & C \\ \hline A & A & \\ \hline A & A & C \\ \hline B & B & F \end{array}$	$\begin{array}{c c} \mathbf{P} \rightarrow \mathbf{A} & \mathbf{P} \rightarrow \mathbf{B} & \mathbf{A} \rightarrow \mathbf{T} & \mathbf{B} \rightarrow \mathbf{T} \\ \hline A & A & A & C \\ \hline C & B & C & D \\ \hline A & A & C & E \\ \hline A & A & C & E \\ \hline B & B & F & G \end{array}$



7 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 06 [mm]



8 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 10 [mm]



ON-OFF VALVES 732

9 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 16 [mm]



10 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 25 [mm]



ON-OFF VALVES 733

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Hydraulic operated directional valves

ISO 4401 size 06, 10, 16, 25 and 32



(1) DH series 75 is a phase-out component not recommended for new applications

2 HYDRAULIC CHARACTERISTICS

Valve model		DH-0 series 80	DH-0 series 75 (1)	DK-1	DP-1	DP-2	DP-4	DP-6	
Max recommended flow	[l/min]	80	50	160	160	300	700	1000	
Max pressure on port P, A, B	[bar]	350 350 315			350				
Max pressure on port T (also X, Y for DP)	[bar]		see note (2)			250			
Minimum pilot pressure	[bar]	5 4							
Max recommended pressure on piloting li	ne[bar]	210 70		70	250				

(1) DH series 75 is a phase-out component not recommended for new applications

(2) The max pressure on port T has to be not over 50% of pilot pressure

3 GENERAL CHARACTERISTICS

Assembly position	Any position except for valves type DH-050, DK-150, DP-*50 (without springs) that must be installed with their longitudinal axis horizontal					
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	150 years, see technical table P007					
Ambient temperature range	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +80^{\circ}C$					
Surface protection	Body: zinc coating with black passivation					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ NBR low temp (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$					
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s					
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog					
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard			
Mineral oils	NBR, FKM, NBR low temp	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without water	FKM	HFDU, HFDR	120 10020			
Flame resistant with water	NBR, NBR low temp	HFC	130 12922			

5 CONFIGURATIONS and SPOOLS valves type DH-*, DK-*



NOTES

- spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank.

- spools type 1, 4 and 5 are also available as 1/1, 4/8 (only for DH), and 5/1. They are properly shaped to reduce water-hammer shocks during the switching. - spools type 1, 1/2, 3, 8 are available as 1P, 1/2P, 3P, 8P (only for DH-0) to limit valve internal leakages.

6 CONFIGURATIONS and SPOOLS valves type DP-*



Special shaped spools

- spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank.

- spools type 1, 4 and 5 are also available as 1/1, 4/8 and 5/1 are properly shaped to reduce water-hammer shocks during the switching.

7 Q/Ap DIAGRAMS

DH-0 series 80	See table E015 relating the DHE valve from which DH-0* are derivated
DK-1	See table E025 relating the DKE valve from which DK-1* are derivated
DP-1	See table E085 relating the DPH*-1 valve from which DP-1* are derivated
DP-2	See table E085 relating the DPH*-2 valve from which DP-2* are derivated
DP-4	See table E085 relating the DPH*-4 valve from which DP-4* are derivated
DP-6	See table E085 relating the DPH*-6 valve from which DP-6* are derivated

8 INSTALLATION DIMENSIONS OF DH-0 [mm]

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005) Fastening bolts: 4 socket head screws M5x30 class 12.9 Tightening torque = 8 Nm Diameter of ports A, B, P, T: \emptyset = 7,5 mm (max) Seals: 4 OR 108

Mounting subplates: see tab. K280



ISO 4401: 2005

Mounting surface: 4401-05-05-0-05 (see table P005) (without X port)

Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm Diameter of ports A, B, P, T: \emptyset = 11,2 mm (max) Diameter of port Y: \emptyset = 5 mm Seals: 5 OR 2050, 1 OR 108

Mounting subplates: see tab. K280 (only version /Y)

Note: Line Y must be always present and no counter pressure are allowed on this line.

① Pilot pressure port G1/4"



10 INSTALLATION DIMENSIONS OF DP-* [mm]



DP-2

ISO 4401: 2005

Mounting surface: 4401-07-07-0-05

Fastening bolts: 4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm Diameter of ports A, B, P, T: $\emptyset = 20$ Diameter of ports X,Y: $\emptyset = 7 \text{ mm}$ Seals: 4 OR 130, 2 OR 2043

Mounting subplates: see tab. K280









Mass: 10 Kg

DP-4

ISO 4401: 2005 Mounting surface: 4401-08-08-0-05 Fastening bolts:

6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm Diameter of ports A, B, P, T : \emptyset = 24 Diameter of ports X,Y: $\emptyset = 7 \text{ mm}$ Seals: 4 OR 4112, 2 OR 3056

Mounting subplates: see tab. K280







Mass: 16,5 Kg

DP-6

ISO 4401: 2005 Mounting surface: 4401-10-09-0-05 Fastening bolts:

6 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm Diameter of ports A, B, P, T : \emptyset = 34 mm Diameter of ports X,Y: $\emptyset = 7 \text{ mm}$ Seals: 4 OR 144, 2 OR 3056

Mounting subplates: see tab. K280







Mass: 38 Kg

Pneumatic operated directional valves

ISO 4401 sizes 06, 10, 16, 25 and 32



2 HYDRAULIC CHARACTERISTICS

Valve model		DH-0	DK-1	DPH-2	DPH-4	DPH-6	
Max recommended flow	[l/min]	50	160	300	700	1000	
Max pressure on port P, A, B (also X for DP)	[bar]	350	315	350			
Max pressure on port T	[bar]	see n	see note (1) 250				
Max pressure on port L and Y	[bar]		– null pr			null pressure	
Recommended oil pressure on piloting line	[bar]		Min = 4 Max = 250 The device /R generates an additional pressure order to ensure the minimum pilot pressure, for operation of the valves with internal pilot and spools type 0 , 0/1 , 4 , 4/8 , 5 . The device /R ha ted when the pressure drop in the valve, verifilir versus pressure diagrams, is lower than the pilot pressure value.				
Recommended pneumatic pressure (2)	[bar]	Min = 5 Min = 2 Max = 12 Max = 12			Min = 5 Max = 12		

(1) The max pressure on port T has to be not over 200% of pilot pressure

(2) Filtered and lubricated air

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	ny position for all valves except for type -*90 (without springs) that must be installed with horizontal axis if operated by impulses.						
Subplate surface finishing	Roughness index Ra 0,4 - flatness	toughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)					
Compliance	RoHS Directive 2011/65/EU as I REACH Regulation (EC) n°1907	NOHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006					
Ambient temperature	Standard execution = -30°C ÷ +70°C; /PE option = -20°C ÷ +70°C;						
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$						
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s						
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog						
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard				
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524				
Flame resistant without water	FKM	HFDU, HFDR					
Flame resistant with water	NBR	HFC	ISO 12922				

4 CONFIGURATIONS and SPOOLS of valves type DH-*, DK-*



NOTES

- spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank.

- spools type 1, 4 and 5 are also available as 1/1, 4/8 (only for DH-0) and 5/1. They are properly shaped to reduce water-hammer shocks during the swiching. - spools type 1, 1/2, 3, 8 are available as 1P, 1/2P, 3P, 8P (only for DH-0) to limit valve internal leakages.

5 CONFIGURATIONS and SPOOLS of valves type DPH-*



Special shaped spools

- spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank.

- spools type 1, 4, and 5 are also available as 1/1, 4/8 and 5/1 are properly shaped to reduce water-hammer shocks during the switching.

6 Q/Ap DIAGRAMS

DH-0	See note and diagrams on table E010 relating the DH* valve from which DH-0* are derivated
DK-1	See note and diagrams on table E025 relating the DKE valve from which DK-1* are derivated
DPH-2	See note and diagrams on table E085 relating the DPH*-2 valve from which DP-2* are derivated
DPH-4	See note and diagrams on table E085 relating the DPH*-4 valve from which DP-4* are derivated
DPH-6	See note and diagrams on table E085 relating the DPH*-6 valve from which DP-6* are derivated







49

40

67

86

Mass: 11,5 Kg

DPH-6

ISO 4401: 2005 Mounting surface: 4401-10-09-0-05

Fastening bolts:

Stroke adjustment

device for option /S

132 max

6 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm Diameter of ports A, B, P, T: Ø = 34 mm Diameter of ports X,Y: $\emptyset = 7 \text{ mm}$ Seals: 4 OR 144, 2 OR 3056





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Cartridge pressure relief valves type CART

screw-in mounting, direct operated



(1) Available also in stainless steel execution, see technical table CW010

(2) Standard execution of CART M-4 and CART ARE-20 provides the leak free feature, then the /R is always present in the valve model code, with the exception in case of RS options

(3) For handwheel and knob features, see sections 7, 8. For their availability see section 5

2 HYDRAULIC SYMBOLS



3 HYDRAULIC CHARACTERISTICS

Valve mode	el	CART M-3	CAR	Г М-4	C	ART N	/I-5	CA	٩RT	M-6	CAF	rt ar	E-15	CAF	T AR	E-20
STAN	DARD	50 100 210 350 420	100	210	50 25	100 50 3	210 350	50 350	100) 210 500	15 150	50 250 420	75 350	50	100	210
Max pressure setting	R		350	420				50 350	100) 210 500	15 150	50 250	75 420	31	5	400
[bar]	RS		220 3	270 50				220 330		270 350	150) 230	190			
STANDA	RD (1)	4÷50 6÷100 7÷210 8÷350 15÷420	6÷100	7÷210	2÷50 7÷25	3÷100 50 8	5÷210 3÷350	2÷50 15÷3	3÷10 50	0 8÷210 15÷500	2÷15 8÷150	3÷50 8÷250 15÷420	4÷75 8÷350	3÷50	5÷100	6÷210
Pressure range [bar]	R (1)		8÷350	15÷420				2÷50 3 15÷3	8÷100 50	0 10÷210 15÷500	2÷15 8÷150	3÷50 8÷250	4÷75 15÷420	8÷3'	15 10	÷400
	RS (1)		210÷260 300-	260÷300 ÷370				200÷25 290÷35	50 50	250÷290 310÷370	130÷1	70 17 210÷25	70÷210 0			
Max pressu on port T [bar]	ure	50	Ę	50		50			50)		50			50	
Max flow [l/m STANDA	nin] .RD, R RS	2,5	1	5		35			40 60			75 100			120	

(1) The values correspond to the min and max regulation of the valve's craking pressure

4 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position						
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006						
Ambient temperature	Standard execution = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$						
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$						
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s						
Max fluid contamination level	ISO 4406 class 20/18/15 NAS	1638 class 9, see also filter sectior	www.atos.com or KTF catalog				
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard				
Mineral oils	NBR, FKM, HNBR HL, HLP, HLPD, HVLP, HVLPD DIN 51524						
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922				
Flame resistant with water	sistant with water NBR, HNBR HFC						

5 OPTIONS AVAILABILITY

Valve mode		CART M-3	CART M-4	CART M-5	CART M-6	CART ARE-15	CART ARE-20
	/R		STANDARD		•	•	STANDARD
Option	/RS		•		•	•	
	/V	•			•	•	•
	/VF				•	•	
	/VS				•	•	
Combinated	/RV				•	•	•
option	/RVF				•	•	
(1)	/RVS				•	•	

(1) RV = leak free and regulating handwheel RVF = leak free and regulating knob

RVS = leak free and regulating knob with safety lock



7 CAVITY AND DIMENSIONS FOR CART M-3, M-4 AND M-5 [mm]



8 CAVITY AND DIMENSIONS FOR CART M-6, CART ARE-15 AND ARE-20 [mm]



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Pressure relief valves type ARE

direct operated, in line mounting



3 HYDRAULIC CHARACTERISTICS

Valve model	ARE-06					ARE-15							
Мах	Standard	50	100	210	350	500	15	50	75	150	250	350	420
pressure setting	/R	50	100	210	350	500	15	50	75	ō	150	250	420
[bar]	/RS	22	20 2	270	330	350			150	190	230		
Prossuro rango	Standard	2÷50	3÷100	10÷210	15÷350	0 30÷500	2÷15	3÷50	4÷75	8÷150	8÷250	30÷350	30÷420
[bar]	/R (1)	2÷50	3÷100	10÷210	15÷35	0 30÷500	2÷15	3÷50	4÷	75 8-	÷150	8÷250	30÷420
[]	/RS (1)	200÷	-250 250	D÷290 29	90÷350	310÷370		13	0÷170	170÷21() 210÷	-250	
Max pressure port T [bar] 50 50			50										
Max flow S	tandard, /R			40						75			
[l/min]	/RS			60						100			

(1) The values correspond to the min and max regulation of the valve's craking pressure

4 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position						
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006						
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C						
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$						
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s						
Fluid contamination class	ISO 4406 class 21/19/16 NAS	1638 class 10, in line filters of 25	μ m (β 25 \geq 75 recommended)				
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard				
Mineral oils	NBR, FKM, HNBR	DIN 51524					
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922				
Flame resistant with water	NBR, HNBR	HFC					

5 **REGULATED PRESSURE VERSUS FLOW DIAGRAMS** (based on mineral oil ISO VG 46 at 50°C)



ARE-15 and ARE-15/R Min. regulated pressure



Regulated pressure [bar]

Regulated pressure [bar]





6 DIMENSIONS [mm]



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Pressure relief valves type ARAM

two stage, in line mounting - G 3/4" and G 11/4" threaded ports



For **PED** version see technical table CY045

(1) Only for ARAM with solenoid valve for venting and/or for the selection of the setting pressure.

(2) Not available for -L version (DHL pilot valve)

2 HYDRAULIC SYMBOL



3 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100					
MTTFd valves according to EN ISO 13849	75 years, see technical table P007					
Ambient temperature range	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +80^{\circ}C$					
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006					

4 HYDRAULIC CHARACTERISTICS

Valve model	ARAM-20		ARAM-32				
Setting [bar]	50;	100;	210;	350			
Pressure range [bar]	4÷50;	6÷100;	7÷210;	8÷350			
Max pressure [bar]	Ports P, X = 350 Ports T, Y = 210 (without pilot solenoid valve) For version with pilot solenoid valve, see technical tables E015 and E018						
Max flow [I/min]	350	500					

5 ELECTRICAL CHARACTERISTICS

Insulation class	H (180°C) for DC coils; F (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See section 6
Supply voltage tolerance	± 10%
Certification	cURus North American standard - only for DHE pilot valve

6 COIL VOLTAGE

External supply nominal voltage ± 10%	Voltage code	Type of connector	-EX Power consumption (2)	-LX Power consumption (2)	Code of spare coil -EX	Code of spare coil -LX
12 DC	12 DC				COE-12DC	COL-12DC
14 DC	14 DC	666	30W	20///	COE-14DC	COL-14DC
110 DC	110 DC	667		2300	COE-110DC	COL-110DC
220 DC	220 DC				COE-220DC	COL-220DC
110/50 AC (1)	110/50/60 AC		58VA (3)		COE-110/50/60AC	COL-110/50/60AC
115/60 AC	115/60 AC	666	80VA (3)	58VA	COE-115/60AC	COL-115/60AC
230/50 AC (1)	230/50 AC (1) 230/50/60 AC		58VA (3	(3)	COE-230/50/60AC	COL-230/50/60AC
230/60 AC	230/60 AC		80VA (3)		COE-230/60AC	COL-230/60AC

(1) For other supply voltages available on request see technical tables E015, E018.

(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHL) and 58 VA (DHE)

(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(4) When solenoid is energized, the inrush current is approx 3 times the holding current.

7 OPTIONS

/E = external pilot

N = regulating handwheel instead of grub screw protected by cap (for handwheel features, see table K150)

/WP = prolunged manual override protected by rubber cap (only for ARAM with pilot solenoid valve)

/Y = external drain (only for ARAM with pilot solenoid valve)

8 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C





9 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C



10 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 for ARAM with solenoid valve (to be ordered separately, see tech table K800)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

11 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, reccomended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$						
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s						
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog						
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard				
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524				
Flame resistant without water	FKM	HFDU, HFDR	100 10000				
Flame resistant with water	NBR, HNBR	HFC	130 12922				

12 DIMENSIONS [mm]



Overall dimensions refer to valves $\ensuremath{\text{DC}}$ voltage, with connectors type 666



Overall dimensions refer to valves $\ensuremath{\text{DC}}$ voltage, with connectors type 666

Pressure relief valves type AGAM

two stage, subplate mounting - ISO 6264 size 10, 20 and 32



AGAM are two stage pressure relief valves with balanced poppet, designed to operate in oil hydraulic systems.

In standard versions the piloting pressure of the poppet ① of the main stage ② is regulated by means of a grub screw protected by cap ③ in the cover ④.

Optional versions with setting adjustment by handwheel (5) instead of the grub screw are available on request.

Clockwise rotation increases the pressure.

AGAM can be equipped with a pilot solenoid valve (a) for venting or for different pressure setting type:

- DHE for AC and DC supply, high performances with **cURus** certified solenoids
- DHL for AC and DC supply, compact execution

Mounting surface: **ISO 6264 size 10, 20** and **32** Max flow: **200, 400** and **600 l/min** Max pressure up to **350 bar**

1 MODEL CODE



For **PED** version see technical table CY066

(1) Only for AGAM with solenoid valve for venting and/or for the selection of the setting pressure

(2) Not available for -L version (DHL pilot valve)
2 HYDRAULIC SYMBOLS



3 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401						
MTTFd valves according to EN ISO 13849	75 years for standard version, 75 years for venting option, see technical table P007					
Ambient temperature range	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +80^{\circ}C$					
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

4 HYDRAULIC CHARACTERISTICS

Valve model	AGAM-10	AG	AM-20	AGAM-32		
Setting [bar]	50;	100;	210;	350		
Pressure range [bar]	4÷50;	6÷100;	7÷210;	8÷350		
Max pressure [bar]	Ports P, X = 350 Ports T, Y = 210 (without pilot solenoid valve) For version with pilot solenoid valve, see technical tables E015 and E018					
Max flow [I/min]	200	400			600	

5 ELECTRICAL CHARACTERISTICS (for AGAM with pilot solenoid valve)

Insulation class	H (180°C) for DC coils; F (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See section 6
Supply voltage tolerance	± 10%
Certification	cURus North American standard - only for DHE pilot valve

6 COIL VOLTAGE

External supply nominal voltage ± 10%	Voltage code	Type of connector	-EX Power consumption (2)	-LX Power consumption (2)	Code of spare coil -EX	Code of spare coil -LX		
12 DC	12 DC				COE-12DC	COL-12DC		
14 DC	14 DC	666 or 667	666	666	2014/	20\\/	COE-14DC	COL-14DC
110 DC	110 DC		3000	2900	COE-110DC	COL-110DC		
220 DC	220 DC				COE-220DC	COL-220DC		
110/50 AC (1)	110/50/60 AC		58VA (3)		COE-110/50/60AC	COL-110/50/60AC		
115/60 AC	115/60 AC	666 80VA	80VA (3)	58VA	COE-115/60AC	COL-115/60AC		
230/50 AC (1)	230/50/60 AC	667	58VA (3	(3)	COE-230/50/60AC	COL-230/50/60AC		
230/60 AC	230/60 AC		80VA (3)		COE-230/60AC	COL-230/60AC		

(1) For other supply voltages available on request see technical tables E015, E018.

(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHL) and 58 VA (DHE)

(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(4) When solenoid is energized, the inrush current is approx 3 times the holding current.

7 OPTIONS

/E = external pilot

N = regulating handwheel instead of grub screw protected by cap (for handwheel features, see table K150)

/WP = prolunged manual override protected by rubber cap (only for AGAM with pilot solenoid valve)

IV = external drain (only for AGAM with pilot solenoid valve)

8 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C



9 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C





10 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 for AGAM with solenoid valve (to be ordered separately, see tech table K800)

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

⁶⁶⁶ = standard connector IP-65, suitable for direct connection to electric supply source

11 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, reccomended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$					
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s					
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog					
Hydraulic fluid	Suitable seals type Classification Ref. Standard					
Mineral oils	NBR, FKM, HNBR HL, HLP, HLPD, HVLP, HVLPD DIN 51524					
Flame resistant without water	FKM HFDU, HFDR					
Flame resistant with water	NBR, HNBR	HFC	100 12922			

12 DIMENSIONS [mm]



Overall dimensions refer to valves $\boldsymbol{\mathsf{DC}}$ voltage, with connectors type 666



Overall dimensions refer to valves DC voltage, with connectors type 666



Overall dimensions refer to valves **DC** voltage, with connectors type 666

13 MOUNTING SUBPLATES

Valve	Subplate model	Port location	Ports			Ø Counterbore [mm]			Mass [Kg]
			Р	Т	х	Р	т	х	[
AGAM-10	BA-306		G 1/2"	G 3/4"	G 1/4"	30	36,5	21,5	1,5
AGAM-20	BA-406	Ports P, T, X underneath;	G 3/4"	G 3/4"	G 1/4"	36,5	36,5	21,5	3,5
	BA-506		G 1"	G 1"	G 1/4"	46	46	21,5	3,5
AGAM-32	BA-706		G 1 1/2"	G 1 1/2"	G 1/4"	63,5	63,5	21,5	6

The subplates are supplied with fastening bolts. For further details see table K280

Pressure relief valves type REM

two stage, flange mounting SAE 3/4", 1", 11/4"



(1) Only for REM with solenoid valve for venting and/or for the selection of the setting pressure

(2) For handwheel features, see technical table K150

2 HYDRAULIC CHARACTERISTICS



3 GENERAL CHARACTERISTICS

Assembly position	Any position					
Subplate surface finishing to ISO 4401						
MTTFd valves according to EN ISO 13849	75 years, see technical table P007					
Ambient temperature range	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$					
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +80^{\circ}C$					
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)					
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h					
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006					

4 HYDRAULIC CHARACTERISTICS

Valve model	REM-3	REM-4	REM-5			
Max flow [I/min]	200	400	600			
Pressure range [bar]	4-50; 6-100; 7-210; 8-350	4÷50; 6÷100; 7÷210				
Max pressure [bar]	Ports P, X= 350 Port T= 210 without pilot solenoi	oid valve, for version -EX and -LX, see tech tables E015 and E01				

5 ELECTRICAL CHARACTERISTICS (for ARAM with pilot solenoid valve)

Insulation class	H (180°C) for DC coils; F (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See section 7
Supply voltage tolerance	± 10%
Certification	cURus North American standard - only for DHE pilot valve

6 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, reccomended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$					
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s					
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog					
Hydraulic fluid	Suitable seals type Classification Ref. Standard					
Mineral oils	NBR, FKM, HNBR	DIN 51524				
Flame resistant without water	FKM HFDU, HFDR					
Flame resistant with water	NBR, HNBR	HFC	190 12922			

7 COIL VOLTAGE

External supply nominal voltage ± 10%	Voltage code	Type of connector	-EX Power consumption (2)	-LX Power consumption (2)	Code of spare coil -EX	Code of spare coil -LX
12 DC	12 DC				COE-12DC	COL-12DC
14 DC	14 DC	666 or 667	30/\/	20///	COE-14DC	COL-14DC
110 DC	110 DC		5000	2911	COE-110DC	COL-110DC
220 DC	220 DC				COE-220DC	COL-220DC
110/50 AC (1)	110/50/60 AC		58VA (3)		COE-110/50/60AC	COL-110/50/60AC
115/60 AC	115/60 AC	666	80VA (3)	58VA	COE-115/60AC	COL-115/60AC
230/50 AC (1)	230/50/60 AC	667	58VA (3	(3)	COE-230/50/60AC	COL-230/50/60AC
230/60 AC	230/60 AC		80VA (3)		COE-230/60AC	COL-230/60AC

(1) For other supply voltages available on request see technical tables E015, E018.

(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHL) and 58 VA (DHE)

(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(4) When solenoid is energized, the inrush current is approx 3 times the holding current.



8 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on fluid viscosity of 25 mm²/s at 40°

9 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on fluid viscosity of 25 mm²/s at 40° C



10 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 for REM with solenoid valve (to be ordered separately, see tech table K800)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC



Overall dimensions refer to valves **DC** voltage, with connectors type 666



Overall dimensions refer to valves $\ensuremath{\text{DC}}$ voltage, with connectors type 666



Overall dimensions refer to valves $\ensuremath{\text{DC}}$ voltage, with connectors type 666





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Pressure control valves type AGIR, AGIS, AGIU

two stage, subplate mounting, ISO 5781 sizes 10, 20 and 32





3 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	75 years for standard version, 75 years for venting option, see technical table P007				
Ambient temperature range	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +80^{\circ}C$				
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

4 HYDRAULIC CHARACTERISTICS

Valve model	AGIR-10	AGIR-20	AGIR-32	AGIS-10	AGIS-20	AGIS-32	AGIU-10	AGIU-20	AGIU-32
Max flow [l/min]	160	300	400	200	400	600	100	200	300
Pressure range [bar]		4÷50 (AGIR*); 6÷100;		7÷210;	8÷350				
Max pressure [bar]			Port	Ports A, B, X = 350 bar		Port Y	[′] = 0		

5 ELECTRICAL CHARACTERISTICS (for AGAM with pilot solenoid valve)

Insulation class	H (180°C) for DC coils; F (155°C) for AC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See section 10
Supply voltage tolerance	± 10%
Certification	cURus North American standard - only for DHE pilot valve

6 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C							
Recommended viscosity	15÷100 mm²/s - max allowed ra	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s						
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog							
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard					
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524					
Flame resistant without water	FKM	HFDU, HFDR	120 12022					
Flame resistant with water	NBR, HNBR	HFC	100 12922					



Note: for AGIU-10, the max flow rate is 100 I/min

Note: for AGIU-20, the max flow rate is 200 l/min

Note: for AGIU-32, the max flow rate is 300 l/min

8 OPERATING DIAGRAM based on mineral oil ISO VG 46 at 50°C

- $\mathbf{1} = AGIR-10 A \rightarrow B$
- $2 = AGIR-20 A \rightarrow B$ $3 = AGIR-32 A \rightarrow B$
- $\mathbf{3} = \operatorname{AGIR-32} A \rightarrow B$ $\mathbf{4} = \operatorname{AGIR-10} B \rightarrow A$
- $\mathbf{4} = \operatorname{AGIR}_{10} \operatorname{B} \rightarrow \operatorname{A}$ $\mathbf{5} = \operatorname{AGIR}_{20} \operatorname{B} \rightarrow \operatorname{A}$
- $6 = AGIR-32 B \rightarrow A$
- **7** = AGIS-10
- 8 = AGIS-20
- **9** = AGIS-32

Opening/closing diagram for AGIU

1 = AGIU-**/...(standard) **3** = AGIU-**/.../6 **2** = AGIU-**/.../5 **4** = AGIU-**/.../7

NOTES

- Short pipes with low resistance must be used between the unloading valve and the accumulator;
- 2)When the resistance is high, the hydraulic pilot signal must be taken as closed as possible to the accumulator;
- With high pump flow and small valve differential pressure of intervention it is advisable to use the version with external drain;
- 4)When to use the BA-*25 subplates:
- a) in applications with working frequencies >10 Hz use subplates type BA-*25/4 (spring with 4 bar of cracking pressure);
- b) in applications with working frequencies
 <10 Hz use subplates type BA-*25/2 (spring with 2 bar of cracking pressure);









9 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 for AGIU with solenoid valve (to be ordered separately, see tech table K800)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

10 COIL VOLTAGE

External supply nominal voltage ± 10%	Voltage code	Type of connector	-EX Power consumption (2)	-LX Power consumption (2)	Code of spare coil -EX	Code of spare coil -LX
12 DC	12 DC				COE-12DC	COL-12DC
14 DC	14 DC	666	2014/	20///	COE-14DC	COL-14DC
110 DC	110 DC	667	5000	2311	COE-110DC	COL-110DC
220 DC	220 DC				COE-220DC	COL-220DC
110/50 AC (1)	110/50/60 AC		58VA (3)		COE-110/50/60AC	COL-110/50/60AC
115/60 AC	115/60 AC	666	80VA (3)	58VA	COE-115/60AC	COL-115/60AC
230/50 AC (1)	230/50/60 AC	667	58VA (3	(3)	COE-230/50/60AC	COL-230/50/60AC
230/60 AC	230/60 AC		80VA (3)		COE-230/60AC	COL-230/60AC

(1) For other supply voltages available on request see technical tables E015, E018.

(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHL) and 58 VA (DHE)

(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(4) When solenoid is energized, the inrush current is approx 3 times the holding current.

11 DIMENSIONS [mm]





Overall dimensions refer to valves DC voltage, with connectors type 666



Overall dimensions refer to valves **DC** voltage, with connectors type 666

12 MOUNTING SUBPLATES

Valves	Subplate model	Port location		Ports				Ø Counterbore [mm]			
			A	В	X-Y	OUT	A	B	X-Y	OUT	[[~9]
AGI*-10	BA-305		G 1/2"	G 1/2"	G 1/4"	-	30	30	21,5	-	1
AGI*-20	BA-505	Ports A, B, Y underneath;	G 1"	G 1"	G 1/4"	-	46	46	21,5	-	2
AGI*-32	BA-705		G 1 1/2	G 1 ¹/2'	G 1/4"	-	63,5	63,5	21,5	-	7,5

The subplates are supplied with fastening bolts. For further details see table K280

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Flow control valves type QV-06

pressure compensated, two way, ISO 4401 size 06



2 HYDRAULIC CHARACTERISTICS

Hydraulic symbols	ith check valve (standard)	B	ut check valve (opti	on /V)	В
Valve model		QV-06/1	QV-06/6	QV-06/11	QV-06/16	QV-06/24
Max regulated flow	[l/min]	1,5	6	11	16	24
Min regulated flow	[cm³/min]			50		
Max flow $B \rightarrow A$ through check	k valve [l/min]			24		
Regulating ∆p	[bar]	3	3	5	6,5	8
Max flow on port A	[l/min]			24		
Max pressure	[bar]			250		

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position							
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006							
Ambient temperature	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$							
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$							
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s							
Max fluid contamination level	ISO4406 class 20/18/15 NAS16	38 class 9, see also filter section	at www.atos.com or KTF catalog					
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard					
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524					
Flame resistant without water	FKM	100 10000						
Flame resistant with water	NBR, HNBR HFC ISO 12922							

4 DIAGRAMS based on mineral oil ISO VG 46 at 50°C



6 MODULAR PLATES TYPE BHQ

The modular plates type BHQ allow the assembling of valves type QV-06 in a modular stack with other components having ISO 4401 size 06 mounting surface. See below for model code and functional sketches; see section is for dimensions and example of assembly.



Available also version for phosphate ester (add /PE at the end of the model code).

7 MOUNTING PLATES TYPE BA

Valve	Subplate model	Ports location	Ports A, B, P, T	Ø Counterbore [mm] A, B, P, T	Mass [Kg]
	BA-202/Q	Ports A, B, P, T underneath;	G 3/8"	-	1,2
QV-06 BA-204/Q P		Ports P, T underneath; Ports A, B on lateral side	G 3/8"	25,5	1,2
	BA-302/Q	Ports A, B, P, T underneath;	G 1/2"	30	1,8

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Flow restrictor valves type AQFR

in-line mounting - from G 3/8" to G 1¹/4" threaded ports



AQFR are not compensated flow throttling valves with a built-in check valve ① to allow the free flow in the opposite direction.

The flow adjustement is done by turning the external exagon ②. Clockwise rotation increases the throtting (reduced passage). The regulated flow is a function of the pressure drop existing between the inlet and outlet ports.

They are available in five sizes: from 3/8" to $1 \frac{1}{4}"$ GAS with flow up 30, 50, 80, 160, 250 l/min respectively and pressure up to 400/350 bar (depending on size).

Max flow: 250 l/min Max pressure: 400 bar

1 MODEL CODE



2 HYDRAULIC CHARACTERISTICS

Hydraulic symbol		<u> </u>				
Valve model		AQFR-10	AQFR-15	AQFR-20	AQFR-25	AQFR-32
Max recommended flow	[l/min]	30	50	80	160	250
Max pressure	[bar]	400		3	50	

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position	Any position					
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006						
Ambient temperature	Standard execution = -30°C ÷ -	+70°C; /PE option = $-20^{\circ}C \div +70^{\circ}$	°C; /BT option = $-40^{\circ}C \div +70^{\circ}C$				
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$						
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s						
Max fluid contamination level	ISO4406 class 20/18/15 NAS16	38 class 9, see also filter section a	at www.atos.com or KTF catalog				
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard				
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524				
Flame resistant without water	FKM	ISO 12922					
Flame resistant with water	NBR, HNBR	HFC					



5 DIMENSIONS [mm]



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Cartridge check valves type DB, DR

screw-in mounting - from G1/4" to G1/2"

DB, DR are direct operated check valves for screw-in mounting in cavities from G1/4" to G1/2". They are specifically designed to reduce the manifold dimensions and simplify the installation. Cartridge designed to operate in hydrau-В В lic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics. Flow up to 95 l/min. Max pressure: 350 bar A A DB-5/G DR-5/G

1 MODEL CODE



2 HYDRAULIC CHARACTERISTICS

Hydraulic symbol		DB-*/G	A — ///Þ — E	}	DR-*/G	. — ФАЛ В		
Valve model		DB-5/G	DR-5/G	DB-10/G	DR-10/G	DB-15/G	DR-15/G	
Nominal flow (at $\Delta p = 8$ bar)	[l/min]	25	35	55	65	85	95	
Max pressure	[bar]		350					
Cracking pressure	[bar]			0	,3			

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position							
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006							
Ambient temperature	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$							
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$							
Recommended viscosity	15÷100 mm²/s - max allowed ra	nge 2,8 ÷ 500 mm²/s						
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog							
Flow direction	As shown in the symbol at section	2						
Rated flow	See diagrams Q/Ap at section 4							
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard					
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524					
Flame resistant without water	FKM HFDU, HFDR							
Flame resistant with water	NBR, HNBR HFC ISO 12922							

4 FLOW VERSUS PRESSURE DROP DIAGRAMS based on mineral oil ISO VG 46 at 50°C



5 RECESS DIMENSIONS [mm]



6 VALVE DIMENSIONS [mm]



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Check valves type ADR

in-line mounting - from G 1/4" to G 1 1/4" threaded ports



2 HYDRAULIC CHARACTERISTICS

Hydraulic symbol		A - \$\vee B							
Valve model	ADR-06	ADR-10	ADR-15	ADR-20	ADR-25	ADR-32			
Max recommended flow [I/m	n] 40	80	150	300	360	500			
Max pressure [b	ır] 4	400 350							

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006
Fluid	Hydraulic oil as per DIN 51524 535;
Fluid temperature	Standard version = -20°C ÷ +80°C BT option = -40°C ÷ +80°C
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog
Flow direction	As shown in the symbol at section 2
Rated flow	See diagrams Q/Δp at section 4



5 DIMENSIONS [mm]

_	A	Ш Т		B 	D A A /* 30	
	¥					
Model	A	в	C	D	E	Mass [kg]
Model	A	B	c	D	E	Mass [kg]
ADR - 06	22	67	12	13	G 1/4"	0,2
Model	A	B	c	D	E	Mass [kg]
ADR - 06	22	67	12	13	G 1/4"	0,2
ADR - 10	27	70	12	13	G 3/8"	0,4
Model	A	B	C	D	E	Mass [kg]
ADR - 06	22	67	12	13	G 1/4"	0,2
ADR - 10	27	70	12	13	G 3/8"	0,4
ADR - 15	32	82,5	14	17	G 1/2"	0,6
Model	A	B	C	D	E	Mass [kg]
ADR - 06	22	67	12	13	G 1/4"	0,2
ADR - 10	27	70	12	13	G 3/8"	0,4
ADR - 15	32	82,5	14	17	G 1/2"	0,6
ADR - 20	36	102,5	16	21,5	G 3/4"	0,9
Model	A	B	C	D	E	Mass [kg]
ADR - 06	22	67	12	13	G 1/4"	0,2
ADR - 10	27	70	12	13	G 3/8"	0,4
ADR - 15	32	82,5	14	17	G 1/2"	0,6
ADR - 20	36	102,5	16	21,5	G 3/4"	0,9
ADR - 25	46	120	18	24,5	G 3/4"	2,1

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Pilot operated check valves type ADRL, AGRL, AGRLE

in-line mounting, port size from G 3/8" to G 1 $_{1/4"}$ subplate mounting, ISO 5781 size 10, 20 and 32



ADRL are pilot operated (port X) check valves for in-line mounting available with port size from 3/8" GAS to 1 1/4" GAS.

Flow up to 300 l/min. Pressure up to 400 bar.

AGRL and **AGRLE** are pilot operated (port X) check valves for subplate mounting available with mounting surface ISO 5781 size 10, 20 and 32. Flow up to 500 l/min. Max pressure: 315 bar.

AGRLE versions have an external drain (port Y) of the pilot chamber to permit a correct use of pilot operated check valve in systems where valve must open in presence of pressure at port A: infact pressure at port A, on regular pilot operated check valves, may affect the check opening by acting against the pilot device.

Valves designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

1 MODEL CODE 10 * ** * AGRL Ε 1 1 Seals material see section 4 ADRL = pilot operated check valve in-line mounting = NBR AGRL =pilot operated check valve PE = FKM BT = HNBR subplate mounting Only for AGRL: = without external drain E = with external drain Series number Threaded connections for ADRL: 10 = G 3/8"15 = G 1/2"20 = G 3/4"Cracking pressure for ADRL for AGRL = 0,5 bar = 0,5 bar 32 = G 1 1/4' **2** = 2 bar Size for AGRL and AGRLE: 4 = 4 bar 10 20 32 8 = 8 bar

2 HYDRAULIC CHARACTERISTICS

Hydraulic symbols				В			B				
Model		ADRL-10	ADRL-15	ADRL-20	ADRL-32	AGRL-10	AGRL-20	AGRL-32	AGRLE-10	AGRLE-20	AGRLE-32
Piloting ratio (1)		2,8	2,7	2,5	2,3	13,6	14,0	14,4	13,6	14,0	14,4
Max recommended flow	[l/min]	30	60	100	300	160	300	500	160	300	500
Max pressure	[bar]	400		350				3	15		

(1) Applying the pilot pressure through the pilot port X, the pilot spool opens the check valve, allowing free flow $B \rightarrow A$.

The minimum pilot pressure for correct operation depends on the pilot ratio indicated in the table and on the pressure closing the check. i.e.: the pilot pressure for ADRL-20 is the pressure on the check divided by 2,5. The valves AGRL-* and AGRLE-*, are equipped with a decompression system.

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position. For AGRLE valves, the drain port Y has to be connected directly to the tank without counter pressure						
Compliance RoHS Directive 2011/65/EU as last update by 2015/863/EU							
	REACH Regulation (EC) n°1907/2006						
	Standard execution = -30°C ÷ +	⊦70°C					
Ambient temperature	/PE option = $-20^{\circ}C \div +70^{\circ}C$						
	$/BT \text{ option} = -40^{\circ}C \div +70^{\circ}C$						
	NBR seals (standard) = -20°C +	+ +80°C, with HFC hydraulic fluid	$s = -20^{\circ}C \div +50^{\circ}C$				
Seals, recommended fluid temperature	FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$						
	HNBR seals (/BT option) = -40°	C ÷ +60°C, with HFC hydraulic flu	uids = $-40^{\circ}C \div +50^{\circ}C$				
Recommended viscosity	15÷100 mm²/s - max allowed ra	nge 2,8 ÷ 500 mm²/s					
Max fluid contamination level	ISO4406 class 20/18/15 NAS16	38 class 9, see also filter section a	at www.atos.com or KTF catalog				
Subplate surface finishing	Roughness index Ra 0,4 - flatne	ess ratio 0,01/100 (ISO 1101)					
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard				
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524				
Flame resistant without water	FKM HFDU, HFDR ISO 12022						
Flame resistant with water	NBR, HNBR	HFC	IOO ILOLL				

4 FLOW VERSUS PRESSURE DROP DIAGRAMS FOR ADRL based on mineral oil ISO VG 46 at 50°C

- 1 = ADRL-10 B→A
- 2 = ADRL-10 A→B
- **3** = **ADRL-15** B→A
- 4 = ADRL-15 A→B
- 5 = **ADRL-20** B→A
- **6 = ADRL-20** $\quad A \rightarrow B \\$ **7 = ADRL-32** $\quad B \rightarrow A$
- $8 = ADRL-32 \quad A \rightarrow B$







Valve pressure drop [bar]











300

400 500

200

0

100

6 DIMENSIONS FOR ADRL VALVES [mm]



7 DIMENSIONS FOR AGRL AND AGRLE VALVES [mm]



8 MOUNTING SUBPLATES FOR AGRL AND AGRLE VALVES

Valve	Subplate model	Port location		GAS ports			Ø Counterbore [mm]				Mass [kg]
			A	в	x	Y	A	в	x	Y	
AGRL-10, AGRLE-10	BA-305		1/2"	1/2"	1/4"	1/4"	30	30	21,5	21,5	1
AGRL-20, AGRLE-20	BA-505	Ports A, B, X, Y underneath;	1"	1"	1/4"	1/4"	46	46	21,5	21,5	2
AGRL-32, AGRLE-32	BA-705		1 1/2"	1 1/2"	1/4"	1/4"	63,5	63,5	21,5	21,5	7,5

The subplates are supplied with fastening bolts. For further details see table K280.

Safety directional valves with spool position monitoring

On-off, direct operated, conforming to Machine Directive 2006/42/EC - certified by 🜚





Direct operated safety directional valves with spool position monitoring, CE marked and certified by TÜV in accordance with safety requirements of Machine Directive 2006/42/EC

DHE, size 06, high performances, for AC and DC supply with cURus certified solenoids

DKE, size 10, for AC and DC supply with cURus certified solenoids

The valves are equipped with FI inductive proximity sensor or FV inductive position switch for the spool position monitoring, see section 1 and 11 for sensors availability and technical characteristics.

Certification

The TÜV certificate can be downloaded from www.atos.com, catalog on line, technical information section.

Mounting surface: ISO 4401, size 06 and 10 DHE 80 l/min Max flow: DKE 150 l/min

Max pressure: 350 bar

1 RANGE OF VALVE'S MODELS

Valvo			DC so	enoids	AC so	enoids			
code	Size	Description	Sensor type						
code			/FI	/FV	/FI	/FV			
DHE-06	06	direct operated solenoid valves, on-off, single solenoid	• • •			•			
DHE-07	06	direct operated solenoid valves, on-off, double solenoid	•	•	•				
DKE-16	10	lirect operated solenoid valves, on-off, single solenoid		•	•	•			
DKE-17	10	direct operated solenoid valves, on-off, double solenoid	•	•	•				

Notes:

FI = inductive proximity sensor, type NO (normally open) or NC (normally closed)

FV = inductive position switch providing both NO and NC contacts to be wired on the electric connector See section 11 for sensor's characteristics

1.1 FI sensor & FV switch configurations

Single solenoid valves size 06 & 10 are provided with n°1 FI sensor or n° 1 FV switch for the spool position monitoring



Double solenoid valves size 06 & 10 are provided with n° 2 FI sensors or n° 1 FV switch for the spool position monitoring



Double solenoid valves size 06 with detent are provided with n°2 FI sensors or n° 1 FV switch for the spool position monitoring



For model code of DHE safety valves, see section 2 For model code of DKE safety valves, see section 4



Double solenoid valves size 10 with detent are provided with nº 1 FI sensor or nº 1 FV switch for the spool position





(1) the FV inductive position switch provides both NC and NO contacts



3 CONFIGURATIONS AND SPOOLS (representation according to ISO 1219-1)

3.1 Configuration for spool */7



3.2 Special shaped spools for DHE

- spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank.

- spools type 1, 4, 5 and 58 are also available as 1/1, 4/8, 5/1 and 58/1.
- They are properly shaped to reduce water-hammer shocks during the swiching.
- spools type 1, 1/2, 3, 8 are available as 1P, 1/2P, 3P, 8P to limit valve internal leakages.
- Other types of spools can be supplied on request.

3.3 Standard spool availability for DHE - spools not listed in the table are available for all valves models

Value tupe		standard spool									
valve type	09	90	39	93	49	94	1/9				
DHE/FI	•	•	•	•	•	•	•				
DHE/FV											



DKE/FI and /FV are always provided with Y drain port

(1) the ${\rm FV}$ inductive position switch provides both NC and NO contacts



5.1 Configuration for spool */7



5.2 Special shaped spools for DKE

- spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank.

- spools type 1 is also available as 1/1, properly shaped to reduce the water-hammer shocks during the switching.

- spool type 1/9 has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.

- other types of spools can be supplied on request.

6 MAIN CHARACTERISTICS

Assembly position / location		Any position				
Subplate surface finishing		Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)				
MTTFd values according to EN ISO 13	3849	150 years, for further details see technical table P007				
Compliance		CE to Machine Directive 2006/42/EC. -EC type-examination certificate for safety components (1) -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				
Ambient temperature		Standard = -30°C ÷ +70°C / PE option = -20°C ÷ +70°C				
Flow direction		As shown in the symbols of table 3 and 5				
Surface protection		Zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)				
Corrosion resistance		Salt spry test (EN ISO 9227) > 200h				
Operating pressure	DHE	P, A, B = 350 bar T = 100 bar (version /FI); 210 bar (DC solenoid - version /FV); 160 bar (AC solenoid - version /FV)				
	DKE	P, A, B = 350 bar T = (with Y port not connected to tank) 100 bar (version /FI); 210 bar (DC solenoid - version /FV); 120 bar (AC solenoid - version /FV) T = (with Y port drained to tank) 250 bar				
Rated flow		see diagrams Q/ Δp at section 14				
E Maximum flow	DHE	80 l/min see section 15				
	OKE	150 l/min see section 15				

(1) The type-examination certificate can be download from www.atos.com

6.1 Coils characteristics

Insulation class	H (180°C) for DC coils
	F (155°C) for AC coils
	Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features 🗹
Supply voltage tolerance	± 10%
Certification	cURus North American standard

7 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$							
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s							
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog							
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard					
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524					
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922					
Flame resistant with water	NBR	HFC	100 TEOLL					

8 OPTIONS

 $/! \setminus$

A = Single solenoid valves: solenoid mounted at side of port B. In standard versions the solenoid is mounted at side of port A. Double solenoid valves DHE/FV(DC), DKE/FV(DC): FV inductive position switch mounted at side of port A. In standard versions the position switch is mounted at side of port B.

WARNING: the manual operation is not permitted for safety valves, than the valve is provided with solenoid blind rings to prevent the access to the manual override. The manual override protected by rubber cup (option /WP) is not available

WARNING: the inobservance of following prescriptions invalidates the certification and may represent a risk for personnel injury

Safety valves must be installed and commissioned only by qualified personnel

Safety valves must not be disassembled

The inductive proximity FI or the inductive position switch FV can be adjusted only by the valve's manufacturer or Atos authorized service centers

Valve's components cannot be interchanged

The valves must operate without switching shocks and spool vibrations

9 ELECTRIC FEATURES

9.1 COILS FOR DHE VALVES

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil	
12 DC	12 DC			COE-12DC	
14 DC	14 DC			COE-14DC	
24 DC	24 DC			COE-24DC	
28 DC	28 DC		30 W	COE-28DC	
48 DC	48 DC	666 		COE-48DC	
110 DC	110 DC			COE-110DC	
125 DC	125 DC	667		COE-125DC	
220 DC	220 DC			COE-220DC	
110/50 AC	110/50/60 AC		58 VA (3)	COE-110/50/60AC	
115/60 AC	115/60 AC		80 VA (3)	COE-115/60AC	
230/50 AC	230/50/60 AC		58 VA (3)	COE-230/50/60AC	
230/60 AC	230/60 AC		80 VA (3)	COE-230/60AC	
110/50 AC	110RC			COE-110BC	
120/60 AC		660	20.14/		
230/50 AC	230BC	009	30 W	COF-230BC	
230/60 AC					

(1) In case of 60 Hz voltage frequency the performances are reduced by 10÷15% and the power consumption is 58 VA

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

9.2 COILS FOR DKE VALVE

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil
12 DC	12 DC			CAE-12DC
14 DC	14 DC			CAE-14DC
24 DC	24 DC		36 W	CAE-24DC
28 DC	28 DC			CAE-28DC
110 DC	110 DC	666		CAE-110DC
125 DC	125 DC	or		CAE-125 DC
220 DC	220 DC	667		CAE-220DC
110/50/60 AC	110/50/60 AC		100 VA	CAE-110/50/60AC (1)
230/50/60 AC	230/50/60 AC		(3)	CAE-230/50/60AC (1)
115/60 AC	115/60 AC		130 VA	CAE-115/60AC
230/60 AC	230/60 AC		(3)	CAE-230/60AC
110/50/60 AC	110 DC	000	20.14/	CAE-110DC
230/50/60 AC	220 DC	609	30 VV	CAE-220DC

(1) In case of 60 Hz voltage frequency the performances are reduced by 10÷15% and the power consumption is 90 VA

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

10 COILS ELECTRIC CONNECTORS - according to din 43650 (to be ordered separately)



11 TECHNICAL CHARACTERISTICS OF INDUCTIVE PROXIMITY AND POSITION SWITCHES



12 CONNECTING SCHEMES OF INDUCTIVE PROXIMITY AND POSITION SWITCHES - FI and FV sensor's connector are always supplied with the valve

DHE/FI single solenoid / double solenoid (dotted line)	/FV (all valves) single solenoid	/FV (all valves) double solenoid	DKE/FI single solenoid	DKE/FI double solenoid
Connector type 345 IP65 - + sol, sol	Connector type ZBE-06 IP65	Connector type ZBE-06 IP65 - + sol. sol. b 2 2 2 2 2 4	Connector type 666 IP65 - +	Connector type 664 IP65
1 =output signal 2 =supply +24 VDC 3 = output signal for double solenoid 4 = GND	1 = supply +24 VDC 2 = output signal NC 3 = GND 4 = output signal NO	1 = supply +24 VDC 2 = output signal sol. b 3 = GND 4 = output signal sol. a	1 = output signal S 2 = supply +24 VDC ⊕= GND	1 = output signal sol. a 2 = supply +24 VDC 3 = output signal sol. b ⊕ = GND

NOTE: the /FI proximity and /FV position switch are not provided with a protective earth connection

13 STATUS OF OUTPUT SIGNAL

13.1 Signal status for FI versions

Signal status io	r standard version										
	Configuration 61	Configuration 63	Configur	ation 67	Cont	iguratio	n 71		Configur	ration 75	
	monitored position "0"	monitored position "2"	' monitored p	position " 2 "	monitor	ed posi	tion " 0 "		monitored	position " 2 "	
								D	H*	DI	۲*
HYDRAULIC	в	в		а в		АВ	Z		А В		А В
CONFIGURATION		1 2 M	0	2 M	1	0 2	<u> </u>	1	2	1	2
			°	P 1	a			-	P T B	•	P [b
spool position	1 0	1 2	0	2	1	0	2	1	2	1	2
ON sensor signal OFF	A.		_	ł							
ON sensor a signal						1		Į.			
OFF											
ON									T		
sensor b signal						t 🔔			t V		
0.1											

Diagrams show the behaviour of the output signal for inductive switches type FI/NO.

For inductive switches type FI/NC option the behaviour is opposite (high level signal instead of low level signal and viceversa)

Signal status for option /A

	Configura monitored	ation 61/A position " 0 "	Configura monitored	ation 63/A position " 1 "	Configuration 67/A monitored position "1"		
HYDRAULIC CONFIGURATION		2		2		0	
spool position	0	2	1	2	1	0	
ON sensor signal							

Diagrams show the behaviour of the output signal for inductive switches type FI/NO.

For inductive switches type FI/NC option the behaviour is opposite (high level signal instead of low level signal and viceversa)

13.2 Signal status for FV versions

Signal status for standard version

DH - DK	Configu	ration 61	Configu	Configuration 63		Configuration 67		Configuration 71		Configu	ration 75
Hydraulic configuration	1		1		7 O	A B		АВ 102			
spool position	1	0	1	2	0	2	1	0	2	1	2
Din 2 OFF		t		ŧ		t.		Ą		ŀ	
ом pin 4 ОFF		Ą.		Ð.		₽		ŧ.		_	1

Note: FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

= intermediate spool position corresponding to the hydraulic configuration change

Signal status for option /A

рн - рк	Configuration 61	A Configura	ation 63/A	Configura	ation 67/A	Config	guratior	n 71/A	Configura	ation 75/A	
Hydraulic configuration			2		0		A B I 0 2 P T				
spool position	0 2	0	2	0	2	1	0	2	1	2	
pin 2 OFF	- Ay	£		<u>t</u>			ŧ.		Ą		
ON pin 4 OFF		f					ł			Į.	

Note: FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

= intermediate spool position corresponding to the hydraulic configuration change

14 Q/∆**P DIAGRAMS** based on mineral oil ISO VG 46 at 50°C

DHE

Flow direction	P→A	P→B	A→T	B→T	P→T
Spool type					
0, 0/1	A	Α	С	С	D
1, 1/1, 1/9	D	С	С	С	
3, 3/1	D	D	Α	Α	
4, 4/8, 5, 5/1, 49, 58, 58/1, 94	F	F	G	С	E
1/2, 0/2	D	D	D	D	
6, 7, 16, 17	D	D	D	D	
8	A	А	E	E	
2	D	D			
2/2	F	F			
09, 19, 90, 91	E	E	D	D	
39, 93	F	F	G	G	
2/7	E		E		
5/7	D	E		С	F
6/7		D	E		
7/7		F	F	F	



DKE

Flow direction	P→A	P→B	A→T	B→T	P→T	B→A	
0, 0/1, 0/2, 2/2	A	Α	В	В			
1, 1/1, 1/9, 6, 8	Α	Α	D	С			
3, 3/1, 7	Α	Α	С	D			
4	В	В	В	В	F		
5, 58	A	В	С	С	G		
1/2	В	С	С	В			
19, 91	E	E	G	G		Н	
39, 93	F	F	G	G		Н	
2/7	G			Н			
5/7	D			С	G		
6/7		G	H				
7/7		Н	Н	Н			



[15] OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%). The curves refer to application with symmetrical flow through the valve (i.e. $P \rightarrow A$ and $B \rightarrow T$). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

	DHE						
Curve	Spo AC	ol type DC					
Α	1,1/2, 8	0, 0/1, 1, 1/2, 3, 8					
в	0, 0/1, 0/2, 1/1, 1/9, 3	0/2, 1/1, 6, 7, 1/9, 19					
с	3, 3/1, 6, 7	3/1, 4, 4/8, 5, 5/1, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94					
D	4, 4/8, 5, 5/1, 16, 17, 19, 39, 58, 58/1, 09, 90, 91, 93, 94	2, 2/2					
Е	2, 2/2	-					
F	2/7, 6/7	2/7, 6/7					
G	5/7	5/7					
н	7/7	7/7					





	DKE							
Curve	Spool type AC DC							
Α	0/1	0, 0/1, 1, 1/1, 3, 3/1, 1/2, 0/2, 8						
В	4, 5, 19, 91	6, 7						
С	0, 1/1, 3, 3/1	19, 91						
D	1, 1/2, 0/2	4, 5						
E	6, 7, 8, 2/2	2/2						
F	2/7	2/7						
G	5/7	5/7						
н	6/7	6/7						
I	7/7	7/7						








atos 🛆

Safety modular valves with spool position monitoring

On-off, direct, conforming to Machine Directive 2006/42/EC - certified by 🜚







3 MAIN CHARACTERISTICS

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
	CE to Machine Directive 2006/42/EC.		
	-EC type-examination certificate for safety components (1)		
Compliance	-ISO 13849 category 1, PLC in high demand mode		
	CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC.		
	RoHS Directive 2011/65/EU as last update by 2015/863/EU		
	REACH Regulation (EC) n°1907/2006		
	Standard = $-30^{\circ}C \div +70^{\circ}C$		
Ambient temperature	/PE option = $-20^{\circ}C \div +70^{\circ}C$		
Flow direction	As shown in the symbols of table 2		
Operating pressure	Ports P,A,B: 350 bar;		
	Port T: 210 bar (DC solenoid); 160 bar (AC solenoid)		
Maximum flow	60 l/min		

(1) The type-examination certificate can be download from www.atos.com

3.1 Coils characteristics

Insulation class	H (180°C) for DC coils F (155°C) for AC coils
	Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with mating connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features 7
Supply voltage tolerance	± 10%
Certification	cURus North American standard

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C \div +80°C, with HFC hydraulic fluids = -20°C \div +50°C FKM seals (/PE option) = -20°C \div +80°C					
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s					
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog					
Hydraulic fluid	Suitable seals type Classification Ref. Standard					
Mineral oils	NBR, FKM HL, HLP, HLPD, HVLP, HVLPD DIN 51524					
Flame resistant without water	FKM HFDU, HFDR ISO 12922					
Flame resistant with water	NBR HFC ISO 12922					

5 OPTIONS

- A = Solenoid mounted at side of port B. In standard versions, solenoid is mounted at side of port A.
- \mathbf{B} = Orientation of coil and proximity connectors rotated of 180°







the manual operation is not permitted for safety valves, than they are provided with solenoid blind rings to prevent the access to the manual override.

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately)



Note: for electronic connectors type E-SD, see tab. K500

7 ELECTRIC FEATURES

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil
12 DC	12 DC			COE-12DC
14 DC	14 DC			COE-14DC
24 DC	24 DC			COE-24DC
28 DC	28 DC		30 W	COE-28DC
48 DC	48 DC	666		COE-48DC
110 DC	110 DC	000		COE-110DC
125 DC	125 DC	667		COE-125DC
220 DC	220 DC	007	007	COE-220DC
110/50 AC	110/50/60 AC		58 VA	COE-110/50/60AC (1)
230/50 AC	230/50/60 AC		(3)	COE-230/50/60AC (1)
115/60 AC	115/60 AC		80 VA	COE-115/60AC
230/60 AC	230/60 AC		(3)	COE-230/60AC
110/50 AC - 120/60 AC	110 RC	660	30 W	COE-110RC
230/50 AC - 230/60 AC	230 RC	009	50 W	COE-230RC

Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷15% and the power consumption is 52 VA.
 Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

8 TECHNICAL CHARACTERISTICS OF FV INDUCTIVE POSITION SWITCH



9 CONNECTING SCHEME OF FV INDUCTIVE POSITION SWITCH



Note: the /FV position switch is not provided with a protective earth connection

10 STATUS OF OUTPUT SIGNAL FOR MODULAR VALVES WITH /FV INDUCTIVE POSITION SWITCH

	Configur	ation 611	Configuration 614		Configuration 673	
Hydraulic configuration						
spool position	‡ ‡		A A V V	Ē		X
pin 2 OFF		₽ 1		ŧ		¥ 1
pin 4 OFF		Ŧ.		Ð		€ y

Note: FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

= intermediate spool position corresponding to the hydraulic configuration change

[11] Q/△P DIAGRAMS based on mineral oil ISO VG 46 at 50°C

Flow direction Valve type	A→A1	B→B1	A→B	A1→T	B1→T
HF-0611	1	2			
HF-0614	1	2	3		
HF-0673	3	3		4	4



12 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%)

Valve type	Curve
HF-0611	Α
HF-0614, HF-0673	В



13 DIMENSIONS [mm]



Safety directional valves with spool position monitoring

On-off, pilot operated, conforming to Machine Directive 2006/42/EC - certified by 📟





Notes:

FV = inductive position switch providing both NO and NC contacts to be wired on the electric connector

The FV inductive position switch is directly connected to the valve main spool

In pilot operated valves only the main spool position is monitored; the pilot solenoid valve is not monitored

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)



2.1 Standard spools availability

DPHE-1 are available only with spools 0, 0/2, 1, 1/2, 3, 4, 5, 58, 6, 7
DPHE-2 and DPHE-4 are available with all spools shown in the above table

- c.c. Special Shaped spools
 spools type 0 and 3 are also available as 0/1 and 3/1 with restricted oil passages in central position, from user ports to tank.
 spools type 1, 4, 5, 58, 6 and 7 are also available as 1/1, 4/8, 5/1, 58/1, 6/1 and 7/1 that are properly shaped to reduce water-hammer shocks during the switching.

2.3 Special spool availability

Valve size				special sha	aped spool			
	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
DPHE-1	•	•		•				
DPHE-2, DPHE-4	•	•	•	•	•	•	•	•

3 MAIN CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Compliance	CE to Machine Directive 2006/42/EC. -EC type-examination certificate for safety components (1) -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard = -30°C ÷ +70°C / PE option = -20°C ÷ +70°C
Flow direction	As shown in the symbols of table 2
Operating pressure	P, A, B, X = 350 bar (for pilot pressure see also option /L9 at section 6) T = 250 bar for external drain (standard) T with internal drain (option /D) = 210 bar DPHE (DC); 160 bar DPHE (AC) Y = 0 bar Minimum pilot pressure for correct operation is 8 bar
Maximum flow	DPHE-1: 160 I/min; DPHE-2: 300 I/min; DPHE-4: 700 I/min (see $Q/\Delta p$ diagrams at section 12 and operating limits at section 13)

(1) The type-examination certificate can be download from www.atos.com

3.1 Coils characteristics

Insulation class	H (180°C) for DC coils F (155°C) for AC coils
	Due to the occuring surface temperatures of the solenoid coils, the European standards
	EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features 🛛
Supply voltage tolerance	± 10%
Certification	cURus North American standard

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C \div +80°C, with HFC hydraulic fluids = -20°C \div +50°C FKM seals (/PE option) = -20°C \div +80°C					
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s					
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog					
Hydraulic fluid	Suitable seals type Classification Ref. Standard					
Mineral oils	NBR, FKM HL, HLP, HLPD, HVLP, HVLPD DIN 51524					
Flame resistant without water	FKM HFDU, HFDR ISO 12922					
Flame resistant with water	NBR	HFC				

5 HYDRAULIC OPTIONS

- **5.1 option /A** = Solenoid mounted at side of port A of main body (only for single solenoid valves) In standard version the solenoid is mounted at side of port B
 - For sensor position, see sect 16
- **5.2 option /D** = Internal drain (standard configuration is external drain)
- 5.3 option /E = External pilot pressure (standard configuration is internal pilot pressure)
- 5.4 option /R = Pilot pressure generator (4 bar on port P not for DPH*-1)

The device **/R** generates an additional pressure drop, in order to ensure the minimum pilot pressure, for correct operation of the valves with internal pilot and fitted with spools type **0**, **0/1**, **4**, **4/8**, **5**, **58**, **09**, **90**, **94**, **49**. The device **/R** has to be fitted when the pressure drop in the valve, verified on flow versus pressure diagrams, is lower than the minimum pilot pressure value.

Pressure drop through the pilot pressure generator /R







WARNING: the manual operation is not permitted for safety valves, than the valve is provided with solenoid blind rings to prevent the access to the manual override. The manual override protected by rubber cup (option /WP) is not available

500

400

WARNING: the inobservance of following prescriptions invalidates the certification and may represent a risk for personnel injury Safety valves must be installed and commissioned only by qualified personnel

Safety valves must not be disassembled

The inductive position switch FV can be adjusted only by the valve's manufacturer or Atos authorized service centers Valve's components cannot be interchanged

The valves must operate without switching shocks and spool vibrations

6 DEVICES FOR MAIN SPOOL SWITCHING CONTROL

Following options are suggested to reduce the hydraulic shocks at the valve operation

FUNCTIONAL SCHEME (config. 71)

example of switching control options

- 6.1 option /H = Adjustable chokes (meter-out to the pilot chambers of the main valve)
 6.2 option /H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve)
 6.2 option /H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve)
- **6.3 option /L9** = Only for DP-2 and DP-4: plug with calibrated restictor in P port of pilot valve, suggested in case of pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

Plug code: **PLUG-12A** Ø1,2 mm for DP-2 **PLUG-15A** Ø1,5 mm for DP-4



7 COIL VOLTAGE

Valve code	External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil DHE
	12 DC	12 DC			COE-12DC
	14 DC	14 DC			COE-14DC
	24 DC	24 DC			COE-24DC
	28 DC	28 DC		20.14/	COE-28DC
	48 DC	48 DC	666 or 667	30 10	COE-48DC
	110 DC	110 DC			COE-110DC
	125 DC	125 DC			COE-125DC
	220 DC	220 DC			COE-220DC
	24/50 AC	24/50/60 AC		58 VA (3)	COE-24/50/60AC (1)
	48/50 AC	48/50/60 AC			COE-48/50/60AC (1)
	110/50 AC	110/50/60 AC			COE-110/50/60AC (1)
	230/50 AC	230/50/60 AC			COE-230/50/60AC (1)
	115/50 AC	115/60 AC		80 VA	COE-115/60AC
	230/50 AC	230/60 AC		(3)	COE-230/60AC
	110/50 AC - 120/60 AC	110 RC	660	30 W/	COE-110RC
	230/50 AC - 230/60 AC	230 RC	009	30 W	COE-230RC

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷15% and the power consumption is 52 VA.

(2) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

8 COILS ELECTRIC CONNECTORS according to din 43650 (to be ordered separately)



9 TECHNICAL CHARACTERISTICS OF FV INDUCTIVE POSITION SWITCH



10 CONNECTING SCHEME OF FV INDUCTIVE POSITION SWITCH



Note: the /FV position switch is not provided with a protective earth connection

11 STATUS OF OUTPUT SIGNAL

DF	DPHE		Configu monitored	ration 61 position " 0 "	Configuration 63 Configuration 67 monitored position "2" monitored p		Con monito	figuratio red posi	n 71 tion " 0 "	Configur monitored	ration 75 position " 2 "		
Hydraulic configuration				7 ∎1 °	A B	□ 0	A B 2 P T		ав 102 РТ				
sp	ool posit	tion	1	0	1	2	0	2	1	0	2	1	2
sensor	pin 2	ON OFF ON		₽ 1		<u>А</u> у		₽ ₽					
side a	pin 4	OFF ON OFF		<u> </u>				Ľ		ŧ			ł
sensoi	pin 4	ON OFF								f			¥ 1
side k	pin 2	OFF								t		•	
sensor	pin 4	ON OFF								ł		. t	

Note:

FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

= intermediate spool position corresponding to the hydraulic configuration change

[12] Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50°C







DPHE-1					
Flow direction Spool type	P→A	P→B	A→T	B→T	P→T
0/2, 1/2	D	E	D	С	-
0	D	E	С	С	E
1	Α	В	D	С	-
3, 6, 7	Α	В	С	С	-
4, 4/8	В	С	D	D	-
5, 58	Α	E	С	С	F

DPHE-2

51 ME 2					
Flow direction Spool type	P→A	P→B	A→T	B→T	P→T
0/2, 1, 3, 6, 7, 8	Α	Α	D	A	-
1/1, 1/2, 7/1	В	В	D	E	-
0	Α	A	D	E	С
0/1	Α	Α	D	-	-
2	Α	A	-	-	-
2/2	В	В	-	-	-
3/1	Α	A	D	D	-
4	С	С	Н	1	F
4/8	С	С	G		F
5	Α	В	F	Н	G
5/1	Α	В	D	F	-
6/1	В	В	С	E	-
09	Α	-	-	G	-
16	Α	С	D	F	-
17	С	Α	E	F	-
19	С	-	-	G	-
39	С	-	-	Н	-
49	-	D	-	-	-
58	В	Α	F	Н	Н
58/1	В	Α	D	F	-
90	Α	Α	E	-	D
91	C	C	Ē	-	-
93	-	С	D	-	-
94	D	-	-	-	-

DPHE-4

Flow direction Spool	P→A	P→B	A→T	B→T	P→T
type	D				
	В	В	В		-
1/1		E	E	F	-
1/2	E	D	B	C	-
0	D	С	D	E	F
0/1, 3/1, 5/1, 6, 7	D	D	D	F	-
0/2	D	D	D	E	-
2	В	В	-	-	-
2/2	Е	D	-	-	-
3	В	В	D	F	-
4	С	С	Н	L	L
5	Α	D	D	D	Н
6/1	D	E	D	F	-
7/1	D	E	F	F	-
8	D	D	E	F	-
09	D	-	-	F	F
16	С	D	E	F	-
17	E	D	E	F	-
19	F	-	-	E	-
39	G	F	-	F	-
58	Ē	A	B	F	Н
58/1	E	D	D	F	-
90	D	D	D	-	F
91	F	F	D		
93	-	G	D	-	-

13 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

For a correct valve operation do not exceed the max recommended flow rates (I/min) shown in the below tables

DPHE-1

	Inlet pressure [bar]						
Spool	70	160	210	350			
	Flow rate [l/min]						
0, 1, 3, 6, 7	160	160	160	145			
4, 4/8	160	160	135	100			
5, 58	160	160	145	110			
0/1, 0/2, 1/2	160	160	145	135			

DPHE-2

	Inlet pressure [bar]					
Spool	70	140	210	350		
_	Flow rate [I/min]					
0, 1, 3, 6, 7, 8	300	300	300	300		
2, 4, 4/8	300	300	240	140		
5	260	220	180	100		
0/1, 0/2, 1/2	300	250	210	180		
16, 17, 56, *9, 9*	300	300	270	200		

DPHE-4

	Inlet pressure [bar]					
Spool	70	140	210	350		
	Flow rate [l/min]					
1, 6, 7, 8	700	700	700	600		
2, 4, 4/8	500	500	450	400		
5, 0/1, 0/2, 1/2	600	520	400	300		
0, 3	700	700	600	540		
16, 17, 58, *9, 9*	500	500	500	450		

14 SWITCHING TIMES (average values in m sec)

TEST CONDITIONS:

- Nominal voltage supply DC (direct) and AC (alternating) with connector type SP-666. The use of other connectors can affect the switching time;
- 2 bar of counter pressure on port T;
- mineral oil: ISO VG 46 at 50°C

Piloting pre	essure	70 bar		140	bar	250 bar			
Valve model		Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current		
	Switch ON	35÷50	50÷75	30÷40	45÷65	20÷30	35÷50		
DPHE-1	Switch OFF	50÷80							
	Switch ON	40÷55	55÷80	30÷45	50÷70	20÷35	40÷55		
DPRE-2	Switch OFF		60÷95						
	Switch ON	60÷95	80÷115	45÷75	60÷95	30÷50	45÷65		
DFRE-4	Switch OFF			80÷	130				

15 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. **Standard valves configuration provides internal pilot and external drain**



16 DIMENSIONS of DPHE PILOT OPERATED SAFETY VALVES [mm]



ON-OFF VALVES 806





atos 🛆

Safety cartridge valves with poppet position monitoring

screw-in, 2-way, poppet type, leak free, conforming to Machine Directive 2006/42/CE - certified by 🜚



2 HYDRAULIC CHARACTERISTICS

Model		JO-DL-4-2/FV	JO-DL-6-2/FV	JO-DL-10-2/FV				
Operating pressure	[bar]		Ports A and B 350					
Max flow	[l/min]	40	75	300				
Response time: energizing	[ms]	35	30	35				
de-energizing	[ms]	50	60	70				
Internal leakage less than 5 drops/min (≤ 0,36 cm³/min) max at 350 bar								

3 GENERAL CHARACTERISTICS

Installation position	Any position				
Cavity	JO-DL-4 = SAE-08-2N; JO-DL-6 = SAE-10-2N; JO-DL-10 = SAE-16-2N				
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007				
Compliance	CE to Machine Directive 2006/42/EC. -EC type-examination certificate for safety components (1) -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC.				
Ambient temperature	Standard execution = -20°C ÷ +50°C /PE option = -20°C ÷ +50°C				

(1) The type-examination certificate can be download from www.atos.com

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult Atos Technical Office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C						
Recommended viscosity 15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s							
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 μ m (β 10 \geq 75 recommended)						
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard				
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524				
Flame resistant without water	FKM	HFDU, HFDR	10022				
Flame resistant with water	NBR	HFC	150 12922				

5 ELECTRIC CHARACTERISTICS

Relative duty factor	100%				
Supply voltage	See model code at section 1				
Supply voltage tolerance	±10%				
Max power	20 Watt				
Power connector	666 (plastic - black); 3 pins, cable clamp PG11, cable max ø 11 mm	to be ordered			
Type of connector for /FV version	Type ZBE-06 (plastic); 4 pins, cable clamp PG9, cable max ø 8 mm	separately			
Connectore features	666: DIN 43650 - ISO 4400; IP65 (DIN 40050); VDE 0110C				
	ZBE-06: M12 - IEC60947-5-2; IP67 (DIN 40050)				

6 INSTALLATION NOTES

 The assembling of cartridges inside manifolds must be done tightening the valve exagonal ring (for tightening torque, see section 1). Excessive values can cause anomalous deformation and poppet sticking.

For the /FV versions avoid to tighten through the position sensor. 2) The CE certification is valid only with shielded electric cables and connector. Consult also tab. P004.

These safety valves must be supplied only and always as one complete component, proximity sensor is factory adjusted.

The supply of subcomponents invalidates the certification.

7 TECHNICAL CHARACTERISTICS AND CONNECTING SCHEME OF INDUCTIVE POSITION SWITCH /FV

Type of switch		position switch /FV
Supply voltage	[V]	20÷32
Ripple max	[%]	10
Max current	[mA]	400
Max peak pressure	[bar]	400
Mechanical life		virtually infinite
Switch logic		PNP



Note: the /FV position switch are not provided with a protective earth connection

8 SIGNAL STATUS - VERSIONS /FV



B: damping stroke



According the criteria of safety specifications, the poppet position signal must change its status inside the overlapping stroke (before the effective valve opening).







Safety cartridge valves with poppet position monitoring ISO standard, on-off, poppet type, conforming to Machine Directive 2006/42/EC - certified by 🜚



1 RANGE OF SAFETY CARTRIDGE MODELS

Safety cartridge valves with poppet position monitoring, CE marked and certified by TÜV, in accordance with safety requirements of Machine Directive 2006/42/EC.

They are used to cut-off the hydraulic user line, preventing undesired movements of the machine actuators.

Contactless sensor type FI (inductive proximity) or FV (inductive position switch) monitors the poppet "closed" position so that the valve "safe" condition can be clearly verified by the machine controller

Available models:

LIFI: intermediate safety element and cartridge with sensor type FI, designed for coupling with functional covers type LIDA, LIDB, LIDEW, LIDBH, to realize different hydraulic schemes.

LIDA: integral cover design and cartridge with sensor type FV (size 16-50) or FI (size 63-100), typically used to intercept the flow in one direction.

LIDAH version with solenoid pilot valve to control the poppet opening / closing.

LIDAS: actively pilot operated valve with sensor type FV.

The valve's poppet is hydraulically controlled in both open or closed position by a pilot pressure though X and Y ports.

LIDASH version with sensor type FV (size 16-50) or FI (size 63-80) and solenoid pilot valve to control the poppet opening / closing.

Certification

The TÜV certificate can be downloaded from www.atos.com, catalog on line, technical information section.

Mounting surface & cavity:

ISO 7368 size 16 to 100 Max flow: 6300 l/min at $\Delta p = 5$ bar Max pressure: up to 420 bar

Valve	size	Description	Max flow	Max	Pilot	Sensor type	
code	code ISO 7368 Description		at Δp 5 bar	[bar]	valve	/FI	/FV
LIFI	16÷50	intermediate elements with cartridge, to be coupled with a functional cover	1800	420	-	•	
LIDA /FV	16÷50	cartridge value, integral cover design	2200	420	-		•
LIDA /FI	63÷100		6300	420	-	•	
LIDAH /FV-E	16÷50	cartridge valve, integral cover design with pilot solenoid	2200	350	DHE		•
LIDAH /FV-EP	16÷50	valve	2200	420	DHEP		•
LIDAS /FV	16÷50	cartridges valve, actively pilot operated	1800	420	-		•
LIDASH /FV-E	16÷50		1800	350	DHE		•
LIDASH /FV-EP	16÷50	cartridge valve, actively pilot operated with pilot solenoid	1800	420	DHEP		•
LIDASH /FI-E	63, 80	valve	3000	350	DKE	•	
LIDASH /FI-EP	63, 80		3000	420	DKEP	•	

Notes: FI = inductive proximity sensor, type NC (normally closed)

FV = inductive position switch providing both NO and NC contacts to be wired on the electric connector See section 18 and 19 for sensor's characteristics

2 MODEL CODE OF LIFI INTERMEDIATE SAFETY ELEMENT to be coupled with covers in section 3



2.1 Hydraulic symbols of LIFI



3 MODEL CODE OF FUNCTIONAL COVERS to be coupled with LIFI safety valves (see also tech tables H030, H040) - 2 / * Α * FI-** 1 * LID Е Х 24DC Cover according to Optional different setting of calibrated ISO 7368 plugs in the pilot channels (see tech. Cover type, see section 3.1 tables H030, H040) for hydraulic configuration: Α = direct pilot Seals material: = with shuttle valve for pilot selection; в **EW*** = with solenoid valve for pilot selection = NBR **PE** = FKM BH** = as EW* but with shuttle valve for pilot selection; Series number Size ISO 7368 Voltage code only for LIDEW* and LIDBH**: 1 = 16; 2 = 25; 3 = 32; 4 = 40; 5 = 50;see section 16 **Options:** Only for LIDEW* and LIDBH**: B = cartridge piloted via port B of solenoid valve (only for LIDEW* and LIDBH**) \mathbf{X} = without connector, to be order separately see section 17 E = with external attachment X (1/4" GAS) and underneath port X plugged Type of pilot solenoid valve only for LIDBH** and LIDEW*: E = DHE Pmax 350 bar F = prearranged for coupling with LIFI cover EP = DHEP Pmax 420 bar For valve type LIDB, LIDEW (in the configuration with external pilot line) Atos can supply leak free poppet type directional pilot valves type

For valve type LIDB, LIDEW (in the configuration with external pilot line) Atos can supply leak free poppet type directional pilot valves type DLEH-3*. Consult our technical office for detailed information.

3.1 HYDRAULIC SYMBOLS OF FUNCTIONAL COVERS

the following symbols show the functional covers coupled with intermediate safety element type LIFI



4 EXAMPLES OF LIFI COUPLED WITH OTHER COVERS (examples in size 32)

А

А



A

A

5 MODEL CODE OF LIDA integral cover design



6 MODEL CODE OF LIDAH integral cover design, with pilot solenoid valve



6.1 HYDRAULIC SYMBOLS OF LIDA /FV (/FI) and LIDAH /FV



7 MODEL CODE OF LIDAS actively pilot operated



8 MODEL CODE OF LIDASH actively pilot, with pilot solenoid valve



8.1 HYDRAULIC SYMBOLS OF LIDAS



9 GENERAL CHARACTERISTICS

Assembly position	Any position				
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100				
MTTFd valves according to EN ISO 13849	150 years for LIFI, LIDA, LIDAS; 75 years for LIDAH, LIDASH for futher details see technical table P007				
Ambient temperature range	Standard = $-20^{\circ}C \div +60^{\circ}C$ /PE option = $-20^{\circ}C \div +60^{\circ}C$				
Storage temperature range	Standard = $-20^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$				
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)				
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h				
Vibration resistance	See technical table G004				
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006				

10 FLOW DIRECTION AND OPERATING PRESSURE

Flow direction	$A \rightarrow B \text{ or } B \rightarrow A$				
	LIFI A, B, X, Z1, Z2 = 420 bar;				
	LIDA /FV (size 16÷50), LIDA /FI (size 63÷100) A, B, X = 420 bar;				
	LIDAH /FV-E A, B, X = 350 bar; Y = 210 bar (DC), 160 bar (AC)				
Operating pressure	LIDAH /FV-EP A, B, X = 420 bar; Y = 210 bar (DC), 160 bar (AC)				
	LIDAS /FV A, B, X, Y, Z1, Z2 = 420 bar;				
	LIDASH /FV-E A, B, X, Z1, Z2 = 350 bar; Y = 210 bar (DC), 160 bar (AC)				
	LIDASH /FV-EP A, B, X, Z1, Z2 = 420 bar; Y = 210 bar (DC), 160 bar (AC)				

11 HYDRAULIC CHARACTERISTICS OF LIFI

Size	16	25	32	40	50
Poppet type 42					
Nominal flowat Δp 5 bar (l/min)	140	300	550	1150	1800
Area ratio A:Ap			1:1,1		
Poppet type 43					
Nominal flow at Δp 5 bar (I/min)	120	280	440	860	1370
Area ratio A:Ap	1	:2		1:1,6	

12 HYDRAULIC CHARACTERISTICS OF LIDA, LIDAH

Size		16	25	32	40	50	63	80	100
Poppet type 43	AP D	240	500	800	1400	2200	3300	4000	6300
at Δp 5 bar (I/min)									
Area ratio A:Ap		1:1,5							

13 HYDRAULIC CHARACTERISTICS OF LIDAS, LIDASH

Size		16	25	32	40	50	63	80
Maximum flow at $\Delta p = 5$ bar	[l/min]	200	300	550	1100	1800	2400	3000
Poppet characteristics		AAP Poppet areas ABP Aa = main flow (side A) Thank ABP AB = main flow (side B) the value of			Thanks to the valve a piloting line press	is to the areas ratio AAP/(AA+AB), live closing is always ensured with ting pressure (X port) equal to the ressure (A or B line).		
Аа	[cm ²]	1,43	3,46	5,30	8,04	13,85	30,19	35,68
Ab (% of Aa)		58,6	41,7	51,5	56,3	41,7	46,34	49,75
ABP (% of AA)		107,0	90,5	85,2	87,9	97,8	30,74	28,40
Aap (% of Aa)		265,6	232,2	236,7	244,1	239,2	177,0	178,20
AA / (AA + AB) poppet ratio		0,6				0,	68	
AAP / (AA + AB) piloting ratio				1,6			1,2	1,19

14 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C \div +80°C, with HFC hydraulic fluids = -20°C \div +50°C FKM seals (/PE option) = -20°C \div +80°C					
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s					
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog					
Hydraulic fluid	Suitable seals type Classification Ref. Standard					
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524			
Flame resistant without water	FKM HFDU, HFDR ISO 12022					
Flame resistant with water	NBR	HFC				

15 COILS CHARACTERISTICS

Insulation class	Pilot valve E , EP : H (180°C) for DC coils F (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 10
Supply voltage tolerance	± 10%
Certification	cURus North American Standard

16 COIL VOLTAGE

External supply nominal voltage ± 10%	Voltage code (1)	-EX, -EPX (DHE, DHEP) Power consumption (3)	-EPX (DKE, DKEP) Power consumption (3)	-EX, -EPX (DHE, DHEP) Code of spare coil pilot valve	-EX, -EPX (DKE, DKEP) Code of spare coil pilot valve
12 DC	12 DC			COE-12DC	CAE-12DC
24 DC	24 DC	30///	36W	COE-24DC	CAE-24DC
110 DC	110 DC	3000		COE-110DC	CAE-110DC
220 DC	220 DC			COE-220DC	CAE-220DC
110/50 AC (2)	110/50/60 AC	58VA (4)	-	COE-110/50/60AC	-
110/50/60 AC	110/50/60 AC	-	100VA (4)	-	CAE-110/50/60AC
115/60 AC (2)	115/60 AC	80VA (4)	130VA (4)	COE-115/60AC	CAE-115/60AC
230/50 AC (2)	000/50/60 40	58VA (4)	-	COE-230/50/60AC	-
230/50/60 AC	230/30/60 AC	-	100VA (4)	-	CAE-230/50/60AC
230/60 AC	230/60 AC	80VA (4)	130VA (4)	COE-230/60AC	CAE-230/60AC

(1) For other supply voltages available on request see technical tables of specific pilot solenoid valve.

(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 58 VA (DHE*), 90 VA (DKE*)

(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(4) When solenoid is energized, the inrush current is approx 3 times the holding current.

17 COILS ELECTRIC CONNECTORS FOR PILOT SOLENOID VALVES according to DIN EN 175201-804 (ex DIN 43651), to be ordered separately

666	6, 667 (for AC or DC s	supply)	669 (for AC :	supply)	CONNECTOR WIRING		DR WIRING
	39.5 29 30 30 30 30 30 30 30 30 30 30		666, 667 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground		669 1,2= Supply voltage VAC 3 = Coil ground		
			╽╣╙┯┯╨┸╩			SUPPLY V	OLTAGES
					666	667	669
					All voltages	24 AC or DC 110 AC or DC 220 AC or DC	110/50 AC 110/60 AC 230/50 AC 230/60 AC

18 TECHNICAL CHARACTERISTICS OF /FI INDUCTIVE PROXIMITY SENSOR

Valve type	LIFI, LIDA*/FI, LIDAS*/FI	/FI scheme	Connector type BKS-B-20-4-03
Type of switch	/FI proximity sensor	 1	1+ 4+
Supply voltage [] 10÷30		
Ripple max [9] ≤ 20	4	
Max current [m.] 200	 3	
Max peak pressure [ba] 500		1 (brown) = supply +24 Vpc
Mechanical life	virtually infinite	3 GND 4 output signal	3 (blue) = GND 4 (black) = output signal
Switch logic	PNP		CABLE LENGHT = 3 m

19 TECHNICAL CHARACTERISTICS OF /FV POSITION SWITCH

Valve type		LIDA*/FV, LIDAS*/FV	/FV scheme	Connector type ZBE-06 IP65
Type of switch		/FV proximity sensor	 1	- +
Supply voltage	[V]	20÷32		
Ripple max	[%]	≤ 10		
Max current	[mA]	400		3
Max peak pressure	[bar]	400	1 supply +24 VDC	1 = supply +24 VDC
Mechanical life		virtually infinite	2 output signal 3 GND	2 = output signal NC 3 = GND
Switch logic		PNP	4 output signal	4 = output signal NO

20 STATUS OF OUTPUT SIGNALS



WARNING: the inobservance of following prescriptions invalidates the certification and may represent a risk for personnel injury Safety valves must be installed and commissioned only by qualified personnel

Safety valves must not be disassembled

The inductive proximity FI or the inductive position switch FV can be adjusted only by the valve's manufacturer or Atos authorized service centers

Valve's components cannot be interchanged

The valves must operate without switching shocks and spool vibrations

21 Q/Ap DIAGRAMS based on mineral oil ISO VG 46 at 50 °C

21.1 Q/Ap DIAGRAMS of LIFI











1 = poppet type 42 **2** = poppet type 43



21.3 Q/Ap DIAGRAMS of LIDA /FI



Flow [l/min]



Flow [l/min]

SIZE 100





21.5 Q/Ap DIAGRAMS OF LIDASH/FI





22 INSTALLATION DIMENSIONS of LIFI [mm]



Note: for cover interface and cavity dimensions ISO 7368, see table P006

23 INSTALLATION DIMENSIONS of LIDA /FV and LIDA /FI [mm]

100

240

Ø300

-

-

175



120

G1/2"

N°8 M30x140 2100 Nm

1 OR 4087

24 INSTALLATION DIMENSIONS of LIDAH /FV [mm] (with pilot solenoid valve)



Note: for cover interface and cavity dimensions ISO 7368, see table P006

Size	А	В	B1	B2	Seal	connection port X	Fastening bolts class 12.9	Mass (Kg)
16	80	65x72	32.5	32.5	4 OR 108	G1/4"	N°4 M8x90 35 Nm	4,5
25	80	85	42.5	42.5	4 OR 108	G1/4"	N°4 M12x80 125 Nm	7,0
32	85	100	50	50	4 OR 2043	G1/4"	N°4 M16x70 300 Nm	8,2
40	91.5	125	62.5	62.5	4 OR 3043	G1/4"	N°4 M20x80 600 Nm	14,2
50	95	140	70	70	4 OR 3043	G1/4"	N°4 M20x80 600 Nm	16

25 INSTALLATION DIMENSIONS of LIDAS /FV [mm]

Size

16

25

32

40

50





9,1

51

80

Safety pressure relief valves

direct, screw-in, conforming to PED Directive 2014/68/EU - certified by



CART /PED (2) (1) CE 68) 3 overpressure. section 6. avoid any tampering. т CART M-6/420/PED Size: G1/2" ÷ M35 Ρ 1) plastic cap lead sealing ③ nameplate with factory pressure setting 1 MODEL CODE CART M-6 420 PED 1 1 1 280 * 1 Series number M-3 = G1/2 (1) M-4 = M14x1 M-5 = M20x1,5 M-6 = M33x1,5 (1) Factory pressure setting (bar):

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from

The valves are factory set at the pressure level required by the costumer, see

The pressure adjustment screw is protected with a lead sealed plastic cap to

The screw-in execution is specifically designed to reduce the dimension of blocks and manifolds, without penalizing the functional characteristics.

*

Max flow: 2,5 ÷ 150 l/min Max pressure: up to 420 bar





3 GENERAL CHARACTERISTICS

Assembly position	Any position			
Cavity	See section 9			
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007			
Ambient temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$			
Storage temperature range	Standard = -30° C \div $+80^{\circ}$ C /PE option = -20° C \div $+80^{\circ}$ C /BT option = -40° C \div $+70^{\circ}$ C			
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h			
Compliance	PED Directive 2014/68/EU - EU type-examination certificate (1) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006			

(1) The type-examination certificate can be download from www.atos.com

4 HYDRAULIC CHARACTERISTICS

Valve model	CART M-3	CART M-4	CART M-5	CART M-6	CART ARE-15	CART ARE-20
Max pressure [bar] on port P	420	420	420	420	420	420
Factory pressure setting range [bar]	25÷420	25÷420	25÷420	25÷420	25÷420	30÷420
Max pressure on port T [bar] (1)	50	50	50	50	50	50
Max flow [l/min]	2,5	15	50	60	100	150

(1) The valves should be operated without counterpressure on T line, see note 2 at section 8

(2) Max flow without conterpressure on T line, see diagrams at section B for max ammissible flow

5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$			
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s			
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog			
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard	
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water	FKM	HFDU, HFDR	150 12922	
Flame resistant with water	NBR, HNBR	HFC	100 12022	

6 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section \boxed{Z}

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (I/min)
CART M-3	0.5
CART M-4	0.5
CART M-5	2
CART M-6	2
CART ARE-15	2
CART ARE-20	2

Any tampering of the lead sealing invalidates the certification

7 NAMEPLATE MARKING



Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient





Max ammissible flow [I/min]

CART M-5 **/PED



Max ammissible flow [I/min]

CART M-6 **/PED



Max ammissible flow [l/min]









Notes:

1) The valves can operate only in the white area of the above diagrams.

The max admissible flow values within the white area are those for which the pressure increase remains within +10% with respect to the factory pressure setting.

Pressure / flow values located in gray areas cannot be performed.

A Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

2) The working range in above diagrams is valid without counterpressure in T line.

The factory pressure setting is increased by the counterpressure valve in T line.

As general rule PED valves should be operated without counter pressure in the T line.

In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

CART M-4 **/PED


10 RELATED DOCUMENTATION

CY900 Operating and maintenance information for PED certified valves

tos

Safety pressure relief valves

in line, direct, conforming to PED Directive 2014/68/EU - certified by









3 GENERAL CHARACTERISTICS

Assembly position	Any position		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$		
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$		
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h		
Compliance	² ED Directive 2014/68/EU - EU type-examination certificate (1) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006		

(1) The type-examination certificate can be download from www.atos.com

4 HYDRAULIC CHARACTERISTICS

Valve model		ARE-06	ARE-15
Max pressure on port P	[bar]	420	420
Factory pressure setting range	[bar]	25÷420	25÷420
Max pressure on port T (1)	[bar]	50	50
Max flow (2)	[l/min]	60	100

(1) Ped valves should be operated without counterpressure on T line, see note 2 at section 8

(2) For PED valves see diagrams at section 8

5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20° C ÷ $+80^{\circ}$ C, with HFC hydraulic fluids = -20° C ÷ $+50^{\circ}$ C FKM seals (/PE option) = -20° C ÷ $+80^{\circ}$ C HNBR seals (/BT option) = -40° C ÷ $+60^{\circ}$ C, with HEC hydraulic fluids = -40° C ÷ $+50^{\circ}$ C			
Recommended viscosity	$15\div100 \text{ mm}^2/\text{s}$ - max allowed range 2,8 ÷ 500 mm ² /s			
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog			
Hydraulic fluid	Suitable seals type Classification Ref. Standard			
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water	FKM	HFDU, HFDR	100 12022	
Flame resistant with water	NBR, HNBR	HFC	100 12922	

6 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section $[\overline{Z}]$

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (I/min)
ARE-06	2
ARE-15	2

 \triangle Any tampering of the lead sealing invalidates the certification

7 NAMEPLATE MARKING



Note: TS values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

8 PERMITTED WORKING RANGE (based on mineral oil ISO VG 46 at 50°C)



Notes:

- 1) The valves can operate only in the white area of the above diagrams.
- The max admissible flow values within the white area are those for which the pressure increase remains within +10% with respect to the factory pressure setting.

Pressure / flow values located in gray areas cannot be performed.

A Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

2) The working range in above diagrams is valid without counterpressure in T line.

The factory pressure setting is increased by the counterpressure valve in T line.

As general rule PED valves should be operated without counter pressure in the T line.

In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.



10 RELATED DOCUMENTATION

CY900 Operating and maintenance information for PED certified valves

*

Safety pressure relief valves

piloted, in-line, conforming to PED Directive 2014/68/EU - certified by



X = without connector (2): Connectors to be ordered separately: Configuration, see section 2 : see section 7 -00-AC = AC solenoid valve without coils - = without pilot solenoid valve -00-DC = DC solenoid valve without coils with pilot solenoid valve for venting 20, 21, 22, 32: Pilot valve (2): with pilot solenoid valve for multiple EP= DHEP for AC and DC supply, high performances pressure selection with cURus certified solenoids Factory pressure setting (bar): to be defined by the customer min step 1 bar Max pressure: (example **280** = 280 bar) 420 = 420 bar min pressure setting 30 bar

PED = EU Type examination to 2014/68/EU - certified by DEKRA Pressure range of second / third setting (1): **50** = 50 bar 100 = 100 bar 420 = 420 bar 210 = 210 bar 350 = 350 bar Е WP γ

Options, see section 9:

(1) Only for ARAM-* /20, /21, /22, /32; the set pressure cannot be higher than PED factory pressure setting

(2) Only for ARAM with pilot solenoid valve

10, 11:

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS



3 GENERAL CHARACTERISTICS

Assembly position / location Any position		Any position		
MTTFd values according to EN ISO 13849		75 years, for further details see technical table P007		
Ambient temperature	Without pilot valve	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$		
	With pilot valve	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$		
Storage temperature range	Without pilot valve	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$		
	With pilot valve	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$		
Surface protection Zinc coating with		Zinc coating with black passivation -salt spray test (EN ISO9227) > 200h		
CompliancePED Directive 2014/68/EU - EU type-examination certificate (1)RoHs Directive 2011/65/EU as last update by 2015/863/EUREACH Regulation (EC) n°1907/2006		PED Directive 2014/68/EU - EU type-examination certificate (1) RoHs Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006		

(1) The type-examinatior certificate can be download from www.atos.com

4 HYDRAULIC CHARACTERISTICS

Valve model		ARAM-20 ARAM-32		
Max pressure on ports P, X	[bar]	420		
Max pressure on ports T, Y (1)	[bar]	0 with internal drain 15 bar with external drain, option Y		
Factory pressure setting range	[bar]	25÷420		
Max flow	[l/min]	400	600	

(1) PED valves must be operated without counterpressure in T line to comply with permessible range in section 12 A max counterpressure of 15 bar is allowed only with external drain configuration (option Y)

5 ELECTRICAL CHARACTERISTICS - for ARAM with pilot solenoid valve

Insulation class	H (180°C) for DC coils; F (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See section 6
Supply voltage tolerance	± 10%
Certification	cURus North American standard

6 COIL VOLTAGE - for ARAM with pilot solenoid valve

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil
12 DC	12 DC			COE-12DC
14 DC	14 DC	-	30 W 666 or 667	COE-14DC
24 DC	24 DC	-		COE-24DC
28 DC	28 DC	-		COE-28DC
48 DC	48 DC	ĺ		COE-48DC
110 DC	110 DC	666 or		COE-110DC
125 DC	125 DC	667		COE-125DC
220 DC	220 DC	58 VA (3) 80 VA (3)		COE-220DC
110/50 AC	110/50/60 AC		58 VA (3)	COE-110/50/60AC
115/60 AC	115/60 AC		80 VA (3)	COE-115/60AC
230/50 AC	230/50/60 AC		58 VA (3)	COE-230/50/60AC
230/60 AC	230/60 AC		80 VA (3)	COE-230/60AC
110/50 AC	110BC			COE-110BC
120/60 AC		660	20.14/	
230/50 AC	230RC	009	30 W	COE-230BC
230/60 AC				

(1) In case of 60 Hz voltage frequency the performances are reduced by $10\div15\%$ and the power consumption is 58 VA

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

7 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 - for ARAM with pilot solenoid valve

The connectors must be ordered separately.

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tech table K800

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$			
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s			
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog			
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard	
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water	FKM	HFDU, HFDR	ISO 12022	
Flame resistant with water	NBR, HNBR	HFC	100 12022	

9 OPTIONS

- E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
 With option E the internal connection between port P and X of the valve is plugged.
 The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").
- WP = Prolunged manual override protected by rubber cap only for AGAM with pilot solenoid valve
- Y = External drain configuration to be selected in case of counterpressure in T line. Valves with option Y are supplied with the drain port G1/4" factory plugged with plastic plug







10 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section [1].

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (I/min)
ARAM-20	25
ARAM-32	25

Any tampering of the lead sealing invalidates the certification

11 NAMEPLATE MARKING



Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient



12 PERMISSIBLE RANGE - based on mineral oil ISO VG 46 at 50°C

Notes:

1) The valves can operate only in the white area of the above diagrams.

The max admissible flow values within the white area are those for which the pressure increase remains within +10% with respect to the factory pressure setting.

Pressure / flow values located in gray areas cannot be performed.

- A Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.
- 2) The permissible range in the above diagrams is valid only without counterpressure in T line.

In case of counterpressure in T line (up to max 15 bar) the external drain configuration (option Y) is highly recommended.

With internal drain (standard configuration), the max system pressure increases by the counter pressure value in the T line . To ensure that this increase in max system pressure does not exceed 10% of the valve's factory pressure setting, the admissible flow must be reduced dependent on the counter pressure value in the T line.



Overall dimensions refer to valves DC voltage, with connectors type 666

14 RELATED DOCUMENTATION

CY900 Operating and maintenance information for PED certified valves

Safety pressure relief valves

piloted, subplate, conforming to PED Directive 2014/68/EU - certified by





AGAM /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure. The valves are factory set at the pressure level required by the costumer, see section 10.

The pressure adjustment screw is protected with a lead sealed plastic cap to avoid any tampering.

AGAM can be equipped with a pilot solenoid valve for venting or for different pressure selection.

Size: 10, 20 and 32 - ISO 6264 Max flow: 200, 400 and 600 l/min Max pressure: 420 bar



(1) Only for AGAM-* /20, /21, /22, /32; the set pressure cannot be higher than PED factory pressure setting

(2) Only for AGAM with pilot solenoid valve

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS



3 GENERAL CHARACTERISTICS

Assembly position / location		Any position		
MTTFd values according to EN ISO 13849		75 years, for further details see technical table P007		
Ambient	Without pilot valve	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$		
temperature	With pilot valve	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$		
Storage temperature range	Without pilot valve	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$		
	With pilot valve	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$		
Surface protection		Zinc coating with black passivation -salt spray test (EN ISO9227) > 200h		
PED Directive 2014/68/EU - EU type-examination certificate (1) Compliance RoHs Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006		PED Directive 2014/68/EU - EU type-examination certificate (1) RoHs Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006		

(1) The type-examinator certificate can be download from www.atos.com

4 HYDRAULIC CHARACTERISTICS

Valve model		AGAM-10	AGAM-20	AGAM-32	
Max pressure on ports P, X	[bar]	420			
Max pressure on ports T (1)	[bar]	0 with internal drain 15 bar with external drain, option Y			
Max pressure on port Y	[bar]	0			
Factory pressure setting range	[bar]	25÷420			
Max flow	[l/min]	200 400 600			

(1) PED valves must be operated without counterpressure in T line to comply with permessible range in section 12 A max counterpressure of 15 bar is allowed only with external drain configuration (option Y)

ON-OFF VALVES 840

5 ELECTRICAL CHARACTERISTICS - for AGAM with pilot solenoid valve

Insulation class	H (180°C) for DC coils; F (155°C) for AC coils Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See section 6
Supply voltage tolerance	± 10%
Certification	cURus North American standard

6 COIL VOLTAGE - for AGAM with pilot solenoid valve

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil
12 DC	12 DC			COE-12DC
14 DC	14 DC			COE-14DC
24 DC	24 DC			COE-24DC
28 DC	28 DC		30 W	COE-28DC
48 DC	48 DC	666		COE-48DC
110 DC	110 DC	or		COE-110DC
125 DC	125 DC	667		COE-125DC
220 DC	220 DC			COE-220DC
110/50 AC	110/50/60 AC		58 VA (3)	COE-110/50/60AC
115/60 AC	115/60 AC		80 VA (3)	COE-115/60AC
230/50 AC	230/50/60 AC		58 VA (3)	COE-230/50/60AC
230/60 AC	230/60 AC		80 VA (3)	COE-230/60AC
110/50 AC	110RC			COE-110BC
120/60 AC		660	20.W/	
230/50 AC	230RC	009	30 W	COE-230BC
230/60 AC				

(1) In case of 60 Hz voltage frequency the performances are reduced by 10÷15% and the power consumption is 58 VA

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

7 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 - for AGAM with pilot solenoid valve

The connectors must be ordered separately.

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tech table K800

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$				
Seals, recommended fluid temperature	FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$				
	HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$				
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s				
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog				
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard		
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922		
Flame resistant with water	NBR, HNBR	HFC			

9 OPTIONS

- E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
 With option E the internal connection between port P and X of the valve is plugged.
 The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").
- WP = Prolunged manual override protected by rubber cap only for AGAM with pilot solenoid valve
- **WF** = Prolunged manual overhole protected by rubber cap only for AGAIN with pilot solenoid valve
- Y = External drain configuration to be selected in case of counterpressure in T line. Valves with option Y are supplied with the drain port G1/4" factory plugged with plastic plug







10 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section [1].

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (I/min)
AGAM-10	10
AGAM-20	25
AGAM-32	25

Any tampering of the lead sealing invalidates the certification

11 NAMEPLATE MARKING



Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient



Notes:

1) The valves can operate only in the white area of the above diagrams.

The max admissible flow values within the white area are those for which the pressure increase remains within +10% with respect to the factory pressure setting.

Pressure / flow values located in gray areas cannot be performed.

A Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

2) The permissible range in the above diagrams is valid only without counterpressure in T line.

In case of counterpressure in T line (up to max 15 bar) the external drain configuration (option Y) is highly recommended.

With internal drain (standard configuration), the max system pressure increases by the counter pressure value in the T line . To ensure that this increase in max system pressure does not exceed 10% of the valve's factory pressure setting, the admissible flow must be reduced dependent on the counter pressure value in the T line.



Overall dimensions refer to valves DC voltage, with connectors type 666



Overall dimensions refer to valves $\boldsymbol{\mathsf{DC}}$ voltage, with connectors type 666



	14 MOUNTING SUBPLATES - see table K280								
Valve		Subplate model	Port location	Ports			Ø Counterbore [mm]		
				Р	т	х	Р	т	:
	AGAM-10	BA-306		G 1/2"	G 3/4"	G 1/4"	30	36,5	2.
	BA-406	Borto R. T. Xundornooth:	G 3/4"	G 3/4"	G 1/4"	36,5	36,5	2.	
	AGAM-20	BA-506		G 1"	G 1"	G 1/4"	46	46	2

G 1"

G 1 1/2" G 1 1/2" G 1/4"

G 1/4"

63,5

15 RELATED DOCUMENTATION

BA-706

AGAM-32

CY900 Operating and maintenance information for PED certified valves Mass

[Kg]

1,5

3,5

3,5

6

46

63,5

Х

21,5

21,5

21,5

21,5



Table D050-1/E

Solenoid modular valves

direct, modular, spool type



3 MAIN CHARACTERISTICS

Assembly position / location	Any position			
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)			
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007			
Compliance	CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006			
Ambient temperature	Standard -30°C ÷ +70°C /PE option -20°C ÷ +70°C /BT option -40°C ÷ +70°C			
Flow direction	As shown in the symbols of table 2			
Operating pressure	Ports P,A,B: 350 bar; Port T: 210 bar (DC solenoid); 160 bar (AC solenoid)			
Maximum flow	60 l/min			

3.1 Coils characteristics

Insulation class	H (180°C) for DC coils F (155°C) for AC coils		
	Due to the occuring surface temperatures of the solenoid coils, the European standards		
	EN ISO 13732-1 and EN ISO 4413 must be taken into account		
Protection degree to DIN EN 60529	IP 65 (with mating connectors correctly assembled)		
Relative duty factor	100%		
Supply voltage and frequency	See electric features 🛛		
Supply voltage tolerance	± 10%		
Certification	cURus North American standard		

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C				
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s				
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog				
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard		
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water	FKM	HFDU, HFDR			
Flame resistant with water	NBR, HNBR	HFC			

5 OPTIONS

A = Solenoid mounted at side of port B. In standard versions, solenoid is mounted at side of port A.

 ${f B}$ = Orientation of coil and proximity connectors rotated of 180°





WP = Prolunged manual override protected by a rubber cap (not for FV)

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately)

666, 667 (for AC or DC supply)	669 (for AC supply)	CONNECTOR WIRING		
	39.5 29 30.5 30 30 30 30 30 5 0 30 5 0 30 5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0 5	666, 667 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground		669 1,2 = Supply voltage V _{AC} 3 = Coil ground
		SUPPLY VOLTAGES		
		666	667	669
		All voltages	24 AC or DC 110 AC or DC 220 AC or DC	110/50 AC 110/60 AC 230/50 AC 230/60 AC

Note: for electronic connectors type **E-SD**, see tab. K500

7 ELECTRIC FEATURES

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil
12 DC	12 DC		30 W	COE-12DC
14 DC	14 DC			COE-14DC
24 DC	24 DC			COE-24DC
28 DC	28 DC			COE-28DC
48 DC	48 DC	666		COE-48DC
110 DC	110 DC	000		COE-110DC
125 DC	125 DC	667		COE-125DC
220 DC	220 DC	007		COE-220DC
110/50 AC	110/50/60 AC		58 VA	COE-110/50/60AC (1)
230/50 AC	230/50/60 AC		(3)	COE-230/50/60AC (1)
115/60 AC	115/60 AC		80 VA	COE-115/60AC
230/60 AC	230/60 AC		(3)	COE-230/60AC
110/50 AC - 120/60 AC	110 RC	660	20 W/	COE-110RC
230/50 AC - 230/60 AC	230 RC	009	50 W	COE-230RC

Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷15% and the power consumption is 52 VA.
 Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.
 When solenoid is energized, the inrush current is approx 3 times the holding current.

Flow direction Valve type	A→A1	B→B1	A→B	A1→T	B1→T
HF-0611	1	2			
HF-0614	1	2	3		
HF-0673	3	3		4	4

8 Q/AP DIAGRAMS based on mineral oil ISO VG 46 at 50°C



9 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value (Vnom - 10%)

Valve type	Curve
HF-0611	Α
HF-0614, HF-0673	В



10 DIMENSIONS [mm]



atos 🛆

Modular relief valves type HMP, HM, KM

ISO 4401 sizes 06 and 10



3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Valve model		НМР	НМ	КМ
Max flow	[l/min]	35	60	120
Pressure range	[bar]	2÷50; 3÷100; 10÷210; 15÷350	4÷50; 5÷100;	5÷210; 5÷350

5 SEALS and HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option)= $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option)= $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	100 10000
Flame resistant with water	NBR, HNBR	HFC	150 12922

6 REGULATED PRESSURE VERSUS FLOW DIAGRAMS (Based on mineral oil ISO VG 46 at 50°C)







7 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS (Based on fluid viscosity of 25 mm²/s at 40°C)









Fastening bolts: nº 4 socket head screws M5. The lenght depends on number and type of modular elements associated.

10 INSTALLATION DIMENSIONS OF KM VALVES [mm]



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Modular sequence valves type HS-011 and KS-011

spool type, ISO 4401 size 06 and 10





3 MAIN CHARACTERISTICS SEALS and HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE	option = $-20^{\circ}C \div +70^{\circ}C$ /BT option	$n = -40^{\circ}C \div +70^{\circ}C$
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option)= $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option)= $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	100 10000
Flame resistant with water	NBR, HNBR	HFC	150 12922





Fastening bolts: n°4 socket head screws M6. The lenght depends on number and type of modular elements associated.

Mass: 3 Kg

Table **D140-16/E**

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Modular reducing valves type HG, KG, JPG-2 and JPG-3

spool type, ISO 4401 sizes 06, 10, 16 and 25



3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$		
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option)= $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option)= $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	100 10000
Flame resistant with water	NBR, HNBR	HFC	ISO 12922

4 DIAGRAMS OF HG-03*

based on mineral oil ISO VG 46 at 50°C

- 1 = regulated pressure variation versus flow:
 - between use port and discharge port
 between inlet port and use port
- 2 = differential pressure variation versus flow between inlet port and use port
- 3 = differential pressure variation versus flow between use port and discharge port
- 5 DIAGRAMS OF KG-03* based on mineral oil ISO VG 46 at 50°C
- 1 = regulated pressure variation versus flow:

 between use port and discharge port
 between inlet port and use port
- 2 = differential pressure variation versus flow between inlet port and use port
- 3 = differential pressure variation versus flow between use port and discharge port

6 DIAGRAMS OF JPG-211 based on mineral oil ISO VG 46 at 50°C

- 1 = regulated pressure variation versus flow between inlet port and use port
- 2 = differential pressure variation versus flow between use port and discharge port
- 7 DIAGRAMS OF JPG-311 based on mineral oil ISO VG 46 at 50°C
- 1 = regulated pressure variation versus flow between inlet port and use port
- 2 = differential pressure variation versus flow between use port and discharge port





















8 INSTALLATION DIMENSIONS OF HG-0 VALVES [mm]



9 INSTALLATION DIMENSIONS OF KG-0 VALVES [mm]



ON-OFF VALVES 857

D140

10 INSTALLATION DIMENSIONS OF JPG-2 VALVES [mm]



11 INSTALLATION DIMENSIONS OF JPG-3 VALVES [mm]



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Modular pressure compensators type HC, KC, and JPC-2

ISO 4401 sizes 06, 10 and 16



(1) The Δp for single flow path is fixed at 8 bar or is adjustable between 5 and 35 bar; it corresponds to values of total Δp across the value of 16 bar or between 10 and 70 bar. Threaded plugged ports Pp and P1 are suitable for pressure adjustment or check of Δp value for single flow path (reading difference between Pp and P1 values).

3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position			
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)			
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006			
Ambient temperature	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$		
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option)= $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option)= $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$			
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s			
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog			
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard	
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water	FKM	HFDU, HFDR	100 10000	
Flame resistant with water	NBR, HNBR	HFC	150 12922	

4 INSTALLATION DIMENSIONS [mm]



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Modular fast/slow valves type DHQ

compensated flow control and by-pass solenoid valve, ISO 4401 size 06



DHQ-014/*, DHQ-024/* are similar to corresponding DHQ-013/*, DHQ-023/* but control the flow through port B of solenoid valve

3 GENERAL CHARACTERISTICS

Assembly position	Any position	
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra 0,4 - flatness ratio 0,01/100	
Ambient temperature range	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$	
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +80^{\circ}C$	
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)	
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006	

4 HYDRAULIC CHARACTERISTICS

Valve model		/1	/6	/11	/16	/24
Max regulated flow	[l/min]	1,5	6	11	16	24
Min regulated flow	[cm ³ /min]	50	50	50	50	50
Regulating ∆p	[bar]	3	3	5	6,5	8
Max reverse flow through ch	eck valve [l/min]			24		
Max free flow through by-pa	ass valve [l/min]			40		
Max pressure	[bar]			250		

5 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option)= $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$		
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	120 12022
Flame resistant with water	NBR	HFC	130 12922

6 ELECTRICAL CHARACTERISTICS

Insulation class	H (180°C) for DC coils; F (155°C) for AC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See section 7
Supply voltage tolerance	± 10%

7 COIL VOLTAGE

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil DHE
12 DC	12 DC	666 or 667	30 W -	COE-12DC
14 DC	14 DC			COE-14DC
24 DC	24 DC			COE-24DC
28 DC	28 DC			COE-28DC
48 DC	48 DC			COE-48DC
110 DC	110 DC			COE-110DC
125 DC	125 DC			COE-125DC
220 DC	220 DC			COE-220DC
24/50 AC	24/50/60 AC		58 VA (3)	COE-24/50/60AC (1)
48/50 AC	48/50/60 AC			COE-48/50/60AC (1)
110/50 AC	110/50/60 AC			COE-110/50/60AC (1)
230/50 AC	230/50/60 AC			COE-230/50/60AC (1)
115/50 AC	115/60 AC		80 VA (3)	COE-115/60AC
230/50 AC	230/60 AC			COE-230/60AC
110/50 AC - 120/60 AC	110 RC	669	30 W	COE-110RC
230/50 AC - 230/60 AC	230 RC	003		COE-230RC

Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷15% and the power consumption is 52 VA.
 Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.
 When solenoid is energized, the inrush current is approx 3 times the holding current.

8 OPTIONS

 $\mathbf{K} =$ lock key for the setting knob $\mathbf{V} =$ without by-pass check valve



9 DIAGRAMS based on mineral oil ISO VG 46 at 50°C



9.2 $\, \ensuremath{\text{Q}}\xspace{-1.5ex}\xspace{-1.$



9.3 Operating limits of by-pass solenoid valve



9.4 $\,$ Q/ $\!\Delta p$ diagram through the by-pass solenoid value



1 = DHQ-013, DHQ-014 **2** = DHQ-011, DHQ-016, DHQ-023, DHQ-024

10 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

- 666 = standard connector IP-65, suitable for direct connection to electric supply source
- 667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - Imax 1A)

11 COIL WITH SPECIAL CONNECTORS only for voltage supply 12, 14, 24, 28 VDC



Note: for the electric characteristics refer to standard coils features - see section \fbox

12 INSTALLATION DIMENSIONS [mm]


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Modular throttle valves type HQ, KQ, JPQ

flow control, ISO 4401 sizes 06, 10, 16 and 25



3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position									
Subplate surface finishing	Roughness index Ra 0,4 - flatness	s ratio 0,01/100 (ISO 1101)								
MTTFd values according to EN ISO 13849	150 years, for further details see to	50 years, for further details see technical table P007								
Compliance	RoHS Directive 2011/65/EU as I REACH Regulation (EC) n°1907	oHS Directive 2011/65/EU as last update by 2015/863/EU EACH Regulation (EC) n°1907/2006								
Ambient temperature	Standard execution = -30°C ÷ +70 /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C	andard execution = $-30^{\circ}C \div +70^{\circ}C$ 'E option = $-20^{\circ}C \div +70^{\circ}C$ 3T option = $-40^{\circ}C \div +70^{\circ}C$								
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$									
Recommended viscosity	15÷100 mm²/s - max allowed rang	je 2.8 ÷ 500 mm²/s								
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638	class 9, see also filter section at ww	w.atos.com or KTF catalog							
Hydraulic fluid	Suitable seals type Classification Ref. Standard									
Mineral oils	NBR, FKM, HNBR HL, HLP, HLPD, HVLP, HVLPD DIN 51524									
Flame resistant without water	FKM	HFDU, HFDR	100 10000							
Flame resistant with water	NBR, HNBR	NBR, HNBR HFC ISO 12922								

⁻low [l/min]

125

4 DIAGRAMS OF HQ-0 based on mineral oil ISO VG 46 at 50°C 60

- 1 = Regulation diagram at Δp 10 bar (1.1 = option /U)
- 2 = Regulation diagram at Δp 30 bar (2.1 = option /U)
- 3 = Regulation diagram at Δp 50 bar (3.1 = option /U)
- $\mathbf{4} = \mathbf{Q}/\Delta \mathbf{p}$ diagram for free flow through the non-return valve







- 5 DIAGRAMS OF KQ-0 based on mineral oil ISO VG 46 at 50°C
- $\mathbf{1}$ = Regulation diagram at Δp 10 bar
- $\mathbf{2}$ = Regulation diagram at Δp 30 bar
- $\mathbf{3}$ = Regulation diagram at Δp 50 bar
- $\mathbf{4} = \mathbf{Q}/\Delta \mathbf{p}$ diagram for free flow through the non-return valve





6 DIAGRAMS OF JPQ-2 based on mineral oil ISO VG 46 at 50°C

- **1** = Regulation diagram at Δp 10 bar
- $\mathbf{2}$ = Regulation diagram at Δp 30 bar
- $\mathbf{3}$ = Regulation diagram at Δp 50 bar
- $\mathbf{4} = \mathbf{Q}/\Delta \mathbf{p}$ diagram for free flow through the non-return valve



- 7 **1** = Regulation diagram at Δp 10 bar
- $\mathbf{2}$ = Regulation diagram at Δp 30 bar
- $\mathbf{3}$ = Regulation diagram at Δp 50 bar
- $\mathbf{4} = \mathbf{Q}/\Delta \mathbf{p}$ diagram for free flow through the non-return valve









300

225

75

0

1.5

Setting [knob turns]

4.5

Flow [I/min] 150



Fastening bolts: nº 4 socket head screws M6. The lenght depends on number and type of modular elements associated.

54

10 INSTALLATION DIMENSIONS OF JPQ-2 VALVES [mm]



11 INSTALLATION DIMENSIONS OF JPQ-3 VALVES [mm]



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Modular check valves type HR, KR, JPR

direct or pilot operated, ISO 4401 sizes 06, 10, 16 and 25



3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position									
Subplate surface finishing	Roughness index Ra 0,4 - flatness	s ratio 0,01/100 (ISO 1101)								
MTTFd values according to EN ISO 13849	50 years, for further details see technical table P007									
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006									
Ambient temperature	tandard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$									
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option)= $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option)= $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$									
Recommended viscosity	15÷100 mm²/s - max allowed rang	je 2.8 ÷ 500 mm²/s								
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638	class 9, see also filter section at ww	w.atos.com or KTF catalog							
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard							
Mineral oils	NBR, FKM, HNBR HL, HLP, HLPD, HVLP, HVLPD DIN 51524									
Flame resistant without water	FKM HFDU, HFDR									
Flame resistant with water	NBR, HNBR	NBR, HNBR HFC ISO 12922								

4 DIAGRAMS OF HR-0

based on mineral oil ISO VG 46 at 50°C Flow through check valve:

- **1** = A→A1; B→B1 of HR-012, HR-013, HR-014
- **2** = A1→A; B1→B of HR-012, HR-013, HR-014
- **3** = HR-011, HR-016
- 5 DIAGRAMS OF KR-0 based on mineral oil ISO VG 46 at 50°C

Flow through check valve:

- **1** = A→A1; B→B1 of KR-012, KR-013, KR-014
- 2 = A1→A; B1→B of KR-012, KR-013, KR-014
- **3** = KR-011, KR-016
- **6 DIAGRAMS OF JPR-2** based on mineral oil ISO VG 46 at 50°C

Flow through check valve:

- $1 = A \rightarrow A_1; B \rightarrow B_1 \text{ of} \\ JPR-212, JPR-213, JPR-214$
- 2 = A1→A; B1→B of JPR-212, JPR-213, JPR-214
- 7 DIAGRAMS OF JPR-3 based on mineral oil ISO VG 46 at 50°C

Flow through check valve:

- $1 = A \rightarrow A_1; B \rightarrow B_1 \text{ of}$ JPR-312, JPR-313, JPR-314
- **2** = A1→A; B1→B of JPR-312, JPR-313, JPR-314









Differential pressure [bar]







9 INSTALLATION DIMENSIONS OF KR-0 VALVES [mm]





11 INSTALLATION DIMENSIONS OF JPR-3 VALVES [mm]



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ISO cartridges type SC LI

2 way slip-in, directional, pressure, flow, check controls



2way slip-in cartridges conforming with ISO 7368 standard cavities for installation in compact manifolds. They are available in several versions to perform directional, pressure, flow and check controls in combination with relevant functional covers.

They permit to control very high flow rates at low pressure drops, reducing the manifold dimensions respect to subplate valves.

The slip-in cartridge ① is made by a poppet ③ sliding into a sleeve ④ and kept in closed position by a spring ⑤ available with different cracking pressure valves.

Optional version **SC LIR** with sealed poppet execution is available for applications requiring improved leak-free features as hydraulic circuits with accumulators or with vertical loads.

The functional covers ② are made by a closing element with ISO 7368 mounting surface ⑦ provided with internal piloting lines for the cartridge operation. They can be equipped with pilot valves ③ and devices performing the specific control (pressure relief, flow metering, directional, check)

Sizes: 16 to 100 ISO 7368

Max flow up to 9000~I/min at $\Delta p~5$ bar Max pressure 420~bar

1 MODEL CODE							
SC LI	R -	16	43	1	*	1	*
Cartridge according to ISO 7368					Series number	-	Seals material: - = NBR PE = FKM BT = NBR low temp.
 = standard execution R = sealed poppet execution (only for poppet type 32, 33, 42, poppet type 32 not available for 	43) size		Type of poppe	Spring crack	ing pressure - see	e sec	ction [7]
100 - see section 6			Pressure contro 31, 34, 35, 36,	ols 37			
Size - see section 6			Directional, flow 32, 33 normally 42, 43 normally	v and check co closed, withou closed, with d	ontrols ut damping nose lamping nose		
16 40 80 25 50 100 32 63			Check controls 52 normally clc 62, 63, 96 norm	sed nally open			

2 GENERAL CHARACTERISTICS

Assembly position	Any position								
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100								
MTTFd valves according to EN ISO 13849	150 years, see technical table P007								
Ambient temperature range	Standard = $-30^{\circ}C \div +70^{\circ}C$ /PE option = $-20^{\circ}C \div +70^{\circ}C$ /BT option = $-40^{\circ}C \div +70^{\circ}C$								
Storage temperature range	Standard = $-30^{\circ}C \div +80^{\circ}C$ /PE option = $-20^{\circ}C \div +80^{\circ}C$ /BT option = $-40^{\circ}C \div +80^{\circ}C$								
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006								

3 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	IBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ KM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ JBR low temp. seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$										
Recommended viscosity)÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s										
Max fluid contamination level	SO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog										
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard								
Mineral oils	NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524								
Flame resistant without water FKM HFDU, HFDR											
Flame resistant with water NBR, NBR low temp. HFC											

4 SC LI CARTRIDGE AREAS

Area ratio	A	B (% of A)	Ap (% of A)
1:1	100%	0	100%
1:1,1	100%	10%	110%
1:1,5	100%	50%	150%
1:1,6	100%	60%	160%



Pressure applied to areas A and B acts to open the poppet. Pressure applied to area AP plus the spring force act to close the poppet

5 INSTALLATION - for cavity dimensions, see table P006



6 TYPE OF POPPET FOR SC LI SLIP-IN CARTRIDGES

HZ IS TYPE	SC LI-16	SC LIR-16	SC LI-25	SC LIR-25	SC LI-32	SC LIR-32	SC LI-40	SC LIR-40	SC LI-50	SC LIR-50	SC LI-63	SC LIR-63	SC LI-80	SC LIR-80	SC LI-100	SC LIR-100	Functional sketch (hydraulic symbol)	Typical section	Area ratio	Related functional cover (only for SC LI) see section 9, [10], [11], [12]
Mass [Kg]	0	.2	0	.5	0	.9	1.	.7	3	3	7	7	1	3	2	2				
31	•	-	•	-	•	-	•	-	•	-	•	-	•	-	-	-	В.		1:1	LIMM, LIMHA, LIMHC, LIC, LICM
$\Delta p = 5 \text{ bar}$	18	30	3.	70	63	30	11	00	19	00	31	00	49	000		-	AI			
32	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	-	B A		1 : 1.1	LIDA, LIDD, LIDB, LIDBH, LIDEW
Dp = 5 bar		-									-									
33 Qmax [l/min]	27	• 70	•	• 50	•	•	•	•	• 25	•	• 40	•	• 55	•	• 90	•	B A		1 : 1.5	LIDA, LIDD, LIDB, LIDBH, LIDEW
Δp = 5 bai																	E I	r a n		
34	18	- 30	0	-	0	-	-	-	-	-	-	-	-	-	-	-			1:1	LIMM, LIMHA, LIMHC
$\Delta p = 5 \text{ bar}$																				
35	•	-	•	-	•	-	•	-	•	-	-	-	-	-	-	-	× B		1:1.1	LIMM, LIMHA, LIMHC
Qmax [l/min] Δp = 5 bar	18	B0	3	70	63	30	11	00	19	00										
36	•	-	•	-	•	-	•	-	•	-	•	-	•	-	-	-	В		1:1	LIC, LICM
Qmax [l/min] $\Delta p = 5 bar$	18	30	3	70	63	30	11	00	19	00	31	00	49	000						
37	•	-	•	-	•	-	•	-	-	-	-	-	-	-	-	-			1:1	LIRA
$\Delta p = 5 \text{ bar}$	14	10 I	2	50	50	00	75	50									1			
42 Qmax [l/min]	•	•	•	•	•	•	•	•	•	•	•	•	•	•	-	-	В		1:1.1	LIDA, LIDD, LIDB, LIDBH, LIDEW
$\Delta p = 5 \text{ bar}$	2-						14				00									
43	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	В		1:1.5	LIDA, LIDD, LIDB, LIDBH, LIDEW
$\Delta p = 5 \text{ bar}$	24	+0	50	50	0		14		22	00	33		40		03					
52 Qmax [l/min]	•	-	•	-	•	-	•	-	•	-	-	-	-	-	-	-			1:1.1	LIDA
$\Delta p = 5 \text{ bar}$			40	00	00		12		10											
62	•	-	•	-	•	-	•	-	•	-	-	-	-	-	-	-			1:1.1	LIDO
$\Delta p = 5 \text{ bar}$	16	50	40	00	60	00	12	00	18	00							A			
63	•	-	•	-	•	-	•	-	•	-	-	-	-	-	-	-	₿		1 : 1.1	LIDO
$\Delta p = 5 \text{ bar}$	10		40		00		12		10								A			
69	•	-	•	-	•	-	•	-	•	-	-	-	-	-	-	-	B A		1 : 1.6	

normally available from stock

on requestnot available

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

7.1 Type of poppets for directional and check controls SC LI and SC LIR

Type of pop	opet		3	2			3	3			4	2			4	3	
Functional sl (Hydraulic sy	ketch mbol)			AF	,			AF	2	AP B				AP AB			
Area ratio A:Ap	C		1:	1,1			1:	1,5			1:	1,1			1:	1,5	
Operating pre	ssure						420 bar max										
				Nomina	al flow a	at ∆p 5	bar (l/m	in) see	diagrar	ms Q/Δp at section 8							
Size 16			2	70			2	70			24	40			2	40	
Size 25			5	50		550					50	00			50	00	
Size 32			10	000			10	000			80	00			80	00	
Size 40			17	00			17	00			14	00			14	00	
Size 50			25	00			25	00			22	00			22	00	
Size 63			40	000			40	00			33	00			33	00	
Size 80			55	00			55	00			40	00			40	00	
Size 100			90	000			90	00				-		6300			
Cracking pressure (bar)																	
Spring (1)		1	2	3	6	1	2	3	6	1	2	3	6	1	2	3	6
Size 16	A→B	0.3	1.5	3	5.3	0.6	1.6	2.9	5.1	0.3	1.7	3.3	6.1	0.7	1.9	3.3	5.7
	B→A	3.2	16	30.5	50.3	1.2	3.2	5.8	10	3.6	17.7	34.5	63.4	1.3	3.7	6.5	11.2
Size 25 (2)	A→B	0.3	1.5	3	5	0.6	1.4	3	5	0.3	1.7	3.3	6.1	0.7	1.5	3.3	5.8
	B→A	3.1	15.1	30.5	50.3	1.2	2.8	5.9	9.9	3.5	17.1	33.3	61.4	1.3	3	6.5	11.3
Size 32 (3)	A→B	0.3	1.5	3	5	0.6	1.6	3	5.4	0.3	1.7	3.7	6.3	0.7	1.8	3.4	6.3
	B→A	3.5	17	34.2	56.7	1.2	3.2	6	10.7	3.9	18.8	41.6	71.1	1.4	3.6	6.9	12.7
Size 40	A→B	0.3	1.5	3	5	0.6	1.5	3	5.5	0.4	1.8	3.5	6.4	0.7	1.8	3.6	7.3
	B→A	2.9	14.7	29.4	48.3	1.2	3	6	11	3.5	17.2	34	62	1.3	3.6	7.2	14.6
Size 50	A→B	0.3	1.5	3	4.3	0.6	1.6	3	4.8	0.4	1./	3.4	5.2	0.7	1.9	3.4	5.7
	B→A	3.6	16.9	33.8	48.4	1.4	3.6	6.7	10.8	4.2	18.9	38.1	58.9	1.5	4.4	1.1	12.9
Size 63	A→B	0.3	1.5	2.9	4.2	0.6	1.5	2.9	5.8	0.4	1.7	3.4	4.7	0.7	1.8	3.3	6.5
	B→A	3.1	15	29.2	42	1.3	3.3	6.4	12.5	3.6	10.0	33.8	47.2	1.5	4	1.2	14.1
Size 80	A→B	0.3	1.5	3	4.6				0.3	1.7	3.3	4.9	U./	1.8	3.3	10.9	
	B→A	3	14.8	29.2	45.2	1.3	3.1 1.5	0.3	11.2	3.4	16.6	32.9	48.8	1.4	3.8	20	12.4
Size 100	a→B B→A	0.3 3	1.5	3 30.5		1.2	3	6.3	ю 12.2					1.5	3.9	3.8 7.8	14.9

(1) Spring type 1 is not available for SC-LIR size 16 to 40

(2) Cracking pressure for SC LIR-25 (A-B / B-A): SC LIR-25332 = 2.1 bar / 4.1 bar

SC LIR-25432 = 2.3 bar / 4.5 bar

(3) Cracking pressure for SC LIR-32 (A-B / B-A): SC LIR-32332 = 2.1 bar / 4.2 bar SC LIR-32432 = 2.3 bar / 4.6 bar

7.2 Type of poppets for check controls SC LI

Type of poppet		5	52		62	63					
Functional sketch (Hydraulic symbol)		A	AP B		B B	B B					
Area ratio A:Ap		1:	1,1		1:1,1	1:1,1					
Operating pressure		420 bar max									
		Nom	inal flow a	at ∆p 5 ba	r (l/min) see diagrams Q/ Δ p at section [8					
Size 16		160			160	160					
Size 25		4	00		400	400					
Size 32		6	00		600	600					
Size 40		12	200		1200	1200					
Size 50		18	300		1800 1800						
				Crac	king pressure (bar)						
Spring	1	2	3	6	3	6					
Size 16 A→B	0.3	1.5	3	6							
Size 25 A→B	A→B 0.3 1.5 3 6		6								
Size 32 A→B	0.3	1.5	3	6	Normally open	Normally open					
Size 40 A→B	0.3	1.5	3	6							
Size 50 A→B	0.3	1.5	3	6							

7.3 Type of poppets for pressure controls SC LI

Type of po	ppet		31			34			3	5		36	3	37
Functional s (Hydraulic s	sketch ymbol)	tch bol)		A AP					C B	P				
Area ratio A:A	vp		1:1			1:1			1:	1,1		1:1	1	:1
Operating pro	essure						4	120 ba	ar max	(
			Ν	Iominal	flow at	∆p 5 ba	r (I/min)	see d	iagrar	ns Q//	Ap at s	ection 8		
Size 16		180				180			18	30		180	1-	40
Size 25			370			-			37	70		370	2	50
Size 32			630			-			63	30		630	5	00
Size 40			1100			-			11	00		1100	7	50
Size 50			1900			-			19	00		1900		-
Size 63			3100			-		-				3100		-
Size 80			4900			-		-				4900		-
						Crac	king pr	essur	e (ba	-)				
Spring		2	3	6	2	3	6	1	2	3	6	6	4	7
Size 16	A→B	1.2	3	6	1.2	3	6	0.3	1.2	3	6	6	4	7
0120 10	B→A												4	7
Size 25	A→B	1.2	3	6				0.3	1.2	3	6	6	4	7
0120 20	B→A												4	7
Size 32	A→B	1.2	3	6				0.3	1.2	3	6	6	4	7
	B→A												4	7
Size 40	A→B	1.2	3	6				0.3	1.2	3	6	6	4	7
	B→A												4	7
Size 50	A→B	1.2	3	6				0.3	1.2	3	6	6		
	B→A											_		
Size 63	A→B	1.2	3	6								6		
	B→A													
Size 80	A→B	1.2	3	6								6		
	B→A													

7.4 Poppet area SC LI and SC LIR

Area	Poppot type	Size (1)										
(cm ²)	Роррег туре	16	25	32	40	50	63	80	100			
	31, 34	2.32	4.68	7.55	11.95	18.10	33.18	47.78	69.40			
	36	2.27	4.52	8.04	12.57	19.63	20.43	-	-			
A	37	2.54	4.91	8.04	12.57	-	-	-	-			
	32, 35, 42, 52, 63	2.87	5.60	9.35	15.07	25.97	40.15	51.53	86.43			
	33, 43	2.09	4.08	6.79	11.04	19.63	30.19	38.48	63.62			
	31, 34	0.22	0.23	0.49	0.62	1.54	3.13	2.48	9.14			
	36	0	0	0	0	0	0	-	-			
В	37	0	0	0	0	-	-	-	-			
	32, 35, 42, 52, 63	0.28	0.56	0.83	1.55	2.31	4.03	5.22	8.61			
	33, 43	1.05	2.07	3.39	5.57	8.64	13.99	18.26	31.42			
	31, 34	2.54	4.91	8.04	12.57	19.63	36.32	50.27	78.54			
Ар	36	2.54	4.91	8.04	12.57	19.63	20.43	-	-			
	37	2.54	4.91	8.04	12.57	-	-	-	-			
	32, 35, 42, 52, 63	3.14	6.16	10.18	16.62	28.27	44.18	56.75	95.03			
	33, 43	3.14	6.16	10.18	16.62	28.27	44.18	56.75	95.03			

7.5 Poppet stroke and pilot volume SC LI and SC LIR

		Bonnot tuno				Size	e (1)			
		Popper type	16	25	32	40	50	63	80	100
		31, 34	0.5	0.71	1.11	1.31	1.52	1.85	2.19	3.00
		36	0.52	0.82	1.15	1.30	1.52	1.27	-	-
Stroke	(cm)	37	0.60	0.67	0.92	1.05	-	-	-	-
		32, 35, 42, 52, 63	0.80	1.00	1.31	1.70	2.10	2.61	2.80	3.80
		33, 43	0.90	1.11	1.40	1.90	2.30	2.80	3.00	3.87
		31, 34	1.27	3.49	8.93	16.46	29.85	67.19	110.08	235.62
		36	1.32	4.03	9.25	16.34	29.85	25.94	-	-
Pilot volume	(cm ³)	37	1.53	3.29	7.40	13.19	-	-	-	-
		32, 35, 42, 52, 63	2.51	6.16	13.28	28.25	59.38	115.89	159.89	361.13
		33, 43	2.83	6.83	14.25	31.49	65.03	123.70	170.24	367.78
		31, 34	7.63	20.91	53.56	98.77	179.07	403.12	660.49	1413.72
		36	7.94	24.15	55.49	98.02	179.07	155.66	-	-
Theoretical pilot flow (2)	(l/min)	37	9.16	19.73	44.39	79.17	-	-	-	-
		32, 35, 42, 52, 63	15.08	36.95	79.70	169.51	356.26	690.51	953.32	2166.76
		33, 43	16.96	41.01	85.50	188.96	390.19	742.20	1021.41	2206.67

(1) See section is for the availability of different sizes for each poppet type(2) Theoretical pilot flow with switching time = 10ms

8.1 Poppets type 32, 33, 42, 43 for directional, flow and check controls





8.3 Poppets type 31, 34, 35, 36, 37 for pressure controls



Flow [l/min]







1 = poppet type 31, 34, 35, 36 **2** = poppet type 37

Note:

poppet type 34 only for size 16 poppet type 37 for size 16 to 40

9 FUNCTIONALS COVERS - DIRECTIONAL CONTROL, see table H030

Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 100	SC LI cartridges
Direct operated directional control valve with solenoid valve for pilot selection LIDEW*	16 25 32 40 50 63 80 100	z_1 r z_1 r z_1 r z_1 r z_1 r r r z_2 r r r r r r r r		SC LI-**32* SC LI-**33* size 16 100 SC LI-**42* size 16 80 SC LI-**43* size 16 100
Direct operated directional control valve with solenoid valve and shuttle valve for pilot selection LIDBH1A = open when solenoid is de-energized LIDBH1C = closed when solenoid is de-energized	16 25 32 40 50 63 80 100	1A WXIII a		SC LI-**32* SC LI-**33* size 16 100 SC LI-**42* size 16 80 SC LI-**43* size 16 100
Direct operated directional control valve with solenoid and shuttle valve for pilot selection LIDBH2A = when solenoid is de-energized only connections X→F LIDBH2C = when solenoid is de-energized only connections Z1→F	16 25 32 40 50 63 80 100	2A $WXIII b \overline{a}XII W 2C\overline{a}XII W 2C$		SC LI-**32* SC LI-**33* size 16 100 SC LI-**42* size 16 80 SC LI-**43* size 16 100

10 FUNCTIONALS COVERS - CHECK FUNCTION, see table H040

Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 25	Functional cover size 32 ÷ 80	SC LI cartridges
Direct operated check valve normally closed LIDA	16 25 32 40 50 63 80 100		x y		SC LI-**32* SC LI-**33* size 16 100 SC LI-**42* size 16 80 SC LI-**43* size 16 100 SC LI-**52* size 16 50
Direct operated check valve normally open LIDO	16 25 32 40 50		P T		SC LI-**62* SC LI-**63* size 16 50
Direct operated check valve with shuttle valve for pilot selection	16 25 32				SC LI-**32* SC LI-**33* size 16 63
selection 40 LIDB 50 63				SC LI-**42* SC LI-**43* size 16 63	
Direct operated check valve with hydraulically operated	16 25 32				SC LI-**32* SC LI-**33* size 16 63
LIDR	40 50 63	$\begin{array}{c} & \overset{PP}{\underset{X}{}} \underbrace{\overset{P}{\underset{Z}{\bigoplus}} \psi \overset{P}{\underset{X}{\bigoplus}} \psi \overset{P}{\underset{X}{\bigoplus}} \psi \overset{P}{\underset{X}{\bigoplus}} \overset{P}{\underset{X}{\longmapsto}} \overset{P}{\underset{X}{\varinjlim}} \overset{P}{\underset{Y}{\underset{X}{\varinjlim}}} \overset{P}{\underset{Y}{\underset{X}{\varinjlim}}} \overset{P}{\underset{X}{\underset{X}{\varinjlim}}} \overset{P}}{\underset{Y}{\underset{X}{\varinjlim}}} \overset{P}{\underset{Y}{\underset{X}{\underset{X}{\varinjlim}}} \overset{P}}{\underset{Y}{\underset{Y}{\underset{X}{\varinjlim}}} \overset{P}{\underset{Y}{\underset{X}{\underset{X}}}} \overset{P}{\underset{Y}{\underset{X}{\underset{X}}} \overset{P}{\underset{X}{\underset{X}}} \overset{P}}{\underset{Y}{\underset{X}}} \overset{P}{\underset{X}} \overset{P}}{\overset{P}} \overset{P}}{\overset{P}} \overset{P}{\underset{X}}} \overset{P}{\underset{X}} \overset{P}}{\underset{Y}} \overset{P}}{\underset{Y}}} \overset{P}}{\underset{Y}}} \overset{P}}{\underset{Y}} \overset{P}$		Ĭ I I V	SC LI-**42* SC LI-**43* size 16 63

H003

11 TYPICAL FUNCTIONS OF COVERS - PRESSURE CONTROL, see table H010

Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 32	Functional cover size 40 ÷ 80	SC LI cartridges
Pressure relief control with	16 25 32				SC LI-**31* size 16 80
LIMM	40 50	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \\ \end{array} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \end{array} \\ $			size 16
	63 80	A	X Y	X HF X	SC LI-**35* size 1650
Pressure relief control with	16 25	╸╡╢╢╖╺┎ ┍╴╼╌╴╴╴			SC LI-**31* size 1680
LIMHA = unloading when solenoid is de-energized	32 40 50				SC LI-**34* size16
solenoid is energized	63 80				SC LI-**35* size1650
Pressure reducing control with manual setting. Open in resting position LIRA	16 25 32 40		x - 1		SC LI-**37* size 1640
Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 25	Functional cover size 32 ÷ 80	SC LI cartridges
Pressure compensator to be coupled with flow control values	16 25 32 40		less and a second s		SC LI-**31* size 1680
LIC 40 63 80		I I I I I I I I I I I I I I I I I I I	x r		SC LI-**36* size 1680
Pressure compensator with mechanical max pressure regulation to be coupled with	16 25 32				SC LI-**31* size 1680
flow control valves.	50 63 80				SC LI-**36* size 1680

12 FUNCTIONAL COVERS - FLOW CONTROL, see table H020

Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 63	SC LI cartridges
Flow control with stroke limiter	16 25 32	₽₽ ₽ ₽		SC LI-**32* SC LI-**33* size 1663
LIDD	40 50 63		x y y	SC LI-**42* SC LI-**43* size 1663

13 RELATED DOCUMENTATION

H020 ISO ca	artridge valves type LIDD
H030 ISO ca	artridge valves type LIDEW* and LIDBH*
H040 ISO ca	artridge valves type LID*

atos 🛆

ISO cartridge valves type LIDEW* and LIDBH*

directional control, high flow, Pmax 420 bar



Directional control valves in ISO cartridge design, used to intercept or to permit the flow passage according to the selected pilot control. They are made by a functional cover ① and a 2-way **SC LI** slip-in cartridge.

LIDEW: functional cover with or without pilot solenoid valve for cartridge operation, available in different configurations depending to the function to be performed.

LIDBH as LIDEW plus shuttle valve for pilot pressure selection.

with different poppet shape to optimize the control, see section **6**.

It is made by a poppet ② sliding into a sleeve ③ and kept in normally closed position by the spring ④ available with different cracking pressure values.

Size: 16 to 100 ISO 7368

Max flow up to **9000** l/min at $\Delta p = 5$ bar Max pressure up to **420 bar**



(1) for solenoid valve's characteristics, see following technical tables:

DHEtech. table E015DHEPtech. table E030DHLtech. table E018DKEtech. table E025DKEPtech. table E035

(2) Not available for LIDEW*-L



3 OPTIONS

- For LIDEW*, LIDBH* covers (sizes 40...100):
- /E = with external attachments Pp and underneath port X supplied plugged;

For all the models:

- **/B** = cartridge piloted via port "B" of solenoid pilot valve;
- //F = prearranged for coupling to an intermediate element with poppet position detector for safety function. See tab. EY120.
 //WP = prolonged manual override protected by rubber cap for solenoid pilot valve. See table K150.
 *** = Calibrated plugs different from standard ones reported in section [7]. The restrictors configuration (if different from the standard) must be indicated at the end of the model code:

LIDEW2 - 1 /* - EX 24DC	**	Р		06		
		Channel where the ori provided: P = channel X, port P F = channel F	fice has to be Z1 = channel Z1 Z2 = channel Z2	Size of the thr 05 = 0,5 mm 06 = 0,6 mm 08 = 0,8 mm	ottling hole in tel 10 = 1 mm 12 = 1,2 mm 15 = 1,5 mm	nths of millimeters: 17 = 1,7 mm 20 = 2 mm

4 STANDARD ORIFICES CONFIGURATION

Cover	LIDEW*-1	LIDEW*-2	LIDEW*-3	LIDEW*-4	LIDEW*-5	LIDEW*-6	LIDEW*-8	LIDEW*-10
Port	LIDBH*-1	LIDBH*-2	LIDBH*-3	LIDBH*-4	LIDBH*-5	LIDBH*-6	LIDBH*-8	LIDBH*-10
Z1 (only for LIDBH*-*)	M4	M4	M6	M6	M6	M6	M8	M8
	12A	12A	15A	17A	20A	20A	20A	20A
Р	M6	M6	M6	M6	M6	M6	M8	M8
	12A	12A	15A	17A	20A	20A	20A	25A

M4 ÷ M8 = screw size; 12A ÷ 20A = calibrated orifices diameter in tenths of mm; A = short calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES



6 TYPE OF POPPET

Type of po	oppet		3	2			3	3			4	2			4	3	
Functional s (Hydraulic s	sketch symbol)	AP A			AP A			AP B				AP B					
Typical se	ection																
Area ratio A:A	٨p		1:	1,1			1:	1,5			1:	1,1			1:	1,5	
Operating pr	essure								420 ba	ar max							
				Nomina	al flow a	at ∆p 5	bar (l/m	iin) see	diagrar	ns Q/Δp	o at sec	tion 🤋					
Size 16			2	70			2	70			24	40			24	40	
Size 25			5	50			5	50			50	00			50	00	
Size 32			10	000			10	00			80	00			80	00	
Size 40			17	00			17	00			14	00			14	00	
Size 50			25	00			25	00			22	00			22	00	
Size 63			40	000			40	00			33	00		3300			
Size 80			55	00			55	00		4000			4000				
Size 100			90	000			90	00		-			6300				
						С	racking	press	ure (bar	.)							
Spring		1	2	3	6	1	2	3	6	1	2	3	6	1	2	3	6
Size 16	A→B	0.3	1.5	3	5.3	0.6	1.6	2.9	5.1	0.3	1.7	3.3	6.1	0.7	1.9	3.3	5.7
	В→А	3.2	16	30.5	50.3	1.2	3.2	5.8	10	3.6	17.7	34.5	63.4	1.3	3.7	6.5	11.2
Size 25	A→B	0.3	1.5	3	5	0.6	1.4	3	5	0.3	1.7	3.3	6.1	0.7	1.5	3.3	5.8
-120 20	В→А	3.1	15.1	30.5	50.3	1.2	2.8	5.9	9.9	3.5	17.1	33.3	61.4	1.3	3	6.5	11.3
Size 32	A→B	0.3	1.5	3	5	0.6	1.6	3	5.4	0.3	1.7	3.7	6.3	0.7	1.8	3.4	6.3
	B→A	3.5	17	34.2	56.7	1.2	3.2	6	10.7	3.9	18.8	41.6	71.1	1.4	3.6	6.9	12.7
Size 40	A→B	0.3	1.5	3	5	0.6	1.5	3	5.5	0.4	1.8	3.5	6.4	0.7	1.8	3.6	7.3
	B→A	2.9	14.7	29.4	48.3	1.2	3	6	11	3.5	17.2	34	62	1.3	3.6	7.2	14.6
Size 50	А→В	0.3	1.5	3	4.3	0.6	1.6	3	4.8	0.4	1.7	3.4	5.2	0.7	1.9	3.4	5.7
	B→A	3.6	16.9	33.8	48.4	1.4	3.6	6.7	10.8	4.2	18.9	38.1	58.9	1.5	4.4	7.7	12.9
Size 63	A→B	0.3	1.5	2.9	4.2	0.6	1.5	2.9	5.8	0.4	1.7	3.4	4.7	0.7	1.8	3.3	6.5
	B→A	3.1	15	29.2	42	1.3	3.3	6.4	12.5	3.6	16.6	33.8	47.2	1.5	4	7.2	14.1
Size 80	A→B	0.3	1.5	3	4.6	0.6	1.5	3	5.3	0.3	1.7	3.3	4.9	0.7	1.8	3.3	5.9
	B→A	3	14.8	29.2	45.2	1.3	3.1	6.3	11.2	3.4	16.6	32.9	48.8	1.4	3.8	7	12.4
Size 100	A→B	0.3	1.5	3		0.6	1.5	3.1	6					0.7	1.9	3.8	7.4
1	B→A	3	15	30.5		1.2	3	6.3	12.2					1.5	3.9	7.8	14.9

7 MAIN CHARACTERISTIC, SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location		Any position						
Subplate surface finishing		Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)						
MTTFd values according to I	EN ISO 13849	150 years, for further details see	e technical table P007					
Compliance		CE to Low Voltage Directive 20 RoHS Directive 2011/65/EU as I REACH Regulation (EC) n°1907	14/35/EU ast update by 2015/863/EU //2006					
Ambient temperature		Standard execution = -30°C ÷ / PE option = -20°C ÷ +70°C / BT option = -40°C ÷ +70°C	+70°C					
Seals, recommended fluid te	emperature	NBR seals (standard) = -20°C = FKM seals (/PE option)= -20°C HNBR seals (/BT option)= -40°C	+ +80°C, with HFC hydraulic fluids + +80°C C + +60°C, with HFC hydraulic flu	$s = -20^{\circ}C \div +50^{\circ}C$ ids = -40°C ÷ +50°C				
Recommended viscosity		15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s						
Max fluid contamination leve	1	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog						
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard				
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524				
Flame resistant without water		FKM	HFDU, HFDR					
Flame resistant with water		NBR, HNBR HFC ISO 12922						
Flow direction		From $A \rightarrow B$ or $B \rightarrow A$						
Functional cover	Pilot valve E, L	L Ports A, B, X, Z1, Z2: 350 bar Port Y: 210 bar for DC version; 160 bar for AC version						
operating pressure	Pilot valve EP	Ports A, B, X, Z1, Z2: 420 bar	Port Y: 210 bar for DC \	version; 160 bar for AC version				

7.1 Coils characteristics

Insulation class	(180°C) for DC coils F (155°C) for AC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO
	13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature
Supply voltage tolerance	± 10%
Certification	cURus North American Standard (not for -L)

8 COIL VOLTAGE

External supply nominal voltage ± 10%	Voltage code (1)	-LX (DHL) Power consumption (3)	-EX, -EPX (DHE*) Power consumption (3)	-EPX (DKE*) Power consumption (3)	-LX (DHL) Code of spare coil pilot valve	-EX, -EPX (DHE*) Code of spare coil pilot valve	-EX, -EPX (DKE*) Code of spare coil pilot valve
12 DC	12 DC				COL-12DC	COE-12DC	CAE-12DC
24 DC	24 DC	20/0/	30///	361/1	COL-24DC	COE-24DC	CAE-24DC
110 DC	110 DC	2.500	3000	5000	COL-110DC	COE-110DC	CAE-110DC
220 DC	220 DC				COL-220DC	COE-220DC	CAE-220DC
110/50 AC (2)	110/50/60 AC	58VA (4)	58VA (4)	-	COL-110/50/60AC	COE-110/50/60AC	-
110/50/60 AC	110,00,00 /10	-	-	100VA (4)	-	-	CAE-110/50/60AC
115/60 AC (2)	115/60 AC	58VA (4)	80VA (4)	130VA (4)	COL-115/60AC	COE-115/60AC	CAE-115/60AC
230/50 AC (2)		58VA (4)	58VA (4)	-	COL-230/50/60AC	COE-230/50/60AC	-
230/50/60 AC	230/50/60 AC		-	100VA (4)	-	-	CAE-230/50/60AC
230/60 AC	230/60 AC	58VA (4)	80VA (4)	130VA (4)	COL-230/60AC	COE-230/60AC	CAE-230/60AC

(1) For other supply voltages available on request see technical tables E015, E018, E025.
(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHL), 52 VA (DHE*), 90 VA (DKE*)

(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(4) When solenoid is energized, the inrush current is approx 3 times the holding current.





Notes referred to the below table:

(1)	LIDEW1*, LIDBH*C: solenoid at side of port Y of cover;
	LIDEW2*, LIDBH*A: solenoid at side of port X of cover;

Size (1)	А	В	С	D (max)	E (max)	F	G	H max LIDEW	H max LIDBH	I	J	К	L (max)	Ports Pp-Dr	Ports Z1-Z2	Seals	Fastening bolts DIN 912 class 12.9	Tightening torque [Nm]	Mass [Kg]
16	70	65	29	104	70.5	4	3	90,5	130,5	40	-	-	125	-	-	4 OR-108	N°4 M8x45	35	2.6÷3
25	85	85	42.5	104	69.5	6	5	90,5	130,5	40	-	-	125	-	-	4 OR-108	N°4 M12x45	125	3÷3.4
32	100	100	50	156	42.5	6	5	100,5	140,5	50	-	-	135	-	-	4 OR-2043	N°4 M16x55	300	3.5÷4
40	125	125	62.5	166	49.5	6	5	110,5	150,5	60	3.5	-	145	G1/4"	-	4 OR-3043	N°4 M20x70	600	6.4÷7
50	140	140	70	140	42	4	6	120,5	160,5	70	3.5	3.5	155	G1/4"	G1/4"	4 OR-3043	N°4 M20x80	600	9.5÷10
63	180	180	90	151	22	4	6	130,5	170,5	80	3.5	3.5	165	G3/8"	G3/8"	4 OR-3050	N°4 M30x90	2100	17÷17.7
80	Ø250	-	125	-	-	6	8	152,5	202,5	80	3.5	3.5	187	G3/8"	G3/8"	4 OR-3075	N°8 M24x90	1000	27÷27.7
100	Ø300	-	150	-	-	8	10	182,5	222,5	100	3.5	3.5	217	G1/2"	G1/2"	4 OR-3093	N°8 M30x120	2100	53÷54

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On-off active cartridges type LIDAS, 2-way

directional control



(1) Not available for LIMH*-L

2 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)



3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUIDS

Assembly position / le	ocation		Any posit	ion									
Subplate surface finis	shing		Roughne	ss index Ra	a 0,4 - flatr	ness ratio 0	,01/100 (IS	O 1101)					
MTTFd valves accord	ling to EN	ISO 13849	LIDAS =	150 years	LIDAS	6H = 75 yea	ars						
Compliance			CE to Lo RoHS Di REACH F	w Voltage rective 20 Regulation	Directive 11/65/EU a (EC) n°19	2014/35/E as last upo 907/2006	U date by 20	15/863/EU	J				
Flow direction			$B \rightarrow A (p$	$B \rightarrow A$ (preferred) or $A \rightarrow B$									
Piloting		LIDAS	Pressure	to X = clos	se Pre	essure to Y	= open						
		LIDASH	De-energ	ized = clo	se En	ergized =	open						
Operating	LIDAS		Ports A,	B, X, Z1, Z	2, Y: 420	oar							
pressure		Pilot valve E, L	Ports A,	B, X, Z1, Z	2: 350 bar	ŕ	Port Y:	210 bar fo	or DC vers	sion; 160	bar for AC	version	
	LIDAGIT	Pilot valve EP	Ports A,	B, X, Z1, Z	2: 420 bar	·	Port Y:	210 bar fo	or DC vers	sion; 160	bar for AC	version	
Size			1	6	2	25		2	4	0	5	0	
Maximum flow		Poppet 31	2	40	450		700		1400		21	00	
at $\Delta p = 5$ bar [l/min]		Poppet 33	2	20	400		600		1300		2000		
		Poppet 43	2	00	3	360		550		00	1800		
Poppet characteris	stics	Poppet type	31	33, 43	31	33, 43	31	33, 43	31	33, 43	31	33, 43	
AA [cm ²]			2,27	1,43	4,91	3,46	8,04	5,30	12,56	8,04	19,63	13,85	
AB (% of AA)	0	58,6	0	41,7	0	51,5	0	56,3	0	41,7			
ABP (% of AA)			67,5	107,0	63,8	90,5	56,3	85,2	56,3	87,9	69	97,8	
AAP (% of AA)			167,5	265,6	163,8	232,2	156,3	236,7	156,3	244,1	169	239,2	
AA/(AA + AB) popper	t ratio		1 for poppet 31 0,6 for poppet 33, 43										
AAP / (AA + AB) pilotin	g ratio		1,6 for poppet 31 1,6 for poppet 33, 43										

3.1 Coils characteristics (only for LIDASH)

Insulation class	H (180°C) for DC coils F (155°C) for AC coils
	Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO
	13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature
Supply voltage tolerance	± 10%
Certification	cURus North American Standard (not for -L)

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$, with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$, with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$							
Recommended viscosity	15÷100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s							
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog							
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard					
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524					
Flame resistant without water	FKM	HFDU, HFDR	150 12922					
Flame resistant with water	NBR, HNBR	HFC						

5 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 - the connectors must be ordered separately

Code of connector	Function						
666 Connector IP-65, suitable for direct connection to electric supply source							
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source.						
669	With built-in rectifier bridge for supplying DC coils by alternating current (AC 110V and 230V - Imax 1A).						

For other available connectors, see tab. K800

6 ELECTRIC FEATURES

Solenoid valve type	Externa nominal ± 10°	I supply I voltage % (1)	Voltage code	Type of connector	Power consumption (3)	Code of spare coil DHE, DHEP	Code of spare coil DHL
DHE	DC	12 DC 24 DC 110 DC 220 DC	12 DC 24 DC 110 DC 220 DC	666 or 667	29 W (DHL) 30 W (DHE, DHEP)	COE-12DC COE-24DC COE-110DC COE-220DC	COL-12DC COL-24DC COL-110DC COL-220DC
DHL	AC	110/50 AC (2) 115/60 AC 120/60 AC 230/50 AC (2) 230/60 AC	110/50/60 AC 115/60 AC 120/60 AC 230/50/60 AC 230/60 AC	666 or 667	58 VA (4)	COE-110/50/60AC COE-115/60AC COE-230/50/60AC COE-230/60AC	COL-110/50/60AC COL-115/60AC COL-230/50/60AC COL-230/60AC

(1) For other supply voltages available on request see technical tables E015, E030, E018.

(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA for DHL and 52VA for DHE and DHEP
(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(4) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

7 Q/Ap DIAGRAMS based on mineral oil ISO VG 46 at 50 °C

0

300

600

900

Flow rate [l/min]

1500

1200

0

500

1000

Flow rate [l/min]



1500 2000 2500

8 INSTALLATION DIMENSIONS [mm]



Note: for mounting interface and cavity dimensions, see tech. table P006

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ISO cartridge valves type LIM*, LIRA, LIC*

Pressure controls: relief, reducing, compensator - Pmax 420 bar



(1) Pressure range 420 bar not available for LIMH*-E and LIMH*-L; LIMH*-EP is available only for pressure range 420 bar (2) Not available for LIMH*-L

ON-OFF VALVES

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2 HYDRAULIC SYMBOLS



3 OPTIONS

Only for LIMM (size 16...32):

/P = predisposed for ISO 4401 size 06 mounting surface

Handwheel for pressure control, only for LIMM, LIMH*, LIRA, LICM (see tech. table K150):

N = regulating handwheel (available for all the sizes)

- **/VF** = regulating knob (available only for sizes 40...80)
- **/VS** = manual override with safety locking (available only for sizes 40...80)
- /WP = prolonged manual override protected by rubber cap for pilot solenoid valve

For all the models:

*** = calibrated plugs different from standard one. The restrictors configuration (if different from the standard) must be indicated at the end of the model code:

LIMHA - 1 / 210 - EX 24DC **	F	06
		Size of the throttling hole in tenths of millimeters:
	Channel where the orifice has to be provided:	05 = 0,5 mm 10 = 1 mm 06 = 0.6 mm 12 = 1.2 mm
	X = channel X F = channel F	08 = 0,8 mm 15 = 1,5 mm 000 = without restrictors

4 STANDARD ORIFICES CONFIGURATION

Cover Port	LIM*-1	LIRA-1	LICM-1	LIC-1	LIM*-2	LIRA-2	LICM-2	LIC-2	LIM*-3	LIRA-3	LICM-3	LIC-3	LIM*-4	LIRA-4	LICM-4	LIC-4	LIM*-5	LICM-5	LIC-5	LIM*-6	LICM-6	LIC-6	LIM*-8	LICM-8	LIC-8
Х	M4	M4	M4	M4	M4	M4	M4	M4	M6	M6	M6	M6	M6	M6	M6	M6	M6	M6	M6	M6	M6	M6	M8	M8	M8
	10A	08A	08A	-	10A	08A	08A	-	10A	08A	12A	10A	10A	12A	10A	10A	10A	10A	10A	10A	10A	10A	10A	10A	10A
F	M4	M4	M4	M4	M4	M4	M4	M4	M6	M6	M6	M6	M6	M6	M6	M6	M6	M6	M6	M6	M6	M6	M8	M8	M8
	12F	12A	05F	05F	12F	12A	05F	05F	12F	12A	12F	05F	12F	08A	12F	12F	12F	12F	12F	12F	12F	12F	12F	12F	12F

M4 ÷ M8 = screw size; 10A ÷ 12F = calibrated orifice diameter in tenths of mm; A = short calibrated hole, F = long calibrated hole - = without orifice;



6 TYPE OF POPPET

Type of poppet			31			34			3	5		36	3	7	
Functional (Hydraulic	sketch symbol)									С В	P				
Typical s	ection														
Area ratio A:	Ар		1:1			1:1			1:	1,1		1:1	1	:1	
Operating p	ressure		420 bar max												
			N	lominal	flow at	∆p 5 ba	ar (I/min)	see d	iagrar	ns Q//	∆p at s	ection 8			
Size 16			180			180			18	30		180	14	40	
Size 25			370			-			3	70		370	2	50	
Size 32			630			-		630				630	50	00	
Size 40			1100			-			11	00		1100	7:	50	
Size 50	ze 50					-			19	00		1900		-	
Size 63			3100			-				-		3100		-	
Size 80			4900			-				-		4900		-	
						Crac	king pr	essur	e (ba	r)					
Spring		2	3	6	2	3	6	1	2	3	6	6	4	7	
Size 16	A→B	1.2	3	6	1.2	3	6	0.3	1.2	3	6	6	4	7	
	В→А												4	7	
Size 25	A→B	1.2	3	6				0.3	1.2	3	6	6	4	7	
0120 20	В→А												4	7	
Size 32	A→B	1.2	3	6				0.3	1.2	3	6	6	4	7	
0120 02	В→А												4	7	
Size 40	A→B	1.2	3	6				0.3	1.2	3	6	6	4	7	
0120 40	В→А												4	7	
Size 50	A→B	1.2	3	6				0.3	1.2	3	6	6			
Size 50 B→A															
Size 63	A→B	1.2	3	6								6			
	В→А														
Sizo 80	A→B	1.2	3	6								6			
0120 00	B→A														

7 MAIN CHARACTERISTICS SEALS AND HYDRAULIC FLUIDS

Assembly position / lo	ocation	Any position							
Subplate surface finis	shing	Roughness index Ra 0,4 - flatness	ratio 0,01/100 (ISO 1101)						
MTTFd values accord	ding to EN ISO 13849	150 years, for further details see technical table P007							
Ambient temperature		Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C							
Compliance		CE to Low Voltage Directive 2014, RoHS Directive 2011/65/EU as las REACH Regulation (EC) n°1907/20	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006						
Seals, recommended	I fluid temperature	80°C, with HFC hydraulic fluids = -20 +80°C - +60°C, with HFC hydraulic fluids =	0°C ÷ +50°C -40°C ÷ +50°C						
Recommended visco	sity	15÷100 mm²/s - max allowed rang	e 2.8 ÷ 500 mm²/s						
Fluid contamination of	lass	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 μ m (β 25 \geq 75 recommended)							
Hydraulic fluid		Suitable seals type	Classification	Ref. Standard					
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524					
Flame resistant witho	ut water	FKM	HFDU, HFDR	100 10000					
Flame resistant with v	vater	NBR, HNBR	150 12922						
Flow direction		As shown in the symbols of table 2							
Functional cover	all models except LIMH*	Ports A, B, X: 420 bar;							
operating	LIMH*-E, LIMH*-L	Ports A, B, X: 350 bar; Port T 210	bar for DC version; 160 bar for AC	version					
pressure LIMH*-EP Ports A, B, X: 420 bar; Port T 210 bar for DC version; 160 bar for AC version									

7.1 Coils characteristics

Insulation class	H (180°C) for DC coils F (155°C) for AC coils
	Due to the occurring surface temperatures of the solenoid coils, the European standards
	EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 🔊
Supply voltage tolerance	± 10%
Coil certification	cURus North American Standard (not for -L)

8 FLOW /Ap DIAGRAMS based on mineral oil ISO VG 46 at 50 °C











1 = poppet type 31, 34, 35, 36 **2** = poppet type 37

Note:

poppet type 34 only for size 16 poppet type 37 for size 16 to 40

9 ELECTRIC FEATURES

Solenoid valve type	Externa nominal ± 10°	l supply voltage % (1)	Voltage code	Type of connector	Power consumption (3)	Code of spare coil DHE, DHEP	Code of spare coil DHL
DHE	DC	12 DC 24 DC 110 DC 220 DC	12 DC 24 DC 110 DC 220 DC	666 or 667	29 W (DHL) 30 W (DHE, DHEP)	COE-12DC COE-24DC COE-110DC COE-220DC	COL-12DC COL-24DC COL-110DC COL-220DC
DHL	AC	110/50 AC (2) 115/60 AC 120/60 AC 230/50 AC (2) 230/60 AC	110/50/60 AC 115/60 AC 120/60 AC 230/50/60 AC 230/60 AC	666 or 667	58 VA (4)	COE-110/50/60AC COE-115/60AC COE-230/50/60AC COE-230/60AC	COL-110/50/60AC COL-115/60AC COL-230/50/60AC COL-230/60AC

(1) For other supply voltages available on request see technical tables E015, E030, E018.

(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA for DHL and 52VA for DHE and DHEP

(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(4) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.



10 COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions see tech. table P006





LIMH* (size 40...80)





For options /V, /VF, /VS, refer to the LIMM drawing

Covers	А	В	С	D	E (max)	F	G	Port Pp-Dr	Seals	Fastening bolts DIN 912 class 12.9	Tightening torque [Nm]	Mass [Kg]
LIMH*-1	65 (1)	40	91	123.5	150	4	3	-	2 OR-108	N°4 M8x45	35	1.7
LIMH*-2	85	40	91	134.5	148	6	5	-	2 OR-108	N°4 M12x45	125	2.2
LIMH*-3	100	50	101	142.5	155	6	5	-	2 OR-2043	N°4 M16x55	300	3.5
LIMH*-4	125	60	151	195	205	6	5	G 1/4"	2 OR-3043	N°4 M20x70	600	8.9
LIMH*-5	140	70	161	202.5	213	4	6	G 1/4"	2 OR-3043	N°4 M20x80	600	12.4
LIMH*-6	180	80	171	222.5	233	4	6	G 3/8"	2 OR-3050	N°4 M30x90	2100	21.6
LIMH*-8	Ø250	80	201	257.5	268	6	8	G 3/8"	2 OR-4075	N°4 M24x90	1000	30.5

(1) Cover is not squared: 65x80

Overall dimensions refer to the pilot valves with connectors type 666



ISO cartridge valves type LIDD

Flow control



LIDD are flow control valves not compensated, in ISO cartridge design, made by a functional "cover" ① and a 2-way SC LI slip-in cartridge.

Covers are provided with regulating screw to adjust the cartridge opening.

The cartridge is made by poppet (2) sliding into a sleeve (3). The position of the spool or poppet and then the controlled flow, is manually set on the regulating screw of the cover; the cracking pressure value depends on poppet spring.

Size: **16 to 63** ISO 7368 Max flow up to **4000** I/min at Δp 5 bar Max pressure: **LIDD 420 bar**

1 MODEL CODE FOR COVERS - for model code of slip-in cartridge/spool, see section 3



(1): New series 50 of LIDD cover is highly recommended in combination with new high flow cartridges series 40 The use of old cartridges series 10, 11 and 31 may cause the impossibility to fully close the poppet

3 MODEL CODE OF SLIP-IN CARTRIDGES - for LIDD



(1) New series 40 is mechanically interchangeable with standard flow series 31, 11 and 10 - cavity according to ISO 7368 New series 50 of LIDD cover is highly recommended in combination with new cartridges series 40 The use of old cartridges series 10, 11 and 31 may cause the impossibility to fully close the poppet

4 TYPE OF POPPET

Type of poppet		32			33				42				43				
Functional sketch (Hydraulic symbol)		AP B				AP B				AP B				AP B			
Typical section																	
Area ratio A:Ap			1:	1,1		1:1,5				1:1,1				1:1,5			
Operating pre	420 bar max																
Nominal flow at Δp 5 bar (I/min) see diagrams Q/ Δp at section 7																	
Size 16		270				2	70			24	40		240				
Size 25		550				550				500				500			
Size 32		1000				1000				800				800			
Size 40		1700				1700				1400				1400			
Size 50		2500			2500				2200				2200				
Size 63		4000			4000				3300				3300				
						C	racking	pressu	ire (bar)							
Spring		1	2	3	6	1	2	3	6	1	2	3	6	1	2	3	6
Size 16	A→B	0.3	1.5	3	5.3	0.6	1.6	2.9	5.1	0.3	1.7	3.3	6.1	0.7	1.9	3.3	5.7
	В→А	3.2	16	30.5	50.3	1.2	3.2	5.8	10	3.6	17.7	34.5	63.4	1.3	3.7	6.5	11.2
Size 25	A→B	0.3	1.5	3	5	0.6	1.4	3	5	0.3	1.7	3.3	6.1	0.7	1.5	3.3	5.8
	В→А	3.1	15.1	30.5	50.3	1.2	2.8	5.9	9.9	3.5	17.1	33.3	61.4	1.3	3	6.5	11.3
Size 32	A→B	0.3	1.5	3	5	0.6	1.6	3	5.4	0.3	1.7	3.7	6.3	0.7	1.8	3.4	6.3
	B→A	3.5	17	34.2	56.7	1.2	3.2	6	10.7	3.9	18.8	41.6	71.1	1.4	3.6	6.9	12.7
Size 40	A→B	0.3	1.5	3	5	0.6	1.5	3	5.5	0.4	1.8	3.5	6.4	0.7	1.8	3.6	7.3
	В→А	2.9	14.7	29.4	48.3	1.2	3	6	11	3.5	17.2	34	62	1.3	3.6	7.2	14.6
Size 50	A→B	0.3	1.5	3	4.3	0.6	1.6	3	4.8	0.4	1.7	3.4	5.2	0.7	1.9	3.4	5.7
	В→А	3.6	16.9	33.8	48.4	1.4	3.6	6.7	10.8	4.2	18.9	38.1	58.9	1.5	4.4	7.7	12.9
Size 63	A→B	0.3	1.5	2.9	4.2	0.6	1.5	2.9	5.8	0.4	1.7	3.4	4.7	0.7	1.8	3.3	6.5
	В→А	3.1	15	29.2	42	1.3	3.3	6.4	12.5	3.6	16.6	33.8	47.2	1.5	4	7.2	14.1
5 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID

Assembly position / location	Any position										
Subplate surface finishing	Roughness index Ra 0,4 - flatness	s ratio 0,01/100 (ISO 1101)									
MTTFd values according to EN ISO 13849	150 years, for further details see t	echnical table P007									
Ambient temperature	Standard execution = -30°C ÷ +7	70°C /PE option = -20°C ÷ +70°C /B	ST option = $-40^{\circ}C \div +70^{\circ}C$								
Compliance	RoHS Directive 2011/65/EU as REACH Regulation (EC) n°1907	last update by 2015/863/EU 7/2006									
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ - FKM seals (/PE option) = -20°C ÷ HNBR seals (/BT option) = -40°C	JBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C ⁻ KM seals (/PE option) = -20°C ÷ +80°C 									
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s										
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638	3 class 9, see also filter section at www	v.atos.com or KTF catalog								
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard								
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524								
Flame resistant without water	FKM	HFDU, HFDR									
Flame resistant with water	NBR, HNBR HFC ISO 12922										
Flow direction	A to B or B to A										
Functional cover operating pressure	ports X, Y: 420 bar										

6 OPTIONS

/E = with external attachments X and underneath port X supplied plugged;

*** = Calibrated plugs different from standard ones. LIDD covers in standard executions are not equipped with restrictors in the pilot channels. When ordering covers equipped with restrictors, it must be indicated at the end of the model code:



Note: For LIDD-*/E, the calibrated orifices are located in the lateral port for external attachment Calibrated orifices are not available for LIDD-1/E (size 16)

7 Q/AP DIAGRAMS - based on mineral oil ISO VG 46 at 50°C

SC LI slip-in cartridges, poppet type 32, 33, 42, 43

1 = poppet type 32 and 33

2 = poppet type 42 and 43











8 LIDD COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions, see tech. table P006



ISO cartridge valves type LID*

Check function, high flow, Pmax 420 bar



Directional control valves in ISO cartridge design, specific for check functions. They are made by a functional cover ① and a 2-way **SC LI** slip-in cartridge. Covers are available with different

check functions:

LIDA, normally closed

LIDO, normally open

LIDB, normally closed with shuttle valve for pilot pressure selection

LIDR, normally closed with pilot operated check valve

The SC LI slip-in cartridge is available with different poppet shape to optimize the check control, see section **I**.

It is made by a poppet (2) sliding into a sleeve (3) and kept in normally closed position (open position for type 62 and 63) by the spring (4) available with different cracking pressure values.

Size: **16 to 100** ISO 7368 Max flow up to **9000** I/min at $\Delta p = 5$ bar Max pressure up to **420 bar**

1 MODEL CODE OF FUNCTIONAL COVERS - for model code of slip-in cartridge, see section 5, 7



(1) LIDR functional cover operates as normally closed check valve with pilot control for bidirectional flow - see the below functional scheme as reference.

Free flow is normally permitted from A to B and blocked form B to A by the pressure on X pilot port The flow from B to A is permitted by opening the valve though the pressure on pilot port Z1 **Piloting ratio Z1 : X = 1 : 2.75**





3 OPTIONS

For LIDA (sizes 16 and 25), for LIDO (all sizes) LIDB (sizes 40 ÷ 63), LIDR (sizes 40 ÷ 63):

/E = with external attachments Pp and underneath port X supplied plugged;

For LIDA, LIDB, LIDR:

/F = prearranged for coupling to an intermediate element with position detector for safety valves, see tab. EY120.

For all models:

= Calibrated plugs different from standard ones reported in section 4. The restrictors configuration (if different from the standard) it must be indicated at the end of the model code:



4 STANDARD ORIFICES CONFIGURATION

Cover Port	LIDA-1	LIDO-1	LIDB-1	LIDR-1	LIDA-2	LIDO-2	LIDB-2	LIDR-2	LIDA-3	LIDO-3	LIDB-3	LIDR-3	LIDA-4	LIDO-4	LIDB-4	LIDR-4	LIDA-5	LIDO-5	LIDB-5	LIDR-5	LIDA-6	LIDB-6	LIDR-6	LIDA-8	LIDA-10
х	M4	M4	-	-	M4	M6	-	-	-	-	-	-	-												
	-	10A	-	-	-	10A	-	-	-	12A	-	-	-	15F	-	-	-	15F	-	-	-	-	-	-	-
P	-	-	M6	M6	-	-	M6	M6	M6	M6	M6	M8	M8												
F	-	-	-	12A	-	-	-	12A	15A	-	-	15A	17A	-	-	17A	20A	-	-	20A	20A	-	20A	20A	25A
70	-	-	M4	M4	-	-	M6	M6	M6	M6	M6	M8	-												
~~~	-	-	-	00F	-	-	-	OOF	-	-	-	00F	-	-	-	OOF	-	-	-	00F	-	-	00F	-	- 1

M4 ÷ M6 = screw size;
 10A ÷ 00F = calibrated orifices diameters in tenths of mm;
 A = short calibrated hole, F = long calibrated hole;
 = without orifice;



32, 33 (size 16 to 100) = without damping nose

**42** (size 16 to 80) = as 32 but with damping nose **43** (size 16 to 100) = as 33 but with damping nose



Spring cracking pressure, see section 6 : 1, 2, 3, 6

6 TYPE OF POPPET

Type of po	ppet		3	2			3	3			4	2			4	3		
Functional s (Hydraulic sy	Functional sketch (Hydraulic symbol)					A A	AF B	2		A A	AF	9	AP B					
Typical section																		
Area ratio A:A	.:Ap <b>1:1,1</b>					1:	1,5			1:	1,1			1:	1,5			
Operating pre	essure					420 bar max												
Nominal flow at Δp 5 bar (I/min) see diag																		
Size 16			270				2	70			24	40			24	40		
Size <b>25</b>			550				55	50			50	00			50	00		
Size <b>32</b>		1000				10	00			80	00			80	00			
Size <b>40</b>		1700			1700				1400				1400					
Size <b>50</b>		2500				2500				2200				2200				
Size <b>63</b>	<b>63</b> 4000					40	00		3300					33	00			
Size <b>80</b>	e <b>80</b> 5500				55	00		4000					40	00				
Size 100		90	000			90	00		-					63	00			
						C	racking	press	<b>ire</b> (bar	)					I			
Spring		1	2	3	6	1	2	3	6	1	2	3	6	1	2	3	6	
Size 16	A→B	0.3	1.5	3	5.3	0.6	1.6	2.9	5.1	0.3	1.7	3.3	6.1	0.7	1.9	3.3	5.7	
	B→A	3.2	16	30.5	50.3	1.2	3.2	5.8	10	3.6	17.7	34.5	63.4	1.3	3.7	6.5	11.2	
Size <b>25</b>	A→B	0.3	1.5	3	5	0.6	1.4	3	5	0.3	1.7	3.3	6.1	0.7	1.5	3.3	5.8	
	B→A	3.1	15.1	30.5	50.3	1.2	2.8	5.9	9.9	3.5	17.1	33.3	61.4	1.3	3	6.5	11.3	
Size <b>32</b>	A→B	0.3	1.5	3	5	0.6	1.6	3	5.4	0.3	1./	3.7	6.3	0.7	1.8	3.4	6.3	
	B→A	3.5	1/	34.2	50.7	1.2	3.2	2	10.7 5.5	3.9	10.0	41.0	6.4	0.7	3.0	0.9	7.2	
Size <b>40</b>		2.0	14.7	20.4	18.3	1.2	1.0	6	11	3.5	17.0	3.0	62	1.2	3.6	7.2	14.6	
	D→A A \R	0.3	14.7	23.4	40.5	0.6	16	3	10	0.4	17.2	3.4	5.2	0.7	1.0	3.4	5.7	
Size <b>50</b>	A→D B→A	3.6	16.9	33.8	4.5	1.4	3.6	67	10.8	4.2	1.7	38.1	58.9	1.5	4.4	7.7	12.9	
	D→A A→B	0.3	1.5	29	42	0.6	1.5	2.9	5.8	0.4	1 7	3.4	4 7	0.7	1.8	3.3	6.5	
Size 63	B→A	3.1	15	29.2	42	1.3	3.3	6.4	12.5	3.6	16.6	33.8	47.2	1.5	4	7.2	14.1	
	A→B	0.3	1.5	3	4.6	0.6	1.5	3	5.3	0.3	1.7	3.3	4.9	0.7	1.8	3.3	5.9	
Size <b>80</b>	B→A	3	14.8	29.2	45.2	1.3	3.1	6.3	11.2	3.4	16.6	32.9	48.8	1.4	3.8	7	12.4	
	A→B	0.3	1.5	3		0.6	1.5	3.1	6					0.7	1.9	3.8	7.4	
Size 100	В→А	3	15	30.5		1.2	3	6.3	12.2					1.5	3.9	7.8	14.9	
B→A			1	1			1	1	1								I	

7 MODEL CODE OF SLIP-IN CARTRIDGES type 52, 62, 63 for LIDA and LIDO



#### 8 TYPICAL FUNCTIONS OF POPPETS

Type of poppet		52				62	63							
Functional sketch (Hydraulic symbol)				AP B		B B	AP B							
Typical section														
Area ratio A:Ap			1:	1,1		1:1,1	1:1,1							
Operating pressure						420 bar max								
	Nominal flow at Δp 5 bar (I/min) see diagrams Q/Δp at section 10													
Size <b>16</b>			16	60		160	160							
Size <b>25</b>			4(	00		400	400							
Size <b>32</b>	600				600	600								
Size <b>40</b>			12	00		1200	1200							
Size <b>50</b>			18	00		1800	1800							
					Crac	king pressure (bar)								
Spring		1	2	3	6	3	6							
Size 16 A-	∍B	0.3	1.5	3	6									
Size 25 A-	∍B	0.3	1.5	3	6									
Size 32 A-	→B	0.3	1.5	3	6	Normally open	Normally open							
Size 40 A-	→B	0.3	1.5	3	6									
Size 50 A-	∍B	0.3	1.5	3	6									

#### 9 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID

Assembly position / location	Any position								
Subplate surface finishing	Roughness index Ra 0,4 - flatness	ratio 0,01/100 (ISO 1101)							
MTTFd values according to EN ISO 13849	150 years, for further details see te	echnical table P007							
Compliance	RoHS Directive 2011/65/EU as I REACH Regulation (EC) n°1907	ast update by 2015/863/EU /2006							
Ambient temperature	<b>Standard</b> execution = -30°C ÷ +7 /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C	0°C							
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +80^{\circ}C$ , with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option) = $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option) = $-40^{\circ}C \div +60^{\circ}C$ , with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$								
Recommended viscosity	15÷100 mm²/s - max allowed rang	e 2.8 ÷ 500 mm²/s							
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638	class 9, see also filter section at ww	w.atos.com or KTF catalog						
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard						
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524						
Flame resistant without water	FKM	HFDU, HFDR	100 10000						
Flame resistant with water	NBR, HNBR HFC ISO 12922								
Flow direction	As shown in the symbols of table	2							
Functional cover operating pressure	Ports P, A, B, X, Z1, Z2: <b>420</b> bar								

10 Q/AP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

10.1 SC LI slip-in cartridges, poppet type 32, 33, 42, 43



LIDA-5

LIDO-5

LIDA-6

LIDA-8

LIDA-10

140

180

Ø250

Ø250

140

180

-

-

70

110

80

80

80

20

20

30 73

30 73 6

66

66 4 6

4

6 8

6 3.5 3.5

10 3.5 3.5

3.5 3.5

3.5

3.5



11 COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions, see tech. table P006



9.3

17.1

27

54

600

2100

1000

2100

H040

G 1/4"

G 3/8"

G 3/8"

G 1/2"

G 1/4"

G 3/8'

G 3/8"

G 3/8'

4 OR-3043

1 OR-3043

4 OR-3050

2 OR-4075

2 OR-4075

N°4 M20x80

N°4 M20x110

N°4 M30x90

N°4 M24x90

N°4 M30x120

ON-OFF VALVES 908







SENSORS		Size	Pmax [bar]	Table	Pag
E-ATR-8	pressure transducer with amplified analog output signal	G1/4"	400	GS465	912
PRESSURE S	WITCHES				
E-DAP-2	electronic pressure switch with digital output signals and display	G1/4"	400	GS470	914
MAP	manual pressure switch with fixed differential switching pressure		630	D250	916
SUBPLATES					
BA	single station, mounting surfaces ISO 4401, 6264 and 5781	06 ÷ 32	350	K280	918
	25				
Auxiliary han	d levers for on-off and proportional valves			E138	922
HANDWHEEL	_S & KNOBS				
Regulating ho	andwheels and knobs for on-off and proportional valves			K150	924
CONNECTOR	S				
Electric and e	lectronic connectors for transducers, pumps, on-off and proportional va	lves		K800	926

Supplementary components range available on www.atos.com

#### Table GS465-2/E

## 

## Pressure transducers type E-ATR-8

analog, for open and closed loop systems



#### 1 MODEL CODE



**160** = 0 ÷ 160 bar **250** = 0 ÷ 250 bar  $400 = 0 \div 400$  bar

### = voltage output signal 0 ÷ 10 V I = current output signal 4 ÷ 20 mA

#### E-ATR-8

This pressure transducers measure the static and dynamic pressure of the hydraulic fluid, supplying a voltage or current output signal.

The sensor is composed by a thin-film circuit (1), with high resistance to overloads and pressure peaks.

The integrated electronic circuit (2) supplies an amplified voltage or current output signal, proportional to the hydraulic pressure, with thermal drift compensation.

E-ATR-8 equip pressure control digital proportional valves with integral transducer and electronics, REB/RES execution.

They are also used in association with other Atos digital proportionals to perform closed loop pressure controls:

- variable displacement axial piston pumps, PE(R)S execution (see tech table AS170)
- · directional control valves with additional closed loop pressure control, SP and SF options on TES/LES execution (see tech table FS500)

#### Features:

· Factory preset and calibrated

- Standard 5 pin M12 main connector (3)
- IP67 protection degree
- CE mark according to EMC directive

#### 2 MAIN CHARACTERISTICS

Pressure measuring range	0 ÷ 60/100/160/250/400 bar; other values availables on request Note: negative pressure can damage the pressure transducer
Overload pressure	2 x FS without exceeding 600 bar
Burst pressure	5 x FS without exceeding 1700 bar
Response time	≤ 2 ms
Temperature range	Operating -40 ÷ +100 °C; Storage -40 ÷ +100 °C; Fluid: -40 ÷ +100 °C
Thermal drift	@ zero: $\leq \pm 0,025$ % FS/°C max; @ FS: $\leq \pm 0,025$ % FS/°C max
Accuracy	≤ ±1,2 % FS
Non-Linearity	≤ ±0,5 % of FS (BFSL) as per IEC 61298-2
Fluid Compatibility	Hydraulic oil as per DIN51524535; for water-glycol, phosphate ester and skydrol [®] , please contact Atos technical department
Power supply	24 Vpc nominal; 14 ÷ 30 Vpc for standard (8 ÷ 30 Vpc for /I option); Imax 25 mA
Output signal	Standard: voltage output signal 0 ÷ 10 V (3 pins); Min load > maximum output signal / 1 mA /I option: current output signal 4 ÷ 20 mA (2 pins); Max load ≤ (power supply - 8 V) / 0,02 mA
Wiring protections	Against reverse polarity on power supply and short-circuit on output signal
Materials	Wetted parts: stainless steel 316L (13-8 PH for sensor); seals: FPM/FKM
Mass	Approx. 57 g
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE EN 61326 emission (group 1, class B) and immunity (industrial application)
Service life	1x10 ⁶ load cycles
MTTF	> 100 years
Compliance	RoHs Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006
Vibration resistance	20 g according to DIN EN 60068-2-6 from 20 to 2000 Hz
Shock resistance	40 g / 6 ms / half-sinusoid, according to DIN EN 60068-2-27
Protection class	IP67 with mating connector
Hydraulic connection	1/4" GAS - DIN 3852 (pressure port orifice Ø 0,6 mm)
Electrical connection	Type: plastic 5 pins M12 at 90° (DIN 43650-C) with cable gland type PG7 for cable max Ø 6 mm Protection: IP67 according to EN 60529; Insulation: according to VDE 0110-C

Notes: FS = Full Scale; BFSL = Best Fit Straight Line

#### **3** INSTALLATION AND COMMISSIONING

#### 3.1 Warning

E-ATR-8 transducers have to be installed as near as possible to the point where the pressure have to be measured, taking care that the oil flow is not turbulent.

#### 3.2 Commissioning

Install the transducer in the hydraulic circuit.

Switch-off the power supply before connecting and disconnecting the transducer connector as shown in scheme 4.



#### 5 OVERALL DIMENSIONS [mm]



### Electronic pressure switches type E-DAP-2

digital, with integral digital display



#### 1 MODEL CODE



#### E-DAP-2

Compact electronic pressure switch with integral digital display, available for 3 different pressure ranges.

The working pressure is real time measured and monitored on a 4 digits display ① in bar, Mpa, kPa, psi or kg/cm². The display can be mechanically rotated on 1 axis ② and turned electronically through 180°.

It provides two independent output with electronic contacts which are triggered when the pressure in the hydraulic circuit reaches the switch point or window (see section  $\boxed{4}$ ).

The functional parameters as the pressure switching point, hysteresis range, pressure measuring units and others additional functions can be easily set by the end user trough proper programming keys (3).

For detailed instructions about the use of the electronic pressure switch refer to the operating manual supplied with the instrument.

#### Features:

• Standard 5 pin M12 main connector ④

IP65 / IP67 protection degree

• CE mark according to EMC directive

#### 2 MAIN CHARACTERISTICS

Model	E-DAP-2-100	E-DAP-2-250	E-DAP-2-400									
Pressure measuring range [bar] (1)	0,5 ÷ 100	1,25 ÷ 250	2 ÷ 400									
Overload pressure	2 x FS	· · · ·										
Response time	≤ 10 ms											
Temperature range	Operating -20 ÷ +80 °C; Storage -20	÷ +80 °C; Fluid: -20 ÷ +85 °C										
Thermal drift	Zero $\leq \pm 0.02$ % FS / °C (typ); span	≤ ±0,01 % FS / °C (typ)										
Accuracy display	$\leq \pm 1,0$ % of FS $\pm 1$ digit											
Non-Linearity	≤ ±0,5 % of span BFSL as per IEC 612	298-2										
Fluid compatibility	Hydraulic oil as per DIN51524535; for water-glycol, phosphate ester and	Jraulic oil as per DIN51524535; water-glycol, phosphate ester and skydrol [®] , please contact Atos technical department										
Power supply	15 ÷ 35 VDC; Imax 600 mA											
N° of outputs	2											
Output type	PNP transistor output (ON state ≅ po	transistor output (ON state ≅ power supply - 1 V)										
Switching current	250 mA max per output (resistive load	) mA max per output (resistive load)										
Wiring protections	Against reverse polarity on power sup	gainst reverse polarity on power supply and short-circuit on output signal										
Display	4 digit, 14 segment led, red, height 9	mm										
Materials	Wetted parts: stainless steel 316L (13	-8 PH for sensor); seals: FPM/FKM										
Mass	174 g											
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE EN 61326 emission (group 1, class B)	and immunity (industrial application)										
Service life	1x10 ⁶ load cycles											
MTTF	> 100 years											
Compliance	RoHs Directive 2011/65/EU as last up REACH Regulation (EC) n°1907/2006	date by 2015/863/EU										
Vibration resistance	10 g according to IEC 60068-2-6, und	er resonance										
Shock resistance	50 g according to IEC 60068-2-27											
Protection class	IP65 / IP67 with mating connector											
Hydraulic connection	1/4" GAS - DIN 3852 form E (pressure	port orifice Ø 0,6 mm)										
Electrical connection	Type: plastic 5 pins M12 at 90° ( Protection: IP67 according to EN 605	DIN 43650-C) with cable gland type PG7 29; Insulation: according to VDE 0110-C	for cable max Ø 6 mm									

Notes: FS = Full Scale; BFSL = Best Fit Straight Line; (1) negative pressure lower than -1 bar can damage the device

#### 3 FEATURES

- Two independent PNP transistor switching outputs. Imax up to 250 mA per output
- 4 digit display, adjustable on one axes without tools for best visual position or visualized digits can be turned electronically of 180°
- Pressure reading selectable in: bar, Mpa, kPa, psi, kg/cm²
- · Selection of different display modes: unit switching, offset adjustment, actual pressure value, minimum or maximum pressure value, function switch points, function reset points, display updates/second.
- Hydraulic connection G1/4'
- Electric connector M12x1 supplied with the pressure switch

#### **4** OUTPUTS SWITCHING FUNCTION

The independent outputs can be settable using two different functions: Hysteresis and Windows.

#### Hysteresis function - see 4.1

If the system pressure fluctuates around the set point, the hysteresis keeps the switching status of the outputs stable. With increasing system pressure, the output switches when reaching the switch point (SP).

- HNO contact normally open: active
- HNC contact normally closed: inactive
- With system pressure falling again, the output will not switch back before the reset point (RP) is reached.
- HNO contact normally open: inactive
  HNC contact normally closed: active

#### Window function - see 4.2

The window function allows for the control of a defined range.

When the system pressure is between window High (FH) and window Low (FL), the output switches on.

• FNO - contact normally open: active • FNC - contact normally closed: inactive

When the system pressure is outside window High (FH) and window Low (FL), the output does not switch on.

FNO - contact normally open: inactive
FNC - contact normally closed: active

#### Delay times (0 ... 50 s) - see 4.3

This makes it possible to filter out unwanted pressure peaks of a short duration or a high frequency (damping)

The pressure must be present for at least a certain pre-set time for the output to switch on. The output does not immediately change its status when it reaches the switching event (SP), but rather only after the pre-set delay time (DS).

If the switching event is no longer present after the delay time, the switch output does not change. The output only switches back when the system pressure has fallen down to the reset point (RP) and stays at or below the reset point (RP) for at least the pre-set delay time (DR).

If the switching event is no longer present after the delay time, the switch output does not change. Delay times is available for Hysteresis and Window functions.

#### 5 INSTALLATION AND USE

#### 6 ELECTRONIC CONNECTIONS



Rotate the 4 digit display in order to provide the best visual orientation.

Connect M12 electric connector according the wiring diagram in section 6

Consult the operating manual, supplied with the electronic pressure switch, for the parameters setting.



#### 7 OVERALL DIMENSIONS [mm]



#### 4.1 Hysteresis Function







4.3 Delay times (0 ... 50 s)



### Pressure switches type MAP

with fixed switching pressure differential and microswitch with gold plated contacts



Pressure range: $160 = 10 \div 160$  bar $40 = 5 \div 40$  bar $320 = 30 \div 320$  bar $80 = 7 \div 80$  bar $630 = 50 \div 630$  bar

 
 Series number
 BT = FNMI BT = HNBR

 Options:
 E = Common electric contact connected to pin 1, see section 3

2 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position									
Subplate surface finishing	Roughness index Ra 0,4 - flatness	s ratio 0,01/100 (ISO 1101)								
Compliance	CE to Low Voltage Directive 20 RoHS Directive 2011/65/EU as I REACH Regulation (EC) n°1907	E to Low Voltage Directive 2014/35/EU ToHS Directive 2011/65/EU as last update by 2015/65/EU TEACH Regulation (EC) n°1907/2006								
Ambient temperature	Standard = $-30^{\circ}C \div +70^{\circ}C$ /F	<b>PE</b> option = -20°C ÷ +70°C <b>/B1</b>	option = $-40^{\circ}C \div +70^{\circ}C$							
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}C \div +60^{\circ}C$ , with HFC hydraulic fluids = $-20^{\circ}C \div +50^{\circ}C$ FKM seals (/PE option)= $-20^{\circ}C \div +80^{\circ}C$ HNBR seals (/BT option)= $-40^{\circ}C \div +60^{\circ}C$ , with HFC hydraulic fluids = $-40^{\circ}C \div +50^{\circ}C$									
Recommended viscosity	15÷100 mm²/s - max allowed rang	ge 2.8 ÷ 500 mm²/s								
Fluid contamination class	ISO 4406 class 21/19/16 NAS 163	38 class 10, in line filters of 25 $\mu$ m ((	325 ≥75 recommended)							
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard							
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524							
Flame resistant without water	FKM	HFDU, HFDR	100 10000							
Flame resistant with water	NBR, HNBR	HFC	150 12922							

#### 3 CHARACTERISTICS AND WIRING OF INTERNAL MICROSWITCH

			Supply vo	oltage [V]			Rest position	Pressure operated position
		125 AC	250 AC	30 DC	250 DC		2	3
Max current resistive load	[A]	7	5	5	0,2	STD		
Max current inductive load (Cos $\varphi = 0,4$ )	[A]	4	2	3	0,02			
Insulating resistance		100 MΩ					2	2
Contact resistance		15 mΩ						
Electrical life-expectancy		1.000.000 s	witchings			/E	<b>3</b>	<b>3</b>
Mechanical life-expectancy		10.000.000s	witchings			1	ĭ	1ĭ



For versions 11 and 13 the pressure switch is mounted on side of port A. For version 14 the pressure switch is mounted on side of port B. For versions 12, 17, 18 the pressure switch is mounted on both sides.

## Mounting subplates type BA

single, for ISO valves size 06 to 32

**BA-*** are single subplates with ISO mounting surface for installation of Atos valves and they are provided with threaded ports for connectios to pressure, tank and users lines. They are characterized by low pressure drops and they are specific for directional, flow and pressure control valves ISO size 06, 10, 16, 20, 25 and 32;

Special subplates or manifolds for customized applications are available upon request.

The set of screws for the valve installation on the BA subplate must be ordered separately, see the code SET SC-* specified in the following sections.

#### 1 TECHNICAL CHARACTERISTICS

Installation position	Any position
Operating pressure	Ports P, T, A, B = 350 bar See technical table of the valves to be assembled
Ambient temperature range	-30°C ÷ +70°C
Fluid	Hydraulic oil as per DIN 51524535, for other fluids contact our technical office
Recommended viscosity	15÷100 mm2/s - max allowed range: see the technical table of the valves to be assembled
Max fluid contamination level	See technical table of the valves to be assembled and filter section at www.atos.com or KTF catalog
Fluid temperature	See technical table of the valves to be assembled
Surface protection	zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006

#### 2 SINGLE STATION SUBPLATES FOR VALVES SIZE 06





#### 4 SINGLE STATION SUBPLATES FOR VALVES SIZE 16

ISO 4401:2005         BA-518         VERSIONS           Mounting surface: 4401-07-07-0-05         BA-518: basic version         BA-518: basic version	version with	ports F	Р. А.
B, T (1") and X, Y BA-519: basic B, T (1") and X, Y (1 A, B (1") on the s	Y (1/4") on t version with I/4") on the side.	he base ports base; p	≥. P, T ports
Matching valvesSet of screw (to be ordered separately)BA-519DP-21 DP-24 DP-25 DP-25 DPH-28 DPH-28 DPH-29 DPH-29 DPH-22 SET SC-DP2 DPH-22 SET SC-DP2 DPH-22 SET SC-DP2 DPH-22 SET SC-DP2 DPH-22 SET SC-DP2 DPH-22 SET SC-DP2 DPH-22 SET SC-DP2 DPH-22 SET SC-DP2 DPH-22 SET SC-DP2 DPH-22 SET SC-DP2 	(GAS) Ø Coui Y-Y S [mm]	nterbore	Mass [Kg]
DP7E-*-2 SET SC-DP2 RA.518 1*	1/4" 46	21.5	8



#### 6 SINGLE STATION SUBPLATES FOR VALVES SIZE 32





## Auxiliary hand levers for solenoid valves

direct operated on-off and proportional, ISO 4401 size 06



Auxiliary hand levers for direct operated on-off solenoid valves size 06, type DHE, DHL, DHA and proportional valves size 06, type DHZO, DHZE, DHZA and QVHZO.

This option allows to operate the valves in absence of electrical power supply, i.e. during commissioning, maintenance or in case of emergency.

It is available with two different configurations depending to the installation requirements:

**MV** = lever positioned vertically (perpendicular to the valve axis)

**MO** = lever positioned horizontally (parallel to the valve axis)

When the valve is electrically operated the hand lever remains stopped in its rest position

The hand lever execution does not affect the performances of the original valves.

MODEL CODE FOR ON-OFF DIRECTIONAL VALVES (for the details, see indicated tech. table) 1 **DHE - 0** 24 DC ** 63 1/2 MV Х Directional control valves size 06 Seals material: **DHE-0** = for AC and DC supply, high performances, with **cURus** certified solenoids - see table E015 - = NBR **PE** = FKM BT = HNBR (1) Series number DHL-0 = for AC and DC supply - see table F018 DHA-0 = ex-proof - see table EX010 Voltage code: see relevant tech. table Valve configuration: 61 - 63 - 71 Available spools: 0 - 0/2 - 1 - 1P - 1/2 - 1/2P - 3 - 3P - 4 - 7 Options, hand lever configuration: Only for DHE and DHL: MO = horizontal hand lever (not for DHA) **00-AC** = AC solenoids without coils **00-DC** = DC solenoids without coils MV = vertical hand lever AMO = horizontal hand lever installed at the side of port B (not for DHA) X = without connector AMV = vertical hand lever installed at the side of port B (1) Not available for DHL

2 MODEL CODE FOR PROPORTIONAL DIRECTIONAL VALVES AND FLOW CONTROL VALVES (for the details, see indicated tech.table)

DHZO	-	Α	-	(	)	71	]-	S	5	1	MV		/*	*	**	/*
Directional proportional valves size 06 DHZO = see table F160 DHZE = see table F150 DHZA = ex-proof - see table FX010												_	Coil opt	Seri num	ies nber	Seals material: - = NBR PE = FKM BT = HNBR nt tech. table
Flow control valves size 06 <b>QVHZO =</b> see tab F410											Options: MO = hc	: Oriz	ontal hand	d lever (	(not for	DHA, DHZA)
<b>A</b> = without position transducer											BMO =	hor	ical hand lever prizontal hand lever installed at the side of prt A (not for DHZA, QVHZO) rtical hand lever installed at the side of port A pt for QVHZO) pontal cable entrance (only for DHZA) hal drain (only for DHZA, DHZO)			lled at the side of
Valve size <b>0</b> = ISO 4401 size 06 (for DHZ*) <b>06</b> = ISO 4401 size 06 (for QVHZO)											<b>BMV</b> = v ( <b>0</b> = Hori <b>Y</b> = Exte	vert (not izor erna				
Valve configuration (only DHZ*): <b>51, 53, 7</b>	1. 73	}						Spo Max	ol siz	ze	e (for DHZ	<u>Z</u> *):	<b>S3 - S5 -</b> or OVHZO	D3 - D5	5 - L3 - 18-36-4	<b>L5</b>

#### 3 LEVER CHARACTERISTICS

Total angle stroke	[°deg]	± 28°	Lever actuating force	[N]	1 ÷ 8
Working angle stroke	[°deg]	± 15°	Lever device weight	[g]	880

#### 4 INSTALLATION DIMENSIONS [mm]



DHL-06*/MV

Ç

15

DHZO-A-05*/MV

DHL-07*/MV (dotted line)



158

85

46

5.6

Mass: 2,8 kg (single solenoid) Mass: 3,5 kg (double solenoid)

Mass: 2,4 kg (single solenoid) Mass: 2,7 kg (double solenoid)

Щ⊏ æ [¦**™** ۱**۵**| 21.5 27.5 69 73 55 7.7 204.7



DHE-06*/MV DHE-07*/MV (dotted line)

Mass: 2,7 kg (single solenoid) Mass: 3,0 kg (double solenoid)



DHZE-05*/MV

DHZE-07*/MV (dotted line)



Mass: 2,7 kg (single solenoid) Mass: 3,0 kg (double solenoid)



æ

226.5

90.5

. 145.5

r A 🖻 B

66

DHZO-A-07*/MV (dotted line)

21.5 27.5

Mass: 3,2 kg

45

46

25.6

0

QVHZO-A-06*/MV



DHA/*-06*/MV DHA/UL-*-06*/MV (dotted line)



Note: see tech. table FX010 for DHA/MV models





UUU 40. <u>21.5</u> 27.5 80.5 66 135.5 15 216.5



DHZA/*-06*/MV Mass: 3.4 kg DHZA/UL-*-06*/MV (dotted line)

Note: see tech. table FX100 for DHZA/MV models

58

8 87



## Handwheels for hydraulic controls

on-off and proportional valves

	OPTIONS CODES AND DIMENSIONS	FEATURES	VALVE TYPE
OPTION	N CH.27 CH.19 CH.19 31 min 38 max	Regulating handwheel	ARE, CART ARE, CART M-6, ARAM, AGAM, REM, AGIR, AGIS, AGIU, HMP, HM, KM, HS, KS, HG, KG, LIMM, LIRA, LICM
OPTION	/VF	Regulating knob	ARE, CART ARE, CART M-6, AGIS, AGIU (as spare part, code VFG
OPTION	VS	Manual override with safety locking. Regulation possible only with pushed knob.	HMP, HS, HG.
OPTION		Prolonged manual override protected by rubber cap	DHI, DHE DKE DLEH, DLEHM DPHI, DPHE LID*
SPARE PART	WPD/HL		DHL (only DC version)
SPARE PART	WPD/H CH 22 54 min 62 max	Manual override with detent, for mechanical operation and fixed actuation of spools	DHI
SPARE PART	WPD/HE-DC		DHE (only DC version)



## **Electric and electronic connectors**

for transducers, on/off and proportional valves, pumps

#### 1 CONNECTORS FOR ON/OFF VALVES AND PUMPS

CODE AN	ID DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
345		Female plastic connector - 4 pin: - inductive proximity sensor, /FI option for DHI, DHE			PG7 ø 4 ÷ 6 mm	DIN EN 61984 (VDE 0627) Protection degree IP 65 EN 60529
664	~ 53	Female plastic connector - 4 pin: - pressure switch type MAP - inductive proximity sensor, /FI option for DKE-17*	₩ 308 0 1 2 0 80€ 0 80 80 80 80 80 80 80 80 80 80 80 80 80			
666 (black) 666/A (grey)		Female plastic connector - 3 pin: - standard coil connector for on/off valves - inductive proximity sensor, /FI option for DKE-16*			PG11 ø8÷10mm	DIN 43650-A/ISO 4400 Protection degree IP 65 EN 60529
667-24 667-110 667-220	_ ∅30	Female plastic connector - 3 pin: - standard coil connector for on/off valves with built-in led	666 1 2 667-*			
ZBE-06		Female plastic connector - 4 pin: - inductive position switch, /FV option			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
BKS-B-20-4-03	32.5	Female plastic connector - 4 pin (3 wire): - inductive proximity sensor for LIFI Cable length: 3 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
669 (black) 669/A (grey)		Female plastic connector - 3 pin: - optional electronic connector for on/off valves with built-in recti- fier bridge for supplying DC coils by AC current			PG11 ø 8 ÷ 10 mm	DIN 43650-A/ISO 4400 Protection degree IP 65 EN 60529

(1) the wiring of electrical terminals has to be made according to specific technical table

#### 2 CONNECTORS FOR PROPORTIONAL VALVES AND PUMPS

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
345	Female plastic connector - 4 pin: - position transducer for ZO(R)-T and ZO-L valves			PG7 ø 4 ÷ 6 mm	Protection degree IP 65 EN 60529
666 (black)	Female plastic connector - 3 pin: - standard coil connector for proportionals valves	短 ④ 0 1 0 一 一 一 一 一 一 一 一 一 一 一 二 一 一 二 一 一 二 一 一 二 一 一 二 一 一 二 一 一 二 一 一 二 一 二 一 二 一 二 一 二 二 一 二 二 二 二 二 二 二 二 二 二 二 二 二		PG11 ø 8 ÷ 10 mm	DIN 43650-A/ISO 4400 Protection degree IP 65 EN 60529
STC09131-6-PG9	Female metallic connector at 90° - 6 pin: - position transducer for LIQZP-L size 125 cartridges			PG9 ø 6 ÷ 8 mm	Protection degree IP 67 EN 60529
ZM-7P	Female metallic connector - 7 pin: - main connector for integral electronic driver	B C C D C C C C C C C C C C C C C C C C		PG11 ø 7 ÷ 9 mm	According to MIL-C-5015 Protection degree IP 67 EN 60529
ZM-12P	Female metallic connector - 12 pin: - main connector for integral electronic driver	5,10,4 6,347,3 7,6,0,0,2 111,0,0,0,9 111,0,0,0,9 9,9 9,9 9,9 9,9 9,9 9,9 9,9 9,9		PG13,5 ø 8 ÷ 11 mm	DIN 43651 Protection degree IP 67 EN 60529
ZM-5PF	Female metallic connector - 5 pin: - CANbus for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding A IEC 60947-5-2 Protection degree IP 67 EN 60529

ZM-5PM		Male metallic connector - 5 pin: - CANbus for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZM-5PF/BP	02 0 - 58	Female metallic connector - 5 pin: - PROFIBUS DP for integral electronic driver	1 4 5 2 3 3		Pressure nut ø 6 ÷ 8 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529
ZM-5PM/BP		Male metallic connector - 5 pin: - PROFIBUS DP for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding B IIEC 61076-2-101 Protection degree IP 67 EN 60529
ZM-4PM/E	€ 0 61	Male metallic connector - 4 pin: - EtherCAT, POWERLINK, EtherNet/IP, PROFINET RT/IRT for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding D IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5PM/1.5 ZH-5PM/5		Male plastic connector - 5 pin - single pressure/force transducer - analog position transducer Cable length: 1.5 m or 5 m		2 5 3 4	Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5PM-2/2		Male plastic connector - 4 pin: - double pressure/force transducers Splitting cable length: 2 m		2	Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-8PM/5 ZH-8PM/10		Male plastic connector - 8 pin: - digital position transducer Cable length: 5 m or 10 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZBE-06		Female plastic connector - 4 pin: - position transducer (LIQZO-T* size 50) - integral pressure transducer (TERS)			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZBE-08		Female plastic connector - 5 pin: - position transducer E-THT-15 (LIQZP)	2 3 5 4 4		PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-7P		Female plastic reinforced with fiber glass connector - 7 pin: - main connector for integral electronic driver	B C C D E		PG11 ø 8 ÷ 10 mm	According to MIL-C-5015 Protection degree IP 67 EN 60529
ZH-12P	~ 100	Female plastic reinforced with fiber glass connector - 12 pin: - main connector for integral electronic driver	5,104 6,544,3 7,46,3 7,46,3 7,46,3 2,42 11,56,9,29 11,86,9,29 11,86,9,29 11,86,9,29 11,86,9,29 11,86,9,29 11,96,10 11,97,10 12,97,10 14,33 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,43 14,433 14,433 14,433 14,433 14,433 14,433 14,433 14,433 14,433 14,433 14,433 14,433 14,433 14,433 14,433 14,433 14,4331		PG16 ø 6 mm x 2 cable	DIN 43651 Protection degree IP 67 EN 60529
ZH-5P	Ro <u>~ 55</u>	Fernale plastic connector - 5 pin: - RS232 Serial, CANbus - digital electronic driver E-MI-AS-IR, /M12 option	4 + 5 + 3		PG9 ø 6 ÷ 8 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5P/BP		Male plastic connector - 5 pin: - PROFIBUS DP			PG9 ø 6 ÷ 8 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5PM	8 -50 -60	Male plastic connector - 5 pin: - pressure, force, position transducers (TEZ/LEZ series 10 or lower)	2 3 3 5 4		PG7 ø 4 ÷ 6 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529

(1) the wiring of electrical terminals has to be realized according to specific technical table

### 3 CONNECTOR FOR PRESSURE TRANSDUCERS AND PRESSURE SWITCHES

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
ZBE-08	Female plastic connector - 5 pin: - pressure transducer E-ATR8 - electronic pressure switch type E-DAP-2			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529

(1) the wiring of electrical terminals has to be made according to specific technical table





	Table	Pag
TECHNICAL INFORMATION		
Basics for digital proportionals electrohydraulics	FS001	930
Basics for on-off solenoid directional valves	E001	934
Basics for safety components	Y010	936
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## Basics for digital proportional electrohydraulics

Digital electrohydraulics enables new functionalities within the conventional control architectures and represents the fundamental premise to realize machines with high technological contents.

The digital electronics integrates several logic and control functions (distributed intelligence) and allows the introduction into the hydraulic system of the most modern fieldbus communication networks.

The integration of advanced digital technologies into Atos proportional valves brings important advantages and innovative features:

- better performances of electrohydraulic components: hysteresis, response time, linearity, repeatability, valve to valve riproducibility
- numerical software setting of hydraulic parameters (scale, bias, ramp, compensation of non-linearities) for full valve to valve riproducibility
- advanced diagnostics (alarms history, built-in oscilloscope function) and computer assisted maintenance
- industry 4.0 connectivity through direct interfacing with fieldbus networks

Atos digital components range includes:

- proportional valves and drivers, see sections 1 and 2
- proportional p/Q pumps, see 4.3
- axis controls and servoactuators, see section



		Valve classification	Type of valve	Transducer	Hydraulic features	Application
s	$\land$	Servoproportionals	Directional	LVDT	Zero spool overlap	Actuator position and speed control p/Q control
			Directional	LVDT	Positive spool overlap	Actuator direction and speed control p/Q control
	ŝ	High performance proportionals	Flow	LVDT	Pressure compensated	System flow regulation, actuator speed control
	RMANCE		Pressure	Pressure	Relief Reducing Compensator	System pressure control Actuator force control Load sensing control
	RFO		Directional		Positive spool overlap	Actuator direction and speed control
PEI	E		Flow	News	Pressure compensated	System flow regulation, actuator speed control
	Proportionals	Pressure	None	Relief Reducing Compensator	System pressure control Actuator force control Load sensing control	

#### 3 FIELDBUS INTERFACES - see tech table GS510

Drivers with fieldbus communication interface allow an higher level of integration with the machine automation architecture: machine central unit (fieldbus master), wired with all the controlled devices (fieldbus node).

Fieldbus available:

BC = CANopen	<b>BP</b> = PROFIBUS DP	EH = EtherCAT
EW = POWERLINK	EI = EtherNet/IP	<b>EP</b> = PROFINET RT/IRT

Fieldbus interface allows:

- complete diagnostic of the driver status
- improved information available for machine operation
- improved accuracy and robustness of digital transmitted information
- real time modification of the valve parameters
- direct access to all driver parameters
- costs reduction due to simpler and standardized wiring solutions
- costs reduction due to fast and simple installation and maintenance



#### 4 p/Q CONTROLS - see tech table FS500

#### 4.1 p/Q controls for servoproportional and high performance directional valves

In most of the machines functions, the typical movement of a single actuator requires direction, speed and sometime force regulations, normally performed by different type of valves.

Digital proportional valves with SP, SF, SL options add the pressure or force closed loop control to the basic directional control.

A single proportional valve with p/Q control allows to manage complex machine operations requiring high performance combined regulations (typical application: injection cycle or mould motion in plastic machinery).

The closed loop pressure or force control requires the installation in the system of one/two remote pressure transducers or a load cell, to be connected to the valve digital driver.

The option SP performs the closed loop pressure control on one side of the actuator by using one remote pressure transducer.

The other two options perform the closed loop force control by two remote pressure transducers (SF) or one load cell (SL).

Pressure/force and flow are regulated according to two different command signals.

The selection from pressure-force to flow control and vice versa is self performed by the digital driver through dedicated algorithm.

#### p/Q control configurations



#### 4.2 Proportional valves with p/Q control - with on-board or off-board driver/axis card

Valve classification	Application
Servoproportionals	SF, SL SP only in 3-way connection
High performance proportionals	SP, SF, SL



#### 4.3 p/Q controls for variable piston pumps - see tech table AS170

PVPC-PERS/PES variable displacement axial piston pumps, integrate the digital combined closed loop pressure and flow control with the electronic max power limitation. A multiple set of PID parameters can be real time selected during the axis motion via the 12 pin connector (option /S) or through the fieldbus interface, to optimize the p/Q control performances.

The PVPC-PES pumps allow the accurate and dynamic closed loop control of the delivered flow and the system pressure.



#### 5 AXIS CONTROLS

The modern architecture of industrial machinery strongly increases the demand of accuracy, repeatability and performance. This leads to the need of devices that integrate to the traditional axis positioning also the pressure/force controls.

Atos focuses the integration of axis cards functions with proportional electrohydraulics either in on-board or off-board format.

They improve motion performances, simplify the automation architecture and may be integrated in the fieldbus network.

#### 5.1 Synthetic comparison

ТҮРЕ		ON BOARD AXIS CARD AND DRIVER	AXIS CARD WITH DRIVER FUNCTION	AXIS CARD
FORMAT MAIN FUNCTION			DIN-rail format	DIN-rail format
Techincal table		FS610 FS620 FS630	GS330	GS340
Valve's driver function		•	•	n.a.
Nr. of controlled axis		1	1	1
Internal programmable cycles		simple	simple	complete
Graphic programming softwar	e	•	•	•
Position control		•	•	•
Position transducer interface:	Analog	•	•	•
	Digital (SSI or Encoder)	•	•	•
p/Q control		•	•	•
Analog transducer interface,	pressure or force	2	2	2
Performance parameters setting (e.g. Dither, PID)		•	•	•
Valve parameters setting (e.g. Bias, Ramp, Scale)		<ul> <li>factory preset</li> </ul>	<ul> <li>factory preset</li> </ul>	•
Alternated control		•	•	•
USB interface		•	•	•
CANopen		•	•	•
PROFIBUS DP		•	•	•
EtherCAT		•	•	•
POWERLINK		•	•	•
EtherNet/IP		•	•	•
PROFINET RT/IRT		•	•	•
Digital input		1	1	3
Digital output		1	1	1
Analog input reference		2	2	2
Analog output monitor		2	2	up to 3

= options

#### 5.2 Servoactuators - see tech table FS700

They are stand-alone units performing closed loop position plus optional alternated p/Q controls. These units are made by a servocylinder with position transducer and a servoproportional valve with on-board driver + axis card, factory assembled and tested.



#### 5.3 Digital servoproportionals with on-board axis card and driver, application example - see FS610, FS620, FS630







#### 5.5 DIN-rail axis card, application example - see tech table GS340



#### 6 **PROGRAMMING TOOLS** - see tech table **GS500**

#### 6.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time. Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.

#### 6.2 E-SW-SETUP & Z-SW-SETUP PC software

Free downloadable software for PC allow to set all valve functional parameters and to access complete diagnostic information of digital valve drivers and axis controls via Bluetooth/USB service port.

Atos PC software support all Atos digital valve drivers and axis controls and they are available at www.atos.com in MyAtos area.

## **Basics for on-off solenoid directional valves**

Atos solenoid valves have been designed and tested with innovative concepts to satisfy the advanced needs of modern machines: rapid or damped switching, quiet operation, reduced power absorbed, versatility, reliability and safety of use. This table gives engineers, in condensed form, a series of useful information for the choice and the use of modern solenoid valves.

#### 1 DESCRIPTION OF FUNCTION

Solenoid directional valves are used for changing flow direction in hydraulic systems.

Main features are:

- 1.1 New integrated design between hydraulic and electrical parts with more compact construction and better efficiencies.
- 1.2 Wet solenoids for maximum reliability, also available in flame-proof, intrinsically safe and stainless steel execution.
- All seals are static and all the moving parts are protected and lubricated by the fluid.
- 1.4 Smoother switching with effective regulation thanks to optional switching control devices.
- 1.5 Plastic encapsulated coils easily interchangeable.
- 1.6 Electric or electronic connectors, depending on the application and on electric control board interface.
- 1.7 Cored oil passages with low pressure drops.
- 1.8 Interchangeable spools for various directional functions.

#### 2 SOLENOID IDENTIFICATION

According to European Convention, solenoid "A" is close to "A" port and solenoid "B" is close to "B" port of the valve body (pilot valve body for two stage valves).

#### **3** SPOOLS CHARACTERISTICS

Standard interchangeable spools are available in a wide range of configurations, as indicated in table 3.

Specific spools to reduce water hammer-shocks during switching: variants 1/1, 4/8 and 5/1. Their special shape reduces water hammer-shocks during switching. Use of these spools is not recommended with maximum flow greater than 80% of the nominal values, because of higher pressure drops generated in the valve.

### Response times and control of switching time: direct operated solenoid valves.

The solenoid valve response times can be controlled by the use of specific devices (option L); associated with the spools */1 and */8 it is possible to control smooth acceleration/deceleration of the connected actuator. The L* devices allow an effective control of the solenoid valve switching time, slowing down the spool speed without reducing the solenoid force. They are available in different configurations. For correct use a slight backpressure (2 bar) on solenoid valve T port is recommended. Valve response time is also influenced by operating conditions (oil characteristics and temperature), elasticity of the hydraulic circuit and by use of electronic connectors.





#### Scheme Intermediate passages Type XHI XHHHH 0 1 2 3 THX [] HITHX 4 THX THHEFT 5 [1]58 6 7 8 XII XHII 0/21/22/2 16 17

Table 3Basic spools, schemes and intermediate passages between central and external<br/>positions. The spools are not available for all the directional valves.For their availability see the relevant valve table.

### Response time and control of switching time: pilot operated solenoid valves.

The response time of the piloted valves can be adjusted by means of the options /H (meter-out control) or /H9 (meter-in control). This options provide the installation between the main stage and the pilot valve of a modular throttle valve, type HQ-*/U specific for fine pilot flow control.

Associated with */1 and */8 spools, smooth acceleration/deceleration can be controlled on loads.

### *P spools for direct operated solenoid valves to reduce leakage.

They are normally used on pilot valve for pressure and directional control valves, for cartridge valves and systems with specific requirements.

Use of these spools is not recommended with maximum flow greater than 70% of the nominal values, because of the higher pressure drops generated in the valve. Following types available: 1P, 3P, 1/2 P, 8P (for ISO size 06 valves).

#### 4 COIL CHARACTERISTICS

Solenoid valves are available both with DC and AC coils.

- OE-AC and OE-DC solenoids for DHE valves are available respectively for AC and DC supply
- AE-AC and AE-DC solenoids for DKE valves are available respectively for AC and DC supply

For solenoids OE and AE, the coils of different voltages are interchangeable only for the same type of power supply AC or DC.

The DC solenoids can be also fed with AC supply, by using 669 connector.

## 5 ELECTRICAL CONNECTORS TO ISO 4400 (DIN 43650)

The cable entry on electrical plugs can be fitted at  $90^{\circ}$  intervals by reassembling the contact holder relative to the plug housing.

The cable entry is Pg. 11 suitable for cable  $\emptyset$  6-10 mm.

Following types are available:

Standard connectors, IP65 protection degree (666);

Connectors with built in LED (667);

Connectors with built in rectifier bridge (669) to supply DC coils by alternating current AC.

In addition to the above DIN connectors, other type of electrical interfaces are available on request:

- Lead Wire connection

- Deutsch connector DT-04-2P (IP67)

- AMP Junior Timer connector (IP67)

## 6 ELECTRONIC CONNECTORS

#### Operational principle

E-SD to eliminate electric disturbances when solenoids are deenergized;

#### 7 OPERATING NOTES

## Tightening of the fixing screws to the subplates and of the plastic coil ring-nut.

It is particularly important to check that the tightening of the fixing screws respects the torque limits indicated in table 4.

Higher values may cause anomalous deformations of the body and prevent sli-

#### Table 3.2 Spools to reduce water hammer shocks associated with switching

Туре	Scheme	Intermediate passages
0/1		
1/1		
3/1		
4/8		

#### Table 3.3 Specific spools for special uses or in regenerative circuits

Туре	Scheme	Intermediate passages
09	XHH	
90	┝─┬│┝─┥│ <b>╇</b>	
19		
91		
39		
93	┝┿╪╎╤┥╟ <b>╸</b>	
49		
94		

ding of the spool. 12.9 class fixing screws are recommended. The plastic coil ringnuts will be fixed on the solenoid with a torque 4Nm: this deforms properly the seals and protects against external particles and water entrance.

#### Operation in circuits with flow exceeding the nominal valve flow

In circuits with flow rates greater than the nominal values and in circuits with accumulators, where the instantaneous flow can exceed nominal values, is recommended a plug-in restrictor on P port of solenoid valve to limit the maximum flow on the valve.

Dilatation and contraction of flexible hoses subjected to variations of system pressure can generate high instantaneous flow rates.

The version indicated in fig.5 can be directly inserted into P port of the valve but also in other valve ports.

The plug-in restrictors can be ordered separately:

PLUG H-** (for DH* valves)

PLUG K-** (for DKE* valves)

** the double asterisk identifies the dimension in tenths of a millimeter.

Example: PLUG H-05 = 0,5 mm diameter

#### Limits on two-way and three-way opera-

tion for direct operated solenoid valves. When used as two-way and three-way valves with P, A or B ports blocked or not subject to flow, or with flow much lower than flow on other ports, maximum catalogue performance cannot be assured.

#### Minimum pilot pressure for pilot operated solenoid valves.

A minimum pressure value must be guaranteed for piloting the valve. This value is 8 bar. For spools with P-T connection in rest position, the option /R should be used.

#### Operation combined with hydraulic cylinders with high section ratios.

Operational limits may occur with cylinders with section ratios (piston/rod) greater than 1.25. In these cases multiplications or demultiplications of flow and pressure may disturb the correct operation of the solenoid valve.

#### 8 SPECIAL VERSION SOLENOID VALVES

- for explosion-proof environments
- for intrinsically safe operation
- stainless steel execution for marine or aggressive environments or water base fluids
- for operation beyond the allowed temperature limits.

#### Table 4

### Recommended torque for the fixing screws

Valve type	Fixing screws class 12.9	Torque
DH*	M5	8 Nm
DKE*	M6	15 Nm
DP**-2	M10 & M6	70 Nm & 15 Nm
DP**-4	M12	125 Nm
DP**-6	M20	600 Nm



## 

### **Basics for safety components**

IEC 61508 Safety Integrity Level and ISO 13849 Performance Level - certified by 应





Safety in engineering of modern machinery is becoming a primary issue to protect people from potential risks caused by accidental failures of machines and systems.

The Machine Directive 2006/42/EC with relevant norms IEC 61508 Safety Integrity Level (SIL) and ISO 13849 Performance Level (PL), represents the framework of the functional safety, which is a key aspect in terms of general principles of prevention concerning safety of devices or systems with health implications.

It defines the safety requirements that the machine manufacturer must comply with, in order to obtain the certification and thus the possibility to apply the CE mark required to sell the machine within the European market.

Machine Directive 2006/42/EC replaces the existing 98/37/EC and it is universally applicable to machinery, safety components, and other specific equipment.

#### 1 SAFETY NORMS

IEC 61508 and relevant norms IEC 61511 (process control system) plus IEC 62061 (machine control systems) introduce the integrated probabilistic approach to the functional safety. They specify the Safety Integrity Levels (SIL) required to perfom safety functions.

ISO 13849 norm provides safety requirements and guidance on the principles for the design and integration of safety-related parts of control systems including the design of software.

It specifies the Performance Level (PL) required to perform safety functions. PL: discrete value that specify the ability of safety related parts of control systems to perform a safety function under forseeable conditions.

The requirements are classified into five Performance Levels, where PL e identifies the highest protection level.

#### 2 CERTIFICATION



Atos safety valves (on-off and proportionals) are certified by TÜV in compliance with IEC 61508, IEC 61511, IEC 62061, ISO 13849

The certification guarantees the valve compliance with related safety norms and it proves that all requirements have been met for the SIL and PL levels claimed for the specific valve.

The certification also confirms the following data which can be used by the machine manufacturer for the certification of the whole system:

- · the design process used by the valve manufacturer to avoid failures
- the design techniques and measures used to control failures
- the methods used to define hardware fault tolerances
- the methods used to measure the safe failure fractions.
- · the methods used to measure the probabilities of failure

The use of non-certified products invests the machine manufacturer of the responsability for validating that all above aspects have been carried out according to the applicable standards.

Without valve's certification the machine manufacturer has to alternatively:

- · collect from valve's manufacturer all the reliability data necessary to evaluate the safety level of the whole system
- consider the worst case concerning the safety level (e.g. assign to valves the lower safety level PL a or SIL 1 in order to calculate system safety)

#### 3 RISK ASSESSMENT

The first step for determining the necessary risk reduction is the Risk Assessment. It is a procedure carried out to identify which risks in the machine require a mitigation by means of safety control systems (e.g. laser barriers, shut-off valves, enabling devices, etc). Each of these control systems become a Safety Function. At that point the safety functions must be defined and satisfied by the machine design (see 3.1).

#### It is the responsibility of the machine manufacturer to ensure that all safety requirements are satisfied and to conduct a documented risk assessment to ensure that all potential machine hazards are covered.
#### 3.1 Machine Manufacturer

With the name of "Machine Manufacturers" are identified OEMs or end users who manufacture machinery for their own needs or everybody who performs "significant modifications "as:

- change the machine function
- change the machine application area
- change the equipment
- change the machine performance

If changing any of the above parameters results in either change of intended use or change of safety system or safety component, a machine modification should be treated as "significant".

Example:

Adding air-gun pneumatic connection = NOT significant modification

Adding hydraulic accumulator to increase the speed and improve cycle time of the machine = significant modification

# 4 SAFETY RELATED PARTS

They are parts of machine control systems performing safety functions, allowing the system to achieve or maintain a safe status. These parts consist of either hardware or software and stand-alone or integrated components of the machine control system. Safety-related parts incorporate the entire effective chain of a safety function provided by control unit, valves, sensors and actuator.



#### 5 SAFETY ANALYSIS

The second step after the identification of the risk is the Safety Analysis. The process for the design of the safety-related parts of control systems, is iterative.

The aside scheme shows the one used by EN ISO 13849-1:

- The first step consists in the identification of the Safety Functions.
- Any characteristics of all safety functions must be described and documented.
- The Performance Level required (PLr) by each safety function must be defined. ISO13849-1 uses a path like the one shown in section 5.1.
- The machine manufacturer must designe a system to protect the operator, granting a Performance Level (PL) equal or higher than the Performance Level required (PLr). The Performance Level (PL) must be defined considering following parameters:
  - MTTFd, reliability of safety system see section 5.2
  - DC, capability to detect faults see section 5.3
  - CCF, vulnerability of the system to failures see section 5.4
  - architecture categories of the safety system see section 6



Y010

#### 5.1 Performance Level required - PLr

The determination of PLr for ISO 13849-1 is carried out analysing the following parameters:

- Severity of harm:
   S1 = slight
- S1 = slight S2 = serious
- · Frequency and duration of exposure to the hazard:
  - F1 = not often
  - F2 = frequent
- Possibility of avoiding the hazard or limiting the harm:
  - P1 = possible
  - P2 = rarely possible

Each of five performance levels corresponds to a further parameter scale, based on the probability of a dangerous failure per hour.



#### 5.2 Mean Time to Failure dangerous - MTTFd

The achievement of a specific PL or SIL relies on the reliability of the system. The reliability is quantified by Mean Time to Failure dangerous (MTTFd ) which is measured in hours. The MTTFd should be determined from the component manufacturer's data.

#### 5.2 Diagnostic Coverage - DC

The Diagnostic Coverage (DC) is a measure of how effectively the potential dangerous failures can be detected by the monitoring system.

EN ISO 13849-1 suggests how to define DC.

Diagnostic Coverage is defined as the measure of the effectiveness of diagnostics: it is determined as the ratio between the failure rate of detected dangerous failures and the failure rate of total dangerous failures;

**DC** = 0% no dangerous faults are detected

 $DC \cong 100\%$  most of dangerous faults are detected (it is impossible to reach a DC = 100% because diagnostics are not considered to be completely reliable)

#### 5.3 Common Cause Failure - CCF

The CCF value is a parameter for evaluating the measures against the common cause failure. It is a failure in redundant systems where two or more channels fail at the same time in consequence of a single common cause. The redundancy can be compromised if both channels fail simultaneously due to the same cause. EN ISO 13849-1 provides a score for CCF, which is used to determine the Performance Level (PL).

For this score, EN ISO13849-1 defines a checklist of seven important countermeasures:

- 1. The signal paths of different channels are physically separated (score = 15 points)
- 2. Diversity in the technology, the design or the physical principles of the channels (score = 20 points)
- 3. Protection against possible overloading (15 points) and the use of well-tried components [which are those components which have been widely used or made and verified for safety related application (score = 5 points)]
- 4. Failure mode and effects analysis during development for the identification of potential common cause failures (score = 5 points)
- 5. Training of designer/service personnel in CCF and its avoidance (score = 5 points)
- 6. Protection against common failures caused by contamination (fluid filtration) and electromagnetic interference for electrical parts(score = 25 points)

7. Protection about common cause failures caused by unfavorable environmental conditions (score = 10 points)

For architecture categories 2, 3 and 4 a minimum score of 65 points is required (see section 6).

Note: CCF always depends on the system and application.

#### Diagnostic Coverage categories:

Category	Range
None	DC < 60%
Low	60% ≤ DC < 90%
Medium	90% ≤ DC < 99%
High	DC ≥ 99%

# 6 ARCHITECTURE CATEGORIES

SIL and PL levels depend not only on the characteristics of the single component but also on the architecture of the hydraulic system and of the signals diagnostic.

Architecture categories help to define the probability of failure and the PL of the safety related parts of a control system in relation to their resistance to faults and their subsequent behavior in the fault condition There are five architecture categories, identified as : **B**, **1**, **2**, **3**, **4** 

The higher is the number, the higher is the complexity of the safety system and the higher is the achieved Performance Level PL.

### 6.1 Architecture categories B and 1

In categories B and 1, the resistance to faults is mainly achieved by the selection of proper components. They are not-redundant architecture so the occurrence of a failure may lead to the loss of the safety function.

Category 1 has a greater resistance than category B because of the use of special components and principles which are considered well-tried and tested in a safety system.

#### Example of architecture category 1



**Safety function** = to prevent the dangerous cylinder movement in a certain phase of the cycle or in emergency

The safety function is achieved by disabling the current to the solenoids of safety proportional valve so that the spool is moved by the springs to the rest position with positive overlap.

Through the continuous monitoring of the valve's spool position, the machine PLC verifies if the "safe condition" is fully accomplished.



- ① Digital proportional valve with double power supply option /U (i.e. DHZO-TES-SN-NP-07*-L5 /U)
- (2) Machine PLC supervising the safety function

③ Fault output signal used for safety diagnostics

#### 6.2 Architecture - category 2

In category 2 all of the requirements of architecture B and 1 are combined. In addition, the system is monitored to intercept faults affecting the safety function.

These monitors are made at regular intervals, e.g. at startup or before the next demand on the safety function. By using an appropriate selection of test intervals, a suitable risk reduction can be obtained.

#### 6.3 Architecture categories 3 and 4

In categories 3 and 4, the occurrence of a single fault does not result in the loss of the safety function. In category 4 such faults are detected automatically. Accumulation of faults will not lead to a loss of the safety function.

#### Example of architecture category 4



 Digital proportional valve - option /K (i.e. DHZO-TES-SN-NP-07*-L5 /K)

- (2) Machine PLC supervising the safety function
- ③ Signals used to enable/disable the current to the valve's solenoids
- (4) Signals confirming the valve safe status
- (5) Fault output signal used for safety diagnostics
- (6) Safety shut-off valve with poppet position monitor (i.e. JO-DL /FV)

**Safety function** = to prevent the dangerous cylinder movement in a certain phase of the cycle or in emergency

In this example a safety shut-off valve with poppet position switch has been added to the safety proportional valves to grant a **redundant safety architecture**.

The safety function is performed by disabling the current to the solenoid of safety proportional valve and safety shut-off valve so that the spool is moved by the springs to the rest position with positive overlap.

The safety condition is confirmed by:

- SAFE_ENABLE_ACK status = 24 VDC
- shut-off valve poppet position monitor signals

# atos 🛆

# Programming tools for valve drivers & axis controls

Atos CONNECT mobile App, Atos PC software, Bluetooth/USB adapters, cables and terminators



#### Atos CONNECT is a free iOS / Android mobile App available in the respective App stores, while E-SW-SETUP and Z-SW-SETUP programming software are developed for Windows and free downloadable at www.atos.com in MyAtos download area. The intuitive interface allows:

- set up valve's functional parameters
- verify the actual working conditions
- identify and quickly solve fault conditions
- adapt the factory preset parameters to the application requirements
- store the customized setting into the valve drivers or axis controls
- archive the customized setting into the PC

The interface is organized in pages related to different specific groups of functions and parameters.

The connected devices models are automatically recognized and the parameters groups will be displayed.

#### General features:

- automatic recognition of connected devices
  numeric parameters settings (scale, bias,
- ramp, linearization, dither, etc.)
- real-time parameters modification
- diagnostic and monitor signals

Atos CONNECT mobile App:

 supports Bluetooth communication for all Atos devices except valves with p/Q control or axis controls (see section ))

E-SW-SETUP / Z-SW-SETUP PC software:

- supports Bluetooth/USB communication for all Atos devices (see section 10)
- internal oscilloscope function
- firmware update

# 1 PROGRAMMING TOOLS

#### 1.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time.

Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth.

It does not support valves with p/Q control or axis controls (see 9.2).









# Minimum requirements

Personal Computer	Pentium® processor 1GHz or equivalent
Operating System	Windows 7 SP1
Monitor Resolution	1024 x 768
Memory	2 GB RAM + Hard Disk with 1 GB free space
Interface	USB port Bluetooth Low Energy (BLE), version 4.0

1.2 PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valves drivers and axis controls via Bluetooth/USB service port.

Atos PC software supports all Atos digital valves drivers and axis controls and it is available in MyAtos area upon web registration at <u>www.atos.com</u>.

Different software versions are available:

**E-SW-SETUP** = for valve drivers

**Z-SW-SETUP** = for axis controls

#### GS500

#### GENERAL INFORMATION 941

Minimum requirements

iOS	iOS 14			
Android	Android 9			
Interface	Bluetooth Low Energy (BLE), version 4.0			

# 2 BLUETOOTH connection - ADAPTER AND CABLE

Bluetooth connection permits the functional parameters programming through mobile App and PC software (1).

#### 2.1 Connection tools

Adapter and cables shown in the image below can be ordered individually or in a single solution purchasing a dedicated kit: E-KIT-BTH



(1) The previous versions of the Bluetooth adapter and cables are still compatible (see 9.1)

(2) Bluetooth not available for off-board E-BM-AES, E-BM-RES and on-board TID-BC valve drivers

#### 2.2 E-A-BTH - Bluetooth adapter

E-A-BTH adapter adds the Bluetooth[®] connectivity to Atos valve drivers and axis controls. E-A-BTH adapter can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers and axis controls at any time. E-A-BTH adapter can be directly supplied with the valve drivers selecting **T** option or purchased separately.

Bluetooth connection to the Atos devices can be protected against unauthorised access by setting a personal password.

The adapter leds visually indicates the status of valve drivers or axis controls and Bluetooth connection.

For more info, please refer to STARTUP-BLUETOOTH guide.







WARNING: Bluetooth adapter is available only for Europe, USA, Canada, China, Japan, India, Korea markets! Bluetooth adapter is certified according to RED (Europe), FCC (USA), ISED (Canada), SRRC (China), MIC (Japan), BIS (India), KC (Korea) directives





#### 3 USB connection - ISOLATOR AND CABLE

USB connection permits the functional parameters programming through PC software.

#### 3.1 Connection tools

Isolator and cables shown in the image below can be ordered individually or in a single solution purchasing a dedicated kit: E-KIT-USB



(1) USB port is not available for on-board TID-BC valve drivers

WARNING: the USB port of valve drivers / axis controls is not isolated and use of USB isolator adapter is highly recommended! Wrong earthing connections may cause high potential difference between GNDs, generating high currents that could damage valve drivers / axis controls or the connected PC.

#### 3.2 E-A-SB-USB/OPT isolator adapter



USB 2.0 Full speed (12 MBps)
electrical isolation 3 kV

- temperature range, -40°C ÷ +80°C
- external power supply not required
- PC driver not required
- status LED
- status LED

#### 3.3 E-C-SB-USB/M12 cable - 4 m length - only for on-board electronics



#### 3.4 E-C-SB-USB/BM cable - 3 m length - only for off-board electronics



### 4 IR infrared - USB COMMUNICATION ADAPTER - only for on-board E-MI-AS-IR valve drivers

The adapter have to be connected to the USB communication port of PC to activate the IR infrared communication interface towards Atos digital electrohydraulics.

#### 4.1 Connection tools



#### 4.2 E-A-PS-USB/IR adapter - 3 m length



- direct infrared communication with the valve driver
- USB male connector, type A
- plug-in format for direct infrared connection on the valve driver
- transmission rate 9,6 kbit/s
- external power supply not required (USB supply)

## 5 PS serial RS232 - USB COMMUNICATION ADAPTER AND CROSS CABLES - only for off-board E-BM-AS valve drivers

The adapter have to be connected to the USB communication port of PC to activate the PS serial RS232 communication interface towards Atos digital electrohydraulics. The cross cables connect the relevant connector of the USB adapter with the communication port of the valve drivers.

#### 5.1 Connection tools



Note: the adapter is not required if PC is already equipped with a serial RS232 communication port

#### 5.2 E-A-PS-USB/DB9 adapter - 0,45 m length



- DB9 male connector according to serial RS232 specification
- USB male connector, type A
- transmission rate from 1,6 kbit/s up to 225 kbit/s
- external power supply not required (USB supply)

#### 5.3 E-C-PS-DB9/RJ45 cable - 2,5 m length



## 6 BC CANopen - USB COMMUNICATION ADAPTER AND CROSS CABLES - only for on-board TID-BC valve drivers

The adapter have to be connected to the USB communication port of PC to activate the BC CANopen communication interface towards Atos digital electrohydraulics. The cross cables connect the relevant connector of the USB adapter with the communication port of the valve drivers.

#### 6.1 Connection tools



#### 6.2 E-A-BC-USB/DB9 adapter - 2 m length



# DB9 male connector according to the CiA specification DR303-1 USB male connector, type A

- transmission rate from 10 kbit/s to 1 Mbit/s
- external power supply not required (USB supply)
- LEDs indicate the actual working condition

#### 6.3 E-C-BC-DB9/M12 cable - 2 m length



## 7 FIELDBUS TERMINATORS - only for BC and BP

The fieldbus terminators are required when output fieldbus connector has to be used as network end point. **Note:** fieldbus terminators not available for ex-proof electronics



(1) for on-board TES, LES, TEZ, LEZ series 40 or higher

(2) for off-board E-BM-AES, E-BM-RES, E-BM-TEB/LEB, E-BM-TES/LES, Z-BM-TEZ/LEZ, Z-BM-KZ and for on-board TID-BC

#### 7.1 M12 terminators



#### 7.2 DB9 terminators



# 8 FIRMWARE UPDATE - only with E-SW-SETUP and Z-SW-SETUP PC software via USB cable

It is possible to update the firmware of the following valve drivers and axis controls, using proper USB communication port. The firmware update is allowed starting from electronics series listed into the table or higher series:

#### Industrial electronics

E-RI-AEB s10 E-RI-AES s40	E-RI-REB s10 E-RI-RES s10	E-RI-TEB s10 E-RI-LEB s10	E-RI-TES s40 E-RI-LES s40	E-RI-TES-S s40 E-RI-LES-S s40	E-RI-TID-NP s10 (1)
E-BM-AES s10	E-BM-RES s10	E-BM-TEB s10 E-BM-LEB s10	E-BM-TES s10 E-BM-LES s10	E-BM-TES-S s10 E-BM-LES-S s10	
Z-RI-TEZ s40 Z-RI-LEZ s40	Z-BM-KZ s10	Z-BM-TEZ s10 Z-BM-LEZ s10		·	-

(1) Firmware update procedure is not available for E-RI-TID-BC

#### **Ex-proof electronics**

E-RA-AES s40	E-RA-RES s40	E-RA-TES s40 E-RA-LES s40	E-RA-TES-S s40 E-RA-LES-S s40
Z-RA-TEZ s40 Z-RA-LEZ s40	Z-RA-TEZ-S s40 Z-RA-LEZ-S s40		

# 9 MOBILE APP COMPATIBILITY AND RECOMMENDED TOOLS SELECTION

# 9.1 Industrial and ex-proof electronics - compatible with Atos CONNECT mobile App

Madel Code	Sorios	Bluetooth tools		Obsolete Bluetooth tools	
	Series		Cable	Adapter	Cable
AEB	10 or higher				
AES	40 or higher	r r E-A-BTH		E-A-SB-USB/BTH	E-C-SB-USB/M12
REB, RES	10 or higher				
TID-NP	10 or higher				
TEB, LEB	10 or higher				
TES-SN, LES-SN	40 or higher	]			
E-BM-TEB, E-BM-LEB	10 or higher				
E-BM-TES-SN, E-BM-LES-SN	10 or higher				L-0-30-030/DIVI

#### 9.2 Industrial and ex-proof electronics - NOT compatible with Atos CONNECT mobile App

Model Code	Series
E-MI-AS-IR	11
E-BM-AS	10 or higher
E-BM-AES	10 or higher
E-BM-RES	10 or higher
TID-BC	10 or higher
TES, LES with p/Q control	40 or higher
E-BM-TES with p/Q control	10 or higher
TEZ, LEZ	40 or higher
Z-BM-KZ	10 or higher
Z-BM-TEZ, Z-BM-LEZ	10 or higher

# 10 PC SOFTWARE AND RECCOMENDED TOOLS SELECTION

# 10.1 Industrial and ex-proof electronics

PC coffwara	Model Code	Sorios	Bluetooth		USB , Serial, Inf	rared	
FC SUILWAIE		Series	Adapter	Cable	Adapter	Cable	Terminator
	E-MI-AS-IR	11			E-A-PS-USB/IR		
	E-BM-AS	10 or higher			E-A-PS-USB/DB9	E-C-PS-DB9/RJ45	
	E-BM-AES	10 or higher					
	E-BM-RES	10 or higher					
	E-BM-TEB, E-BM-LEB	10 or higher				E-C-28-028/BM	
	E-BM-TES, E-BM-LES	10 or higher		E-C-BIN			
E-SW-SETUP	AES	40 or higher				E-C-SB-USB/M12	
	AEB	10 or higher	- E-A-BTH	E-A-D-U	L-A-3B-03B/0F1		
	REB, RES	10 or higher					
	TEB, LEB	10 or higher					
	TES, LES	40 or higher					
	TID-NP	10 or higher					
	TID-BC	10 or higher			E-A-BC-USB/DB9	E-C-BC-DB9/M12	E-TRM-BC-DB9/DB9
	TEZ, LEZ	40 or higher				E-C-SB-USB/M12	
Z-SW-SETUP	Z-BM-KZ	10 or higher	E-A-BTH	E-C-BTH	E-A-SB-USB/OPT	E-C-SB-USB/BM	
	Z-BM-TEZ, Z-BM-LEZ	10 or higher					

#### **10.2 Obsolete industrial electronics**

PC software	Model Code	Series	Communication type	Adapter	Cable	Terminator
	E-BM-TID, E-BM-LID	10	NP - fieldbus not present	E-A-SB-USB/OPT	E-C-SB-USB/BM	
	AES	30	DC Coriol	E-A-PS-USB/DB9		
	AERS, TERS, TES, LES	31	ro - Senai		E-C-PS-DB9/M12	
	AES	30	BC CANopop			
E-SW-SETUP	AERS, TERS, TES, LES	31	BC - CAlvopen	E-A-BC-USB/DB9	E-C-BC-DB9/M12	E-TRM-BC-DB9/DB9
	AES	30		E-A-PS-USB/DB9	E-C-PS-DB9/M12	
	AERS, TERS, TES, LES	31	BP - PROFIBUS	E-A-BP-USB/DB9	E-C-BP-DB9/M12	E-TRM-BP-DB9/DB9
	AES	30	EH - EtherCAT	E-A-PS-USB/DB9	E-C-PS-DB9/M12	
	TEZ,LEZ	10			E-C-PS-DB9/M12	
	Z-BM-KZ-PS	10 or higher	PS - Senai	E-A-PS-USB/DB9	E-C-PS-DB9/DB9	
Z-SW-SETUP	TEZ,LEZ	10	BC - CANopen	E-A-BC-USB/DB9	E-C-BC-DB9/M12	E-TRM-BC-DB9/DB9
	TEZ,LEZ	10		E-A-BP-USB/DB9	E-C-BP-DB9/M12	E-TRM-BP-DB9/DB9
	Z-BM-KZ-PS/BP	10 or higher		E-A-PS-USB/DB9	E-C-PS-DB9/DB9	

# 10.3 Obsolete ex-proof electronics

PC software	Model Code	Series	Communication type	Adapter	Cable	Terminator
E-SW-SETUP	AES	30	DC Carial	E-A-PS-USB/DB9	E-C-PS-DB9/M8	
	AERS, TERS, TES, LES	31				
	AES	30	BC - CANopen BP - PROFIBUS	E-A-PS-USB/DB9	E-C-PS-DB9/M8	
	AERS, TERS, TES, LES	31		E-A-BC-USB/DB9	E-C-BC-DB9/RA	E-TRM-BC-DB9/DB9
	AES	30		E-A-PS-USB/DB9	E-C-PS-DB9/M8	
	AERS, TERS, TES, LES	31		E-A-BP-USB/DB9	E-C-BP-DB9/RA	E-TRM-BP-DB9/DB9

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# **Fieldbus features**

BC (CANopen), BP (PROFIBUS DP), EH (EtherCAT), EW (POWERLINK), EI (EtherNet/IP), EP (PROFINET RT/IRT)

# Typical CANopen or PROFIBUS DP fieldbus network



Typical EtherCAT, POWERLINK, EtherNet/IP or PROFINET RT/IRT fieldbus network



Fieldbus communication interfaces are available for valve drivers, pump drivers, axis controls and servopump drives, granting several plus:

- more information available for machine operation to enhance its performances
- improved accuracy and robustness of digital transmitted information
- costs reduction due to simpler and standardized wiring solutions
- costs reduction due to fast and simple installation and maintenance
- direct integration into machine's communication networks

These executions allow to operate valve drivers, pump drivers, axis controls and servopump drives through fieldbus or using the analog signals on main connector ().

#### Fieldbus distributed-control

Fieldbus communication allows to share all the available information of the valve drivers, pump drivers, axis controls and servopump drives (reference, monitor, etc).

This distributed-control design allows to implement powerful machines functionalities for tuning, diagnostic, maintenance, etc.

**CANopen and PROFIBUS DP** networks consist of a common cable (2 twisted wire, 2) for digital communication: several devices (node 3) can be connected to this main cable by means of short cable branches (4).

The two endpoints of the main cable must be terminated with specific devices (terminator, (5)) to dissipate the communication signal's energy thus preventing interferences and degradations of fieldbus transmission.

EtherCAT, POWERLINK, EtherNet/IP and PROFINET RT/IRT networks consist in a Ethernet common cable (4 twisted wire, (6)) for digital communication. All slave, adapter and IO device have always the double connector for signal input (7) and signal output (8).

The main Ethernet cable starting from the master, scanner and IO controller has to be connected to the slave, adapter and IO device input connector.

The slave, adapter and IO device output connector has to be connected to the next slave, adapter and IO device input connector.

# Physical

Serial input format	Industrial field-bus with optical insulation type CAN-Bus ISO11898
Transmission rate	Transmission rates from 10 Kbit/s to 1 Mbit/s
Max node	32 per segment without repeater; 127 per segment with repeater

Standard references

Road Vehicles – Interchange of digital information controller area network (CAN) for High-speed communication

Industrial communication subsystem

CANopen – Application Layer and Communication Profile for Industrial

Cabling and connector pin assignment

CANopen - Layer Setting Services and

CANopen - Device Profile for Proportional

based on ISO 11898 (CAN) for controller

ISO 11898

EN50325-4

CiA DS301

Systems

Protocol CiA DS408 (1)

CiA DR303-1

CiA DSP305 (1)

Hydraulic Valves v 1.5.2

device interfaces

# **Communication Protocol**

Data Link LayerDS301 V4.2.0 - based on CAN standard frame with 11-bit identifierDevice ProfileDS408 - Fluid Power Technology (EN50325-4) (1)Device typeSlave

#### Startup and configuration - as per DS301 + DSP305

Boot up process	Minimum boot-up
Node setting	LSS (Layer Setting Services) (1)
	SDO
	E-SW-SETUP, Z-SW-SETUP and S-SW-SETUP programming software
Baudrate setting	LSS (Layer Setting Services) (1)
	SDO
Baudrate	10 / 20 / 50 (default) / 125 / 250 / 500 / 1000Kbit/s

# Fieldbus communication diagnostic - as per DS301

Device Error	Emergency
Network Error	Node Guarding
	Heartbeat

#### Real-time communication - as per DS301 + DS408

RPDO	4 mappable PDOs to the valve drivers and pump drivers: AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES, PES, TID
	4 mappable PDOs to the axis controls: TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ
	4 mappable PDOs to the servopump drives: D-MP
TPDO	4 mappable PDOs from the valve drivers and pump drivers: AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES, PES, TID
	4 mappable PDOs from the controllers: TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ
	4 mappable PDOs from the servopump drives: D-MP

R(T)PDO types Event Triggered, Remotely requested, Sync(cyclic) and Sync(acyclic)

#### Non real-time communication - as per DS301 + DS408

SDO

1 SDO (1 Server + 1 Client)

# (1) Not for D-MP servopump drives

#### Programming interface

E-SW-SETUP, Z-SW-SETUP and S-SW-SETUP software using proper cable/adapter (see GS500 and AS800) or CANopen master device

#### Configuration file

EDS (Electronic Data Sheet) enclosed in MyAtos area at www.atos.com

#### Manuals

E-MAN-S-BC enclosed in programming software E-SW-SETUP and in MyAtos area at www.atos.com

Z-MAN-S-BC enclosed in programming software Z-SW-SETUP and in MyAtos area at www.atos.com

S-MAN-BC enclosed in programming software S-SW-SETUP and in MyAtos area at www.atos.com

# 2 PROFIBUS DP features for BP executions

Dhundin al		Other stand we ferrer and
Physical		Standard references
Serial input format	Industrial field-bus with optical insulation type PROFIBUS-DP RS485	PROFIBUS profile
Transmission rato	Transmission rates from 9.6 Khit/s to 12 Mbit/s	Fluid Power Technology
Max node	32 per segment without repeater: 126 pode with repeater	Edition Oct. 2001
Max House	oz per segment without repeater, 120 hode with repeater	VDMA profile (1)
		Fluid Power Technology,
Communication P	rotocol	Proportional Valves and
Data Link Layer	PROFIBUS DPV0 - IEC 61158 (type 3)	Hydrostatic Transmissions, ver 1.1
Device Profile	PROFIBUS-DP Profile for Fluid Power Technology (1)	
Device type	Slave	
Startup and config	uration	
Boot up process	SAP 61 for sending parameter setting data	
	SAP 62 for checking configuration data	
Node setting	SAP 55	
0	E-SW-SETUP, Z-SW-SETUP and S-SW-SETUP programming software	
Baudrate setting	Automatic	
Baudrate	9,6 / 19,2 / 45,45 / 93,75 / 187,5 / 500 / 1500 / 3000 / 6000 / 12000 Kbit/s	
Fieldbus commun	ication diagnostic	
Device error	SAP 60	
Real-time commun	lication	
PZD	Process data area of PPO telegram by Data Exchange, default SAP:	
	cyclic transmission of standard Profibus frame	
	Valve drivers and pump drivers	
	PPO type 3, 113, 213, 230 for:	
	AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES	
	PPO type 5, 115, 214, 240 for: TES, BM-TES, LES, BM-LES, PES with alternated P/Q control	
	Note: PPO type 213, 230, 214, 240 are customizable by user	
	Axis controls	
	<i>PPO type 1, 111, 121, 123 for:</i> TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ	
	PPO type 1, 101, 103, 111, 121, 123, 223, 227 for: TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ with alternated P/Q control	
	Note: PPO type 223, 227 are customizable by user	
	Servopump drives	
	from 0 to 10 customizable Word - INPUT from 0 to 10 customizable Word - OUTPUT	
Cyclic mode	standard, sync and freeze	
Non real-time com	munication	
PKW	Parameter data area of PPO telegram by Data Exchange, default SAP:	
	acyclic transmission of standard Profibus frame (for D-MP servopump drives,	
	PWK part may be enabled or disabled)	
(I) NOT TOP D-MP SE	rvopump anves	

#### Programming interface

E-SW-SETUP, Z-SW-SETUP and S-SW-SETUP software using proper cable/adapter (see GS500 and AS800) or PROFIBUS DP master device

#### **Configuration file**

GSD (General Station Description) enclosed in MyAtos area at www.atos.com

#### Manuals

E-MAN-S-BP enclosed in programming software E-SW-SETUP and in MyAtos area at www.atos.com

Z-MAN-S-BP enclosed in programming software Z-SW-SETUP and in MyAtos area at www.atos.com

S-MAN-BP enclosed in programming software S-SW-SETUP and in MyAtos area at www.atos.com

# 3 EtherCAT features for EH executions

Physical		Standard references
Serial input format	Industrial fieldbus type Fast Ethernet galvanically insulated IEC 61158-2	ISO 11898
Transmission rate	2 x 100 Mbit/s (Fast Ethernet, Full-Duplex)	Road Vehicles – Interchange of digital
Max node	65535 slaves	information controller area network (CAN)
Ethernet Standard	ISO/IEC 8802-3 frame format	for High-speed communication
EtherType	0x88A4 according to IEEE 802.3	EN 50325-4
Cable length	0,2 - 100m (between two slave devices)	Industrial communication subsystem
Cable type	CAT5 (4 wire twisted pair) according with T568B	based on ISO 11898 (CAIN) for controller
Network topology	Line, tree and star	
Termination	Device internally	CANopen – Application Layer and Communication Profile for Industrial Systems
Communication P	rotocol	CIA DSP305
Data Link Layer	EtherCAT use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2	CANopen – Layer Setting Services and Protocol
Device Profile	CANopen over EtherCAT (CoE) DS408 - Fluid Power Technology (1) and	CiA DS408 (1)
	DS402 (2)	CANopen – Device Profile for
	EN 50325-4	Proportional Hydraulic Valves v 1.5.1
Device type	Slave	CiA DS402 (2)
Supported protocol	CANopen SDO Mailbox-Interface "CoE"	CANopen – Device Profile for
	Network Management	
		IEC 610/6-2-101
	PDO Walchdog Cycle time min 1 msoc	- Product Requirements -
		Part 2-101: Circular connectors
		- Detail specification for M12 connectors
Startup and config	juration - as per DS301 + DSP305	with screw-locking
Node setting	Automatic position addressing	IEC 61158-2
	Device node addressing	Industrial communication networks
Baudrate	100 Mbit/s (Automatic)	Part 2: Physical layer specification and service definition
Fieldbus commun	ication diagnostic - as per DS301	IEC 61784-2
Device Error		Industrial communication networks
Device Liter	Energency	- Promes - Part 2 [.] Additional fieldbus profiles for real-
		time networks based on ISO/IEC 8802-3
Real-time commun	nication - as per DS301 + DS408 + DS402	
RPDO	4 PDOs messages	
	to the valve drivers, pump drivers, axis controls and servopump drives	
	(up to 32 byte for each PDO)	
TPDO	4 PDOs messages	
	from the valve drivers, pump drivers, axis controls and servopump drives (up to 32 byte for each PDO)	
R(T)PDO types	Remotely requested	
Non real-time com	munication - as per DS301 + DS408 + DS402	
SDO	1 SDO (1 Server + 1 Client)	
(2) Only for D-MP s	ervopump drives	

# Programming interface

E-SW-SETUP, Z-SW-SETUP and S-SW-SETUP software using proper cable/adapter (see GS500 and AS800) or EtherCAT master device

### Configuration file

XML (Extensible Markup Language) enclosed in MyAtos area at www.atos.com

#### Manuals

E-MAN-S-EH enclosed in programming software E-SW-SETUP and in MyAtos area at www.atos.com

Z-MAN-S-EH enclosed in programming software Z-SW-SETUP and in MyAtos area at www.atos.com

S-MAN-EH enclosed in programming software S-SW-SETUP and in MyAtos area at www.atos.com

# 4 POWERLINK features for EW executions - not available for servopump drives

Physical		Standard references
Serial input format Transmission rate Max node	Industrial fieldbus type Fast Ethernet galvanically insulated IEC 61158-2 2 x 100 Mbit/s (Fast Ethernet, Half-Duplex) 239 slaves	EPSG DS301 Ethernet POWERKLINK Communication Profile Specification v 1.2
Ethernet Standard EtherType Integrated Hub Cable length Cable type	ISO/IEC 8802-3 frame format 0x88AB according to IEEE 802.3 0,2 - 100m (between two slave devices) CAT5 (4 wire twisted pair) according with T568B	<i>EPSG DS302-A/B/C/D/E</i> Ethernet POWERKLINK Part A: High Availability v1.1 Part B: Multiple ASnd v1.0 Part C: PollResponse Chaining v1.0 Part D: Multiple PReq/PRes v1.0
Ethernet Hub	Line, tree, star, daisy chain, ring structure or any combination of these topo- logies Integrated with 2 ports: - one led for Link/Activity indicator (on each port) - one bicolor led Status/Error indicator	Part E: Dynamic Node Allocation v1.0 EPSG DS311 Ethernet POWERKLINK XML Device Description v 1.0 CiA DS408 CANopen – Device Profile for Proportional
Communication Pro	otocol	Hydraulic Valves V 1.5.1
Data Link Layer Comm. Profile	POWERLINK use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2 EPSG DS 301 v1.2	IEC 61076-2-101 Connectors for electronic equipment - Product Requirements - Part 2-101: Circular connectors - Detail specification for M12 connectors
Device type	<ul> <li>Slave - supported features:</li> <li>Ethernet POWERLINK v2.0</li> <li>Ring Redundancy</li> <li>Support PollRsponse Chaining</li> <li>Support Multiplexing</li> <li>Cycle time min 200 µsec</li> <li>SDO Multiple Parameter Read/Write</li> </ul>	with screw-locking <i>IEC 61158-2</i> Industrial communication networks - Fieldbus specification - Part 2: Physical layer specification and service definition <i>IEC 61784-2</i> Industrial communication networks - Profiles - Dat 0: Additional fieldbus profiles for coal
Startup and configu	uration (as per EPSG DS301 + EPSG DS 302-A/B/C/D/E)	Part 2: Additional fieldbus profiles for real- time networks based on ISO/IEC 8802-3
Node setting Baudrate	E-SW-SETUP and Z-SW-SETUP programming software 100 Mbit/s (Automatic)	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses -
Fieldbus communie	cation diagnostic	General rules and profile definitions
Custom parameters r	nappable on TPDO for emergency diagnosis	<i>IEC 61158-300/400/500/600</i> Industrial communication networks - Fieldbus specifications -
Real-time commun	ication (as per EPSG DS301 + DS408)	Part 300: Data Link Layer service defini-
RPDO	1 PDO message to the driver (max number of of mapping parameters is Device specific) 1 PDO message from the driver	tion Part 400: Data Link Layer protocol speci- fication
	(max number of of mapping parameters is Device specific)	Part 500: Application Layer service defini- tion Part 600: Application Layer protocol spe- cification <i>ISO 15745-1</i> Industrial automation systems and integration - Open systems application integration framework - Part 1: Generic reference description
	-	

# Programming interface

E-SW-SETUP, Z-SW-SETUP software using proper cable/adapter (see GS500 and AS800) or POWERLINK master device

#### **Configuration file**

XDD (XML Device Description) enclosed in MyAtos area at www.atos.com

#### Manuals

E-MAN-S-EW enclosed in programming software E-SW-SETUP and in MyAtos area at www.atos.com Z-MAN-S-EW enclosed in programming software Z-SW-SETUP and in MyAtos area at www.atos.com

Physical		Standard references
Ethernet Standard	ISO/IEC 8802-3 frame format	IEC 61918
EtherType	0x08E1 according to IEEE 802.3	Industrial communication networks
Transmission rate	10/100 Mbit Full/Half-Duplex	- Installation of communication networks
Integrated	2-port switch	in industrial premises
Cable length	max 100m	IEC 61076-2-101
Cable type	CAT5 (4 wire twisted pair) according with T568B	Connectors for electronic equipment
Network topology	Device Level Ring (DLR), linear, star structure	Part 2-101: Circular connectors
Ethernet switch	integrated with two ports	- Detail specification for M12 connectors
Led indicator	2 led for Link/Activity indicator (on each port) and	with screw-locking
	1 bicolor led for Status/Error indicator	IEC 61158-1
		Industrial communication networks
		- Fieldbus specification -
Communication Pr	atocal	Part 1: Overview and guidance for the
	Iuuei arcru for Conorio Dovico Profilo	IEC 61158-2
- Identity Object III		- Fieldbus specification -
- Message Bo	(0,0,0)	Part 2: Physical layer specification and
- Assembly Ob	$p_{iect}(0x04)$	service definition
- Connection N	Manager Object (0x06)	IEC 61784-1
- Parameter Ob	piect (0x0F)	Industrial communication networks
- DLR Object (	0x47)	- Profiles - Part 1: Fieldhus profile
- QoS Object (	0x48h)	
- Port Object (0	0xF4)	Industrial communication networks
- TCP/IP Object	t (0xF5)	- Profiles -
- Ethernet Link	Object (0xF6)	Part 2: Additional fieldbus profiles for real-
Valve parameters ad	ccessible via Vendor Specific Object 0xA2	time networks based on ISO/IEC 8802-3
IP address setting (r	ange 0.0.0.0 - 255.255.255.255):	IEC 61784-3
- TCP/IP Object	tt (0xF5)	Industrial communication networks
- DHCP		- Promes - Part 3: Functional safety fieldbuses -
- Auxiliary USB	communication + Atos Software	General rules and profile definitions
I/O Adapter and Exp	Dicit Message Server device type	IEC 61784-5-2
Cyclic data transmis	sion via Implicit Messages (transport class 1)	Industrial communication networks
- Minimum RPI	for implicit Messages Tris	- Profiles -
- Total number	notors and 20 bytes for each connection	Part 5-2: Installation of fieldbuses -
- Op to 5 parai	· Cyclic CoS	Installation profiles for CPF 2
Acyclic data transm	ission via Connected and Unconnected Explicit Messages (transport class 3)	ISO 15/45-4
- Minimum RPI	for Explicit Messages 100ms	integration - Open systems application
- No. of simulta	ineous Class 3 connections: 6	integration framework -
		Part 4: Reference description for Ethernet
		based control systems
1		

# Programming interface

E-SW-SETUP, Z-SW-SETUP software using proper cable/adapter (see GS500 and AS800) or EtherNet/IP scanner device

#### **Configuration file**

EDS (Electronic Data Sheet) enclosed in MyAtos area at www.atos.com

#### Manuals

E-MAN-S-El enclosed in programming software E-SW-SETUP and in MyAtos area at www.atos.com Z-MAN-S-El enclosed in programming software Z-SW-SETUP and in MyAtos area at www.atos.com

# 6 PROFINET RT/IRT features for EP executions

Physical		Standard references
Ethernet Standard EtherType	ISO/IEC 8802-3 frame format 0x8892 according to IEEE 802.3	IEC 61918 Industrial communication networks
Transmission rate	100 Mbit Full-Duplex	- Installation of communication networks
Integrated	2-port switch	in industrial premises
Cable length	max 100m	IEC 61076-2-101
Cable type	CAT5 (4 wire twisted pair) according with T568B	Connectors for electronic equipment
Network topology	line, star, tree and ring structure	- Product Requirements -
Ethernet switch	integrated with two ports	Part 2-101 (1): Circular connectors
Led indicator	2 led for Link/Activity indicator (on each port)	with screw-locking
	1 bicolor led for Status/Error indicator (1)	
		Industrial communication networks
Communication Pr	otocol	Part 1: Overview and guidance for the
Data Link Layer	PROFINET use Standard Ethernet Frames:	IEC 61158 and IEC 61784 series
,	ISO/IEC 8802-3 + IEC 61784-2	IEC 61158-2
Device type	IO device - supported features:	Industrial communication networks
	- complies with PROFINET IO conformance Class A, B, C	- Fieldbus specification -
	- Acyclic parameter Channel	Part 2: Physical layer specification and
	- Real Time (RT) and Isochronous Real Time (IRT) communication	service definition
	for valve drivers, pump drivers, axis controllers	IEC 61158-5-10
	- Up to 10 input/output parameters for real time data exchange	Industrial communication networks
	for servopump drives	- Fieldbus specification -
	- PROFINET specific diagnostic support	tion – Type 10 elements
	- Media Redundancy Protocol (MRP)	IEC 61784-1
	- DCP Discovery and Configuration Protocol supported	Industrial communication networks
	- Identification & Maintenance (I&M) Cycle time min: 1 msec [RT] 250 usec [IRT]	- Profiles -
		Part 1: Fieldbus profile
		IEC 61784-2
Startup and config	uration	Industrial communication networks
Address setting	IP Address and Station Name are assigned automatically by IO controller (e.g.	- Profiles -
Developte	Discovery and Configuration Protocol)	Part 2: Additional fieldbus profiles for real-
Dauurale	Too Molly's (Automatic)	LITTLE THE WORKS DASED OF ISO/IEC 8002-3
		IEC 61/84-5-3
Fieldbus communi	cation diagnostic	- Profiles -
Custom parameters i	nappable on real time communication for emergency diagnosis	Part 5-3: Installation of fieldbuses - Installation profiles for CPF 3
Real-time commun	ication	
Modular config	for valve drivers and pump drivers:	
	AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES, PES	
	- up to 5 input parameters for real time data exchange	
	- up to 5 output parameters for real time data exchange	
	for axis controls:	
	TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ	
	- up to 8 input parameters for real time data exchange	
	- up to 8 output parameters for real time data exchange	
	for servopump drives: D-MP	
	- up to 10 input configurable parameters for real time data exchange	
	- up to 10 output configurable parameters for real time data exchange	
(I) NOT FOR D-MP Set	vopump drives	

# Programming interface

E-SW-SETUP, Z-SW-SETUP and S-SW-SETUP software using proper cable/adapter (see GS500 and AS800) or PROFINET controller

#### Configuration file

GSDML (GSD Markup Language) enclosed in MyAtos area at www.atos.com

#### Manuals

E-MAN-S-EP enclosed in programming software E-SW-SETUP and in MyAtos area at www.atos.com Z-MAN-S-EP enclosed in programming software Z-SW-SETUP and in MyAtos area at www.atos.com S-MAN-EP enclosed in programming software S-SW-SETUP and in MyAtos area at www.atos.com



# **IO-Link features**

Point-to-point digital communication protocol

## Typical IO-Link network



#### 1 GENERAL DESCRIPTION

IO-Link is a standard digital communication used for connecting digital sensors and actuators to the fieldbus network.

An IO-Link system consits of the following components:

- IO-Link master
- IO-Link devices (valves, transducers,...)
- Standard unshielded molded cables

Each device is connected to a single port of the master via low cost unshielded cables (point-to-point communication) and the master works as a hub establishing the communication between the devices and the machine central unit which manages the automation system. IO-Link masters support various fieldbuses for the communication with the machine central unit (CANopen, PROFIBUS, EtherCAT, POWERLINK, PROFINET, EtherNet/IP, ...).

The IO-Link system offers several advantages as a digital communication interface:

- low cost cables with standarized wiring
- improved accuracy and robustness of digital transmitted information
- more information available for machine optimization, diagnostics and troubleshooting
- dynamic change of device parameters for increasing machine flexibility and performances
- automatic device identification and parametrization for simplifying commissioning and maintenance operations

# 2 IO-Link features for digital drivers in IL execution

Physical		Standard references
Serial input format	24V pulse modulation	IEC 61131-9
Transmission rate	230.4 kbit/s (COM3)	Programmable controllers - Part 9:
Port Class	Class B	Single-drop digital communication interface
Network Topology	Point-to-point connection	for small sensor and actuators (SDCI)
Cable lenght	Un to 20 m	
Cable type	5 wires unshielded	IO-Link
Cable type	5 wires, unsineraed	Interface and System Specifications 1.1.3
Communication Pr	otocol	IO-Link
Data Link Lawar		Test Specifications 1.1.3
Dala LIIK Layei	n sequence type.	
	- operate mode = 11PE 2_V	
Device type	Device - supported features:	
	- Cyclic transmission of process data	
	- Acyclic transmission of parameters	
	- Acyclic transmission of identification data	
	- Acyclic transmission of diagnostic events	
Configuration and	Commissioning	
- setting via Atos PC	software	
- setting via IO-Link	/ USB adapter and configuration tool	
- setting via IO-Link	Master and configuration tool	
- setting via Machine	e Central Unit	
Cyclic transmission	n of process data	
Cycle time	Min 2 ms	
Number input data	2 word	
Number output data	2 word	
Diagnostic Events		
	0 ma	
	2 ms	
Event category type	Error, warning, Notification	
Status code	Type 2 with details	
Number of event	Max 6 concurrent errors	
Programming inter	face	
E-SW-SETUP softwa	re using proper cable/adapter (see tech table GS500)	

# Configuration file

IODD (IO Device Description), enclosed in MyAtos area at www.atos.com

#### Manuals

E-MAN-S-IL enclosed in programming software E-SW-SETUP and in MyAtos area at www.atos.com

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# Mounting surfaces for electrohydraulic valves

ISO standard, for directional, pressure and flow control valves plus pressure switches



# 1 ISO 4401: 2005 - for directional, pressure and flow control valves

Mounting surfaces dimensions [mm]	ISO code / ports	Valve type	
	size [mm]	industrial	ex-proof
M 12 M 12	<b>4401-08-08-0-05</b> P, A, B, T = Ø 25 max X, Y, L = Ø 11,2 max	DP-4* DPH*-4* DPZO-*-4* JP*-3* (modular)	DPHA-4 / DPHW-2 DPZA-*-4
94,5 100.8 112.7 130.2	<b>4401-08-08-0-05</b> P, A, B, T = Ø 32 max X, Y, L = Ø 11,2 max	DPZO-*-4M*	DPZA-*-4M*
M20 $M20$ $T$ $P$ $Y$ $G$	<b>4401-10-09-0-05</b> P, A, B, T = Ø 32 max X, Y, L = Ø 11,2 max	DP-6* DPH*-6* DPZO-*-6*	DPHA-6 DPZA-*-6
M20 M20 T P Y G G G G G G G G	<b>4401-10-09-0-05</b> P, A, B, T = Ø 50 max X, Y, L = Ø 11,2 max	DPZO-*-8*	-

Mounting surfaces dimensions [mm] ISO code / ports size		de / ports size Valve type	
	[mm]	industrial	ex-proof
M12 P T X Z2 47.5 54	<b>6264-06-09-1-97</b> P, T = Ø 14,7 max X = Ø 4,8 max	AGAM-10 AGMZO-*-10	AGAM-10 / AO AGAM-10 / WO AGMZA-*-10
M 16 P T P T P T P C P C P P P P P P P P P P P P P	<b>6264-08-11-1-97</b> P, T = Ø 23,4 max X = Ø 6,3 max	AGAM-20 AGMZO-*-20	AGAM -20 / AO AGAM-20 / WO AGMZA-*-20
M 20 P T S S S S S S S S S S S S S	<b>6264-10-17-1-97</b> P, T = Ø 32 max X = Ø 6,3 max	AGAM-32 AGMZO-*-32	AGAM-32 / AO AGAM-32 / WO AGMZA-*-32

3	ISO 5781: 2000 - for pressure reducing and piloted check valves
---	-----------------------------------------------------------------

Mounting ourfoco dimensions [mm] ISO code / ports		ISO code / ports size Valve	
	[mm]	industrial	ex-proof
$\begin{array}{c} M10 \\ \hline \\ $	<b>5781-06-07-0-00</b> A, B = Ø 14,7 max X, Y = Ø 4,8 max	AGIS-10 AGIR-10 AGIU-10 AGRL*-10 AGRCZO-*-10	AGRCZA-*-10
$\begin{array}{c} M10 \\ \hline \\ $	<b>5781-08-10-0-00</b> A, B = Ø 23,4 max X, Y = Ø 4,8 max	AGIS-20 AGIR-20 AGIU-20 AGRL*-20 AGRCZO-*-20	AGRZA-*-20
$\begin{array}{c} M10 \\ \hline \\ $	<b>5781-10-13-0-00</b> A, B = Ø 32 max X, Y = Ø 4,8 max	AGIS-32 AGIR-32 AGIU-32 AGRL*-32	-

# 4 ISO 16873: 2002 - for pressure switches

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type		
	16873-01-01-0-02	MAP		
	P = Ø 4 max			

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# Mounting surfaces and cavities for cartridge valves









#### 4 CAVITIES DIMENSIONS for CARTRIDGE PRESSURE RELIEF VALVES type CART [mm]



#### 5 CAVITIES DIMENSIONS for 2 WAY SOLENOID CARTRIDGE VALVES type JO-DL [mm]



#### 6 ISO 7368 COVER INTERFACE DIMENSIONS for 2 WAY and 3 WAY CARTRIDGE VALVES [mm]



-

Ø300

Ø380

M30

M36

10

8

20

32

63

78

(64.8 min)

10

10

_

100

125

-

-

-

-

-

-

-

-

-

Ø245

Ø300



### 8 CAVITIES DIMENSIONS for 3 WAY CARTRIDGE VALVES [mm]

(1) Minimun the spec H7 tolera General Tol (except cha	(1) Minimum length over which the specific surface finish and H7 tolerance shall apply (1) Minimum length over which												5 (size 5 (size	20.01 100	<u>40)</u> 80)		/ALVE proport QZO-L [*] QZA-L*	TYPE ional 3 way 3 way 3 way	
Size	ød1	ød2	ød3	ød4	ød5	L1	L2	L3	L4	L5	L6	L7	L8	(L9)	(L10)	L11	L12	U	W
25	45	43	34	20	20	12,5	56	89	103	45	78	25	15	1	1	2,5	2,5	0,03	0,05
32	60	58	55	32	24	14	43.5	85	100	30	70.5	18	15	1.5	2.5	2.5	2.5	0.03	0.05
40	75	73	55	40	30	17.5	54	105	125	36	87	21	18	3	3	3	3	0.03	0.05
50	90	87	68	50	35	18,5	87	143	165	66	122	48	18	3,5	3,5	4	3	0.03	0.05
63	120	116	90	63	48	26,5	85	165	195	57	137	33	28	4	4	4	4	0,03	0,05
80	145	140	110	80	60	26,5	125	215	245	90	180	60	25	5	5	5	5	0,03	0,05

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# **Operating and maintenance information for proportional valves**

directional, flow, pressure controls

safety valves conforming to Machine Directive 2006/42/EC

This operating and maintenance information applies to Atos proportional directional, flow, pressure control valves and safety proportional valves. It is intended to provide useful guidelines to avoid risks when the valves are installed in the hydraulic system.

It contains important information on the safe and proper installation, commissioning, operation transport and maintenance of the products.

The prescriptions included in this document must be strictly observed to avoid damages and injury.

The respect of this operating and maintenance information grants an increased working life, trouble-free operation and thus reduced repairing costs.



#### 1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided. In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

	Death or serious injury could occur					
	CAUTION         Minor or moderate injury could occur					
NOTICE	Property damage could occur					
SAFETY CERTIFIED	Notes relevant to safety proportional valves					
	Information to be observed					

# 2 GENERAL NOTES

This document is intended for machine manufacturers, assemblers and system end-users.



Personal injury and property damage may be caused by incorrect use of the products!

The products have been designed for use in industrial environments and may only be used in the appropriate way.

Before using Atos proportional valves, the following requisites must be met to ensure appropriate use of the products:

• personnel who uses Atos proportional valves must first read and understand the operating and maintenance information,

- particularly the Safety Notes in section 5.
- the products must remain in their original state, no modifications are permitted
- it is not permitted to decompile software products or alter source codes
- damaged or faulty valves must not be installed or put into operation
- $\bullet$  make sure that the products have been installed as described in section  $\fbox{6}$  and  $\fbox{7}$

#### 2.1 Warranty

- The expiration of warranty results from the following operations:
- incorrect assembly and commissioning
- improper handling and storage, see 9.4

improper use, see 5.2

modification of the original condition

# 3 CERTIFICATION

Atos range of proportional directional valves, provides functional safety options **/U** and **/K**. They are designed to accomplish a safety function, intended to reduce the risk in process control systems. The valves are **TÜV certified** in compliance with **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e** 



#### 4 PRODUCT IDENTIFICATION EXAMPLES - nameplates

# 4.1 Direct valve with on-board driver/axis card - DLHZO-TES example



- Digital driver serial number
- Digital driver factory firmware version
- Connectors pinout

#### 4.2 Piloted valve with on-board driver - AGMZO-AES example



- 1 Digital driver code
- 2 Valve code
- 3 Digital driver serial number
- 4 Digital driver factory firmware version
- (5) Connectors pinout

6 Pilot valve code

- 7 Pilot hydraulic symbol (simplified)
- (8) Pilot valve serial number

(9) Valve serial number

- 10 Hydraulic symbol (simplified)
- (1) Valve code

#### 4.3 Piloted valve with on-board driver/axis card - DPZO-LES example



4.4 Safety piloted valve with on-board driver/axis card - DPZO-LES /K example



# 5 SAFETY NOTES

#### 5.1 Intended use

Atos proportional valves are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system. They may only be operated under the environmental and operating conditions described in the valves technical tables.



For safety-relevant applications, use only safety proportional valves /U or /K, indentified by the Safety Certified logo The superior control logic in connection with the proportional valve, is responsible for the control of the machine's motion sequence and also for its safety-related monitoring.

#### 5.2 Improper use

Any improper use of the components is not admissible. Improper use of the product includes:

- use in explosive environments
- incorrect storage
- incorrect transport
  lack of cleanliness during storage and installation
- incorrect installationuse of inappropriate or non-admissible fluids
- operation outside the specified performance limits
- operation outside the approved temperature range

Atos spa does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use.

#### 5.3 Installation

Installation must be performed following the recommendations contained in the valves technical tables.

#### WARNING: non-compliance with functional safety



**SAFETY** In case of mechanical or electric failures, risk of death or persons injury could occur. **CERTIFIED** Functional safety prescriptions according to EN ISO 13849 must be observed in the hydraulic circuit.



WARNING: fixing bolts

For the valve mounting, use only class 12.9 bolts, with dimensions and length reported in the valves technical tables. Observe the specified tightening torque.

Using inappropriate fixing bolts or insufficient tightening torque, can cause the valve to loosen with consequent leakage of fluid under pressure which may cause personal injury and property damage.



#### WARNING: hot surface

The valve considerably heats up during operation. Allow the valve to cool down sufficiently before touching it. During operation, touch the valve solenoid only by using protective gloves. Please also observe ISO 13732-1 and EN 982.



#### WARNING: electronic driver/axis control

Before operating/connect the valve with the Atos CONNECT mobile App or E-SW-SETUP & Z-SW-SETUP PC software, carefully read the user manual: mobile App or PC software can change/inhibit the behaviour of the valve causing damage and injury!

During store/restore operations of the electronic driver/axis control permanent memory:

- current to valve solenoid is switched off: operate store/restore with no active valve regulation in the system
- do not turn off power supply: driver/axis control parameter lose may occur

Faults of driver/axis control may compromise safety or change operating conditions, shut down the driver/axis control immediately and notify qualified personnel.



## CAUTION

Use of the valve outside the approved temperature range may lead to functional failures like overheating of the valve solenoid/driver. Only use the valve within the specified ambient and fluid temperature range.

#### CAUTION: pressurized systems

When working at hydraulic systems with stored energy (accumulator or cylinders working under gravity), proportional valves may even be pressurized after the hydraulic power supply has been switched off. During assembly and disassembly works, serious injury may be caused by a powerful leaking of hydraulic fluid jet. Ensure that the whole hydraulic system is depressurized and the electrical control is de-energized.



**CAUTION: missing equipotential bonding** Electrostatic phenomena, an incorrect earthing or missing equipotential bonding may lead to malfunctions or uncontrolled move-



#### ments at the machine and thus cause injuries. Provide for correct earthing or proper equipotential bonding.



#### CAUTION: penetrating water and humidity

In case of use in humid or wet environments, water or humidity may penetrate at electrical connectors or into the valve electronics. This may lead to malfunctions at the valve and to unexpected movements in the hydraulic system which may result in personal injury and damage to property:

- only use the proportional valve within the intended IP protection class
- ensure that all seals and caps of the plug-in connections are tight and intact

#### NOTICE

High-pressure water jets could damage the valve seals. Do not use a high-pressure washer for the valve cleaning.

#### NOTICE: disconnection and connection of plug-in connectors

Do not plug-in or disconnect the electric connector as long as the voltage supply is ON.

# NOTICE: impact

Impact or shock may damage the valves. Never use the valves as step.

## NOTICE: dirt and foreign particles

Penetrating dirt and foreign particles lead to wear and malfunctions of the valves. During assembly, be careful to prevent foreign particles such as metal chips getting into the valve or into the hydraulic system. Do not use linting fabric for the valve cleaning.



# Environmental protection

Hydraulic fluids are harmful to the environment.

Leaking hydraulic fluid may leads to environmental pollution.

In case of fluid leakage immediately act to contain the problem.

Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

Atos components do not contain substances hazardous for the environment. The materials contained in Atos components are mainly: Copper, Steel, Aluminium, Electronic components, Rubber. Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

# 6 HYDRAULIC AND MECHANICAL INSTALLATION

#### 6.1 Power packs tank and tubes cleaning

The power unit tank has to be accurately cleaned, removing all the contaminants and any extraneous object. Piping has to be cold bended, burred and pickled. When completely assembled an accurate washing of the piping (flushing) is requested to eliminate the contaminants; during this operation the proportional valves have to be removed and replaced with by-pass connections, or on-off valves.

#### 6.2 Hydraulic connections

Flexible hoses are normally used on pressure line between powerpack and proportional valve and on user lines to connect the actuators. If their potential breakage may cause damages to the machine or system or can cause injure to the operator, a proper retenction (as the chain locking at both the pipe-ends) or alternately a protecting carter must be provided. The proportional valve must be installed as close as possible to the actuator, to assure the maximum stiffness of the circuit and so the best dynamic performances.

6.3 Hydraulic drains and return lines

Drain lines must be connected to the tank without counter pressure. The drain pipe must end above the oil level. Return line has to be sized in order to avoid variable counter pressure peaks caused by instantaneous flow variations.

#### 6.4 Fluid conditioning

A high-performance system must be thermally conditioned to ensure a limited fluid temperature excursion (generically between 40 and 50°C) so that the fluid viscosity remains constant during operation.

The machine working cycle should start after the prescribed temperature has been reached.

#### 6.5 Air bleeds

Air in the hydraulic circuits affects the hydraulic stiffness and it is the cause of malfunctioning and vibrations. Air bleeds are provided in the proportional valves.



#### Directional valves air bleeding:

- $\bullet$  release 2 or 3 turns the air bleed screw  ${\bm V}$
- cycle the valve at low pressure until the oil leaking from the V port is exempted from air bubbles
- ullet lock the air bleed screw  $oldsymbol{V}$

Note: to facilitate bleeding operations, apply a light backpressure (0,5 bar) on T port by adding a check valve on T line



#### Pressure control valves air bleeding:

- $\bullet$  release 2 or 3 turns the air bleed screw  ${\bm V}$
- cycle the valve at low pressure until the oil leaking from the V port is exempted from air bubbles
- $\bullet$  lock the air bleed screw  ${\bm V}$

Following precautions have to be considered:

- at the system start-up all the bleeds must be released to allow removal of air
- untight the connections of the piping
- the system must be bled at first start-up or after maintenance
- a check valve (e.g. 0,5 bar) should be installed on the return line to tank to avoid emptying of the pipes following a long stop of the system

#### 6.6 System flushing

The whole system must be flushed replacing the proportional valves with specific flushing plates or with on-off directional valves. Make sure that also external pilot lines, if present in the system, are flushed.

In order to obtain the required minimum cleanliness level, the hydraulic system must be flushed for a sufficient time.

A decisive factor for the flushing time is the contamination level of the hydraulic fluid which can only be determined by means of a particle counter.

During the flushing procedure, perform a frequent monitor of the filters clogging indicator, replacing the filter elements when required.

#### 6.7 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.

The hydraulic fluids must be compatible with the selected seals.

The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard		
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524		
Flame resistant without water	FKM	HFDU, HFDR	ISO 12022		
Flame resistant with water	NBR, HNBR	HFC	130 12922		

Fluid viscosity: 20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s

#### CAUTION: easily inflammable hydraulic fluid

In connection with fire or other hot sources, leaking hydraulic fluid may lead to fire or explosions.
### 6.8 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevent anomalous wearing or sticking.

## CAUTION

Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet. In the worst case, this may result in unexpected actuators movements and thus it constitutes a risk of injury. Ensure adequate hydraulic fluid cleanliness according to the cleanliness class required for the valve.

Max fluid contamination level, see also filter section at www.atos.com or KTF catalog:

- normal operation: ISO4406 class 18/16/13 NAS1638 class 7
- ISO4406 class 16/14/11 NAS1638 class 5

### 6.9 Valve fastening

Remove the protection pad located on the valve mounting surface.

Check the correct positioning of the seals on the valve ports.

Verify that the valve mounting surface is clean and free from damages and burrs.

Lock the fastening bolts in cross sequence (like in aside example) at the tightening torque specified in the valve technical table.



### 7 ELECTRICAL INSTALLATION

### 7.1 Power supply

The power supply device must be sized in order to generate the correct voltage when all utilities require the max current at same time; in general 50W max power can be considered for each proportional valve.

Following additional notes have to be considered:

- power supply from a battery: overvoltages (typically greater than 34 Volts) damage the electronic circuits; it is recommended the use of suitable filters and voltage suppressors
- the power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000  $\mu$ F/40 V capacitance to single phase rectifiers or a 4700  $\mu$ F/40 V capacitance to three phase rectifiers
- a safety fuse is required in series to each power supply: see relevant technical tables for fuses value

### 7.2 Electrical wiring

The electrical cables must be shielded as indicated in section **a** with shield or cablebraid connected to the ground.

### On-board driver/axis card - recommended cables characteristics

Main connector	Cable
7 pin - Metallic / Plastic	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
12 pin - Metallic	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)
12 pin - Plastic	LiYCY 10 x 0,14 mm ² max 40 m (logic) plus LiYY 3 x 1 mm ² max 40 m (power supply)

Off-board driver/axis card - recommended cables characteristics

Driver/axis card	Cable
E-BM-AES E-BM-RES E-BM-T*/L* Z-BM-TEZ/LEZ Z-BM-KZ	LiYCY shielded cables: 0,5 mm ² max 50 m for logic 1,5 mm ² max 50 m for power supply
E-MI-AS-IR	2 poles x 0,5 $mm^2$ plus 4 poles x 0,35 $mm^2$ - cable lenght 4 m factory wired external diameter 7,4 mm
E-MI-AC	LiYCY shielded cables: 0,5 mm ² max 40 m for logic 1 mm ² max 40 m for power supply

Note: for transducers wiring cable please consult the transducers datasheet

### 7.3 Suppression of interferences by electrical noise

When starting the system, it is always advisable to check that feedback, references signal are free from interferences and electrical noise which can affect the characteristics of the signals and generate instability in the whole system.

Electrical noises can be suppressed by shielding and grounding the signal cables, see section 8.

Most of electrical noises are due to external magnetic fields generated by transformers, electric motors, switchboards, etc.

# 8 SHIELD CONNECTION

The correct shielding of signal cables has to be provided to protect the electronics from electrical noise disturbances, which could affect the valve functioning.

In general following basic rules should be observed:

• power supply cables and signal cables should be routed in separate cable conduits.

• signal cables should be kept far from strong electromagnetic disturbance sources such as electric motor, inverters or transformers.

In the following examples are shown simple shielding criteria to avoid ground loops which may enhance the noise effect and in the worst cases they could cause the driver burning.

Refer to the applicable international standards for details about the shielding criteria.

# CORRECT SHIELD CONNECTIONS EXAMPLES



# WRONG SHIELD CONNECTIONS EXAMPLES



# 9 MAINTENANCE



Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

### 9.1 Ordinary maintenance

- The valves does not require other maintenance operations except seals replacement
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer
- Any preventive maintenance should be performed only by experienced personnel authorized by Atos.
- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components

### 9.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos or to Atos authorized service centers which will provide for the reparation.

Unauthorized opening of the valves during the warranty period invalidates the warranty.

### 9.3 Transport

Atos proportional valves are high-quality products. In order to prevent damage, the valves have to be transported in the original packaging or with equivalent transport protection. Observe the following guidelines for transportation of valves:

- before any movement check the valve weight reported in the relevant technical table
- use soft lifting belts to move or lift the heavy valves to avoid damages



### WARNING

The valve may fall down and cause damage and injuries, if transported improperly. Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.



#### 9.4 Storage

Valves are boxed using a VpCi protective packing system, offering best protection to oxidation during components sea transport or long storage in humid environments.

The valve surface is protected with a zinc coating, which guarantees a corrosion resistance of over 200 hours in the salt spray test. Additionally all valves are tested with mineral oil ISO VG 46; the oil film left after testing ensure the internal corrosion protection.

For the valves transporting and storing always observe the environmental conditions specified in the relevant technical tables. Improper storage may damage the product.

The valves can be stored for up to 12 months under the following conditions:

- If there is no specific information in the components technical tables, comply with a storage temperature of -20 °C to +50 °C
- Do not store the valves outdoors
- · Protect the valves against water and humidity in case of storage in open air
- · Store the valves in the shelf or on a pallet
- Store the valves in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office

# atos 🛆

# Operating and maintenance information for on-off valves

directional, flow, and pressure controls

safety valves with spool position monitor, conforming to Machine Directive 2006/42/EC

This operating and maintenance information applies to Atos on-off directional, flow, pressure control valves and safety valves with spool position monitor. It is intended to provide useful guidelines to avoid risks when the valves are installed in the hydraulic system.

It contains important information on the safe and proper installation, commissioning, operation, transport, and maintenance of the products.

The prescriptions included in this document must be strictly observed to avoid damages and injury.

The respect of this operating and maintenance information grants an increased working life, trouble-free operation and thus reduced repairing costs.



# 1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided. In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

	Death or serious injury could occur	
	Minor or moderate injury could occur	risk classes to ANSI Z535.6 / ISO 3864
NOTICE	Property damage could occur	
<mark>SAFETY</mark> CERTIFIED	Notes relevant to safety valves	
	Information to be observed	

# 2 GENERAL NOTES

This document is relevant to the installation, use and maintenance of on-off directional, flow and pressure control valves. It is intended for machine manufacturers, assemblers and system end-users.



### WARNING Personal injury and property damage may be caused by incorrect use of the products!

The products have been designed for use in industrial environments and may only be used in the appropriate way.

- Before using Atos valves, the following requirements must be met to ensure the appropriate use of the products:
- personnel who uses Atos valves must first read and understand the operating and maintenance information,
- particularly the Safety Notes in section **5**
- the products must remain in their original state, no modifications are permitted
  damaged or faulty valves must not be installed or put into operation
- damaged or radiity valves must not be installed or put into operation
   make sure that the products have been installed as described in section

# 2.1 Warranty

- The expiration of warranty results from the following operations:
- incorrect assembly and commissioning
- improper use, see 5.2

improper handling and storage, see 6.4modification of the original condition

# 3 CERTIFICATION

Atos safety valves with spool / poppet position monitor are designed to accomplish a safety function intented to reduce the risk in process control systems.

The valves are **TÜV certified** in compliance with Machine Directive 2006/42/EC Annex IX – EC type-examination certificate for safety components (ref. Annex IV – 21) Norms EN ISO13849-1 and EN ISO13849-2 They can be used in applications up to Category 1, PL c in high demand mode.

The spool / poppet position monitor is factory set in conformity to the relevant norms, and their regulation is properly sealed.





Any tampering of the sealing invalidates the certification

# 4 PRODUCT IDENTIFICATION EXAMPLES - nameplates

4.1 Directional solenoid valve, direct - DHE example



1 2 3

Valve code Hydraulic symbol (simplified)

) Valve serial number

# 4.2 Directional solenoid valve, piloted - DPHE example



4.3 Pressure relief valve, piloted - AGAM example



- 1 Pilot valve code
- 2 Pilot valve hydraulic symbol
- 3 Pilot valve serial number

1 Valve code

3

- (2) Hydraulic symbol (simplified)
  - Valve serial number

4.4 Directional solenoid valve, direct - DHE-*/FI example



- 1 Valve code
- 2 Hydraulic symbol (simplified)
- 3 Valve serial number
- 4 Logo identifying the safety component
- 5 Sensor electric connection

## 4.5 Directional solenoid valve, piloted - DPHE-*/FV example



- 1 Pilot valve code
- 2 3 Valve code
  - Valve hydraulic symbol
- 4 Pilot valve serial number
- 5 Logo identifying the safety component
- 6 Sensor electric connection

# 4.6 Pressure relief valve, piloted - LIDA-*/FV example



- 1 Valve code
  - Valve hydraulic symbol
- () (2) (3) (4) Pilot valve serial number
  - Logo identifying the safety component
- (5) Sensor electric connection

# 5 SAFETY NOTES

### 5.1 Intended use

Atos valves are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system. They may only be operated under the environmental and operating conditions described in the valves technical tables.



For safety-relevant applications, use only on-off safety valves identified by the Safety Certified logo. The superior control logic in connection with the safety valve, is responsible for the control of the machine's motion sequence and also for its safety-related monitoring.

### 5.2 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:

• use in explosive environments

- incorrect storage
- incorrect transport
- lack of cleanliness during storage and installation
- incorrect installation
- use of inappropriate or non-admissible fluids
- operation outside the specified performance limits
- operation outside the approved temperature range

Atos spa does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use.

### 5.3 Installation

Installation must be performed following the recommendations contained in the valves technical tables.

### WARNING: non-compliance with functional safety

**SAFETY** In case of mechanical or electric failures, risk of death or persons injury could occur. **CERTIFIED** Functional safety prescriptions according to EN ISO 13849 must be observed in the hydraulic circuit.



### WARNING: fixing bolts

For the valve mounting, use only class 12.9 bolts, with dimensions and length reported in the valves technical tables. Observe the specified tightening torque.

Using inappropriate fixing bolts or insufficient tightening torque, can cause the valve to loosen with consequent leakage of fluid under pressure which may cause personal injury and property damage.



### WARNING: hot surface

The valve considerably heats up during operation. Allow the valve to cool down sufficiently before touching it.

² During operation, touch the valve solenoid only by using protective gloves. Please also observe ISO 13732-1 and EN 982.



# CAUTION

Use of the valve outside the approved temperature range may lead to functional failures like overheating of the valve solenoid. Only use the valve within the specified ambient and fluid temperature range.



### CAUTION: pressurized systems

When working at hydraulic systems with stored energy (accumulator or cylinders working under gravity), valves may even be pressurized after the hydraulic power supply has been switched off. During assembly and disassembly works, serious injury may be caused by a powerful leaking of hydraulic fluid jet. Ensure that the whole hydraulic system is depressurized and the electrical control is de-energized.



## CAUTION: missing equipotential bonding

Electrostatic phenomena, an incorrect earthing or missing equipotential bonding may lead to malfunctions or uncontrolled movements at the machine and thus cause injuries.

Provide for correct earthing or proper equipotential bonding.



### CAUTION: penetrating water and humidity

In case of use in humid or wet environments, water or humidity may penetrate at electrical connectors.

This may lead to malfunctions at the valve and to unexpected movements in the hydraulic system which may result in personal injury and damage to property:

- only use the valve within the intended IP protection class
- ensure that all seals and caps of the plug-in connections are tight and intact

### NOTICE

High-pressure water jets could damage the valve seals. Do not use a high-pressure washer for the valve cleaning.

### NOTICE: disconnection and connection of plug-in connectors

Do not plug-in or disconnect the electric connector as long as the voltage supply is ON.

### NOTICE: impact

Impact or shock may damage the valves. Never use the valves as step.

### NOTICE: dirt and foreign particles

Penetrating dirt and foreign particles lead to wear and malfunctions of the valves. During assembly, be careful to prevent foreign particles such as metal chips getting into the valve or into the hydraulic system Do not use linting fabric for the valve cleaning.



# Environmental protection

Hydraulic fluids are harmful to the environment.

Leaking hydraulic fluid may leads to environmental pollution.

In case of fluid leakage immediately act to contain the problem.

Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

Atos components do not contain substances hazardous for the environment.

The materials contained in Atos components are mainly: Copper, Steel, Aluminium, Electronic components, Rubber Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

### 6 HYDRAULIC AND MECHANICAL INSTALLATION

### 6.1 Power packs tank and tubes cleaning

The power unit tank has to be accurately cleaned, removing all the contaminants and any extraneous object. When completely assembled an accurate washing of the piping (flushing) is requested to eliminate the contaminants.

### 6.2 Hydraulic connections

Flexible hoses are normally used on pressure line between powerpack and the valve and on user lines to connect the actuators. If their potential breakage may cause damages to the machine or system or can cause injure to the operator, a proper retenction (as the chain locking at both the pipe-ends) or alternately a protecting carter must be provided.

### 6.3 Hydraulic drains and return lines

Drain lines must be connected to the tank without counter pressure. The drain pipe must end above the oil level. Return line has to be sized in order to avoid pressure peaks caused by istantaneous flow variations.

### 6.4 Fluid conditioning

A high-performance system must be thermally conditioned to ensure a limited fluid temperature excursion (generically between 40 and  $50^{\circ}$ C) so that the fluid viscosity remains constant during operation.

The machine working cycle should start after the prescribed temperature has been reached.

### 6.5 Air bleeds

Air in the hydraulic circuits affects the hydraulic stiffness and it causes malfunctioning and vibrations. Following precautions have to be considered:

- at the system start-up all the bleeds must be released to allow the air removal
- untight the connections of the piping
- the system must be bled at first start-up or after maintenance
- a check valve (e.g. 0,5 bar) should be installed on the return line to tank to avoid emptying of the pipes following a long stop of the system

### 6.6 System flushing

The whole system must be flushed for a sufficient time in order to obtain the required minimum cleanliness level. Make sure that also external pilot lines, if present in the system, are flushed.

A decisive factor for the flushing time is the contamination level of the hydraulic fluid which can only be determined by means of a particle counter.

During the flushing procedure, perform a frequent monitor of the filters clogging indicator, replacing the filter elements when required.

### 6.7 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.

The hydraulic fluids must be compatible with the selected seals.

The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	120 12022
Flame resistant with water	NBR, HNBR	HFC	130 12922

Fluid viscosity: 15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s

### CAUTION: easily inflammable hydraulic fluid

 $\Delta$  In connection with fire or other hot sources, leaking hydraulic fluid may lead to fire or explosions.

### 6.8 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevent anomalous wearing or sticking.



# CAUTION

Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet. In the worst case, this may result in unexpected actuators movements and thus it constitutes a risk of injury. Ensure an adequate hydraulic fluid cleanliness according to the cleanliness class required for the the valve.

Max fluid contamination level, see also filter section at www.atos.com or KTF catalog:

ISO4406 class 20/18/15 NAS1638 class 9

### 6.9 Valve fastening

Remove the protection pad located on the valve mounting surface. Check the correct positioning of the seals on the valve ports. Verify that the valve mounting surface is clean and free from damages and burrs. Lock the fastening bolts in cross sequence (like in aside example) at the tightening torque specified in





# 7 MAINTENANCE



Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

### 7.1 Ordinary maintenance

- The valves does not require other maintenance operations except seals replacement
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer
- Any preventive maintenance should be performed only by experienced personnel authorized by Atos.
- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer
- . Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components

### 7.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos or to Atos authorized service centers which will provide for the reparation.

Unauthorized opening of the valves during the warranty period invalidates the warranty.

### 7.3 Transport

In order to prevent damage, the valves have to be transported in the original packaging or with equivalent transport protection.

Observe the following guidelines for transportation of valves:

- before any movement check the valve weight reported in the relevant technical table
- use soft lifting belts to move or lift the heavy valves to avoid damages



### WARNING

The valve may fall down and cause damage and injuries, if transported improperly. Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.



#### 7.4 Storage

Valves are boxed using a VpCi protective packing system, offering best protection to oxidation during components sea transport or long storage in humid environments.

The valve surface is protected with a zinc coating, which guarantees a corrosion resistance of over 200 hours in the salt spray test. Additionally all valves are tested with mineral oil ISO VG 46; the oil film left after testing ensure the internal corrosion protection.

For the valves transporting and storing always observe the environmental conditions specified in the relevant technical tables. Improper storage may damage the product.

The valves can be stored for up to 12 months under the following conditions:

- If there is no specific information in the components technical tables, comply with a storage temperature of -20 °C to +50 °C
- Do not store the valves outdoors
- · Protect the valves against water and humidity in case of storage in open air
- · Store the valves in the shelf or on a pallet
- Store the valves in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office

# atos 🛆

# **Operating and maintenance information**

safety PED pressure relief valves, conforming to PED Directive 2014/68/EU

This operating and maintenance information applies to Atos safety pressure relief valves conforming to Pressure Equipment Directive (PED) 2014/68/EU. It is intended to provide useful guidelines on the safe and proper assembly, commissioning, operation, use, maintenance and transport of PED valves. The prescriptions included in this document must be strictly observed to avoid damages and injury.



# 1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided. In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

	Death or serious injury could occur	
	Minor or moderate injury could occur	risk classes to ANSI Z535.6 / ISO 3864
NOTICE	Property damage could occur	
	Information to be observed	

# 2 GENERAL NOTES

This document is relevant to the installation, use and maintenance of on-off directional, flow and pressure control valves. It is intended for machine manufacturers, assemblers and system end-users.

# 

Personal injury and property damage may be caused by incorrect use of the products!

The products have been designed for use in industrial environments and may only be used in the appropriate way.

Before using Atos valves, the following requirements must be met to ensure the appropriate use of the products:

- personnel who uses Atos valves must first read and understand the operating and maintenance information,
- particularly the Safety Notes in section 5
- the products must remain in their original state, no modifications are permitted
- damaged or faulty valves must not be installed or put into operation
- $\bullet$  make sure that the products have been installed as described in section  $\ensuremath{\mbox{\tiny 6}}$

### 2.1 Warranty

- The expiration of warranty results from the following operations:
- incorrect assembly and commissioning improper handling and storage, see 6.4
- improper use, see 5.2

modification of the original condition

# 3 CERTIFICATION

Safety pressure relief valves are certified by DEKRA, according to Pressure Equipment Directive 2014/68/EU (PED).

They meet the requirements specified in: Module B - EU Type Examination - Production Type (Annex III) of Directive 2014/68/EU - PED category IV

# 4 COMPONENTS DESCRIPTION

This document applies to direct and pilot operated safety pressure relief valves type CART*/PED, ARE*/PED, ARAM*/PED, AGAM*/PED. These valves are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the circuit from overpressure.

They are also used as safety valves to protect hydraulic accumulators.

The valves are factory set at the pressure level required by the costumer.

The pressure adjustment screw of the valves is protected with a lead sealed plastic cap to avoid manumission of the factory setting.



Any tampering of the lead sealing invalidates the certification.

### 5 PRODUCT IDENTIFICATION EXAMPLES - nameplates

### 5.1 Screw-in cartridges type CART



- 1 Valve code
- 2 Factory pressure setting
- (3) Burst pressure
- (4) Min ÷ Max fluid or ambient temperature range
- 5 Valve serial number (1)
- 6 Notified body reference number
- ⑦ Hydraulic symbol

### 5.2 In-line valves type ARE and ARAM



- (1) Valve code
- 2 Factory pressure setting
- 3 Burst pressure
- Min ÷ Max fluid or ambient temperature range
- 5 Valve serial number (1)
- 6 Notified body reference number
- Hydraulic symbol (simplified)

### 5.3 Subplate valves type AGAM



- (1) Valve code
- 2 Factory pressure setting
- 3 Burst pressure
- 4 Min ÷ Max fluid or ambient temperature range
- 5 Valve serial number (1)
- 6 Notified body reference number
- Hydraulic symbol (simplified)

### (1) Example for serial number:

23	-	001
Year: <b>23</b> = 2023		Progressive

Note: nameplates may not be painted but must be kept in a readable condition

# 6 SAFETY NOTES

### 6.1 Intended use

Atos valves are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system. They may only be operated under the environmental and operating conditions described in the valves technical tables.

### 6.2 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:

- Wrong installation
- Use of inappropriate or non-admissible hydraulic fluids
- Use outside of specified performance limits
- Use outside the specified temperature range
- The safety valves must not be used if the maximum system flow exceeds the value indicated as "max admissible" reported in the relevant technical table
- · Manumission of the factory pressure setting
- Incorrect transport

### 6.3 Installation

Installation must beperformed following the raccomandations contained in the valves technical tables



Any tampering of the lead sealing invalidates the certification.



# WARNING: fixing bolts - for AGAM

For the valve mounting, use only class 12.9 bolts, with dimensions and length reported in the valves technical tables. Observe the specified tightening torque.

Using inappropriate fixing bolts or insufficient tightening torque, can cause the valve to loosen with consequent leakage of fluid under pressure which may cause personal injury and property damage.



### CAUTION

Use of the valve outside the approved temperature range may lead to functional failures like overheating of the valve solenoid. Only use the valve within the specified ambient and fluid temperature range.



### $\label{eq:cauchy_constraint} \textbf{CAUTION: penetrating water and humidity} \ \ \text{- for ARAM with solenoid valve}$

In case of use in humid or wet environments, water or humidity may penetrate at electrical connectors.

- This may lead to malfunctions at the valve and to unexpected movements in the hydraulic system which may result in personal injury and damage to property:
- only use the valve within the intended IP protection class
- ensure that all seals and caps of the plug-in connections are tight and intact

### NOTICE: dirt and foreign particles

Penetrating dirt and foreign particles lead to wear and malfunctions of the valves. During assembly, be careful to prevent foreign particles such as metal chips getting into the valve or into the hydraulic system Do not use linting fabric for the valve cleaning.



## Environmental protection

Hydraulic fluids are harmful to the environment.

Leaking hydraulic fluid may leads to environmental pollution.

In case of fluid leakage immediately act to contain the problem. Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

Atos components do not contain substances hazardous for the environment.

The materials contained in Atos components are mainly: Copper, Steel, Aluminium, Electronic components, Rubber Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

# 7 HYDRAULIC AND MECHANICAL INSTALLATION

Safety pressure relief valves must be used as supplied by Atos, without unduly opening, division and/or substitution of internal parts.

Oil direction: $P \rightarrow T$ Inlet oil port:POutlet oil port:T

Pressure on the discharge line T must be close to zero.

Verify that the seals are in good conditions before install the valves in the system.

Screw-in cartridges type CART, must not be removed from their manifold after commissioning, in order to avoid the loosening of internal parts. The end user must provide proper systems to avoid the cartridge disassembling.

CART in-line valves have to be mounted screwing into the seat, as per technical table CY010.

ARE in-line valves have to be assembled with proper fittings as per technical table **CY020**.

ARAM in-line valves have to be assembled with proper fittings as per technical table CY045.

AGAM subplate valves have to be mounted on proper surfaces, using screws as per technical table CY066.

See also section 7.1 for tightening torque.

### 7.1 Tightening torque - for CART and AGAM

Valve code	2=		Class 12.9	Tightening torque (Nm)
CART M-3	22			60
CART M-4	17			25
CART M-5	17			30
CART M-6	27			55
CART ARE-15	27			65
CART ARE-20	36			140
AGAM-10		10	n.4 M12x35	125
AGAM-20		14	n.4 M15x50	300
AGAM-32		17	n.4 M20x60	600

### 7.2 Application notes for valves ARAM and AGAM with pilot solenoid valve for multiple pressure selection.

The valve main regulation is factory set and lead sealed at the value required by the customer. This regulation corresponds to the max pressure controlled by the valve and it complies with the requirement of PED Directive 2014/68/EU.

The additional second and third pressure settings, selectable by the pilot solenoid valve, are without sealed regulation and they can be adjusted by the end user according to the system requirements.

The second and third pressure setting must be regulated at lower value respect to the lead sealed factory setting.

If the end user tries to adjust the second or third pressure setting at a higher value than the lead sealed factory setting, this last intervenes to limit the pressure according to PED requirements.



- 1 Main pressure regulation lead sealed factory setting
- 2 Second pressure setting
- 3 Third pressure setting
- ④ Pilot solenoid valve

### 7.3 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.

The hydraulic fluids must be compatible with the selected seals.

Make sure that the working fluid is compatible with gas and dust present in the environment.

The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, NBR low temp.	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	180 13033
Flame resistant with water	NBR, NBR low temp.	HFC	130 12922

Fluid viscosity: 15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s

### 7.4 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevent anomalous wearing or sticking.



Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet. In the worst case, this may result in unexpected system movements and thus constitute a risk of injury. Ensure adequate hydraulic fluid cleanliness according to the cleanliness classes of the valve over the entire operating range.

### Max fluid contamination level:

ISO 4406 class 20/18/15 NAS 1638 class 9

Note: see also filter section at www.atos.com or KTF catalog

### 8 CERTIFIED DISCHARGE COEFFICIENT Kdr - not available AGAM and ARAM

### CART M-3/420/PED

minimum calibration flow: Q =0.5 l/min

Pset [bar] (1)	Qmax [l/min] (2)	Kdr (3)	Pmax [bar] (4)
25 - 50	1,2 - 1,2	0,18	55
51 - 100	1,2 - 1,35	0,18	110
101 - 150	1,6 - 1,6	0,12	165
151 - 210	2 - 2,5	0,18	231
211 - 350	2,1 - 2,5	0,41	385
351 - 420	2,5 - 2,5	0,39	462

## CART M-4/420/PED

minimum calibration flow: Q =0.5 l/min

Pset [bar] (1)	Qmax [l/min] (2)	Kdr (3)	Pmax [bar] (4)
25 - 50	3,4 - 5,4	0,41	55
51 - 100	3,7 - 7,7	0,31	110
101 - 150	7,7 - 13	0,31	165
151 - 210	10,5 - 13,5	0,33	231
211 - 280	12 - 15	0,37	308
281 - 350	15 - 15	0,7	385
351 - 420	15	0,73	462

# CART M-5/420/PED

minimum calibration flow: Q =2 I/min

Pset [bar] (1)	Qmax [l/min] (2)	Kdr (3)	Pmax [bar] (4)
25 - 50	7,5 - 23	0,742	55
51 - 100	20 - 32	0,742	110
101 - 160	27 - 50	0,724	176
161 - 210	32 - 50	0,745	231
211 - 260	50 - 50	0,740	286
261 - 350	50 - 50	0,750	385
351 - 420	50 - 50	0,759	462

## CART M-6/420/PED and ARE-6/420/PED

minimum calibration flow: Q =2 I/min

Pset [bar] (1)	Qmax [l/min] (2)	Kdr (3)	Pmax [bar] (4)
25 - 50	8 - 34	0,71	55
51 - 100	34 - 60	0,89	110
101 - 210	60 - 60	0,57	231
211 - 280	60 - 60	0,58	308
281 - 350	60 - 60	0,39	385
351 - 420	60 - 60	0,58	462

### CART ARE-15/420/PED and ARE-15/420/PED

minimum calibration flow: Q =2 I/min

Pset [bar] (1)	Qmax [l/min] (2)	Kdr (3)	Pmax [bar] (4)
25 - 50	60 - 100	0,55	55
51 - 75	100 - 100	0,82	82.5
76 - 150	100 - 100	0,85	165
151 - 250	100 - 100	0,8	275
251 - 300	100 - 100	0,8	330
301 - 350	100 - 100	0,8	385
351 - 420	100 - 100	0,79	462

### CART ARE-20/420/PED and ARE-20/420/PED

minimum calibration flow: Q =2 I/min

Pset [bar] (1)	Qmax [l/min] (2)	Kdr (3)	Pmax [bar] (4)
30 - 60	55 - 75	0,705	66
61 - 110	50 - 110	0,682	121
111 - 200	70 - 150	0,731	220
201 - 230	120 - 150	0,752	253
231 - 290	65 - 120	0,765	319
291 - 315	150 - 150	0,766	346
316 - 420	150 - 150	0,862	462

# AGAM-10/420/PED/* and AGAM-10/420/PED/*-EPX

minimum calibration flow: Q = 10 l/min

Pset [bar] (1)	Qmax [l/min] (2)	Kdr (3)	Pmax [bar] (4)
25 - 50	200 - 200	0,528	55
51 - 110	200 - 200	0,678	121
111 - 200	200 - 200	0,772	220
201 - 350	200 - 200	0,796	385
351 - 420	200 - 200	0,877	462

# AGAM-32/420/PED/* and AGAM-32/420/PED/*-EPX

minimum calibration flow: Q =25 l/min

Pset [bar] (1)	Qmax [l/min] (2)	Kdr (3)	Pmax [bar] (4)
25 - 50	200 - 265	0,526	55
51 - 110	265 - 400	0,519	121
111 - 200	430 - 600	0,683	220
201 - 350	600 - 600	0,738	385
351 - 420	600 - 600	0,773	462

# ARAM-20/420/PED/* and ARAM-20/420/PED/*-EPX

minimum calibration flow: Q =25 l/min

Pset [bar] (1)	Qmax [l/min] (2)	Kdr (3)	Pmax [bar] (4)
25 - 50	400 - 400	0,437	55
51 - 110	400 - 400	0,671	121
111 - 200	400 - 400	0,671	220
201 - 350	400 - 400	0,750	385
351 - 420	400 - 400	0,754	462

### Notes:

(1) Pset: factory pressure setting at the indicated minimum flow (Q)

(2) Qmax: max flow rate reached at Pset + 10%

(3) Kdr: Certified discharge coefficient. It represents the ratio between the actual flow that is discharged by the valve and the theoretical flow calculated on the basis of the passage section and the  $\Delta p$ .

(4) Pmax: pressure reached at Qmax (with limit of Pset + 10%)

### AGAM-20/420/PED/* and AGAM-20/420/PED/*-EPX

minimum calibration flow: Q =25 l/min

Pset [bar] (1)	Qmax [l/min] (2)	Kdr (3)	Pmax [bar] (4)
25 - 50	200 - 200	0,523	55
51 - 110	280 - 400	0,481	121
111 - 200	400 - 400	0,656	220
201 - 350	400 - 400	0,766	385
351 - 420	400 - 400	0,785	462

# ARAM-32/420/PED/* and ARAM-32/420/PED/*-EPX

minimum calibration flow: Q =25 l/min

Pset [bar] (1)	Qmax [l/min] (2)	Kdr (3)	Pmax [bar] (4)
25 - 50	200 - 300	0,516	55
51 - 110	300 - 500	0,531	121
111 - 200	500 - 600	0,652	220
201 - 350	600 - 600	0,745	385
351 - 420	600 - 600	0,774	462

# 9 MAINTENANCE

A Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

### 9.1 Ordinary maintenance

Safety pressure relief valves do not require specific maintenance. A visual inspection is definitely useful to check the integrity of lead sealing and the absence of external oil leakages. Periodically the external surface of the valve should be cleaned from dirt to allow a clear readability of the identification plate.

### 9.2 Repairing

Safety pressure relief valves are supplied as single assembled unit: spare parts are not allowed. In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos which will provide for the reparation. Only for ARAM and AGAM versions equipped with pilot solenoid valve, the replacement of the pilot solenoid valve with another Atos valve of the same type and with the same function is allowed.

### 10 TRANSPORT AND STORAGE

### 10.1 Transport

- Observe the following guidelines for transportation of valves:
- Before any movement check the valve weight reported in the technical table relevant to the specific component
- Use soft lifting belts to move or lift the heavy valves to avoid damages



# WARNING

The valve may fall down and cause damage and injuries, if transported improperly. Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.



### 10.2 Storage

Valves are boxed using a VpCi protective packing system, offering best protection to oxidation during components sea transport or long storage in humid environments.

The valve surface is protected with a zinc coating, which guarantees a corrosion resistance of over 200 hours in the salt spray test. Additionally all valves are tested with mineral oil ISO VG 46; the oil film left after testing ensure the internal corrosion protection.

For the valves transporting and storing always observe the environmental conditions specified in the relevant technical tables. Improper storage may damage the product.

The valves can be stored for up to 12 months under the following conditions:

- If there is no specific information in the components technical tables, comply with a storage temperature of -20 °C to +50 °C
- Do not store the valves outdoors
- Protect the valves against water and humidity in case of storage in open air
- Store the valves in the shelf or on a pallet
- Store the valves in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office

### 11 RELATED DOCUMENTATION

CY010	CART M*/PED, CART ARE*/PED – direct, screw-in safety cartridges with PED certification
CY020	ARE-*/PED - direct, in-line safety valves with PED certification
CY045	ARAM-*/PED - piloted, in-line safety valves with PED certification
CY066	AGAM-*/PED - piloted, subplate safety valves with PED certification



# Worldwide Sales Organization

A sales network with 25 branches, 120 sales professionals and distributors in more than 80 countries, together with great responsiveness and focus on customers



# Atos spa

Italy - 21018 Sesto Calende Phone +39 0331 922078 info@atos.com www.atos.com

