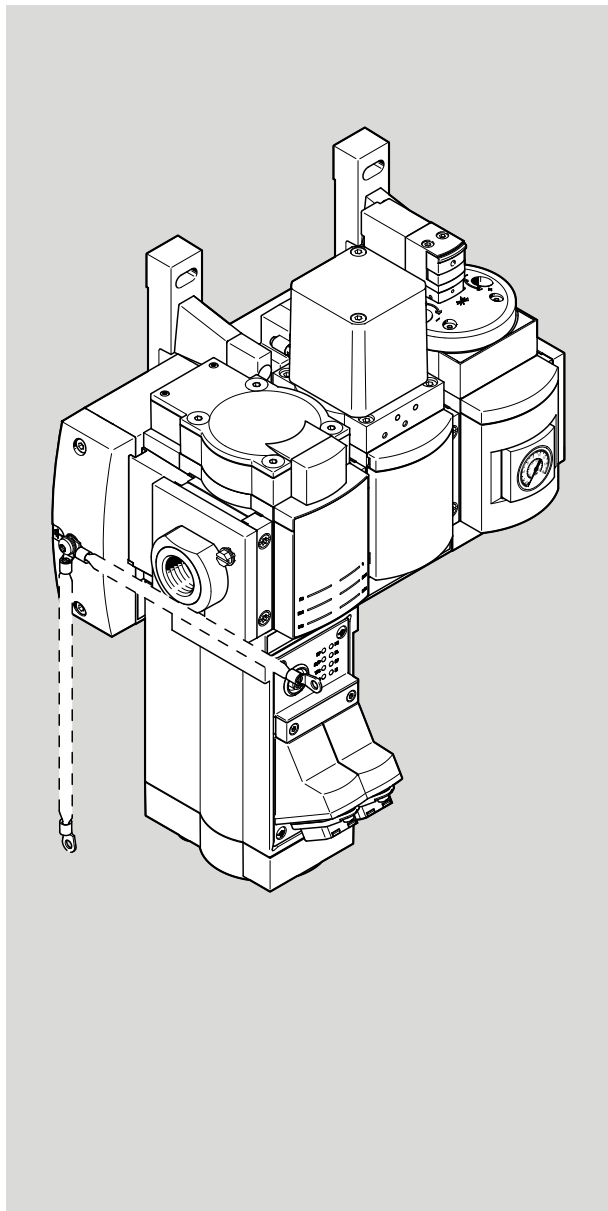


MSE6-C2M

Energy efficiency module



FESTO

Description | Commissioning, Function, Electronics



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Translation of the original instructions

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1 Applicable documents



All available documents for the product → www.festo.com/pk.

Document	Product	Contents
Instructions	Energy efficiency module MSE6-C2M-IN	Operating, Assembly
Description	CPX system description P.BE-CPX-SYS-...	Installation, Commissioning
Description	PROFINET bus node IO P.BE-CPX-PNIO-...	PROFINET
Instructions	Wall mounting-SET MS6-WPG	Assembly

Tab. 1 Documentation on the product

2 Safety

2.1 Safety instructions

- Only use the product in original status without unauthorised modifications.
- Only use the product if it is in perfect technical condition.
- Only use the product in an industrial environment.
- This product can generate high frequency malfunctions, which may make it necessary to implement interference suppression measures in residential areas.
- Observe labelling on the product.
- Prior to mounting, installation and maintenance work: Switch off power supply and secure it from being switched back on. Only switch on the power supply when the product has been assembled and installation and maintenance work is complete.
- Product is opened in normal position (pressurisation status). If the minimum supply voltage is not reached, the shut-off valve of the product switches to the pressurisation status.
- Note that, when the input pressure is switched off, depending on the function a residual pressure of < 1 bar (< 0.1 MPa) can remain at the output.

2.2 Intended use

The energy efficiency module MSE6-C2M monitors and optimises the compressed air consumption via an adjustable outlet pressure.

2.3 Foreseeable misuse

The following examples of foreseeable misuse are among those not approved as intended use:

- Outdoor use
- Exhaust ports sealed
- Use of the integrated shut-off valve in continuous switching operation for pneumatic components

2.4 Training of qualified personnel

Installation, commissioning, service and disassembly should only be conducted by skilled personnel. The skilled personnel must be familiar with the installation of electrical and pneumatic control systems.

3 Additional information

- Accessories → www.festo.com/catalogue.
- Spare parts → www.festo.com/spareparts.
- Information on the CPX field bus node → www.festo.com/sp.
- Information on the short documentation for the CPX-Extension → www.festo.com/sp.

4 Service

Contact your regional Festo contact person if you have technical questions → www.festo.com.

5 Product Overview

5.1 Structure

5.1.1 Product design

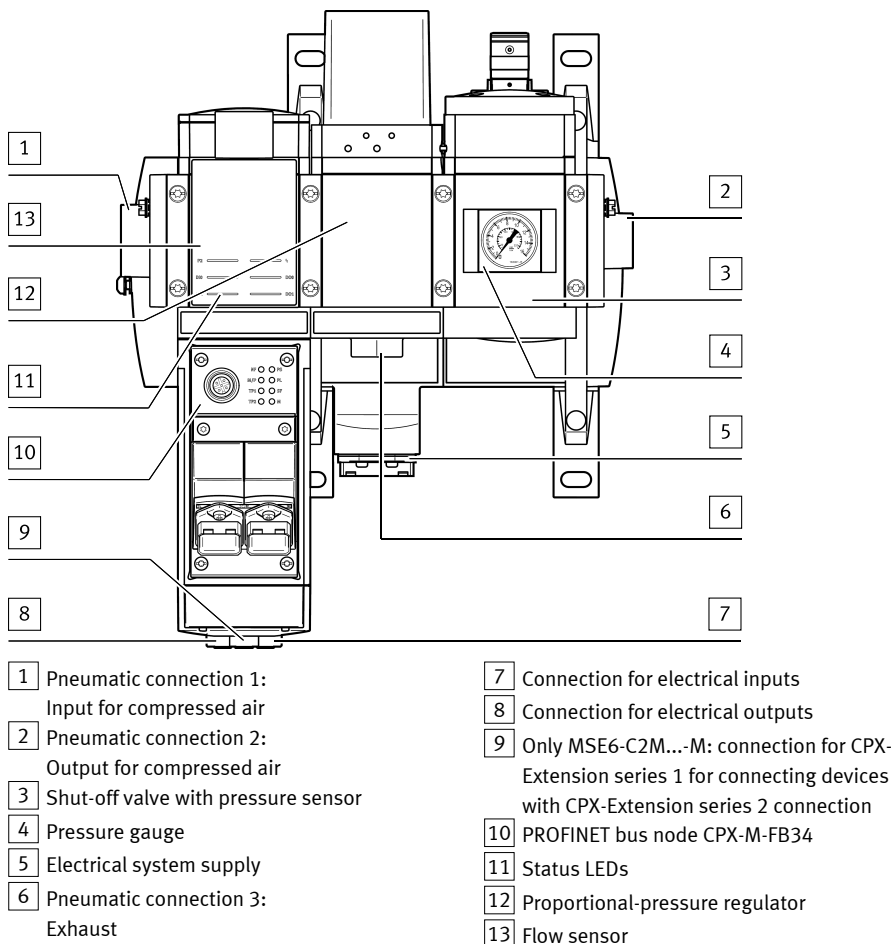


Fig. 1 Product design

5.1.2 Display components

The product has two electrical inputs and two electrical outputs.

LED		Meaning
P2 (green)		
	LED illuminated	Outlet pressure $p_2 \geq$ lower critical limit pressure p_2
	LED flashes	Outlet pressure $p_2 <$ lower critical limit pressure p_2 and Outlet pressure $p_2 \geq$ pressure setpoint auto standby -0.5 bar
	LED does not illuminate	Outlet pressure $p_2 <$ pressure setpoint auto standby -0.5 bar
DI0 and DI1 (green)		
	LED illuminated	Signal at electrical input 0 or 1 is present (logic 1)
	LED does not illuminate	Signal at electrical input 0 or 1 is not present (logic 0)
DO0 and DO1 (yellow)		
	LED illuminated	Electrical output 0 or 1 sends 1-signal (logic 1)
	LED does not illuminate	Electrical output 0 or 1 sends 0-signal (logic 0)
Red		
	LED illuminated	Module error
	LED does not illuminate	No module error

Tab. 2 Status LED display for module functions

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Display elements bus node ➔ 6 Commissioning.

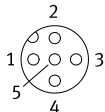
5.1.3 Connecting elements

Electrical inputs and outputs

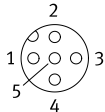
The product has two electrical inputs and two electrical outputs.

Bus node

The product has a PROFINET bus node CPX-M-FB34

Plug	Pin	Signal name	Function
M12 	1	24 V DC U_{SEN}	Supply voltage
	2	Input-1	Input 1
	3	0 V U_{SEN}	0 V load
	4	Input-0	Input 0
	5	FE	Functional earth

Tab. 3 Electrical inputs DI0 and DI1

Plug	Pin	Signal name	Function
M12 	1	–	Not assigned
	2	Output-1	Output 1
	3	0 V _{VA}	0 V load
	4	Output-0	Output 0
	5	FE	Functional earth

Tab. 4 Electrical outputs DO0 and DO1

Connection	Position	Plug
Electrical inputs	Connections on the cover under the bus node	Design: M12, 5-pin Identification: X2
Electrical outputs	Connections on the cover under the bus node	Design: M12, 5-pin Identification: X1

Tab. 5 Electrical inputs, electrical outputs

System supply

The electrical power supply of the product is via an AIDA push-pull plug.

Plug	Pin	Signal name	Function
AIDA push-pull 5 4 3 2 1 	1	24 V DC $U_{EL/SEN}$	Operating voltage supply for electronics and sensors
	2	0 V $U_{EL/SEN}$	Operating voltage for electronics and sensors
	3	24 V DC $U_{OUT/A}$	Load voltage supply for actuator technology
	4	0 V $U_{OUT/A}$	Load voltage of actuator technology
	5	FE	Functional earth

Tab. 6 Pin allocation, system supply

CPX-Extension (only energy efficiency module MSE6-C2M-...-M)

The product has a CPX-Extension series 1 connection. Use only the preassembled extension connecting cables from Festo → www.festo.com/catalogue.

Connection	Position	Plug
CPX-Extension	Connections on the cover under the bus node	Design: M12, hybrid, 8-pin Identification: none

Tab. 7 CPX-Extension

5.2 Functions**Overview**

- Pressure regulation and blocking function (energy efficiency function)
 - Automatic blocking and subsequent regulation to the standby target pressure with a prolonged reduced flow rate
 - User-controlled blocking and pressure regulation
 - Parameterisable target pressure rise limitation
- Recording and processing of measurement data
 - Outlet pressure P2
 - Pressure change (for pressure tightness testing)
 - Flow rate
 - Air consumption
- Limit monitoring
 - Pressure, lower and upper critical limit
 - Pressure change, upper critical limit
 - Flow rate, upper critical limit value
- Electrical I/Os
 - 2 digital inputs
 - 2 digital outputs
 - Channel-based status indicator via LED
 - Parameterisable special functions
- Fieldbus connection
 - e. g. PROFINET connection CPX-M-FB34

Standby detection and automatic pressure reduction

The product detects downtimes of a pneumatic system upon corresponding parameterisation. If the parameterised flow rate critical limit is continuously not reached during the parameterised delay period, when the automatic function is activated (controller auto-user and controller auto-enable logic 1), the supply air is blocked until the parameterised standby target pressure value is reached. The outlet pressure is then adjusted to this value. This prevents unnecessary exhausting of the system and enables leakage detection via an analysis of the pressure drop. A control signal can be used to switch back over from standby pressure regulation to normal pressure regulation. When the automatic function is deactivated, the shut-off valve and the pressure regulator can be directly controlled by the machine controller.

Regulation of the compressed air supply

The product regulates the compressed air supply to the set pressure setpoint. This can be done in manual mode by the setting from the controller. In automatic mode, regulation takes place via the parameterised target pressure values. Prerequisite: operating pressure $P1 \geq \text{target pressure} + 1 \text{ bar}$.

Pressure tightness testing

The product continuously measures the pressure change in the parameterised time interval and monitors this value to ensure it is not exceeded in the blocking status. The measured pressure change serves as a measure of the leakage existing in the downstream system.

Pressure recording

The product continuously measures the outlet pressure, prepares the data and makes it available cyclically. To detect operating pressures that are too high or too low, the product offers the option of parameterising critical limits for pressure. If the parameterised critical limit is exceeded, the product will output a diagnostic message. The status of monitoring to ensure the critical limit is not exceeded is indicated via an input bit and via the P2 LED on the module.

Flow recording

The product continuously records the flow rate, prepares the data and makes it available cyclically. To detect excessive flow rates, the product offers the option of parameterising the upper critical limit for the flow rate. If the parameterised critical limit is exceeded, the product will output a diagnostic message.

Consumption recording

The product determines the compressed air consumption by recording the system flow rate. With the aid of output data, the consumption measurement can be switched on and off and the consumption value can be reset.

Operational functions

The behaviour of the product can be influenced by accessing the internal parameters, e. g.:

- Diagnostic behaviour by enabling maskable diagnostic messages
- Specification of the units and the measuring interval
- Setting of critical limits

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The product is delivered with pre-set parameters. Information on parameterisation → 9 Parameter.

5.3 Electrical system configuration

The maximum permissible current load of the system supply for the MSE6-C2M-...-M (with CPX extension) is 6 A.

The product is equipped with a field bus node. Input and output data as well as parameters and diagnostic information can be transferred to the higher-level controller via the field bus node. Power is supplied via a separate supply port.

The MSE6-C2M-...-M product variant has a CPX-Extension Series 1 interface to which certain products with a CPX-Extension Series 2 interface can be connected:

- 1 energy efficiency module MSE6-D2M or
- up to a maximum of 3 digital and/or analogue CPX input and output modules

The following CPX I/O modules are permitted:

- CPX-4DE (4 digital inputs)
- CPX-8DE (8 digital inputs)
- CPX-4DA (4 digital outputs)
- CPX-8DA (8 digital outputs)
- CPX-8DE/8DA (8 digital inputs and 8 digital outputs)
- CPX-4AE-U-I (4 analogue inputs)
- CPX-2AA-U-I (2 analogue outputs)

The MSE6-C2M consists of the energy efficiency module and field bus node sub-functions, each of which is assigned its own fixed module number.

Additional modules can be connected to the MSE6-C2M-...-M via CPX-Extension. These form a complete system with the MSE6-C2M-...-M and have a consecutive module number (from module number 2).

Module number	MSE6-C2M-... Individual device	MSE6-C2M-...-M with MSE6-D2M	MSE6-C2M-...-M with CPX I/O modules
0	Energy efficiency module MSE6-C2M	Energy efficiency module MSE6-C2M	Energy efficiency module MSE6-C2M
1	Bus node CPX-FBxx	Bus node CPX-FBxx	Bus node CPX-FBxx
2	–	Energy efficiency module MSE6-D2M	1st CPX I/O module in CPX-Extension series 2
3	–	–	2nd CPX I/O module in CPX-Extension series 2 (optional)
4	–	–	3rd CPX I/O module in CPX-Extension series 2 (optional)

Tab. 8 Module numbers

The following illustrations show the communication paths for system configurations with the MSE6-C2M-...-M and system extensions via CPX-Extension.

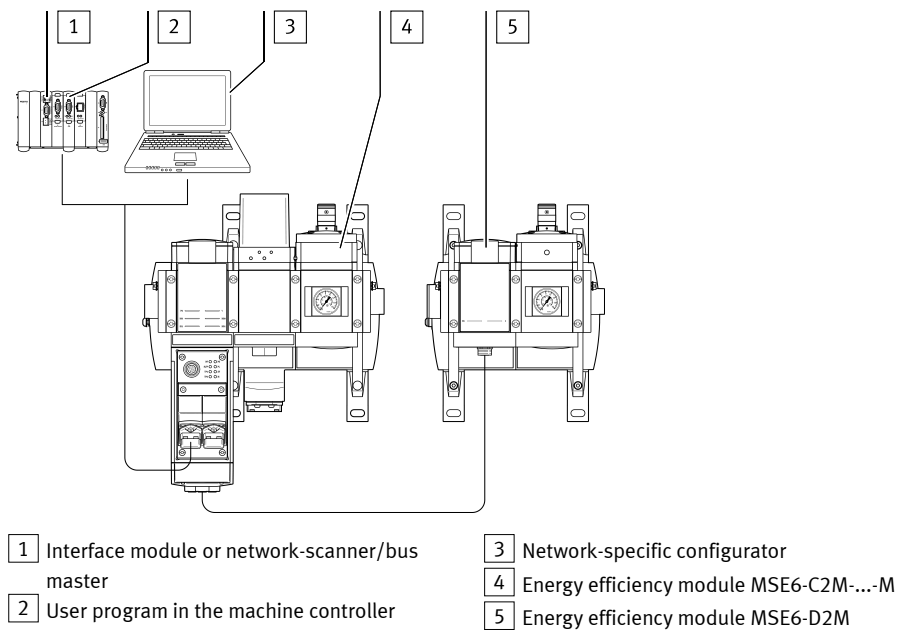


Fig. 2 System configuration with MSE6-C2M-...-M and MSE6-D2M

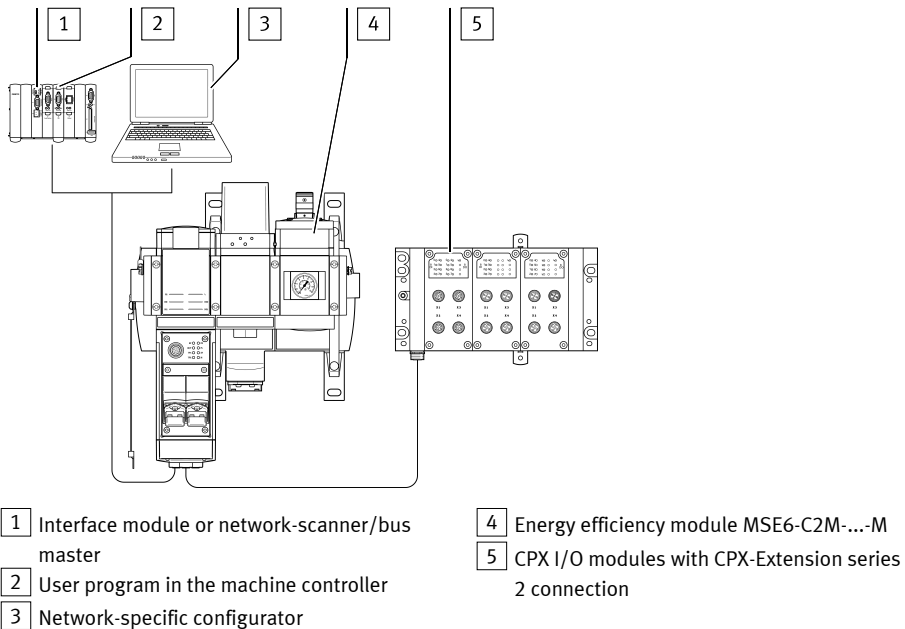


Fig. 3 System configuration with MSE6-C2M-...-M and 3 CPX I/O modules (maximum configuration)

5.4 Combination with MS6 modules

The product can be extended on the left and right side with service unit components of the MS6 series.

Information on operating and assembly → Instructions for energy efficiency module MSE6-C2M-IN, www.festo.com/spareparts

6 Commissioning

6.1 Safety

The product is equipped with a pneumatically-piloted proportional-pressure regulator and a downstream shut-off valve. The shut-off valve is pneumatically piloted and is open in a normal position. When input pressure P1 is applied, the product automatically regulates the outlet pressure in the following cases to the last parameterised power-on target pressure (default setting 10 bar):

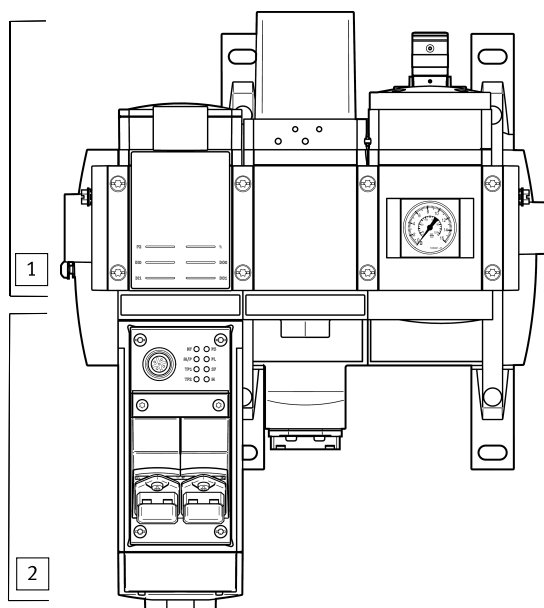
- Switch on of operating voltage until the connection is successfully made with the high-order controller.
- Interruption of the network communication with correspondingly set system parameters
- Stopping of the higher-order controller (see manufacturer's specifications), e. g. in the case of transmission of control programs, parameters, configuration data.

In the basic state, the module regulates the output pressure to the preset Power-On target pressure when the shut-off valve is open. In the event of undervoltage in the operating voltage or the load

voltage, the electronic pressure regulation is inactive when the shut-off valve is open. If prolonged, this can lead to an undefined drop in the outlet pressure.

6.2 Commissioning the product

In order to avoid connection and addressing errors, you should carry out the commissioning steps as follows.



1 Step 1 - Check the connected pneumatic application

2 Step 2 - Commissioning on bus node with testing of the address allocation

Fig. 4 Commissioning steps

Preparing for commissioning

1. Check pneumatic tubing connection.
2. Check the electrical wiring.
3. Check earth terminal.
4. Check settings of the DIL switches.



The characteristics of the product can be adapted to various requirements.

You can carry out important settings as follows:

- With the DIL switch directly on the bus node
- With parameterisation



The product is delivered with pre-set DIL switch and parameters.

Information about DIL switches → www.festo.com/sp.

6.3 Commissioning with bus node CPX-M-FB34

This section provides a brief overview of the interfaces of the bus node.

Detailed information on the bus → [nodes www.festo.com/sp](http://nodes.festo.com/sp) .

6.3.1 Interfaces and display components

Interfaces and display components on the bus node CPX-M-FB34

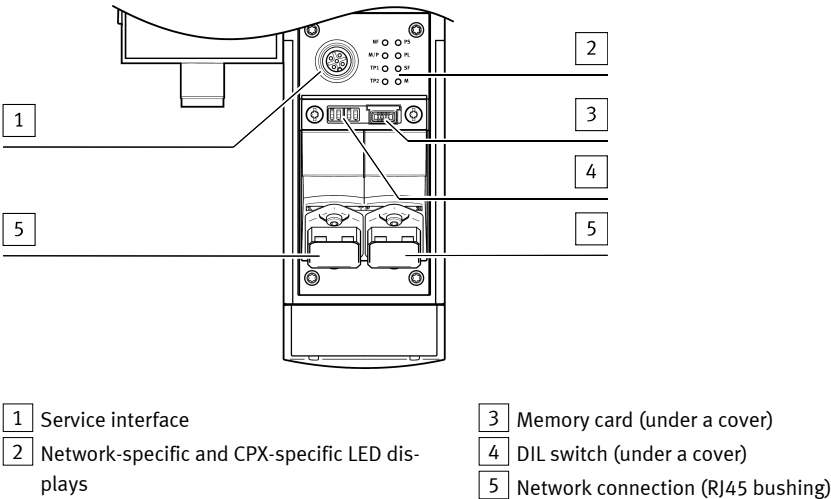
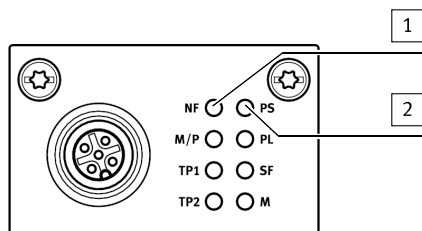


Fig. 5 Interfaces and display components on the bus node CPX-M-FB34

LED displays on the bus node CPX-M-FB34



1 Network-specific LEDs

2 CPX-specific LEDs

Fig. 6 LED display on the bus node CPX-M-FB34

Network-specific LEDs ¹⁾		CPX-specific LEDs ²⁾	
NF	Network failure (red)	PS	Power system (green)
M/P	Maintenance/PROFenergy (green)	PL	Power load (green)
TP1	Link 1 (green)	SF	System failure (red)
TP2	Link 2 (green)	M	Modify (yellow) ³⁾

1) Without network connection, the LED NF flashes.

2) In normal operating status, all green LEDs light up. The yellow and red LEDs do not light up.

3) parameterisation modified or Force active.

Tab. 9 LED displays

6.3.2 Using the memory card

The memory card is used as a carrier of configuration data for PROFINET addressing and thus simplifies bus node replacement:

- PROFINET I/O device name
- IP address

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Inserting or removing the memory card while the power supply is switched on may cause malfunctions or damage to the memory card.

- Disconnect the power supply before you insert or remove the memory card.

i

Data stored on the memory card has priority over other configuration data which is stored, e. g. in the bus node memory or in the higher-order controller.

1. Switch off power supply.
2. Unscrew and remove the retaining screws of the cover.
3. Remove cover.
4. Inserting the memory card.

- 5. Fit cover.
- 6. Tighten the retaining screws of the cover. Tightening torque: 0.4 Nm ± 10 %.

6.3.3 Network interface

The connection from the bus node to the network is effected with a specific connection technology.

Bus node	Connection technology	Network connectors
CPX-M-FB34	2x RJ45 bushing, push-pull, AIDA-compliant, corresponding to IEC 60603, IEC 61076-3	Plug connector FBD-RJ45-PP-GS

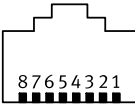
Tab. 10 Connection technology and network connectors

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Seal unused connections with cover caps or blanking plugs to achieve the specified degree of protection.

Network interface on bus node CPX-M-FB34

There are two RJ45 push-pull socket bushings (AIDA-compliant) on the bus node CPX-M-FB34 for the network connection.

RJ45 bushing	Pin	Signal	Explanation
Push-pull			
	1	TD+	transmit data (transmit data, TD) +
	2	TD	transmit data –
	3	RD+	receive data (receive data, RD) +
	4	n.c.	Not connected
	5	n.c.	Not connected
	6	RD	receive data –
	7	n.c.	Not connected
	8	n.c.	Not connected
	Housing	Shield/FE	Shield/functional earth

Tab. 11 Pin allocation of network interfaces on bus node CPX-M-FB34 (RJ45)

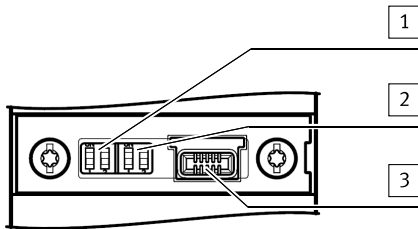
i

Connect the bus node to the network with a Festo plug connector (FBD-RJ45-PP-GS). The plug connector is designed for Ethernet lines with cable diameters 5 ... 8 mm.

6.3.4 Setting the DIL switches

You can set the following parameters with the DIL switches:

- Operating mode (the MSE6-C2M-...(-M) only supports the Remote I/O operating mode in connection with the bus node CPX-M-FB34)
 - Diagnostics mode
1. Switch off power supply.
 2. Unscrew and remove the retaining screws of the cover.
 3. Remove cover → 2 DIL switches are visible.
 4. Use DIL switch 1 to set operating mode.
 5. Set diagnostic mode using DIL switch 2.
 6. Fit cover.
 7. Tighten the retaining screws of the cover. Tightening torque: $0.4 \text{ Nm} \pm 10 \%$.



1 DIL switch 1: operating mode

2 DIL switch 2: diagnostic mode

3 Memory card

Fig. 7 DIL switches on bus node CPX-M-FB34

Setting the operating mode (DIL switch 1)

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The MSE6-C2M-...(-M) with the bus node CPX-M-FB34 only supports the operating mode Remote I/O (factory setting).

All switch elements of the DIL switch 1 must be in the OFF position.

Setting DIL switch 1	Setting the operating mode
 DIL 1.1: OFF DIL 1.2: OFF (factory setting)	Operating mode: remote I/O All functions of the MSE6-C2M-...(-M) are controlled directly by the controller or by a higher-level PLC.
 DIL 1.1: ON DIL 1.2: OFF	Is not supported by MSE6-C2M-...(-M). The DIL switch elements 1.1 and 1.2 must be in the OFF position.
 DIL 1.1: OFF DIL 1.2: ON	
 DIL 1.1: ON DIL 1.2: ON	

Tab. 12 Setting the operating mode with DIL switch 1

Setting the diagnostic mode (DIL switch 2)

Setting DIL switch 2	Setting the operating mode (in the Remote I/O operating mode)
 DIL 2.1: OFF DIL 2.2: OFF (factory setting)	I/O diagnostics interface and status bits are switched off or diagnostic mode is set via the hardware configuration of the configuration software ¹⁾ (+ 0 Byte E/O byte A)
 DIL 2.1: OFF DIL 2.2: ON	Status bits are switched on (+ 1 byte I/O byte A) ²⁾
 DIL 2.1: ON DIL 2.2: OFF	I/O diagnostics interface is switched on (+ 2 byte I/2 byte O) ³⁾
 DIL 2.1: ON DIL 2.2: ON	Reserved for future extensions

1) from Revision 21
2) Status bits occupy 1 byte address space (8 E bits)
3) I/O diagnostics interface occupies 4 bytes of address space (16 I and 16 O bits)

Tab. 13 Setting the diagnostic mode using DIL switch 2

6.3.5 Commissioning and configuration

Commissioning and configuration of the bus node depend on the higher-order control.



The following steps provide an example for the use of the Siemens SIMATIC S7-315 and the Siemens STEP 7 controller software (version 5.5 with Service Pack SP 3) with in English. → Documentation of higher-level control and control software.

Switching on the power supply

If the control and network participants have separate power supplies, the devices must be switched in the following sequence:

1. Switch on the power supply of the MSE6-C2M...(-M).
2. Switch on the power supply for the controller.

Addressing the network

The controller uses the following for addressing:

- Device names
- IP addresses (optional MAC-ID)
- Input and output addresses (I/O addresses)

Basic addressing rules

Bus node:

- The bus node occupies 0 inputs and 0 outputs if no diagnostic message is active.
 - Active status bits occupy 8 input bits.
 - 1 active I/O diagnostic interface occupies 16 input and 16 output bits.

Network:

- The address assignment of the inputs does not depend on the address assignment of the outputs.
- Addressing is carried out in bytes

Device description file (GSDML file)

A device description file (GSDML file) is needed for configuration and parameterisation of the bus node. The device description file contains all information required to integrate the module into the higher-order controller.

Device description file → www.festo.com/sp.

Setting up automation project and controller

1. Start the controller software.
2. Create a new project: [File] > [New...].
3. Enter a project name, e. g. MSE6-C2M, PROFINET.
4. Insert control used: [Insert] > [Station, e. g. SIMATIC 300 Station].
5. Extend project tree and select controller.
6. Open the hardware configuration window: [Edit] > [Open Object].

Installing the device description file

1. Open the Festo Support Portal → www.festo.com/sp.
2. Enter search term "GSDML MSE".
3. Select, save and unpack the current device description file in the Software tab.

4. Install the device description file: [Options] > [Install GSD File...]. Select the file path of the device description file: [Browse]. Select and install the file: [Install].
5. Update hardware catalogue: [Options] > [Update Catalog].
→ All available CPX modules appear in the hardware catalogue under:
 \PROFINET IO\Additional Field Devices\Valves\Festo MSE Air Supply

Setting up automation project and controller

1. Open hardware catalogue: [View] > [Catalog].
2. Extend control in hardware catalogue (e. g. SIMATIC 300) and folder structure.
3. Expand folder RACK-300.
4. Insert profile rail in controller.
5. Reproduce the controller configuration using the components from the rack rail table in the hardware catalogue.

Row 1 (Slot 1) is reserved, e. g. for a fixed power supply.

Creating a PROFIBUS network

1. Open Properties... dialogue. Right-click on the interface, e. g. X2 and [Object Properties].
2. Switch to the "General" tab.
3. Open the dialogue "Properties Ethernet...": Click on the button "Properties".
4. Creating a new network: click on the button "New" and adjust specific settings.
5. Right-click on interface, e. g. X2 and [Insert PROFINET IO System].

Insert PROFINET station ("Station")

- Drag the status symbol MSE6-C2M-5000-FB34 from the hardware catalogue onto the bus line of the PROFINET-IO system.

\PROFINET-IO\Additional Field Devices\Valves\Festo MSE Air Supply

– MSE6-C2M-5000-FB34

Assigning a "Device Name"

1. Assign device names: [PLC] > [Ethernet] > [Assign Device Name].
2. Search participant: click on the button "Update".
3. Select device. Click the Assign name button.

Transmitting hardware configuration

- Translate hardware configuration and transmit it to controller.

6.3.6 Faultless commissioning, normal operating status

After faultless commissioning, specific LED displays on the bus node light up. The other LEDs are for diagnostics and error handling → 10 Diagnostics.

LED displays			Operating status
NF		 PS	Normal, no error
M/P		 PL	
TP1		 SF	
TP2		 M	
The following LEDs light green: – PS – PL – TP1 ¹⁾ – TP2 ¹⁾ The following LEDs do not light: – NF – M/P – SF The "M" LED lights or flashes if parameterisation is changed or Force is active.			

1) Only if port used: continuous light (network connection OK).

Tab. 14 Normal operating status of the MSE6-C2M-...(-M) with bus node CPX-M-FB34

7 Measuring and control function

The following sections provide an overview of the individual measurement and control functions of the product and present their setting options and their influencing variables.

Individual functions and their behaviour can be controlled using the outputs and/or parameters.

Measurement and status signals are available as input values. Diagnostic information is made available as a combination of the error number and their respective channel allocation.

For the following designations of inputs and outputs and parameters, m is the module number that is based on the address position of the product in the CPX overall system and has the fixed value m = 0.

7.1 Flow rate

Input signal

The measured flow rate is prepared according to the set parameters flow rate (Pm.8.2-8.3) and "Unit flow rate" (Pm.8.6-8.7) and "Unit flow rate standard" and provided as an input signal (Em.0).

Critical limit monitoring

A comparator is used to compare the measured flow rate value with the parameter "Upper critical limit flow rate" (Pm.11-12). When the time set in the parameter "Monitor critical limits" startup (Pm.7) has elapsed and critical limit monitoring is activated (Pm.0.6), the appropriate error/diagnostic message is output if a critical limit is exceeded.

Monitoring of parameters

The parameters flow rate (Pm.8.2-8.3), flow standard (Pm.8.6-8.7), upper limit flow (Pm.11-12) and monitoring critical limit startup (Pm.7) are checked for permissible values when entered. In case of error, the appropriate error message is output if parameterisation error monitoring is activated (Pm.0.7).

Sensor monitoring

If there is a sensor error, the appropriate error message, which cannot be deactivated, is output.

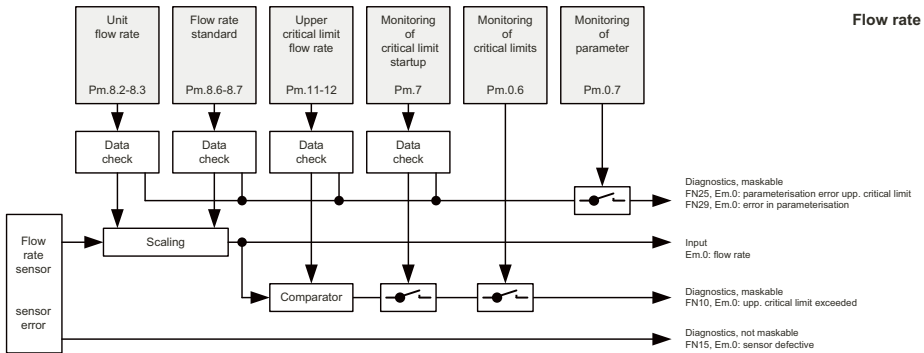


Fig. 8 Block diagram of the "Flow rate" function

7.2 Consumption

Input signals

The consumption measurement is based on the prepared flow rate value. Depending on the unit consumption (Pm.8.4-8.5) and flow standard (Pm.8.6-8.7) parameters, the consumption values are processed in 2 independent channels and provided as input signals in 16-bit and 32-bit data format:

- Consumption V0 (16 bit): input Em.1 and selectable inputs Em.5 and/or Em.6
- Consumption V0 (32 bit): selectable inputs Em.5-6
- Consumption V1 (16 Bit): selectable inputs Em.5 and/or Em.6
- Consumption V1 (32 bit): selectable inputs Em.5-6

There is also a continuous consumption measurement which, after a certain, unit-dependent consumption, generates a logic 1 measurement impulse with a duration of 100 ms. For the consumption units l and m³, the consumption value is 200 l. For the consumption unit scf, the consumption value is 10 scf.

The measuring pulse is provided at the input Measuring pulse consumption VC (Em.3.7). In addition, the signal is output at electrical output 0 if the parameter Select DO0 signal has the value Pm.28.3 = 1.

i

If there is a change to the parameter values "Unit flow rate" or "Flow rate standard", the measured consumption values are reset to the value "0".

If there is a change to the parameter value "Unit consumption", the current measured consumption values are saved and converted to the new consumption unit.

User-controlled consumption measurement

2-channel consumption measurement is controlled using two data bits in the output word for module control (Am.0). With the outputs Consumption V0 Run (Am.0.12) or Consumption V1 Run (Am.0.14),

the respective consumption measurement is started, continued or stopped. Via the outputs Consumption V0 Reset (Am.0.13) or Consumption V1 Reset (Am.0.15), the respective consumption measurement values can be reset to the value 0.

Monitoring of parameters

The parameters “Unit flow rate”, (Pm.8.2-8.3), “Unit flow rate standard” (Pm.8.6-8.7) and “Unit consumption” (Pm.8.4-8.5) are checked on entry for permitted values. In the event of an error, the corresponding error message is output if parameterisation error monitoring is activated (Pm.0.7).

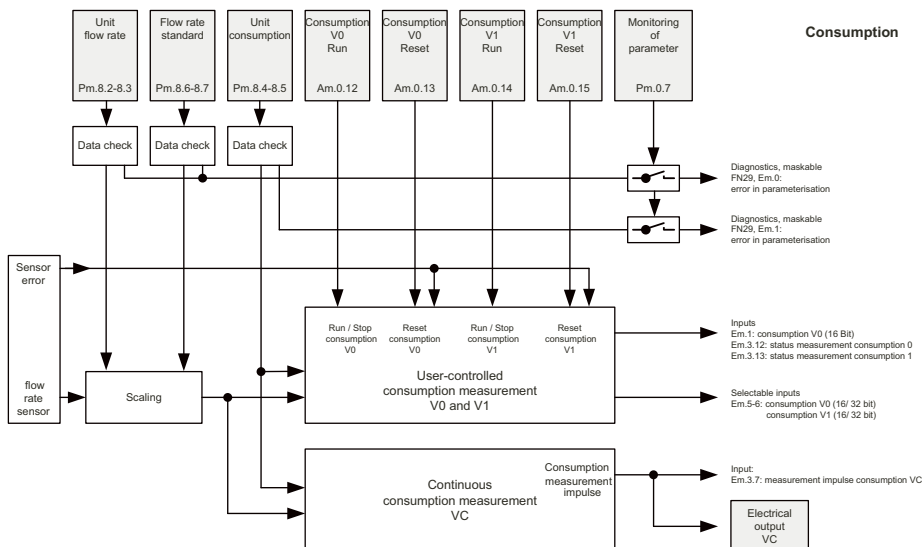


Fig. 9 Block diagram of the “Consumption” function

7.3 Pressure

Input signal

The measured value output pressure P2 is prepared according to the parameter “Unit pressure” (Pm.8.0-8.1) and made available as an input signal pressure P2 (Em.2).

Monitoring of lower pressure critical limit P2 and status indicator

A comparator is used to compare the measured pressure value with the parameter “Lower pressure critical limit” P2. The result is indicated in two ways.

- Status LED P2
 - LED lights up: outlet pressure $P2 \geq$ lower critical limit pressure P2
 - LED flashes: outlet pressure $P2 <$ lower critical limit pressure P2 and Outlet pressure $p2 \geq$ pressure setpoint auto standby - 0.5 bar
- Condition not applicable if:
- Lower critical limit pressure P2 < Pressure setpoint Auto Standby - 0.5 bar
- LED not illuminated: outlet pressure $P2 <$ pressure setpoint auto standby - 0.5 bar

- Input monitoring "Lower pressure critical limit" P2 (Em.3.6)
 - Logic 1: outlet pressure P2 < lower critical limit pressure P2
 - Logic 0: outlet pressure P2 ≥ lower critical limit pressure P2

The figures show the behaviour of the status LED P2 and the input signal Monitoring of lower critical limit pressure P2 for the two parameterisation cases:

- Case 1: Lower critical limit pressure P2 > pressure setpoint Auto Standby - 0.5 bar
- Case 2: Lower critical limit pressure P2 < pressure setpoint Auto Standby - 0.5 bar

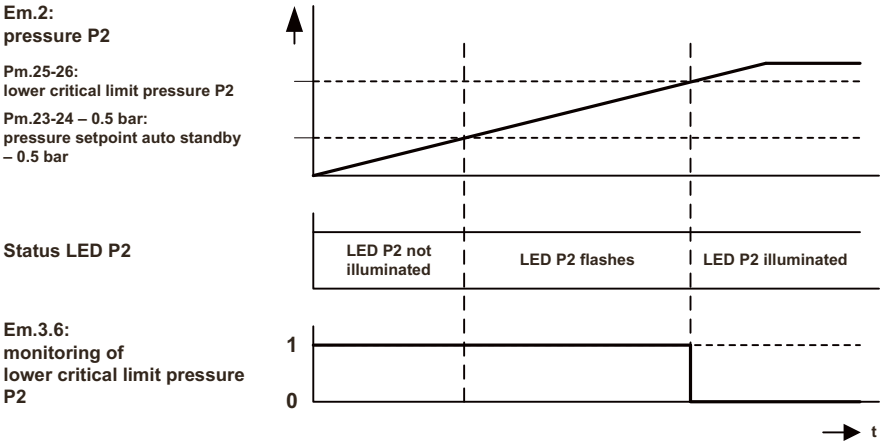


Fig. 10 Monitoring of lower pressure critical limit P2 and status indicator (case 1)

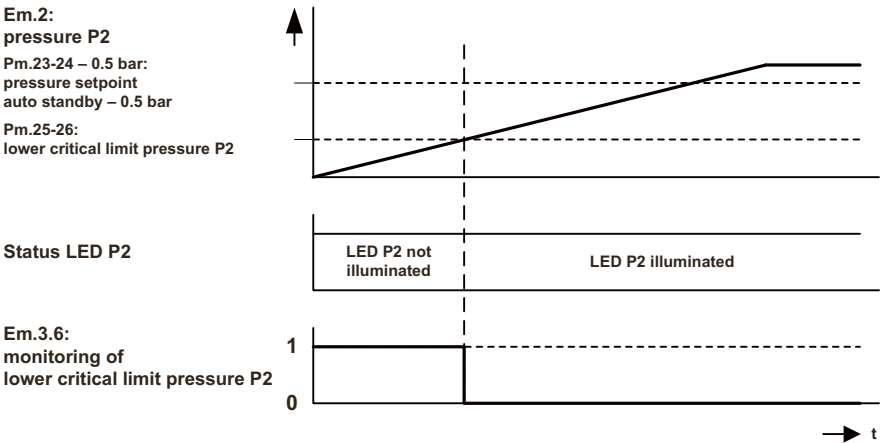


Fig. 11 Monitoring of lower pressure critical limit P2 and status indicator (case 2)

Monitoring of upper pressure critical limit

A comparator is used to compare the measured pressure value with the parameter "Upper pressure critical limit" (Pm.13-14). When the time set in the parameter "Monitor critical limits" startup (Pm.7) has elapsed and critical limit monitoring is activated (Pm.0.6), the appropriate error/diagnostic message is output if a critical limit is exceeded.

Monitoring of parameters

The parameters unit pressure (Pm.8.0-8.1), lower critical limit pressure P2 (Pm.25-26), upper critical limit pressure (Pm.13-14) and monitoring critical limit startup (Pm.0.7) are checked for permissible values during input. In the event of an error, the corresponding error message is output if parameterisation error monitoring is activated (Pm.0.7).

Sensor monitoring

If there is a sensor error, the appropriate error message, which cannot be deactivated, is output.

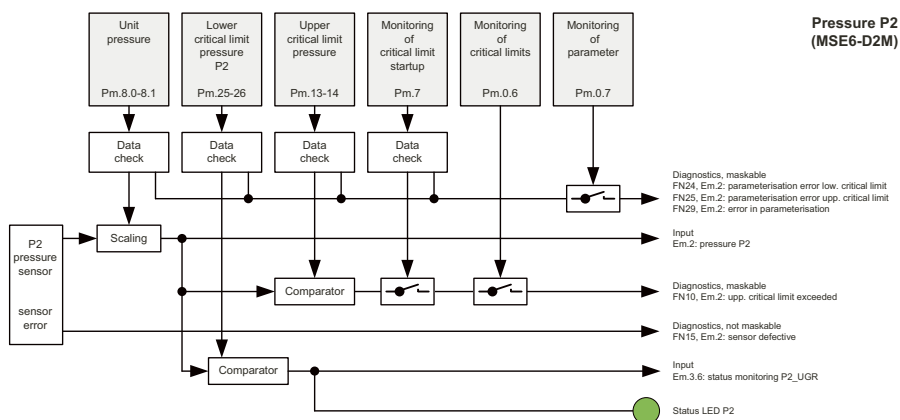


Fig. 12 Block diagram of the “Pressure” function

7.4 Pressure change

7.4.1 Method of measurement

The pressure change DP2 is determined cyclically at intervals of the parameterisable pressure change sample time DT. When calculating the pressure change, the difference between the current measured pressure value and the measured pressure value DT, based on the pressure change sample time P2, is calculated:

$$DP2 = P2(t) - P2(t-DT); t = \text{current measurement time.}$$

The start of the measuring cycle to calculate the pressure change is automatically synchronised with the activation signal of the shut-off valve. The current pressure change value DP2 remains constant up to the next measuring time. Each time the parameter "Unit" (Pm.8) is written, a re-synchronisation follows.

In the blocking state, the amount of the pressure change value is compared to the upper pressure change critical limit DP2_OGR and monitored to determine whether the critical limit has been exceeded. Once critical limit monitoring is activated, a diagnostic message is generated if the parameter $ABS(DP2)$ is $> DP2_OGR$.

DT synchronisation and DP2 OGR critical limit monitoring

The time diagrams show the DT synchronisation and DP2 OGR critical limit monitoring.

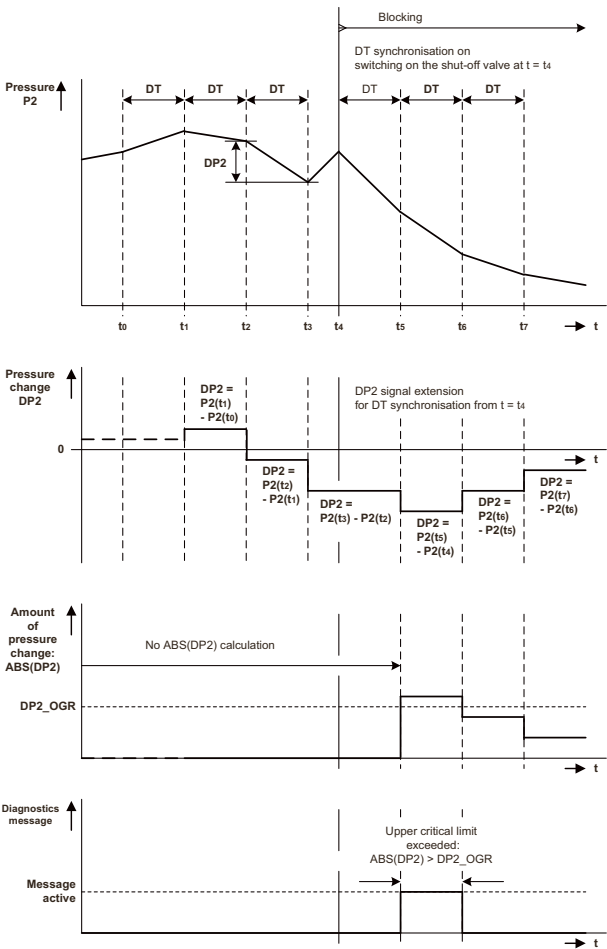


Fig. 13 DT synchronisation and DP2 OGR critical limit monitoring

7.4.2 Function structure

Input signal

The measured pressure change value DP2 is prepared according to the set parameters “Unit pressure” (Pm.8.0-8.1) and “Pressure change sample time” (Pm.10) and can be shown as a selectable input signal in Em.5 and/or Em.6.

Critical limit monitoring

If the shut-off valve is in the blocking state, the amount of the measured pressure change is compared with the parameter “Upper critical limit pressure change” (Pm.15-16) using a comparator. If critical limit monitoring is activated (Pm.0.6), the appropriate error/diagnostic message is output if the critical limit is exceeded.

Monitoring of parameters

The parameters “Unit Pressure” (Pm.8.0-8.1), “Pressure change sample time” (Pm.0) and “Upper limit pressure change” (Pm.15-16) are checked on entry for permitted values. In the event of an error, the corresponding error message is output if parameterisation error monitoring is activated (Pm.0.7).

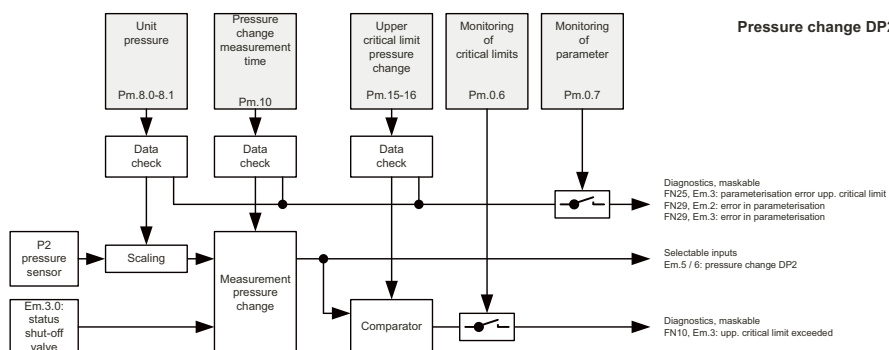


Fig. 14 Block diagram of the “Pressure change” function

7.5 Pressure regulation and blocking function

7.5.1 Overview

The pressure regulation and blocking function determines the current module status by evaluating pressure and flow measured values. The desired outlet pressure P2 is set by controlling the pressure regulator and the shut-off valve accordingly.

Depending on the setting, the module works in user-controlled or automatic pressure regulation and blocking function.

In the user-controlled pressure regulation and blocking function, the shut-off valve is controlled directly. One of the various fixed values or a variable value can be set as the target pressure.

In automatic pressure regulation and blocking function, the target pressure is set to Auto Normal in the basic state. If the flow rate falls below the set flow rate critical limit for the specified period of time, the automatic pressure regulation and blocking function first switches to shut-off mode if activated accordingly. After a pressure drop to the target pressure Auto Standby, the function then switches to pressure regulation mode with the target pressure Auto Standby.

In this state, a corresponding control signal is required to change to pressure regulation mode with the target pressure Auto Normal. Depending on the selection, this control signal must be generated by an output control bit or one of the two electrical inputs.

Status and status signals of the pressure regulation and blocking function are displayed in an input word for user-side sequence monitoring.

In both user-controlled and automatic pressure regulation and blocking function, there is a module-internal target pressure value limitation to a range between 2.5 ... and 10 bar and a parameterisable target pressure rise limitation.

The entire structure of the pressure regulation and blocking function with all sub-functions, operands (inputs, outputs, parameters) and error/diagnostic messages is described in the subchapter Function Structure.

7.5.2 User-controlled pressure regulation and blocking function (USER)

The user-controlled pressure regulation and blocking function is activated if the output control Auto-User (Am.0.1) has the value 0 (not active).

In this state, the shut-off valve can then be switched by the user to the status "Pressurise" or "Block" with the output Controller Shut-off valve (Am.0.0). The switching status of the shut-off valve is signalled in input Em.3.0.

For the target pressure for the pressure regulating valve, the target pressure user selection (Am.0.3-0.4) output can be used to select between the following values and functions:

- Power-On target pressure, adjustable to 10 bar or 6 bar with the parameter Power-On target pressure (Pm.28.2)
- Minimum target pressure (2.5 bar)
- Deactivated electronic pressure regulation
- Variable target pressure setting via output target pressure user (Am.2)

With Power-On and any further user-side increase in the target pressure value, the rise slope is limited to the value set with the target pressure rise limitation parameter (Pm.28.4-28.6).

The time diagram shows the module behaviour after Power-On and subsequent variable target pressure adjustment to 2 different values.

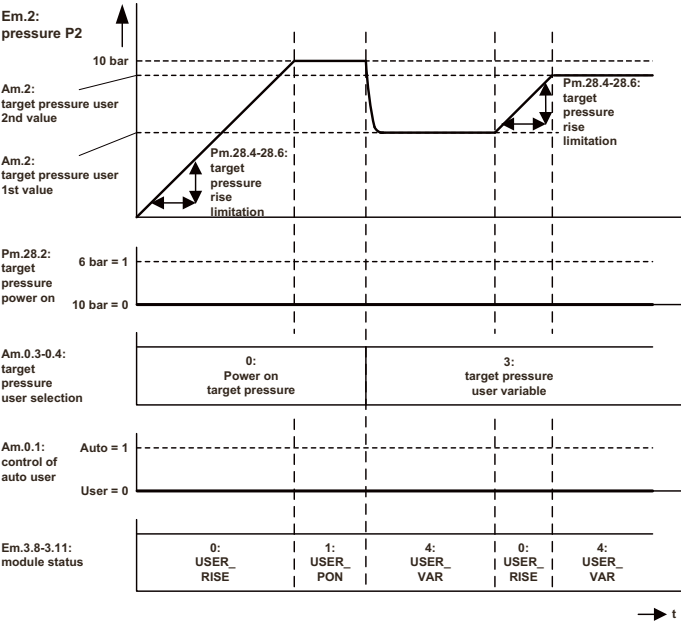


Fig. 15 User-controlled pressure regulation and blocking function

7.5.3 Automatic pressure regulation and blocking function (AUTO)

The automatic pressure regulation and blocking function is activated when the output control Auto-User (Am.0.1) has the value 1 (active).

The automatic pressure regulation and blocking function starts with each activation in module state AUTO_NORMAL (Em.3.8-3.11 = 8). In this state, the shut-off valve is open and the pressure regulating valve regulates to the parameter value Target pressure Auto Normal (Pm.21-22). At the same time, the Q_low-Timerfunction starts monitoring to check whether the flow rate value falls below the parameter value Auto-controller flow rate critical limit (Pm.19-20). If the value falls below the critical limit, a change to the state AUTO_WAIT(Em.3.8-3.11 = 9) takes place and the duration of the state is monitored by the Q_low-Timer. If the critical limit underrun exceeds the time limit set with the parameter Auto-controller delay time (Q_low-Timer has elapsed), a change to the state AUTO_HOLDoccurs (Em.3.8-3.11 = 10). In this state, if the shut-off valve is still open, the setpoint pressure is set to Auto Normal. If the flow rate reaches or exceeds the Auto-controller flow rate critical limit during the states AUTO_NORMAL, AUTO_WAITandAUTO_HOLD, the flow rate immediately returns to the state AUTO_NORMAL(Em.3.8-3.11 = 8).

To switch the target pressure from Auto Normal to Auto Standby in the stateAUTO_HOLD, the output control Auto-Enable (Am.0.5 = 1) must be activated. This can be done permanently or by the user depending on the system, e. g. if automatic switching is not permitted due to the situation.

If Auto-Enable is activated ($Am.0.5 = 1$) in the output control state `AUTO_HOLD`, the shut-off valve switches to the shut-off state and the new module state is `AUTO_SHUTOFF` ($Em.3.8-3.11 = 11$). As soon as the pressure P_2 has dropped to the target pressure Auto Standby, the module status changes to `AUTO_STANDBY` ($Em.3.8-3.11 = 12$). The shut-off valve is open again and the pressure regulating valve regulates to the target pressure Auto Standby.

A change from the module state `AUTO_STANDBY` with target pressure Auto Standby to the module state `AUTO_NORMAL` with target pressure Auto Normal is only possible by resetting the Q_{low} -Timers.

While the pressure increases, the function is in module `AUTO_RISE` state ($Em.3.8-3.11 = 13$). In this state, the slope of the pressure rise is limited to the value set with the target pressure rise limitation parameter ($Pm.28.4-28.6$).

The following figure gives an overview of the relevant measurement, control and status signals of the automatic pressure regulation and blocking function by means of an exemplary flow rate curve. The output Q_{low} -Timer-Reset ($Am.0.2$) is set as the signal source for resetting the Q_{low} -Timers.

Measuring and control function

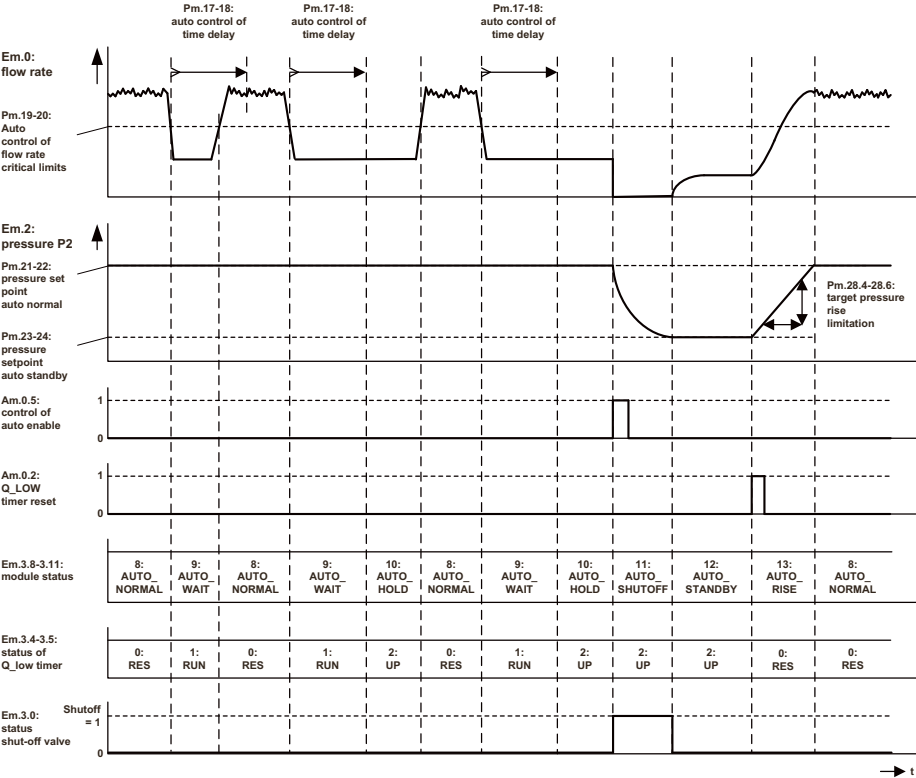


Fig. 16 Automatic pressure regulation and blocking function

7.5.4 Functional states

The current functional state is displayed in the input module state (Em.3.6-3.9).

The table shows an overview of the possible functional states in all operating modes.

Em.3.8-3.11 Module Status	Functional status	Functional mode	Meaning
0	USER_RISE	USER	Pressure increase until the target pressure set by the user is reached
1	USER_PON	USER	Pressure regulation to set Power-On target pressure
2	USER_MIN	USER	Pressure regulation to minimum target pressure (2.5 bar)
3	USER_REGOFF	USER	Electronic pressure regulation is deactivated
4	USER_VAR	USER	Pressure regulation to set target pressure according to Am.2
5	USER_SHUTOFF	USER_	Module in shut-off mode
7	OFF_24VA	USER/AUTO	No load power supply Pressure regulation and blocking function not active
8	AUTO_NORMAL	AUTO	Pressure regulation at parameterised target pressure Auto Normal
9	AUTO_WAIT	AUTO	Pressure regulation at parameterised target pressure Auto Normal, Q_low-Timer expired, automatic pressure regulation and blocking function not activated
10	AUTO_HOLD	AUTO	Pressure regulation at parameterised target pressure Auto Normal, Q_low-Timer expired, automatic pressure regulation and blocking function not activated
11	AUTO_SHUTOFF	AUTO	Module in shut-off mode, Q_low-Timer expired, automatic pressure regulation and blocking function activated
12	AUTO_STANDBY	AUTO	Pressure regulation at parameterised target pressure Auto Standby
13	AUTO_RISE	AUTO	Pressure increase up to the parameterised target pressure Auto Normal

Tab. 15 Possible functional states in all operating modes

7.5.5 Function structure

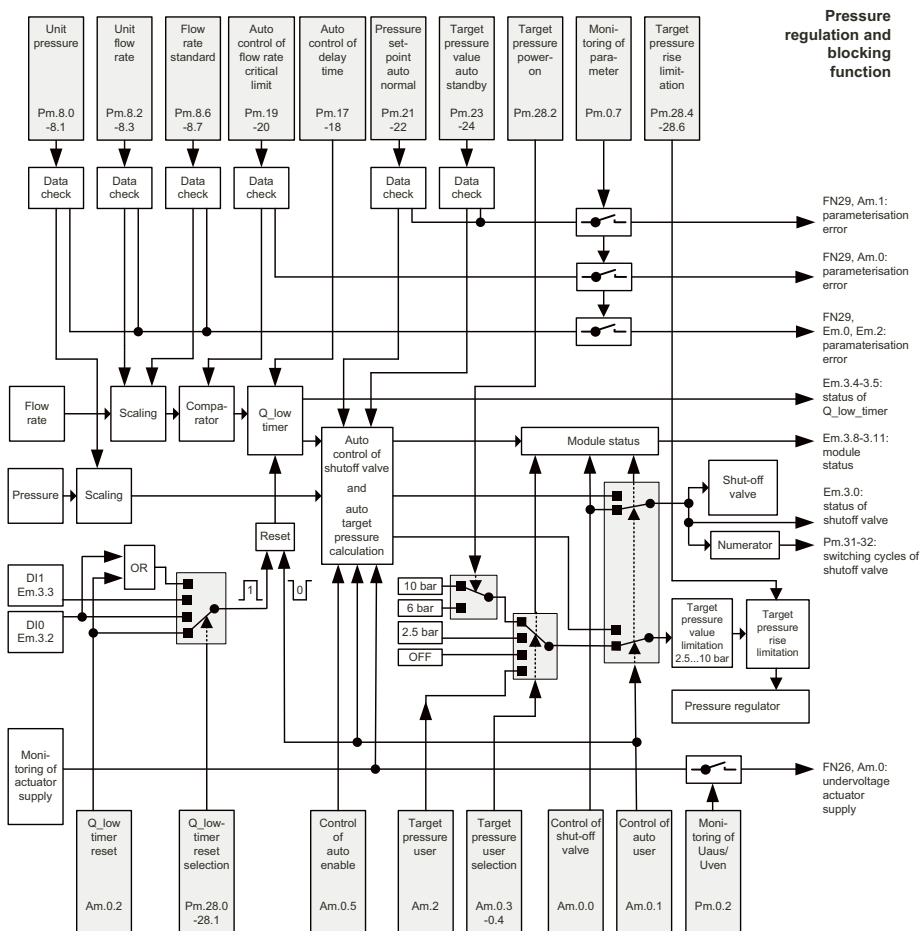


Fig. 17 Block diagram of the pressure regulation and blocking function

Q_low-Timer

The function Q_low-Timer continuously compares the prepared measured flow rate value with the parameter Auto-controller flow rate critical limit. If the critical limits are not reached, Q_low-Timer is started. The Q_low-Timer enters status UP if the flow rate critical limit is not reached for longer than the time parameterised in the parameter Auto-controller delay time (Pm.17-18).

The timer status is displayed in the input status Q_low-Timer (Em.3.4-3.5) and can have the following values:

- 0 = RES: the timer is reset and not started.

- 1 = RUN: the timer was started and is running.
The timer has not yet exceeded the parameter value Auto-controller delay time (Pm.17-18).
- 2 = UP: the Timer has expired.
The timer has exceeded the parameter value Auto-controller delay time (Pm.17-18).

The Q_low-Timer is reset in the following cases:

- In module state AUTO_WAIT(Em.3.8-11 = 9) and
In module state AUTO_HOLD(Em.3.8-11 = 10) when Auto-controller flow rate critical limit is exceeded (Pm.19-20)
- by a reset control signal (1 = active). The signal can be selected with the parameter Q_low-Timer-Reset selection (Pm.28.0-28.1):
 - Output Q_low-Timer-Reset (Am.0.2)
 - Electrical input DI0
 - Electrical input DI1
 - Logic operation: electrical input DI0 OR output Q_low-Timer-Reset(Am.0.2)

Module status

The module status results from the status or status of sub-functions of the pressure regulation and blocking function and is displayed in input (Em.3.8-3.11).

The individual module states are described in chapter Function states.

Shut-off valve

Depending on the setting of output control Auto-User (Am.0.1), the shut-off valve is controlled either by the user or by the partial function Auto-controller shut-off valve.

The switching status of the shut-off valve is determined by the input Status shut-off valve (Em.3.0):

The shut-off valve switching cycle number is provided in different types and data formats:

- 16-bit or 32-bit input value via selectable inputs Em.5 and/or Em.6
- 16 bit parameter value (Pm.31-32)

Pressure regulator

Depending on the setting of output control Auto-User (Am.0.1), the target pressure for the pressure regulator is determined as follows:

- By the target pressure value set by the user
- By the target pressure value specified by the Auto target pressure sub-function.

Before being passed on to the pressure regulator, the setpoint value is limited to values between 2.5 and ... 10.0 bar within the module. The rise is limited to the set parameter value when the target pressure is increased.

Monitoring of parameters

The parameters "Pressure unit" (Pm.8.0-8.1), "Flow rate unit" (Pm.8.2-8.3), "Flow rate standard" (Pm.8.6-8.7), "Auto-controller flow rate critical limit" (Pm.19-20) are checked for permissible values when entered. In case of error, the appropriate error message is generated if parameterisation error monitoring is activated (Pm0.7).

Actuator supply monitoring

This function is used to monitor the actuator supply for undervoltage. In the event of an error, the corresponding error message is generated with activated monitoring (Pm.0.2).

7.6 Electrical inputs

The "Electrical inputs" function is equipped with 2 digital inputs, which can also be used to reset the Q_{low}-Timers of the pressure regulation and blocking functions with appropriate parameterisation.

Input signals

The signals of the electrical inputs 0 and 1 are processed according to the parameters debounce time DI (Pm.27.4-27.5) and signal extension time DI (Pm.27.2-27.3). The times are valid for both channels. The activation of the signal extension is set channel by channel with the parameters Signal extension channel DI0 (Pm.27.0) and Signal extension channel DI1 (Pm.27.1). The input signals are provided as electrical input DI0 (Em.3.2) and electrical input DI1 (Em.3.3).

Status indicators

The status of the electrical inputs is indicated channel by channel by status LEDs. When the LED is lit, a logic 1 is present at the input, when the LED is not lit, a logic 0.

Sensor supply

The sensor supply voltage 24VSEN is provided at the connections for the electrical inputs. The sensor supply voltage 24VSEN is internally protected against short-circuit/overload. The parameter Behaviour after short-circuit/overload sensor supply (Pm.27.6) is used to set whether the sensor supply is switched on again after short-circuit/overload end or remains switched off. If the diagnosis with the parameter Monitoring short-circuit/overload sensor supply (Pm.0.0) is activated, the corresponding error message is generated in case of overload.

m = module number (0)

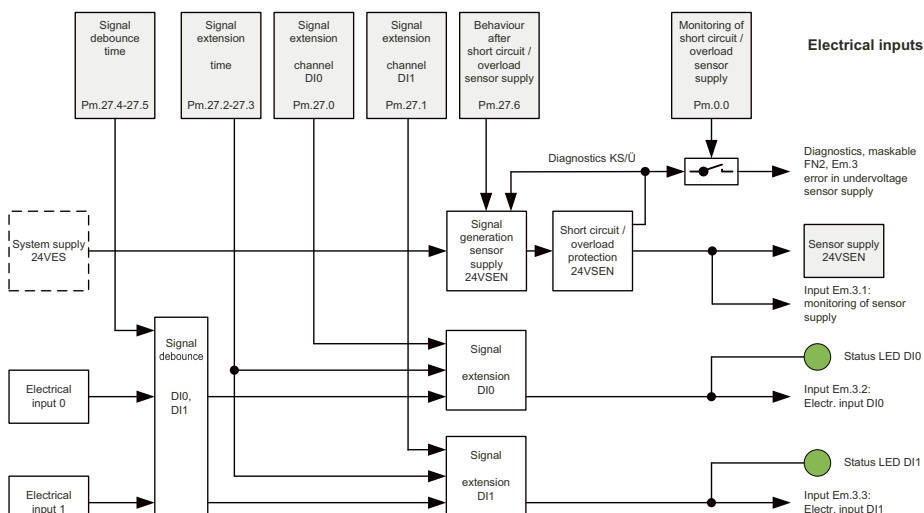


Fig. 18 Block diagram, electrical inputs

7.7 Electrical outputs

The electrical outputs function is equipped with 2 digital outputs, one of which can be used alternatively for the output of the consumption measurement pulse.

Output signals

The electrical outputs are controlled via the outputs module control Am.0.6 and Am.0.7 during basic setting. Alternatively, the consumption measurement pulse VC can be output at output DO0 if the DO0 Signal Selection (Pm.28.3) parameter is set accordingly.

The electrical outputs have an internal short-circuit/overload protection. The parameter Behaviour after short-circuit/overload outputs (Pm.27.7) defines whether the electrical outputs remain switched off after short-circuit/overload end or are switched on again automatically.

Status indicators

The status of the electrical outputs is displayed channel by channel by means of a status LED. When the LED is lit, the output provides a logic 1. If the LED is not lit, the output provides a logic 0.

Monitoring of short circuit/overload

The electrical outputs are monitored channel by channel for short-circuit/overload. The error status is signalled in input module status (Em.3.14 for output 0, Em.3.15 for output 1). In addition, with activated diagnostics (setting with parameter Pm.0.1), a group error message is generated for outputs 0 and 1 if at least 1 channel is overloaded.

Actuator supply monitoring

The actuator supply is monitored for undervoltage. In the event of an error, the corresponding error message is generated with activated monitoring (Pm.0.2).

Input/output data

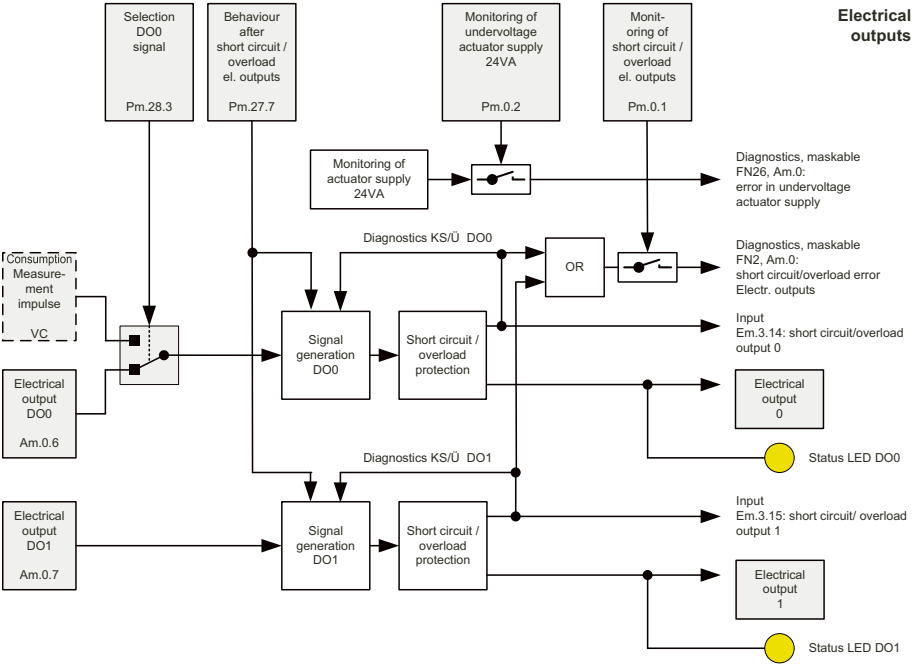


Fig. 19 Block diagram, electrical outputs

8 Input/output data

The product possesses multiple items of functional module data, which can be replaced with the higher-order controller using the I/O data presented below.

8.1 Overview

Data field / function	Input ¹⁾	Output
Flow measurement		
Measured value	Em.0	–
Consumption measurement		
Measured value V0 (16 bit)	Em.1 ²⁾	Input address for data selection: Am.1
Measured value V0 (32 bit)	Data access via selectable input data: Em.5, Em.6	
Measured value V1 (16 bit)		
Measured value V1 (32 bit)		
Measurement impulse VC	Em.3.7	–

Data field / function	Input ¹⁾	Output
Status V0	Em.3.12	–
Status V1	Em.3.13	–
Consumption V0 Run	–	Am.0.12
Consumption V0 Reset	–	Am.0.13
Consumption V1 Run	–	Am.0.14
Consumption V1 Reset	–	Am.0.15
Pressure measurement		
Measured value	Em.2	–
Monitoring of lower critical limit	Em.3.6	–
Pressure change measurement		
Measured value	Data access via selectable input data: Em.5, Em.6 → 8.3 Selectable input data function.	Input address for data selection: Am.1 → 8.3 Selectable input data function.
Pressure regulation and blocking function		
Status of shut-off valve	Em.3.0	–
Status Q_low-Timer	Em.3.4-3.5	–
Module status	Em.3.8-3.11	–
Shut-off valve controller	–	Am.0.0
Auto-user controller	–	Am.0.1
Q_low-Timer-Reset	–	Am.0.2
Selection of user target pressure	–	Am.0.3-0.4
Auto enable controller	–	Am.0.5
User pressure setpoint	–	Am.2
Electrical inputs		
Monitoring Sensor supply	Em.3.1	–
Status of electrical input 0	Em.3.2	–
Status of electrical input 1	Em.3.3	–
Electrical outputs		
Monitoring Electrical output 0	Em.3.14	–

Data field / function	Input ¹⁾	Output
Monitoring Electrical output 1	Em.3.15	–
Control Electrical output 0	–	Am.0.6
Control Electrical output 1	–	Am.0.7
Selectable input data		
Input address	Em.4	Am.1
Input data	Em.5 (data bits 0 ... 15)	–
	Em.6 (data bits 16 ... 32)	–

1) m = Module number (0)

2) Data access also possible via selectable input data.

Tab. 16 Overview of I/O data

8.2 Description of I/O data

- The input and output words of all I/O data are shown in Motorola format (MSB-LSB).
- The output words (2 byte, 16 bit) are transferred to the higher-order controller.
- The output words (2 byte, 16 bit) are transmitted from the higher-order controller.

8.2.1 Output word Am.0 "Module control" [Modul control]

Output word Am.0 is used to control the pressure regulation and blocking function as well as the consumption measurement.

Data format of output word "16 bits, right-justified"															
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
B15	B14	B13	B12	—	—	—	—	B7	B6	B5	B4	B3	B2	B1	B0
MSB															LSB
Abbreviations used															
B0	Shut-off valve controller														
B1	Auto-user controller														
B2	Q_low-Timer-Reset														
B3, B4	Selection of user target pressure														
B5	Auto enable controller														
B6	Electrical controller output 0														
B7	Electrical controller output 1														
B12	Consumption V0 Run														
B13	Consumption V0 Reset														
B14	Consumption V1 Run														
B15	Consumption V1 Reset														
—	Reserved data bits														
D0 ... D15	16 bit output data field														
MSB/LSB	Most significant bit /least significant bit														

Tab. 17 Data format of output word Am.0

Output data, pressure regulation and blocking function

Data bit B0 has the following values:

- 0 = open shut-off valve - (pressurisation state, default)
- 1 = closed shut-off valve (blocking state)

Data bit B1 has the following values:

- 0 = operating mode "User-controlled pressure regulation and blocking function" active (default)
- 1 = operating mode "Automatic pressure regulation and blocking function" active

Data bit B2 has the following values:

- 0 = no change in status of the Q_low-Timers (default)
- 1 = Resetting the Q_low-Timers

Data bits B3 and B4 have the following values:

- 0 = user-controlled target pressure = Power-On target pressure (depending on Pm.28.2, default)
- 1 = user-controlled target pressure = 2.5 bar
- 2 = electronic pressure regulation not active
- 3 = user-controlled target pressure = target pressure user variable (Am.2)

Data bit B5 has the following values:

- 0 = automatic pressure regulation and blocking function not active (default)
- 1 = automatic pressure regulation and blocking function active

The control signal can be used for a user-controlled or permanent activation of the automatic pressure regulation and blocking function.

Output data, electrical outputs

Data bit B6 has the following values:

- 0 = electrical output 0 sends logic 0 (default)
- 1 = electrical output 0 sends logic 1

Data bit B7 has the following values:

- 0 = electrical output 1 sends logic 0 (default)
- 1 = electrical output 1 sends logic 1

Consumption measurement output data

Data bits B12 and B14 have the following values:

- 0 = measurement not active: measurement is stopped (default)
- 1 = measurement active: measurement is started or continued

Data bits B13 and B15 have the following values:

- 0 = reset function not active (default)
- 1 = reset function active: measured consumption value is reset to value 0

8.2.2 Output word Am.1 "Input address" [Input address]

The output word Am.1 belongs to the function Selectable input data and is described in the chapter of the same name.

8.2.3 Output word Am.2 "Pressure setpoint P2" [Set point pressure P2]

Setting target pressure P2

- In the operating mode "User-controlled pressure regulation and blocking function" (Am.0.1)
- With output word P2
- With user-controlled target pressure (Am.0.3 = 3)
- In the currently valid pressure unit (Pm.8.0-8.1)

Data format of output word "sign + 15 bits, right-justified"															
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
VZ	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
MSB															LSB
Abbreviations used															
VZ	Sign (for data format sign + 15 bits always = 0, i. e. positive value)														
B0 ... B14	Pressure setpoint P2														
D0 ... D15	16 bit output data field														
MSB/LSB	Most significant bit /least significant bit														
Remarks:	Pressure setpoints are automatically limited within the permissible value range (0 ... 32767) to the end values of the nominal pressure range within the module, depending on the parameterised pressure unit and without an error message: – mbar: 2500 ... 10000 – kPa: 250 ... 1000 – psi/10: 363 ... 1450														

Tab. 18 Data format of output word Am.2

8.2.4 Input word Em.0 "Flow rate" [Flow]

In the input word Em.0, the flow rate value is displayed in accordance with the parameterised flow rate unit and flow rate standard. The presetting of the module parameter "Unit flow rate" is "l/min", the presetting of the module parameter "Flow rate standard" is "DIN 1343".

Data format of input word "Sign + 15 bits, right-justified"															
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
VZ	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
MSB															LSB
Abbreviations used															
VZ	Sign (for data format Sign + 15 bits always = 0, i. e. positive value)														
B0 ... B14	Flow rate value														
D0 ... D15	16-bit input data field														

Data format of input word "Sign + 15 bits, right-justified"	
MSB/LSB	Most significant bit /least significant bit

Tab. 19 Data format of input word Em.0 "Flow rate"

Flow rate	Input value	
[l/min]	[l/min]	[scfm/10]
0	0	0
50	50	18
...	...	...
5000	5000	1766

Tab. 20 Unit-dependent flow rate values

8.2.5 Input word Em.1 "Consumption" [Consumption]

In the input word Em.1, the consumption value V0 (16 bit) is displayed in accordance with the parameterised consumption unit and flow rate standard and limited to max. 65535 (16-bit value) independently of the parameterised unit. Via selectable input data, the measurement value is also available as a 32-bit value. The presetting of the module parameter "Unit consumption" is l, the presetting of the module parameter "Unit flow rate standard" is "DIN 1343". If there is a change to the flow rate unit and/or flow rate standard, the consumption is reset to the value "0". If there is a change to the consumption unit, the consumption value remains unchanged and is converted correspondingly.

Data format of input word "16 bits, right-justified"															
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
MSB															LSB
Abbreviations used															
B0 ... B15		Consumption value													
D0 ... D15		16-bit input data field													
MSB/LSB		Most significant bit /least significant bit													

Tab. 21 Data format of input word Em.1 "Consumption"

8.2.6 Input word Em.2 "Pressure P2" [Pressure P2]

In the input word Em.2, the pressure value P2 is displayed in accordance with the parameterised pressure unit. The presetting of the module parameter "Unit pressure" is "mbar".

Data format of input word "Sign + 15 bits, right-justified"															
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
VZ	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
MSB															LSB
Abbreviations used															
VZ	Sign (for data format "Sign + 15 bits" always = 0, i. e. a positive value)														
B0 ... B14	Pressure value P2														
DO ... D15	16-bit input data field														
MSB/LSB	Most significant bit /least significant bit														

Tab. 22 Data format of input word Em.2 "Pressure P2"

Pressure P2	Input value		
[bar]	[mbar]	[kPa]	[psi/10]
0	0	0	0
1	1000	100	145
4	4000	400	580
...	...	...	...
7.36	7360	736	1067
...	...	...	...
14	14000	1400	2030

Tab. 23 Unit-dependent pressure values

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The pressure measurement data is presented according to the unit and is rounded off. Measured value resolution:
• mbar: 20 • kPa: 2 • psi/10: 5

8.2.7 Input word "Pressure change DP2"

The value of the pressure change can only be displayed via selectable input data as a signed 16-bit value in the input words Em.5 and/or Em.6 in accordance with the parameterised pressure unit and pressure change measurement time.

Data format of input word "Sign + 15 bits, right-justified"															
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
VZ	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
MSB															LSB
Abbreviations used															
VZ	Sign														
B0 ... B14	Pressure change value														
D0 ... D15	16-bit input data field														
MSB/LSB	Most significant bit /least significant bit														

Tab. 24 Data format of input word Em.5/Em.6 "Pressure change"

8.2.8 Input word Em.3 "Module status" [Status]

In the input word Em.3, status information on the module is displayed.

Data format of input word "16 bits, right-justified"															
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
MSB															LSB
Abbreviations used															
B0	Status of shut-off valve														
B1	Monitoring sensor supply														
B2	Status of electrical input 0														
B3	Status of electrical input 1														
B4, B5	Status Q_low-Timer														
B6	Monitoring of lower critical limit pressure P2														
B7	Measurement of impulse consumption VC														
B8 ... B11	Module status														
B12	Status of consumption V0														
B13	Status of consumption V1														
B14	Monitoring of electrical output 0														
B15	Monitoring of electrical output 1														
D0 ... D15	16 bit input data field														
MSB/LSB	Most significant bit /least significant bit														

Tab. 25 Data format of the input word Em.3 "Module status"

Input data, shut-off function

Data bit B0 has the following values:

- 0 = open shut-off valve (pressurise status)
- 1 = closed shut-off valve (blocking state)

Data bits B4, B5 indicate the status of Q_low-Timers and have the following values:

- 0 = RESET: Q_low-Timernot started
- 1 = RUN: Q_low-Timer running
- 2 = UP: Q_low-Timer expired

Data bits B8 ... B11 signal the current function status and have the following values:

- 0 = USER_RISE: pressure increase until user-set target pressure is reached (USER mode)
- 1 = USER_PON: pressure regulation to set Power-On target pressure (USER mode)
- 2 = USER_MIN: pressure regulation to minimum target pressure = 2.5 bar (USER mode)
- 3 = USER_REGOFF: electronic pressure regulation deactivated (USER mode)
- 4 = USER_VAR: pressure regulation to set target pressure according to Am.2 (USER mode)
- 5 = USER_SHUTOFF: module in shut-off mode (USER mode)
- 7 = OFF_24VA: missing load voltage supply, pressure pressure regulation and blocking function not active (USER/AUTO mode)
- 8 = AUTO_NORMAL: pressure regulation at parameterised target pressure Auto Normal (AUTO mode)
- 9 = AUTO_WAIT: pressure regulation at parameterised set point pressure Auto Normal during an under-run of the parameter value Auto-controller flow rate critical limit, Q_low-Timerrunning (AUTO mode)
- 10 = AUTO_HOLD: pressure regulation at parameterised target pressure Auto Normal, Q_low-Timerexpired, automatic pressure regulation and blocking function not activated (AUTO mode)
- 11 = AUTO_SHUTOFF: module in blocking state, Q_low-Timerexpired, automatic pressure regulation and blocking function activated (AUTO mode)
- 12 = AUTO_STANDBY: pressure regulation to parameterised target pressure Auto Standby (AUTO mode)
- 13 = AUTO_RISE: pressure increase up to the configured target pressure Auto Normal (AUTO mode)

Input data of pressure measurement

Data bit B6 has the following values:

- 0 = pressure P2 is $\geq$ the parameter value Lower pressure critical limit P2
- 1 = pressure P2 is $<$ the parameter value Lower pressure critical limit P2

Consumption measurement input data

Data bit B7 indicates the measurement impulse of the continuous consumption measurement and has the following values:

- 0 = idle signal between consumption measurement impulses
- 1 = 100 ms continuous consumption measurement impulse after 200 l with consumption unit l³
- 1 = 100 ms continuous consumption measurement impulse after 10 scf with consumption unit scf

Data bit B12 has the following values:

- 0 = measurement of consumption V0 not active
- 1 = measurement of consumption V0 active

Data bit B13 has the following values:

- 0 = measurement of consumption V1 not active
- 1 = measurement of consumption V1 active

Input data Electrical inputs

Data bit B1 has the following values:

- 0 = sensor supply is switched off (after short-circuit/overload)
- 1 = sensor supply is switched on

Data bit B2 has the following values:

- 0 = signal at electrical input 0 not present (logic 0)
- 1 = signal at electrical input 0 applied (logic 1)

Data bit B3 has the following values:

- 0 = signal at electrical input 1 not present (logic 0)
- 1 = signal at electrical input 1 applied (logic 1)

Input data Electrical outputs

Data bit B14 has the following values:

- 0 = no short-circuit/overload at electrical output 0
- 1 = short-circuit/overload at electrical output 0

Data bit B15 has the following values:

- 0 = no short-circuit/overload at electrical output 1
- 1 = short-circuit/overload at electrical output 1

8.3 Selectable input data function

The input and output words of all I/O data are shown in Motorola format (MSB-LSB).

The selectable input data function allows a special read access to functional module data. By setting an address in the output word Am.1, depending on the address value in the input words Em.5 and Em.6, 2 16-bit values or one 32-bit value can be read at the same time. In the input word Em.4, the address of the currently shown input value is displayed. With invalid address values, the error bit is set (Em.4, B15 = 1).

8.3.1 Procedure

The extended read access must be performed by the user as follows:

1. Set the desired address in the output word Am.1.
2. Compare input word Em.4 (current input address) and output word Am.1 (set address).

3. Distinguish between the following cases:
- Addresses are identical

→ Read in valid data from input words Em.5 and Em.6.

– Addresses are different (Em.4, B15 (ERR) = 0)

→ Input data of the new address is not yet available. Repeat address comparison.

– Addresses are different (Em.4, B15 (ERR) = 1)

→ Set address is not available. Set valid address value.

As long as the set address remains unchanged, a comparison of the addresses and an evaluation of the error bit is not necessary. The data is updated cyclically.

If an invalid or unsupported input address is set in Am.1, the set address value is taken over in Em.4 (selected input address) and bit 15 (ERR) in Em.4 is set to 1 at the same time. The selected input data words 0 and 1 in Em.5 and Em.6 each have the value 0.

8.3.2 Output word Am.1 "Input address" [Input address]

The address of the desired input value is transmitted.

Data format of input word "16 bits, right-justified"															
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
MSB															LSB
Abbreviations used															
B0 ... B14		Address of the requested input value													
B15		Output bit with fixed value 0													
D0 ... D15		16-bit output data field													
MSB/LSB		Most significant bit /least significant bit													

Tab. 26 Data format of output word Am.1

8.3.3 Input word Em.4 "Selected input address" [Selected input address]

The address of the current input value is transmitted. In the basic setting, the address value 0 is set.

Data format of input word "16 bits, right-justified"															
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
MSB															LSB
Abbreviations used															
B0 ... B14		Address of the input value shown													
B15		Error bit. ERR = 1: invalid/unsupported address													
D0 ... D15		16-bit input data field													
MSB/LSB		Most significant bit /least significant bit													

Tab. 27 Data format of the input word Em.4

8.3.4 Input word Em.5 "Selected input data word" 0 [Selected input data word 0]

The input data of the currently set address is transmitted.

Data format of input word "16 bits, right-justified"															
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
MSB															LSB
Abbreviations used															
B0 ... B15		Input data word 0 of the currently set address													
D0 ... D15		16-bit input data field													
MSB/LSB		Most significant bit /least significant bit													

Tab. 28 Data format of the input word Em.5

8.3.5 Input word Em.6 Selected input data word 1 [Selected input data word 1]

The input data of the currently set address is transmitted.

Data format of input word “16 bits, right-justified”															
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
MSB															LSB
Abbreviations used															
B0 ... B15		Input word 1 of the currently set address													
D0 ... D15		16-bit input data field													
MSB/LSB		Most significant bit /least significant bit													

Tab. 29 Data format of the input word Em.6

8.3.6 Selectable 32-bit input data with permanently assigned address

Selectable 32-bit input data with permanent addresses are displayed at the fixed position in the input words Em.5 and Em.6.

Input address		Selected input data		
Output word Am.1		Input word Em.6	Input word Em.5	
Input address [Input address]		Selected input data word 1 [Selected input data word 1]	Selected input data word 0 [Selected input data word 0]	
Decimal	Hexadecimal	Value	Value	Description
10000	0x2710	Consumption V0 B31 ... B16	Consumption V0 B15 ... B0	Consumption value V0 with 32-bit limit
10001	0x2711	Consumption V1 B31 ... B16	Consumption V1 B15 ... B0	Consumption value V1 with 32-bit limit
10002	0x2712	Module time of operation B31 ... B16	Module time of operation B15 ... B0	Module time of operation with 32-bit limit
10003	0x2713	Shut-off valve cycles B31 ... B16	Shut-off valve cycles B15 ... B0	Switching cycles Shut-off valve with 32-bit limitation

Tab. 30 Selectable input data with permanently assigned address

8.3.7 Selectable, freely combinable 16-bit input data with address to be calculated

The freely combinable 16-bit input data are values that can be displayed by the user in both Em.5 and in Em.6. For this, the address value must be calculated and displayed as follows in Am.1:

Input in hexadecimal display:

- Am.1, High Byte: Address of data in Em.6
- Am.1, Low Byte: Address of data in Em.5

Input in decimal display:

- Address value = (address value of data in Em.6) x 256 + (address of data in Em.5)

i

An address value is only valid if the individual address values (low-byte value, high-byte value) are valid.

Available selectable individual data

Input address		Selected input data	
Low byte and/or high byte Address value in output word Am.1		Input word Em.5 or Em.6	
Decimal	Hexadecimal	Value	Description
0	0x00	Pressure change P2	Pressure change DP2 during the parameterised pressure change sample time
1	0x01	Fixed value 0	Reserved
2	0x02	Consumption V0	Consumption measurement value V0 with 16-bit limit
3	0x03	Consumption V1	Consumption measurement value V1 with 16-bit limit
4	0x04	Module time of operation	Module time of operation with 16-bit limit
5	0x05	Shut-off valve cycles	Shut-off valve cycles with 16-bit limitation
6	0x06	Current module error	Current module error (only errors for which monitoring is activated and are reported): Low byte (8 bit): Error number High byte (8 bit): Error channel ¹⁾ (Em.x, Am.x continuous)
7	0x07	All module errors	All module errors (independent of parameterised activation): Low byte (8 bit): Error number High Byte (8 bit): Error channel ¹⁾ (Em.x, Am.x continuous)

1) Error channel input in a continuous counting method: 0 ... 6:Em.0 ... Em.6; 7 ... 9:Am.0 ... Am.2

Tab. 31 Available selectable individual data

Examples of addressing

Output word Am.1		Input word Em.6	Input word Em.5
Input address		Selected input data word 1	Selected input data word 0
[Input address]		[Selected input data word 1]	[Selected input data word 0]
Decimal	Hexadecimal	Value	Value
256 * 0 + 0 = 0 Default	0x000	Pressure change DP2	Pressure change DP2
256 * 6 + 0 = 1536	0x0600	Current module error	Pressure change DP2
256 * 3 + 2 = 770	0x0302	Consumption V1	Consumption V0
256 * 2 + 3 = 515	0x0203	Consumption V0	Consumption V1

Tab. 32 Examples of addressing

9 Parameter

9.1 Overview of module parameters

The product can only be parameterised via the fieldbus or diagnostic interface.

The module parameters differ as follows:

- Modifiable module parameters
- Read-only module parameters



Detailed information on parameterisation → 1 Applicable documents.

Module parameters

Function no. ¹⁾	Changeable module parameters	Function						
		Q ²⁾	V ³⁾	P ⁴⁾	DP2 ⁵⁾	REG ⁶⁾	DI ⁷⁾	DO ⁸⁾
4828 + m * 64 + 0	Monitoring							
	Bit 0: SCS (short circuit/overload in sensor supply)	–	–	–	–	–	■	–

Function no. ¹⁾	Changeable module parameters	Function						
		Q ²⁾	V ³⁾	P2 ⁴⁾	DP2 ⁵⁾	REG ⁶⁾	DI ⁷⁾	DO ⁸⁾
4828 + m * 64 + 0	Bit 1: SCO (short circuit/overload at outputs)	–	–	–	–	–	–	■
	Bit 2: Uaus/Uven (under-voltage in actuator supply)	–	–	–	–	■	–	■
	Bit 6: Critical limits	■	–	■	■	–	–	–
	Bit 7: Parameters	■	■	■	■	■	–	–
4828 + m * 64 + 7	Critical limit startup	■	–	■	–	–	–	–
4828 + m * 64 + 8	Units							
	Bit 0 ... 1: pressure	–	–	■	■	■	–	–
	Bit 2 ... 3: flow rate	■	–	–	–	■	–	–
	Bit 4 ... 5: consumption	–	■	–	–	–	–	–
	Bit 6 ... 7: flow standard	■	■	–	–	■	–	–
4828 + m * 64 + 9	Energy-save functions ⁹⁾							
	Bit 0: energy-save function DO0	–	–	–	–	–	–	–
	Bit 1: energy-save function DO1	–	–	–	–	–	–	–
	Bit 2: energy-save function 24VS	–	–	–	–	–	–	–
	Bit 3: energy-save function status LEDs	–	–	–	–	–	–	–
	Bit 4: energy-save function display	–	–	–	–	–	–	–
4828 + m * 64 + 10	Pressure change sample time	–	–	–	■	–	–	–
4828 + m * 64 + 11 ... 12	Upper critical limit flow rate	■	–	–	–	–	–	–
4828 + m * 64 + 13 ... 14	Upper critical limit pressure	–	–	■	–	–	–	–
4828 + m * 64 + 15 ... 16	Upper critical limit pressure change	–	–	–	■	–	–	–

Function no. ¹⁾	Changeable module parameters	Function						
		Q ²⁾	V ³⁾	P2 ⁴⁾	DP2 ⁵⁾	REG ⁶⁾	DI ⁷⁾	DO ⁸⁾
4828 + m * 64 + 17 ... 18	Auto controller delay time	–	–	–	–	■	–	–
4828 + m * 64 + 19 ... 20	Auto controller flow rate critical limit	–	–	–	–	■	–	–
4828 + m * 64 + 21 ... 22	Pressure setpoint auto normal	–	–	–	–	■	–	–
4828 + m * 64 + 23 ... 24	Pressure setpoint auto standby	–	–	–	–	■	–	–
4828 + m * 64 + 25 ... 26	Lower critical limit pressure P2	–	–	■	–	–	–	–
4828 + m * 64 + 27	Module control (byte 0)							
	Bit 0: signal extension channel digital input 0	–	–	–	–	–	■	–
	Bit 1: signal extension channel digital input 1	–	–	–	–	–	■	–
	Bit 2 ... 3: signal extension time digital inputs	–	–	–	–	–	■	–
	Bit 4 ... 5: debounce time digital inputs	–	–	–	–	–	■	–
	Bit 6: behaviour of sensor supply U _{SEN/EL} after short circuit/overload	–	–	–	–	–	■	–
	Bit 7: behaviour of digital outputs after short circuit / overload	–	–	–	–	–	–	■
4828 + m * 64 + 28	Module control (byte 1)							
	Bit 0 ... 1: Q _{low} -Timer Reset selection	–	–	–	–	■	–	–
	Bit 2: target pressure power on	–	–	–	–	■	–	–
	Bit 3: selection for digital output 0	–	–	–	–	–	–	■

Function no. ¹⁾	Changeable module parameters	Function						
		Q ²⁾	V ³⁾	P2 ⁴⁾	DP2 ⁵⁾	REG ⁶⁾	DI ⁷⁾	DO ⁸⁾
4828 + m * 64 + 28	Bit 4 ... 6: target pressure rise limit	–	–	–	–	■	–	–

1) m = module number (0)

2) flow measurement

3) consumption measurement

4) pressure measurement

5) pressure change

6) control and blocking function

7) digital inputs

8) digital outputs

9) are not currently supported

Tab. 33 Overview - changeable module parameters

Function no. ¹⁾	Read-only module parameters
4828 + m * 64 + 29 ... 30	Module time of operation
4828 + m * 64 + 31 ... 32	Shut-off valve cycles

1) m = module number (0)

Tab. 34 Overview - read-only module parameters

9.2 Modifiable module parameters

Module parameter: monitor [Monitor]		
Function no.	4828 + m * 64 + 0	m = module number
Description	For the product, monitoring of individual errors can be independently activated or deactivated (suppressed). Activation of the monitoring function causes the following: – Error is sent to the bus node – Error is displayed via the module error LED	
Bit	Description	
0	SCS monitoring (short circuit/overload in sensor supply)	[Monitor SCS]
1	SCO monitoring (short circuit/overload at outputs)	[Monitor SCO]
2	Monitoring of Uaus/Uven	[Monitor Vout/Vval]
6	Monitoring of critical limits	[Monitor limit values]
7	Monitoring of parameters	[Monitor parameters]
Values	0 = not active	[Inactive]
	1 = active (default)	[Active]

Module parameter: monitor [Monitor]	
Comment	Monitoring of parameters: Some parameters are checked for non-permitted values during parameterisation, e.g. – Critical limit monitoring startup – Units – Limit values – Pressure setpoints

Tab. 35 Monitor module parameter

Module parameter: monitor critical limit startup [Monitor limit values]		
Function no.	$4828 + m * 64 + 7$	m = module number
Description	Specifies the time after the supply voltage has been switched on, during which the critical limit monitoring is deactivated.	
Bit	Bit 0 ... 7: Critical limit monitoring startup	
Values	Meaning	
0	0 s	
1	3 s	
2	5 s	
3	10 s default	
4	30 s	
5	60 s	
6	120 s	
7	300 s	
8 ... 255	Not permissible	
Comment	If parameter monitoring is active (Pm.0.7), invalid values will lead to the parameterisation error FN29 → 10.1 Error numbers.	

Tab. 36 Module parameter "Monitor critical limits" startup

Units module parameter [Units]

The parameter determines the unit for pressure, flow rate, consumption and flow rate standard and applies for all the related input and output values as well as parameter values. The data width is 8 bits (1 byte). In the “Units” module parameter, the parameters “Pressure”, “Flow rate”, “Consumption” and “Flow rate standard” each occupy 2 bits.

Module parameter: unit pressure [Unit Pressure]			
Function no.	4828 + m * 64 + 8	m = module number	
Description	Specifies the unit for all pressure-related data.		
Bit	Bit 0, 1: Unit pressure All other bits are reserved.		
Values			
Bit	1 0	Value	Meaning
	0 0	0	mbar (default)
	0 1	1	kPa
	1 0	2	psi/10
	1 1	3	Not permissible
Comment	If parameter monitoring is active (Pm.0.7), invalid values will lead to the parameterisation error FN29 → 10.1 Error numbers. When the module parameter “Unit pressure” is changed, the values of other pressure-related module parameters remain unchanged and are not adjusted automatically.		

Tab. 37 Module parameter "Unit pressure"

Module parameter: unit flow rate [Unit Flow]		
Function no.	4828 + m * 64 + 8	m = module number
Description	Specifies the unit for all flow-related data.	
Bit	Bit 2, 3: Unit flow rate All other bits are reserved.	
Values		
Bit	3 2	Value
	0 0	0
	0 1	1
	1 0	2
	1 1	3
Meaning		
	l/min (default)	
	Not permissible	
	scfm/10	
	Not permissible	
Comment	If parameter monitoring is active (Pm.0.7), invalid values will lead to the parameterisation error FN29 → 10.1 Error numbers. When the module parameter "Unit flow rate" is changed, the values of other flow-related module parameters remain unchanged and are not adjusted automatically.	

Tab. 38 Module parameter "Unit flow rate"

Module parameter: unit consumption [Unit Consumption]		
Function no.	4828 + m * 64 + 8	m = module number
Description	Specifies the unit for all consumption-related data.	
Bit	Bit 4, 5: Unit consumption All other bits are reserved.	
Values		
Bit	5 4	Value
	0 0	0
	0 1	1
	1 0	2
	1 1	3
Meaning		
	l (default)	
	m ³	
	scf	
	Not permissible	
Comment	If parameter monitoring is active (Pm.0.7), invalid values will lead to the parameterisation error FN29 → 10.1 Error numbers.	

Tab. 39 Module parameter "Unit consumption"

Module parameter: flow rate standard [Unit Flow standard]		
Function no.	4828 + m * 64 + 8	m = module number
Description	Specifies the flow rate standard for all data related to the flow rate and consumption.	
Bit	Bit 6, 7: Flow rate standard All other bits are reserved.	
Values		
Bit	7 6	Value
	0 0	0
	0 1	1
	1 0	2
	1 1	3
Meaning		
	DIN 1343 (default)	
	ISO 2533	
	ISO 6358	
	Not permissible	
Comment	If parameter monitoring is active (Pm.0.7), invalid values will lead to the parameterisation error FN29 → 10.1 Error numbers. When the module parameter “Unit flow rate standard” is changed, the values of other module parameters related to the flow rate remain unchanged and are not adjusted automatically.	

Tab. 40 Module parameter “Flow rate standard”

Module parameter: energy save functions		
Function no.	4828 + m * 64 + 9	m = module number
Description	Defines the setting for all energy-save functions. This parameter is reserved for later products models and is not supported in current products. Settings of values have no effect on the behaviour of the module.	
Bit	Description	
0	Energy-save function D00	[Energy save D00]
1	Energy-save function D01	[Energy save D01]
2	Energy-save function 24VS	[Energy save 24VS]
3	Energy-save function status LEDs	[Energy save status LEDs]
4	Energy-save function display	[Energy save display]
Values	0 = inactive (default) 1 = active	[Inactive] [Active]
Comment	Parameter is not currently supported. The parameter may appear in software tools for product parameterisation.	

Tab. 41 Module parameters energy-save functions

Module parameter “Pressure change sample time”

The parameter specifies the time of the measuring interval, during which the pressure values for the calculation of the pressure change are determined. The set time corresponds to the parameterised value, multiplied by 100 ms. The data width is 8 bits (1 byte).

Module parameter: pressure change sample time [Pressure change sample time]		
Function no.	4828 + m * 64 + 10	m = module number
Description	Specifies the time interval between two pressure measurements, from whose measured values the pressure change is calculated.	
Bit	Bit 0 ... 8: Time interval between 2 measurements	
Values	1 ... 255	100 (default) ... 25500 ms
Comment	If parameter monitoring is active (Pm.0.7), invalid values will lead to the parameterisation error FN29 → 10.1 Error numbers.	

Tab. 42 Module parameter “Pressure change sample time”

Module parameter “Critical limits”

The module parameter “Critical limits” can be used to specify the specific critical limits “Upper critical limit pressure”, “Upper critical limit flow rate” and “Upper critical limit pressure change”. The data width is 16 bits (2 bytes).

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If the unit is changed, the data for the critical limits is not changed and may need to be adjusted separately.

Module parameter: upper critical limit flow rate [Upper limit flow]		
Function no.	4828 + m * 64 + 11 (low byte) 4828 + m * 64 + 12 (high byte)	m = module number
Description	An upper flow limit can be set for the module.	
Values	2-byte value: low byte + 256 * high byte Default: 32767 (low byte = 255; high byte = 127) Permissible values: 0 ... 32767	
Comment	If parameter monitoring is active (Pm.0.7), invalid values will lead to the parameterisation error FN29 → 10.1 Error numbers. If the flow rate set according to the parameterised unit exceeds the parameterised upper critical limit, the diagnostic message FN10 is output if the parameter “Monitor critical limits” is active. The monitoring of critical limit violation only becomes active after the expiry of the time set in the parameter “Monitor critical limits” startup. The time is active even after shifting to the state “Pressurise”.	

Tab. 43 Module parameter “Upper critical limit flow rate”

Module parameter: upper critical limit pressure [Upper limit pressure]		
Function no.	4828 + m * 64 + 13 (low byte) 4828 + m * 64 + 14 (high byte)	m = module number
Description	An upper pressure limit can be set for the module.	
Values	2-byte value: low byte + 256 * high byte Default: 32767 (low byte = 255; high byte = 127) Permissible values: 0 ... 32767	
Comment	If parameter monitoring is active (Pm.0.7), invalid values will lead to the parameterisation error FN29 → 10.1 Error numbers. If the pressure P2 according to the parameterised unit exceeds the parameterised upper critical limit, the diagnostic message FN10 is output if the parameter “Monitor critical limits” is active. The monitoring of critical limit violation only becomes active after the expiry of the time set in the parameter “Monitor critical limits” startup.	

Tab. 44 Module parameter "Upper pressure critical limit"

Module parameter: upper critical limit pressure change [Upper limit pressure change]		
Function no.	4828 + m * 64 + 15 (low byte) 4828 + m * 64 + 16 (high byte)	m = module number
Description	An upper limit for the pressure change can be set for the module.	
Values	2-byte value: low byte + 256 * high byte Default: 32767 (low byte = 160 = 0xA0; high byte = 15 = 0x0F) Permissible values: 0 ... 32767	
Comment	If parameter monitoring is active (Pm.0.7), invalid values will lead to the parameterisation error FN25 → 10.1 Error numbers. If the amount of the pressure change set according to the parameterised unit exceeds the parameterised critical limit, the diagnostic message FN10 is output if the parameter “Monitor critical limits” is active. The monitoring of critical limit violation only becomes active after the expiry of the time parameterised in the parameter diagnostics “Monitor critical limits” startup. The monitoring function is only active if the shut-off valve is in the blocking state (Em.3.0 = 1).	

Tab. 45 Module parameter "Upper critical limit pressure change"

Module parameter: auto-controller delay time [Auto control delay time]		
Function no.	4828 + m * 64 + 17 (low byte) 4828 + m * 64 + 18 (high byte)	m = module number
Description	Time in minutes after which an uninterrupted underrun of the parameter value "Auto-controller flow rate critical limit" switches to the expired state (UP) in the operating mode "Automatically controlled blocking" (Am.0.1 = 1) of the Q_low-Timer. With the active output Auto-Enable (Am.0.5 = 1), the product automatically switches to the blocking state.	
Values	2-byte value: low byte + 256 * high byte Default: 10 (low byte = 10; high byte = 0) Permissible values: 0 ... 65535	
Comment	Changes to the parameter value are immediately effective. With an expired Q_low-Timer, i.e. status Q_low-Timer = 2 (UP), extending the delay time no longer affects the status. In other words, there is no status change from UP to RUN.	

Tab. 46 Module parameter "Auto-controller delay time"

Module parameter: auto-controller flow rate critical limit [Auto control low flow limit]		
Function no.	4828 + m * 64 + 19 4828 + m * 64 + 20	m = module number
Description	Flow rate critical limit that must be underrun in the "Automatically controlled blocking" operating mode (Am.0.1 = 1) on an uninterrupted basis for the parameterised duration of the Auto-controller delay time (Pm.17-18) so the Q_low-Timer switches to the expired status (UP). With the active output Auto-Enable (Am.0.5 = 1), the product automatically switches to the blocking state.	
Values	2-byte value: low byte + 256 * high byte Default: 0 (low byte = 0; high byte = 0) Permissible values: 0 ... 32767	
Comment	Changes to the parameter value are immediately effective. If the shut-off valve is already in the automatic blocking state, i.e. module status = AUTO_SHUTOFF (Em.8-11 = 11), this status will not change if there is a change to the flow rate critical limit. If parameter monitoring is active (Pm.0.7), invalid values will lead to the parameterisation error FN29 → 10.1 Error numbers.	

Tab. 47 Module parameter "Auto-controller flow rate critical limit"

Module parameter pressure setpoint Auto Normal [Pressure setpoint auto normal]		
Function no.	4828 + m * 64 + 21 (low byte) 4828 + m * 64 + 22 (high byte)	m = module number
Description	The parameter determines the target pressure that applies when the automatic pressure regulation and blocking function is activated in the module states AUTO_NORMAL, AUTO_WAIT and AUTO_HOLD (Em.3.8-3.11 = 8, 9, 10).	
Values	2-byte value: low byte + 256 * high byte Default: 10000 (low byte = 16; high byte = 39) Permissible values: 0 ... 32767 Parameter value Pressure setpoint Auto Normal (Pm.21-22) must be greater than parameter value Pressure setpoint Auto Standby (Pm.23-24).	
Comment	If parameter monitoring is active (Pm.0.7), invalid values will lead to the parameterisation error FN29 → 10.1 Error numbers. The parameterised pressure setpoints are automatically limited within the permissible value range, depending on the parameterised pressure unit, to the end values of the nominal pressure range within the module without an error message: – mbar: 2500 ... 10000 – kPa: 250 ... 1000 – psi/10: 363 ... 1450	

Tab. 48 Module parameter "Pressure setpoint Auto Normal"

Module parameter: pressure setpoint Auto Standby [Pressure setpoint auto standby]		
Function no.	4828 + m * 64 + 23 (low byte) 4828 + m * 64 + 24 (high byte)	m = module number
Description	The parameter determines the target pressure that applies when the automatic pressure regulation and blocking function is activated in the module state AUTO_STANDBY(Em.3.8-3.11 = 12).	
Values	2-byte value: low byte + 256 * high byte Default: 4000 (low byte = 160; high byte = 15) Permissible values: 0 ... 32767 Parameter value Pressure setpoint Auto Normal (Pm.21-22) must be greater than parameter value Pressure setpoint Auto Standby (Pm.23-24).	
Comment	If parameter monitoring is active (Pm.0.7), invalid values will lead to the parameterisation error FN29 → 10.1 Error numbers. The parameterised pressure setpoints are automatically limited within the permissible value range, depending on the parameterised pressure unit, to the end values of the nominal pressure range within the module without an error message: – mbar: 2500 ... 10000 – kPa: 250 ... 1000 – psi/10: 363 ... 1450	

Tab. 49 Module parameter "Pressure setpoint Auto Standby"

Module parameter: lower pressure critical limit P2 [Lower limit pressure P2]		
Function no.	4828 + m * 64 + 25 (low byte) 4828 + m * 64 + 26 (high byte)	m = module number
Description	For the module, a lower critical limit can be set for the output pressure P2.	
Values	2-byte value: low byte + 256 * high byte Default: 4000 (low byte = 160; high byte = 15) Permissible values: 0 ... 32767	
Comment	If parameter monitoring is active (Pm.0.7), invalid values will lead to the parameterisation error FN24 → 10.1 Error numbers. The pressure P2 prepared according to the parameterised unit is continuously compared with the parameterised lower critical limit. The result is indicated in input Em.3.6 and with the status LED P2. Detailed description → 7.3 Pressure.	

Tab. 50 Module parameter "Lower pressure critical limit P2"

Module parameter: signal extension channel DI0 [Signal extension channel DI0]		
Function no.	$4828 + m \cdot 64 + 27$	$m = \text{module number}$
Description	The parameter determines whether the signal extension for the electrical input 0 is active or not.	
Bit	Bit 0	
Values	0 = not active (default)	[Inactive]
	1 = active	[Active]

Tab. 51 Module parameter "Signal extension channel DI0"

Module parameter: signal extension channel DI1 [Signal extension channel DI1]		
Function no.	$4828 + m \cdot 64 + 27$	$m = \text{module number}$
Description	The parameter determines whether the signal extension for the electrical input 1 is active or not.	
Bit	Bit 1	
Values	0 = not active (default)	[Inactive]
	1 = active	[Active]

Tab. 52 Module parameter "Signal extension channel DI1"

Module parameter: signal extension time DI [Signal extension time DI]		
Function no.	$4828 + m \cdot 64 + 27$	$m = \text{module number}$
Description	The parameter defines the signal extension time for the electrical inputs 0 and 1 of this module. Signal statuses accepted as logical input signals usually remain valid at least until the specified signal extension time (minimum signal duration) has expired. Signal changes within the extension time are ignored.	
Bit	Bit 2, 3	
Values		
Bit	3 2	Value
	0 0	0
	0 1	1
	1 0	2
	1 1	3
Meaning		
	0 0	5 ms
	0 1	15 ms (presetting)
	1 0	50 ms
	1 1	100 ms
Comment	If a higher-order controller has long cycle times, there is the danger that short signals cannot be detected by this controller. A signal extension time can be set in order for signals of this type to be considered in the control sequence → CPX system description.	

Module parameter: signal extension time DI [Signal extension time DI]	
	The signal extension time defined with this parameter applies to the electrical inputs of this module and can be activated channel by channel with separate module parameters.

Tab. 53 Module parameter "Signal extension time" DI

Module parameter: debounce time DI [Debounce time DI]		
Function no.	$4828 + m * 64 + 27$	m = module number
Description	The parameter determines when an edge change of the electrical inputs is to be accepted as a logical input signal for this module.	
Bit	Bit 4, 5	
Values		
Bit	5 4	Value
	0 0	0
	0 1	1
	1 0	2
	1 1	3
Comment	Input debounce times are set to eliminate interference from signal edge changes during switching operations (bouncing of the input signal). The setting applies to the electrical inputs of this module. Further information on this parameter → CPX system description.	

Tab. 54 Module parameter Debounce time DI

Module parameter: behaviour after SCS [Behavior after SCS]		
Function no.	$4828 + m * 64 + 27$	m = module number
Description	The parameter determines whether the voltage remains switched off after a short-circuit/overload of the sensor power supply 24 V DC Usen or is switched on again automatically.	
Bit	Bit 6	
Values	0 = leave switched off	[Leave switched off]
	1 = switch on again (default)	[Resume]
Comment	If the setting is leave switched off, Power Off/On is required to restore the power. – Check which setting is required for the safe operation of the system	

Tab. 55 Module parameter behaviour after SCS

Module parameter: behaviour after SCO [Behavior after SCO]		
Function no.	$4828 + m * 64 + 27$	m = module number
Description	The parameter determines whether the corresponding voltage remains switched off or is switched on again automatically after a short-circuit/overload of the electrical outputs (Output-1) in this module.	
Bit	Bit 7	
Values	0 = leave switched off (default)	[Leave switched off]
	1 = switch on again	[Resume]
Comment	If the setting is leave switched off, Power Off/On or Reset/Setting of the corresponding output is required to restore power. – Check which setting is required for the safe operation of the system.	

Tab. 56 Module parameter Behaviour after SCO

Module parameter: Q_low-Timer reset selection [Q_low timer reset select]		
Function no.	$4828 + m * 64 + 28$	m = module number
Description	The parameter defines the signal source for resetting the Q_low-Timers when automatic pressure regulation and blocking functions are activated.	
Bit	Bit 0, 1	
Values		
Bit	1 0	Value
	0 0	0 = Am.0.2 (default)
	0 1	1 = DI0
	1 0	2 = DI1
	1 1	3 = Am.0.2 OR DI0
		Logical OR signal: Output Am.0.2 OR Electrical input 0 (logic 1 if Am.0.2 = 1 or electrical input 0 = 1)

Tab. 57 Module parameter Q_low-Timer Reset selection

Module parameter: target pressure Power-On [Pressure setpoint power on]		
Function no.	4828 + m * 64 + 28	m = module number
Description	The parameter is used to define the target pressure when the supply voltage is switched on (Power-On) if the module is in user-controlled pressure regulation and blocking function.	
Bit	Bit 2	
Values	0 = 10 bar (default)	[1000 kPa; 1450 psi/10]
	1 = 6 bar	[600 kPa; 870 psi/10]
Comment	The parameter value is permanently stored in the module and is the valid value for the next power-on. A change in the parameter value is effective immediately and can be used in the user-controlled pressure regulation and blocking function to set a fixed target pressure value.	

Tab. 58 Module parameter Target Pressure Power-On

Module parameter: output DO0 selection [Output DO0 select]		
Function no.	4828 + m * 64 + 28	m = module number
Description	The parameter defines the signal to be output at electrical output 0.	
Bit	Bit 3	
Values	0: DO0 = Am.0.6 (default)	Signal source for the electrical output 0 is the output value Am.0.6
	1: DO0 = VC_PULSE	Signal source for the electrical output 0 is the measuring pulse signal of the continuous consumption measurement VC

Tab. 59 Module parameter output DO0 selection

Module parameter: target pressure rise limitation [Pressure setpoint rise limit]		
Function no.	4828 + m * 64 + 28	m = module number
Description	The parameter defines the slope as the target pressure increases. The limitation is effective for both automatic and user-controlled operation, including Power-On. The set rise limitation also applies when the operating mode is changed.	
Bit	Bit 4 ... 6	
Values		
Bit	6 5 4	Value
	0 0 0	0 = OFF (default)
	0 0 1	1 = 10 bar/s
	0 1 0	2 = 5 bar/s
	0 1 1	3 = 2.5 bar/s
	1 0 0	4 = 1 bar/s
	1 0 1	5 = 0.5 bar/s
	1 1 0	6 = 0.25 bar/s
	1 1 1	7 = 0.125 bar/s
Com- ment	The target pressure can deviate up to 15% from the ideal value during the target pressure increase. The parameter value is permanently stored in the module and is the valid value for the next power-on. A change of the parameter value is effective immediately.	

Tab. 60 Module parameter target pressure rise limitation

Module parameter: user measure select [User measure select]		
Function no.	4828 + m * 64 + 28	m = module number
Description	Defines the setting for all measuring functions. This parameter is reserved for later products models and is not supported in current products. Settings of values have no effect on the behaviour of the module.	
Bit	Bit 7	
Values	0 = Control with Am.0.8-9 (default)	[Control with Am.0.8-9]
	1 = Control with DI1	[Control with DI1]
Comment	Parameter is not currently supported. The parameter may appear in software tools for product parameterisation.	

Tab. 61 Module parameter user measure select

9.3 Read-only module parameters

Module parameter: Module time of operation [Module time of operation]		
Function no.	4828 + m * 64 + 29 (low byte) 4828 + m * 64 + 30 (high byte)	m = module number
Description	Operating time of the function module in hours. The operating time is the duration for which the module was supplied with electrical energy.	
Values	Unsigned binary number with the decimal value range: 0 ... 65535 Hours (low byte + 256 * high byte)	
Comment	The operating time is limited to a maximum value of 65535. The operating hours counter is increased by 1 each time the operating voltage is switched on and then when each additional hour elapses. If the operation takes place more often than 65535 times, the parameter remains at this value. This parameter can only be read.	

Tab. 62 Module parameter "Module time of operation"

Module parameter: Shut-off valve switching cycles [Shut off valve cycles]		
Function no.	4828 + m * 64 + 31 (low byte) 4828 + m * 64 + 32 (high byte)	m = module number
Description	Counts the switching cycles of the shut-off valve.	
Values	Unsigned binary number with the decimal value range: 0 ... 65535 Cycles (Low Byte + 256 * high byte)	
Comment	The switching cycles counter is limited to a maximum value of 65535. If the operation takes place more often than 65535 times, the parameter remains at this value. This parameter can only be read.	

Tab. 63 Module parameter "Shut-off valve cycles"

10 Diagnostics

The product offers extensive possibilities of diagnosis and error handling via the fieldbus or diagnostic interface of a CPX field bus node.

Diagnostics		Description	Information
1	Via status LEDs on product	The LEDs on the module indicate the status of the outlet pressure p2, the status of the electrical inputs and outputs and module errors.	→ 5.1.2 Display components.
	Via status LEDs on CPX field bus node	The LEDs on the module indicate hardware errors, bus errors, etc.	CPX system description → 3 Additional information → 6.3.1 Interfaces and display components.
2	Locally via the bus node diagnostic interface and operation using the CPX FMT (Festo Maintenance Tool)	The CPX-FMT: – Shows current error messages in plain text – Offers access to the diagnostic memory.	→ 1 Applicable documents.
3	System status scanning via the network (status bits scanning)	The 8 status bits display common diagnostic messages (global error message).	CPX system description → 3 Additional information.
	System diagnostics with the network (via I/O diagnostic interface)	Internal diagnostics data can be read via the I/O diagnostics interface. In this way, detailed diagnostic information can be accessed, even if the network used does not offer any extensive network-specific diagnostic functions. The I/O diagnostic interface offers: – Access to the current error message – Access to the diagnostic memory – Read access to internal parameters and data.	
	Network-specific diagnostic functions	Diagnostic functions or communication services e. g. DPV1 (PROFIBUS)	

Tab. 64 Description of diagnostic options

10.1 Error numbers

Error no.	Error channel ¹⁾	Meaning	Remedy	Activation parameter
0	No error or end of a message status [No error]			
	–	–	–	cannot Can be deactivated
2	Short circuit/overload [Short circuit]			
	Em.3	Short circuit/ Overload sensor supply 24V DC Usen	– Eliminate short circuit/overload and check connected sensors if necessary. – Depending on the set parameter value, behaviour according to SCS (Pm.27.6): – Setting 1 = switch on again: sensor supply voltage is automatically switched on again after elimination of short-circuit/overload – Setting 0 = leave off. Switching on the sensor supply voltage again: Power Off/On necessary. - or - Change parameter "Behaviour after SCS" (Pm.27.6) to 1 = switch on again	Pm.0.0 Monitoring Short circuit/ Overload Sensor supply
2	Am.0	Short circuit/ overload at electrical outputs on at least one electrical output	– Check the connected actuators, eliminate short circuit/overload if necessary. The number of the faulty channel is signalled in the inputs Em.3.14 (DO0) and Em.3.15 (DO1).	Pm.0.1 Monitoring Short circuit/ Overload Electrical outputs

Error no.	Error channel ¹⁾	Meaning	Remedy	Activation parameter
			- Depending on the set parameter "Behaviour according to SCO" (Pm.27.7): - Setting 1 = switch on again: output is automatically switched on again after elimination of short-circuit/overload - Setting 0 = leave off: output remains reset to 0. Switch the output back on: set the output to 0 and then set it back to 1. - or - Change parameter "Behaviour after SCO" (Pm.27.7) to 1 = switch on again	
10	Upper critical limit exceeded [Upper limit exceeded] ²⁾			
	Em.0	Upper flow rate critical limit exceeded	- Check flow rate - Check parameterised critical limit - If necessary, adjust the parameter "Monitor critical limits"startup	Pm.0.6: Monitoring of critical limits
	Em.2	Upper pressure critical limit exceeded	- Check pressure - Check parameterised critical limit - If necessary, adjust the parameter "Monitor critical limits"startup	
	Em.3	Upper pressure change critical limit exceeded	- Check pressure change - Check parameterised critical limit - If necessary, adjust the parameter "Monitor critical limits"startup - Check system for leakage	
15	Module/channel failure [Module/channel failure] ³⁾			
	Em.0	Flow sensor defective	- Power off/on necessary - If this error occurs again, replace device	cannot Can be deactivated
	Em.2	Pressure sensor P2 defective	- Power off/on necessary - If this error occurs again, replace device	

Error no.	Error channel ¹⁾	Meaning	Remedy	Activation parameter
24	Fault in parameterisation of the lower critical limit [Fault in parametrizing lower limit]			
	Em.2	An error has occurred in the setting of the “Lower critical limit pressure” P2 parameter	– Check the parameterisation undertaken and carry out the parameterisation again	Pm.0.7: Monitoring of parameters
25	Fault in parameterising the upper critical limit [Fault in parametrizing upper limit] ^{2)a)}			
	Em.0	An error has occurred in the setting of the “Upper critical limit flow rate” parameter	– Check the parameterisation undertaken and carry out the parameterisation.	Pm.0.7: Monitoring of parameters
	Em.2	An error has occurred in the setting of the “Upper critical limit pressure” parameter		
	Em.3	An error has occurred in the setting of the “Upper critical limit pressure change” parameter		
26	Actuator supply undervoltage [Fault in actuator supply] ²⁾			
	Am.0	Undervoltage in load voltage supply 24 V DC	– Load voltage supply 24 V DC and increase if required – Check the cabling of the load voltage supply and repair if required.	Pm.0.2: Monitoring of Uaus/Uven

Error no.	Error channel ¹⁾	Meaning	Remedy	Activation parameter
29	Error in parameterisation [Fault in parametrizing] ²⁾⁴⁾			
	Em.0	Error in setting the parameter: – Unit flow rate – Flow standard	– Check the parameterisation undertaken and carry out the parameterisation again	Pm.0.7: Monitoring of parameters
	Em.1	An error has occurred in the setting of the “Unit consumption” parameter		
	Em.2	An error has occurred in the setting of the “Unit pressure” parameter		
	Em.3	An error has occurred in the setting of the “Pressure change sample time” parameter		
	Em.5	An error has occurred in the setting of the “Monitor critical limits” parameter startup		
	Am.0	Error in setting the parameter "Auto-controller flow rate critical limit"		

Error no.	Error channel ¹⁾	Meaning	Remedy	Activation parameter
29	Am.2	Error when creating the parameters: – Auto target pressure Normal and/or – Auto target pressure Standby	– Check the parameterisation undertaken and carry out the parameterisation again	Pm.0.7: Monitoring of parameters

1) m = module number (0)

2) With active monitoring, the module displays the relevant error depending on the parameterisation. Input signals will, however, be processed further.

3) All the electrical module functions are stopped.

4) The parameter values entered will be ignored. The module operates internally with the last valid parameter values.

Tab. 65 Module-specific error numbers

11 Commissioning examples of parameterisation

11.1 Commissioning example – automatic shut-off function

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Each system must be set individually. The sample values are only intended as general orientation.

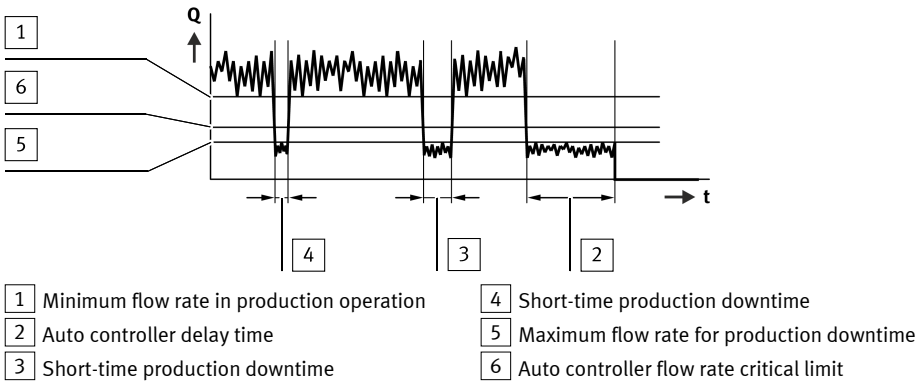


Fig. 20 Commissioning of the automatic pressure regulation and blocking function

Recommended procedure for determining the Auto-controller flow rate critical limits and Auto-controller delay time parameters

1. Record the relevant function-specific production data.

The following data of the downstream system is required in order to be able to set the parameters for the automatic blocking function of the product correctly:

- Minimum flow rate in production operation
 - Pneumatic and electrical system in operation
 - Actuators in action
- Maximum time at continuous minimum flow rate (e.g. short-term production downtime, automatic blocking is not wanted in this period)
- Maximum flow rate for production downtime
 - Pneumatic and electrical in operation
 - Actuators not in action

Sample values in the “Pressurise” state:

- Minimum flow rate in production operation: 250 l/min
- Maximum pause time in production operation: 2 min
- Maximum flow rate for production downtime: 80 l/min

2. Set parameters for automatic pressure regulation and blocking function.



Additional tolerances and safety additions must be taken into account during parameterisation.

- The module must be in the operating mode User-controlled blocking ($Am.0.1 = 0$) for parameterisation and the automatic shut-off valve controller must be deactivated ($Am.0.5 = 0$). This ensures that the Q_{low} -Timer is reset for activating the automatic blocking function and the shut-off valve does not unintentionally switch to the blocking state.
- Set the Auto-controller delay time parameter (Pm.17-18). Here, set a greater value than the actual production pause time to prevent unwanted blocking during production operation, e.g. to 10 min.
- Set the Auto-controller flow rate critical limit parameter (Pm.19-20). The parameter value must be greater than the maximum flow rate for production downtime than the minimum flow rate in production operation.

In the example, a parameter value can be set between 90 and 240 l/min.

3. Activate automatic pressure regulation and blocking function.

- With the change to automatic pressure regulation and blocking function by setting the output $Am.0.1 = 1$ and resetting the Q_{low} -Timer reset function by $Am.0.2 = 0$ the parameterised flow monitoring by the Q_{low} -Timer is started.

The Q_{low} -Timer status is indicated at input Em.3.4-3.5. When the Q_{low} -Timer has expired, the automatic pressure regulation and blocking function is executed with supply air shut-off and subsequent control to the target pressure Auto Standby if the Auto-Enable output control is set ($Am.0.5 = 1$). This prevents unintentional blocking of the supply air and reduction of the outlet pressure when the Q_{low} -Timer has expired.

If the flow rate of the system exceeds the set Auto-controller flow rate critical limit with output $Am.0.5$ not yet set, the Q_{low} -Timer is reset. The Auto-controller delay time starts again. It continues to regulate to the target pressure Auto Normal, even if the Auto-Enable output control is set ($Am.0.5 = 1$).

As soon as the module is in the state AUTO_SHUTOFF (shut-off state) or AUTO_STANDBY (control to pressure setpoint Auto Standby), only the user can exit this state.

4. Switch the module from the blocking state (AUTO_SHUTOFF) or Auto Standby pressure regulation state (AUTO_STANDBY) back to the Auto Normal pressure regulation state.

- The Q_{low} -Timer status is UP (Em.3.4-3.5 = 2) and the module status is AUTO_SHUTOFF (Em.3.8-3.11 = 11) or AUTO_STANDBY (Em.3.8-3.11 = 12).
- To switch to the Auto Normal pressure regulation state AUTO_NORMAL (Em.3.8-3.11 = 8), the Q_{low} -Timer Reset output must first be set ($Am.0.2 = 1$) and then reset ($Am.0.2 = 0$).

5. Check the set values over multiple production cycles.



Changes to system parameters can lead to a change in the determined production data.

- If necessary, check whether the set parameter values are still valid.

- The current module status at any time can be tracked in input Em.3.8-3.11. The status of the Q_{low} -Timers in input Em.3.4-3.5 and the switching position of the shut-off valve in input Em.3.0.

11.2 Commissioning example – monitoring of pressure drop



Each system must be set individually. The sample values are only intended as an orientation.

Recommended procedure for determining the parameters "Upper critical limit pressure change" and "Pressure change sample time"

1. At output pressure setpoint P2 (Am.2), set the parameterised target pressure value Auto Normal (Pm.21-22). Switch the shut-off valve at the control output to the pressurisation state (Am.0.1 = 0). At the Auto-User control output, activate the user-controlled pressure regulation and blocking function (Am.0.1 = 0).
 2. Set the parameter "Pressure change sample time" (Pm.10).
-



If the system shows a high pressure drop, start with a setting of 100 ms (corresponds to Pm.10 = 1). If there is a lower pressure drop, increase the pressure change sample time, e. g. to 1 s (Pm.10 = 10), the pressure change is displayed per 1 s. Vary the parameter value until you have determined a suitable value for your system.

3. Switch the shut-off valve to the shut-off state (Am.0.1 = 1).
 4. Record pressure change values as long as the output pressure is greater than the parameterised pressure setpoint Auto Standby (Pm.23-24). The values are available as selectable input data in the inputs Em.5 or Em.6. The corresponding input address must first be set in Am.1. Z. B. Am.0 = 0 indicates the pressure change in both Em.5 and Em.6.
-



The pressure change is a signed value. When the pressure falls, the values are correspondingly negative.

5. Generate the amount of the pressure change. With positive values, adopt the input value, with negative values, reverse the sign, e. g. -10 becomes 10.
 6. Determine the amount of the largest pressure change value during the blocking state.
 7. By repeatedly switching the shut-off valve from the pressurise to the shut-off state with the pressure setpoint unchanged, determine the largest pressure change value in the shut-off state in terms of amount.
-



If you have obtained very low values, it may be wise to increase the value for the parameter "Pressure change sample time" (Pm.10).

8. Set the specified value, with an added safety tolerance, for the parameter “Upper critical limit pressure change” (Pm.15-16). In this way, you can avoid accidental error messages.

Sample values:

- Parameter “Pressure change sample time: 1 s
- Parameter “Upper critical limit pressure change”:
 - Specified, amount of maximum pressure change value: 160 mbar
 - Set critical limit including safety tolerance: 200 mbar



The monitoring of the pressure change only takes place in the blocking state and with activated critical limit monitoring (Pm.0.6 = 1).

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Festo SE & Co. KG
Ruiter Straße 82
73734 Esslingen
Germany

Phone:
+49 711 347-0

Internet:
www.festo.com