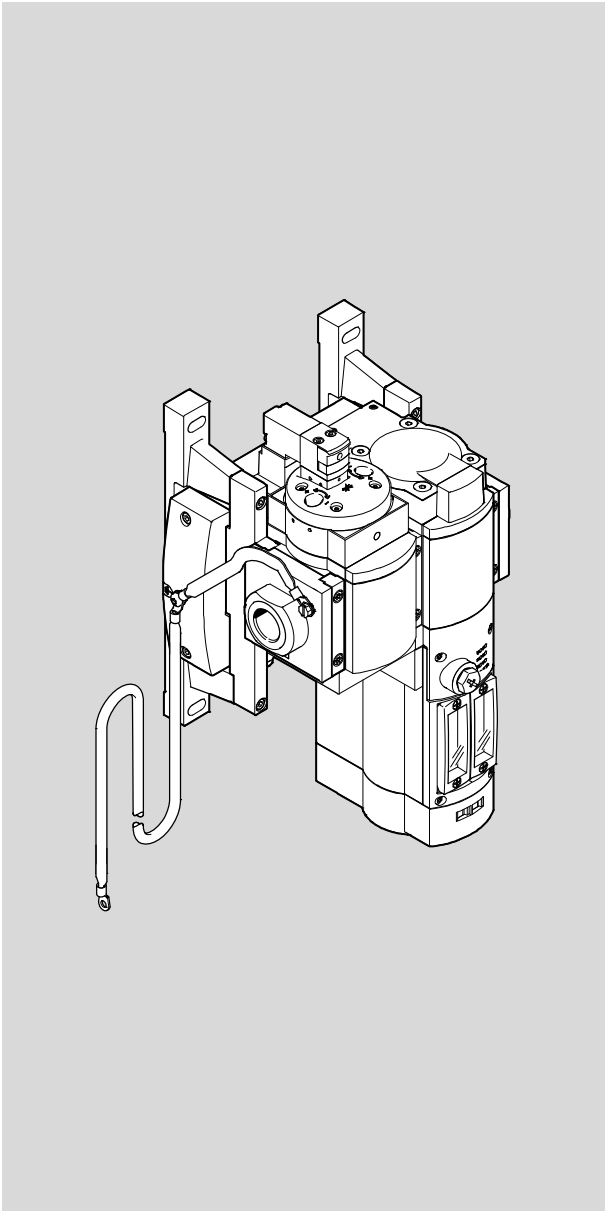
Energy efficiency module

MSE6-E2M



FESTO

Description

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[8041746]

GDCB-MSE6-E2M-PB-EN

PROFIBUS® is a registered trademark of its respective trademark holder in certain countries.

Identification of hazards and instructions on how to prevent them:

Warning
Hazards that can cause death or serious injuries.

Caution
Hazards that can cause minor injuries or serious material damage.

Other symbols:

Note
Material damage or loss of function.

Recommendations, tips, references to other documentation.

Essential or useful accessories.

Information on environmentally sound usage.

Text designations:
- Activities that may be carried out in any order.
1. Activities that should be carried out in the order stated.
– General lists.

Table of Contents – MSE6-E2M

Notes on this description

This description contains general basic information on the assembly, installation and commissioning
- the energy efficiency module MSE6-E2M, as well as on its mode of operation.

Special information on commissioning, parameterising and diagnosing with the field bus node you are using can be found in the appropriate description for the fieldbus node.
Overview of the descriptions ➔ Tab. 1.

Conventions

The section 7.2 describes the parameters and data of the MSE6-E2M. These appear on the operator unit CPX-MMI-1 in English.

[.....] The data and parameters in the text displayed in English on the operator unit are shown in square brackets in this description, e.g. [Limits]. To the left of this is the translation, e. g.:
Limits [Limits]

Service

Please consult your local Festo repair service if you have any technical problems.

Additional documentation

User documentation for the MSE6-E2M	
Title	**Table of contents**
“CPX bus node” P.BE-CPX-FB13-...	Notes on assembly, installation, commissioning and diagnostics of the bus node CPX-FB13 (for use as a participant on the PROFIBUS-DP).
“Operator unit” P.BE-CPX-MMI-1	Notes on commissioning and diagnostics with the operator unit CPX-MMI-1

Tab. 1 Descriptions for the MSE6-E2M

1 Safety and requirements for product use

1.1 Safety

1.1.1 General safety information

Warning
Danger of injury
If there is an error (e.g. fieldbus interruption, PLC failure, no voltage) on the MSE6-E2M, then the shut-off valve switches to the initial position (pressurise). If there is a previously shut-off valve, the system is pressurised suddenly.
- Use suitable measures to ensure that, in case of error, unintentional pressurization of the system does not result in a hazard.

Warning
Danger of injury due to residual pressure
When venting the system via the MSE6-E2M, a residual pressure P2 < of 1 bar remains.
- Use appropriate measures to ensure that the residual pressure does not result in a hazard.

Please note
Damage to the product from incorrect handling.
- Switch off the compressed air and supply voltage before performing assembly and installation work. Switch on supply voltage only when assembly and installation work are completely finished.

- Observe the handling specifications for electrostatically-sensitive devices.

Please note
The compressed air must not contain ester oils.

1.1.2 Intended use

The energy efficiency module MSE6-E2M is intended for installation in a machine or automated system and must be used exclusively as follows:
– In perfect technical condition
– In original status, without unauthorised modifications
– Within the limits of the product defined by the technical data (➔ Appendix A)
– In an industrial environment

1.1.3 Foreseeable misuse

Please note
In the event of damage caused by unauthorised manipulation or other than intended use, the guarantee is invalidated and the manufacturer is not liable for damages.

The following foreseeable misuses are among those not approved as intended use:
- Use outdoors
- Shutting off a system as a safety function
- Use in safety functions:
  - The MSE6-E2M must not be installed behind an exhaust valve that fulfils a safety function, since otherwise the safety functions installed in the system can be impeded.
  - For an installation of the MSE6-E2M in front of a safety valve, it must be ensured that this layout is expressly allowed for the safety valve. For example, mounting of the MSE6-E2M in front of a soft-start/quick exhaust valve MS6-SV-...-E-... is not permissible.

1.2 Requirements for product use

- Make this documentation available to the design engineer, installer and personnel responsible for commissioning the machine or system in which this product is used.
- Make sure that the specifications of the documentation are always complied with. Also consider the documentation for the other components and modules (e. g. bus node).
- Take into consideration the legal regulations applicable for the destination, as well as:
  - Regulations and standards,
  - Regulations of the testing organisations and insurers,
  - National specifications.

1.2.1 Technical prerequisites

General conditions for the correct and safe use of the product, which must be observed at all times:
- Comply with the connection and ambient conditions specified in the technical data of the product (➔ Appendix A.1).
- Observe the instructions and warnings in this documentation.

1.2.2 Qualification of specialised personnel

The product may only be operated by qualified personnel with knowledge of and experience with electrical and pneumatic control technology.

1.2.3 Range of application and certifications

Standards and test values, which the product complies with and fulfils, can be found in the “Technical data” section (➔ Appendix A.1). The product-relevant EU directives can be found in the declaration of conformity.

For certificates and the declaration of conformity for this product please refer to ➔ www.festo.com/sp.

The product fulfils the requirements of EU directives and is marked with the CE marking.

CE

2 Overview

2.1 Design

The MSE6-E2M is an intelligent pneumatic service unit, which is equipped with measurement, control and diagnostic functions and which supports energy-efficient operation of pneumatic systems. The module is typically assembled behind a service unit combination.
The MSE6-E2M consists of the main components: Shut-off valve, flow sensor, pressure sensor and bus node. The fieldbus interface allows complete integration into a machine controller. As an alternative to networked communication, the MSE6-E2M can also be operated using an external handheld or a PC.

2.1.1 Overview of product features

- Control function (energy efficiency function)
  - Automatic shut-off on flow underrunning
  - User-controlled shut-off and pressurising
- Recording and provision of measurement data
  - Output pressure
  - Pressure change (for pressure tightness testing)
  - Flow
  - Air consumption
- Limit monitoring
  - Pressure, upper limit value
  - Pressure change, upper limit value
  - Flow, upper limit value
- Fieldbus connection
  - PROFIBUS (CPX-FB13)

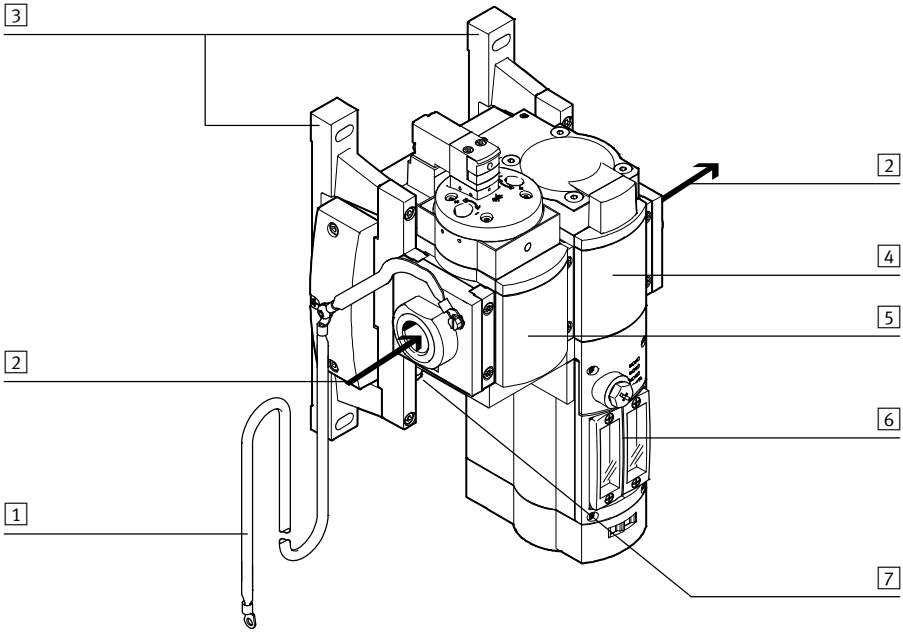


Fig. 2.1 Design

MSE6-E2M		Brief description
1	Earth terminal	FE connection of the device
2	Pneumatic connections	– Pneumatic connection 1: Compressed air inlet – Pneumatic connection 2: Compressed air outlet
3	Wall bracket	Mounting of the device
4	Sensor module	Module for measuring pressure, flow and consumption as well as activation of the shut-off valve
5	Shut-off valve	Used to enable and shut-off the system supply air.
6	Bus node	Fieldbus module for connection of the MSE6-E2M to a higher-order control system
7	System supply	Electrical power supply of the device

Tab. 2.1 Individual functions

2.1.2 Mode of operation

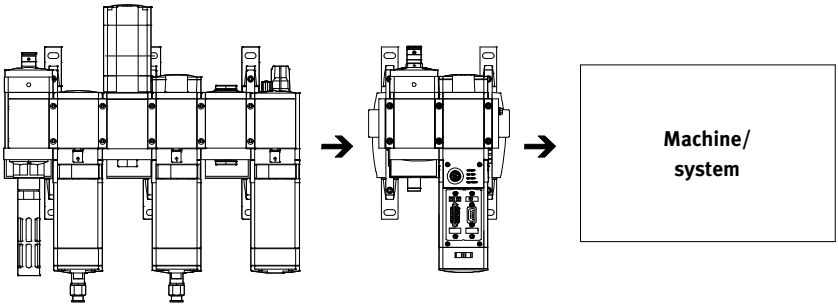


Fig. 2.2 Typical mounting position

The MSE6-E2M is typically assembled behind a service unit combination.
It allows venting of the following system, both in the “Pressurise” state and in the “Shut-off” state through a reverse flow (2 → 1). In the shut-off state, the reverse flow is considerably reduced. For this reason, for more rapid venting, the MSE6-E2M should be in the “Pressurise” state.

The key functions are:

Standby detection and automatic shut-off of the compressed air supply
The MSE6-E2M uses settable parameters to detect production down times of a pneumatic system. The system is separated from the compressed air supply using the 2/2 shut-off valve, without venting the subsequent system. This avoids additional air consumption through leakages. If production is to continue on the system, then it must be signalled to the MSE6-E2M. The shut-off valve opens and the system is again supplied with compressed air.
Automatic shut-off of the compressed air supply can be activated and deactivated by the user. In the deactivated state, the shut-off valve can be controlled directly by the PLC.

Pressure tightness testing
When in the shut-off state, the MSE6-E2M measures the pressure curve over time.
Even in well-serviced systems, the pressure falls continuously due to leakages. The fewer leakages the system has, the slower the pressure drop will be. The measured pressure change serves as a measure of the leakage existing in the system. If the parameterised limit value is exceeded, then the device will output a diagnostic message.

Pressure recording
The MSE6-E2M continuously measures the output pressure, prepares the data and makes it available cyclically.
To detect high operating pressures, the MSE6-E2M offers the option of parameterising limit values for pressure. If the parameterised limit value is exceeded, then the device will output a diagnostic message.

Flow recording
The MSE6-E2M continuously records the flow, prepares the data and makes it available cyclically.
To detect high flow rates, the MSE6-E2M offers the option of parameterising limit values for the flow. If the parameterised limit value is exceeded, then the device will output a diagnostic message.

Consumption recording
The MSE6-E2M determines the compressed air consumption by recording the system flow rate. The user has the option of using appropriate signalling to record the compressed air consumption over a specific period of time.

2.2 Commissioning, diagnostics and operational functions

The system reaction of the MSE6-E2M can be adapted to the relevant application. The MSE6-E2M provides extensive functions for commissioning, diagnosis and operation.

Commissioning and operational functions

The MSE6-E2M is supplied from the factory with preset parameters.

The behaviour of the MSE6-E2M can be adapted to the respective requirements through parameterisation. The following behaviour can be influenced, for example, by accessing the internal parameters:
- The diagnostic behaviour by enabling maskable diagnostic messages
- Specification of the units and the measuring interval
- Setting of limit values
- The operating method of the diagnostic memory.

Caution
A different parameterisation will result in different characteristics.
- In particular, check which settings are required when replacing the MSE6-E2M.
- Ensure that the settings can be restored (e.g. in the start-up phase by the higher-order PLC / IPC).

Basic information on the different parameters can be found in Chapter 7 and C in this description.

Diagnostic functions

Extensive diagnostic information can be accessed depending on the fieldbus used.

Diagnostic information	Brief description
Status bits	Common diagnostic messages (global error messages) are displayed by means of 8 internal inputs (8 status bits).
I/O diagnostics interface	With fieldbuses that do not possess extensive diagnostic functions, the diagnostic information of the MSE6-E2M is available via the I/O diagnostic interface. The I/O diagnostic interface enables bus-independent access to diagnostic information, data and parameters via internal digital I/Os (16 inputs and 16 outputs).
Diagnostic memory	Errors which occur during operation are entered in a diagnostic memory. The first or the last 40 entries are saved, as well as the respective time measured from the moment the power supply was switched on.
Fieldbus-specific diagnostic functions	Special diagnostic functions or communication services are available, depending on the fieldbus used, for example communication services via: – DPV1 (PROFIBUS)

Tab. 2.2 Diagnostic information

3 Mounting and installation

3.1 General instructions

Warning
Accidental movements of the connected actuator technology and uncontrollable movements of loose tubing lines can cause injury to people or material damage.
Before carrying out mounting, installation and maintenance work, switch off the following:
- Compressed air supply including venting of the system
- Operating and load voltage supplies.

Pay particular attention to the following:
- Screw connections must be fitted without warping and mechanical stress. Position screws exactly before tightening (otherwise their threads will be damaged).
- Observation of the specified tightening torques.
- Contact surfaces must be clean (avoid leakage and contact errors).
- Seal the unused connections with the protective caps or blanking plugs, in order to achieve the IP65 degree of protection.

- Electrostatically-sensitive devices.
  Do not touch the contact surfaces of the plug connectors on the modules and components.

3.2 Mounting

Note
Fit the MSE6-E2M so that there is sufficient space for heat dissipation and ensure that the maximum limit values for temperatures are observed (➔ Technical data).

Note
Place the MSE6-E2M in such a position in your system that the necessary air quality class for the operating medium is maintained (➔ Technical Data).

The MSE6-E2M is intended for mounting on the wall. The mounting brackets are integrated and contain drill holes for wall mounting.

1. Ensure that the compressed air supply, as well as the operation and load/actuator supply, are switched off.
2. Make sure that the fastening surface is flat and can support the weight of the MSE6-E2M.
3. Adjust the MSE6-E2M when it is standing vertically (±5°).
4. Fasten the MSE6-E2M using the mounting brackets and 2 screws each (➔ Fig. 3.1).

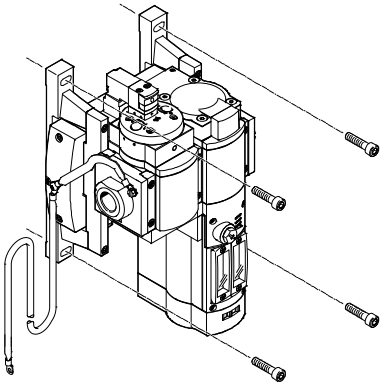
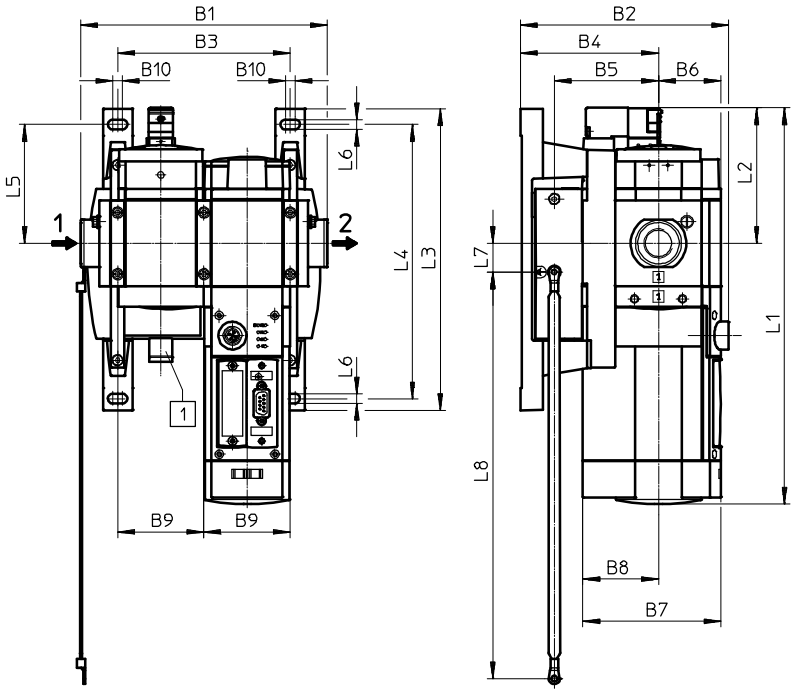


Fig. 3.1

Make sure there is sufficient space for connecting the power supply cables and tubing.

Dimension MSE6-E2M



1 Connecting thread M18x1, 4-pin

Type	B1	B2	B3	B4	B5	B6	B7	B8	B9
MSE6-E2M	177.2	149.5	124	99	74.9	45	99.3	54.3	62

Type	B10	L1	L2	L3	L4	L5	L6	L7	L8
MSE6-E2M	7	284.6	97.3	216.6	196.9	85.3	7	20.7	292

Fig. 3.2 Dimensions table [mm]

3.3 Dismantling

Warning
Switch off the following before dismantling the MSE6-E2M:
- Compressed air supply including venting of the system
- Operating and load voltage supplies.

Warning
Danger of injury due to residual pressure
When venting the system via the MSE6-E2M, a residual pressure P2 < of 1 bar remains.
- Use appropriate measures to ensure that the residual pressure does not result in a hazard.

Warning
Loads which suddenly fall down may cause injury to people.
- Take the product's weight into account. The MSE6-E2M weighs 3.3 kg.

Disconnect all the electrical and pneumatic connections of the MSE6-E2M in this order:
1. Remove the fieldbus cable from the bus node.
2. Remove the electrical connection cable.
3. Remove the earth terminal on the left-hand end place of the electrical interlinking module.
4. Loosen the pneumatic connections.
5. Loosen the screws from all the mounting brackets, one after the other. Start with the screws beneath the MSE6-E2M.
6. Remove the complete MSE6-E2M.

3.4 Installation

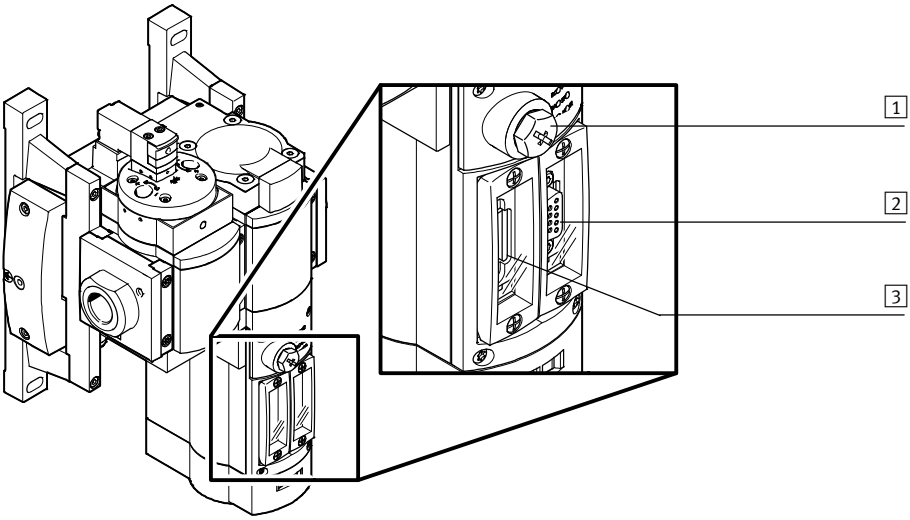
3.4.1 General instructions on installation

Warning
Accidental movements of the connected actuator technology and uncontrolled movements of loose tubing can cause injury to people or material damage.
- Before carrying out installation and maintenance work, switch off the following:
  – Compressed air supply including venting of the system
  – Operating and load voltage supplies.

Warning
Danger of injury due to residual pressure
When venting the system via the MSE6-E2M, a residual pressure P2 < of 1 bar remains.
- Use appropriate measures to ensure that the residual pressure does not result in a hazard.

3.4.2 Settings for configuration on the fieldbus module

The characteristics of the MSE6-E2M can be adapted to various requirements. Important application-specific settings can be made with DIL switches directly on the fieldbus module.



1 Service interface, operator unit
2 Fieldbus connection (Sub-D, 9-pin)
3 DIL switch

Fig. 3.3 Fieldbus module with DIL switch

Settings on the bus node

The fieldbus is connected via the integrated fieldbus module, which is matched to the appropriate fieldbus type. Setting options may vary according to the fieldbus type.
The fieldbus-specific settings can be made with DIL switches on the module. The DIL switches are behind an easily accessible cover on the bus node.

Information on the method of procedure as well as on the setting possibilities on your fieldbus module ➔ Section 4.3.

3.4.3 Selection of the power supply unit

Warning

- Use only PELV **circuits** in accordance with IEC/DIN EN 60204-1 (protective extra-low voltage, PELV) for the electrical power supply.
  Also observe the general requirements for PELV circuits in accordance with IEC/DIN EN 60204-1.
- Use only power **sources** which guarantee reliable electrical separation of the operating voltage as per IEC/DIN EN 60204-1.

Protection against electric shock (protection against direct and indirect contact) is guaranteed in accordance with IEC/DIN EN 60204-1 by using PELV circuits (Electrical equipment of machines, general requirements).
Recommendation:

- Use regulated power supplies to ensure that the load voltage of the outputs remains within the permitted tolerances even during continuous operation.

Note

- When selecting the power supplies, check that they have sufficient output.

3.4.4 Power supply of the MSE6-E2M

Warning
Danger of injury
If the load of operating voltage of the MSE6-E2M is switched off, then the shut-off valve switches to the initial position (pressurise). If there is a previously shut-off valve, the system is pressurised suddenly.
- Use suitable measures to ensure that unintentional pressurisation of the system is not possible.

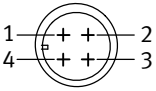
Note
Check within the framework of your EMERGENCY OFF system to ascertain the measures necessary for putting your machine/system into a safe state in the event of an EMERGENCY OFF (e.g. switching off the load voltage for the valves, switching off the compressed air, etc.).
If there is an undervoltage, the MSE6-E2M switches to the “Pressurise” status.

Note
Note that the partially lower tolerance range must be observed when the operating and load voltage supplies are provided by a shared power unit.
Tolerance ranges:
– Operating voltage: ±25%
– Load voltage: -25%, +10%

Supply of the operating and load voltage
– The load voltage supplied will be available to the integrated module.
– The operating voltage supply is transmitted without interruption.

Pin allocation

Caution
Short circuits can cause damage.
- Secure the system supplies externally.
  The permissible current per pin at the supplies is:
  – M18 plug, 4-pin: max. 16 A
- Please note that with the 4-pin system supply via pin “0 V”, the **sum of both currents** of the operating and load voltages flows.

Plug (Top view of device)	Pin	System supply	Function
M18 	1	24 $V_{EL/SEN}$	Power supply for the electronics and sensors
	2	24 $V_{OUT/A}$	Power supply for the actuator technology
	3	0 $V_{EL/SEN}$/ 0 $V_{OUT/A}$	Operating voltage
	4	FE	Functional earth

Tab. 3.1 Pin allocation, system supply

Potential equalisation

The MSE6-E2M has two earth terminals for potential equalisation:

– Pin 4 (M18 plug) on the power supply connection of the system supply
– Earth terminal on the left-hand end place of the electrical interlinking module
– Earth terminal on left-hand pneumatic base plate

Note

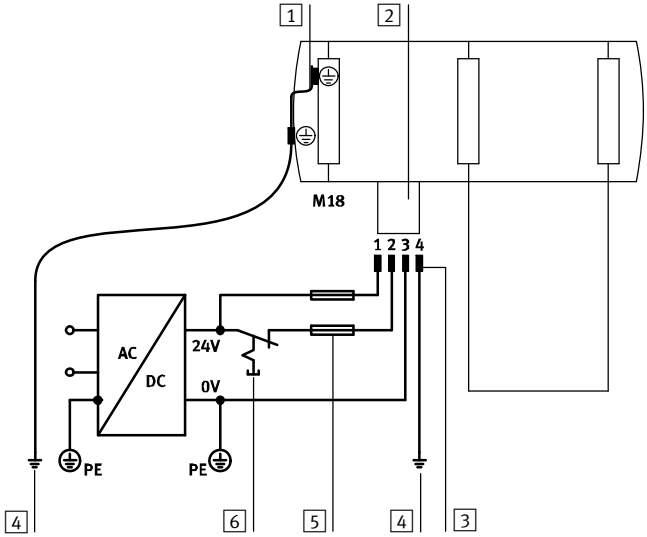
- Always connect the earth potential to pin 4 (M18 plug) “functional earth”.
- Connect the earth terminal on the left-hand pneumatic base plate with low impedance (short cable with large cross-sectional area) to the left end plate of the electrical interlinking module (pre-assembled on delivery).
- Connect the earth terminal on the left-hand end place of the electrical interlinking module with low impedance to the earth potential.
- With low-impedance connections you can ensure that the earth terminal at the left-hand end plate and the earth terminal at the power supply connection have the same potential and that there are no equalising currents.

This prevents interference from electromagnetic sources and ensures electromagnetic compatibility in accordance with EMC directives.

Electrical connection example

The diagram below shows as an example the connection of a common 24 V power supply for pins 1 and 2 on the M18 plug. Observe the following:

– Maintain the lower tolerance of the load supply voltage (24 V DC actuator +10/-25 %).
– Connect the earth terminals for potential equalisation and ensure that compensating currents are prevented.
– Apply the load voltage at pin 2 of the M18 plug (actuator technology) in which a way that it can be switched off separately.
– Use external fuses, depending on the application (total maximum value at pin “0 V” for both fuses: 16 A).



1 Potential equalisation between the earth terminal of the left-hand pneumatic base plate and the left end plate of the electrical interlinking module.
2 System supply
3 Earth terminal on pin 4, rated for max. 16 A
4 Potential equalisation of functional earth (FE)
5 External fuses
6 Separately switchable actuator technology supply

Fig. 3.4 Example – connecting a common 24 V power supply and the potential equalisation

4 Commissioning

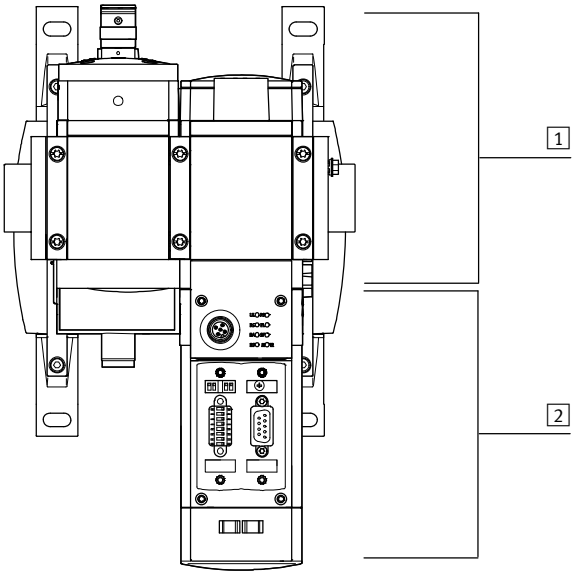
Warning
Danger of injury
Stopping the controller (e.g. after the transmission of parameters, system configuration or controller program) interrupts the communication to the MSE6-E2M and the shut-off valve then switches to the initial position (pressurise). If there is a previously shut-off valve, the system is pressurised suddenly.
- Use appropriate measures to ensure that unintentional pressurisation of the system is not possible.

Warning
Danger of injury
If the load or operating voltage of the MSE6-E2M is switched off, then the shut-off valve switches to the initial position (pressurise). If there is a previously shut-off valve, the system is pressurised suddenly.
- Use appropriate measures to ensure that unintentional pressurisation of the system is not possible.

The MSE6-E2M is equipped with a pneumatically-piloted shut-off valve. When the input pressure P1 is applied, the valve automatically switches to the “Pressurise” state in the following cases:
– Switch-off of the operating voltage or the load voltage
– Interruption in fieldbus communication
– Stopping of the fieldbus master controller (see manufacturer's specifications), e.g. in the case of the transmission of control programs, parameters, configuration data.

4.1 Procedure

In order to avoid connecting and addressing errors, you should carry out commissioning in steps as follows. The individual commissioning steps are shown in the diagram below.



1 Step 1 – Checking of the connected pneumatic application
2 Step 2 – Commissioning on the fieldbus with testing of the address allocation

Fig. 4.1 Commissioning steps

4.2 Prior to commissioning

The connection is made via the bus node that is adapted to suit the fieldbus.
The characteristics of the MSE6-E2M can be adapted to various requirements. You can carry out important settings as follows:
– With the DIL switch directly on the bus node (➔ Section 4.3.3).
– By parameterisation (➔ Section 4.2.2).
The DIL switches and the parameters are preset at the factory.

Caution
Incorrectly set DIL switches and parameters can cause damage during operation. You must observe the following notes in order to prevent damage.

- Check the DIL switch settings before using or replacing a MSE6-E2M.
- Make sure that the desired parameterisation of the MSE6-E2M in the start-up phase or after fieldbus interruptions is carried out by the plug-in module or the scanner/bus master, providing this is supported by the fieldbus protocol used. This ensures that, after replacement, the new MSE6-E2M will also be operated with the desired parameter settings.

Preparations
Prepare the MSE6-E2M for commissioning before commissioning a fieldbus system.

Note
Do not connect the cables for the fieldbus connection when preparing for commissioning.

In this way, you can avoid:
– Addressing faults which may occur in various fieldbus systems when address ranges are modified during operation.
Proceed with preparation as follows:
1. Check the pneumatic tubing connection of the MSE6-E2M.
2. Check the electric cabling of the MSE6-E2M.
3. Check the DIL switch settings of your MSE6-E2M.

4.2.1 Module numbers

The MSE6-E2M is always assigned the number 1 automatically and the number 0 is assigned to the bus node.

4.2.2 Types of parameters

The parameters are preset at the factory. These presettings can be used for a large number of applications. Through parameterisation, the behaviour of the MSE6-E2M can be adapted to each particular application.

The options available depend on the fieldbus protocol used. You can find information on this in the description of the CPX bus node (➔ Tab. 1).

A distinction is made between the following types of parameters:

Types of parameters	Description
System parameters	Influence the behaviour of the complete system
Module parameters	Influence the behaviour of a particular module
Diagnostic memory parameters	Influence the operating method of the internal diagnostic memory

Tab. 4.1 Types of parameters

Chapter 7 Parameterisation describes the individual parameters in detail. Fundamentals of using the parameters can be found in Appendix C. The tables below give a brief overview of the most important parameters.

System parameters	Description
Diagnostics monitoring on undervoltage in the actuator technology	The monitoring of undervoltage of the load voltage can be switched on or off with this parameter.
System start	Specifies the start-up behaviour of the MSE6-E2M.

Tab. 4.2 System parameters

Module-specific parameters	Description
Changeable module parameters	
Diagnostic monitoring with: – Undervoltage of the actuator supply – Limit value violation – Parameterisation error	The monitoring functions shown alongside can be switched on or off on the module side using this parameter.
Monitor limit values startup	Defines the period in which limit monitoring remains deactivated after the power supply is switched on. For flow monitoring, the diagnostics delay also applies after each change into the “Pressurise” status.
Units	Defines the units, in which the individual input data is shown and/or processed. In addition, the flow standard is set using this parameter.

Module-specific parameters	Description
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.
Limit values	This is used to set upper limit values of individual inputs, using which limit value violations can be monitored. If there are limit value violations when monitoring is activated, appropriate diagnostic messages are generated.
Read-only module parameters	
Operating hours and cycles counter	This provides information on module operational data, such as operating time and valve switching cycles.

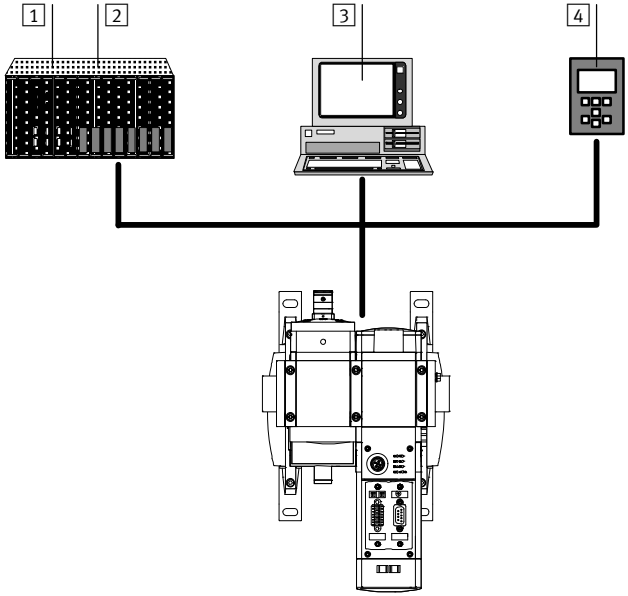
Tab. 4.3 Module-specific parameters

Diagnostic memory parameters	Description
Entries are remanent	Determines whether the contents of the diagnostic memory are to be retained after a new Power ON or whether they are to be deleted.
– Diagnostic memory filters – Run/stop filter 1 + 2 – End of error filter – Error number filter – Module/channel filter	With the diagnostic memory filters, you can suppress the registering of certain error messages and control both the starting and stopping of the error recording.

Tab. 4.4 Diagnostic memory parameters

4.2.3 Options for parameterisation

The parameterisation of the MSE6-E2M can be undertaken as follows, depending on the fieldbus protocol used:



1 Interface module or scanner/bus master; the desired parameterisation can be guaranteed e.g. in the start-up phase or after fieldbus interruptions.
2 User program in the higher-order PLC/IPC; parameters can be modified during operation.
3 Fieldbus-specific configurators; parameters can be modified during the commissioning phase or during troubleshooting.
4 Operator unit; parameters can be modified during commissioning or during troubleshooting.

Fig. 4.2 Options for parameterisation

4.3 Brief instructions for Profibus commissioning

This section provides a brief overview of the interfaces of the bus node with Profibus-DP.

Detailed and continuing information on the bus node with Profibus DP can be found in the description of the CPX bus node (➔ Tab. 1).

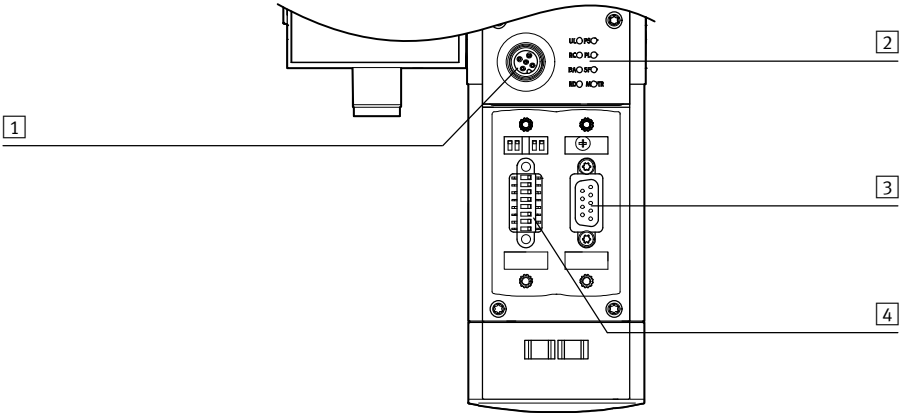
Use the current GSD file for your system. The current version is available from the Festo Support Portal. ➔ www.festo.com/sp

4.3.1 System configuration

The module consists of two single modules. The CPX-FB13 must be selected as a DP slave as the first module (m). Then, the energy efficiency module must be loaded into the control configuration as the second module (m+1).

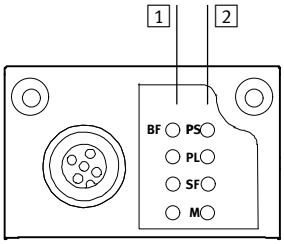
Fig. 4.3 Sample configuration Step 7

4.3.2 Interfaces and display components



1 Service interface, operator unit
2 Bus status and terminal-specific LEDs
3 Fieldbus connection (Sub-D, 9-pin)
4 DIL switches

Fig. 4.4 Connection and display components



1 Fieldbus-specific LEDs (➔ Section 4.3.7) 2 Terminal-specific LEDs (➔ Section 8.2)

Fig. 4.5 LED indicator on the fieldbus module (example)

Bus status LEDs[1]			Terminal-specific LEDs[2]
BF	Bus error/status (red)	PS	Power system (green)
		PL	Power load (green)
		SF	System failure (red)
		M	Modify (yellow)[3]

1) If there is no field bus connection, the LED BF will flash

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

3) Parameterisation modified or Force active

Tab. 4.5 LED indicator

4.3.3 Setting the DIL switch

Note

The bus node includes electrostatically-sensitive components. Touching components can lead to the destruction of the electronics.

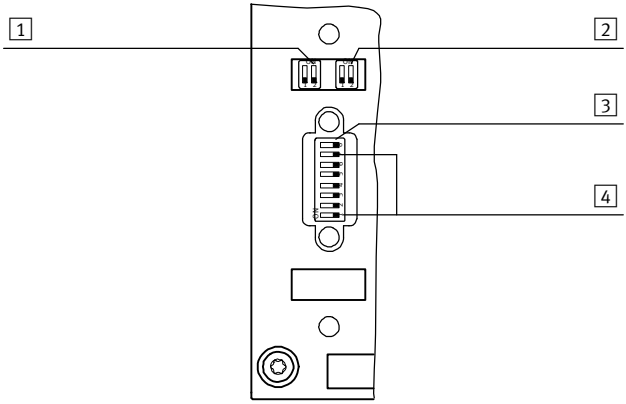
- Do not touch any components, contact surfaces or conductive tracks.
- Observe the handling specifications for electrostatically-sensitive devices.

You can set the following parameters with the DIL switches:

– Operating mode (MSE6-E2M only supports the Remote I/O operating mode)
– PROFIBUS address
– Diagnostic mode.

1. Switch off the power supply.
2. Unscrew the fastening screws of the cover.
3. Lift off the cover.
   ➔ In the bus node, you can see three DIL switches (➔ Fig. 4.6).
4. On DIL switch 3, set an as yet unassigned station number for the MSE6-E2M (➔ Tab. 4.10).
5. On DIL switch 3, set diagnostic mode.

6. Attach the cover carefully.
7. Tighten the two mounting screws at first by hand and then with 0.4 Nm ±10 %.

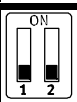


1 DIL switch 1: Operating mode
2 DIL switch 2: Reserved
3 DIL switch 3: Diagnostic mode (switch element 8)
4 DIL switch 3: Station number (switch element 1 ... 7)

Fig. 4.6 DIL switches in the bus node

Setting the operating mode (DIL switch 1)

The MSE6-E2M only supports the operating mode Remote I/O (factory setting). Settings are not required.
All the switch elements of the DIL switch 1 must be set to OFF.

Operating mode	Setting DIL switch 1	
Remote I/O operating mode All the functions of the MSE6-E2M are controlled directly by the PROFIBUS master.		DIL 1.1: OFF DIL 1.2: OFF (Factory setting)

Tab. 4.6 Setting the operating mode with DIL switch 1

Reserved DIL switch 2

All the switch elements of DIL switch 2 must be set to OFF (factory setting).

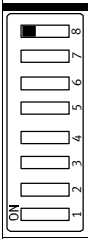
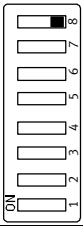
Setting DIL switch 2	
	DIL 2.1: OFF DIL 2.2: OFF (Factory setting)

Tab. 4.7 Setting DIL switch 2

Setting the diagnostic mode (DIL switch 3)

With the switch element 8 of DIL switch 3, you can deactivate the device-related diagnosis of the PROFIBUS-DP.

If device-related diagnostics are deactivated, then no device-related diagnostic information about the MSE6-E2M will be sent to the master system.

Device-related diagnostics active	Device-related diagnostics inactive
	
DIL 3.8: ON	DIL 3.8: OFF

Tab. 4.8 Setting the diagnostic mode (DIL switch 3)

Setting the station number (DIL switch 3)

Station numbers may only be assigned once per fieldbus master.

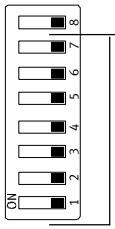
You can set the PROFIBUS address of the MSE6-E2Min binary coded form with DIL switch 3.
The following station numbers are permitted:

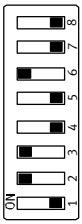
Protocol	Address designation	Permissible station numbers
PROFIBUS DP	PROFIBUS address	1; ...; 125

Tab. 4.9 Permissible station numbers

Recommendation:
Assign the station numbers in ascending order. Assign the station numbers in accordance with the machine structure of your system.

Setting the station number





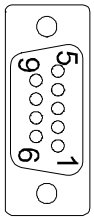
Example: Station number 38
$2^1 + 2^2 + 2^5 =$
$2 + 4 + 32 =$
38

Tab. 4.10 Station numbers (binary coded)

4.3.4 Fieldbus interface

The fieldbus is connected to the Sub-D socket of the MSE6-E2M. This connection is used for the supply line and continuing fieldbus cable.
You can use the Festo fieldbus plug FBS-SUB-9-GS-DP-B to connect the MSE6-E2M.

Only the fieldbus plug from Festo guarantees IP65.
Before connecting the Sub-D plugs of other manufacturers:
- Replace the two flat screws with bolts (UNC4-40/M3x5).

Socket	PIN	Fieldbus plug IP65[1)]	PROFIBUS DP	Designation
	1	–	Screening	Connection to functional earth
	2	–	n.c.	Not connected
	3	B	RxD/TxD-P	Received/transmitted data P
	4	–	CNTR-P	Repeater control signal[2)]
	5	–	DGND	Data reference potential (M5V)
	6	–	VP	Supply voltage positive (P5V)
	7	–	n.c.	Not connected
	8	A	RxD/TxD-N	Received/transmitted data N
	9	–	n.c.	Not connected
	Housing	Clamp strap	Screening	Connection to functional earth

1) Festo FBS-SUB-9-GS-DP-B

2) The repeater control signal CNTR-P is realised as a TTL signal.

Tab. 4.11 Pin allocation for the fieldbus interface

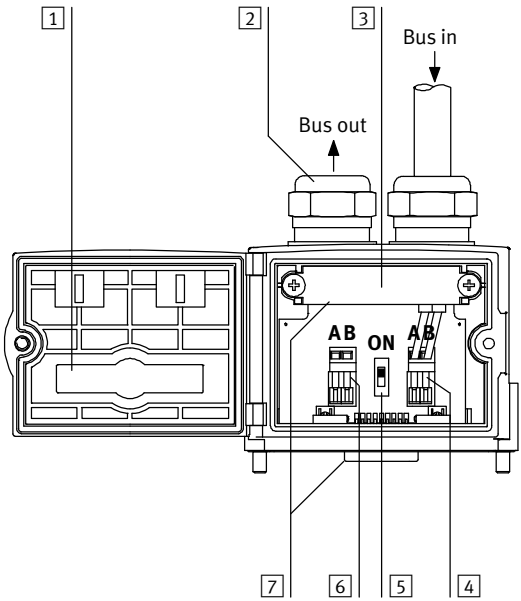
Seal unused connections with protective caps or blanking plugs. You will then achieve the IP65 degree of protection.

Connection with fieldbus plugs from Festo

- Observe the assembly instructions for the fieldbus plug. Turn the two fastening screws at first by hand and then with 0.5 Nm ±10 %.

With the fieldbus plug from Festo (FBS-SUB-9-GS-DP-B), you can connect the MSE6-E2M easily to the fieldbus. You can disconnect the plug from the node without interrupting the bus cable (T-TAP function).

The clamp strap in the fieldbus plug from Festo is connected internally only capacitively with the metallic housing of the Sub-D plug. This is to prevent compensating currents flowing through the screening of the fieldbus line.



1 Folding cover with inspection window
2 Blanking plug if connection unused
3 Clamp strap for screened connection
4 Fieldbus incoming (IN)
5 Switch for bus terminal and continuing fieldbus (DIL switch)
6 Fieldbus continuing (OUT)
7 Only capacitively connected

Fig. 4.7 Fieldbus plug from Festo, FBS-SUB-9-GS-DP-B

DIL switches

Switch position	Bus termination	The continuing fieldbus cable
OFF	Not switched	Switched on
ON	Switched	Switched off

Tab. 4.12 Meaning of switch position

Note the type code of your fieldbus plug. The new plug FBS-SUB-9-GS-DP-B switches the continuing fieldbus cable off when the bus termination is switched.

4.3.5 Bus termination with terminating resistors

If the MSE6-E2M is at the beginning or end of the fieldbus segment, a bus terminal is required.

- Fit a bus terminal to both ends of a bus segment.

Use the ready-to-use fieldbus plugs from Festo for the bus terminal. A suitable resistor network is integrated in the housing of this plug.

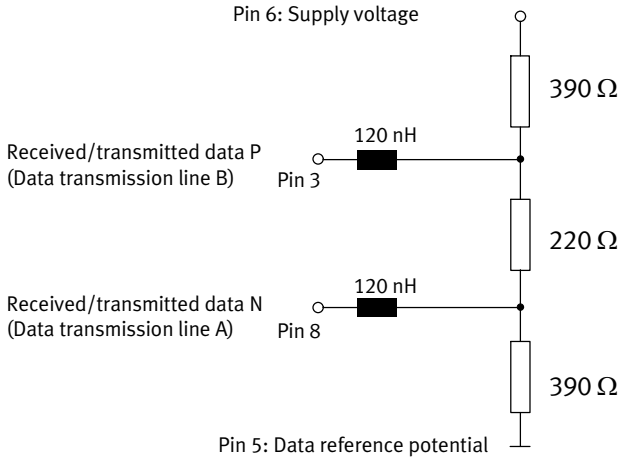


Fig. 4.8 Circuit diagram for bus termination network for cable type A as per EN 50 170 (switch in Festo fieldbus plug set to ON)

4.3.6 Faultless commissioning, normal operating status

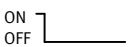
After faultless commissioning, the LEDs PS (Power System) and PL (Power Load) light up green. The BF (bus error) LED does not light up. Information on the other LEDs for diagnostics and error handling ➔ Chapter 8 Diagnostics and error handling.

LED	Colour	Operating status	Error handling
PS 	LED illuminated green	Standard	None
PL 	LED illuminated green	Standard	None
BF 	LED not illuminated	Standard	None

Tab. 4.13 Normal operating status of the MSE6-E2M

4.3.7 Error displays of the bus error/status LED BF

If device-related diagnostics are activated, errors will also be sent to the master PLC via the fieldbus.

BF (Bus error)			
LED (red)	**Process**	**Status**	**Error handling**
 LED not illuminated		No error (if the green PS LED lights up)	–
 LED flashes		Fieldbus connection not OK. Possible causes: – Station number not correct (e.g. address assigned twice) – Defective fieldbus interface – Interrupted, short-circuited or faulty fieldbus connection – Faulty configuration	Check the: • Address setting of the DIL switches in the fieldbus node • Fieldbus interface/master • Fieldbus connection • Configuration of the master in respect of the modules of the CPX terminal

Tab. 4.14 Error diagnostics with the red LED “BF”

4.4 Start-up behaviour

The desired parameterisation should be carried out in the start-up phase or after fieldbus□ interruptions by the interface module or the scanner/bus master, providing this is supported by the fieldbus protocol used. In this way, you can be sure that when the MSE6-E2M has been replaced, the new terminal is operated with the same parameter settings.
You can influence the start-up behaviour with the aid of the system parameter System start (➔ Section 4.2.2). Select the setting “System start with default parameterisation and current CPX expansion”.
The desired parameterisation can then be created in the start-up phase or after fieldbus interruptions e.g. by the plug-in module or the scanner/bus master (depending on the fieldbus used).
If the M LED lights up permanently after system start-up, then “System start with saved parameterisation and current CPX expansion” is set.

Caution
If the M-LED lights up permanently, parameterisation will not be restored automatically by the higher-order system if the MSE6-E2M is replaced after servicing. In these cases, check before replacing to see which settings are required and carry out these settings.

Detailed notes can be found in the description for the appropriate CPX fieldbus module or the manual for the operator unit.

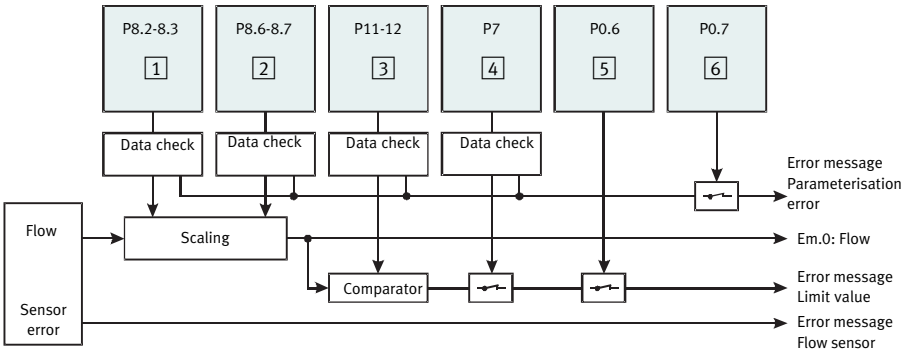
5 Measurement and control functions

The following sections provide an overview of the individual measurement and control functions of the MSE6-E2M 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 channel allocation.

5.1 Flow

Input signal
The measured flow value is prepared according to the set parameters “Flow unit” (P8.2-8.3) and “Flow standard” (P8.6-8.7) and made available as an input signal (Em.0).
Limit value monitoring
A comparator is used to compare the flow measured value with the parameter “Upper limit flow” (P11-P12). When the time set in the parameter “Monitor limit values startup” (P7) has elapsed and limit value monitoring is activated (P0.6), the appropriate error/diagnostic message is output on violation of a limit value.
Monitoring of parameters
The parameters “Unit flow”, (P8.2-8.3), “Flow standard” (P8.6-8.7), “Upper limit flow” (P11-12) and “Monitor limit values startup” (P7) are checked on entry for permitted values. In case of error, if parameterisation error monitoring is activated (P0.7), the appropriate error message is output.
Sensor monitoring
If there is a sensor error, the appropriate error message, which cannot be deactivated, is output.

Module number m = 1
Function number = 4828 + m * 64 + Parameter number



1 Parameter Unit flow
2 Parameter Flow standard
3 Parameter Upper limit flow
4 Parameter Monitor limit values startup
5 Parameter Monitor limit values
6 Parameter Monitor parameters

Fig. 5.1 Block diagram of the “Flow” function

5.2 Consumption

Input signal

The consumption value is based on the prepared flow measured value. The value is prepared according to the parameters “Unit consumption” (P8.4-8.5) and “Flow standard” (P8.6-8.7) and made available as an input signal (Em.1).

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

If there is a change to the parameter value “Unit consumption”, then the current measured consumption value is saved and is converted to the new consumption unit.

Consumption measurement

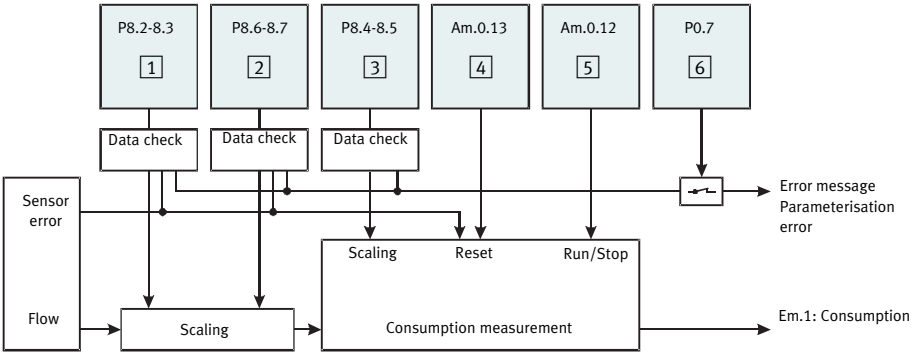
Consumption measurement is controlled using two data bits in the output word Am.0. Consumption measurement is started, continued or stopped using the output “Control bit Consumption measurement” (Am.0.12). The measured consumption value can be reset to the value “0” using the output “Reset consumption measurement” (Am.0.13).

Monitoring of parameters

The parameters “Unit flow”, (P8.2-8.3), “Flow standard” (P8.6-8.7) and “Unit consumption” (P8.4-8.5) are checked on entry for permitted values. In case of error, if parameterisation error monitoring is activated (P0.7), the appropriate error message is output.

Module number m = 1

Function number = 4828 + m * 64 + Parameter number



1 Parameter Unit flow
2 Parameter Flow standard
3 Parameter Unit consumption
4 Output control bit, Reset consumption measurement
5 Output control bit, Consumption measurement
6 Parameter Monitor parameters

Fig. 5.2 Block diagram of the “Consumption” function

5.3 Pressure

Input signal

The measured pressure value is prepared according to the set parameter “Unit pressure” (P8.0-8.1) and made available as an input signal (Em.2).

Limit value monitoring

A comparator is used to compare the measured pressure value with the parameter “Upper limit pressure” (P13-14). When the time set in the parameter “Monitor limit values startup” (P7) has elapsed and limit value monitoring is activated (P0.6), the appropriate error/diagnostic message is output on violation of a limit value.

Monitoring of parameters

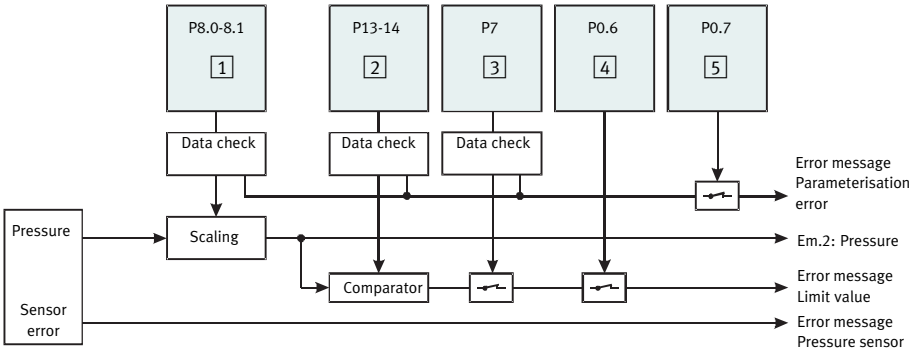
The parameters “Unit pressure”, (P8.0-8.1), “Upper limit pressure” (P13-14) and “Monitor limit values startup” (P7) are checked on entry for permitted values. In case of error, if parameterisation error monitoring is activated (P0.7), the appropriate error message is output.

Sensor monitoring

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

Module number m = 1

Function number = 4828 + m * 64 + Parameter number



1 Parameter Unit pressure
2 Parameter Upper limit pressure
3 Parameter Monitor limit values startup
4 Parameter Monitor limit values
5 Parameter Monitor parameters

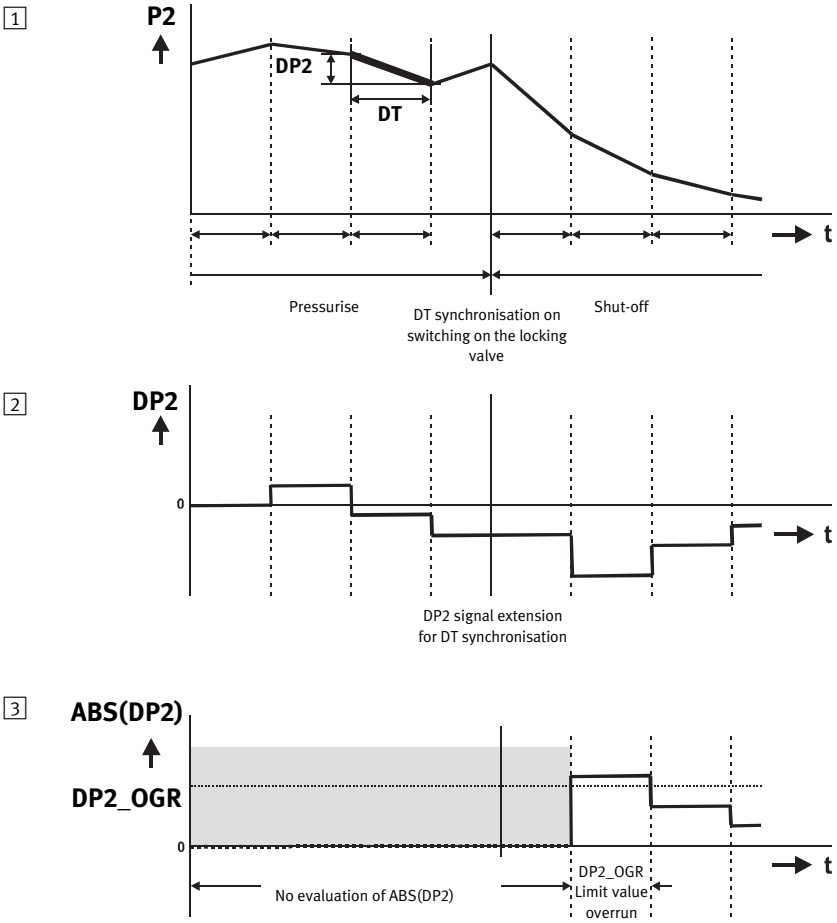
Fig. 5.3 Block diagram of the “Pressure” function

5.4 Pressure change

5.4.1 Method of measurement

The pressure change DP2 is determined cyclically at intervals, the settable pressure change sample time DT. To determine the differential pressure, the difference between the current measured pressure value and the measured pressure value P2, based on the pressure change sample time, is calculated:
DP2 = P2(t) - P2(t-DT); t = Current measuring time.

The start of the measuring cycle to determine the pressure change is automatically synchronised to the activation signal of the shut-off valve. The current pressure change value DP2 remains constant up to the next measuring time point.
In the shut-off state, the amount of the pressure change value is compared to the upper pressure change limit value DP2_OGR and monitored for violation of the limit value. If limit value diagnostics are activated, a diagnostic message is generated when:
ABS(DP2) › DP2_OGR.



P2	Output pressure P2	DP2_OGR	Upper limit value for the pressure change DP2
DP2	Pressure change		
ABS(DP2)	Amount of the pressure change	DT	Pressure change sample time

Fig. 5.4

– Time diagram 1 in Fig. 5.4 shows a sample pressure curve with switching of the valve from the pressurised to the shut-off state.
– Time diagram 2 in Fig. 5.4 shows the resulting curve of the pressure change signal.
– Time diagram 3 in Fig. 5.4 shows the derived amount with a sample limit value violation at the start of the shut-off state.

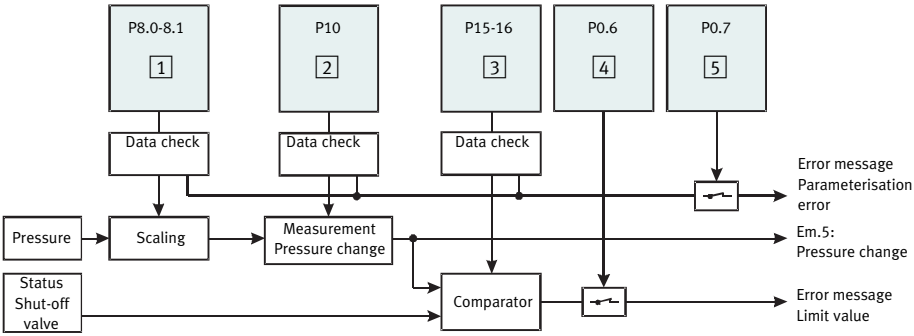
5.4.2 Function structure

Input signal
The pressure change sample value is prepared according to the set parameters “Pressure unit” (P8.0-8.1) and “Flow standard” (P10) and made available as an input signal (Em.5).

Limit value monitoring
If the shut-off valve is in the “Shut-off” state, the amount of the measured pressure change is compared with the parameter “Upper limit pressure change” (P15-16) using a comparator. If limit value monitoring is activated (P0.6), the appropriate error/diagnostic message is output on violation of a limit value.

Monitoring of parameters
The parameters “Unit pressure”, (P8.0-8.1), “Pressure change sample time” (P10) and “Upper limit pressure change” (P15-16) are checked on entry for permitted values. In case of error, if parameterisation error monitoring is activated (P0.7), the appropriate error message is output.

Module number m = 1
Function number = 4828 + m * 64 + Parameter number



1 Parameter Unit pressure
2 Parameter Press. change sample time
3 Parameter Upper limit pressure change
4 Parameter Monitor limit values
5 Parameter Monitor parameters

Fig. 5.5 Block diagram of the “Pressure change” function

5.5 Shut-off

5.5.1 Automatic shut-off function

If the shut-off valve is in the “Pressurise” state, then, if the output “Control bit Auto shut-off” (Am.0.1) is activated, the measured flow is compared with the limit settable in the parameter “Auto shut-off flow limit” (P19-20). If this limit value is not reached for the length of the value set in the parameter “Auto shut-off delay time” (P17-18), then the shut-off valve will switch to the “Shut-off” state.

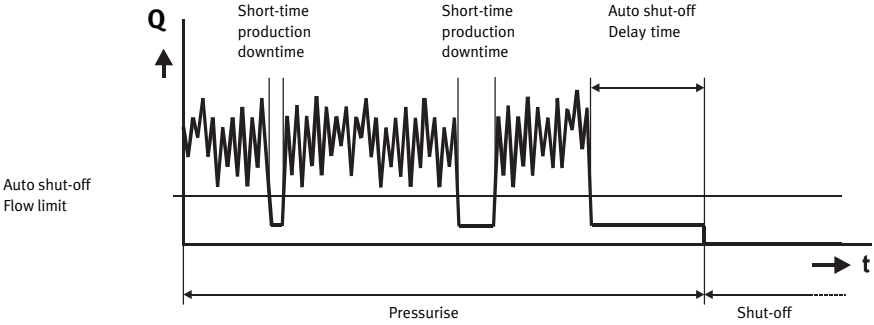


Fig. 5.6 Function “Auto block”

5.5.2 User-controlled blocking

If the output “Control bit Auto shut-off” (Am.0.1) is inactive, then the shut-off valve can be controlled directly using the “Control bit shut-off” output (Am.0.0). The output “Control bit Pressurise” (Am.0.2) has no influence on the switching status of the shut-off valve.

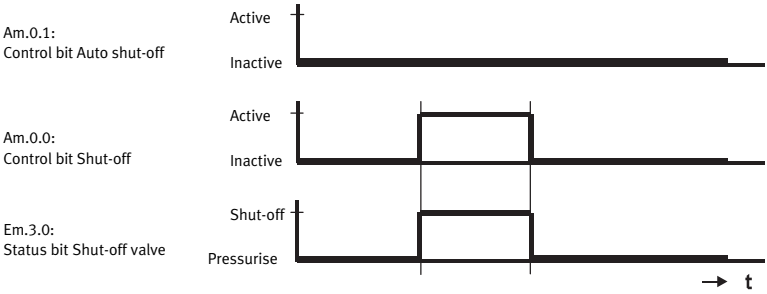


Fig. 5.7 Behaviour of user-controlled shut-off

5.5.3 Automatically controlled shut-off

The automatic shut-off function is activated when the output “Control bit Auto shut-off” (Am.0.1) is activated and the output “Control bit Shut-off” (Am.0.0) is inactive. In this state, the flow measured value is compared with the limit value set in the parameter “Auto shut-off flow limit” (P19-20). If the limit value is underrun, the “Auto shut-off timer” is started.

The status of the timer is available in the input “Status bits Auto shut-off timer” (Em.3.4-3.5) and can assume the following values:

RESET: The timer is reset and not started,
the shut-off valve is in the “Pressurise” state.

RUN: Timer is started,
the time delay has not yet elapsed,
the shut-off valve is in the “Pressurise” state.

UP: The time delay has elapsed,
the shut-off valve is in the “Shut-off” state.

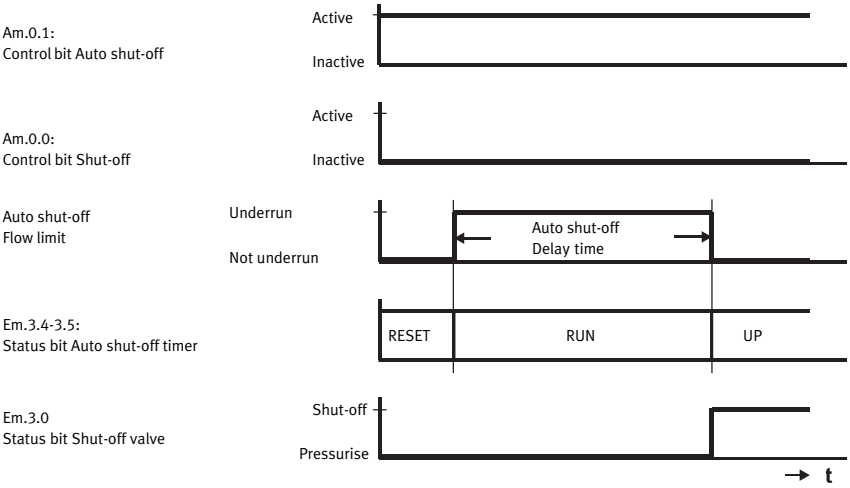


Fig. 5.8 Behaviour of automatically-controlled shut-off

5.5.4 Switching to the pressurised state after automatically-controlled shut-off

When the “Auto shut-off timer” has expired (Status = UP), the blocked shut-off valve can only be switched to the “Pressurise” state when controlled by the user. There are the following options for switching:

- Flank-controlled: Positive signal flank at the output “Control bit Pressurise” (Am.0.2).
  Detection of a positive flank resets the timer to the “RESET” status once only. Automatically-controlled shut-off remains active.
- Level-controlled: Deactivation of the output “Control bit Auto shut-off” (Am.0.1).
  The timer remains in the “RESET” status for as long as this output is deactivated. When the “Control bit Auto shut-off” output is reactivated, automatically-controlled shut-off is active again.

When the timer is reset and the “Control bit Shut-off” (Am.0.0) is deactivated, the shut-off valve switches to the “Pressurise” state.

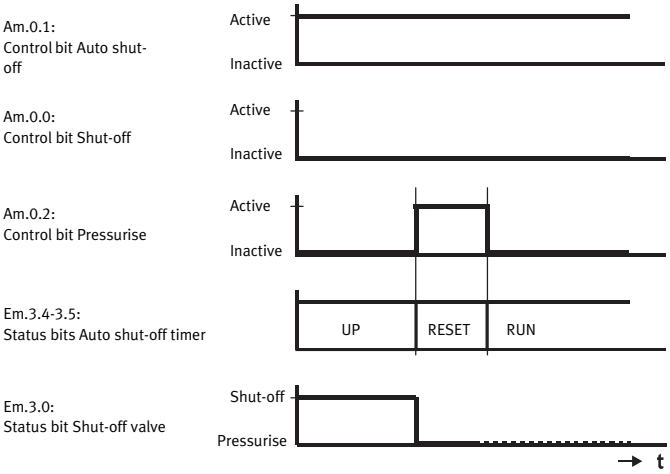


Fig. 5.9 Flank-controlled pressurising

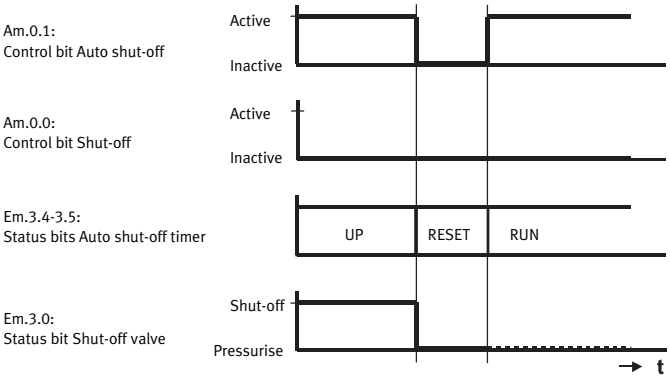


Fig. 5.10 Level-controlled pressurising

5.5.5 Function structure

Control shut-off valve

The shut-off valve can be controlled by the user or, with appropriate activation, automatically:

- If the output “Control bit Auto shut-off” (Am.0.1) has been deactivated, then the shut-off valve is switched directly using the “Control bit shut-off” output (Am.0.0).
  - When the output is activated, the shut-off valve switches to the shut-off state
  - When the output is deactivated, the shut-off valve switches to the pressurise state.
- When the output “Control bit Auto shut-off” (Am.0.1) is activated and the output “Control bit shut-off” (Am.0.0) is deactivated, the switching status of the shut-off valve is determined by the “Status bit Auto shut-off timer” (Em.3.4-3.5) (timer of the function for automatic shut-off). After the expiry of the parameterised delay time (“Auto shut-off delay time”, P17-18), the shut-off valve is automatically switched to the status “Shut-off”.
- When the output “Control bit Shut-off” (Am.0.0) is activated, the shut-off valve always switches to the status “Shut-off”, irrespective of other signal statuses.

The switching status of the shut-off valve is signalled via the input “Status bit Shut-off valve” (Em.3.0) and the number of valve switching cycles via the parameter “Valve switching cycles” (P31-32).

Auto shut-off timer

The status of the auto shut-off timer is determined by the following input variables:

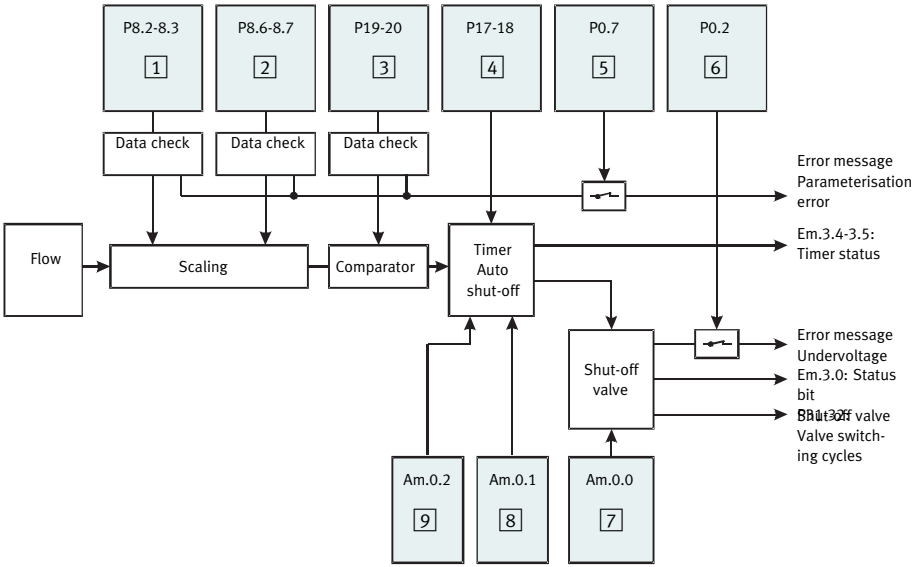
- If the parameterised value “Auto shut-off low flow limit” is underrun, a comparator activates (P19-20) the Auto shut-off function.
- Activating the output “Control bit Auto shut-off” (Am.0.1) activates the auto shut-off function.
- The output “Control bit Pressurise” (Am.0.2) can be used to switch the shut-off valve back to the pressurise status after an automatic shut-off operation. Automatically-controlled shut-off remains active.

The status of the auto shut-off timer is signalled via the input “Status bits Auto shut-off timer” (Em.3.4-3.5).

Monitoring of parameters

The parameters “Unit flow”, (P8.2-8.3), “Flow standard” (P8.6-8.7) and “Auto shut-off low flow limit” (P19-20) are checked on entry for permitted values. In case of error, if parameterisation error monitoring is activated (P0.7), the appropriate error message is output.

Module number m = 1
Function number = 4828 + m * 64 + Parameter number



1 Parameter Unit flow
2 Parameter Flow standard
3 Parameter Auto shut-off low flow limit
4 Parameter Auto shut-off delay time
5 Parameter Monitor parameters
6 Parameter Monitor actuator supply
7 Output “Control bit Shut-off”
8 Output “Control bit Auto shut-off”
9 Output “Control bit Pressurise”

Fig. 5.11 Block diagram of the “Shut-off” function

6 Input/output data

6.1 Overview

The MSE6-E2M possesses multiple items of functional module data, which can be replaced with the higher-order controller using the I/O data presented below.

Data field for	Input word	Output word
Flow measurement	Em.0	–
Consumption measurement		
– Measured value	Em.1	–
– Function status	Em.3	–
– Control/operation	–	Am.0
Pressure measurement	Em.2	–
Pressure change measurement	Via selectable input data ➔ Section 6.3	
Shut-off function		
– Function status	Em.3	–
– Control/operation	–	Am.0
Selectable input data		
– Input address	Em.4	Am.1 (➔ Section 6.3)
– Input data	Em.5	–

Tab. 6.1 Overview of I/O data

6.2 Description of the I/O data

6.2.1 Output word Am.0 “Module control” [Modul control]

The output word is shown in Motorola format (MSB-LSB).
In the output word Am.0, the user can control the consumption measurement and the shut-off function of the shut-off valve.
The output value (2-byte, 16-bit) is transmitted by the higher-order controller.

Data format “Output word, 16 bits right-justified”															
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
B15 MSB	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0 LSB
Abbreviations used B0: Control bit Shut-off B1: Control bit Auto shut-off B2: Control bit Pressurise B12: Control bit Consumption measurement B13: Reset consumption measurement B3 ... B11: Irrelevant data bits B14, B15: Irrelevant data bits D0 ... D15 16-bit output data field MSB/LSB Most significant bit / least significant bit															

Tab. 6.2 Data format “Output word, 16 bits right-justified”

Output data, shut-off function

Data bit B0 has the following values:

– 0 = Open shut-off valve (Pressurise status - default value)
– 1 = Close shut-off valve (Shut-off status)

Data bit B1 has the following values:

– 0 = Deactivation of the automatic shut-off function (Auto shut-off), activation of the shut-off valve via the output bit B0 (default value)
– 1 = Activation of the automatic shut-off function (Auto shut-off)

Data bit B2 has the following values:

– 0/1 = Open shut-off valve (pressurise state) on positive signal flank
– 0 = No change in status in the case of static signal level (default value)
– 1 = No change in status in the case of static signal level

Output data, consumption measurement

Data bit B12 has the following values:

– 0 = Consumption measurement inactive. Consumption measurement is stopped (default value)
– 1 = Consumption measurement active. Consumption measurement is started or continued.

Data bit B13 has the following values:

– 0 = Reset function, consumption measurement, inactive (default value)
– 1 = Reset function, consumption measurement, active. The consumption measurement value is reset to the value 0.

6.2.2 Input word Em.0 “Flow” [Flow]

The input word is shown in Motorola format (MSB-LSB).

Depending on the parameterised flow unit and the parameterised flow standard, the measured flow is transferred to the higher-order control system as the input word (2-byte, 16-bit).

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
Sign MSB	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0 LSB
Abbreviations used Sign: Sign (for data format “Sign + 15 bits” always = 0, i.e. a positive value) B0 ... B14: Flow rate D0 ... D15 16-bit input data field MSB/LSB Most significant bit / least significant bit															

Tab. 6.3 Data format of input word, “Sign + 15 bits, right-justified”

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

Tab. 6.4 Unit-dependent flow rates

6.2.3 Input word Em.1 “Consumption” [Consumption]

The input word is shown in Motorola format (MSB-LSB).

Depending on the parameterised air consumption unit and the parameterised flow standard, the air consumption measured is transferred to the higher-order control system as the input word (2-byte, 16-bit).

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 MSB	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0 LSB
Abbreviations used B0 ... B15: Consumption measurement D0 ... D15 16-bit input data field MSB/LSB Most significant bit / least significant bit															

Tab. 6.5 Data format of input word “16 bits, right-justified”

6.2.4 Input word Em.2 “Pressure P2” [Pressure P2]

The input word is shown in Motorola format (MSB-LSB).
Depending on the parameterised pressure unit, the pressure P2 is transferred to the higher-order control system as the input word (2-byte, 16-bit).
The input word is always specified in the data format “Sign + 15 bits”. The pressure value is stored in the input word as follows.

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
Sign MSB	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0 LSB
Abbreviations used Sign: Sign (for data format “Sign + 15 bits” always = 0, i.e. a positive value) B0 ... B14: Pressure value D0 ... D15 16-bit input data field MSB/LSB Most significant bit / least significant bit															

Tab. 6.6 Data format of input word, “Sign + 15 bits, right-justified”

The default setting of the “Unit pressure” module parameter is “mbar”. With this setting, the pressure is represented in the input word as follows:

Pressure P2	**Input value**		
[bar]	**[mbar]**	**[kPa]**	**[psi/10]**
0	0	0	0
1	1000	100	145
2	2000	200	290
...	...	...	...
7.36	7360	736	1067
...	...	...	...
14	14000	1400	2030

Tab. 6.7 Unit-dependent pressure values

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

The meaning of the module parameter “Upper limit pressure” is dependent on the module parameter “Unit pressure”. When the module parameter “Unit pressure” changes, the value of the module parameter “Upper limit pressure” is retained unchanged and is not adjusted automatically.

Input word Em.5 “Pressure change”

The pressure change value is solely transmitted as a selectable input word Em.5. It is specified in the data format “Sign + 15 bits”.

The input word is shown in Motorola format (MSB-LSB).

Depending on the parameterised pressure unit and the parameterised measurement interval, the pressure change is transferred to the higher-order control system as the input word (2-byte, 16-bit).

The pressure change value is stored in the input word as follows.

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
Sign MSB	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0 LSB

Abbreviations used

Sign:	Positive/negative sign
B0 ... B14:	Pressure change value
D0 ... D15	16-bit input data field
MSB/LSB	Most significant bit / least significant bit

Tab. 6.8 Data format of input word, “Sign + 15 bits, right-justified”

6.2.5 Input word Em.3 “Module status” [Status]

The input word is shown in Motorola format (MSB-LSB).

The status information of the module (consumption measurement and shut-off function of the shut-off valve) is transferred to the higher-order control system as the input word (2-byte, 16-bit).

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 MSB	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0 LSB
Abbreviations used															
B0:	Status bit Shut-off valve														
B4, B5:	Status bits Auto shut-off timer														
B12:	Status bit Consumption measurement														
B1 ... B3:	Reserved, with fixed value “0”														
B6 ... B11:	Reserved, with fixed value “0”														
B13 ... B15:	Reserved, with fixed value “0”														
D0 ... D15	16-bit output data field														
MSB/LSB	Most significant bit / least significant bit														

Tab. 6.9 Data format of input word “16 bits, right-justified”

Input data, shut-off function

Data bit B0 has the following values:

– 0 = Shut-off valve opened, status “Pressurised”
– 1 = Shut-off valve closed, status “Shut-off”

Data bit B4, B5 has the following values:

– 0 = Timer not started, Timer status = RESET
– 1 = Timer running, Timer status = RUN
– 2 = Timer expired, Timer status = UP

Input data, consumption measurement

Data bit B12 has the following values:

– 0 = Consumption measurement inactive.
– 1 = Consumption measurement active.

6.3 Function Selectable input data

The function Selectable input data allows extended read access to functional module data (e. g. pressure change). The extended read access must be performed by the user as follows.

1. Setting of the address of the desired date with output word Am.1
2. Read-in of the current input address from input word Em.4
3. Comparison of output and read-in address
4. Case distinction
   - Address identical = Read in input word Em.5
   - Addresses different = Desired address not available (ERR = 1)
   - Addresses different = Internal module data provision not yet completed(BUSY = 1)

6.3.1 Output word Am.1 “Input address” [Input address]

The output word is shown in Motorola format (MSB-LSB).

In so doing, the address of the desired date is transmitted.

Data format, output word “16 bits right-justified”															
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
B15 MSB	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0 LSB
Abbreviations used															
B0 ... B13:	SEL_ADR: 14-bit address of the requested read value														
B14, B15:	Output bits with fixed value “0”														
D0 ... D15	16-bit output data field														
MSB/LSB	Most significant bit / least significant bit														

Tab. 6.10 Data format, output word “16 bits right-justified”

6.3.2 Input word Em.4 “Selected input address” [Selected input address]

The input word is shown in Motorola format (MSB-LSB).

In so doing, the current 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 MSB	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0 LSB
Abbreviations used															
B0 ... B13:	ADR: 14-bit address of the shown read value														
B14:	BUSY: 1 = Data provision still underway														
B15:	ERR: 1 = Faulty/unsupported address														
D0 ... D15	16-bit output data field														
MSB/LSB	Most significant bit / least significant bit														

Tab. 6.11 Data format of input word “16 bits, right-justified”

6.3.3 Input word Em.5 “Selected input data” [Selected input data]

The input word is shown in Motorola format (MSB-LSB).

In so doing, the current data of the requested read 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 MSB	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0 LSB

Abbreviations used

B0 ... B15: DAT: Data of the requested read value

D0 ... D15 16-bit output data field

MSB/LSB Most significant bit / least significant bit

Tab. 6.12 Data format of input word “16 bits, right-justified”

7 Parameterisation

7.1 Parameterisation information

General notes on parameterisation

The characteristics of the MSE6-E2M can be parameterised.

Due in some cases to necessary calculations, modified parameters are not valid until they have been thoroughly checked and saved. Until then, as in the case of invalid parameters, the previous internal settings apply.

Depending on the parameter, no valid input data is available for up to max. 30 ms after a value modification.

Special notes on avoiding parameterisation errors

In order to avoid parameterisation errors, note the sequence described below when modifying the following parameters:

– Units
– Upper limit value x

Example: Parameterisation of pressure

Sequence for first or startup parameterisation (MSE6-E2M in delivery status, monitoring of parameterisation □errors active):

1. Set the desired unit in the module parameter “Units”.
2. Set the upper and lower limit values in the module parameter “Limit values pressure”.

Sequence for modifying the parameterisation:

1. Deactivate the monitoring for parameterisation errors in the module parameter “Monitoring”.
2. Parameterise the MSE6-E2M.
   - In the “Limit values” module parameter, set the upper limit value to 32767.
   - Set the desired unit in the module parameter “Unit pressure”.
   - If necessary, set the upper and lower limit values in the module parameter “Limit values”.
3. Activate the monitoring for parameterisation errors in the module parameter “Monitoring”.

7.2 Description of the parameters

The following tables offer an overview of the module parameters of the function module. A distinction is made between “Changeable module parameters” and “Read-only module parameters”.

Function no. 1)	Changeable module parameters	Validity				
		Flow measurement	Consumption measurement	Pressure measurement	Pressure change	Blocking function
4828 + m * 64 + 0	Monitoring					
	Bit 2: Undervoltage in actuator supply	–	–	–	–	■
	Bit 6: Limit values	■	–	■	■	–
	Bit 7: Parameterisation errors	■	■	■	■	■
4828 + m * 64 + 7	Monitor limit values startup	■	–	■	–	–
4828 + m * 64 + 8	Units	■	■	■	■	–
4828 + m * 64 + 10	Pressure change sample time	–	–	–	■	–
4828 + m * 64 + 11...12	Upper limit flow	■	–	–	–	–
4828 + m * 64 + 13...14	Upper limit pressure	–	–	■	–	–
4828 + m * 64 + 15...16	Upper limit pressure change	–	–	–	■	–
4828 + m * 64 + 17...18	Auto shut-off delay	–	–	–	–	■
4828 + m * 64 + 19...20	Auto shut-off low flow limit	–	–	–	–	■

1) m = 1

Tab. 7.1 Overview - Changeable module parameters

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

1) m = 1

Tab. 7.2 Overview - Read-only module parameters

7.2.1 Changeable module parameters

Module parameter: Monitoring		**[Monitor]**
Function no.	4828 + m * 64 + 0	m = Module number (1)
Description	With the MSE6-E2M, monitoring of individual errors can be independently activated or deactivated (suppressed). Active monitoring causes the error: – To be sent to the bus node – To be displayed by the module common error LED.	
Bit	Description	
2	Monitor undervoltage in actuator supply	[Monitor Vout/Vval]
6	Monitoring of limit values	[Monitor limit values]
7	Monitoring parameterisation errors	[Monitor parameters]
	All other bits are reserved.	
Values	1 = Active (presetting)	[Active]
	0 = Inactive	[Inactive]
Comment	– Monitoring parameterisation errors: Some parameters are checked for non-permitted values during parameterisation: – Monitor limit values startup – Units – Limit values	

Tab. 7.3 Monitoring

Module parameter: Monitor limit values startup		**[Monitor limit values startup]**
Function no.	4828 + m * 64 + 7	m = Module number (1)
Description	Specifies the time after the supply voltage has been switched on, during which limit monitoring is deactivated.	
Bit	Bit 0...7 Monitor limit values startup	
Values		
Bit 2 1 0	Value	Meaning
0 0 0	0	0 s
0 0 1	1	3 s
0 1 0	2	5 s
0 1 1	3	10 s (presetting)
1 0 0	4	30 s
1 0 1	5	60 s
1 1 0	6	120 s
1 1 1	7	300 s
...	8 ... 255	Not permissible
Comment	If parameterisation error monitoring is active (P0.7), invalid values will lead to the parameterisation error FN29 ➔ Tab. 8.12	

Tab. 7.4 Monitor limit values startup

Module parameter “Units”

The parameter specifies in which unit flow, air consumption, module output pressure P2 and the standard conditions for the flow measurement of the MSE6-E2M are transmitted to the control system. In addition, the standard conditions for the measurement of the flow are specified.

The data width is 8 bits (1 byte).

In the module parameter “Units”, the parameters “Unit pressure”, “Unit flow”, “Unit consumption” and “Flow standard” each occupy 2 bits.

Module parameter: Unit pressure			**[Unit Pressure]**
Function no.	4828 + m * 64 + 8		m = Module number (1)
Description	Specifies the unit for all pressure-related input values and parameters.		
Bit	Bit 0, 1: Unit pressure All other bits are reserved.		
Values			
Bit 1 0	Value	Meaning	
0 0	0	mbar (presetting)	
0 1	1	kPa	
1 0	2	psi/10	
1 1	3	Not permissible	
Comment	If parameterisation error monitoring is active (P0.7), invalid values will lead to the parameterisation error FN29 ➔ Tab. 8.12		

Tab. 7.5 Unit pressure

Module parameter: Unit flow			**[Unit Flow]**
Function no.	4828 + m * 64 + 8		m = Module number (1)
Description	Specifies the unit for all flow-related input values and parameters.		
Bit	Bit 2, 3: Unit flow All other bits are reserved.		
Values			
Bit 3 2	Value	Meaning	
0 0	0	l/min (presetting)	
0 1	1	Not permissible	
1 0	2	scfm/10	
1 1	3	Not permissible	
Comment	If parameterisation error monitoring is active (P0.7), invalid values will lead to the parameterisation error FN29 ➔ Tab. 8.12		

Tab. 7.6 Unit flow

Module parameter: Unit consumption		**[Unit Consumption]**
Function no.	4828 + m * 64 + 8	m = Module number (1)
Description	Specifies the unit for all consumption-related input values and parameters.	
Bit	Bit 4, 5: Unit consumption All other bits are reserved.	
Values Bit 5 4	Value	Meaning
0 0	0	l (presetting)
0 1	1	m^3
1 0	2	scf
1 1	3	Not permissible
Comment	If parameterisation error monitoring is active (P0.7), invalid values will lead to the parameterisation error FN29 ➔ Tab. 8.12	

Tab. 7.7 Unit consumption

Module parameter: Flow standard		**[Unit Flow standard]**
Function no.	4828 + m * 64 + 8	m = Module number (1)
Description	Specifies the flow standard for all flow and consumption-related input values and parameters.	
Bit	Bit 6, 7: Flow standard All other bits are reserved.	
Values Bit 7 6	Value	Meaning
0 0	0	DIN 1343 (presetting)
0 1	1	ISO 2533
1 0	2	ISO 6358
1 1	3	Not permissible
Comment	If parameterisation error monitoring is active (P0.7), invalid values will lead to the parameterisation error FN29 ➔ Tab. 8.12	

Tab. 7.8 Flow standard

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 (1)
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 two measurements
Values	1 ... 255	100 ... 25500 ms
Comment	If parameterisation error monitoring is active (P0.7), invalid values will lead to the parameterisation error FN29 ➔ Tab. 8.12	

Tab. 7.9 Pressure change sample time

Module parameter “Limit values”

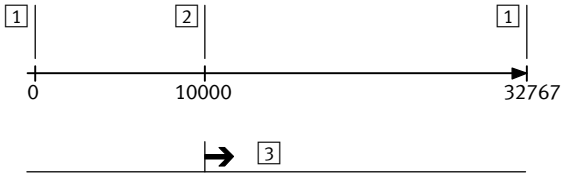
The module parameter “Limit values” can be used to specify the specific limit values “Upper limit pressure”, “Upper limit flow” and “Upper limit pressure change”.

The data width is 16 bits (2 bytes).

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

The following diagram shows an example of the data format “Sign + 15 bits, right-justified” with the limit value:

– Upper limit pressure = 10000



1 End values of the data range
2 Upper limit pressure
3 Limit value overrun

Fig. 7.1 Limit monitoring

Module parameter: Upper limit flow		**[Upper limit flow]**
Function no.	4828 + m * 64 + 11 (Low Byte) 4828 + m * 64 + 12 (High Byte)	m = Module number (1)
Description	An upper flow limit can be set for the module.	
Values	2-byte value: Low Byte + 256 * High Byte Presetting: 32767 (Low Byte = 255; High Byte = 127) Permitted values: 0 ... 32767	
Comment	If the flow set according to the parameterisation (unit) exceeds the parameterised upper limit, the diagnostic message FN10 is output (if “Monitoring limits” is active in the standard parameter). Permitted limit values: The limit values are checked for validity during parameterisation. Invalid parameterisations are not accepted; the module uses the previous (last valid) internal parameterisation values. If the monitoring of parameterisation errors in the module parameter “Monitoring” is set to “active,” the relevant error will be displayed. The monitoring of limit values only becomes active after the expiry of the time parameterised in the parameter “Monitor limit values startup”.	

Tab. 7.10 Upper limit flow

Module parameter: Upper pressure limit		**[Upper limit pressure]**
Function no.	4828 + m * 64 + 13 (Low Byte) 4828 + m * 64 + 14 (High Byte)	m = Module number (1)
Description	An upper pressure limit can be set for the module.	
Values	2-byte value: Low Byte + 256 * High Byte Presetting: 32767 (Low Byte = 255; High Byte = 127) Permitted values: 0 ... 32767	
Comment	If the pressure P2 set according to the parameterisation (unit) exceeds the parameterised upper limit, the diagnostic message FN10 is output (providing that “Monitoring limits” is active in the standard parameter). Permitted limit values: The limit values are checked for validity during parameterisation. Invalid parameterisations are not accepted; the module uses the previous (last valid) internal parameterisation values. If the monitoring of parameterisation errors in the module parameter “Monitoring” is set to “active,” the relevant error will be displayed. The monitoring of limit values only becomes active after the expiry of the time parameterised in the parameter “Monitor limit values startup”.	

Tab. 7.11 Upper limit pressure

Module parameter: Upper limit pressure change	**[Upper limit pressure change]**
Function no.	4828 + m * 64 + 15 (Low Byte) m = Module number (1) 4828 + m * 64 + 16 (High Byte)
Description	An upper pressure limit for pressure change can be set for the module.
Values	2-byte value: Low Byte + 256 * High Byte Presetting: 32767 (Low Byte = 255; High Byte = 127) Permitted values: 0 ... 32767
Comment	If the amount of the pressure change set according to the parameterisation (unit) exceeds the parameterised limit, the diagnostic message FN10 is output (providing that “Monitoring limits” is active in the standard parameter). Permitted limit values: The limit values are checked for validity during parameterisation. Invalid parameterisations are not accepted; the module uses the previous (last valid) internal parameterisation values. If the monitoring of parameterisation errors in the module parameter “Monitoring” is set to “active,” the relevant error will be displayed. The monitoring of limit values only becomes active after the expiry of the time parameterised in the parameter “Monitor limit values startup”. This comparison function is only active in the module status “Shut-off”.

Tab. 7.12 Upper limit pressure change

Module parameter: Auto shut-off delay	**[Auto shut-off delay time]**
Function no.	4828 + m * 64 + 17 m = Module number (1) 4828 + m * 64 + 18
Description	Time in minutes which is waited after an uninterrupted underrun of the parameter value “Auto shut-off low flow limit” before the MSE6-E2M automatically switches to the “Shut-off” status.
Values	2-byte value: Low Byte + 256 * High Byte Presetting: 10 (Low Byte = 10; High Byte = 0) Permitted values: 0 ... 65535
Comment	– Data transfer only takes place in the module status “Pressurise”. In the case of a valve which has already been shut-off automatically, the parameter value only takes effect on the next auto shut-off operation. – The automatic shut-off function is also influenced by the parameter “Auto shut-off low flow limit”. – The automatic shut-off function is only activated with an appropriately set output data bit (➔ Section 6.2.1).

Tab. 7.13 Auto shut-off delay

Module parameter: Auto shut-off low flow limit	**[Auto shut-off low flow limit]**
Function no.	4828 + m * 64 + 19 4828 + m * 64 + 20 m = Module number (1)
Description	Flow threshold value which must be underrun for the parameterised “Auto shut-off delay” time for the MSE6-E2M to switch automatically to the “Shut-off” status.
Values	2-byte value: Low Byte + 256 * High Byte Presetting: 0 (Low Byte = 0; High Byte = 0) Permitted values: 0 … 32767
Comment	– Data transfer only takes place in the module status “Pressurise”. In the case of a valve which has already been shut-off automatically, the parameter value only takes effect on the next auto shut-off operation. – The automatic shut-off function is also influenced by the parameter “Auto shut-off delay”. – The automatic shut-off function is only activated with an appropriately set output data bit (➔ Section 6.2.1). – The limit values are checked for validity during parameterisation. Invalid parameterisations are not accepted; the module uses the previous (last valid) internal parameterisation values. – If parameterisation error monitoring is active (P0.7), invalid values will lead to the parameterisation error FN29 ➔ Tab. 8.12

Tab. 7.14 Auto shut-off low flow limit

7.2.2 Read-only module parameters

Module parameter: Module operating time	**[Module time of operation]**
Function no.	4828 + m * 64 + 29 (Low Byte) 4828 + m * 64 + 30 (High Byte) m = Module number (1)
Description	Operating time of the function module in hours. The operating time is the time with which the module is supplied with electrical energy, irrespective of the pneumatic flow.
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 supply voltage is switched on and then when each additional hour elapses. If the operation takes place more often than 65535 times, then the parameter remains at this value. This parameter can only be read.

Tab. 7.15 Module operating time

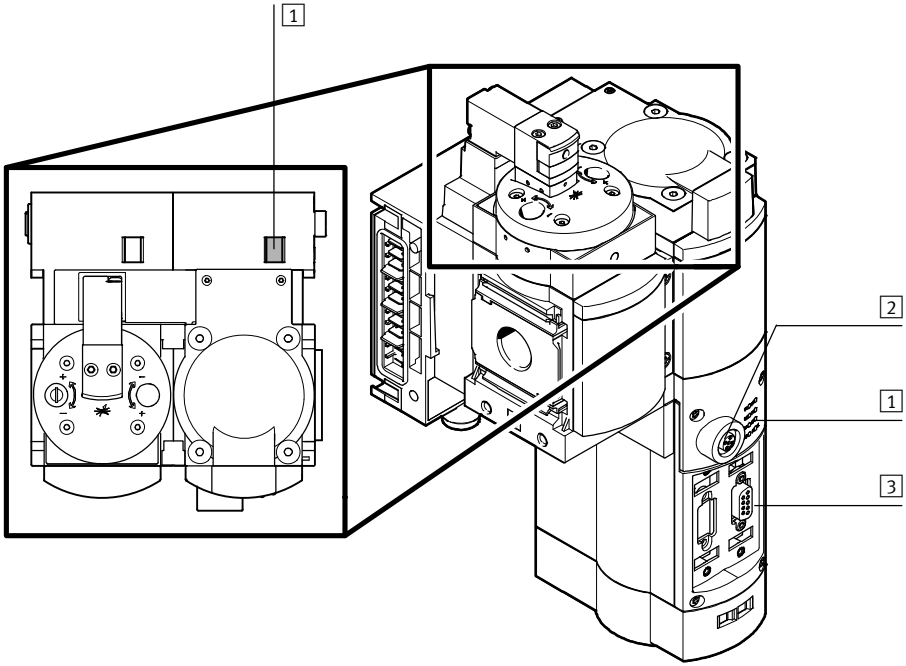
Module parameter: Shut-off valve switching cycles		**[Shut-off Valve cycles]**
Function no.	4828 + m * 64 + 31 (Low Byte) 4828 + m * 64 + 32 (High Byte)	m = Module number (1)
Description	Counting the switching cycles of the shut-off valve.	
Values	Unsigned binary number with the decimal value range: 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, then the parameter remains at this value. This parameter can only be read.	

Tab. 7.16 Shut-off valve switching cycles

8 Diagnostics and error handling

8.1 Summary of diagnostics options

The MSE6-E2M offers comprehensive options for diagnostics and error handling. The following options are available (➔ Also Tab. 8.1):



1 On the spot diagnostics via LEDs
2 On the spot diagnostics via the operator unit
3 Diagnostics via the fieldbus

Fig. 8.1 Diagnostics options

Diagnostics options		Description	See
1	On-site via LEDs	The LEDs on the module display hardware errors, bus errors, etc.	Section 8.2
2	On-site via the operator unit	The operator unit: – Shows current error messages in plain text – Offers access to the diagnostic memory.	Description of CPX-MMI operator unit (➔ Tab. 1)

Diagnostics options		Description	See
3	System status scanning with the fieldbus (status bits scanning)	The 8 status bits display common diagnostic messages (global error message).	Section 8.3.1
	System diagnostics with the fieldbus (via I/O diagnostics 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 fieldbus used does not offer any extensive fieldbus-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.	Section 8.3.2
	Fieldbus-specific diagnostic functions	Diagnostic functions or communication services via DPV1 (PROFIBUS)	Description of CPX bus node (➔ Tab. 1)

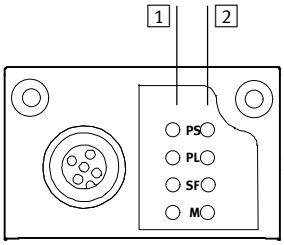
Tab. 8.1 Diagnostics options

On the spot diagnostics via module common error LEDs

The LEDs of the MSE6-E2M are located under the transparent cover on the top side of the interlinking block.

LEDs of the fieldbus modules

CPX fieldbus modules possess fieldbus and terminal-specific LEDs. The terminal-specific LEDs exist on each fieldbus module:

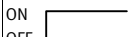


1 Fieldbus-specific LEDs (➔ Section 4.3.7) 2 Terminal-specific LEDs (➔ Section 8.2)

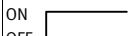
Fig. 8.2 LED display on the fieldbus module (example)

8.2 On the spot diagnostics via LEDs

8.2.1 Terminal-specific LEDs

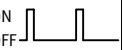
PS (power system) – power sensor/logic supply			
LED (green)	**Sequence**	**Status**	**Significance / error handling**
 LED illuminated		No error. Operating voltage/sensor supply applied	–
 LED flashing		Operating voltage/sensor supply outside of tolerance range	Eliminate undervoltage.
LED not illuminated		The operating voltage/sensor supply is not applied	Check the operating voltage connection.

Tab. 8.2 LED PS

PL (power load) – power load supply (electrical actuators and outputs) [1]			
LED (green)	**Sequence**	**Status**	**Significance / error handling**
 LED illuminated		No error. Operating voltage/sensor supply applied	–
LED not illuminated		The operating voltage/sensor supply is not applied	Check the operating voltage connection.

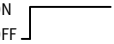
1) For MSE6-E2M, low voltage at the load supply is signalled by messaging a system error (flashing of the red SF-LED); the green PL-LED lights up when operating voltage is present, independently of the condition of the load voltage.

Tab. 8.3 LED PL

SF (system failure) – system error			
LED (red)	**Sequence [1)]**	**Status**	**Significance / error handling**
LED not illuminated		No error	–
LED flashing		Simple error/information (Error class 1)	Description of the error numbers ➔ Section 8.4
LED flashing		Error (Error class 2)	Description of the error numbers ➔ Section 8.4
LED flashing		Serious error (Error class 3)	Description of the error numbers ➔ Section 8.4

1) The system error LED flashes depending on the error class.
Error class 1 (simple error): 1 * flash, pause
Error class 2 (error) 2 * flash, pause
Error class 3 (serious error): 3 * flash, pause

Tab. 8.4 LED SF

M (modify) – parameterisation modified or Force active			
LED (yellow)	**Sequence**	**Status**	**Significance / error handling**
LED not illuminated		System start with default parameterisation (factory setting) has been set – External parameterisation possible (presetting)	–
LED flashing		Force is active [1)]	The Force function is enabled.
LED illuminated		System start with saved parameterising has been set. – Parameters are saved remanently – External parameterisation is blocked [1)]	Caution when replacing the MSE6-E2M with saved parameterisation. Parameterisation is not carried out automatically by the higher-order PLC/IPC on replacement. In these cases, check which settings are required before the replacement and make these settings if necessary.

1) The display of the Force function (LED flashes) has priority over the display of the setting for the system start (LED lights up).

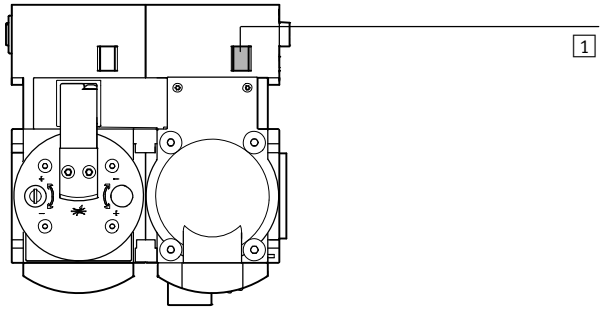
Tab. 8.5 LED M

8.2.2 Module common error LED

Errors of the module are indicated via the module common error LED on the electrical interlinking block and can, if necessary, be evaluated using the operator unit or a PC with diagnostic software.
The errors are indicated on the module common error LED and are reported to the bus node, dependent on the module parametrisation, where they can be evaluated according to the fieldbus protocol used.
Specific errors of the module can be masked. Maskable errors are only indicated when the appropriate monitoring has been activated.

The representation of the faults in the various bus nodes depends on the fieldbus protocol (➔ Description of the CPX bus node).

The module is equipped with a red module common error LED, which signals the presence of a module error.



1 Module common error LED (red)
Fig. 8.3 LED on the module

MSE6-E2M Module common error LED			
LED (red)	**Sequence**	**Status**	**Significance / error handling**
LED not illuminated	ON / OFF	No error	–
LED illuminated	ON / OFF	Module common error	Description of the error numbers ➔ Section 8.4

Tab. 8.6 Module common error LED

8.3 Diagnosis via status bits or the diagnostic interface

The MSE6-E2M offers the following two modes for diagnostics:

Mode	Description
Status bits (System status)	The status bits serve to display common diagnostic messages (global error message). Access to the status bits is made via 8 internal inputs (➔ Section 8.3.1).
I/O diagnostics interface (System diagnostics)	The I/O diagnostic interface is a fieldbus-independent diagnostic interface. This can be used to read out all the internal data and parameters via 16 internal inputs and 16 outputs (➔ Section 8.3.2 and Appendix B). All diagnostic information is then also available even if the fieldbus protocol used does not offer any extensive diagnostic functions.

Tab. 8.7 Fieldbus-independent diagnostic modes

8.3.1 Structure of the status bits

Irrespective of the bus node used, the MSE6-E2M provides 8 status bits for displaying common diagnostic messages (global error messages).

Status bits are configured like inputs. The input addresses, which are to be assigned to status bits, depend on the fieldbus protocol used (➔ Description of the CPX bus node).

The status bits supply coded diagnostic information. Bits 0 to 3 specify the module types in which faults have occurred. Bits 4 to 7 specify the type of fault.

Bit	Diagnostic information with 1 signal	Description
0	Error does not occur on the MSE6-E2M in the current equipment level.	
1	Error at output	Module type, on which an error has occurred
2	Error at input	
3	Error on MSE6-E2M	
4	Undervoltage	Error type
5	Short circuit/overload	
6	Wire break	
7	Other error	

Tab. 8.8 Structure of the status bits

If all status bits supply a 0 signal, no error will be reported.

Examples of typical status information

No error signalled								
	Other error	Wire break	Short circuit	Under-voltage	Funct./ analogue	Input	Output	Valve
Bit	7	6	5	4	3	2	1	0
Status	0	0	0	0	0	0	0	0

Tab. 8.9 Example 1 – no fault

Exceeding of upper flow limit								
	Other error	Wire break	Short circuit	Under-voltage	Funct./ analogue	Input	Output	Valve
Bit	7	6	5	4	3	2	1	0
Status	1	0	0	0	1	0	0	0

Tab. 8.10 Example 2 - Exceeding of upper flow limit value

If different errors occur simultaneously on different types of modules, errors cannot be distinguished. Use the I/O diagnostic interface in order to distinguish errors clearly.

8.3.2 The I/O diagnostic interface

Organisation of internal data and parameters

Internal data and parameters of the MSE6-E2M are stored in a common memory area. With the I/O diagnostic interface, read access can be achieved with the aid of the function number to individual bytes of this memory area.

Parameters can be modified with the aid of fieldbus-specific functions (depending on the fieldbus used) or using the operator unit (➔ Also Section 4.2.3).

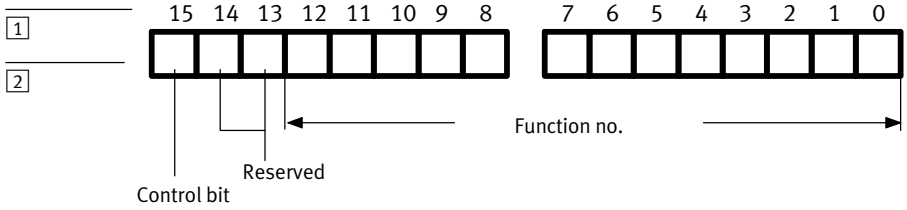
Mode of operation of the I/O diagnostic interface

Detailed diagnostic information can be accessed via the I/O diagnostic interface. For example, you can ascertain exactly on which module an error has occurred. 16 input bits and 16 output bits, through which all diagnostic data can be retrieved, are available for accessing the system diagnostics.

The addresses of the input and output bits of the I/O diagnostic interface depend on the fieldbus used (➔ Description of the CPX bus node).

Output bits

The function no. of the desired data is specified in binary coded form using the output bits A0 ... A12 of the I/O diagnostic interface. The function number is accepted when control bit A15 supplies a 1 signal.

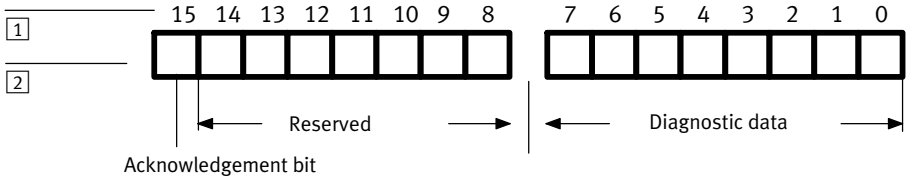


1 Bit number 2 Outputs

Fig. 8.4 Output bits of the I/O diagnostic interface

Input bits

The reply data is output by the MSE6-E2M via the input bits E0 ... E7 when the acknowledgement bit E15 supplies a 1 signal.



1 Bit number 2 Inputs

Fig. 8.5 Input bits of the I/O diagnostic interface

If control bit A15 supplies a 0 signal, acknowledgement bit E15 will be reset automatically and the status byte will be shown with the diagnostic data bits.

Reading out the diagnostic data flow diagram

The function number is accepted if there is a positive edge at control bit A15. The input bits E0 ... E7 supply the diagnostic data when the acknowledgement bit supplies a 1 signal.

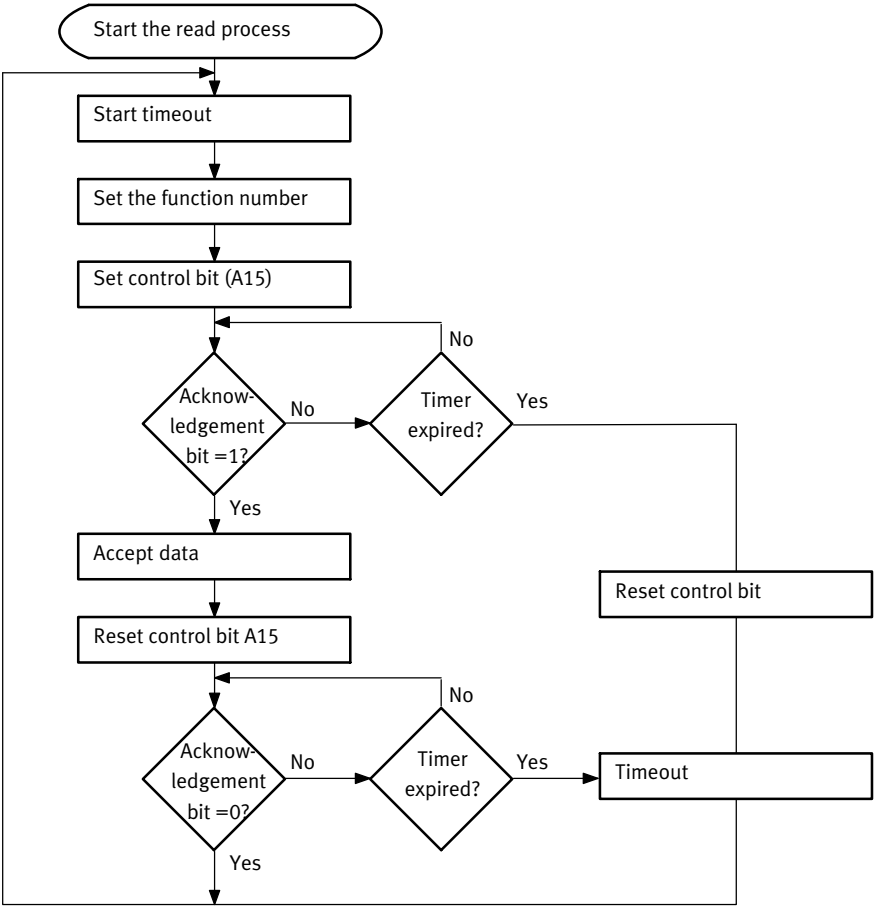


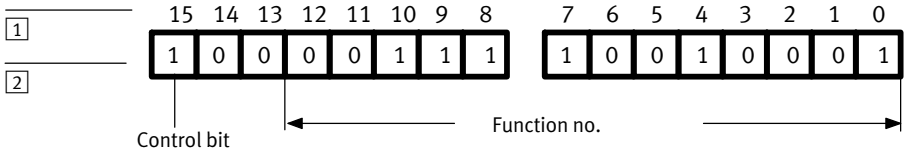
Fig. 8.6 Reading out the diagnostic data flow diagram

Example 1: Check to see if there is diagnostic data

Function no. 1937 specifies whether there is diagnostic data and contains, where applicable, the number of the first module on which an error has occurred (➔ Section C.4).

Function no. = 1937

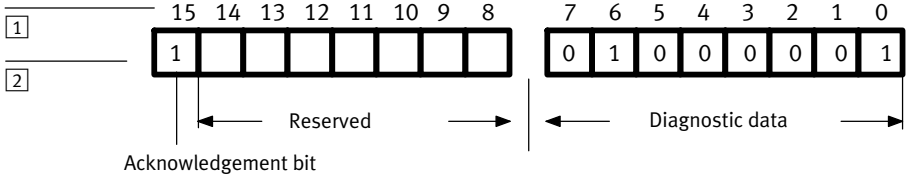
1937 dec. = 11110010001 Bin



[1] Bit number of the outputs [2] Signal status of the outputs

Fig. 8.7 Reading out function no. 1937

There is diagnostic data if bit 6 supplies a 1 signal. Bits 0 ... 5 contain the module number of the first faulty module (➔ Also Section C.4). If, for example, there was an error on module 1 (1 Dec. = 1 Bin), there would be the following input data:



[1] Bit number of the inputs [2] Signal status of the inputs

Fig. 8.8 Reply data (example)

Detailed information on the module diagnostic data can be found in section C.5.

Example 2: Read out current error numbers of module 1

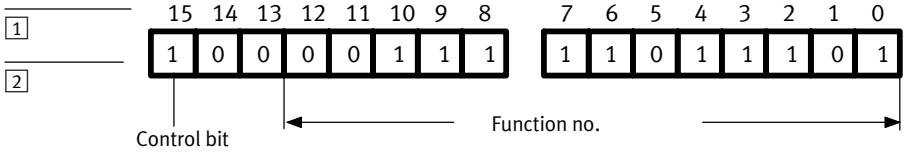
With the aid of the module number of the faulty module, you can ascertain the function numbers of the relevant module diagnostic data (➔ Also Section C.5). Module diagnostic data can be e.g.:

– The number of the faulty channel
– The module error number.

With the following function number, you can ascertain e.g. the module error number of module 1:

Function no. = 2008 + 4 * 1 + 1 = 2013

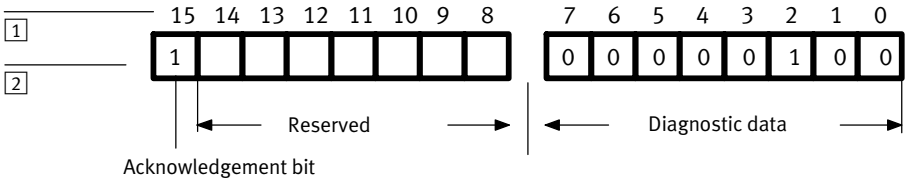
2013 Dec. = 11111011101 Bin



1 Bit number 2 Signal status of the outputs

Fig. 8.9 Reading out the module error number of module 1

Fig. 8.10 shows the reply data in the case of error number 4, as an example.



1 Bit number of the inputs 2 Signal status of the inputs

Fig. 8.10 Reply data with error number 4 (4 Dec. = 100 Bin)

8.4 Error numbers

Possible errors of the MSE6-E2M are divided into three error classes with different priority, depending on the seriousness of the error. If an error occurs, the system error LED (SF LED) will flash depending on the error class.

Error class	Flashing sequence of the SF LED	Error weighting	Priority
1	1 * flashes, pause time	Simple (e.g. simple user error)	Low
2	2 * flashes, pause time	Medium (standard diagnostics and extended diagnostics)	Medium
3	3 * flashes, pause time	High (hardware error/internal error)	High

Tab. 8.11 Error classification

If several errors occur together, the error with the highest priority will have precedence. This means that:
– The system error LED flashes according to the higher priority
– The number of the error with the higher priority will be entered in the system diagnostic data under function number 1938 (error number).

Within an error class, errors of modules with a lower module number have higher priority. For example, errors of module number 0 have the highest priority within an error class. Errors of module number 1 have the second highest priority, etc.

Overview of all possible error numbers ➔ Appendix E.

The following errors can be signalled by the function module:

Note
In the “Enable parameter” column, it can be seen whether the appropriate error message can be deactivated and with which parameter this can be set.

Error no.	Error channel[4]	Description	Error handling	Enable parameter
0	**No error or end of a signal state**			
		–	–	Non-deactivatable diagnostic message
10	**Upper limit exceeded [Upper limit exceeded][1]**			
	Em.0	Upper flow limit exceeded (➔ Parameter “Upper flow limit“)	• Check flow • Check parameterised limit value • If necessary, adapt the parameter “Monitor limit values startup”	Standard parameter “Monitor”: 4828 + m * 64 + 0, Bit 6 “Monitoring of limit values” ➔ Tab. 7.3
	Em.2	Upper pressure limit exceeded (➔ Parameter “Upper pressure limit“)	• Check pressure • Check parameterised limit value • If necessary, adapt the parameter “Monitor limit values startup”	
	Em.3	Upper pressure change limit value exceeded (➔ Parameter “Upper limit pressure change“)	• Check pressure change • Check parameterised limit value • If necessary, adapt the parameter “Monitor limit values startup”	

1) The module displays the relevant error, depending on the parameterisation. The analogue input signals will, however, be processed further.
2) All the electrical module functions are stopped.
3) The parameter values entered will be ignored, the module operates internally with the last valid parameter values.
4) m = Module number

Error no.	Error channel[4]	Description	Error handling	Enable parameter
15	**Module/channel failed[2]**			
	Em.0	Flow sensor defective	• Power off/on necessary. • If this error occurs again, replace device.	Non-deactivatable diagnostic message
	Em.2	Pressure sensor defective	• Check whether the supply pressure is too high. • Power off/on necessary. • If this error occurs again, replace device.	
25	**Error in parameterisation of the upper limit [Fault in parametrizing upper limit][1)3)]**			
	Em.0	An error has occurred in the setting of the “Upper limit flow” parameter.	• Check the parameterisation undertaken and carry out the parameterisation again with the correct parameters (valid parameters ➔ Tab. 7.11).	Standard parameter “Monitor”: 4828 + m * 64 + 0, Bit 7 “Monitor parameters” ➔ Tab. 7.3
	Em.2	An error has occurred in the setting of the “Upper limit pressure”.		
	Em.3	An error has occurred in the setting of the “Upper limit pressure change” parameter.		

1) The module displays the relevant error, depending on the parameterisation. The analogue input signals will, however, be processed further.
2) All the electrical module functions are stopped.
3) The parameter values entered will be ignored, the module operates internally with the last valid parameter values.
4) m = Module number

Error no.	Error channel[4]	Description	Error handling	Enable parameter
26	**Undervoltage in actuator supply [Fault in actuator supply][1]**			
	Am.0	The 24 VA supply voltage for the actuator technology is beneath the permitted range.	• Check the power supply of the actuator technology and, if necessary, increase the voltage. • Check the cabling of the actuator technology supply voltage and, if necessary, repair it.	Standard parameter “Monitor”: 4828 + m * 64 + 0, Bit 2 “Monitor undervoltage in actuator supply” ➔ Tab. 7.3
29	**Error in parameterisation [Fault in parametrizing][1][3]**			
	Em.0 … Em.3	– Monitor limit values startup – Pressure unit – Flow unit – Consumption unit – Flow standard – Pressure change sample time Channel-dependent error difference	• Check the parameterisation undertaken and carry out the parameterisation again with the correct parameters (valid parameters, see section 7.2).	Standard parameter “Monitor”: 4828 + m * 64 + 0, Bit 7 “Monitor parameters” ➔ Tab. 7.3

1) The module displays the relevant error, depending on the parameterisation. The analogue input signals will, however, be processed further.
2) All the electrical module functions are stopped.
3) The parameter values entered will be ignored, the module operates internally with the last valid parameter values.
4) m = Module number

Tab. 8.12 Error numbers

A Technical appendix

A.1 Technical data

MSE6		-E2M
Operating pressure	[bar]	4 ... 10
Operating pressure, Overload range	[bar]	10 ... 12
Operating medium[1)]		Compressed air to ISO 8573-1:2010 [7:4:4]
		Nitrogen
Temperature of medium	[°C]	0 ... 50
Note on the operating medium		Lubricated operation not possible
Mounting position		Horizontal ±5°
Standard nominal flow rate 1 ⟶ 2 (at P1 = 6 bar, = 5 bar)	[l/min]	4500
Flow direction		Unidirectional P1 ➔ P2
Standard flow rate 2 ⟶ 1 (at 6 bar)	[l/min]	4500[2)]
Product weight	[g]	3300
Operating voltage supply Electronics/sensor		
– Nominal voltage	[V DC]	24 ±25%
– Current consumption at 24 V	[mA]	Max. 300
Actuator technology load voltage supply		
– Nominal voltage	[V DC]	24 –25%/+10%
– Current consumption	[mA]	Max. 100
– Undervoltage diagnostic message (trigger level without hysteresis)	[V]	15 ... 17
Pressure sensors		
– Pressure measuring range	[bar]	0 ... 14
– Accuracy	[%FS]	typ. ±3
– Repetition accuracy	[%FS]	±0.3
Flow sensor		
– Flow measuring range	[l/min]	50 ... 5000
– Accuracy, zero point	[%FS]	±0.3
– Accuracy, range	[%FS]	±3
– Repetition accuracy, zero point	[%FS]	±0.2
– Repetition accuracy, range	[%FS]	±0.8

MSE6		-E2M
Shut-off valve		
– Switch-on pressure	[bar]	≤ 4
– Switch-off pressure	[bar]	< 1
– Residual pressure	[bar]	< 1
Degree of protection to EN 60529		IP65
Electromagnetic compatibility		
– Emitted interference		➔ Declaration of conformity (www.festo.com)
– Resistance to interference		➔ Declaration of conformity (www.festo.com)
Vibration and shock[3)]		
– Vibration		Tested according to DIN/IEC 68/EN 60068 Part 2-6; severity level 1
– Shock		Tested according to DIN/IEC 68/EN 60068 Part 2-27; severity level 1

1) Lubricated operation not possible

2) Shut-off valve in the "Pressurise" state

3) Explanations of the severity levels ➔ Tab. A.2.

Tab. A.1 Technical data

Load	Severity level 1 (SL1)	Severity level 2 (SL2)
Vibration	0.15 mm path at 10 ... 58 Hz; 2 g acceleration at 58 ... 150 Hz	0.35 mm path at 10 ... 60 Hz; 5 g acceleration at 60 ... 150 Hz
Shock	± 15 g at 11 ms duration; 5 shocks per direction	± 30 g at 11 ms duration; 5 shocks per direction
Continuous shock	± 15 g at 6 ms duration; 1000 shocks per direction	-

Tab. A.2 Values for vibration and shock as per DIN/IEC68

A.2 Connecting cable

Fieldbus cable

Use a suitable cable for your field bus system. Refer to the manual of your controller for the cable type to be used. Also take into account here the distance and the fieldbus baud rate.

Operating voltage cable

Use an operating voltage cable with a sufficient cable cross-section. Avoid long distances between the power unit and the MSE6-E2M. Long operating voltage cables reduce the voltage supplied by the power supply unit.

Preparing the connecting cable

Caution

The position of the pins on the plug is different from that on the socket!

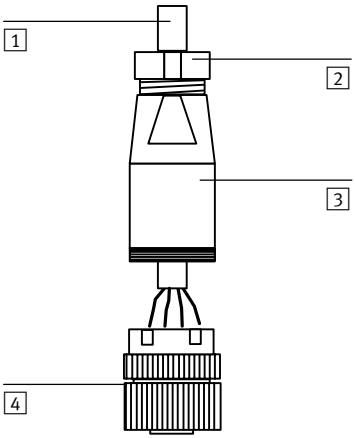
– Pin allocation of the fieldbus interface, see manual for the appropriate fieldbus node.
– The operating voltage and load voltage connections are in the form of plugs. Information on the pin allocation can be found in the following chapters.

Use plugs and sockets from the Festo product range which match the outside diameter of the cables used.

Preparing the plugs and cables

Connect the plugs and cables as follows (example):

1. Open the plugs/sockets as follows:
   – Power supply socket:
     • Insert the mains power socket into the operating voltage connection of the MSE6-E2M.
     • Unscrew the housing of the socket.
     • Then remove the connecting part of the socket which is inserted in the operating voltage □connection.



1 Cable
2 Strain relief
3 Housing
4 Connecting part

Fig. A.1 Component parts of the socket and cable throughfeed

2. Open the strain relief on the rear part of the housing. Then pass the cable through.
3. Remove 5 mm of insulation from the end of the conductors and fit wire end sleeves on the stranded wires.
4. Connect the ends of the conductors.
5. Replace the connecting part on the housing of the plug/socket. Pull the cable back so that there are no loops inside the housing.
6. Tighten the strain relief.

B Parameterisation examples

The following examples for determining parameters must be carried out under normal production conditions.

B.1 Commissioning example for the automatic shut-off function

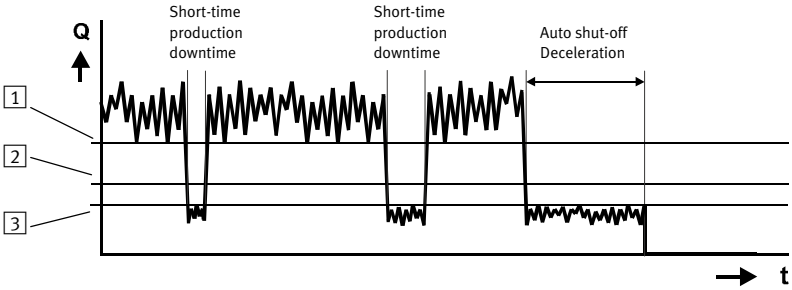
Each system must be set individually. The sample values are only intended as an orientation.

Recommended approach:

1. Recording the relevant function-specific production data

To be able to set the parameters for the automatic shut-off function of the MSE6-E2M correctly, the following data of the following system is required (➔ Fig. B.1):

- Minimum flow in production operation
  - Pneumatic and electrical in operation
  - Actuator technology in action
- Maximum time at continuous minimum flow (e.g. production downtime)
- Maximum flow for production downtime
  - Pneumatic and electrical in operation
  - Actuators not in action



1 Minimum flow rate in production operation
2 Auto shut-off low flow limit
3 Maximum flow for production downtime

Fig. B.1

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 for production downtime: 80 l/min

2. Set parameters for automatic shut-off function

To avoid unintentional behaviour, additional tolerances and safety additions must be taken into account during parameterisation.

- The module must be in the “Shut-off” state for the parameters to be effective (otherwise, the previously set values apply).
- The “Auto shut-off” function must be deactivated.
- Parameter “Auto shut-off delay”
  Set the parameter higher than the actual pause time, in order to avoid accidental advance shut-off, in the upper example values, for example, to 10 min.
- Parameter “Auto shut-off low flow limit”
  The parameter must be higher than the maximum flow rate at rest, but lower than the minimum flow in production operation.
  In the example, it could be set between 90 and 240 l/min.

3. Activate automatic shut-off function
   - The control bit “Auto shut-off” (B1 in the output word Am.0 “Module control”) must be set.
     After the set time, if there is an underrun of the flow limit value, the module should switch to the “Shut-off” state.
4. After automatic shut-off, switch the module back to the “Pressurise” state.
   – The module has switched automatically to the “Shut-off” state (shut-off valve closed: Status bit Shut-off valve Em.3.0 = 1)
   – The control bit “Shut-off” (B0 in the output word “Module control”) must stay deactivated.
   - Positive signal flank on control bit B2 in the output word “Module control” (automatic shut-off function remains active)
   - Otherwise, deactivation of the automatic shut-off function by resetting the control bit B1 in the output word “Module control”; it may occur that the automatic shut-off function may need to be reactivated.
5. Check the set values over multiple production cycles.

Changes to system parameters can lead to a change in the determined production data. Check whether the system parameters are still valid.

B.2 Commissioning example for monitoring the pressure drop

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

Recommended procedure for determining the value for the parameter “Upper limit pressure change”:

1. Switch the MSE6-E2M to the “Pressurise” status.
2. Specify a value for the “Pressure change sample time” parameter.

If your system shows a high pressure drop, start with 100 ms (corresponds to parameter value 1).
This displays the value for the pressure change every 100 ms. If there is a smaller pressure drop, increase the parameter value for the “Pressure change sample time”, e. g. to 10, meaning that the pressure change every 1 s will be displayed. Vary the value for the “Pressure change sample time”, until you have determined a suitable value for your system.

3. Switch the MSE6-E2M to the “Shut-off” status.
4. Record the pressure change values of the selectable input word (Em.5). For this, Am.1 must have the value 0.

A pressure change is a signed value and, when there is a pressure drop, can thus be a negative value.

5. Generate the amount of the pressure change (sign reversal for negative values).
6. Determine the amount of the largest pressure change value.
7. Through multiple switching from the Pressurise to the Shut-off status, determine the amount of the maximum pressure change value.

If you have obtained very small values, it may be wise to increase the value for the parameter “Pressure change sample time”.

8. Specify this value, with an added safety tolerance, for the parameter “Upper limit pressure change”. In this way, you can avoid accidental error messages.

Sample values:

- Parameter “Pressure change sample time”: 1 s
- Parameter “Upper limit pressure change”:
  - Amount of maximum pressure change value: 160 mbar
  - Set limit value incl. safety tolerance: 200 mbar

Monitoring of the pressure change only takes place in the status “Shut-off”.

C Parameters and data

Overview of the function numbers

Function no. [1]	Data and parameters	See
0	Operating mode (system data)	Tab. C.34
0	Expansion (system data)	Tab. C.35
0	Operator unit (system data)	Tab. C.36
0	Force mode (system data)	Tab. C.37
0	System start (system data)	Tab. C.38
1	Fail safe (system data)	Tab. C.39
2	Monitoring (system data)	Tab. C.40
16 + m * 16 + 0	Module code (module data)	Tab. C.44
16 + m * 16 + 13	Revision code (module data)	Tab. C.45
784 + m * 4 + 0 784 + m * 4 + 1 784 + m * 4 + 2 784 + m * 4 + 3	Serial number (module data)	Tab. C.46
1936	Status bits (system diagnostic data)	Tab. C.25
1937	Module number and diagnostic status (system diagnostic data)	Tab. C.26
1938	Error number (system diagnostic data)	Tab. C.27
2008 + m * 4 + 0	Number of the first faulty channel (module diagnostic data)	Tab. C.29
2008 + m * 4 + 1	Module error number (module diagnostic data)	Tab. C.30
2008 + m * 4 + 2	Information 2 (module diagnostic data)	Tab. C.31
2008 + m * 4 + 3	Information 3 (module diagnostic data)	Tab. C.32
3480	Entries remanent with Power ON (diagnostic memory parameters)	Tab. C.10
3480	Run/stop filter 1 (diagnostic memory parameters)	Tab. C.11
3482	Number of entries in the diagnostic memory (diagnostic memory data)	Tab. C.20
3483	Overflow (diagnostic memory data)	Tab. C.21
3483	Status (diagnostic memory data)	Tab. C.22
3484	Run/stop filter 2 (diagnostic memory parameters)	Tab. C.12
3484	Error end filter (diagnostic memory parameters)	Tab. C.13
3484	Error number filter (diagnostic memory parameters)	Tab. C.14
3484	Module/channel filter (diagnostic memory parameters)	Tab. C.15
3485	Module number MN (diagnostic memory parameters)	Tab. C.16
3486	Channel number KN (diagnostic memory parameters)	Tab. C.17
3487	Error number FN (diagnostic memory parameters)	Tab. C.18
3488 + n	Diagnostic memory data (diagnostic memory data)	Tab. C.23
4401	Monitoring (system parameters)	Tab. C.4

1) m = Module number
n = Function-specific number

Function no. [1]	Data and parameters	See
4402	Fail safe (system parameters)	Tab. C.5
4402	Force mode (system parameters)	Tab. C.6
4402	System start (system parameters)	Tab. C.7
4402	Analogue process value representation (data format)	Tab. C.8
4828 + m * 64 + 0	Monitoring (module parameter)	Tab. 7.3
4828 + m * 64 + 7	Monitor limit values startup (module parameter)	Tab. 7.4
4828 + m * 64 + 8	Unit pressure (module parameter)	Tab. 7.5
4828 + m * 64 + 8	Unit flow (module parameter)	Tab. 7.6
4828 + m * 64 + 8	Unit consumption (module parameter)	Tab. 7.7
4828 + m * 64 + 8	Flow standard (module parameter)	Tab. 7.8
4828 + m * 64 + 10	Pressure change sample time (module parameter)	Tab. 7.9
4828 + m * 64 + 11...12	Upper limit flow (module parameter)	Tab. 7.10
4828 + m * 64 + 13...14	Upper limit pressure (module parameter)	Tab. 7.11
4828 + m * 64 + 15...16	Upper limit pressure change (module parameter)	Tab. 7.12
4828 + m * 64 + 17...18	Auto shut-off delay (module parameter)	Tab. 7.13
4828 + m * 64 + 19...20	Auto shut-off low flow limit (module parameter)	Tab. 7.14
4828 + m * 64 + 29...30	Module operating time (module parameter)	Tab. 7.15
4828 + m * 64 + 31...32	Shut-off valve switching cycles (module parameter)	Tab. 7.16

1) m = Module number
n = Function-specific number

Tab. C.1 Function numbers, data and parameters

Function no.	Fieldbus-specific system data	See
–	Number of input bytes (Rx size) [1]	Tab. C.41
–	Number of output bytes (Tx size) [1]	Tab. C.42

1) Only relevant with certain fieldbus protocols (see description of CPX bus node)

Tab. C.2 Function numbers, fieldbus-specific system data

C.1 System parameters

The system parameters refer to global functions of the MSE6-E2M. The following system parameters are available:

Function no.	System parameters
4400	Reserved
4401	Monitoring (active/inactive)
4402	Fail safe (behaviour on communication faults)
4402	Force mode (enable/block Force)
4402	System start
4402	Analogue process value display (data format)[1)]

1) Only relevant with certain fieldbus protocols (see description of CPX bus node)

Tab. C.3 Overview – system parameters

[.....] The data and parameters in the text displayed in English on the operator unit are shown in square brackets in this description, e.g. [Limits]. To the left of this is the translation, e. g.:
Limit values [Limits]

System parameter: Monitoring		
Function no.	4401	
Description	The monitoring of short circuit/overload and undervoltage for the MSE6-E2M can be activated or deactivated (suppressed). Active monitoring causes the following. An error registered by the module will be: – Sent to the higher-order fieldbus master – Entered, if applicable, in the diagnostic memory (depending on filter settings) – Entered in the module diagnostic data and, if applicable, in the status bits – Displayed by the module common error LED – Displayed by the red SF LED on the node.	
	Monitoring	[Monitor]
Bit	Description	
0	Short circuit/overload in sensor supply (SCS)	[Monitor SCS]
1	Short circuit/overload at the outputs (SCO)	[Monitor SCO]
2	Undervoltage of outputs (U_{OUT})	[Monitor Vout]
3	Reserved	
4	Short circuit at valves (SCV)	[Monitor SCV]
5 ... 7	Reserved	
Values	1 = Active (presetting)	[Active]
	0 = Inactive	[Inactive]
Comment	The mode of operation of the channel error LED remains unaltered. Monitoring can also be set separately for each module (see module parameter Monitoring ➔ Tab. 7.3).	

Tab. C.4 Monitoring short circuit/overload/undervoltage

System parameter: Fail safe (reaction to communication errors)		
Function no.	4402	
Description	Specifies which signal status the outputs/actuators are to assume in the event of fieldbus communication errors, e.g. in the event of: – Communication failure (bus interruption, PLC/IPC failure) – Communication stop. In the following case, the channel-orientated Fail safe settings (module parameters Error mode and Error state) are reset automatically for safety reasons in order to avoid undesired signal states: – When changing from “Assume fault mode” to “Reset all outputs” or to “Hold last state”.	
Bit	Bit 0, 1	
Values Bit 1 0 0 0 0 1 1 0	Fail safe Description Reset all outputs (presetting) Hold last state (retain signal status) Assume Fault mode	[Fail safe] [Reset outputs] [Hold last state] [Assume fault mode]
Comment	The Fault mode status is set with the channel-specific module parameters. Additional information on this parameter can be found in section D.1.	

Tab. C.5 Fail safe

System parameter: Force mode		
Function no.	4402	
Description	Specifies for the MSE6-E2M whether the Force function is blocked or enabled. By changing this parameter, the channel-orientated Force settings (module parameters Force mode and Force state) are reset automatically for safety reasons in the following cases in order to avoid undesired signal states: – Change via operator unit: When changed from “Enabled” to “Blocked”. – Change via fieldbus: When changed from “Enabled” to “Blocked”.	
Bit	Bit 2, 3	
Values Bit 3 2 0 0 0 1	Force mode Description Blocked (presetting) Enabled	[Force mode] [Disabled] [Enabled]
Comment	Force signals have precedence over Fail safe signals.	

Tab. C.6 Force mode

System parameter: System start [1]		
Function no.	4402	
Description	With this parameter, you can determine the start-up reaction of the MSE6-E2M and save all current parameter settings and the current expansion.	
Bit	Bit 6	
Values	System start	[System start]
Bit 6	Description	
0	System start with default parameterisation (factory setting) and current expansion; external parameterisation is possible (presetting)	[Default parameters]
1	System start with stored parameterisation and stored expansion; parameter and expansion are stored remanently; external parameterisation is blocked; the M-LED on the fieldbus module is lit	[Saved parameters]
Comment	If bit 6 is set to 1, the current parameter settings will be “frozen” (write-protected) and the current expansion will be saved, except for bit 6 itself and the module parameter “Force channel X”. Recommendation: Select “System start with default parameterisation and current CPX equipment status”. The desired parameterisation can then be created in the start-up phase or after fieldbus interruptions e.g. by the interface module or the scanner/bus master (depending on the fieldbus used). If “System start with default parameterisation and current CPX equipment status” is active, the factory settings for all module and system parameters will become valid after Power On.	

1) This parameter does **not** exist with the CPX-FEC in the operating modes Stand Alone and Remote Controller (control function active).

Tab. C.7 System start

System parameter: Analogue process value display (data format) 1)		
Function no.	4402	
Description	Switches the data format for displaying analogue process values. This is a special parameter for certain CPX bus nodes only (CPX-FB13, FB33/34).	
Bit	Bit 7	
Values	Analogue process value representation	[Analogue data format]
Bit 7	Description	
0	INTEL byte sequence (LSB-MSB, factory setting): Process values are displayed in the Intel format (least significant bit on the left, most significant bit on the right)	[Intel format]
1	MOTOROLA byte sequence (MSB-LSB): Process values are displayed in the Motorola format (most significant bit on the left, least significant bit on the right)	[Motorola format]

1) This is a special parameter for certain CPX bus nodes only (CPX-FB13, FB33/34)

Tab. C.8 Analogue process value representation

C.2 Diagnostic memory parameters

The operating method of the diagnostic memory can be adapted to individual requirements by means of the diagnostic memory parameters.

The diagnostic memory parameters retain their last setting after power off/on. They are saved securely against power outages. The parameter values marked with Presetting correspond to the factory condition. Additional information on the working method of the diagnostic memory can be found in section D.2.

The following parameters can be influenced:

Function no.	Diagnostic memory parameters
3480	Entries remanent with power ON
3480	Run/stop filter 1
3484	Run/stop filter 2
3484	End of error filter
3484	Error number filter
3484	Module/channel filter
3485	Module number MN
3486	Channel number CN
3487	Error number FN

Tab. C.9 Overview – Diagnostic parameters

Diagnostic memory parameters: Entries remanent on Power On		
Function no.	3480	
Description	Determines whether the contents of the diagnostic memory are to be retained after new Power on or whether they are to be deleted.	
Bit 0	Entries remanent with new power ON	[Entries remanent at Power ON]
Values	1 = Inactive 0 = Active (presetting)	[Inactive] [Active]
Comment	The diagnostic memory will be deleted if the mode is changed.	

Tab. C.10 Entries remanent on Power on

Diagnostic memory parameters: Run/Stop filter 1		
Function no.	3480	
Description	Diagnostic memory filter with which you can determine whether the first 40 errors or the last 40 errors are to be saved.	
Bit	Bit 1	
Values	Run/stop filter 1:	[Run/Stop 1]
Bit 1	Description	
0	Save the first 40 entries (stop after 40 entries);	[Save the first 40 entries]
1	Save the last 40 entries (overwrite old entries, presetting)	[Save the last 40 entries]
Comment	The diagnostic memory will be deleted if the mode is changed.	

Tab. C.11 Run/stop filter 1

Diagnostic memory parameters: Run/Stop filter 2		
Function no.	3484	
Description	Diagnostic memory filter with which you can determine when the registering of errors is to be started or stopped.	
Bit	Bit 0 ... 2	
Values	Run/stop filter 2 MN = Module number, CN = Channel number, FN = Error number	[Run/Stop 2]
Bit 2 1 0	Description	
0 0 0	Run/stop filter 2 inactive (presetting)	[Inactive]
0 0 1	Register up to the defined FN	[Rec. up to def. FN]
0 1 0	Register up to the defined FN + MN	[Rec. up to def. FN + MN]
0 1 1	Record up to the defined FN + MN + KN	[Rec. up to def. FN + MN + CN]
1 0 0	Record as from the defined FN	[Rec. as of def. FN]
1 0 1	Record as from the defined FN + MN	[Rec. as of def. FN + MN]
1 1 0	Record as from the defined FN + MN + KN	[Rec. as of def. FN + MN + CN]
1 1 1	Reserved	–
Comment	The numbers are determined by means of the diagnostic memory parameters “Module, channel and error numbers” (function nos. 3485...3487).	

Tab. C.12 Run/stop filter 2

Diagnostic memory parameters: End of error filter		
Function no.	3484	
Description	Diagnostic memory filter with which you can determine whether running errors are to be recorded or not.	
Bit	Bit 3	
Values	End of error filter	[Fault end filter]
Bit 3	Description	
0	Record running errors (end of error) (filter inactive, presetting)	[Rec. outg. faults]
1	Do not record running errors (end of error) (filter active)	[Do not rec. outg. faults]
Comment	By record the outgoing error, you can ascertain how long the error has existed. Incoming and running errors each represent one entry. With running errors, the error number “0” is entered. A maximum of 40 entries are saved together.	

Tab. C.13 End of error filter

Diagnostic memory parameters: Error number filter		
Function no.	3484	
Description	With this diagnostic memory filter you can: – Suppress the recording of a desired error message – Record exclusively a desired error message.	
Bit	Bit 4, 5	
Values	Error number filter FN = Error number	[Fault numbers filter]
Bit 5 4	Description	
0 0	Error number filter inactive (presetting)	[Inactive]
0 1	Record only defined FN	[Rec. only def. FN]
1 0	Do not record defined FN	[Do not rec. def. FN]
1 1	Reserved	–
Comment	The error number is determined by means of the diagnostic memory parameter “Error number” (function no. 3487).	

Tab. C.14 Error number filter

Diagnostic memory parameters: Module/channel filter		
Function no.	3484	
Description	With this diagnostic memory filter, the recording of errors of other modules or channels can be suppressed in order that errors in a particular module or channel can be analysed.	
Bit	Bit 6, 7	
Values	Module/channel filter FN = Error number	[Module/channel filter]
Bit 7 6	Description	
0 0	Module/channel filter inactive (presetting)	[Inactiv]
0 1	Record only the FN of a module	[Rec. FN of a mod.]
1 0	Record only the FN of a channel	[Rec, FN of a ch.]
1 1	Reserved	–
Comment	The appropriate numbers are determined by means of the diagnostic memory parameters “Module and channel numbers” (function nos. 3485...3486).	

Tab. C.15 Module/channel filter

Diagnostic memory parameters: Module number (MN)		
Function no.	3485	
Description	Module number for the diagnostic memory filter	
Bit	0 ... 7 (1 byte)	
Values	Module number (MN) 0 ... 47 Module number (0 = presetting)	[Module number MN]
Comment	Is only effective if an appropriate diagnostic memory filter is active.	

Tab. C.16 Module number (MN)

Diagnostic memory parameters: Channel number (CN)		
Function no.	3486	
Description	Channel number for the diagnostic memory filter	
Bit	0 ... 7 (1 byte)	
Values	Channel number (CN) 0 ... 63 Channel number (0 = presetting)	[Channel number CN]
Comment	Is only effective if an appropriate diagnostic memory filter is active.	

Tab. C.17 Channel number (CN)

Diagnostic memory parameters: Error number (FN)		
Function no.	3487	
Description	Error number for the diagnostic memory filter	
Bit	0 … 7 (1 byte)	
Values	Error number (FN) 0 … 255 Error number (0 = presetting)	[Fault numer FN]
Comment	Is only effective if an appropriate diagnostic memory filter is active.	

Tab. C.18 Error number (FN)

C.3 Diagnostic memory data

The following diagnostic memory data is available:

Function no.	Diagnostic memory data
3482	Number of entries in the diagnostic memory
3483	Overflow
3483	Status
3488 + n	Diagnostic memory data (10 bytes per diagnostic entry, max. 40 entries)

Tab. C.19 Overview – Diagnostic memory data

Diagnostic memory data: Number of entries in the diagnostic memory		
Function no.	3482	
Description	Specifies the number of entries in the diagnostic memory.	
Bit	0 … 7 (1 byte)	
Values	Number of entries in the diagnostic memory 0 … 40	[recorded faults …]
Comment	Can be used as a loop counter if the complete diagnostic memory is to be read out by PLC program.	

Tab. C.20 Number of entries in the diagnostic memory

Diagnostic memory data: Overflow		
Function no.	3483	
Description	Specifies whether the diagnostic memory has overflowed.	
Bit	Bit 0	
Values	Overflow	
Bit 0	Description	
0	No overflow	[no overflow]
1	Overflow	[overflow]
Comment	The overflow is displayed when the first 40 errors are recorded as well as when the last 40 errors are recorded. Overflow means that more than 40 errors have occurred.	

Tab. C.21 Overflow

Diagnostic memory data: Status		
Function no.	3483	
Description	Specifies whether the error recording is active or inactive.	
Bit	Bit 1	
Values		
Bit 0	Description	
0	Recording active	[Recording active]
1	Recording inactive	[Recording inactive]
Comment	Error recording can be stopped and started with the run/stop filters.	

Tab. C.22 Status

Structure of thediagnostic memory

The diagnostic memory contains up to 40 diagnostic entries. A diagnostic entry consists of 10 bytes. The first five bytes contain information on the error time. The last five bytes contain information on the error. The following table shows the structure of diagnostic entries.

Diagnostic memory data (10 bytes per entry, max. 40 entries)				**Function no. 1)**
Byte no.	**Description**	**Description**	**Value**	**3488 + n**
1	Days [day]	Number of days 2)	0 … 255	n = 10 * d + 0
2	Hours [h]	Number of hours 2)	0 … 23	n = 10 * d + 1
3	Minutes [m]	Number of minutes 2)	0 … 59	n = 10 * d + 2
4	Seconds [s]	Number of seconds 2)	0 … 59	n = 10 * d + 3
5	Milliseconds [ms]	Number of 10 msec 2) In addition: Bit 7 is set if it is the first entry after Power ON.	0 … 99 or 128 … 227	n = 10 * d + 4
6	Module code 3)	Module code of the module which registered the error	0 … 255	n = 10 * d + 5
7	Module position [Pos]	Module number of the module that signalled the error; 63 = Error not module-related	0 … 47, 63	n = 10 * d + 6
8	Channel number 3)	Bit 7 6 5 … 0: Description 0 0 0 … 63: No. of the 1st defective A channel 1 0 0 … 63: No. of the 1st defective Input channel 0 1 0 … 63: Module error 1 1 0 … 63: Reserved	0 … 255	n = 10 * d + 7
9	Error number [FN]	0 … 255: Error number (possible error messages ➔ Section 8.4)	0 … 255	n = 10 * d + 8
10	Following channels 3)	Number of subsequent channels with the same error	0 … 63	n = 10 * d + 9

1) d (Diagnostic event) [NB] = 0 … 39 ; Most current diagnostic event = 0;

2) Measured from the moment the power supply is switched on

3) If the error number = 0, the content of these bytes is also 0. If the error number lies between 128 … 199 (error class 3), the content of these bytes is not relevant (servicing required).

Tab. C.23 Diagnostic memory data

C.4 System diagnostics data

The following system diagnostic data is available:

Function no.	System diagnostics data
1936	Status bits (error type and error source)
1937	Module number and diagnostic status
1938	Error number

Tab. C.24 Overview - Diagnostic data

System diagnostic data: Status bits			
Function no.	1936		
Description	The 8 status bits display common diagnostic messages (global error messages). Bits 0 ... 3 display the source of the error and bits 4 ... 7 display the type of the error.		
Bit	Status bits		[System diagnostics]
	Source of error:	Bit 0: Reserved	–
		Bit 1: Output	[Output]
		Bit 2: Input	[Input]
		Bit 3: Analogue/function module	[Analogue/function module]
	Type of error:	Bit 4: Undervoltage	[Undervoltage]
		Bit 5: Short circuit/overload	[Short circuit/overload]
		Bit 6: Wire break	[Wire fracture]
		Bit 7: Other error	[Other error]
Values	1 = There is an error; 0 = No error		

Tab. C.25 Status bits

System diagnostic data: Module number and diagnostic status			
Function no.	1937		
Description	Function no. 1937 specifies whether there is diagnostic data and contains, where applicable, the number of the first module on which an error has occurred. With the aid of the module number of the faulty module, you can ascertain the function numbers of the relevant diagnostic data.		
Bit	Bit 0 ... 5	Module number of the first faulty module	[First faulty module]
	Bit 6:	Diagnostic status	
	Bit 7:	Reserved	
Values	Bit 0 ... 5	0...47 (Module number)	
	Bit 6:	1 = Diagnostic data is available	
		0 = There is no diagnostic data	

Comment	Function no. 1938 contains the relevant error number. Examples ➔ Fig. 8.7 and Fig. 8.9.

Tab. C.26 Module number and diagnostic status

System diagnostic data: Error number			
Function no.	1938		
Description	Contains the current error number		
Bit	Bit 0 ... 7:	Error number	[Fault number]
Values	0 ... 255	Error number	
Comment	For possible error messages, see ➔ Section 8.4. Function no. 1937 specifies whether there is diagnostic data and contains, where applicable, the number of the first module on which the error occurred.		

Tab. C.27 Error number

C.5 Module diagnostics data

The module diagnostic data is assigned to the function numbers 2008 to 2199. There are 4 diagnostic information items in 4 consecutive bytes for each module. The function numbers of the diagnostic data of the faulty module are therefore calculated as follows:
Function no. = 2008 + (4 * module number) + information no.

You can ascertain the module number of the first faulty module with the aid of the system diagnostic data (function no. 1937).

The following module diagnostic data is available:

Function no. [1)]	Module diagnostics data
2008 + m * 4 + 0	Number of the first faulty channel
2008 + m * 4 + 1	Module error number
2008 + m * 4 + 2	Information 2 (reserved)
2008 + m * 4 + 3	Information 3 (reserved)

1) m = 1

Tab. C.28 Overview - Module diagnostic data

Module diagnostic data: Number of the first faulty channel	
Function no.	2008 + m * 4 + 0 m = Module number (1)
Description	Specifies the number of the faulty channel (bits 0...5)
Bit	Bit 7 6 5 ... 0: Description 0 0 0 ... 63: No. of the 1st defective A channel 1 0 0 ... 63: No. of the 1st defective Input channel 0 1 0 ... 63: Module error 1 1 0 ... 63: Reserved
Values	Bit 0...5: 0 ... 63 (Channel number) Bit 6: 0 ... 1 Bit 7: 0 ... 1
Comment	With the aid of the module number of the faulty module (see system diagnostic data, byte address 1937), you can ascertain the function numbers of the relevant diagnostic data.

Tab. C.29 Number of the first faulty channel

Module diagnostic data: Module error number	
Function no.	2008 + m * 4 + 1 m = Module number (1)
Description	Error number
Bit	Bit 0 ... 7: Error number
Values	0 ... 255 (Error number)
Comment	For possible error messages, see ➔ Section 8.4.

Tab. C.30 Module error number

Module diagnostic data: Information 2 (reserved)	
Function no.	2008 + m * 4 + 2 m = Module number (1)
Description	Reserved

Tab. C.31 Information 2 (reserved)

Module diagnostic data: Information 3 (reserved)	
Function no.	2008 + m * 4 + 3 m = Module number (1)
Description	Reserved

Tab. C.32 Information 3 (reserved)

C.6 System data

System data provides information about global system settings and system states. System data is lost after Power Off (non-remanent). The following system data is available:

Function no.	System data
0	CPX operating mode
0	Expansion
0	Operator unit
0	Force mode
0	System start
1	Fail safe
1	System idle mode 1)
2	Monitoring MSE6-E2M
–	Number of input bytes (Rx size) 1)
–	Number of output bytes (Tx size) 1)

1) Only relevant for certain fieldbus protocols

Tab. C.33 Overview – System data

System data: CPX operating mode		
Function no.	0	
Description	Specifies the CPX operating mode that is currently active. In the operating mode “Remote I/O”, all functions are controlled via the protocol implemented in the fieldbus node. In the operating mode “Remote controller”, the FEC takes complete control of the I/Os. 8 I/O bytes are provided for communication with the CPX bus node.	
Bit	Bit 0...3	
Values	CPX operating mode	[CPX mode]
Bit 3 2 1 0	Description	
0 0 0 1	Remote I/O without FEC	[Remote I/O]
0 0 1 0	Remote I/O with FEC	[Remote I/O with FEC]
0 1 0 0	Remote controller without fieldbus node	[Remote controller]
1 0 0 0	Remote controller with fieldbus node	[Remote contr. with FB]
Comment	The CPX operating mode is determined and entered during the start-up phase.	

Tab. C.34 CPX operating mode

System data: Expansion		
Function no.	0	
Description	Specifies whether the current expansion to the corresponds to the saved expansion.	
Bit	Bit 4	
Values	Expansion	[CPX structure]
Bit 4	Description	
0	Equal	[equal]
1	Not equal	[unequal]
Comment	See also system parameter “System start”.	

Tab. C.35 Expansion

System data: Operator unit		
Function no.	0	
Description	Specifies whether or not an operator unit is connected.	
Bit	Bit 5	
Values	Operator unit	[Handheld]
Bit 5	Description	
0	No operator unit is connected	–
1	Operator unit connected	[connection OK]
Comment	Information for the higher-order controller. If necessary for test purposes, a parameterisation carried out using an operator unit is to be cancelled by reloading the parameters, or forcing by higher-order PLC/IPC is to be blocked whilst an operator unit is connected.	

Tab. C.36 Operator unit

System data: Force mode		
Function no.	0	
Description	Specifies whether Force is blocked or enabled.	
Bit	Bit 6	
Values	Force mode	[Force mode]
Bit 6	Description	
0	Blocked	[Disabled]
1	Enabled	[Enabled]
Comment	➔ Also system parameter Force mode, Tab. C.6.	

Tab. C.37 Force mode

System data: System start		
Function no.	0	
Description	Specifies how the system start of the MSE6-E2M is to be carried out.	
Bit	Bit 7	
Values	System start	[System start]
Bit 7	Description	
0	System start with default parameterisation (factory setting) and current expansion	[Default parameters]
1	System start with saved parameterisation and saved equipment status	[Saved parameters]
Comment	➔ Also system parameter “System start”, Tab. C.7 .	

Tab. C.38 System start

System data: Fail safe		
Function no.	1	
Description	Specifies whether Fail safe is active or inactive.	
Bit	Bit 0, 1	
Values	Fail safe	[Fail safe]
Bit 1 0	Description	
0 0	Reset all outputs	[Reset outputs]
0 1	Hold last state (retain signal status)	[Hold last state]
1 0	Assume Fault mode	[Assume fault mode]

Tab. C.39 Fail safe

System data: Monitoring		
Function no.	2	
Description	Specifies whether the monitoring of short circuit/overload and undervoltage is active or inactive.	
	Monitoring	[Monitor]
Bit	Description	
0	Short circuit/overload in sensor supply (SCS)	[Monitor SCS]
1	Short circuit/overload at the outputs (SCO)	[Monitor SCO]
2	Undervoltage of outputs (U_{OUT})	[Monitor Vout]
3	Reserved	–
4	Short circuit at the valve (SCV)	[Monitor SCV]
5	Reserved	–
6	Reserved	–
7	Reserved	–
Values	1 = Active 0 = Inactive	
Comment	➔ Also system parameter Monitoring, Tab. C.4	

Tab. C.40 Monitoring

System data: Number of input bytes (Rx size)	
Function no.	–
Description	Specifies the number of input bytes of the MSE6-E2M.
Comment	Only relevant with certain fieldbus protocols (➔ Description of CPX bus node)

Tab. C.41 Number of input bytes

System data: Number of output bytes (Tx size)	
Function no.	–
Description	Specifies the number of output bytes of the MSE6-E2M.
Comment	Only relevant with certain fieldbus protocols (➔ Description of CPX bus node)

Tab. C.42 Number of output bytes

C.7 Module data

Please note
With regard to the module codes, the MSE6-E2M is classified as an analogue module.

The following module data is available for identifying modules:

Function no. [1]	Module data
16 + 16 m + 0	Module code
16 + 16 m + 13	Revision code
784 + m * 4 + 0 784 + m * 4 + 1 784 + m * 4 + 2 784 + m * 4 + 3	Serial number

1) m = Module number

Tab. C.43 Overview of module data

Module data: Module code			
Function no.	16 + 16 m + 0;		m = Module number (0 ... 1)
Description	Specifies the module code of the module.		
Bit	0...7		
Values			
Values	Module code 143: 202 ... 245:	Energy efficiency module MSE6-E2M CPX bus node	[Modul code]
Comment	See description for the relevant module		

Tab. C.44 Module code

Module data: Revision code		
Function no.	16 + 16 m + 13;	m = Module number (0 ... 1)
Description	Specifies the output status of the module.	
Bit	0 ... 7	
Values	Revision code 0 ... 255	[Revision]
Comment	See rating plate	

Tab. C.45 Revision code

Module data: Serial number	
Function no.	784 + m * 4 + 0 (Byte 0)
	784 + m * 4 + 1 (Byte 1)
	784 + m * 4 + 2 (Byte 2)
	784 + m * 4 + 3 (Byte 3); m = Module number ((0 ... 1)
Description	Specifies the serial number of the module.

Tab. C.46 Serial number

D Fundamentals of parameterisation

D.1 Influencing signal states

You can influence the signal states of the MSE6-E2M through the following functions:

Function	Priority	Brief description	Signals able to be influenced
Force [2)]	1	Influences signal states independently of actual signal states (➔ Section D.1.1)	I/O signals
Fail safe	2	Specifies signal states, which take effect in the case of fieldbus communication errors (➔ Section D.1.2)	A signals

1) Only relevant for certain fieldbus protocols

2) Mainly used for test purposes in the commissioning phase.

Tab. D.1 Functions for influencing signal states

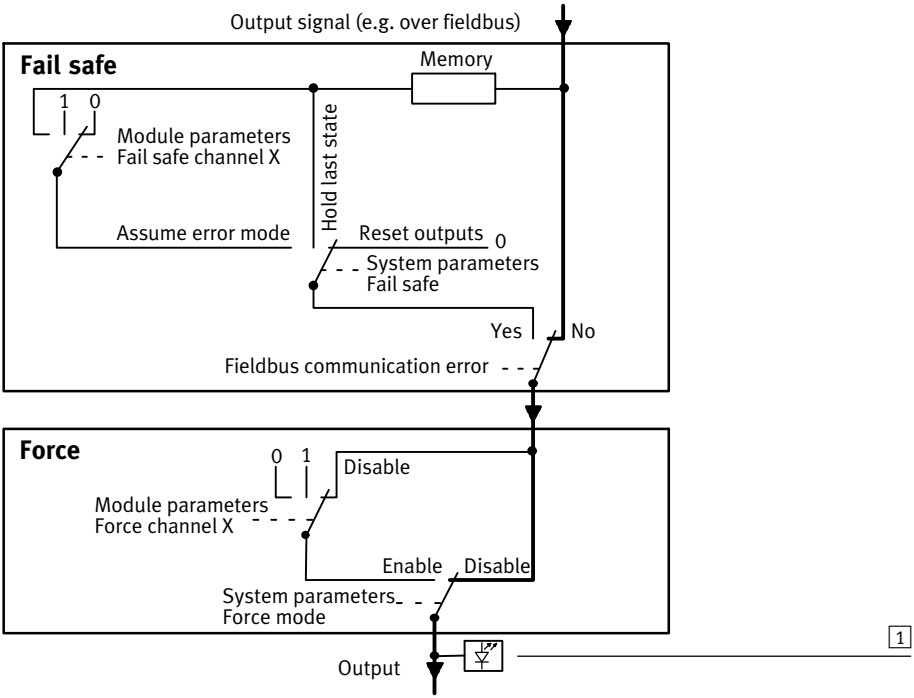
If several functions are active at the same time, the following applies:

– Force signals have the highest priority

Overview on the Force, Failsafe functions

Influencing output signals

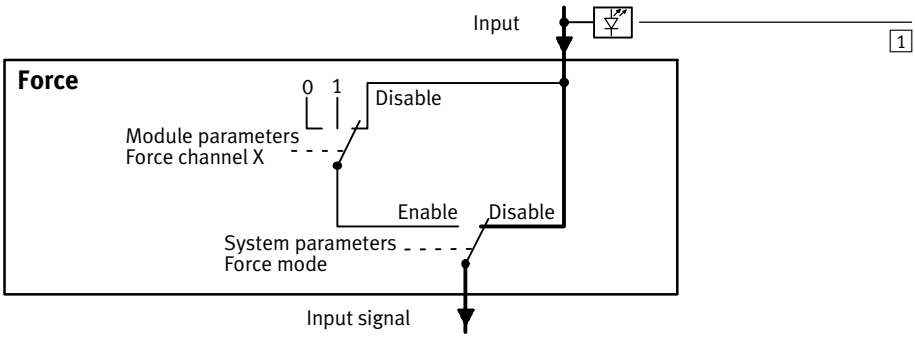
With system parameters, you enter the fundamental settings for the respective function. With appropriate setting of the system parameter, you can specify, through channel-specific module parameters, the desired signal status for each channel individually. The following diagrams give an overview of this:



1 Status LED of the respective output

Fig. D.1 Influencing output signals

Influencing input signals



1 Status LED of the respective input

Fig. D.2 Influencing input signals

Forcing an input does **not** modify the input signal itself. The logical status of the input only changes internally and may be effective in a program.

Obtain further information on Fail safe and Force from the following sections.

D.1.1 Force

Fundamentals

The function Force permits the manipulation of signal states independently of actual operating conditions. Force enables input and output signals to be overwritten. Input signals actually present or changes in status by the program will be ignored. The input signals actually present and the output signals generated by the user program only become valid again when the Force function is deactivated.

Warning
Depending on the functions of the machine/system, the manipulation of signal states can cause serious injury to human beings and damage to property.
Use the Force function very carefully, in order to avoid damage.

The “Force” function is used mainly in the commissioning phase in order to set certain signals to the desired status for test purposes even if the wiring is not complete.

Parameterisation

With MSE6-E2M, Force parameterisation can be used for:

– Inputs of the I/O diagnostic interface and status bits
– Outputs of the I/O diagnostic interface and status bits

By means of a system parameter, Force is enabled globally for the MSE6-E2M or blocked.

System parameters	Settings	Description
Force mode	Blocked (Presetting)	Force is blocked for the complete MSE6-E2M
	Enabled	Force is enabled for the complete MSE6-E2M

Tab. D.2 System parameter Force mode

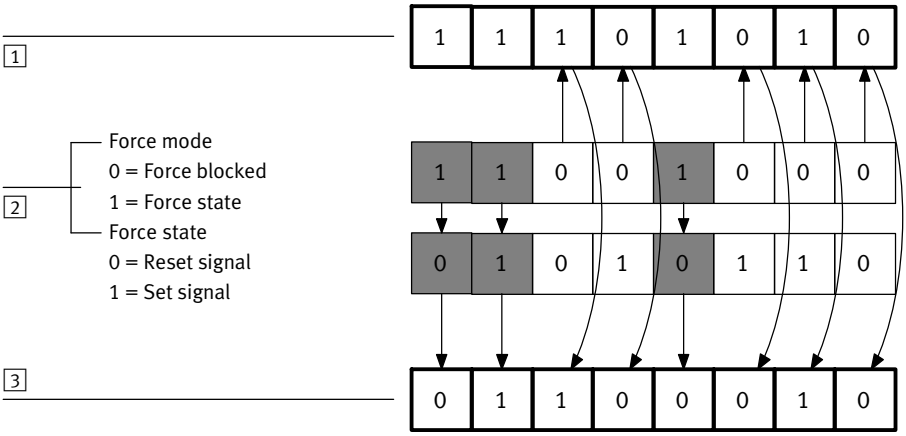
The signal status can be determined in channel-orientated manner (output/input) for each module (➔ Tab. D.3).

Module parameters	Settings	Description
Force mode	Blocked (Presetting)	Force is blocked for the channel
	Force state	Accept the signal status defined by Force state
Force state – Digital signal – Analogue signal	Reset signal (presetting)	Reset input/output signal
	Set signal	Set input/output signal
	Analogue value (0 = Presetting)	Value of the analogue signal

Tab. D.3 Module parameters “Force mode” and “Force state”

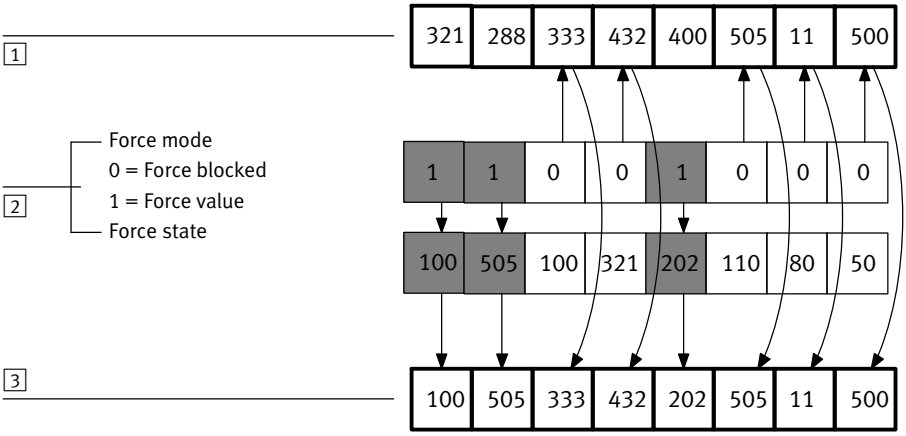
Mode of operation

Input information actually present will be replaced by the values entered in the Force table in the process image inputs. Information actually present in the process image outputs will be replaced by the values entered in the Force table and transmitted to the physical outputs.



1 Signal status previously
2 Module parameter (channel-orientated)
3 Signal status afterwards

Fig. D.3 Force parameterisation – example for binary signals



1 Analogue signal previously
2 Module parameter (channel-orientated)
3 Analogue signal afterwards

Fig. D.4 Force parameterisation – example for analogue signals

D.1.2 Signal status in the event of an error (fail safe)

Fundamentals

With the aid of the so-called fail safe parameterisation, the signal status, which the outputs are to assume in the event of fieldbus communication errors, can be determined (fail safe status). In this way, a defined machine/system status should be created in the event of fieldbus communication errors (e.g. failure of the higher-order PLC/IPC).

Warning
Depending on the functions of the machine/system, the manipulation of signal states can cause serious injury to human beings and damage to property.
Use the fail safe parameterisation very carefully, in order to avoid damage.

Parameterisation

With the MSE6-E2M, fail safe parameterisation can be used for:
– Digital outputs
– Analogue outputs.

By means of the system parameter Fail safe, you can globally determine the signal status which the outputs/valves are to assume in the event of fieldbus communication errors, e.g. in the event of:
– Communication failure (fieldbus interruption, PLC failure)
– Communication stop.

System parameters	Settings	Description
Fail safe	Reset outputs (Presetting)	Reset all outputs, shut-off valve switches to the “Pressurise” state
	Hold last state	Retain current signal status for all outputs
	Assume Fault mode value	Accept the signal status defined for the relevant channel

Tab. D.4 System parameter “Fail safe”

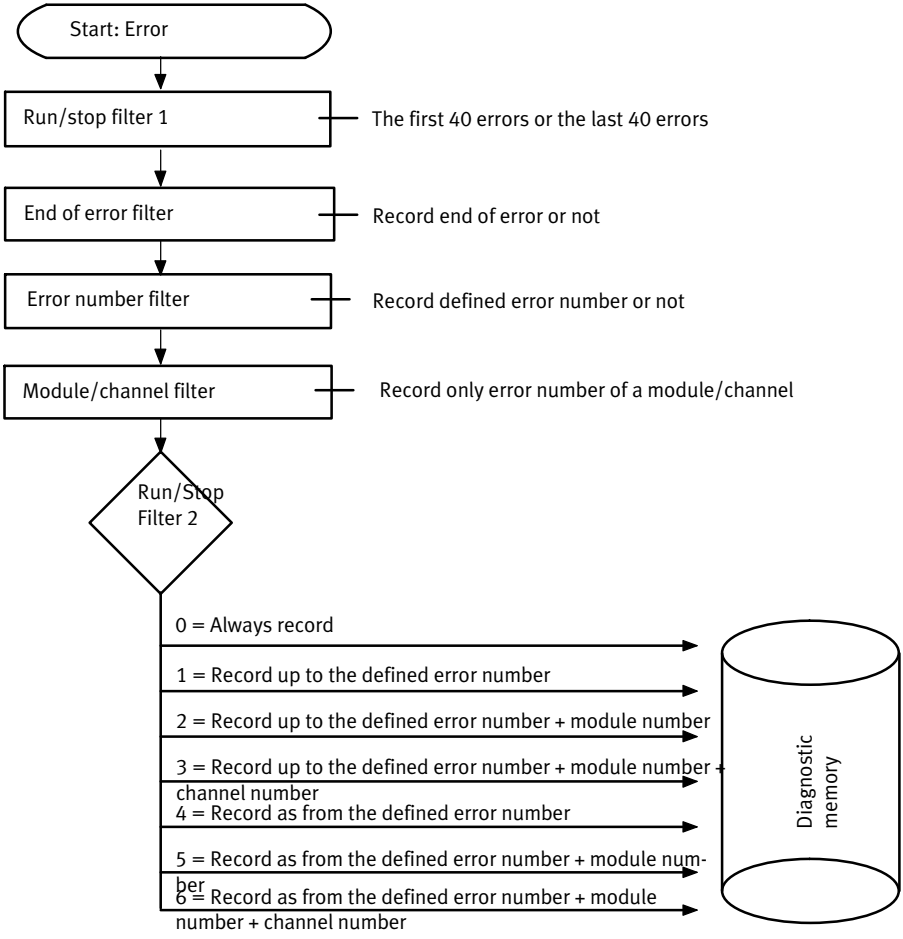
D.2 Diagnostic memory

Fundamentals

A diagnostic memory serves for logging error states. Recording the time when errors occur and error sequences facilitates the search for the cause of the errors which are otherwise difficult to locate. If the causes are eliminated, errors can be avoided in the long term.

Parameterisation

Various diagnostic memory filters can be parameterised by means of diagnostic memory parameters (➔ Section 4.2.2). With these filters, the recording of certain system states can be suppressed, and both starting and stopping can be controlled. The mode of operation of the diagnostic memory filters is shown in Fig. D.5.



MN = module number, CN = channel number, FN = error number

Fig. D.5 The mode of operation of the diagnostic memory filters

Mode of operation

With the MSE6-E2M, the start and end of an error can be logged in the internal diagnostic memory. The diagnostic memory contains up to 40 entries. In addition to information on localising the error, the relevant time point is saved, measured from the moment the power supply is switched on. A diagnostic entry consists of 10 bytes. The first 5 bytes contain information on the time. The last five bytes contain information on the error (➔ Section C.3).

With the aid of the function number, entries in the diagnostic memory can be read out via the I/O diagnostic interface, irrespective of the fieldbus protocol used. The various fieldbus protocols provide, where applicable, further possibilities for reading out and configuring the CPX diagnostic memory (➔ Description of CPX bus node).

D.3 Monitoring errors

Fundamentals

Monitoring functions that run automatically can be activated and deactivated by parameterisation. The activation of monitoring functions helps to guarantee the functionality of the machine/system and to avoid unnecessary idle periods. The deactivation of monitoring functions helps to avoid disturbing error messages, e.g.:

– During commissioning
– During an EMERGENCY OFF, if the EMERGENCY OFF concept of the machine/system requires that the load voltage for the valves and output modules be switched off. The error messages (e.g. undervoltage), which are triggered when the load voltage is switched off, should be frequently suppressed here.

Parameterisation

The MSE6-E2M permits the monitoring of various types of fault (e.g. limit monitoring, undervoltage, etc.). The different monitoring functions can be activated or deactivated globally by system parameters for the complete MSE6-E2M and by module parameters for a single module or an individual channel. Activation of a monitoring function causes the following:

Monitoring	Behaviour on activation
Module parameters Monitoring	An error on the module will be: – Passed on to the fieldbus node – Displayed by the module common error LED
System parameters Monitoring	An error registered by the module will be: – Sent to the higher-order fieldbus master – Displayed by the red SF-LED on the fieldbus node – Entered in the module diagnostic data and, if applicable, in the status bits – Entered, if applicable, in the diagnostic memory

Tab. D.5 Monitoring

The following monitoring functions can be activated or deactivated globally:

System parameter monitoring	Description
Undervoltage at outputs	Monitors the load voltage supply for the shut-off valve.

Tab. D.6 System parameter monitoring

The following monitoring functions can be activated or deactivated by modules, providing the module supports the relevant monitoring function:

Module parameter monitoring	Description
Undervoltage actuator technology MSE6-E2M	Monitors the load voltage supply for the shut-off valve.
Limit values	Monitors the upper limit value
Parameterisation error	Monitors module parameterisation (plausibility check)

Tab. D.7 Module parameter monitoring

E Possible error numbers

Not all error numbers are supported by MSE6-E2M.

Error numbers of error class 2			
No.	**Handheld display**	**Operating status**	**Error elimination**
0	[No error]	No error	-
1	[General diagnosis]	General diagnostics (module-specific error)	See description for the relevant module
2	[Short circuit]	Short circuit/overload in sensor supply (SCS) or at output (SCO)	Eliminate short circuit/overload (see description for the specific module)
3	[Wire fracture/idling current I/O]	Wire break/idling at current input/output	Check and, if necessary, replace the cable and connected sensors/actuators
4	[Short circuit in actuator supply]	Failure of load voltage supply due to short circuit/overload (on output side)	Check connected actuators as well as their connections
5	[Undervoltage in power supply]	Undervoltage in power supply (on input side)	Eliminate undervoltage at system supply or additional power supply (pin allocation ➔ Tab. 3.1)
6 ... 8	Reserved		
9	[Lower limit exceeded]	Value falling below nominal range	Check signal range and parameterised limit value
10	[Upper limit exceeded]	Value exceeding nominal range	Check signal range and parameterised limit value
11	[Short circuit valve]	Short circuit at valve	Check valve and pneumatic interface
12	Reserved		
13	[Wire fracture (open load)]	Wire break at valve (open load)	Check valve and pneumatic interface
14	[Condition counter exceeded]	Limit value of the condition counter exceeded	Set or delete the limit value of the condition counter by parameterising
15	[Module/channel failure]	Module/channel failed	Check module (function/installation), replace if necessary

Error numbers of error class 2			
No.	**Handheld display**	**Operating status**	**Error elimination**
16	[Module code incorrect]	– Saved configuration is different to the actual system structure	For the terminal: • Check the structure and resave, if necessary (for the procedure, see ➔ Section C.1, System parameter System start) For the fieldbus module: • Modify the System Start parameter to “Default parameterisation and current CPX expansion” With the CPX-FEC: • Save the actual configuration as the set configuration using the FST software
17	[I/O length incorrect]	Saved I/O length of the module is different to the actual system structure. With CPX-CP interface: – The saved string allocation of the CPX-CP interface is not the same as the configuration saved in the CPX bus node or in the CPX-FEC	For the terminal: • Check the structure and resave, if necessary (for the procedure, see ➔ Section C.1, System parameter System start) For the fieldbus module: • Modify the System Start parameter to “Default parameterisation and current CPX expansion” With the CPX-FEC: • Save the actual configuration as the set configuration using the FST software
18	[Address range exceeded]	Number of I/O points exceeded	Check the DIL switch setting or the terminal expansion. See description for the specific CPX bus node/CPX-FEC
19	[Life cycle exceeded]	Nominal service life/product lifecycle exceeded	Replace module or spare part (e.g. air filter) See description for the relevant module

Error numbers of error class 2			
No.	**Handheld display**	**Operating status**	**Error elimination**
20	[Fault in parametrizing signal range]	Error in parameterisation (signal range)	Check the parameterisation undertaken and, if necessary, undertake the parameterisation again with the correct parameters
21	[Fault in parametrizing data format]	Error in parameterisation (data format)	Check the parameterisation undertaken and, if necessary, undertake the parameterisation again with the correct parameters
22	[Fault in parametrizing linear scaling]	Error in parameterisation (linear scaling)	Check the parameterisation undertaken and, if necessary, undertake the parameterisation again with the correct parameters
23	[Fault in filter meas.value]	Error in parameterisation (measured value smoothing)	Check the parameterisation undertaken and, if necessary, undertake the parameterisation again with the correct parameters
24	[Fault in parametrizing lower limit]	Error in parameterisation (lower limit value)	Check the parameterisation undertaken and, if necessary, undertake the parameterisation again with the correct parameters
25	[Fault in parametrizing upper limit]	Error in parameterisation (upper limit value)	Check the parameterisation undertaken and, if necessary, undertake the parameterisation again with the correct parameters
26	[Fault in actuator supply]	Error in actuator supply	Eliminate short circuit/overload or check actuator supply, if necessary, check connected actuators
27	[Wrong device type mounted]	Missing or incorrect spare part	Replace module or spare part (e.g. air filter) See description for the relevant module
28	[Alarm value reached]	Alarm value reached	Check operating conditions See description for the relevant module

Error numbers of error class 2			
No.	**Handheld display**	**Operating status**	**Error elimination**
29	[Fault in parametrizing]	Error in parameterisation	Check the parameterisation undertaken and, if necessary, undertake the parameterisation again with the correct parameters
30	[No new output data (slave)]	Error in internal communication (no new output data)	Replace module if Power Off/On does not remedy problem
31	[No bus connection (slave)]	Bus connection interrupted	Set up bus connection or check configuration
32	[No STI read access (slave)]	STI read access defective	Repeat STI read access
33	[No parameter access (slave)]	Read access parameter defective	Repeat read access parameter
34	[CP module lost / fault]	– Incorrect string allocation ascertained during operation (e.g. CP module failed or CP cable defective) – More than one module failed during operation – modules are no longer recognised.	• Check CP strings (CP modules and CP cables), if necessary replace CP modules or CP cables • Switch power supply off and then on again. If the error still occurs, check and, if necessary, replace CP cables and CP modules
35	[CP configuration failure]	– When the power supply is switched on, the string allocation does not match the saved string allocation – Incorrect module recognised during operation (different type, see description of CPX-CP interface)	• Check CP strings (CP modules and CP cables), if necessary replace CP modules or CP cables • With correct string allocation: String allocation must be saved (see description of CPX-CP interface) • Check string allocation, if necessary replace CP module
36	[Short circuit CP-Line]	Short circuit in CP string ($24\ V_{EL/SEN}$ or $24\ V_{VAL}$) – Communication on CP string interrupted	• Check string assignments, if necessary replace CP cable
37	[Fault in controlling]	Defect in the controller function (e. g. setpoint value cannot be reached)	Check pressure and actuator supply
38	[Missing valve]	No valve recognised	Check valve (function/installation), replace if necessary

Error numbers of error class 2			
No.	**Handheld display**	**Operating status**	**Error elimination**
39	[Maintenance required]	Maintenance required	See description for the relevant module
40	[CO-Life Guard]	Error resulting from Life Guard monitoring	Check cabling, check CAN bus load, check Guard Time and Life Factor and adjust if necessary
41	[CO-Heart Beat]	Error resulting from Heart Beat monitoring	Check cabling, check CAN bus load, check Heart Beat Time, adjust if necessary
42	Reserved		
43	[CO-CAN Overrun (Objects lost)]	Telegrams have been lost	Check CAN bus load
44	[CO-Invalid PDO received]	PDO received with too few data bytes	Possibly correct PDO mapping or increase number of PDO bytes
45	[CO-CAN WarnLimit reached]	Some defective CAN telegrams have been discovered	Check cabling
46	[CO-CAN recovered from BusOff]	Defective CAN telegrams have been increasingly discovered	Check cabling; a CAN participant may be defective
47	[CO-Bus Power lost]	No supply voltage at the CAN interface	Check power supply at 24 VDC bus and 0 V bus
48	[Fault in Calibration]	Calibration error (factory adjustment missing)	Replace module
49	[Lower drop out signal]	Current loop is in the lower drop-out range	Check the installation/parameterisation of the actuator technology See description for the relevant module
50	[Upper drop out signal]	Current loop is in the upper drop-out range	Check the installation/parameterisation of the actuator technology See description for the relevant module
51	[Sensor limit exceeded]	Physical limit value for a sensor exceeded – Process value invalid – Possible hardware damage	– Check structure (compliance with module specification) – Check module for damage, if necessary replace
52	[Short circuit cold junction comp.]	Short circuit at cold junction compensation	Eliminate short circuit or check connected CJC sensors

Error numbers of error class 2			
No.	**Handheld display**	**Operating status**	**Error elimination**
53	[Open load cold junction comp.]	Wire break at cold junction compensation	Check and, if necessary, replace the cable and connected CJC sensors
54	[Calibration data incorrect]	Calibration data is faulty	Replace module
55	[Invalid process value]	Formation of the process value is invalid due to faulty structure	Check structure (compliance with module specification)
56 ... 63	Reserved		
64	[Number of Modules incorrect]	The number of modules in the current CPX equipment status does not equal the saved expansion	Correct module expansion or save new one
65 ... 69	Reserved		
70	[CC-L: Station equip. status incorrect]	CPX expansion is greater than the number of stations set	Check DIL switch setting (increase number of stations)
71	[CC-L: Bus connection lost]	Bus connection interrupted	Check cabling
72 ... 77	Reserved		
78	[Value out of range]	Measured value outside the rated range	See description for the relevant module
79	Reserved		
80	[Function failure]	Module-specific malfunction	See description for the relevant module
81 ... 99	Reserved		
100	[Configuration error]	Error in configuration or parameterisation	Check configuration, correct if necessary or repeat commissioning
101	[Execution error]	Error executing a positioning job	Check and, if necessary, correct the positioning job
102	[Record error]	Error executing a positioning record	Check and, if necessary, correct the positioning job
103	[Control error]	Error in control or in the parameters of a positioning job	Check and, if necessary, correct the positioning job
104	[System error A]	Error in the process control or the system configuration	Check system configuration or positioning job, I/O signals or system status and correct as necessary
105	[System error B]	Error in the peripherals; power supply, operating pressure, etc.	Check peripherals, power supply and operating pressure
106	[Error in valve]	Error in valve or on axis string	Check valve or lines for damage, if necessary replace

Error numbers of error class 2			
No.	**Handheld display**	**Operating status**	**Error elimination**
107	[Controller error]	Error in the controller or drive regulator	Check controller or drive regulator for damage, if necessary replace
108	[Encoder error]	Error in measuring system or on axis string	Check measuring system or lines for damage, if necessary replace
109	[Error motor or power stage]	Error in the motor or power section	Check motor or power section for damage, if necessary replace
110 ... 114	Reserved		
115	[Subsystem module/ channel failure]	Module/channel in a subordinate system has failed	Check subordinate module (function/installation), replace if necessary See description for the relevant module

Tab. E.1 Possible errors (error class 2)

Error numbers of error class 3			
No.	**Handheld display**	**Operating status**	**Error elimination**
128	[Switch unit defective]	Hardware defective in the switch unit	Check module, if necessary replace
129	[CBUS asic not ready]	Hardware defective	Replace module
130	[CPU Hardware Trap]	System error has occurred	Replace module if Power Off/On does not remedy problem
131	[CBUS C-manager not ready]	Error in internal communication	Check terminal and, if necessary, replace
132	[Watchdog overflow]	System error has occurred	Replace module if Power Off/On does not remedy problem
133	[Remanent memory defective]	Hardware defective	Replace module
134	[Flash system memory defective]	Hardware defective	Replace module
135	[Number of mod. params.more than 64]	Error in internal configuration	Check terminal and, if necessary, replace
136	[Slave not ready]	System error has occurred	Replace module if Power Off/On does not remedy problem

Error numbers of error class 3			
No.	**Handheld display**	**Operating status**	**Error elimination**
137	[CBUS diagnostic telegram]	Error in internal communication	Check terminal and, if necessary, replace
138	[CBUS init fault (gap)]	Error in internal configuration	Check module array (there must not be any configuration gaps in the terminal)
139	[Order queue full]	Error in internal communication	Check terminal and, if necessary, replace
140	[CBUS-EEPROM error]	Hardware defective	Replace module
141	[CBUS C-timeout error]	Error in internal communication	Check terminal and, if necessary, replace
142	[CBUS telegram fault]	Error in internal communication	Check terminal and, if necessary, replace
143	[BIU access error]	System error has occurred	Replace module if Power Off/On does not remedy problem
144	[Licence error]	Module does not have a valid licence	Procure licence, if necessary replace module
145 ... 149	Reserved		
150	[NETOS fatal error]	System error has occurred	Replace module if Power Off/On does not remedy problem
151 ... 199	Reserved		

Tab. E.2 Possible errors (error class 3)

Error numbers of error class 1			
No.	**Handheld display**	**Operating status**	**Error elimination**
200	[Fault param. transfer module n]	Error in parameterisation (parameter transfer failed)	Replace module if Power Off/ On does not remedy problem
201	[Invalid field bus address]	Address incorrect	Check the DIL switch setting, correct if necessary
202	[Protokoll Asic not ready]	Initialisation of the protocol chip defective	Replace module if Power Off/ On does not remedy problem
203	[MMI serves CPX module]	MMI serves CPX modules, parameterisation is not possible via the fieldbus node or FEC	Terminate MMI access
204	[Invalid setting switch unit]	Invalid switch setting	Check the DIL switch setting, correct if necessary
205 ... 254	Reserved		
255	[unknown fault]		

Tab. E.3 Possible errors (error class 1)

F Glossary

Term/abbreviation	Significance
Bus node	Consists, in terms of functions and numbers, of two independent modules: A fieldbus module and a pressure sensor module.
DIL switches	Dual-in-line switches consist of several switch elements with which settings can be made.
Fieldbus module	Component of the bus node, which creates the communicative connection to a certain fieldbus, conducts control signals to the connected modules and monitors their functioning capability.
I	Input
I/O diagnostics interface	The I/O diagnostic interface is a bus-independent diagnostic interface at I/O level, permitting access to internal data of the MSE6-E2M.
I/Os	Inputs and outputs
O	Output
PLC/IPC	Programmable logic controller/industrial PC
Status bits	Internal inputs that supply coded common diagnostic messages.

Tab. F.1 Product-specific terms and abbreviations

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