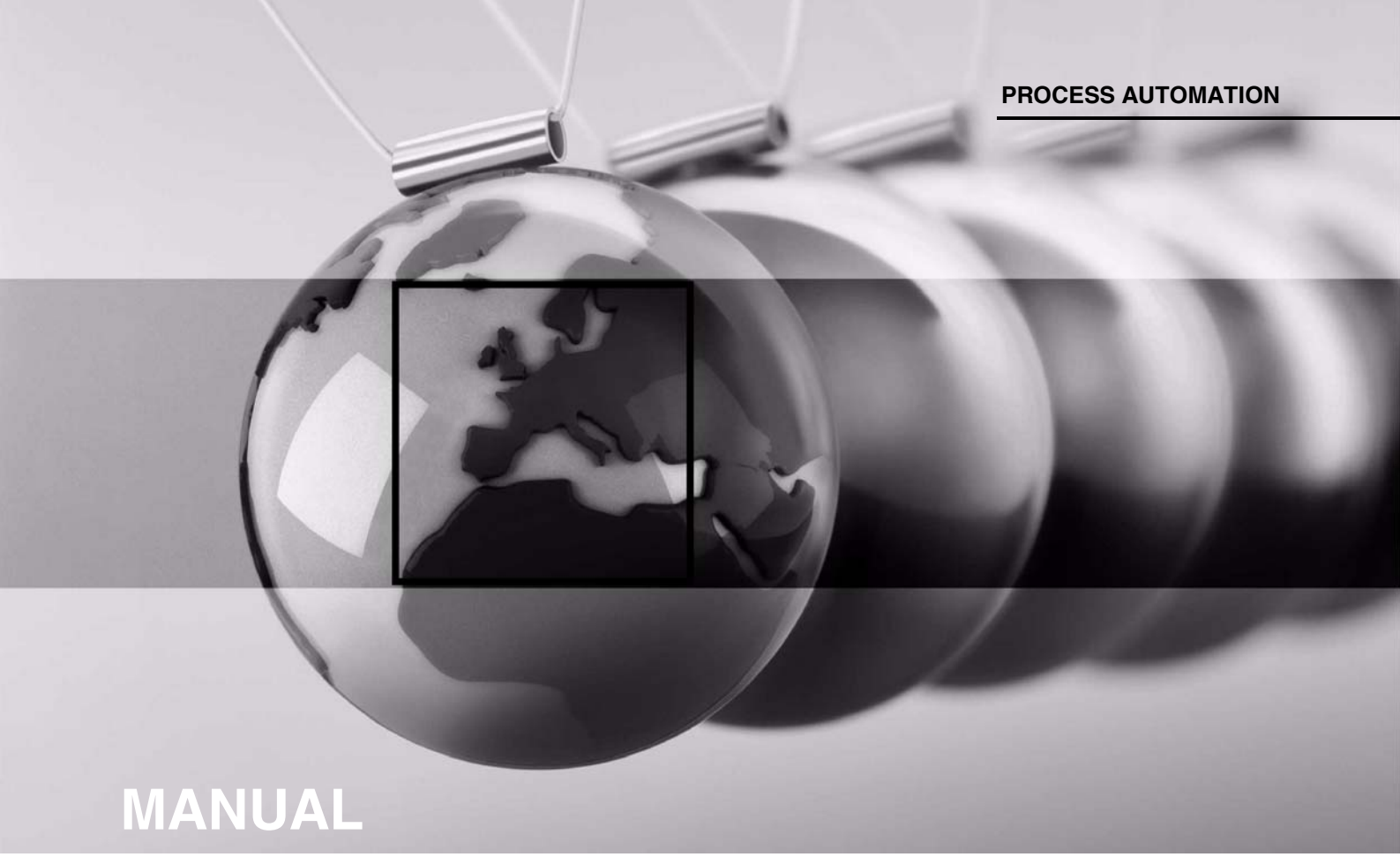

MANUAL

Multi-Input/Output Device

F2D0-MIO-Ex12.FF.*
R8D0-MIO-Ex12.FF.*

FOUNDATION™

PEPPERL+FUCHS
PROTECTING YOUR PROCESS

With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

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1 Introduction

1.1 Content of this Document

This document contains information that you need in order to use your product throughout the applicable stages of the product life cycle. These can include the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal

Note!

This document does not substitute the instruction manual.

Note!

For full information on the product, refer to the instruction manual and further documentation on the Internet at www.pepperl-fuchs.com.

The documentation consists of the following parts:

- Present document
- Instruction manual
- Datasheet

Additionally, the following parts may belong to the documentation, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Additional documents

1.2 Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismounting of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

1.3 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:

Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.

Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.

Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Informative Symbols

Note!

This symbol brings important information to your attention.

Action

This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

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2 Product Specifications

2.1 Overview and Application

The FieldConnex® Multi-Input/Output device (MIO) for FOUNDATION Fieldbus provides discrete inputs, discrete outputs, 1 frequency input, and 1 counter to process control systems. The device is is suitable for DIN rail mounting and field installation with different housing options. The F2 type housing is made of sturdy cast aluminum for installation in rough environments. Fieldbus and sensor-actuator cable entries can be selected individually from a range of cable glands. Optionally, either screw terminals or spring terminals can be chosen. Contact your Pepperl+Fuchs representative for further information on housing options.

The device can be installed in hazardous areas Zones 1, 21, 2, 22, and Division 1, 2. FOUNDATION Fieldbus and input/output sensor and actuator connections are rated intrinsically safe for installation in Zone 0 and Division 1.

The device provides different configurable modes of operation.

The valve coupler mode allows connecting 4 low-power valves with 2 end position inputs per valve.

The sensor input mode allows connecting up to 12 binary sensors. 4 sensor inputs are designed to support vibrating forks for level control. In frequency mode, 1 frequency input and 8 discrete inputs are provided. In counter input mode, 1 counter input and 8 discrete sensor input modes are provided.

The MIO is intended to be used as a replacement for Pepperl+Fuchs process interface FD0-VC-Ex4.FF.

2.2 Modes of Operation

The device supports 12 hardware channels which can be configured as inputs and outputs. The functional configuration of the channels is determined by selecting a dedicated mode of operation.

Valve Coupler Mode

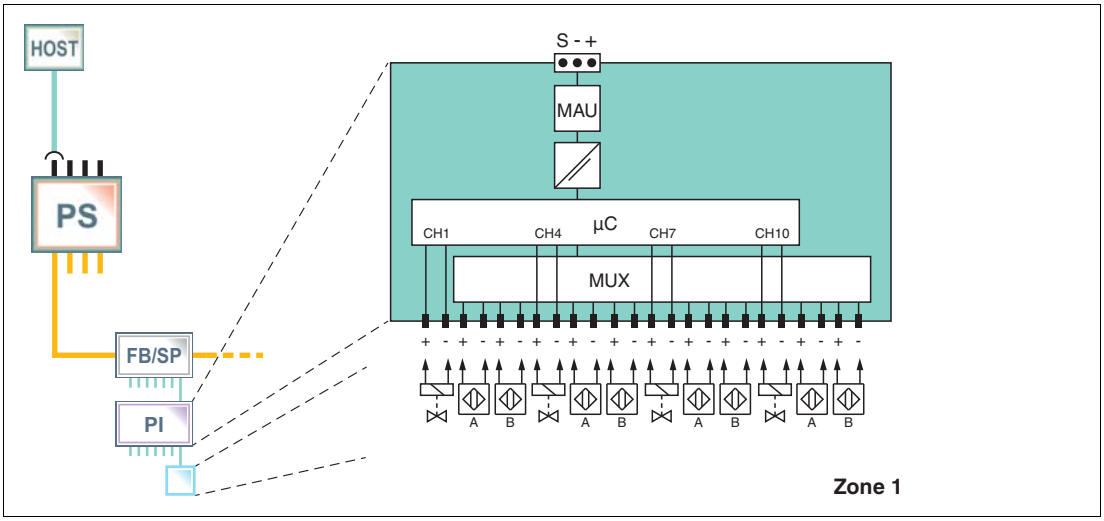
In the valve coupler mode, the channels 1, 4, 7, and 10 are used to control 4 low power valves. The channels 2, 3, 5, 6, 8, 9, 11, and 12 are used as valve position feedback inputs for NAMUR proximity switches or mechanical switches. An auxiliary valve is used as a pilot valve for 1 actuator which can be provided with final position feedback contacts to feed back the drive position. In the manual, the term "valve" denotes the overall chain consisting of auxiliary valve, control drive, and regulation unit. Condition monitoring functions like stroke counter, partial stroke test, and travel time survey allow to detect evolving faults, before they become critical for the process control.

The device is designed particularly for intrinsically safe low power auxiliary valves in 6 V design that control the supply of compressed air to the drive. An auxiliary valve of this type is triggered by an intrinsically safe current (I_S).

U_S = 6.4 V ... 7.9 V, I_S = 1.5 mA

Refer to the technical data of the MIO for specification of compatible valves and sensors. A list of compatible low power valves and NAMUR sensors are available on the Pepper+Fuchs website.

Valve Coupler Mode



Channel	Valve Coupler Modes
1	Output 1, low-power valve
2	Position feedback sensor/switch A for output 1
3	Position feedback sensor/switch B for output 1
4	Output 2, low-power valve
5	Position feedback sensor/switch A for output 2
6	Position feedback sensor/switch B for output 2
7	Output 3, low-power valve
8	Position feedback sensor/switch A for output 3
9	Position feedback sensor/switch B for output 3
10	Output 4, low-power valve
11	Position feedback sensor/switch A for output 4
12	Position feedback sensor/switch B for output 4

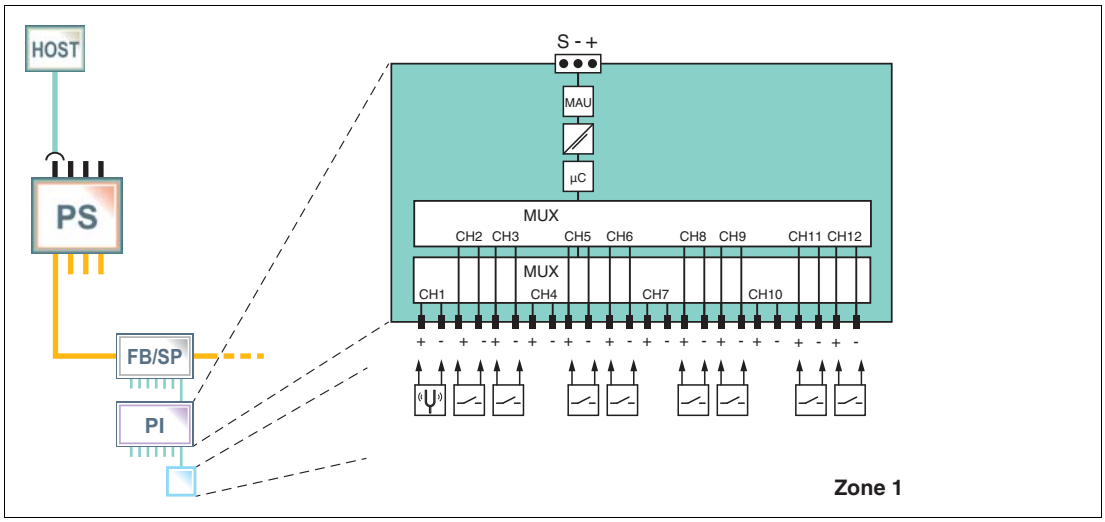
Binary Input Mode

The device samples the inputs in 2 independent cycles. Channels 1, 4, 7, and 10 are intended to be used for sensing multiplexed binary inputs as vibrating forks, NAMUR sensors, or mechanical switches. Channel 1 can also be configured to be used as a frequency or counter input. If the channel 1 frequency or counter input is activated, channels 4, 7, and 10 are deactivated. The ON-time of channel 1, 4, 7, and 10 can be adjusted individually between 10 ms ... 11 000 ms. The total cycle time is the sum of the 4 individual ON-times.

Channels 2, 3, 5, 6, 8, 9, 11, and 12 are intended to be used for sensing multiplexed binary inputs as NAMUR sensors and mechanical switches. The sampling time of 10 ms is not adjustable. The total cycle time is calculated as follows: number of used channels * 10 ms (minimum 50 ms). If all 8 sensors are used, the total cycle time is 80 ms.

Refer to the technical data of the MIO for the specification of compatible sensors. A list of compatible NAMUR sensors is available on the Pepperl+Fuchs website.

Sensor Input Mode (Including Frequency and Counter)



Channel	Sensor Input Modes	Frequency Input Mode	Counter Input Mode
1	Vibration fork or sensor/switch	Frequency input	Counter input
2	Sensor/switch	Sensor/switch	Sensor/switch
3	Sensor/switch	Sensor/switch	Sensor/switch
4	Vibration fork or sensor/switch	Disabled	Disabled
5	Sensor/switch	Sensor/switch	Sensor/switch
6	Sensor/switch	Sensor/switch	Sensor/switch
7	Vibration fork or sensor/switch	Disabled	Disabled
8	Sensor/switch	Sensor/switch	Sensor/switch
9	Sensor/switch	Sensor/switch	Sensor/switch
10	Vibration fork or sensor/switch	Disabled	Disabled
11	Sensor/switch	Sensor/switch	Sensor/switch
12	Sensor/switch	Sensor/switch	Sensor/switch

Frequency or Counter Input Mode

Hardware channel 1 can be configured to be used as frequency or counter. If hardware channel 1 is configured as frequency or counter input, the hardware channels 4, 7, and 10 are deactivated.

The hardware channels 2, 3, 5, 6, 8, 9, 11, and 12 provide binary inputs as described in the section "Binary Input Mode".

2.3 Hazardous Area Installation and Use

The device may be operated in Zone 1.

For applications in Zone 1, the type of protection must be Ex i according to Entity or FISCO.

The device may be installed in Zone 2.

The type of protection for the trunk interface is Ex ec or Ex ic according to Entity or FISCO.

Independent of the type of protection of the fieldbus interface, the inputs/outputs remain intrinsically safe and may be installed in Zone 1.

Zone 2

Danger!

Explosion hazard from live wiring of non-intrinsically safe circuits

If you connect or disconnect energized non-intrinsically safe circuits in a potentially explosive atmosphere, sparks can ignite the surrounding atmosphere.

Only connect or disconnect energized non-intrinsically safe circuits in the absence of a potentially explosive atmosphere.

Type of Protection "Ex i"

Danger!

Explosion hazard from wrong separation distances

Non-observance of the separation distances between circuits can result in added currents or voltages. This can result in a current/voltage flashover generating sparks. The sparks can ignite the surrounding potentially explosive atmosphere.

Ensure you observe the compliance of the separation distances according to IEC/EN 60079–14.

Danger!

Explosion hazard from wrong calculation of verification of intrinsic safety

If you do not consider the maximum permissible peak values of all components when connecting intrinsically safe devices with intrinsically safe circuits of associated apparatus, this can lead to added currents or voltages. This, in return, can result in a current/voltage flashover generating sparks. The sparks can ignite the surrounding potentially explosive atmosphere.

Ensure you observe IEC/EN 60079-14 and IEC/EN 60079-25 for the verification of intrinsic safety.

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Type of Protection "Ex ec"

Danger!

Explosion hazard from pollution

An excessively polluted surface of the device can become conductive and consequently ignite a surrounding potentially explosive atmosphere.

Ensure that you install the device only in environments with a pollution degree 2 or better according to IEC/EN 60664–1.

Danger!

Explosion hazard from exposure to potentially explosive gas atmosphere

If the device is installed in Zone 2 without mounting it in a sufficiently suitable enclosure, gas, dust, water or other external interferences can cause the live device to spark. The sparks can ignite the surrounding potentially explosive atmosphere.

Only mount the device in an enclosure with degree of protection IP54 according to IEC/EN 60529. The enclosure must have an EU declaration of conformity according to the ATEX Directive for at least equipment category 3G.

Hazardous Area Installation Options

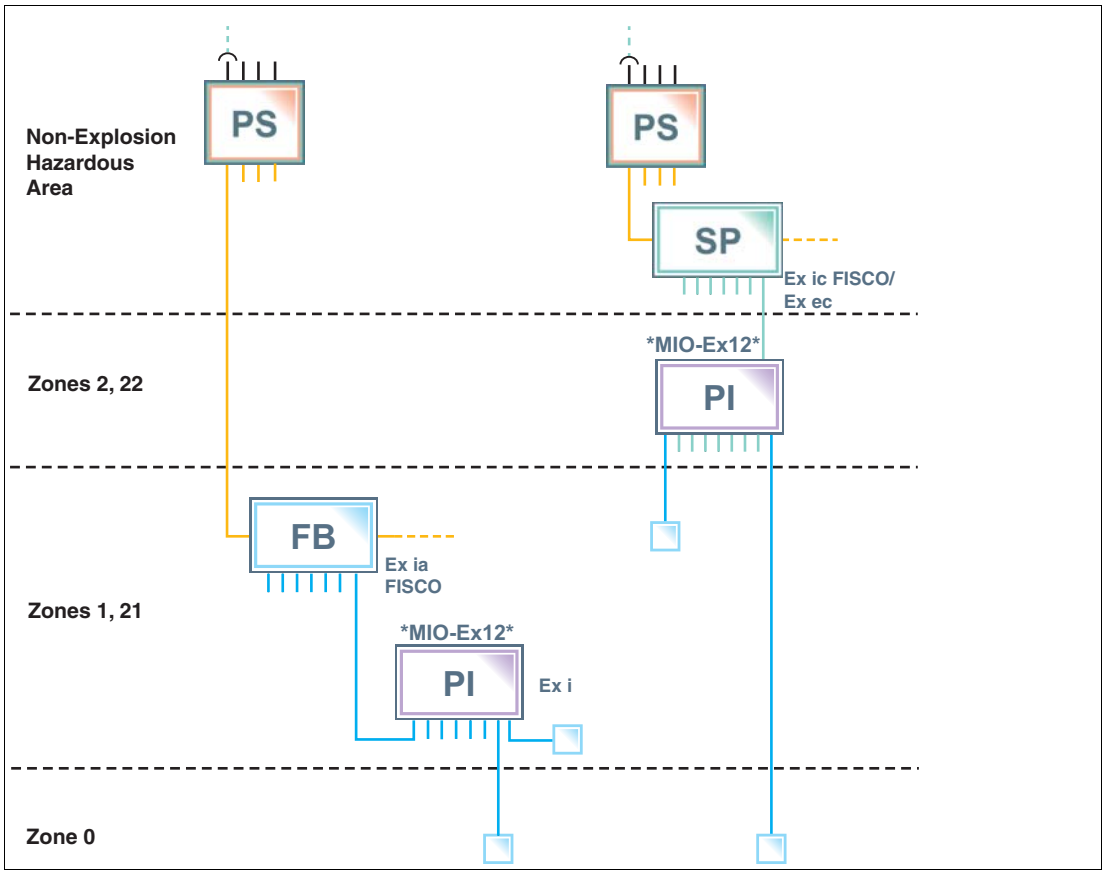


Figure 2.1 Installation options for the multi-input/output device in the hazardous area

Observe the EC-type-examination certificate or the statement of conformity. Pay particular attention to any "special conditions" that may be indicated.

3 Installation and Commissioning

In the following section you find information on how to install and commission the multi-input/output (MIO) device in your fieldbus topology.

Danger!

Danger to life from using damaged or repaired devices.

Using a defective or repaired device can compromise its function and its electrical safety.

- Do not use a damaged or polluted device.
- The device must not be repaired, changed or manipulated.
- If there is a defect, always replace the device with an original device from Pepperl+Fuchs.

Danger!

Explosion hazard from damaged electronic components

Premature wear of electronic components in a device that was previously used in a general electrical installation can cause sparks that can ignite the surrounding potentially explosive atmosphere.

Never install devices that have already been operated in general electrical installations in electrical installations used in combination with hazardous areas!

3.1 Mounting and Dismounting

Mounting/Dismounting F2D0-MIO*

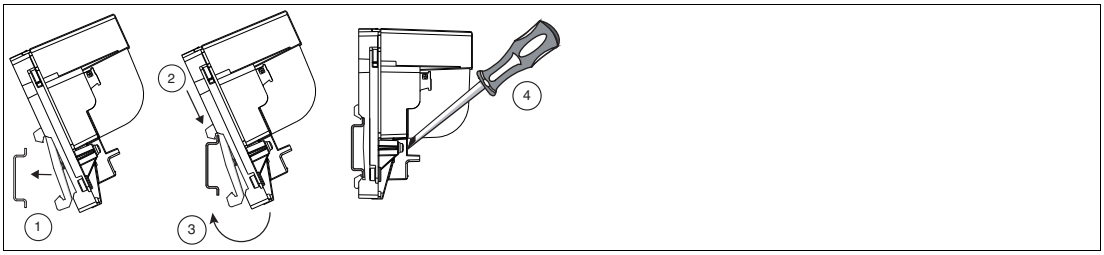
F2D0-MIO* is designed for panel (wall) mounting.

- Select mounting material that is suitable for the sub-surface (the wall).
- Ensure that the mounting material guarantees secure fastening.
- To attach the device: use 2 fixing screws with a diameter of 6 mm.
- To dismount the device: Undo the fixing screws and take the device off the wall.

Mounting/Dismounting R8D0-MIO*

R8D0-MIO* is designed for mounting on a 35 mm DIN mounting rail in accordance with EN 50022.

Mounting the R8D0-MIO* Electronics onto the DIN Mounting Rail



1 Place the R8D0-MIO* on the DIN mounting rail.

2 Use the top hook in order to hook the electronics onto the DIN mounting rail.

3 Move the bottom hook over the lower end of the DIN mounting rail.

4 Tighten the 2 fastening screws to attach the electronics on the DIN mounting rail. Tightening torque: 0.4 Nm

To dismount the device: Take off the device in reverse order.

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R8D0-MIO* Installation

Depending on the application, the R8D0-MIO* must be mounted in a suitable environment.

If mounted in Zone 2 for an Ex ec application, the environment (housing or enclosure) must ensure the following:

- IP54 in accordance with IEC 60529 for hazardous area Zone 2
- Pollution degree 2 or better according to IEC/EN 60664-1

3.2 Hardware Installation

3.2.1 R8D0-MIO* Cable and Connection Information

Danger!

Explosion hazard from insufficient insulation

Insufficient dielectric strength of insulators between intrinsically safe circuits may lead to interferences and to charge transfers that cause sparks. These sparks can ignite a potentially explosive atmosphere.

Ensure that the dielectric strength of the insulation between intrinsically safe circuits is at least 500 V according to IEC/EN 60079–14.

Danger!

Explosion hazard or danger to life from inadequate installation of cables and connection lines

If you do not install cables and connection lines according to the instructions given in the instruction manual, this can generate sparks that can ignite the surrounding potentially explosive atmosphere. Furthermore, insufficient installation practice can result in electric shock.

Ensure you carry out any cable gland installations in accordance with the instructions given in the instruction manual.

Danger!

Explosion hazard from connection damage

Manipulating connections outside of the specified ambient temperature range can lead to material damage, resulting in an unwanted failure of the connection. This could result in an increased explosion hazard in potentially explosive atmospheres.

Only manipulate connections in the specified ambient temperature range.
Temperature range: -5 C° ... +70 C°

Danger!

Danger to life from incorrect installation

Incorrect installation of cables and connection lines can compromise the function and the electrical safety of the device.

- Observe the permissible core cross section of the conductor.
- When using stranded conductors, crimp wire end ferrules on the conductor ends.
- Use only one conductor per terminal.
- When installing the conductors the insulation must reach up to the terminal.
- Observe the tightening torque of the terminal screws.

The following section describes the different connection details of the multi-input/output with particular reference to the torques required for a safe installation.

For any terminal connections, observe the following cable and connection information.

Screw Terminals: Cable and Connection Information

- Permissible core cross section:
  - Screw terminals with flexible or rigid wires: 0.2 mm^2 ... 2.5 mm^2
- Insulation stripping length: 7 mm
- If you use stranded connectors: Crimp on wire end ferrules
- Ensure that connectors are mechanically locked
- Torque required for tightening terminal screws: 0.5 Nm ... 0.6 Nm

Spring Terminals: Cable and Connection Information

- Permissible core cross section:
  - Spring terminals with flexible or rigid wires: 0.5 mm^2 ... 2.5 mm^2
- Insulation stripping length: 10 mm
- Ensure that connectors are mechanically locked
- Torque required for tightening terminal screws: 0.5 Nm ... 0.6 Nm

Tip

Double-check that the correct torques are used when un- and reinstalling the terminal during wiring activities!

Connecting the Trunk

The multi-input/output is connected to the trunk line via designated screw or spring terminals.

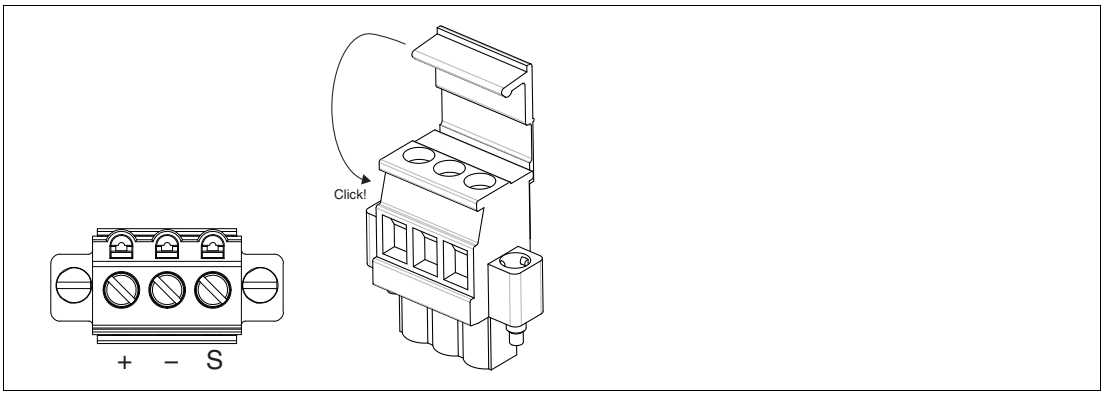
Danger!

Explosion hazard from open or missing trunk terminal cover

If the device is installed Zone 2 and powered by a non-intrinsically safe power source, carrying out hot work on the input/output terminals with an uncovered trunk terminal can lead to contact with solid particles or tools. This can cause the live device to spark. The sparks can ignite the surrounding potentially explosive atmosphere.

Ensure that the trunk terminal cover is present and correctly snapped onto the connector housing to guarantee IP30 rating.

Trunk Connection with Covered Screw Terminal



+ Segment +

- Segment -

S Shield connection

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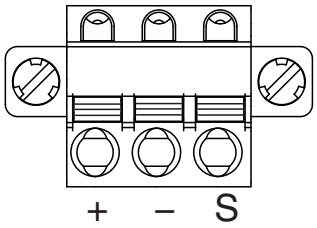
Trunk Connection with Spring Terminal

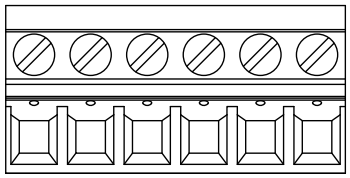


+ Segment +

- Segment -

S Shield connection

Multi-Input/Output Screw Terminal

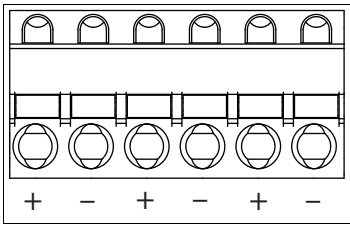


6-pin screw terminal for multi-inputs/outputs

+ Input/output +

- Input/output -

Multi-Input/Output Spring Terminal

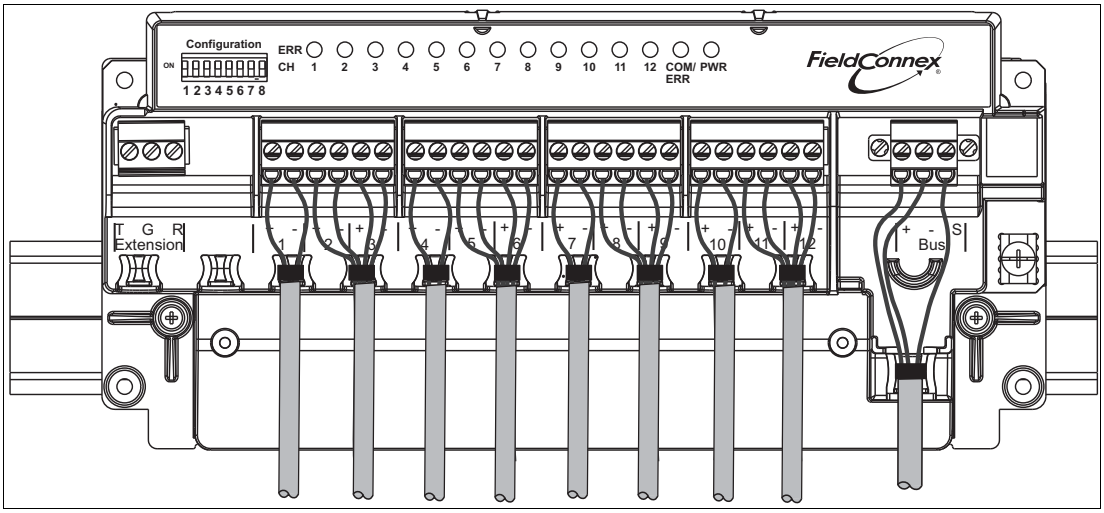


6-pin spring terminal for multi-inputs/outputs

+ Input/output +

- Input/output -

R8D0-MIO* Sample Connection Diagram



The connection diagram shows the sample connection of the multi-input/output as a valve coupler

Cable Position Fixture

The R8D0-MIO* electronics provides special fixtures for cable ties. To keep the cabling in a safe position, use the fixtures with cable ties.

Cable tie width: up to 4 mm

Using Mechanical Switches

If mechanical contacts are used as valve final position feedbacks, observe the following. The lead breakage and short circuit monitoring can be used after adding series and parallel resistors in the lead. In this case the prerequisites are:

- 1 x 1-kOhm series resistance for monitoring short circuit
- 1 x 10-kOhm parallel resistance for lead breakage detection

3.2.2 F2 Housing Degree of Protection

The following section contains information concerning the installation and sealing of the cable glands and the housing cover.

Danger!

Explosion hazard or danger to life from inadequate installation of cable glands

If you do not install cable glands according to the instructions given in the instruction manual, this can generate sparks that can ignite the surrounding potentially explosive atmosphere. Furthermore, insufficient installation practice can result in electric shock.

Ensure you carry out any cable gland installations in accordance with the instructions given in the instruction manual.

Fixing the Housing Cover

Before closing the housing cover: Visually inspect the housing for any visible signs of damage on the cover seal. If damaged, replace the seal with an original seal wear part.

Tightening torque for the screws of the housing cover: 2.5 Nm

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General Information on the Installation of Cable Glands

When installing cable glands, observe the following:

- Only insert permanently laid cables and wires into the cable glands.
  - Ensure that the cables laid do not execute any strain on the cable glands.
  - For permissible cable diameters, refer to the respective datasheet.
- Use an appropriate strain relief clamp, e.g., a suitable cable clamp.
- Seal unused cable glands with a suitable plug or replace them with appropriate screw plugs. Observe the required degree of protection IP66.
  - For a choice of stop plugs and screw plugs, refer to the respective datasheets.
  - Note that the ambient temperature range can be restricted by the stopping plug.
- Protect plastic cable glands against mechanical hazard.
- Ensure you use the correct tightening torques when installing cable glands or plugs. For detail see tables with torque information below.

The specific technical data may vary depending on the type of cable gland or plug you use for your installation. The following cable glands or plug types are documented and information is available at www.pepperl-fuchs.com:

Cable Entry Option		Cable Gland or Plug Type
00	Sealing plug plastic: 1 x M20, 8 x M16	SP.PE.M20.PA.C SP.PE.M16.PA.C
01	Sealing plug stainless steel: 1 x M20, 8 x M16	SP.MD.M20.SS.C SP.MD.M16.SS.C
02	Cable glands plastic: 1 x M20, 8 x M16	CG.PEDS.M20.PA.C.10 CG.PIDS.M16S.PA.C.10
03	Cable glands nickel plated brass: 1 x M20, 8 x M16	CG.NA.M20S.BN.C CG.NA.M16.BN.C
04	Cable glands stainless steel: 1 x M20, 8 x M16	CG.NA.M20S.SS.C CG.NA.M16.SS.C
05	Cable glands plastic 5 x M20	CG.PEDS.M20.PA.C.10 CG.PIDS.M20.PA.C.10
		SP.PE.M20.PA.C

F2D0-MIO* Input/Output Cable Glands

		Sensor Entries Clamping Ranges: Torques				
Cable Entry Option		**CG or Plug Type**	**S1+S2+S3**	**S1+S2**	**S1**	**Body**
00	1 x M20, 8 x M16 sealing plug plastic	SP.PE.M16.PA.C	-	-	-	1.5 Nm
01	1 x M20, 8 x M16 sealing plug stainless steel	SP.MD.M16.SS.C	-	-	-	4 Nm
02	1 x M20, 8 x M16 cable glands plastic	CG.PIDS.M16S.PA.C.10	-	4 … 5 mm: 3.5 Nm	5 … 8 mm: 4 Nm	1.5 Nm
03	1 x M20, 8 x M16 cable glands nickel plated brass	CG.NA.M16.BN.C	4 … 6 mm: 20 Nm	6 … 9 mm: 18 Nm	9 … 12 mm: 15 Nm	4 Nm
04	1 x M20, 8 x M16 cable glands stainless steel	CG.NA.M16.SS.C	4 … 6 mm: 20 Nm	6 … 9 mm: 18 Nm	9 … 12 mm: 15 Nm	4 Nm
05	5 x M20 cable glands plastic	CG.PIDS.M20.PA.C.10	-	6 … 8.5 mm: 5 Nm	7 … 12 mm: 5 Nm	2 Nm

Table 3.1 The torques that are actually required depend on the clamping range. This range is determined by the diameter of the cable and the resulting seal combinations (S1+S2+S3, S1+S2, S1) used with the cable gland or plug. For details see the documentation on the cable gland or plug type available at www.pepperl-fuchs.com.

F2D0-MIO* Fieldbus Cable Gland

		Fieldbus Entries Clamping Ranges: Torques				
Cable Entry Option		**CG or Plug Type**	**S1+S2+S3**	**S1+S2**	**S1**	**Body**
00	1 x M20, 8 x M16 blind plug plastic	SP.PE.M20.PA.C	-	-	-	2 Nm
01	1 x M20, 8 x M16 blind plug stainless steel	SP.MD.M20.SS.C	-	-	-	5.5 Nm
02	1 x M20, 8 x M16 cable glands plastic	CG.PEDS.M20.PA.C.10	-	6 … 8.5 mm: 5 Nm	7 … 12 mm: 5 Nm	2 Nm
03	1 x M20, 8 x M16 cable glands nickel plated brass	CG.NA.M20S.BN.C	4 … 6 mm: 20 Nm	6 … 9 mm: 18 Nm	9 … 12 mm: 15 Nm	5.5 Nm
04	1 x M20, 8 x M16 cable glands stainless steel	CG.NA.M20S.SS.C	4 … 6 mm: 20 Nm	6 … 9 mm: 18 Nm	9 … 12 mm: 15 Nm	5.5 Nm
05	5 x M20 cable glands plastic	CG.PEDS.M20.PA.C.10	-	6 … 8.5 mm: 5 Nm	7 … 12 mm: 5 Nm	2 Nm
05	5 x M20 cable glands plastic	SP.PE.M20.PA.C	Unused thread			2 Nm

Table 3.2 The torques that are actually required depend on the clamping range. This range is determined by the diameter of the cable and the resulting seal combinations (S1+S2+S3, S1+S2, S1) used with the cable gland or plug. For details see the documentation on the cable gland or plug type available at www.pepperl-fuchs.com.

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Note!

Careful when tightening cap nuts!

- The cap nuts must be securely tightened. Tightening the cap nuts too much or not enough both can affect the degree of protection.
- The tightening torques of cap nuts vary, depending on the cable type used. For exact details refer to the documentation of your cable manufacturer.

3.2.3 Grounding and Shielding

Equipotential Bonding of Devices in F2* Metal Housings

For electronic components in F2* metal housings in hazardous areas, suitable equipotential bonding in accordance with IEC/EN 60079 is required. Therefore, the device is designed as follows:

- The shield (terminal S) of the intrinsically safe fieldbus trunk is internally connected to the F2* metal housing.
- The housing has a grounding point with a grounding screw. The grounding connection must be secured against loosening and corrosion, e. g., by using tinned cable plates.

Note!

Ensure potential equalization of F2 Metal Housings

Ensure that the housing is connected properly to the potential equalization.

Shielding of the Fieldbus Trunk Using the R* Electronic Component in Intrinsically Safe Segments

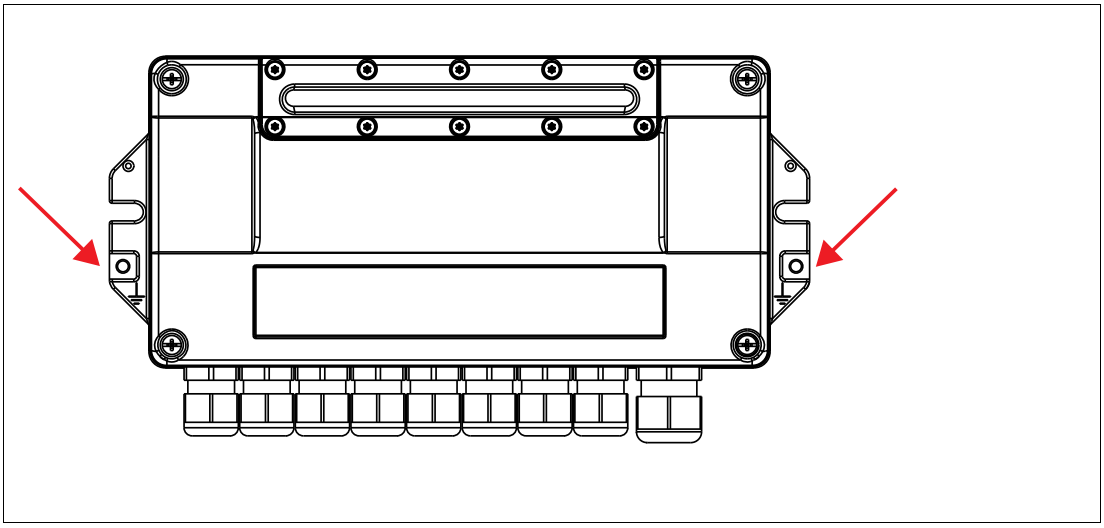
The shield (terminal S) of the fieldbus trunk is internally connected to the grounding point.

Grounding and Shielding *D0-MIO-Ex12*

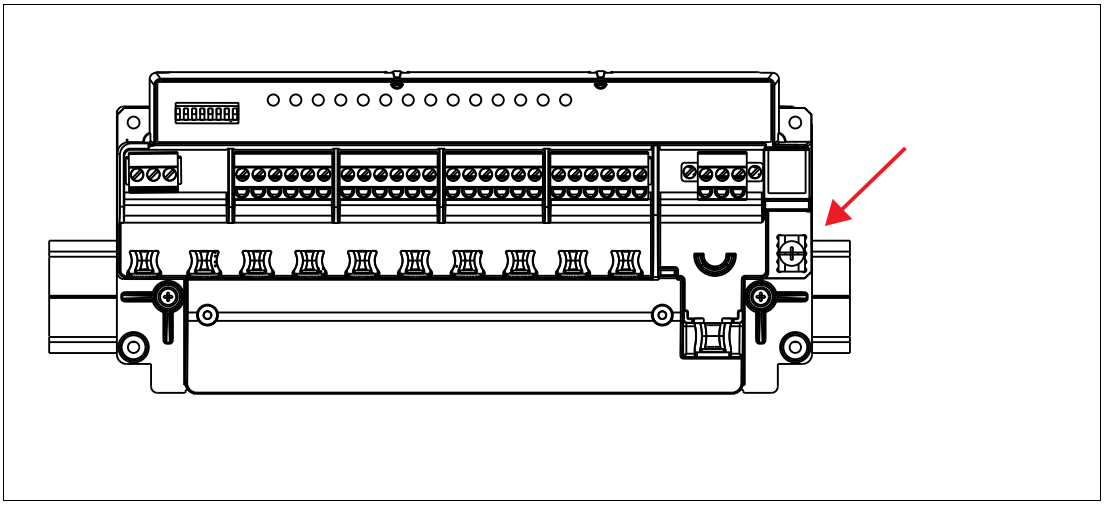
Shielded cables for the valve or sensor are not required.

The device provides a grounding terminal for connecting to an equipotential bonding.

F2D0-MIO-Ex12* Grounding Points



R8D0-MIO-Ex12* Grounding Point



Connection to Equipotential Bonding System

Caution!

Risk of electric shock or property damage from inadequate grounding

If you fail to connect all metal parts of the device to protective local earth correctly, this could result in potential equalization currents. These currents could hurt operating personnel or cause property damage.

The grounding terminal is not a safety earth: Do not use the grounding terminal to ground exposed metal parts.
Ground exposed metal parts of the device separately. Ensure that a correct grounding is guaranteed at all times.

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All shield connections are internally connected to the "Shield/Screen GND" grounding terminal.

Connecting the Ground Connection Cable

Note!

Use a cable with a minimum cross section of 4 mm².

1. Connect the ground cable to a cable lug.
2. Position the cable lug over the grounding terminal with the cable pointing downwards.
3. Screw the cable lug to the grounding terminal with 2 toothed lock washers inserted between screw, lug, and terminal as illustrated:

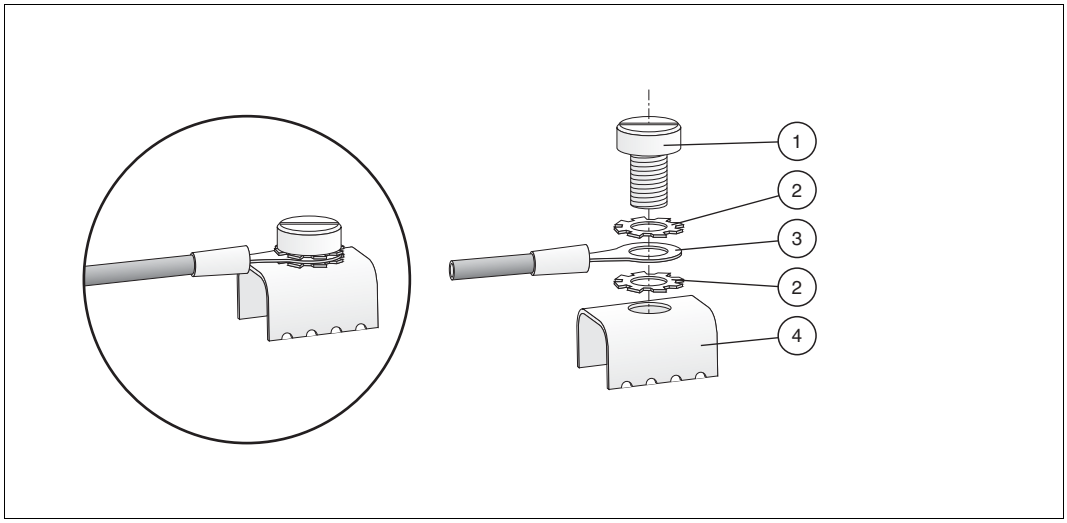

Figure 3.1 Connecting the ground connection cable

1 Screw
2 Toothed lock washer
3 Cable lug
4 Grounding terminal on motherboard

4. Tighten the screw with a torque of 1.5 Nm.

   ↳ The cable lug is properly attached and cannot come loose.

Connect the "Shield/Screen GND" grounding terminal to an equipotential bonding system.

3.2.4 Dip Switch Settings

You can use the DIP switches of the device in order to enable or disable the simulation and the hardware write protection.

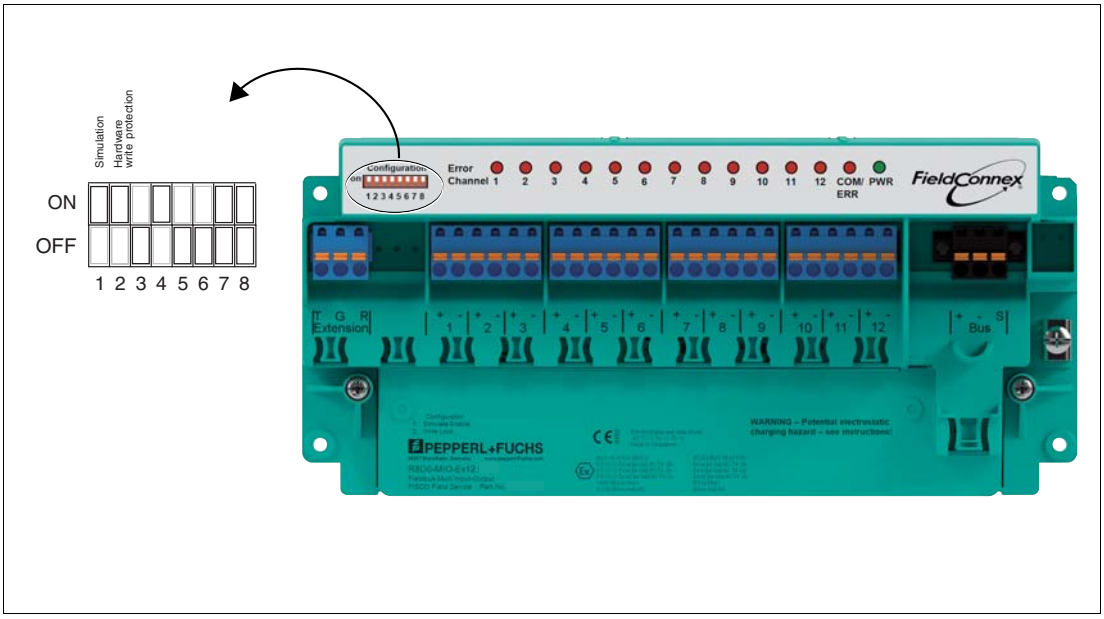

Figure 3.2 DIP switches to set the hardware write protection and simulation

The device has 8 DIP switches:

- DIP switch S1: Simulation ON/OFF.
  With activated simulation (ON), the valve position transferred from the transducer block to the function block can be set by the control system independent from the actual valve position.
- DIP switch S2: Hardware write protection ON/OFF.
  Parameterization of the device via the bus is no longer possible when write protection is activated (ON).
- DIP switch 3 ... 8: Unused

3.3 Firmware Download

The MIO supports firmware download according to FF-883 device download, class 2. In order to enable the firmware download, set the resource block out of service (OoS).

During the firmware download, the MIO device does not operate its IO function and goes through a reset, while activating the new firmware version.

Refer to your system software documentation for information on how to perform the firmware download. If available, new firmware files can be downloaded from www.pepperl-fuchs.com.

3.4 Commissioning in Valve Coupler Mode

Danger!

Danger to life from unannounced operation of plant parts

During the initialization run, the valve is opened and closed once. Performing an initialization run without explicit permission or having the plant in maintenance mode can pose personnel in the plant at risk of coming into contact with hazardous substances or being exposed to unexpected mechanical hazards.

Before starting the initialization run, ensure that you have permission/the plant is in maintenance mode, so you do not endanger persons.

Caution!

Property damage from unannounced operation of plant parts

During the initialization run, the valve is opened and closed once. Performing an initialization run without explicit permission or having the plant in maintenance mode can pose the plant at risk of being damaged.

Before starting the initialization run, ensure that you have permission/the plant is in maintenance mode.

When commissioning the MIO device in the valve coupler mode, a transducer block is parameterized in 2 steps.

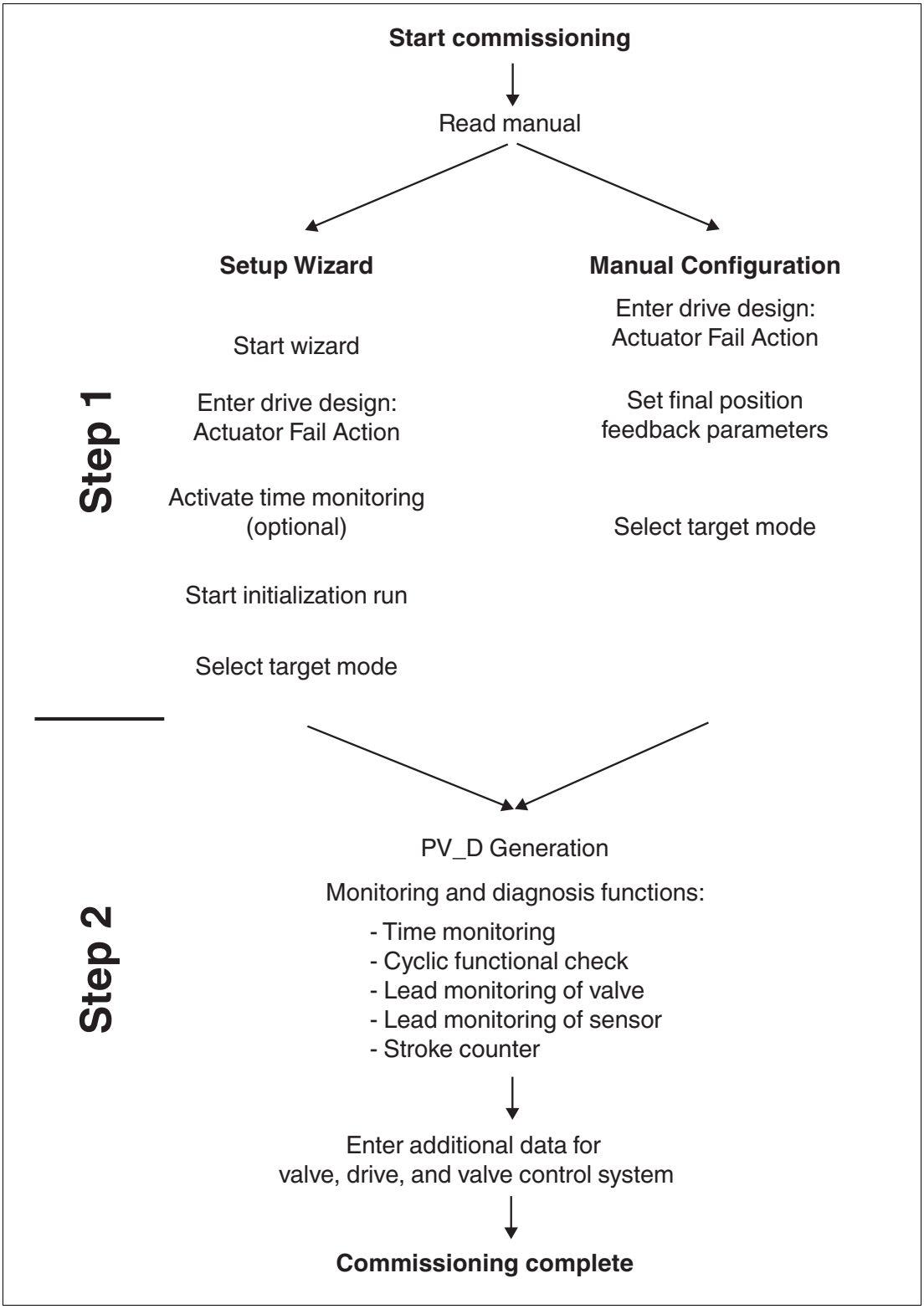

Figure 3.3 Flowchart for valve coupler commissioning

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Note!

Implementing the Setup Wizard

The setup wizard is executed in the device description as a method. Refer to the documentation of the control system in use for information on how to start this method. For the use of the setup wizard, we recommend you also read the procedure for manual configuration.

Valve Coupler Mode Commissioning - Step 1

Set parameters in order to describe the valve used and connected position feedback sensors (PFCs). Select whether to perform the parameterization manually or with the setup wizard.

1. Set the actuator fail action and PFC parameters manually use the wizard to assist you with the following parameterization tasks:
   - Selecting a valve drive design in the Act. Fail Action parameter.
   - Initialization run: Automatic value determination for the Sensor Usage parameter Note: During the initialization run, the valve is opened and closed once. Ensure, that your plant is in maintenance mode, before starting the initialization run so you do not endanger persons and tamper dangerously with the plant process.
   - Activation of time monitoring of breakaway and transit times. In this case, the current breakaway and running times of the valve are determined during the initialization run and taken over as reference values. The maximum permitted deviation is set to 30 %.
2. Determine the "target mode" of the transducer block.

Parameterization Step 1 for Commissioning a Valve Coupler

Step	Description	Transducer Block Parameters	Further Information
1.1	Setting the valve design.	Act. Fail Action	See chapter 4.5.2
1.2	Automatic determination of the sensor usage parameter.	Sensor Usage	See chapter 4.5.3
1.3	Activation of time monitoring and breakaway times.	Valve Monitoring	See chapter 4.5.5
1.4	Setting the target mode.	TARGET_MODE	See chapter 4.5.4

Valve Coupler Mode Commissioning - Step 2

During the second step of parameterization, you can adapt the valve position information that was transferred to the function block according to your requirements.

Prerequisite: Set the device in the mode Out of Service (OOS) in order to modify the PV_D Generation parameter.

You can activate the following diagnostic options:

- Lead breakage or lead short circuit monitoring for the valve lead.
- Lead breakage or short circuit monitoring for the PFC lead.
- Cyclic functional test for the position "open" or "closed".
- Stroke counter and limit value.

The diagnostic information can be stored in the MIO device via the connected valve and the connected drive.

After having set all parameters, ensure that no "configuration error" is displayed in the BLOCK_ERR parameter of the parameterized transducer block.

Parameterization Step 2 for Commissioning a Valve Coupler

Step	Description	Transducer Block Parameters	Further Information
2.1	Sensor signals for the value position feedback.	PV_D Generation	See chapter 4.5.3
2.2	Diagnostic settings for lead interruption or short circuit monitoring.	Lead Fault Monitoring	See chapter 4.5.8
2.3	Diagnostic settings the cyclic function test.	Valve Monitoring	See chapter 4.5.6
2.4	Setting the stroke counter and limit value.	Valve Monitoring	See chapter 4.5.7

More Information
For more information on diagnostic messages and alarms, see chapter 4.5.12. For a detailed list of the messages of the tranducer block parameters and for troubleshooting, see chapter 5.4.

Tip

Test During Commissioning

During commissioning, you can perform function tests as follows: Set the DO function block to the manual mode ("Man") and specify the reference value for the valve position directly via OUT_D.

3.5 Commissioning in Binary Input Mode

In order to commission the MIO device in the binary input mode, parameterize the transducer block parameters in the suggested order below.

Parameterization Steps for Commissioning a Binary Input

Step	Description	Transducer Block Parameters	Further Information
1	Enable/disable hardware inputs 1, 4, 7, 10	Mode	See chapter 4.6.2
2	Set sampling time hardware inputs 1, 4, 7, 10	Sensor On Time	See chapter 6
3	Enable/disable hardware inputs 2, 5, 8, 11	Sensor A Mode	See chapter 4.6.3
4	Enable/disable hardware inputs 3, 6, 9, 12	Sensor B Mode	See chapter 4.6.3
5	Enable/disable lead fault monitoring for all hardware inputs	Lead Fault Monitoring	See chapter 4.6.4
6	Set fault state value for all hardware inputs	Sensor Fault State	See chapter 4.6.4
7	Set information parameters of the transducer blocks	e. g., TAG_DESC	See chapter 6

3.6 Commissioning in Frequency or Counter Mode

In order to commission the MIO device in the frequency or counter mode, parameterize the transducer block parameters in the suggested order below.

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Parameterization Steps for Commissioning a Frequency Input or Counter

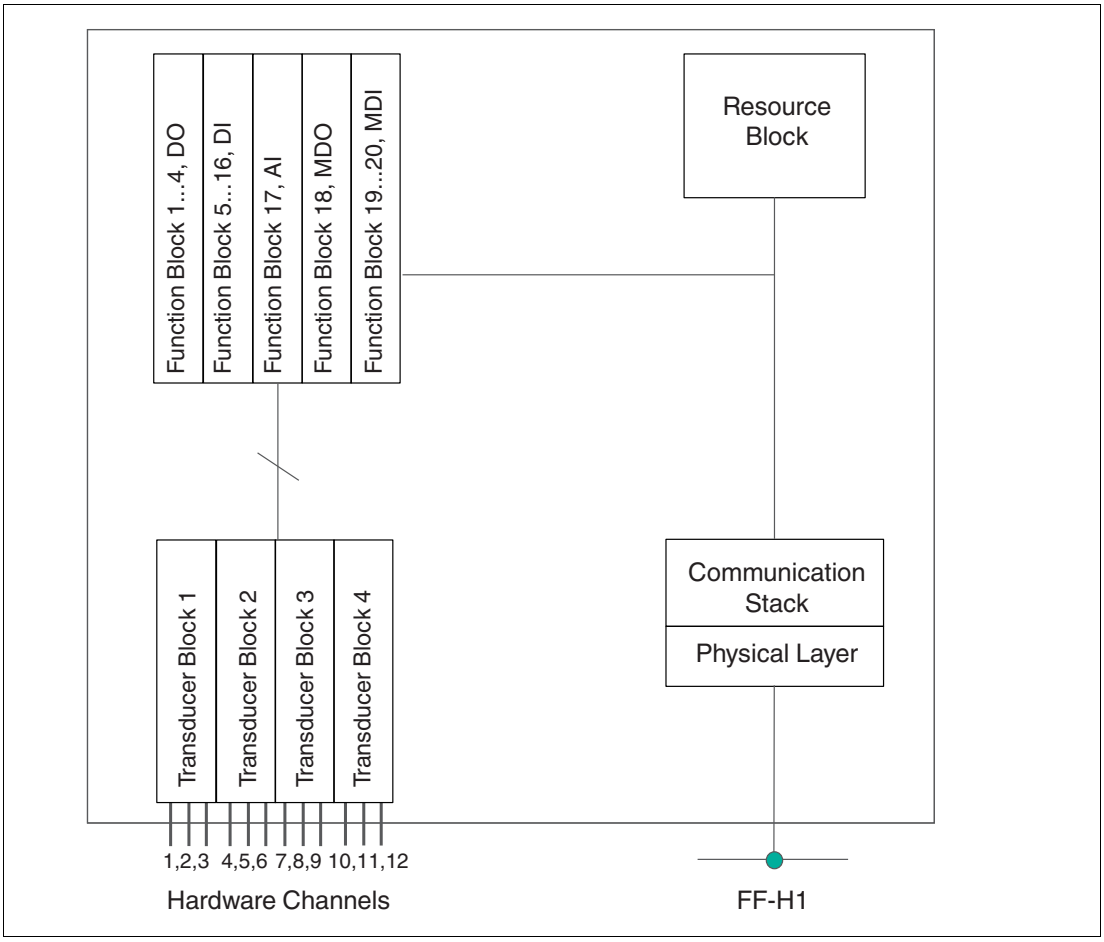
Step	Description	Transducer Block Parameters	Further Information
1	Enable/disable hardware inputs 2, 5, 8, 11	Sensor A Mode	See chapter 4.6.2
2	Enable/disable hardware inputs 3, 6, 9, 12	Sensor B Mode	See chapter 4.6.3
3	Enable/disable lead fault monitoring for all hardware inputs 1, 2, 3, 4, 8, 9, 11, 12	Lead Fault Monitoring	See chapter 4.6.4
4	Set fault state value for hardware inputs 2, 3, 5, 6, 8, 9, 11, 12	Sensor Fault State	See chapter 6
5	Set information parameters of the transducer blocks	e. g., TAG_DESC	See chapter 6

4 Parameterization and Operation

The following section explains how to parameterize and operation the *D0-MIO-Ex12.FF devices.

4.1 Introduction

The MIO FOUNDATION Fieldbus device supports 1 resource block, 4 transducer blocks, and multiple function blocks. The I/O hardware channels are fixed assigned to the transducer blocks.



Also, a "communication stack" is available that organizes the data exchange between the fieldbus and the application. Depending on the mode of operation, a selection of instantiable function blocks are available.

Function Block Overview

Function Block Type	Max. Number of Function Blocks*	Default Number of Function Blocks
DO, Discrete Output	4	4
DI, Discrete Input	12	2
AI, Analog Input	1	1
MDO, Multiple Discrete Output	1	1
MDI, Multiple Discrete Input	2	2

Table 4.1 *The MIO device supports instantiable function blocks. Refer to your control system documentation for information on how to instantiate function blocks.

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The link between a specific function block and a transducer block is made by channel reference.

4 different types of operation modes are available which are selectable with the resource block parameter MIO_MODE:

Valve Coupler

In the valve coupler mode, 4 discrete output (DO) function blocks and 1 multiple discrete output (MDO) function block can be used individually to establish a FOUNDATION Fieldbus application.

A reference value is specified for the valve position and the current valve position feedback. The reference value for the valve position is transferred to one of the transducer blocks. This transducer block then controls the valve and reads back the current position via the position feedback sensors (PFCs).

In addition, several diagnostic and monitoring functions for the valve can be activated in the transducer blocks.

Binary Input

In the binary input mode, up to 12 discrete inputs are available. 12 discrete input function blocks (DI) and 2 multiple discrete input (MDI) function blocks are available.

For 4 inputs, the sampling time is configurable, for the remaining 8, the sampling rate is fixed.

Diagnostic functions like lead short circuit and breakage can be activated in the transducer blocks.

The position feedback input values can also be transmitted by using individual discrete input function blocks (DI) or multiple input function blocks (MDI).

Frequency Input

In the frequency input mode, 1 frequency input and 8 discrete inputs are available. 1 analog input (AI), 8 discrete inputs (DI), and 1 multiple discrete input (MDI) function block are available.

Diagnostic functions like lead short circuit and breakage can be activated in the transducer blocks.

Counter Input

In the counter input mode, 1 counter input and 8 discrete inputs are available. 1 analog input (AI), 1 discrete output (DO) function block, 8 discrete input (DI) function blocks, and 1 multiple discrete input (MDI) function block are available.

The DO function block allows you to reset the counter value.

The diagnostic function lead breakage can be activated in the transducer blocks.

The following sections are focused on the commissioning of the transducer blocks and their interaction with the function blocks and the resource block. Representation and commissioning of the function blocks and resource block are specific to the control system. Detailed information can be found the documentation of the control system. This document includes a concise list with the explanation of all parameters of the different types of blocks.

4.2 Prerequisites

To parameterize the MIO device, the associated device description (DD) must be included in the engineering tool used. If you require to integrate the MIO device in the control system by yourself, you find the necessary files on the Internet under www.pepperl-fuchs.com.

For detailed information on the import of the device description, refer to the documentation of the the control system in use.

4.3 Device Identification

Each FOUNDATION Fieldbus device has a unique device ID. The device ID is structured as follows for the MIO device:

Manufacturer Idenification	Type	Serial Number
502B46 = Pepperl+Fuchs	0007 = Multi-Input/Output (MIO) device	28583027543174

These 3 identification fields are identically structured for all FOUNDATION Fieldbus MIO devices. If several MIO devices are connected to one FF-H1 segment, these devices are differentiated via their individual 14-digit serial numbers. The serial number is also provided on a label attached to the device.

4.4 Commissioning Procedure

The MIO device supports different modes of operation as described. For more information, see chapter 4.1.

Depending on the mode of operation you selected, adhere to the commissioning procedure that applies for this mode.

1. Read manual.
2. Start commissioning.
3. Set mode of operation MIO_MODE (resource block) to either one of the following modes:
    1. Valve Coupler
    2. Binary Input
    3. Frequency Input
    4. Counter Input
4. Complete commissioning.

4.5 Parameterization in Valve Coupler Mode

4.5.1 Interaction of Transducer Blocks and DO Function Blocks

In each of the DO function blocks, a reference value is calculated for the valve position in the OUT_D parameter. This value is transferred to the transducer block that is connected with the function block. A function block is connected to a transducer block through the Channel function block parameter. This parameter contains the channel number 1 ... 4 of the transducer block that the function block requires for interaction.

OUT_D of the function block can assume values from 0 ... 255. The value "0" means valve "closed", values ≠ 0 mean valve "open".

Note!

Specifics of Reference Value

This specific reference value is contrary to many conventional devices where the value "0" means "valve current OFF" and "1" means "valve current ON".

The transducer block accepts this reference value only if the status is GOOD (C) or GOOD (NC). However, if the status is UNCERTAIN or BAD, the auxiliary valve is not controlled electrically and the drive moves into the mechanical safety position.

If the current valve position is determined by 2 final position feedback sensors, the transducer block transfers the current valve position back to the DO function block. The function block represents the transferred value in the READBACK_D parameter. The numerical value depends on the parameterization of the transducer block.

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More Information
For more information on the paramterization of the transducer block, see chapter 4.5.3.

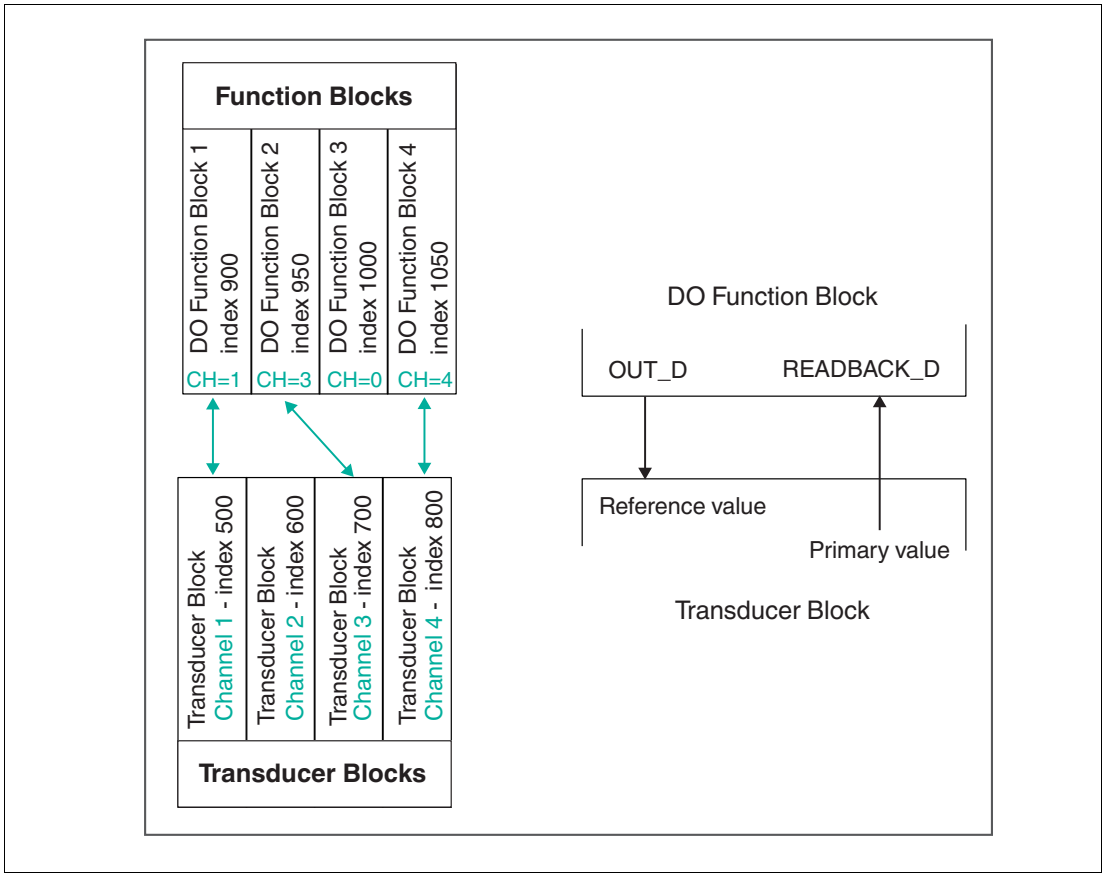

Figure 4.1 Interface of DO function block/transducer block

Additional Diagnostic Information

In addition to the reference value for the valve position and the current valve position, also diagnostic information is transferred between the function block and the transducer block. Thus, it is possible to receive diagnostic messages from the transducer block also with control systems which do not support alarms of transducer blocks.

For more information, see chapter 4.5.12.

Primary Value Parameter - Inversion and Behavior in Cyclic Transfer

The READBACK_D parameter is shown with the Primary Value parameter within the DO function block. If the IO option "invert" is activated in the function block, the numerical value is inverted. That means, a value of "0" becomes "1", a value ≠ 0 becomes "0".

If the current valve position is to be cyclically transferred to a control system or used in a function block application, the value of the Primary Value parameter can be transferred to BKCAL_OUT_D via the IO option "PV for BKCal_Out". If this option is not activated, the value of BKCAL_OUT_D is only a copy of the current reference value.

4.5.2 Valve/Actuator Design

This section explains the setting options for the behavior of the valve or actuator with the Act. Fail Action parameter, i.e., the actuator fail action.

Note that for setting this parameter, the target mode of the transducer block must be set to "Out of Service" (OOS).

Actuator Drive Design with Act. Fail Action Parameter

The MIO device supports the 2 most frequent valve drive designs "self-opening" and "self-closing". For choosing between these 2 options, the actuator drive and the control actuators must be considered a unit. Self-opening and self-closing designate the behavior of the drive when setting the electrical control system to "0". This is independent of the behavior of the drive during a failure of the auxiliary power. The following values can be set:

- Undefined
- Self-opening
- Self-closing

The value "undefined" is the default setting at the time of delivery. Setting the valve drive to a defined state is required for the configuration of the MIO device. The transducer block leaves the mode "Out of Service" only if 1 of the 2 options "self-opening" or "self-closing" is set.

Depending on the setting of the Act. Fail Action parameter, the transducer block determines whether or not the connected auxiliary valve must be controlled electrically for starting a position set by the function block.

Controlling a double-acting drive requires 2 channels, i. e., 2 DO function blocks and 2 transducer blocks.

4.5.3 Final Position Feedback

This section describes the options for parameterizing the final position feedback contact.

Prerequisite: Ensure that the Act. Fail Action parameter has a value assigned for the design of the valve drive.

The response of the final position feedback contact is influenced by the following 2 parameters:

- Sensor Usage parameter: Describes whether a final position feedback contact is connected to the MIO device and how to evaluate its signals.
- PV_D Generation parameter: If the signals of the final position feedback contacts are evaluated, this parameter determines how to further process the evaluated signals prior to transferring them to the function block.

Sensor Usage Parameter

The following settings are possible:

- No position detection
- Use sensor values for the Primary Value
- Use options A ... D to determine the Sensor Usage parameter

No position detection

No final position feedback contact is connected to the MIO device. The current reference value is returned as valve position to the function block.

Use sensor values for the Primary Value parameter

The 2 signals of the final position feedback contacts are transferred to the function block without evaluation. The 2 binary signals are represented on bit 0 (position feedback contact A) and bit 1 (position feedback contact B). Here, numerical values can be generated from 0 ... 3. Possible problems are described in the next section PV_D Generation parameter.

Observe that the MIO device interprets a final position feedback contact signal as follows:

High current => logical 1

Low current => logical 0

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A ... D Sensor Usage

When selecting one of the options A ... D, the transducer block determines from the position feedback contact signals the position of the valve as "open", "closed", "intermediate" at that moment. Whether an actuated sensor or activated mechanical contact represents an open or a closed valve, depends on the design of the position feedback and the electrical characteristics of the final position feedback contacts. A general representation is thus not possible.

Each of the 4 options corresponds to 1 set of combinations of the 2 final position feedback contacts signals and the valve positions "open", "intermediate", and "closed". The following 4 tables show the signal combinations of final position feedback contact A and final position feedback contact B assigned to a valve position for the options A ... D.

Sensor Usage A

Valve Position	Final Position Feedback Contact A	Final Position Feedback Contact B
Closed	0	1
Intermediate	0	0
Open	1	0
Uncertain	1	1

Sensor Usage B

Valve Position	Final Position Feedback Contact A	Final Position Feedback Contact B
Closed	1	0
Intermediate	1	1
Open	0	1
Uncertain	0	0

Sensor Usage C

Valve Position	Final Position Feedback Contact A	Final Position Feedback Contact B
Closed	1	0
Intermediate	0	0
Open	0	1
Uncertain	1	1

Sensor Usage D

Valve Position	Final Position Feedback Contact A	Final Position Feedback Contact B
Closed	0	1
Intermediate	1	1
Open	1	0
Uncertain	0	0

One of the options A ... D must be selected in order to make use of time monitoring, stroke counter function, or cyclic functional tests.

The letter/number combinations after the options A ... D denote the signal input for the positions:

- O: open
- I: intermediate
- C: closed

The following table gives the assignment of the position feedback contact signals "0" and "1" to the numerical values 0 ... 3:

Number	Position Feedback Contact A	Position Feedback Contact B
0	0	0
1	1	0
2	0	1
3	1	1

PV_D Generation Parameter

If you selected one option from A ... D for the Sensor Usage parameter, you can use the PV_D Generation parameter to determine what to do with the evaluated signals prior to transferring them to the function block. You can select one of the following options:

- Valve position
- Valve position extended
- Intermediate => Closed
- Intermediate => Open
- Intermediate => Next
- Intermediate => Last (default)

Valve Position

The position of the valve is transferred to the function block as a numerical value:

Numerical Value	Valve Position
1	Closed
2	Open
3	Intermediate position
0	Unkown

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Valve Position Extended

In the intermediate position of the valve, the information on the valve position is extended with the information "opening" and "closing". This information is determined by the current control process and need not coincide with the actual direction of travel (e. g., when changing the set position while the valve is in the intermediate position).

Numerical Value	Valve Position
1	Closed
2	Open
3	Intermediate position/opening
4	Intermediate position/closing
0	Unkown

The options "Valve Position" and "Valve Position Extended", and the setting "Use sensor values for PV_D" in the Sensor Usage parameter are intricate to be used with the function block.

The transducer block transfers the valve position to the function block as part of the READBACK_D parameter. From there, the valve position information is transferred to the Primary Value parameter which can be cyclically transferred to a control system via BKCAL_OUT_D. Alternatively, the valve position information can be used in a function block application.

If an inversion is active in the function block, the numerical value "0" becomes "1" and all numerical values ≠ 0 become "0". That means, all valid valve positions are inverted to "0".

Also, the IO options of the DO function block "SP-PV Track in LO" and "SP-PV Track in Man" do no longer work because the range of values of the Primary Value parameter does not correspond to that of SP_D.

In order to ensure a more straightforward use of the valve position information in the function block, you can choose one of the following options.

These options show the valve position at the value range of the set position "closed" (0) or "open" (1) and determine the position information to be issued in the intermediate position:

- **Intermediate => Closed**: The intermediate position is always interpreted as "closed"
- **Intermediate => Open**: The intermediate position is always interpreted as "open"
- **Intermediate => Next**: During a closing process, the intermediate position is always interpreted as "closed" and during an opening process as "open"
- **Intermediate => Last** (default setting): During a closing process, the intermediate position is interpreted as "open" and during an opening process as "closed"

The default setting "Intermediate => Last" has the effect that during an opening or closing process, the last position is displayed until the valve has actually reached the reference position. This is useful, e. g., for a sequential valve control when any further steps can only take place after the valve has fully reached the desired position. In this case, only the reference value must be compared with the feedback.

4.5.4 Target Mode

The "Target mode" determines the mode of operation of the MIO device. The modes of operation are possible:

- Out of service (OOS, default setting)
- Auto
- Manual (Man)

In OOS mode, the transducer block is deactivated and the valve output is not controlled. Thus, a connected actuator drive moves in its mechanical safety position. Use this mode if you intend to adjust basic function parameters, e. g., Act. Fail Action, Sensor Usage, and PV_D Generation or if the corresponding channel is not used.

The "Auto" mode is provided for operation. The transducer block operates in this mode as specified by parameterization.

"Man" is used by the setup wizard and must not be modified.

4.5.5 Time Monitoring

The MIO device can monitor the breakaway and transit times of a valve. You can activate the time monitoring parameter to measure the breakaway and transit times of the connected valve. You can compare the measured values to the reference values during each reference value modification of the valve position.

If a measured time is longer or shorter than the reference time plus a specified tolerance, an alarm is generated. The times measured last are also displayed.

Prerequisites

The following parameters must be set as a prerequisite for time monitoring:

- Act. Fail Action. For more information, see chapter 4.5.2.
- Sensor Usage. For more information, see chapter 4.5.3.

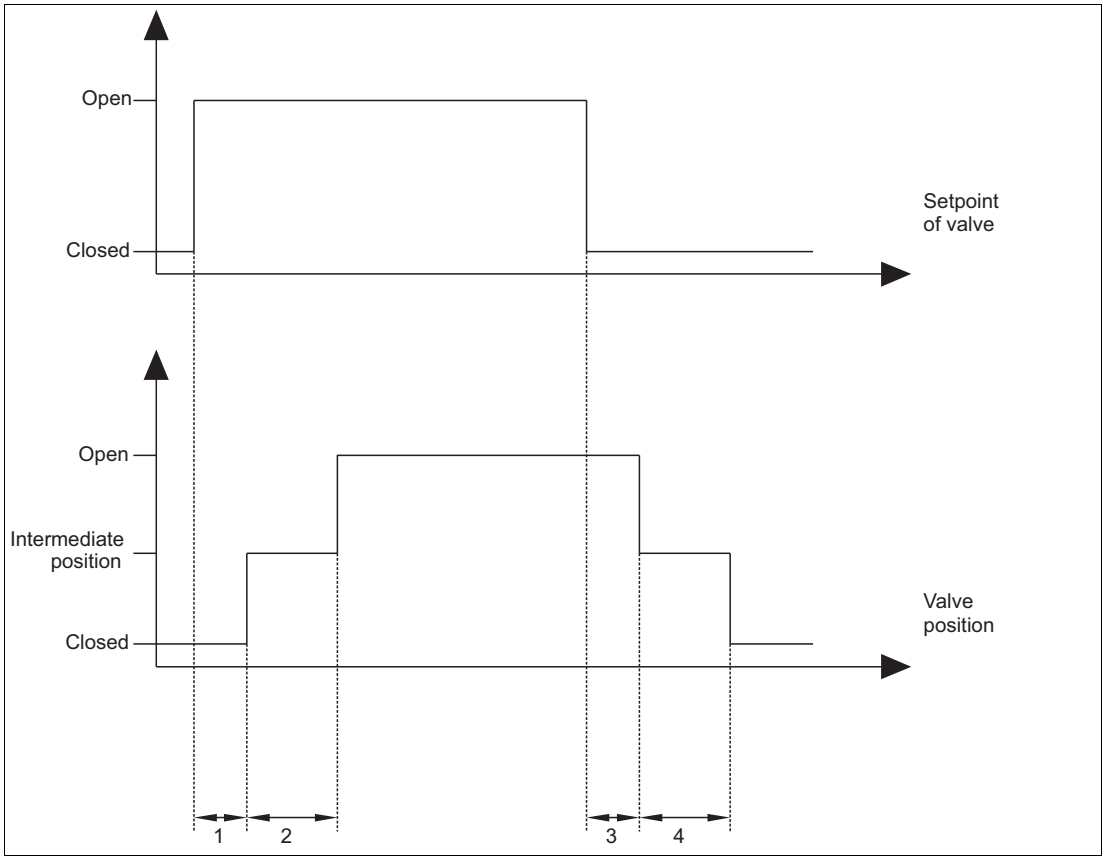
Activation of Time Monitoring

You can activate time monitoring by setting the option Time Monitoring in the Valve Monitoring parameter.

Reference Times

Enter the reference times for the 4 different monitoring times in seconds (s) during commissioning. The breakaway and transit times are defined as follows:

Definition of Breakaway and Transit Times



1 = breakaway time closed->open

2 = transit time closed->open

3 = breakaway time open->closed

4 = transit time open->closed

Each reference value consists of the reference value in seconds (s) plus the maximum admissible percentage deviation. If a measured time is shorter or longer than the specified tolerance, an alarm is generated.

- Reference value of breakaway times, value range: 0 s ... 60 s
- Reference value of transit times, value range: 0 s ... 180 s
- Max. deviation, value range: 0 % ... 100 %

The accuracy of time measurement is +/- 0.05 s

Note!

Time Monitoring with the Setup Wizard

When using the setup wizard, the reference parameters are set automatically:

- The current time values of the valve are set as the reference times.
- The maximum admissible deviation is set to 30 %. This tolerance can be adapted separately for each time value as required.

4.5.6 Cyclic Function Test (Partial Stroke Test)

Prerequisites

The following parameters must be set as a prerequisite for the cyclic function test:

- Act. Fail Action parameter. For more information, see chapter 4.5.2.
- Sensor Usage parameter. For more information, see chapter 4.5.3.
- Valve Monitoring parameter > Time Monitoring is activated. For more information, see chapter 4.5.5.

"Cyclic Test Open" and "Cyclic Test Closed"

The MIO device provides a function check for the connected valve or actuator within an adjustable period of time. This way, you can monitor valves or actuator that are rarely triggered for faults. When active, the MIO device controls the valve or actuator contrary to the current control until the breakaway point. Then, the MIO device controls the valve or actuator back into the initial position.

The measured breakaway time is displayed as the last breakaway time measured, and falling below or exceeding the admissible range of values generates an alarm.

Depending on the operation, the cyclic function test for the valve position "open" or "closed" can be switched ON or OFF under the Valve Monitoring parameter.

Note that the time monitoring option must be activated in Valve Monitoring in order to use the cyclic function test.

"Period Cyclic Test"

You can set a time interval for the cyclic function test. The interval can range between 10 seconds and 7 days, 23 hours, 59 minutes and 59 seconds. If the set valve position is not modified after this time, the device automatically carries out a cyclic function test.

4.5.7 Stroke Counter

The MIO device can monitor the number of strokes of a valve.

In the Valve Monitoring parameter, use the Stroke Counter to activate this function.

A stroke starts in the valve status "open" and continues with a closing and opening procedure. When activated, the Stroke Counter increases by 1, after the valve is closed and opened again.

This parameter can be initialized with a start value. The current count remains unaffected even after a voltage failure.

Stroke Counter Limit

You can determine a count as the limit value for the counter function. If the count of the Stroke Counter exceeds the stroke counter limit entered, the alarm "Maintenance needed now“ is generated. No alarm is given if the stroke counter limit is 0. This way, you can count the number of strokes without releasing an alarm for a limit value.

4.5.8 Lead Breakage and Lead Short Circuit Monitoring

You can independently enable or disable lead short circuit and lead breakage monitoring of the valve and position feedback sensors. Use the Lead Fault Monitoring parameter to achieve this.

Option	Description	Hardware Channels
Short Circuit Sensor-A	Enable/disable lead short circuit detection for final position feedback sensor A connection	TB1: 2 TB2: 5 TB3: 8 TB4: 11
Lead Breakage Sensor-A	Enable/disable lead breakage detection for final position feedback sensor A connection	
Short Circuit Sensor-B	Enable/disable lead short circuit detection for final position feedback sensor B connection	TB1: 3 TB2: 6 TB3: 9 TB4: 12
Lead Breakage Sensor-B	Enable/disable lead breakage detection for final position feedback sensor B connection	
Short Circuit Valve	Enable/disable lead short circuit detection for valve connection	TB1: 1 TB2: 4 TB3: 7 TB4: 10
Lead Breakage Valve	Enable/disable lead breakage detection for valve connection	

The Lead Fault parameter contains the fault status of the valve and sensor connection. Structure and content is identical to the Lead Fault Monitoring parameter.

The Sensor Fault State parameter defines the process value handling of position feedback sensors in case of a lead fault.

Option	Description
Set Fault State to Sensor A	Enable/disable fault handling of position feedback sensor A
Sensor A Fault State	Fault value of position feedback sensor A
Set Fault State to Sensor B	Enable/disable fault handling of position feedback sensor B
Sensor B Fault State	Fault value of position feedback sensor B

4.5.9 Valve and Drive Information

You can enter information of the valve drive or transducer block in the following parameters. The first 3 parameters are part of all FOUNDATION Fieldbus blocks. Their use depends on the control system.

- Strategy: Identify grouped blocks by entering a number. This number is not controlled or used by the block.
- Alert Key: Identification number for the plant unit which is used by the master computer to sort, e. g., alarm or operation messages. Values from 0 ... 65535 are valid.
- Tag Desc.: Description of the task of the TB.
- Act. Man.: Mechanical drive manufacturer
- Act. Model: Mechanical drive model
- Act. Ser. Num.: Mechanical drive serial number
- Valve Man.: Valve manufacturer
- Valve ID: Valve model
- Valve Type: undefined, linear, turning, other
- Valve Ser. Num.: Valve serial number

4.5.10 Final Value as Valve Reference Value

The reference value for the valve position and the associated status are issued in the Final Value parameter. The Final Value is a copy of the OUT_D value of the DO function block connected with the transducer block. This reference value can assume the values "closed" (0) or "open" (≠ 0).

The value is accepted only with a status GOOD-NonCascade or GOOD-Cascade. If the status is BAD or UNCERTAIN, the connected auxiliary valve is not controlled electrically, so that the associated drive moves into the mechanical safety position.

4.5.11 Valve Position

The signals recorded by a connected final position feedback contact are indicated in several parameters of different significance.

Sensor Value A or Sensor Value B Parameter

These parameters display the input signal of final position feedback contact A or final position feedback contact B. The MIO device interprets a final position feedback contact signal as follows:
high current => logical 1
low current => logical 0

Valve Position Parameter

The current valve position "open", "intermediate", or "closed" is displayed as value. By setting the Sensor Usage parameter accordingly, the signals of the final position feedback contacts are assigned a definite position.

For more information, see chapter 4.5.3.

Valve Position Extended Parameter

In the intermediate valve position, the information in the valve position parameter is extended by the information "opening" and "closing". This information is determined by the current control process and need not coincide with the actual direction of travel - i. e., when changing the set position while the valve is in the intermediate position.

Primary Value Parameter

This parameter issues the value which is fed back as valve position to the assigned function block. The Primary Value parameter is an unsigned 8 with the status which is displayed in the function block as READBACK_D. Which information is issued at which value range in the Primary Value parameter depends on how you set the Sensor Usage and PV_D Generation parameters.

For more information, see chapter 4.5.3.

Valve Info Parameter

This parameter displays information of the current status of the valve or transducer block. This includes the following information:

- Stroke counter limit exceeded
- Cyclic function test running
- Actuation - The valve has not yet reached the new final position after having changed the reference value.

4.5.12 Diagnostic Messages and Alarms

The MIO device features several diagnostic options.

If a fault occurs, the transducer block sets a block alarm. The block alarm is a combined error signal for all fault signals and remains set, as long as a fault in the block exists. For detailed information of the alarm cause after a block alarm, the MIO device provides the following parameters:

- Block Err.
- XD Error
- Valve Lead Fault
- Sensor Lead Fault
- Valve Warning
- Valve Error
- Valve Info

If the control system in use supports alarm messages via the FOUNDATION Fieldbus, setting and resetting of the block alarm is transferred via the bus to the control system. As this function is currently not supported by all control systems, the MIO device offers an alternative option to issue faults:

As soon as the transducer block recognizes a fault, a message is set in Block Err. parameter of the connected DO function block. Normally, this parameter is read out and evaluated in cycles by control systems which do not support alarm messages via FOUNDATION Fieldbus.

If the fault is related to the valve control (e. g., lead breakage of valve feeding lead or exceeding the admitted valve transit time), the message "Output failure" is set. If the final position feedback contact fails (e. g., lead short circuit of the lead that feeds the final position feedback contact), the message is "Input failure".

All messages, except a configuration error, are transferred this way. Therefore, check after each modification of parameterization of the MIO device that this message is not set in the Block Err. parameter. If the control system used does not support alarm messages via FOUNDATION Fieldbus, in the Features Sel. resource block parameter, deactivate the option "Reports".

More Information
For more information on diagnostic options and troubleshooting, see chapter 5. For a detailed list of the messages of the tranduceer block parameters and for troubleshooting, see chapter 5.4.

4.6 Parameterization in Binary Input Mode

The binary mode supports up to 12 discrete inputs, organized in the following 2 groups:

- Group 1: Hardware channels 1, 4, 7, 10
- Group 2: Hardware channels 2, 3, 5, 6, 11, 12

The device samples the inputs in 2 independent cycles. Group 1 hardware channels 1, 4, 7, 10 are intended to be used for sensing multiplexed binary inputs as vibration forks, NAMUR sensors, or mechanical switches. The ON-time of group 1 channels can be adjusted individually in a range between 10 ms ... 11 000 ms. The total cycle time is the sum of the 4 individual ON-times.

Group 2 hardware channels 2, 3, 5, 6, 11, 12 are intended to be used for sensing multiplexed binary inputs as NAMUR sensors and mechanical switches. The sampling time is fixed to 10 ms and is not adjustable. The total cycle time is the product of the number of channels used x 10 ms. The minimum total cycle time is 50 ms. If all 8 sensors are used, the total cycle time is 80 ms.

4.6.1 Transducer Blocks Interacting with DI or MDI Function Blocks

For the discrete inputs, the hardware channels can be linked to function blocks in different ways.

Using 12 Individual DI Function Blocks

Each discrete input is linked to the independent DI function blocks 5 … 17.

For group 1 hardware inputs, the transducer block channels 301 … 304 are used.

For group 2 hardware inputs, the channels 201 … 208 are used.

Transducer Block	Transducer Channel	Hardware Input
1	301	1
	201	2
	202	3
2	302	4
	203	5
	204	6
3	303	7
	205	8
	206	9
4	304	10
	207	11
	208	12

Using 2 MDI Function Blocks

Group 1 hardware inputs are linked to an MDI by using channel number 300.

Group 2 hardware inputs are linked to an MDI using channel number 200.

Hardware Group	Transducer Channel	Hardware Input
1	300	1,4,7,10
2	200	2,3,5,6,8,9,11,12

Using 2 DI Function Blocks

If required, you can use this option to increase the update time performance. Use the sensor inputs with 2 DI function blocks to read the input states of the 2 hardware input groups.

Group 1 sensor inputs are linked to a DI by using channel number 305.

Group 2 sensor inputs are linked to a DI using channel number 5.

The input values are assigned to the respective bits of the FIELD_VAL_D parameter value of the transducer blocks according to the following tables:

Group 1 Hardware Inputs

Bit	Description
0	Sensor value hardware channel 1
1	Sensor value hardware channel 4
2	Sensor value hardware channel 7

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Bit	Description
3	Sensor value hardware channel 10
4 ... 7	not used

Group 2 Hardware Inputs

Bit	Description
0	Sensor value hardware channel 2
1	Sensor value hardware channel 3
2	Sensor value hardware channel 5
3	Sensor value hardware channel 6
4	Sensor value hardware channel 8
5	Sensor value hardware channel 9
6	Sensor value hardware channel 11
7	Sensor value hardware channel 12

In the DI function block, the value of the FIELD_VAL_D parameter is assigned to the Primary Value parameter, and from there, to the OUT_D parameter value. Thus, cyclic transmission of the groups of sensor values to a control system is possible as well as their further use in a function block application.

Because of the many inputs mapped to a single parameter, the status does not reflect the status of a specific input any more. Failures, such as lead breakage or lead short circuit of the sensor wires are no longer issued using the status. The status remains GOOD in all instances.

Only hardware failures of the MIO device are issued with the status BAD - Device Failure.

With the PV_FTIME parameter, you can determine for how long (in seconds) the final position feedback sensor values have to be stable, before they are passed on from the FIELD_VSL_D parameter to the Primary Value parameter.

Depending on the application used, sensor values can keep changing or influencing one another. In this case, an inappropriate numeric value can result in the Primary Value parameter not being updated at all. Therefore, Pepperl+Fuchs recommends setting the PV_FTIME parameter to 0. If time monitoring is not necessary, Pepperl+Fuchs recommends setting the Sensor Usage parameter to "Use sensor values for PV_D".

4.6.2 Enabling/Disabling Hardware Channels 1, 4, 7, 10

Use the Sensor Exe Mode parameter to individually enable or disable the channels 1, 4, 7, 10. The Sensor On-Time parameter defines the time a specific hardware input is powered and processed before the next hardware input is switched on.

Transducer Block	Hardware Channel
1	1
2	4
3	7
4	10

4.6.3 Enabling/Disabling Hardware Channels 2, 3, 5, 6, 8, 9, 11, 12

Use the Sensor A Mode and Sensor B Mode parameters to individually enable or disable the channels 2, 3, 5, 6, 8, 9, 11, 12.

Transducer Block	**Hardware Channel**	
	Sensor A Mode	Sensor B Mode
1	2	3
2	5	6
3	8	9
4	11	12

4.6.4 Lead Fault Monitoring

You can independently enable or disable lead short circuit and lead breakage monitoring of the sensor connections with the Lead Fault Monitoring parameter.

Option	**Description**	**Hardware Inputs**
Short Circuit Sensor-A	Enable/disable lead short circuit detection for position feedback sensor – sensor A connection	TB1: 2 TB2: 5 TB3: 8 TB4: 11
Lead Breakage Sensor-A	Enable/disable lead breakage detection for position feedback sensor – sensor A connection	
Short Circuit Sensor-B	Enable/disable lead short circuit detection for position feedback sensor – sensor B connection	TB1: 3 TB2: 6 TB3: 9 TB4: 12
Lead Breakage Sensor-B	Enable/disable lead breakage detection for position feedback sensor – sensor B connection	
Short Circuit Sensor	Enable/disable lead short circuit detection for sensor connection	TB1: 1 TB2: 4 TB3: 7 TB4: 10
Lead Breakage Sensor	Enable/disable lead breakage detection for sensor connection	

The Lead Fault parameter contains the fault status of the sensor connection. Structure and content is identical to the Lead Fault Monitoring parameter.

The Sensor Fault State parameter defines the process value handling of sensor inputs in case of a lead fault.

Option	Description
Set Fault State to Sensor A	Enable/disable fault handling of position feedback sensor A
Sensor A Fault State	Fault value of position feedback sensor A
Set Fault State to Sensor B	Enable/disable fault handling of position feedback sensor B
Sensor B Fault State	Fault value of position feedback sensor B
Set Fault State to Sensor	Enable/disable lead short circuit detection for sensor connection
Sensor Fault State	Fault value of sensor connection

4.7 Parameterization in Frequency Mode

In the frequency mode, the hardware channel 1 or transducer block 1 is used. The hardware channels 4, 7, 10 are disabled. The hardware channels 2, 3, 5, 6, 8, 9, 11, 12 can be handled as described in the binary mode section.

4.7.1 Interaction of the Transducer Blocks and AI Function Blocks

The hardware channel 1 frequency input is linked to an AI function block by using channel number 400. The frequency value is provided by the transducer block 1 via the FREQ parameter. The XD_SCALE parameter supports “Hz” as unit.

4.7.2 Lead Fault Monitoring

You can independently enable or disable lead short circuit and lead breakage monitoring of the sensor connections with the Lead Fault Monitoring parameter.

Option	Description	Hardware Inputs
Short Circuit Sensor-A	Enable/disable lead short circuit detection for position feedback sensor – sensor A connection	TB1: 2 TB2: 5 TB3: 8 TB4: 11
Lead Breakage Sensor-A	Enable/disable lead breakage detection for position feedback sensor – sensor A connection	
Short Circuit Sensor-B	Enable/disable lead short circuit detection for position feedback sensor – sensor B connection	TB1: 3 TB2: 6 TB3: 9 TB4: 12
Lead Breakage Sensor-B	Enable/disable lead breakage detection for position feedback sensor – sensor B connection	
Short Circuit Sensor	Enable/disable lead short circuit detection for sensor connection	TB1: 1
Lead Breakage Sensor	Enable/disable lead breakage detection for sensor connection	

The Lead Fault parameter contains the fault status of the sensor connection. Structure and content is identical to the Lead Fault Monitoring parameter.

The Sensor Fault State parameter defines the process value handling of sensor inputs in case of a lead fault.

Option	Description
Set Fault State to Sensor A	Enable/disable fault handling of position feedback sensor A
Sensor A Fault State	Fault value of position feedback sensor A
Set Fault State to Sensor B	Enable/disable fault handling of position feedback sensor B
Sensor B Fault State	Fault value of position feedback sensor B

4.8 Parameterization in Counter Mode

In the counter mode, the hardware channel 1 or transducer block 1 is used. The hardware channels 4, 7, and 10 are disabled. The counter value can be either linked to an AI function block as a float value or to a DI function block as an unsigned 8 value. The hardware channels 2, 3, 5, 6, 8, 9, 11, and 12 can be handled as described in the sensor mode section. One DO function block serves for resetting the counter value to 0.

4.8.1 Interaction of the Transducer Blocks and AI, DO Function Blocks

The hardware channel 1 counter input is linked to an AI function block by using channel number 400. To reset the counter value, a DO is available which is linked to the transducer block by using channel number 500. The hardware channels 2, 3, 5, 6, 8, 9, 11, and 12 can be handled as described in the sensor mode section.

The counter value is provided by the transducer block 1 via the CNTR_VALUE_D parameter.

The FINAL_VALUE_D transducer block parameter contains the actual counter reset state.

4.8.2 Interaction of the Transducer Blocks and DI, DO Function Blocks

The counter value can be mapped as an unsigned 8 bit value to a DI function block using channel number 401. If the counter value exceeds 255, the HI_LIMIT status is set. To reset the counter value, a DO is available which is linked to the transducer block by using channel number 500. The hardware channels 2, 3, 5, 6, 8, 9, 11, and 12 can be handled as described in the sensor mode section.

4.8.3 Lead Fault Monitoring

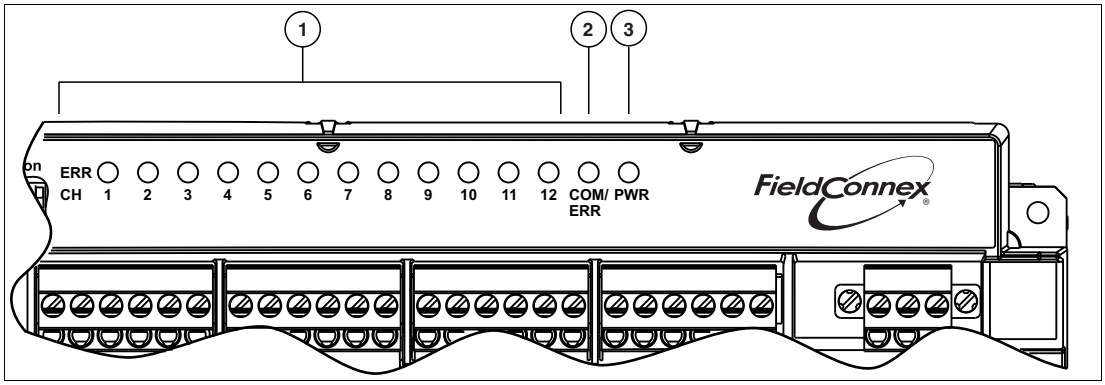
In counter mode, no lead short circuit monitoring is supported.

5 Troubleshooting and Diagnosis

The following information helps you to identify problems with the multi-input/output device and interpret diagnostic issues.

5.1 LED Status and Error Indication

The device is providing LED indication for each channel, the communication status and the fieldbus voltage.



1 LED CH ERR 1 ... 12 for indicating channel errors

2 LED COM ERR for indicating communication errors

3 LED PWR for indicating operation

LED	Indication	Color	Information	Reason	Remedy
CH ERR	Flashing	Red	Status of the corresponding channel	Lead breakage or short circuit of valve or sensor connection. Only available if wire check is activated and mode of operation is not "out of service".	Check the cable wires.
	OFF	--		Channel works as expected.	--
COM ERR	ON	Red	Communication status.	Hardware error.	Hardware error in the device. Check the device and replace if required.
	Flashing	Red		No communication activity.	Device is not configured for cyclic communication. Check the PROFIBUS master.
	OFF	--		Cyclic communication with master, class I.	--
PWR	ON	Green	Status of the fieldbus power.	Fieldbus voltage at the trunk.	--
	OFF	--		No fieldbus voltage at the trunk.	Check the fieldbus power supply. Check the trunk cable.

5.2 Recommended Action for Field Diagnostics according to NE 107

Alarm Type	Diagnostic Event	Alarm Text String
Maintenance required	Configuration error	Check blocks for configuration error.
	Stroke counter exceeded	Check transducer blocks for more details.
	Valve maintenance	
Failed	Valve failure	
	Sensor lead fault	
	Valve lead fault	
	Device failure	Send the device to Pepperl+Fuchs for repair.
Function Check	Check	Check block modes according to normal mode.

5.3 Resource Block

Problem		Troubleshooting	
Parameter	**Message**	**Cause**	**Solution**
BLOCK_ERR	Lost Static Data	The parameterization data stored in the device were faulty and replaced by the default settings.	Repeat parameterization. If this error occurs repeatedly, send the device to Pepperl+Fuchs for repair.
	Device Maintenance	Hardware error.	Send device to Pepperl+Fuchs for repair.
	Simulation	Switch 1 is set to "Simulation enabled".	Check if the simulation setting was intended.
	OOS	The target mode of the block is OOS.	Set block to "Auto" mode.
RS_STATE	Online	No error.	
	Failure	Hardware error.	Send device to Pepperl+Fuchs for repair.
	Stand-by	The target mode of the block is OOS.	Set block into "Auto" mode.
	Online Linking	One or several communication links to other field devices are not established.	Check whether all necessary field devices are available at the segment. Check configuration.

5.4 Transducer Block

Diagnostic Messages

Problem		Troubleshooting	
Parameter	**Message**	**Cause**	**Solution**
Block Err.	Block Configuration Error	The target mode is "Auto" or "Man" and the Act. Fail Action parameter is "undefined".	Set the actuator fail action parameter to the drive mode "self-closing" or "self-opening". See chapter 4.5.2
		Time monitoring or stroke counter are ON and the Sensor Usage parameter is set to "No position detection" or "Use sensor values for PV_D".	Set or have the Sensor Usage parameter automatically determine one of the options A ... D. See chapter 4.5.3
		Time monitoring is ON and one of the reference values for time monitoring is 0.	Enter reference values or determine them automatically by starting the setup wizard. See chapter 4.5.5
	Input Failure	The status of the valve position feedback to the function block (Primary Value) is BAD.	See section "Status Values of Process Parameters".
	Output Failure	The combined error signal of the errors is displayed in the XD Error parameter.	See XD Error parameter.
	Maintenance Needed	The Stroke Counter Limit has been exceeded.	Drive and valve need maintenance since the stroke number specified for this was exceeded. After maintenance, increase the stroke counter limit or reset the counter value in the Stroke Counter parameter.
	Device Maintenance	The combined error signal of the errors is displayed in the Valve Warning parameter.	See Valve Warning parameter.
	Readback Check Failed	Set if status of the Primary Value parameter is BAD.	Valve coupler mode: Check wire connection.
	Sensor Failure	In MIO sensor mode. One or more sensor inputs have a lead short circuit or lead breakage.	Check wire connection.
	Out of Service	Block mode is out of service.	Set block mode to auto.

Problem		Troubleshooting	
XD Error	Mechanical error	The combined error signal of the errors is displayed in the Valve Error parameter.	See Valve Error parameter.
	Valve Lead Fault	The combined error signal of the errors is displayed in the Valve Lead Fault Monitoring parameter.	See Valve Lead Fault Monitoring parameter.
	Sensor Lead Fault	The combined error signal of the errors is displayed in the Sensor Lead Fault Monitoring parameter.	See Sensor Lead Fault Monitoring parameter.
	Valve needs Maintenance	Set if one of the Valve Warning parameter conditions occurs.	See Valve Warning parameter.
	Stroke Count Limit	Stroke Counter Limit is exceeded.	Maintain or replace the valve.
Valve Warning	Breakaway time ... too long Transit time ... too long (... = C -> O or O -> C)	The measured time exceeded the reference value plus the admissible allowance.	■ Check auxiliary power. ■ Check reference times and allowances. ■ Check final position feedback contacts for proper functioning. ■ Check friction of valve.
	Breakaway time ... too short Transit time ... too short (... = C -> O or O -> C)	The measured time undercut the reference value minus the admissible allowance.	■ Check auxiliary power. ■ Check reference times and allowances. ■ Check final position feedback contacts for proper functioning. ■ Check friction of valve.

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Problem		Troubleshooting	
Valve Error	Valve blocked	The valve is signalled blocked, if a time t > 5*(breakaway time + transit time) elapsed since the issue of the new reference value.	■ Check reference times and allowances. ■ Check final position feedback contacts for proper functioning. ■ Check auxiliary power. ■ Test valve drive.
	Valve left final position	The valve has left the reached final position without modification of the reference value for the valve position.	■ Check settings of the Sensor Usage parameter, see chapter 4.5.3. ■ Check final position feedback contacts for proper functioning. ■ Check auxiliary power. ■ Test valve drive.
	Position detection failure	The signal combination of the final position feedback contacts is not assigned to a valve position.	■ Check settings of the Sensor Usage parameter, see chapter 4.5.3. ■ Check final position feedback contacts for proper functioning.
		The final position feedback contacts have signalled an unexpected valve position. Open - intermediate - closed or vice versa was expected.	■ Check settings of the Sensor Usage parameter, see chapter 4.5.3. ■ Check final position feedback contacts for proper functioning. ■ Check auxiliary power. ■ Test valve drive.
Valve Lead Fault	Short Circuit Valve	Lead short circuit at valve lead.	Check wiring.
	Lead Breakage Valve	Lead short circuit at valve lead.	Check wiring.

Problem		Troubleshooting	
Sensor Lead Fault	Short Circuit Sensor A/B	Lead short circuit at lead to final position feedback contact A/B.	Check wiring.
	Lead Breakage Sensor A/B	Lead interruption at lead to final position feedback contact A/B.	Check wiring.

Status Values of Process Parameters

Status Messages	Cause	Solution	Further Information
Bad - Out of Service	Mode of block is "Out of Service".	Specify target mode "Auto".	See chapter 4.5.4 See chapter 4.5.12
Bad - Device Failure	Hardware error	Send device to Pepperl+Fuchs for repair.	
Bad - Sensor Failure, Low limited	Lead interruption sensor	Determine the affected sensor in the device from the sensor lead fault parameter.	See chapter 4.5.8
Bad - Sensor Failure, High limited	Lead short circuit sensor	Determine the affected sensor in the device from the sensor lead fault parameter.	See chapter 4.5.8
Bad - Sensor Failure	"Position detection failure" - the signal combination of the final position feedback contacts is not assigned to a valve position.	■ Check the settings of the Sensor Usage parameter. ■ Check final position feedback contacts for proper functioning.	See chapter 4.5.3 See chapter 4.5.12
Bad - Non Specific	This value is not used due to the current parameterization.	Check the settings of the Sensor Usage parameter.	See chapter 4.5.3

Miscellaneous

Problem	Cause	Solution	Further Information
The transducer block does not leave the "Out of service" mode	A block configuration error issued in the Block Err. parameter.	Set the Act. Fail Action parameter by entering the drive mode "self-closing" or "self-opening".	See chapter 4.5.3 Block Err., see chapter 5.4
	The resource block is in "Out of service" mode.	Set resource block into "Auto" mode.	See chapter 5.3

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Problem	Cause	Solution	Further Information
Auxiliary valve not controlled	The reference value specified by the DO function block has the status BAD or UNCERTAIN.	Check reference value and correct it, if necessary.	See chapter 4.5.10
	Transducer block is in "Out of service" mode.	Set transducer block to "Auto" mode.	See chapter 5.4
	Hardware or lead error.	Check diagnostic messages.	See chapter 5.4
	Simulation is switched ON in function block.	Switch OFF simulation.	See chapter 3.2.4 Resource Block parameters, see chapter 6

5.5 Initialization Run

Message	Cause	Solution
Error before start	Valve is actuating.	Start initialization run again as soon as the valve has reached the set position.
	Lead breakage or short circuit at valve or sensor.	Check wiring of sensors and valve.
	Valve is not in final position.	■ Check PFCs. ■ Check auxiliary power. ■ Check drive.
	Resource block is in "Out of Service" mode.	Set resource block into "Auto" mode.
Error while running	The PFCs have displayed an unexpected valve position. The expected position is open - intermediate - closed and vice versa.	Check PFCs and contacts.
	Breakaway time is longer than 1 min. ■ Auxiliary power too low. ■ Friction too high. ■ Drive or pilot valve defective. ■ System pressure too high.	■ Check auxiliary power. ■ Check friction. ■ Check drive and pilot valve. ■ Checks system pressure.
	Transit time is longer than 3 min. ■ Auxiliary power too low. ■ Friction too low. ■ Drive or pilot valve defective.	■ Check auxiliary power. ■ Check friction. ■ Check drive and pilot valve.
	The lead or short circuit monitoring has detected an error.	Check wiring of sensors and valve. For more information, see chapter 5.1 and see chapter 4.6.2.

6 Reference List of MIO Parameters

List of Parameters, Legend

Char.: The column Char. shows characteristics or conditions applicable to this parameter. These are:

- OOS: Out of Service. The parameter can be written only if the target mode of the block is "Out of Service".
- S: Static. During each writing process an identified parameter of this type, the ST_REV parameter is increased by one.
- W: Writeable. The parameter can be modified by the user.
- R: Readable. As all parameters can be read, this is not marked explicitly.

Transducer Block

Parameter	Char.	Description
Breakaway Time Close -> Open		The last breakaway time measured from "closed" to "open". This value is not stored on the device, i. e., this value is available after a power failure only after opening and closing the valve once.
Breakaway Time Close -> Open Setpoint	W S	Reference value for the breakaway time from "closed" to "open". Range of values: ■ Reference value: 0 s ... 60 s ■ Maximum admissible deviation: 0 % ... 100 %
Breakaway Time Open -> Close		The last breakaway time from measured "open" to "closed". This value is not stored on the device, i. e., this value is available after a power failure only after opening and closing the valve once.
Breakaway Time Open -> Close Setpoint	W S	Reference value for the breakaway time from "open" to "closed". Range of values: ■ Reference value: 0 s ... 60 s ■ Maximum admissible deviation: 0 % ... 100 %
Counter Value		Counter value as float value with status information.
Cyclic Test Period	W S	If the reference value of the valve is not modified for this time, a cyclic function test is carried out. Applicable if activated.
MIO Mode		This parameter contains the MIO device mode defined in the resource block parameter MIO Mode.
Primary Value		The valve position which is transferred to the function block.
PV_D Generation	W S OOS	If the signals of the final position feedback are evaluated, this parameter determines how to further process the evaluated signals prior to transferring them to the function block.
RELATED_HW_CHANNELS		Contains the specific connected hardware inputs to a transducer block. TB1: hardware input 1, 2, 3 TB2: hardware input 4, 5, 6 TB3: hardware input 7, 8, 9 TB4: hardware input 10, 11, 12
Sensor A Mode	W OOS	In MIO binary mode: Enabling/disabling of the hardware group 2 channels: TB1:2, TB2:5, TB3:8, TB4:11

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Parameter	Char.	Description
Sensor B Mode	W OOS	In MIO binary mode: Enabling/disabling of the hardware group 1 channels: TB1:3, TB2:6, TB3:9, TB4:12
Mode	W OOS	In MIO binary mode: Enabling/disabling of the hardware group 1 channels: TB1:1, TB2:4, TB3:7, TB4:10
Sensor Fault State	W OOS	In MIO binary mode: Contains information about fault handling of the transducer-block-specific hardware channels. Bit 0: Enable/disable fault handling of hardware channel TB1:2, TB2:5, TB3:8, TB4:11 Bit 1: Fault value of hardware channel TB1:1, TB2:4, TB3:7, TB4:10 Bit 2: Enable/disable fault handling of hardware channel TB1:1, TB2:4, TB3:7, TB4:10 Bit 3: Fault value of hardware channel TB1:1, TB2:4, TB3:7, TB4:10 Bit 4: Enable/disable lead short circuit detection for hardware channel TB1:1, TB2:4, TB3:7, TB4:10 Bit 5: Fault value for hardware channel TB1:1, TB2:4, TB3:7, TB4:10
Lead Fault for Sensor/Valve		Lead breakage and lead short circuit of the final position feedback contact wiring are displayed. Applicable if monitoring is active.
Lead Fault Monitoring for Sensor/Valve	W S	In this parameter, the lead breakage or lead short circuit monitoring can be activated for the final position feedback contact wiring.
Sensor On-Time	W OOS	In MIO binary mode: Sample time of the hardware group 1 channels: TB1:1, TB2:4, TB3:7, TB4:10
Sensor Usage	W S OOS	This parameter describes whether a final position feedback contact is connected to the valve interface, if and how to evaluate its signals.
Sensor A Value		The current value of final position feedback contact A 0 = low current 1 = high current
Sensor B Value		The current value of final position feedback contact B 0 = low current 1 = high current
Sensor Value		Sensor value as an unsigned 8 with status information.
Stroke Counter	W	The current value of the stroke counter. This value is always increased by 1 as soon as the valve reaches the open position after a modification of the reference value. It is possible to specify a start value.
Stroke Counter Limit	W S	As soon as the stroke counter exceeds this value, a diagnosis message is released.
Transit Time Close -> Open		The last transit time measured from "closed" to "open". This value is not stored on the device, i. e., this value is available after a power failure only after opening and closing the valve once.
Transit Time Close -> Open Setpoint	W S	Reference value for the transit time from "closed" to "open". Range of values: ■ Reference value: 0 s ... 180 s ■ Maximum admissible deviation: 0 % ... 100 %.

Parameter	Char.	Description
Transit Time Open -> Close		The last transit time measured from "open" to "closed". This value is not stored on the device, i. e., this value is available after a power failure only after opening and closing the valve once.
Transit Time Open -> Close Setpoint	W S	Reference value for the transit time from "open" to "closed". Range of values: ■ Reference value: 0 s ... 180 s ■ Maximum admissible deviation: 0 % ... 100 %.
Valve Error		Parameter indicates mechanical valve faults that the transducer block recognized.
Valve ID	W S	Valve model: Valve design.
Valve Info		Valve information: Parameter indicates the information of the current status of the valve or transducer block.
Valve Man.	W S	Valve manufacturer: Name of valve manufacturer.
Valve Model	W S	Product name of the valve.
Valve Monitoring	W S	Time measurement for the valve, stroke counter, and the cyclic function tests can be activated in this parameter.
Valve Position		Parameter indicates the current valve position: closed, open, intermediate, unknown.
Valve Position Extended		Parameter indicates the current valve position with additional information such as "valve opening" and "valve closing" if the valve is in the intermediate position.
Valve Serial Number	W S	Serial number of the valve.
Valve Type	W S	Describes the type of valve: linear, turning, other, undefined.
Valve Warning		Parameter that indicates that the measured transit or breakaway time is higher or lower than the reference value including the maximum admissible deviation.

Resource Block

Parameter	Char.	Description
BI_CYCLE_TIMES		Parameter that contains the overall measurement cycle times for the indivual group 1 and group 2 hardware channels.
MIO_MODE	W S OOS	Defines the MIO mode in which the device operates: 1. Valve coupler 2. Binary Input 3. Frequency Input 4. Counter

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