Digital Axis Motion Controllers

1 ABOUT DIGITAL AXIS MOTION CONTROLLERS

The modern architectures of industrial machinery strongly increase the demand of accuracy, repeatability and performance.
This leads to the need of devices with complete regulations that integrate to the traditional axis positioning also the force and/or pressure controls.

Atos developments on digital electronics focus the integration of axis cards functions into proportional electrohydraulics either in integral-to valve or separate format.

Digital controllers are the up to date solution for the motion control in modern machines and systems: they can be easily configured and PC programmed to best manage, in closed loop, position, speed or force, of any electrohydraulic axis, piloted by a digital proportional valve.

They improve motion performances, simplify the automation architecture and may be interfaced by fieldbus the machine main control unit.

2 SYNTHETIC COMPARISON

TYPE		ON BOARD AXIS CARD AND DRIVER	AXIS CARD WITH DRIVER FUNCTION	AXIS CARD
Format / Main Function		 integral to valve	 DIN-rail format	 DIN-rail format
Valve's driver function		●	●	n.a.
Nr. of controlled axis		1	1	1
Internal programmable cycles		simple	simple	complete
Graphic programming software		●	●	●
Position control		●	●	●
Position transducer interface:	Analog	●	●	●
	Digital (SSI or Encoder)	●	●	●
Pressure transducer interface: Analog		2	2	2
Performance parameters setting (e.g. Dither, PID)		●	●	●
Valve parameters setting (e.g. Bias, Ramp, Scale)		● factory preset	● factory preset	●
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

3 DIGITAL PROPORTIONALS WITH ON BOARD AXIS CARD AND DRIVER - tech table **FS230**

Z-RI-TEZ/LEZ include valve's driver + axis controller to perform the position closed loop of any linear or rotative hydraulic actuator.

They are integrate to direct or pilot operated directional proportionals and operated by an external or internally generated reference position signal.

The selection of the electronic interface for one of the following position transducers, integral or external to the actuator, is required in the controller's code:

Analog:

- potentiometer (voltage signal)
- magnetosonic (voltage or current signal)

Digital:

- magnetosonic (SSI serial interface)
- linear or rotative encoder (TTL signal logics)

Two main functional command modes can be selected by software:

- real time external reference input – analog or digital by fieldbus communication
- internal reference generation of simple motion profiles, programmable by Atos PC software and sequenced by the external machine central unit using on-off inputs

Available interfaces:

- analog input for reference command signals: position (default) and pressure/force
- analog output for monitor command signals: position (default) and pressure/force
- on/off output for controller fault detection and axis status diagnostics
- USB communication interface, always present
- fieldbus: CANopen, PROFIBUS DP, EtherCAT, POWERLINK, EtherNet/IP or PROFINET RT/IRT

Additional functionalities:

- full software setting of the controller including the compensation of the main hydraulic system characteristics, closed-loop PID gains and max error windows
- electronic compensation function for actuator's seals friction
- separate power supply for the controller circuit and for the solenoid output stage, to allow the safety emergency stop of the axis while maintaining active the controller and the fieldbus communication with the machine central unit
- S option is available, to combine pressure or force closed-loops to the original position control: in this case additional interface is available for connection of load cell or 1-2 pressure transducers
- analog reference input signals can be used as on/off commands
- real time oscilloscope function to dynamically analyze the valve and axis performances
- detailed diagnostics of the axis status, faults and performance
- three LEDs for controller operative conditions
- software setting of safety predefined procedures in case of faulty conditions

The digital valve with integral axis controller can be delivered already assembled on Atos servocylinder and wired to the relevant transducer, to realize a smart motion units, called "Servoactuator".

This execution speed up the installation and the start-up of the electrohydraulic axis and simplify the overall machine control architecture.

The integral construction and the fixed number of electrical interfaces may involve customizing of the mechanics, firmware and software, thus requiring technical cooperation with leading customers, a detailed presales analysis is ever required.

In the sketch at side are shown two typical examples of integral axis controller applications:

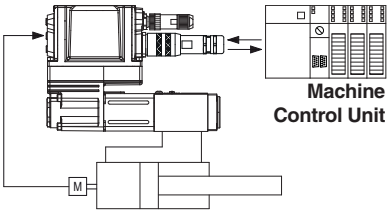
Parison

The Parison servoactuator integrates the 4-way servoproportional valve with integral axis controller, to manage the position closed-loop control of the parison axis in plastic blow molding machines; the machine electronic central unit supplies in real time the position analog command signal to the controller and obtain the parison actual position by the controller's monitor analog interface.

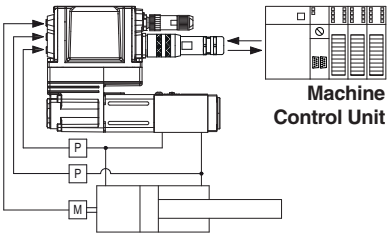
Sheet Punching

The controller is integrated on a pilot operated 4-way directional valve to manage the punching axis position. It generates the motion sequences and the relevant closed-loop control. The machine electronic central unit synchronizes punching and sheet movements through the controller's on-off interface: input (start a new cycle) and output (cycle ended).

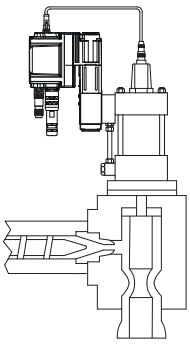
Proportional valve with on board axis card and driver



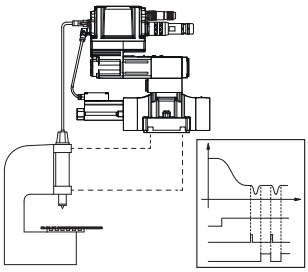
4-way directional valve Position control



4-way directional valve Position / Force control



Parison Control



Punching Axis

Legend:

P pressure transducer

M actuator's position transducer

4 DIN-RAIL AXIS CARD WITH DRIVER FUNCTION - tech table **GS330**

Z-BM-TEZ/LEZ are designed for axis controls and they integrate the driver function with alternated pressure/force control for directional proportional valves without on board driver.

The DIN-rail mounting makes them particularly suitable for remote cabinet installation in applications with critical temperatures or vibrations.

Two main functional command modes can be selected by software:

- real time external reference input – analog or digital by fieldbus communication
- internal reference generation of simple motion profiles, programmable by Atos PC software and sequenced by the external machine central unit using on-off inputs

Available interfaces:

- analog input for reference command signals: position (default) and pressure/force
- analog output for monitor command signals: position (default) and pressure/force
- on/off output for controller fault detection and axis status diagnostics
- USB communication interface, always present
- fieldbus: CANopen, PROFIBUS DP, EtherCAT, POWERLINK, EtherNet/IP or PROFINET RT/IRT

Additional functionalities:

- full software setting of the controller including the compensation of the main hydraulic system characteristics, closed-loop PID gains and max error windows
- electronic compensation function for actuator's seals friction
- separate power supply for the controller circuit and for the solenoid output stage, to allow the safety emergency stop of the axis while maintaining active the controller and the fieldbus communication with the machine central unit
- alternated P/Q control is available, to combine pressure or force closed-loops to the original position control: in this case additional interface is available for connection of load cell or 1-2 pressure transducers
- analog reference input signals can be used as on/off commands
- real time oscilloscope function to dynamically analyze the valve and axis performances
- detailed diagnostics of the axis status, faults and performance
- eight LEDs for controller operative conditions
- software setting of safety predefined procedures in case of faulty conditions

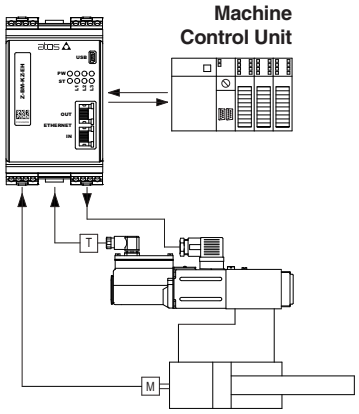
Pressure or force closed-loop controls can be combined to the main position control by simple software setting. In this case additional pressure transducers or load cell have to be installed in the hydraulic system and connected to the relevant analog interfaces available on the controller, see the examples at side.

The DIN-rail format axis controllers are particularly indicated for motion control of a single axis with multiple interfacing to the machine auxiliary subsystems, like proximity sensors and safety valves/circuits, manual commands by operators during start up and emergencies, management of motion sequences coordinated with other axis.

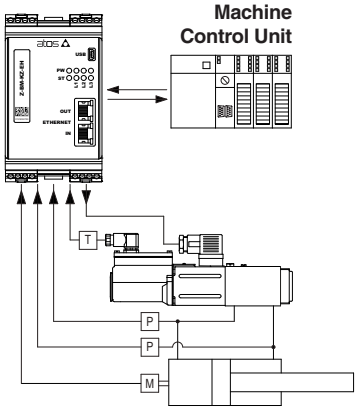
Thanks to the flexible general purpose controller's structure and to the Atos easy PC programming software, the DIN-rail format axis controllers can be simply adapted and optimized to any specific application.

For standard and repetitive applications with requirements of integration with machine automation and high number of interfaces, the DIN-rail format axis controllers can be directly supplied by Atos to leading OEMs with firmware and software customized to their specific application requirements; in these cases a detailed presales analysis is strictly required.

DIN-rail axis card with driver function



4-way directional valve Position control



4-way directional valve Position / Force control

Legend:

P pressure transducer

T valve's spool transducer

M actuator's position transducer

5 DIN-RAIL AXIS CARD - tech table GS340

Z-BM-KZ are designed for axis controls with alternated pressure/force control for directional proportional valves with on board driver.

The DIN-rail mounting makes them particularly suitable for remote cabinet installation in applications with critical temperatures or vibrations.

These controllers must be interfaced to a 4-way proportional directional valve, analog or digital, connected with the actuator to be controlled. They generate an analog voltage/current signal to command the valve's electronic driver.

Available interfaces:

- analog input for reference command signals: position (default) and pressure/force
- analog output for monitor command signals: position (default), pressure/force and valve demand
- on/off input for pressure/force PID selection (default)
- on/off output for controller fault detection and axis status diagnostics
- USB communication interface, always present
- fieldbus: CANopen, PROFIBUS DP, EtherCAT, POWERLINK, EtherNet/IP or PROFINET RT/IRT

Additional functionalities:

- full software setting of the controller including the compensation of the main hydraulic system characteristics, closed-loop PID gains and max error windows
- electronic compensation function for actuator's seals friction
- alternated P/Q control is available, to combine pressure or force closed-loops to the original position control: in this case additional interface is available for connection of load cell or 1-2 pressure transducers
- analog reference input signals can be used as on/off commands
- real time oscilloscope function to dynamically analyze the valve and axis performances
- detailed diagnostics of the axis status, faults and performance
- eight LEDs for controller operative conditions
- software setting of safety predefined procedures in case of faulty conditions

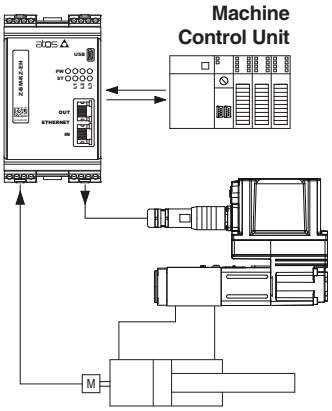
Pressure or force closed-loop controls can be combined to the main position control by simple software setting. In this case additional pressure transducers or load cell have to be installed in the hydraulic system and connected to the relevant analog interfaces available on the controller, see the examples at side.

The DIN-rail format axis controllers are particularly indicated for motion control of a single axis with multiple interfacing to the machine auxiliary subsystems, like proximity sensors and safety valves/circuits, manual commands by operators during start up and emergencies, management of motion sequences coordinated with other axis.

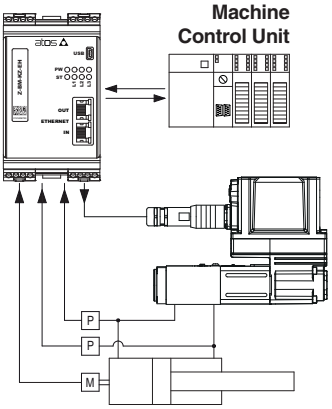
Thanks to the flexible general purpose controller's structure and to the Atos easy PC programming software, the DIN-rail format axis controllers can be simply adapted and optimized to any specific application.

For standard and repetitive applications with requirements of integration with machine automation and high number of interfaces, the DIN-rail format axis controllers can be directly supplied by Atos to leading OEMs with firmware and software customized to their specific application requirements; in these cases a detailed presales analysis is strictly required.

DIN-rail axis card



4-way directional valve
Position control



4-way directional valve
Position / Force control

Legend:

P pressure transducer

M actuator's position transducer