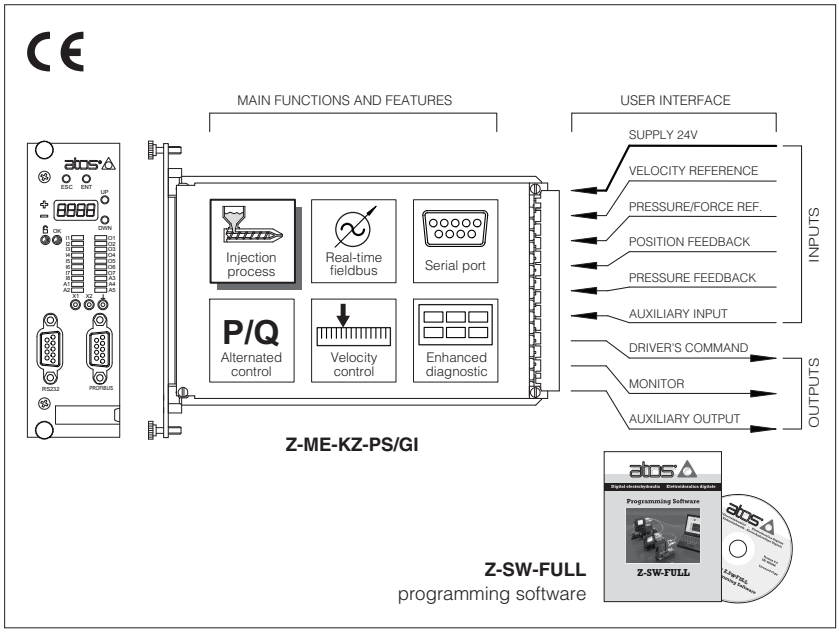
Plastic injection Z-ME-KZ-PS/GI controllers

Eurocard format, for electrohydraulic closed loop controls of injection in plastic presses

obsolete components - availability on request



Z-SW-FULL
programming software

1 MODEL CODE

Z-ME	-	KZ	-	PS	/	*	GI	/	*	/	*

- **Z-ME**: Electronic axis controller in Eurocard format
- **KZ**: Alternated position / velocity / force control module
- **PS**: Serial communication interface for configuration and monitoring function
- *****: **Optional fieldbus interfaces:**
  - = standard without fieldbus interface
  BC = CANopen communication interface
  BP = PROFIBUS DP communication interface
- **GI**: Injection process control
- ***** (Series number)
- ***** (Set code)

Z-ME-KZ-PS/GI

Plastic injection controllers perform velocity and force closed loop controls, according to real time commands (analog or fieldbus) generated by machine control unit (e.g. PLC).

The controller receives position / pressure feedbacks and generates reference signal to the proportional valve which regulates the hydraulic flow to the injection actuator.

The position feedback signal is software selectable: SSI, incremental encoder, potentiometer or analog (voltage or current).

Remote pressure transducers have to be remotely installed close to the injection actuator and connected to the controller (see section 5).

The machine electronic control unit manages the injection process through dedicated digital commands or fieldbus communication.

Serial and Profibus (only for BP option) ports are available on the front panel for controller configuration and diagnostics.

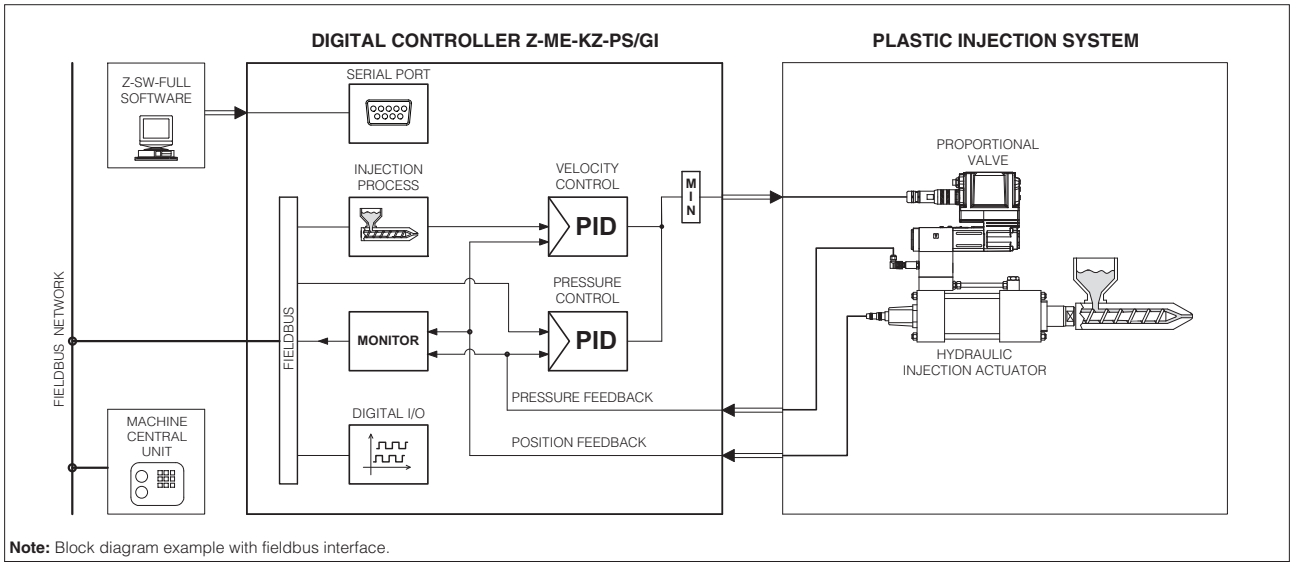
Electrical Features:

- 4 digits front panel display to check and change parameters as well as for diagnostics
- Front panel DB9 connector for serial programming interface
- Front panel test points for debug and maintenance
- Eurocard format (DIN 41494 - Plug-in-units)
- CE mark according to EMC directive

Software Features:

- Internal generation of injection cycle
- Setting of axis's dynamic response (PID) to optimize the injection performances
- Monitoring of injection process
- Software selectable range of electronic reference analog inputs: voltage or current
- Diagnostics of the injection status
- Intuitive graphic interface
- In field firmware update through standard serial communication port
- Internal oscilloscope function

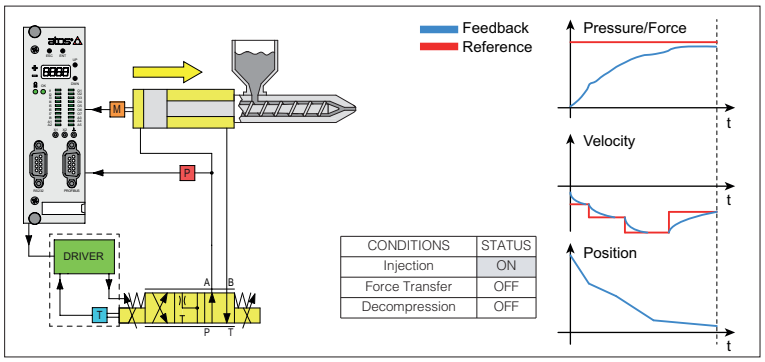
2 BLOCK DIAGRAM



Note: Block diagram example with fieldbus interface.

3 INJECTION PHASES

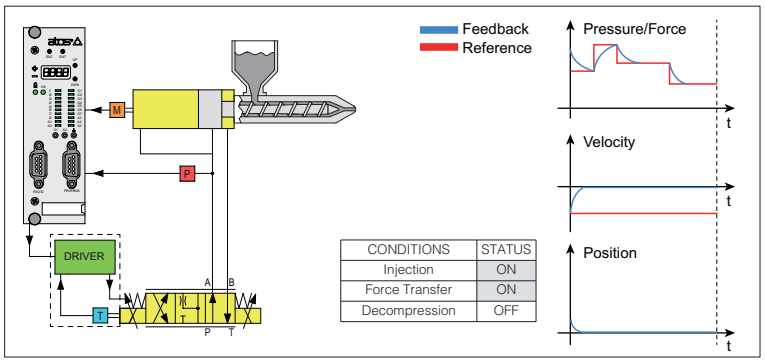
3.1 Injection - Velocity closed loop control with max pressure limitation



3.1 Injection

Injection phase starts when the machine control unit (e.g. PLC) enables the command “Injection”. The controller performs velocity closed loop profile according to the external velocity reference, with a maximum force limitation during traversing. Machine control unit provides velocity step reference to the controller, which internally limits acceleration and deceleration in order to avoid mechanicals stress during velocity variations

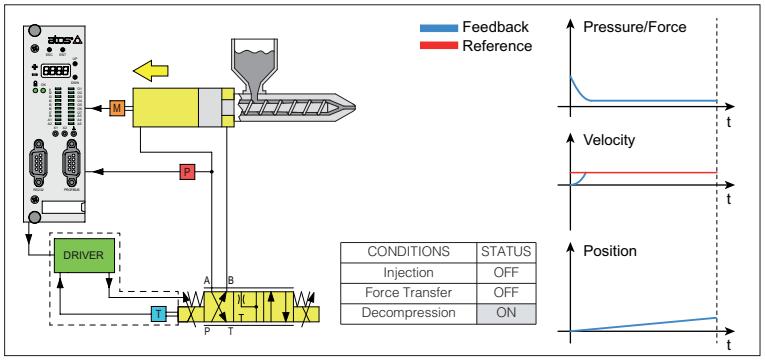
3.2 Pack and Hold - Pressure closed loop control with max velocity limitation



3.2 Pack and Hold

Pack and Hold phase starts when the machine control unit enables the command “Force Transfer” with “Injection” condition active. The controller performs pressure/force closed loop control with max velocity limitation to prevent sudden forward actuator movements in the transition from Injection to Pack and Hold phase

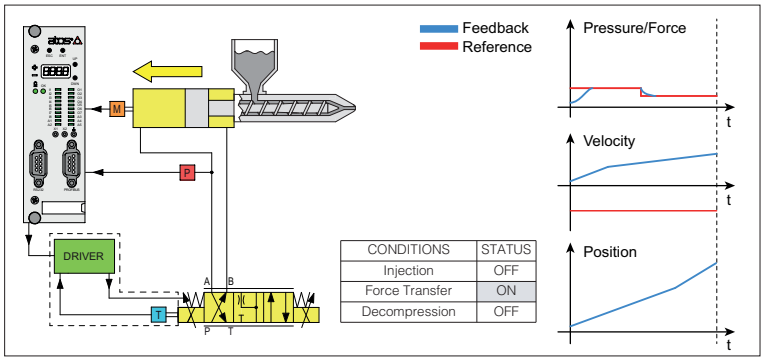
3.3 Pre-Decompression - Velocity open loop control



3.3 Pre-Decompression - optional phase

Pre-Decompression phase starts when the machine control unit enables the “Decompression” condition. The controller regulates in open loop the backward velocity of the injection actuator according to the external command signal (velocity reference)

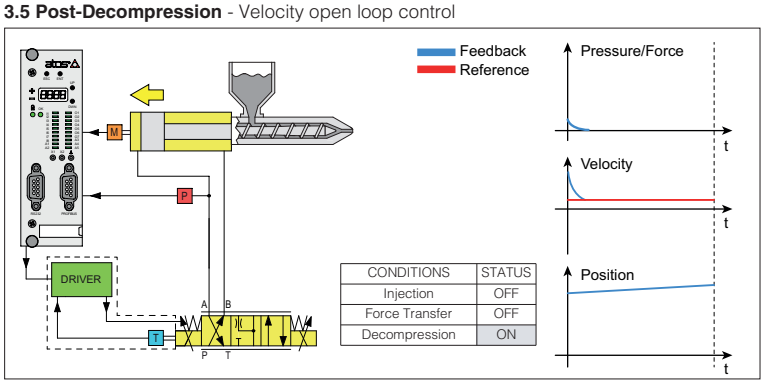
3.4 Back Pressure - Pressure closed loop control with max velocity limitation



3.4 Back Pressure

Back Pressure phase starts when the machine control unit enables the command “Force Transfer” with “Injection” condition not active. The controller performs force closed loop control with max velocity limitation to prevent sudden backward actuator movements in the transition from Pack and Hold or Pre-Decompression phase to Back Pressure ones

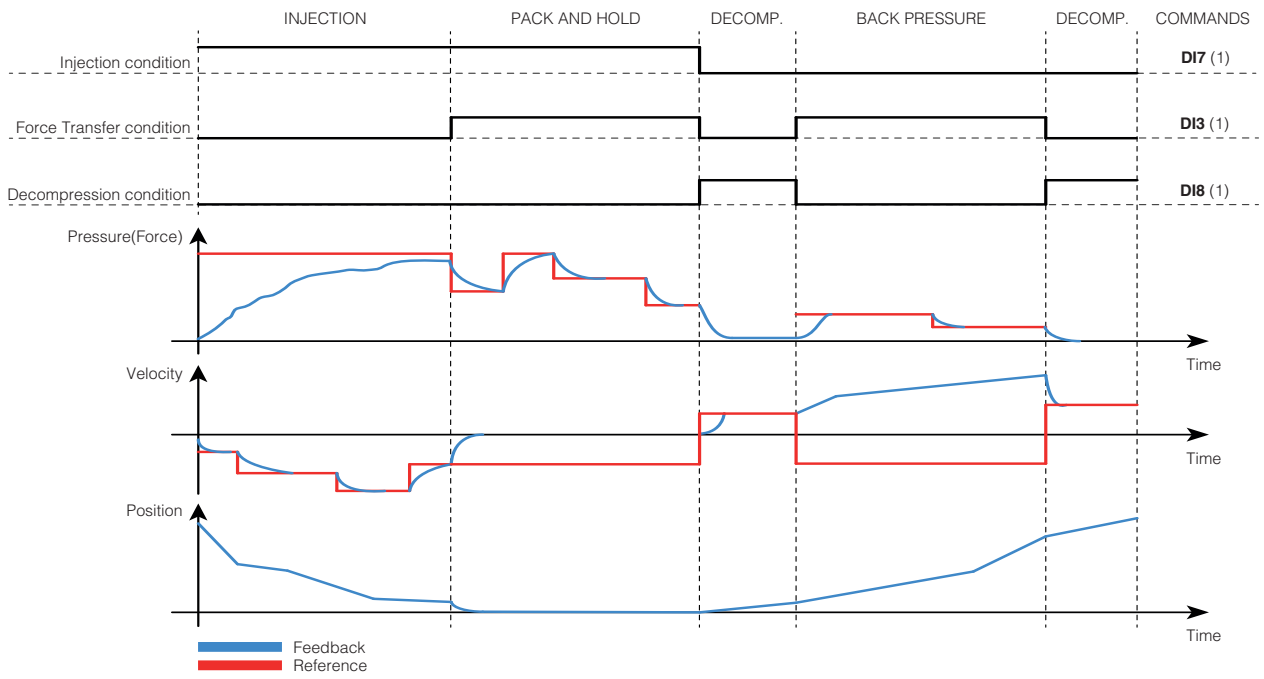
3.5 Post-Decompression - Velocity open loop control



3.5 Post-Decompression - optional phase

Post-Decompression phase starts when the machine control unit enables the “Decompression” condition. The controller regulates in open loop the backward velocity of the injection actuator according to the external command signal (velocity reference)

4 EXAMPLE OF INJECTION CYCLE WITH DIGITAL COMMANDS FROM MACHINE CENTRAL UNIT

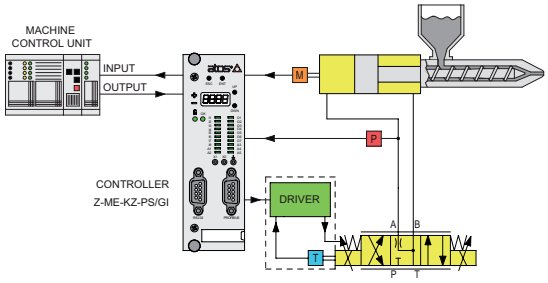
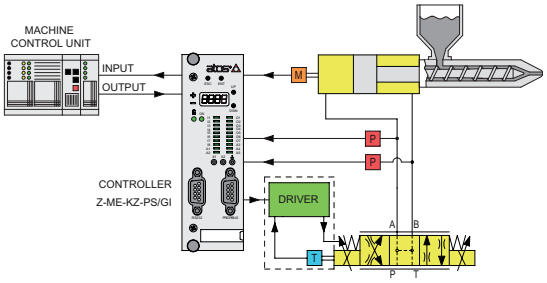


Note: (1) see section 11 for digital inputs commands connection

Note: for controllers with BP or BC option the injection cycle is managed by fieldbus commands

5 PRESSURE / FORCE CONFIGURATION

For technical support about proportional valve selection and control electronic configuration, please contact Atos tech assistance at ele-support@atos.com

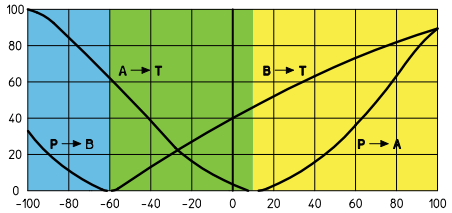
Alternated Velocity/Pressure Control - One pressure transducer	Alternated Velocity/Force Control - Two pressure transducers
	
Typical schemes used in injection molding machines designed for **high/medium density materials**. Proportional valves with V9 spool type (see section 6) should be used. A remote pressure transducer has to be installed on the injection line of the actuator.	Typical schemes used in injection molding machines designed for **low density materials**. Proportional valves with linear spool type with zero overlap characteristics is strictly recommended to obtain improved force control. Two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb).

T valve's spool transducer M actuator's position transducer P pressure transducer

6 SPECIAL SPOOL FOR INJECTION PROCESS

V9 main features:

- strong meter-in characteristic allows the pressure control during the holding pressure and the plasticizing phases
- safety central position depressurizes the actuator chambers
- large flow capability, required during the plasticizing phase, discharges big oil volumes from injection actuators with low pressure drops and also permits the contemporary oil suction from tank



backward movements (flow active)

depressuring (pressure active)

forward movements (flow or pressure active)

7 CONTROLLER CHARACTERISTICS

Power supply (see 12.1)	Nominal: +24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)		
Max power consumption	10 W		
Position transducer	SSI, incremental encoder, potentiometer, analog		
Analog Inputs	Input range : voltage ±10 VDC - input impedance: Ri > 100 kΩ current 0 ÷ 20 mA - input impedance: Ri < 500 Ω		
Analog Outputs	Output range : voltage ±10 VDC @ max 10 mA current 0 ÷ 20 mA @ max 500 Ω load resistance		
Digital Inputs	Input range : 0 ÷ 5 VDC (OFF state), 16 ÷ 24 VDC (ON state), 5 ÷ 16 VDC (not accepted); Input impedance: Ri > 10 kΩ		
Digital Outputs **(1)**	Output range : 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 30 mA		
Enable input	Range : 0 ÷ 5 VDC (OFF state), 16 ÷ 24 VDC (ON state), 5 ÷ 16 VDC (not accepted); Input impedance: Ri > 10 kΩ		
Fault output **(1)**	Output range : 0 ÷ 24 VDC (no fault state > [power supply - 2 V] ; fault state < 1 V) @ max 50 mA		
Analog reference outputs	±10 VDC @ max 30 mA		
Inceremental encoder power supply	+5 VDC @ max 100 mA		
Alarms	Position transducer out of range, analog input out of range		
Card format	Eurocard 100x160 mm (Plug-in unit DIN 41494)		
Card rear connector	Male DIN EN 60603/G. Available frame snap connector type E-K-64M (see tech table G800) **To be ordered separately**		
Operating temperature	0 ÷ +50 °C (storage -20 ÷ +70 °C)		
Front panel dimensions	128,4 x 40 mm		
Mass	Approx. 250 g		
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 50082-2; Emission: EN 50081-2)		
Communication interface	Serial Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS EN50170-2/IEC61158
Communication physical layer	not insulated serial RS232	optical insulated CAN ISO11898	optical insulated RS485

Note: (1) external negative voltage not allowed (e.g. due to inductive loads)

8 TRANSDUCER CHARACTERISTICS

8.1 Position transducers

The accuracy of the velocity control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the controller, according to the system requirements: potentiometer, analog signal, SSI, and encoder, see 8.3.
Transducers with digital interface (SSI and encoder) allow the user to get high resolution and accurate measures. Transducers with analog interface (potentiometer and analog signal) grant simple and cost effective solutions.

8.2 Pressure transducers

The accuracy of the pressure/force controls is strongly dependent to the selected pressure transducers. Alternated pressure or force controls require to install pressure transducers to measure the actual pressure values.
Pressure transducers allow easy system integration and cost effective solution for both alternated position/pressure and position/force controls (see tech table **GS465** for pressure transducers details).
The characteristics of the remote pressure 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.

8.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position				**Pressure/Force**
Input type	Potentiometer	Analog	SSI	Incremental Encoder	Analog
Power supply **(1)**	±10 VDC	+24 VDC	+5 VDC / +24 VDC	+5 VDC / +24 VDC	+24 VDC
Controller Interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 VDC 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max Resolution	< 0.4 % FS	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error **(2)**	± 0.1% FS	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability **(2)**	± 0.05% FS	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

Notes: **(1)** power supply provided by digital controller **(2)** percentage of total stroke

9 FRONT PANEL DESCRIPTION

9.1 Keyboard and display

On the Z-ME-KZ-PS/GI front panel are available 4 function keys (ESC, ENT, UP, DWN), and a numeric display (4 digits plus sign) to allow the user to view and change the controller's parameters as well as to display diagnostic messages.
The following parameters can be accessed (viewed or changed) via corresponding menu structure:
- command and actual values
- analog input / output values
- digital input / output status
- position sensor indication
- force / pressure sensor indication

Parameter's changes of the configuration, control gains, trigger conditions, internal cycle, fault monitoring are not allowed via front panel operations.

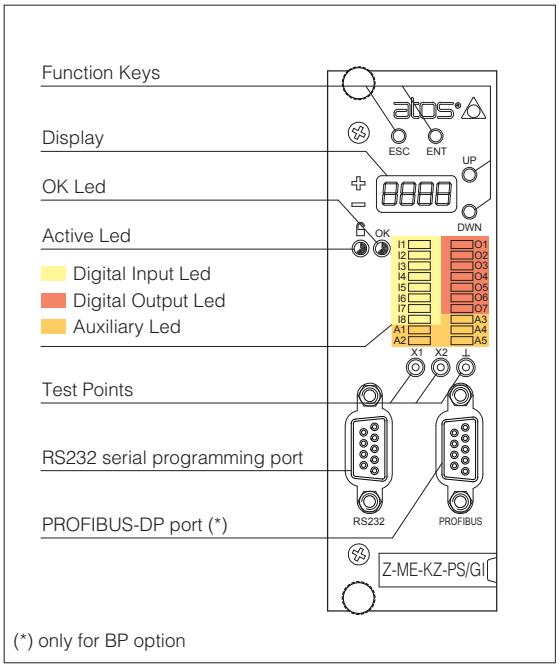
9.2 LED indication

The led indications are used to display the internal status (Active, OK) of the controller or the status of the digital IO of the Z-ME-KZ-PS/GI. There are 22 led divided in four different types:
- internal controller's status (Active - OK)
- digital input status (I1 ÷ I8)
- digital output status (O1 ÷ O7)
- software programmable led (A1 ÷ A5) for specific functions

9.3 Test points

The test points present on the controller front panel can be used to monitor the actual position (X1) and the force / pressure (X2) value measured by the relevant transducers. Both signals are referred to the analog ground (⊥) pin. The two signals are respectively connected to P_MONITOR+ (X1) and F_MONITOR+ (X2) analog output present on the rear connector of the controller card. These signals can be software set to show other signals available in the controller (see 12.7 and

10 FRONT PANEL VIEW



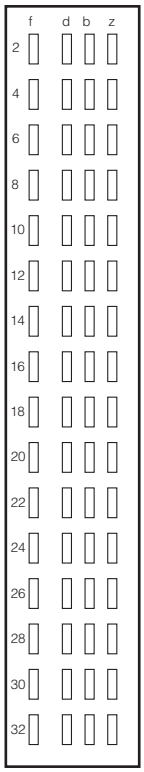
(*) only for BP option

9.4 Communication ports

On the front panel of the Z-ME-KZ-PS/GI is always present a serial RS232 port to program the controller by the Atos Z-SW software (see section 13). All the functional parameters of digital controller, like internal reference generation, controller dynamics, IO configurations, can be easily set and optimized by the user.
For BP or BC options, a second communication port dedicated to the selected fieldbus connection is present on the controller. For BP option the PROFIBUS-DP port is located on the front panel of the Z-ME-KZ-PS/GI controller. For BC option the CANopen connection is located on the rear connector of the Z-ME-KZ-PS/GI controller.
Through the fieldbus communication only the real-time parameters may be exchanged:
- position, velocity and force / pressure reference
- position, velocity and force / pressure feedback
- controller commands and status
- diagnostic / error messages

For more information about the front panel settings and fieldbus communication, please refer to the controller user manual.

11 ELECTRONIC CONNECTIONS - 64 PIN REAR CONNECTOR



rear view

pin	f		d		b		z	
2	DO 7	(O)	DI 1	(I)	nc	(I)	nc	
4	SSI clock +	(D)	DI 2 (*)	(I)	nc	(I)	nc	
6	SSI clock -	(D)	DI 3 Force Transfer	(I)	F_TR1 +	(I)	nc	
8	SSI data + / Inc Ua1	(D)	DI 4 Jog +	(I)	F_TR1 -	(I)	nc	
10	SSI data - / Inc /Ua1	(D)	DI 5	(I)	F_INPUT +	(I)	nc	
12	Inc Ua2	(D)	DI 6 Jog -	(I)	F_INPUT -	(I)	nc	
14	Inc /Ua2	(D)	DI 7 Injection	(I)	F_TR2 +	(I)	nc	
16	Inc Ua0	(D)	DI 8 Decompression	(I)	F_TR2 -	(I)	nc	
18	Inc /Ua0	(D)	ENABLE	(I)	P_TR +	(I)	nc	
20	Inc +5VDC	(O)	DO 1	(O)	P_TR -	(I)	GND	
22	nc		FAULT	(O)	V_INPUT +	(I)	DO 3	(O)
24	nc		nc		V_INPUT -	(I)	DO 4	(O)
26	nc		DO 2	(O)	P_MONITOR +	(O)	DO 5	(O)
28	CAN_GND	(F)	nc		AGND		DO 6	(O)
30	CAN_L	(F)	CONTROL_OUTPUT +	(O)	VREF -10VDC	(O)	V+	(PS)
32	CAN_H	(F)	F_MONITOR +	(O)	VREF +10VDC	(O)	V0	(PS)

(I) Input - **(O)** Output - **(D)** Digital transducers - **(PS)** Power supply - **(F)** Fieldbus interface, only for BC option
(*) Digital Input status must be always disabled (OFF) - Do Not Connect