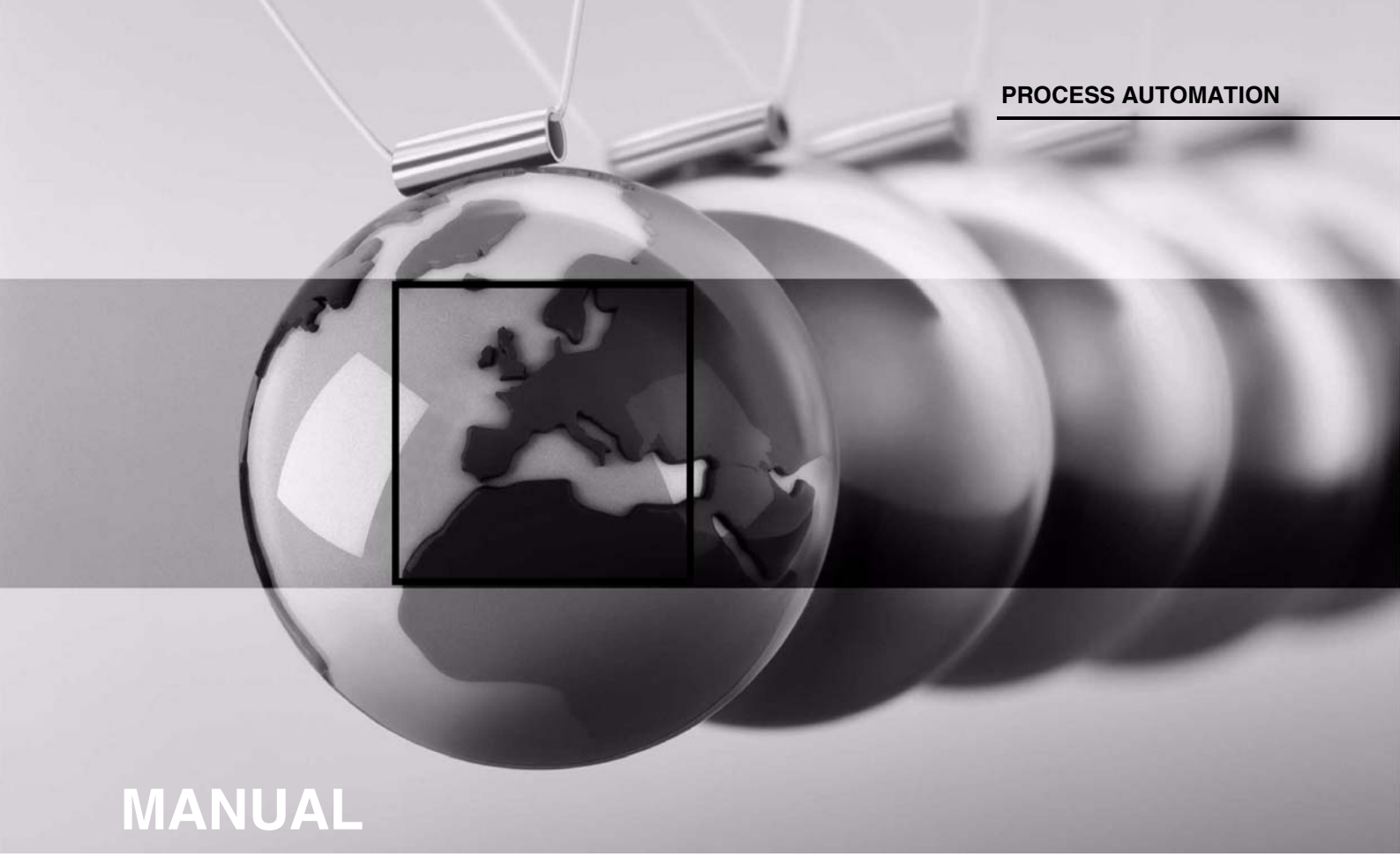

MANUAL

Temperature Multi-Input Device

F2D0-TI-Ex8.FF.*,
RD0-TI-Ex8.FF.*
6.2.0 (DEV_REV 02)

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"

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 8-channel temperature multi-input device measures temperature with resistance thermometers (RTD) or thermocouples (TC) via FOUNDATION Fieldbus. Each channel can be configured independently.

The device is designed for use in intrinsically safe fieldbus systems according to FISCO or Entity.

Use the device only within the specified ambient temperature range.

The device is only approved for appropriate and intended use. Ignoring these instructions will void any warranty and absolve the manufacturer from any liability.

This manual describes the following temperature multi-input devices:

- F2D0-TI-Ex8.*.*:* in a fieldbus housing for panel mounting
- RD0-TI-Ex8.*.* for mounting on a 35 mm DIN rail in accordance with EN 50022

2.2 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.

The device may be installed in Zone 2.

For Zone 2 applications, the type of protection must be Ex nA or Ex i.

Independent of the type of protection of the fieldbus, the sensor inputs remain intrinsically safe.

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.

Danger!

Explosion hazard from inadequate or missing separation appliance

If you fail to apply the required separation appliance, e. g. a separation wall, between an intrinsically safe and a non–intrinsically safe circuit, this can result in a current/voltage flashover generating sparks. The sparks can ignite the surrounding potentially explosive atmosphere.

Ensure you apply the required separation appliance in order to meet the requirements according to IEC/EN 60079–11.

Hazardous Area Installation Options

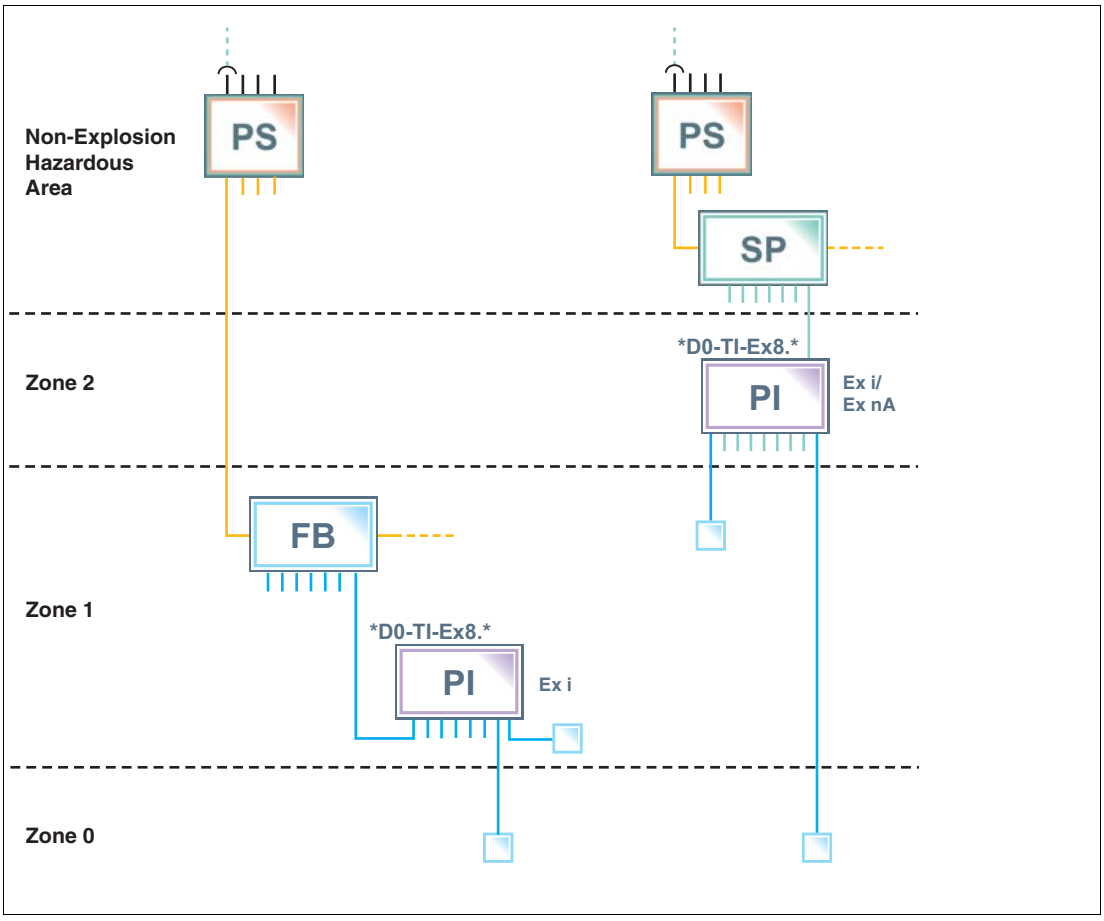

Figure 2.1 Installation options for the temperature multi-input device in the hazardous area

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

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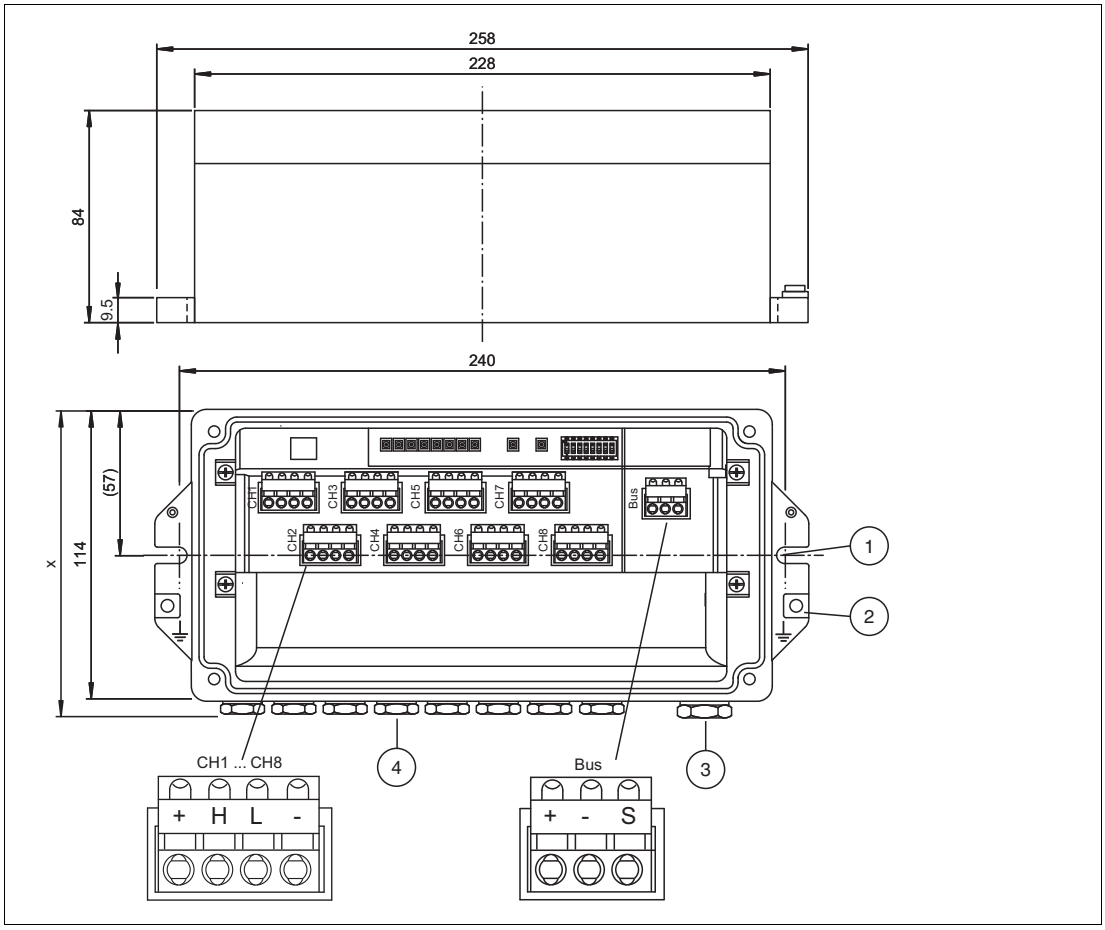
2.3 Component Identity

The following section shows the dimensions, the inside connections, and the options of the device.

F2D0-TI-Ex8.* Housing and Dimensions

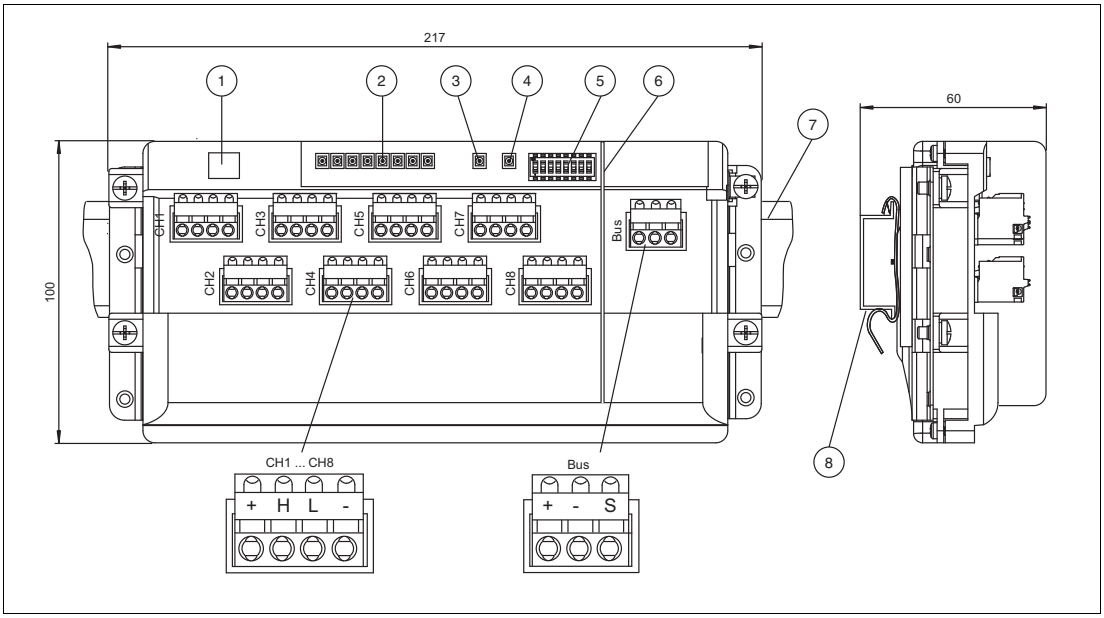


1. Notch for fixing the temperature multi-input device housing with M6 screw.
2. Grounding point for connecting the temperature multi-Input device to earth with M4 screw.
3. Cable gland for the fieldbus IN cable. For outside dimensions, see datasheet.
4. 8 cables glands for inputs, wrench size AF 20. For outside dimensions, see datasheet.

X: Height depending on cable gland, see datasheet.

All dimensions in millimeters (mm).

RD0-TI-Ex8.* Components and Dimensions



1. Service interface (covered)
2. Status LEDs for channel fault indication
3. Status LED for communication
4. Status LED for power
5. Dip switches for configuration:
6. Separation wall: Used if the temperature multi-input device is supplied by a non-intrinsically safe fieldbus.
7. DIN mounting rail
8. Mounting on DIN rail

All dimensions in millimeters (mm).

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

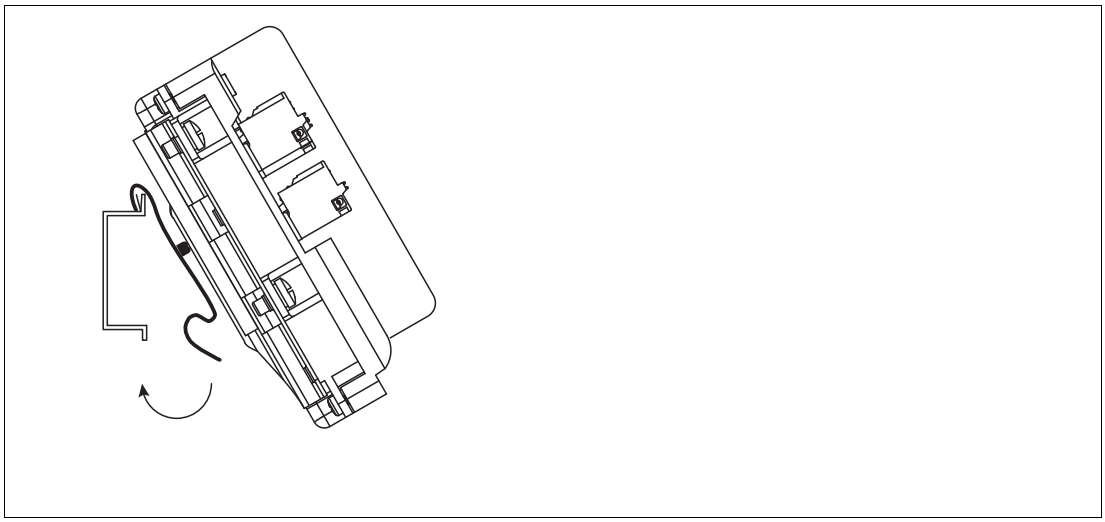
Mounting/Dismounting F2D0-TI-Ex8.*

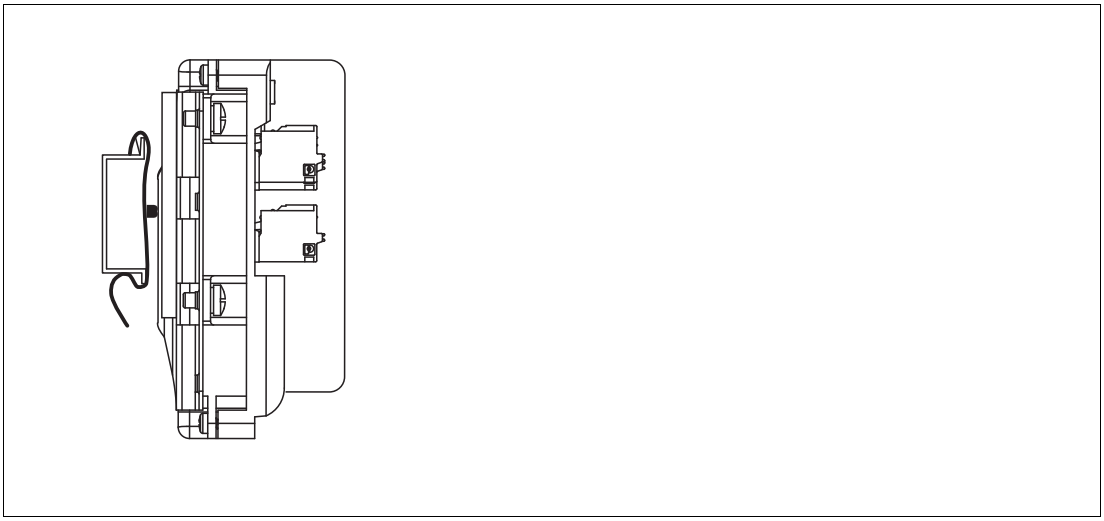
F2D0-TI-Ex8.* is designed for panel (wall) mounting.

- 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 RD0-TI-Ex8.*

RD0-TI-Ex8.* is designed for mounting on a 35 mm DIN rail in accordance with EN 50022.





Ensure that the device is firmly fixed on the DIN rail.

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

RD0-TI-Ex8.* Installations

Depending on the application, the RD0-TI-Ex8.* must be mounted in a suitable environment.

If mounted in Zone 2 for an Ex nA application, the environment must ensure the following degree of protection:

- IP54 in accordance with IEC 60529 for hazardous area Zone 2

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3.1.1 Using the Separation Wall

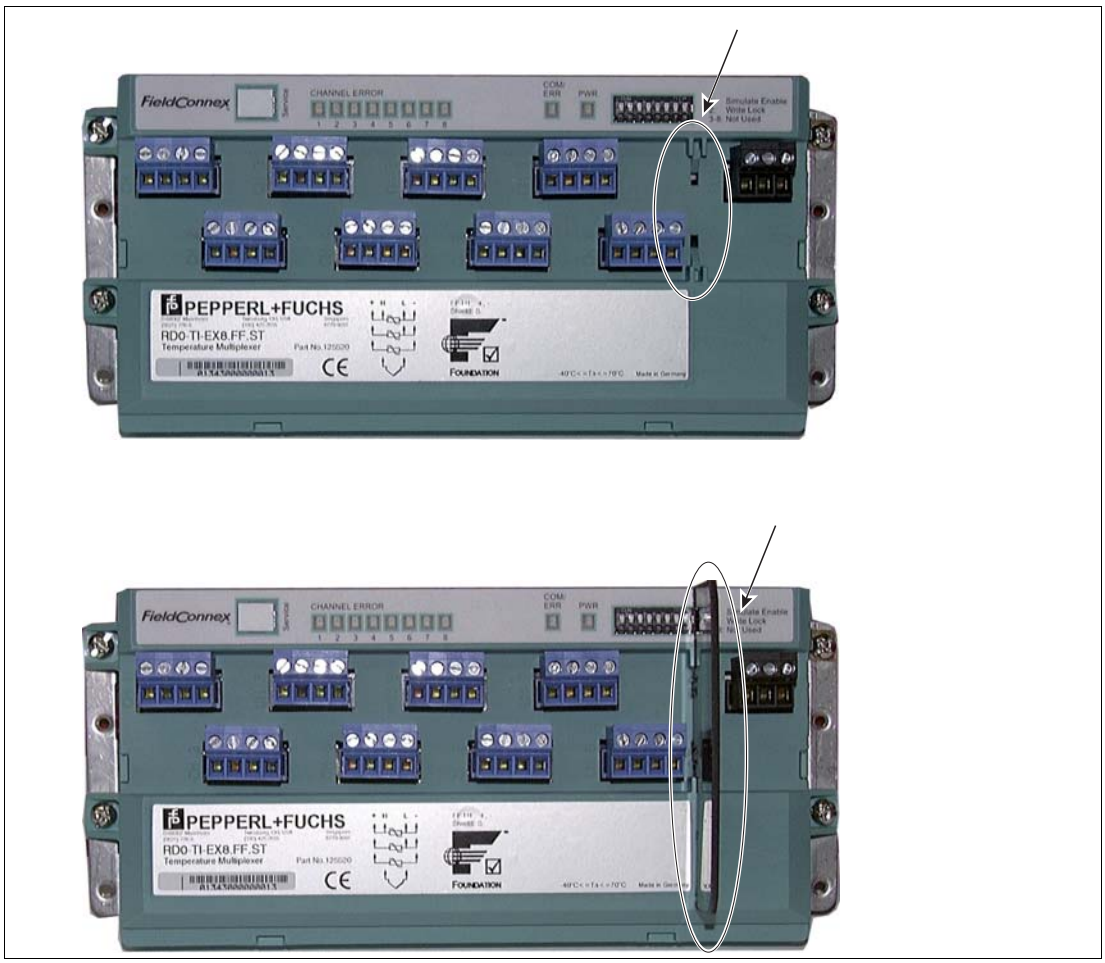
Danger!

Explosion hazard from inadequate or missing separation appliance

If you fail to apply the required separation appliance, e. g. a separation wall, between an intrinsically safe and a non–intrinsically safe circuit, this can result in a current/voltage flashover generating sparks. The sparks can ignite the surrounding potentially explosive atmosphere.

Ensure you apply the required separation appliance in order to meet the requirements according to IEC/EN 60079–11.

The device is delivered with a removable separation wall. The separation wall separates the fieldbus terminals from the terminals of the sensor inputs. This way it ensures the clearance requirements of IEC/EN 60079-11 between intrinsically safe and non-intrinsically safe signals.



3.2 Hardware Installation

3.2.1 TM-I 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.

Connection Details

You can connect sensors to one of the following 2 pre–engineered terminal options :

- Spring terminals
- Screw terminals

Adhere to the following information when connecting cables to terminals:

- Insulation stripping length of wires: 10 mm
- Core cross-section: 0.2 mm² ... 2.5 mm² or AWG 24 ... 14
- If you use stranded conductors: Protect the conductor ends by crimping wire end ferrules on them.
- Screw terminals tightening torque: 0.5 ... 0.6 Nm
- Insulation voltage between the fieldbus line and the shield for intrinsically safe segments: ≥ 500 V
- Do not strain the cables and connection lines. Provide an adequate strain relief.
- Connect unused cables and connection lines to terminals or securely tie them down and isolate them.

Parameterization interface: Service interface. → see image on page 10.
Only trained specialists authorized by Pepperl+Fuchs may carry out parameterization tasks via the Service interface.

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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.

Installing 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.

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.

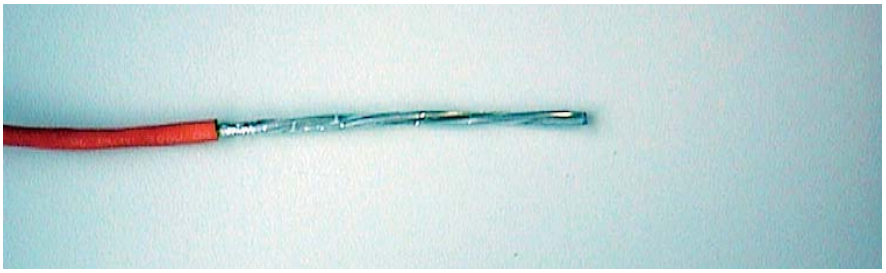
The following table with tightening torques offers an approximate guideline:

F2D0-TI-Ex8.* Tightening Torques for Cap Nuts and Counterparts

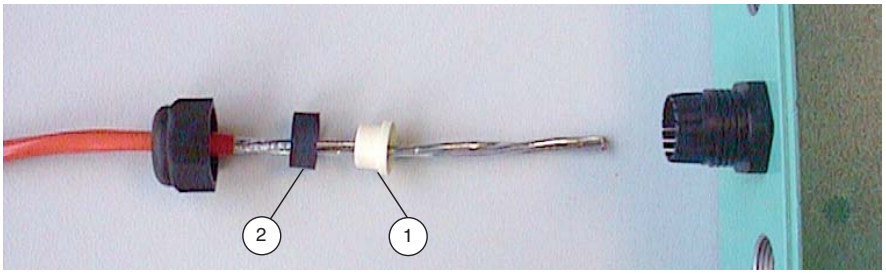
Type	Size	Cap nut	Counterpart
F2D0-TI-Ex8.*.*:*.CG	M16	2.5 Nm	3.75 Nm
	M20	2.5 Nm	3.75 Nm
F2D0-TI-Ex8.*.*:*.CGB	M16	6 Nm	6 Nm
	M20	10 Nm	10 Nm
F2D0-TI-Ex8.*.*:*.CGS	M16	6 Nm	6 Nm
	M20	10 Nm	10 Nm

Connectorizing Cables Using F*D0-TI-Ex8.*.CG Cable Glands

1. Strip the insulation of the cable up to about 120 mm.

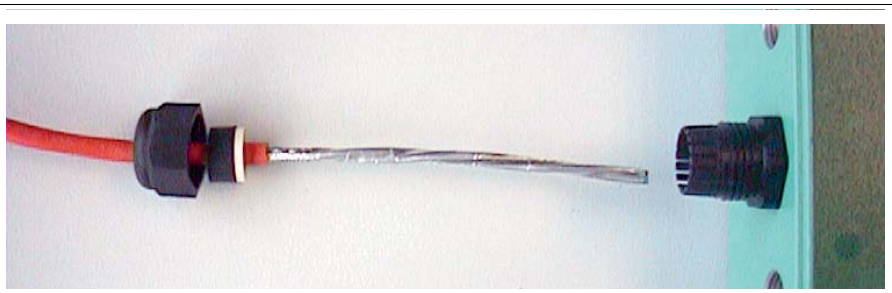


2. Loosen the cap nut and the seals from the temperature multi-input device. Depending on the application, slip Seal 1 & Seal 2 or only the obligatory Seal 2 over the cable as shown:

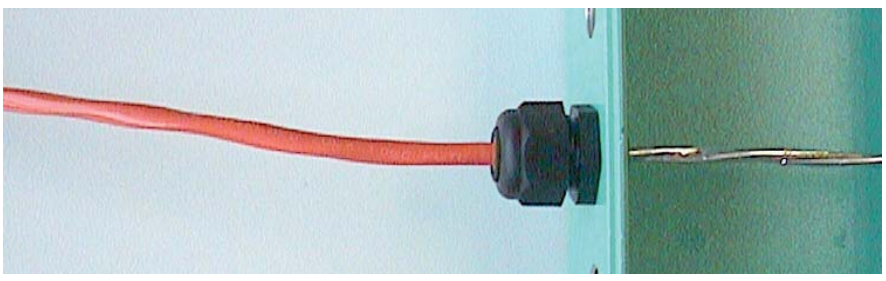


1. Seal 1, used in the following instance: Type: M20 x 1.5, Terminal area: 5 ... 8 mm
2. Seal 2, obligatory

3. Move the required seal(s) over the cable until after the last seal about 5 mm insulation protrude before the stripped wire begins:



4. Insert the cable with the seals into the cable gland of the temperature multi-input device and tighten the cap nut.
The tightening torques of cap nuts vary depending on the cable type used. Ensure that you use the cap nuts according to the table "F2D0-TI-Ex8.* Tightening Torques for Cap Nuts and Counterparts" above.



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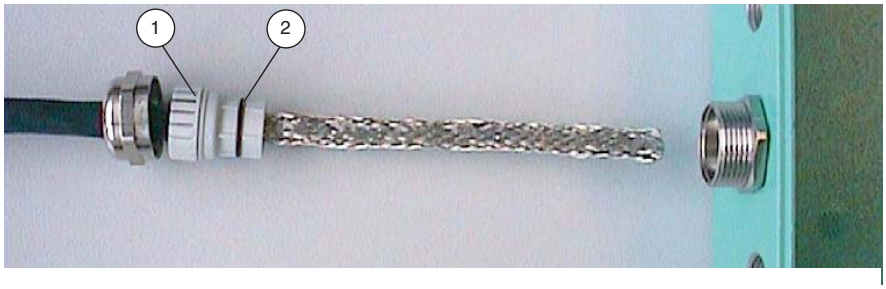
Connectorizing Cables Using F*D0-TI-Ex8.*.CGB and F*D0-TI-Ex8.*.CGS Cable Glands

1. Strip the insulation of the cable up to about 120 mm.

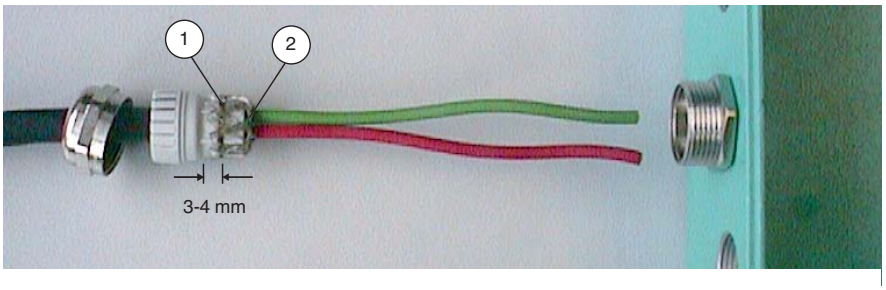
2. Loosen the cap nut from the temperature multi-input device.

3. Remove the inner plastic piece and slip it onto the cable: move it far enough over the cable, so it completely surrounds the cable insulation.
   Ensure that no cable insulation protrudes behind the inner plastic piece.



1. Inner plastic piece
2. O-ring

3. Invert the cable shield over the inside plastic piece and shorten it to a length of 3 ... 4 mm behind the O-ring.



1. O-ring
2. Inverted cable shield

3. Insert the cable wires with the inner plastic piece into the counterpart of the cable gland.

4. Tighten the cap nut and the counterpart.
   The tightening torques of cap nuts vary depending on the cable type used. Ensure that you use the cap nuts according to the table "F2D0-TI-Ex8.* Tightening Torques for Cap Nuts and Counterparts" above.

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

3.2.3 Grounding and Shielding

Note!

Electromagnetic Compatibility and Grounding

If the shield of the fieldbus data transfer line is grounded for electromagnetic compatibility reasons, the following guideline must always be observed:

- FOUNDATION Fieldbus Application Guide "31.35 bit/s Intrinsically Safe Systems"

Note!

Ensure Equipotential Bonding of F2* Metal Housings

Ensure that the metal housing is connected properly to the equipotential bonding.

Equipotential Bonding of Devices in F2* Metal Housings

For electronic components in F2* metal housings in Zone 1 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 segment 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.

Shielding the R* Electronic Component in Intrinsically Safe Segments

The shield (terminal S) of the intrinsically safe segment is internally connected to the DIN mounting rail.

Note!

Ensure Shielding of the R* Electronic Component

Ensure that the DIN mounting rail is connected to the cabinet and the cabinet itself is connected to the equipotential bonding.

3.2.4 Electrical Connection

Sensor Types Connecting to Temperature Multi-Input Devices

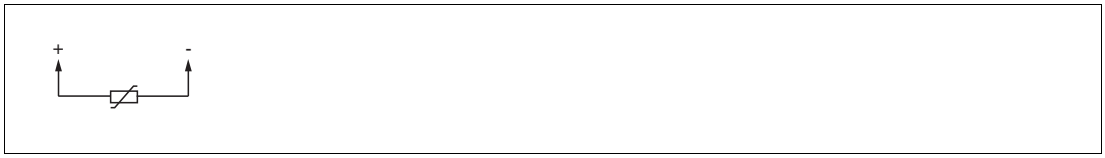


Figure 3.1 RTD, 2-wire technology

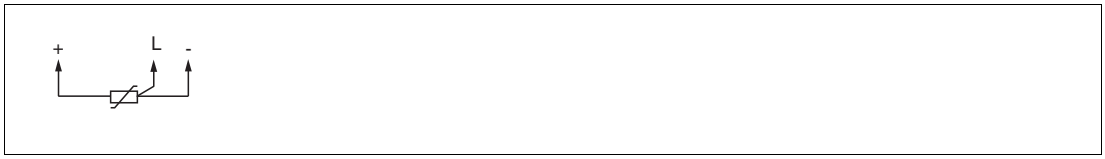


Figure 3.2 RTD, 3-wire technology

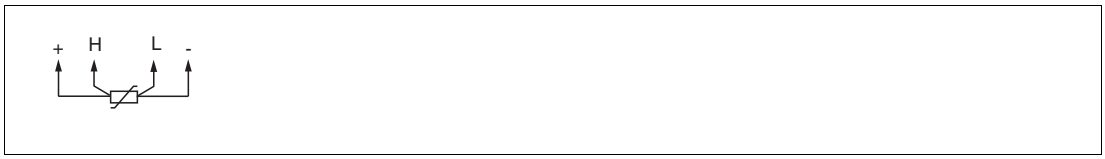


Figure 3.3 RTD, 4-wire technology

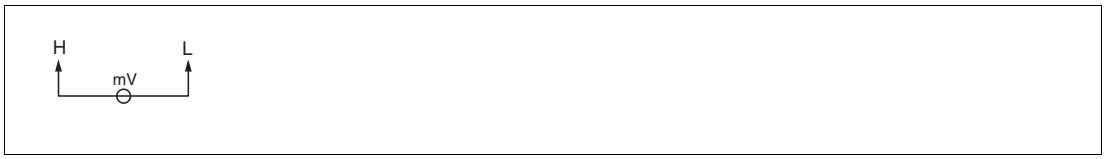


Figure 3.4 Millivolt

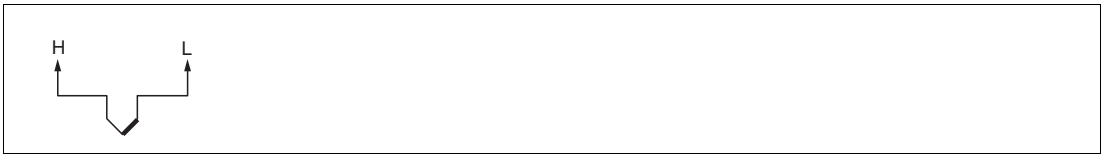


Figure 3.5 Thermocouple

3.2.5 Fieldbus and Shield Connection

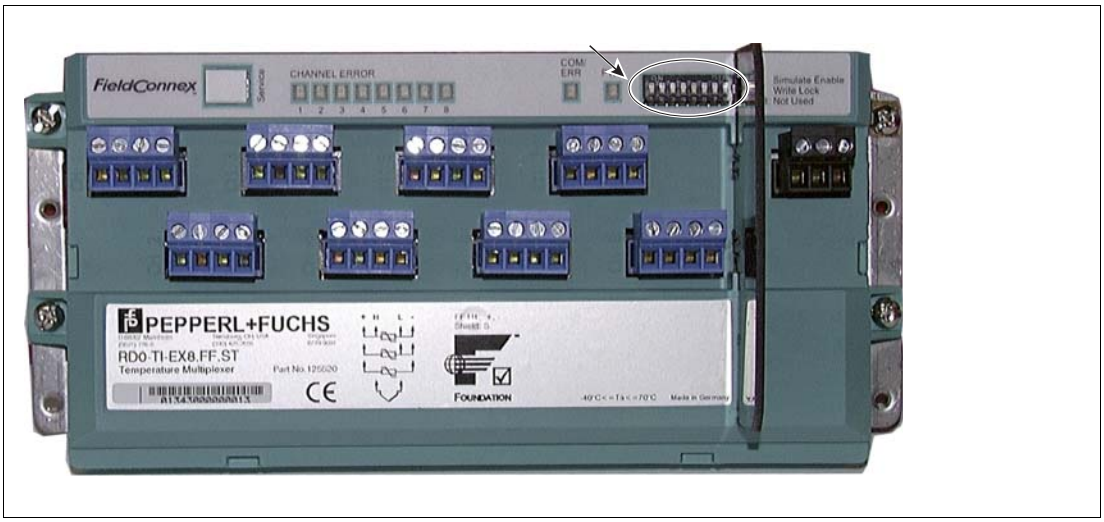
The TM-I device provides a connection for the fieldbus cable.

The device itself can operate in both polarities.

Not all FOUNDATION Fieldbus devices support polarity independent operation, therefore we recommend you always wire all field devices consistently.

3.2.6 Dip Switch Settings

The device has 8 DIP switches, with DIP switch 1 and 2 in use. The DIP switches can be activated during operation.



- Switch 1, Simulation ON/OFF
- Switch 2, Hardware write protection ON/OFF

Dip switch 1 "Simulation ON":
The control system sets the sensor input that is transferred from the transducer block to the function block, independent of the hardware input of an input channel.
For safety reasons, it is recommended to set the switch to OFF for normal operation.

Dip switch 2 "Hardware write protection ON":
Parameterization of the device via the bus is disabled.

3.3 Firmware Download

The temperature input 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 temperature input 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.

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4 TM-I Configuration

The following chapter explains the function block specifications, and how to parameterize the temperature multi-input device for your application.

4.1 Introduction

Like all FOUNDATION Fieldbus devices, the temperature multi-input device uses the following function blocks:

- 1 resource block
- 9 transducer blocks, consisting of 8 sensor blocks and 1 concentrator block
- 9 standard FOUNDATION fieldbus function blocks, consisting of 8 AI blocks and 1 MAI block

Sensor Transducer Blocks

The sensor transducer blocks connect to the sensor hardware and can be used to configure up to eight temperature sensors connected to the device.

Concentrator Transducer Block

For optimum productivity and configuration time, the concentrator transducer block provides the following options and information:

- Easily accessible sensor configuration options
- Device description (DD) methods for easy configuration of the TM-I device
- Information on body temperature of the TM-I device
- Information on EMC filter settings
- Simultaneous output of values and diagnostics information of all channels

Analog Input (AI) Blocks

The analog input (AI) blocks conform to the FOUNDATION Fieldbus specification and can be used to build a FOUNDATION fieldbus application. Depending on the configuration, AI blocks provide temperature, voltage, and resistance values.

Multiple Analog Input (MAI) Block

The multiple analog input (MAI) block conforms to the FOUNDATION Fieldbus specification and provides all eight sensor values in one block. Limits handling and alarms are not implemented in the MAI block. Also, the MAI block consumes only one execution time, so the FOUNDATION Fieldbus schedule time can be reduced.

The MAI block is useful, e. g., if the device is used for monitoring purposes, because it is easy to implement and does not require configuration. Additionally, only 1 block needs to be configured instead of 8.

4.2 Function Block Interaction and Channel Mapping

Transducer blocks transmit a measurement value to AI and MAI blocks. The connection between the blocks is established via the "Channel" parameter of the AI block. The AI block chooses the sensor block to get the process data from.

Channel Mapping

Number	Selected sensor	Usable by
1	Sensor 1	AI
2	Sensor 2	AI
3	Sensor 3	AI
4	Sensor 4	AI
5	Sensor 5	AI
6	Sensor 6	AI
7	Sensor 7	AI
8	Sensor 8	AI
9	Sensor 1 to 8	MAI
10	Body temperature	AI

In addition to the measurement value, status information is transmitted to the AI and MAI blocks that can be used to determine the quality of the measurement value. For more information see chapter 5

Function Block Interaction

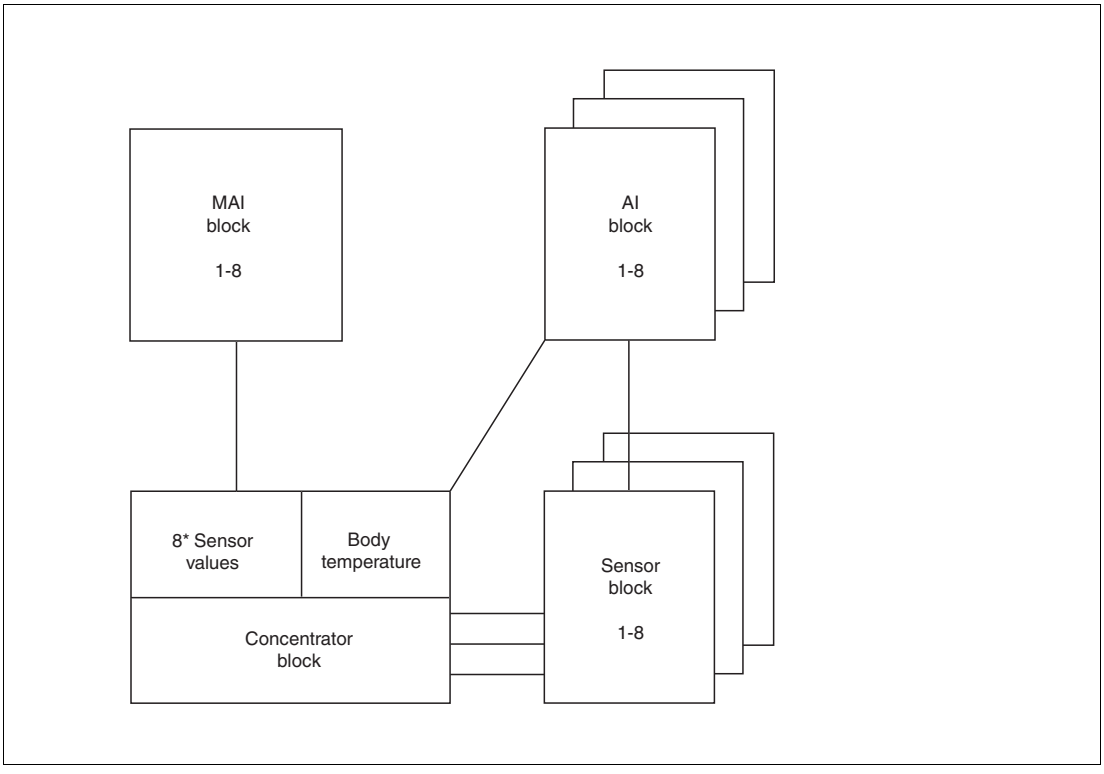

Figure 4.1 Function block interaction

4.3 Identification, Device ID, PD Tag

Each FOUNDATION Fieldbus device has a unique device ID. The temperature multi-input device ID is structured as follows:

Manufacturer identification	Device type	Serial number
502B46	0003	12345678901234

Table 4.1 Example of a device ID

The device ID "502B460003-12345678901234" contains the following information:

- Manufacturer identification "502B46" for Pepperl+Fuchs
- The device type "0003" for temperature multi-input
- The unique serial number "12345678901234"

The first 2 fields are the same for all temperature multi-input devices *-TI-Ex8.*.*. The serial number is unique for each device. Thus, the serial number is essential in order to differentiate several temperature multi-inputs connected to one FOUNDATION Fieldbus H1 segment.

The serial number is also provided on the nameplate of the device:

- RD0*: on the upper right side of the device
- F2D0*: on the inner left side of the housing

By default, the PD tag contains a clear text identification for the device and the last 9 characters of the serial number, e.g., "P+F TM-I Device 123456789".

4.4 Parameterization Prerequisites and Procedure

Preparing the Tools, Establishing the Fieldbus Connection, and Commissioning the TM-I Device

1. **Integrate the device description (DD) and capability file in the configuration tool of the host system:**
   To parameterize the temperature multi-input device in the online mode, import the associated device description (DD) in the engineering tool you use. For offline parameterization, a capability file is available. Unless the manufacturer of the control system has imported the files already, you find them on the Internet, on the Pepperl+Fuchs website. Consult the control system manual for instructions on how to import the files.
2. **Physically connect the temperature multi-input device with the fieldbus, assign an address:**
   Connect the fieldbus to the appropriate terminals of the device. If a power supply is connected, the device starts up and the LEDs indicate the connection progress in the following sequence:
   - Green PWR LED: ON
   - Sensor ERR LEDs: OFF
   - COM LED: flashes until communication with a link master is established
   Upon delivery, the device is configured to address 248. Most control systems automatically change the address after startup, so no user action is required. Refer to the control system manual for details.
3. **Commission the temperature multi-input device:**
   1. Configure the transducer blocks in either of the 2 ways:
   - Execute the DD methods of the sensor or concentrator block. You are guided through the setup process
   - Parameterize the transducer blocks manually, using the parameters described in the following sections
   2. Configure the AI/MAI blocks according to the requirements of the application.
   3. Build a schedule for the complete application and transfer it to all devices involved. For a more detailed temperature multi-input device configuration description, refer to the following sections.

4.5 Sensor Block Configuration

Tip

The concentrator and sensor block contain DD methods for convenient and fast sensor configuration.

Measurement Dataflow

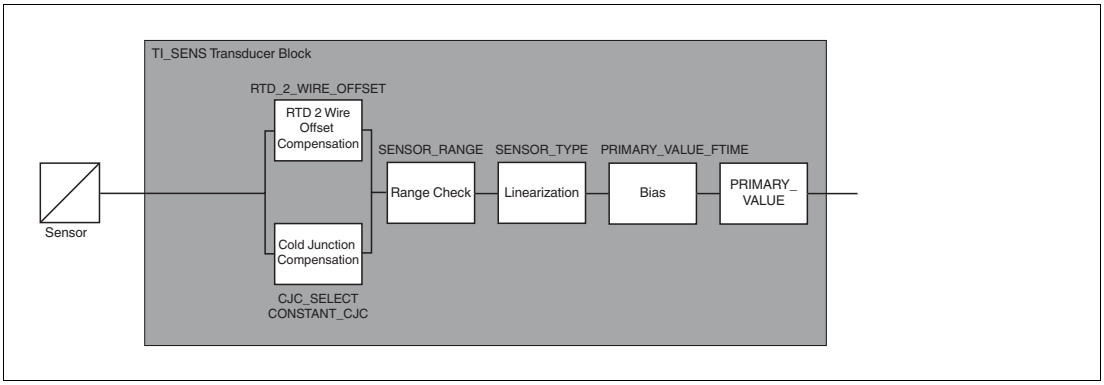

Figure 4.2 Measurement dataflow: The diagram shows the internal dataflow in the sensor block and illustrates the influence of the block parameters on the measurement. These parameters are explained in detail in the following sections.

Sensor Type

You can configure the sensor type attached to the corresponding connector via the "Sensor Type" parameter. The temperature multi-input device supports thermocouples, RTDs, and bare voltage or resistance measurement. For a list of supported sensors, refer to the respective product datasheet.

Sensor Wiring and Wire Resistance

For resistive sensors, choose a wiring method using the "Sensor Connection" parameter. A maximum value of 50 Ω is allowed for the resistance of a sensor wire. For a 2–wire connection, you can set a constant wire resistance value that is subtracted from the measured resistance via the "RTD 2 Wiring Resistance" parameter. For all other sensor connection methods, the parameter is ignored. The allowed value range is 0 ... 100 Ω. For voltage based sensors, the "Sensor Connection" parameter is ignored. It will not produce a configuration error if it is set to another value than 2–wire.

Measurement Unit

You can select between several units for "Primary Value.Value" via the "Sensor Range.Units Index" parameter. If you select an invalid unit for the sensor (e. g., "mV“ for a resistance based sensor), the "Configuration error" bit is set in the "BLOCK_ERR" parameter.

Filtering

The "Primary Value.Value" can be filtered by a first order lag. The filter time can be selected between 0 s ... 255 s via the "Primary Value Filtertime" parameter. Setting the value to 0 s disables filtering.

Sensor Diagnostics

You can enable sensor monitoring for each sensor via the "Sensor Diagnostics" parameter. If the sensor diagnostics indicates an sensor error, this will be reported in the "BLOCK_ERR", "Sensor status", and "Transducer error" parameters. The "Primary Value.Status" will be set to BAD. The default adjustment is sensor diagnostics enabled. Pepperl+Fuchs recommends to use sensor diagnostics for normal operation.

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Cold Junction Compensation (CJC)

Thermocouple temperature sensors require cold junction compensation (CJC) for accurate measurement. The temperature multi-input device supports 2 methods of CJC compensation:

- Internal: The cold junction temperature measured by built-in temperature sensors is used for compensation. This is the recommended method.
- Constant: You can set a constant cold junction temperature that is used for compensation.

Choose between one of these 2 methods via the "CJC Select" parameter for this. If you set it to "Constant", the TM-I device uses the value in "CJC Constant" for compensation. The unit is the same as for the "Primary Value.Value" parameter, that is specified by the "Sensor Range.Units Index" parameter. If you change the unit, the "CJC Constant" value is automatically converted to the new unit.

User Calibration

Note!

Pepperl+Fuchs recommends not to use the user calibration. The device is delivered with a suitable factory calibration.

Calibrating the Temperature Multi-Input Device (User Calibration)

If needed, you can calibrate the device manually ("user calibration"). Enable user-calibrated measurement by writing "Calibration on" to the "Calibration Mode" parameter. Calibrate the device as follows:

1. Select sensor type, wiring, and sensor diagnostics. It may be necessary to turn off sensor diagnostics if the device is connected to a calibration source that interferes with the sensor monitoring.
2. Write "Execute user calibration" to "Calibration Mode" parameter.
3. The unit used for calibration can be read from "Calibration Units" parameter.
4. Wait until "Calibration State" reads "Wait first calibration point".
5. Connect first resistor / apply first calibration voltage.
   Note: Consider the limits that can be read from "Calibration Highest/Lowest Point Limit".
6. Write the first calibration value to "Calibration Highest/Lowest Point", depending on the applied physical value.
7. Wait until "Calibration state" reads "Wait HI/LO Calibration Point", depending on whether high or low point was calibrated first.
8. Connect second resistor / apply second calibration voltage.
   Note: Consider the limits that can be read from "Calibration Highest/Lowest Point Limit" and "Calibration Minimum Span".
9. Write the second calibration value to "Calibration Highest/Lowest Point", depending on the point that was calibrated first.
   Note: It is not possible to write two times to the same parameter during the same calibration procedure to prevent errors.
10. "Calibration state" now reads "OK".
11. Enable user calibrated measurement by writing "Calibration On" to "User Calibration" parameter.

↳ If "Calibration State" reads "Failure" during calibration, the following errors may have occurred:
- Sensor diagnostics is enabled and a sensor error was detected
- A higher value was written to "Calibration Lowest Point" instead of "Calibration Highest Point"
- Calibration span was too small (see parameter "Calibration Minimum Span" during calibration)
- Values higher / lower than specified in "Calibration Highest/Lowest Point Limit" were applied

Non-Functional Parameters

The device offers several non-functional parameters to store additional information, i. e., parameters that do not affect the operation of the device in any way.
These parameters are:

- "Primary Value Type"
- "Sensor Serial No."
- "Sensor Calibration Method"
- "Sensor Calibration Location"
- "Sensor Calibration Date"
- "Sensor Calibration Who"
- "Calibration Location"
- "Calibration Date"
- "Calibration Who"

Block Mode

Sensor blocks support 2 modes: OOS (out-of-service) and AUTO.

In OOS mode, measurement is disabled and the sensor can be configured and/or calibrated.

In AUTO mode, measurement is enabled, all functional parameters except "Sensor Diagnostics" are write-protected.

4.6 Concentrator Block Configuration

The concentrator block provides a summary view for the most important sensor configuration parameters of each sensor block. These parameters are simply mapped with their corresponding counterparts in the sensor blocks. The write protection of the parameters depends on the target block mode of the sensor block.

Body Temperature

The "Body Temperature" parameter issues the body temperature of the device. You can configure the temperature unit via the "Body Temperature Unit" parameter. Note that you can map body temperature to an AI block,see chapter 4.2.

EMC Filter

Measurement values are filtered internally with a 50 Hz or 60 Hz filter to suppress EMC disurbance by that frequency. The filter can be configured via the "ASIC Rejection" parameter.

Pepperl+Fuchs recommends to configure the filter in accordance to the power supply system frequency used in the country of application.

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Block Mode

The block mode supports two modes of operation: OOS (out-of-service) and AUTO. In OOS mode, the body temperature status is always BAD and the body temperature unit can be configured. In AUTO mode, body temperature status is GOOD.

Note that the concentrator block mode does not affect write protection of the sensor parameters, since they solely depend on the target block mode of the sensor block.

4.7 AI and MAI Block Configuration

The AI and MAI blocks are standard FOUNDATION Fieldbus block types. Refer to the FOUNDATION Fieldbus standard for configuration information. For the channel mapping,see chapter 4.2.

5 Operation

5.1 Primary Value Status

The primary value of the sensor blocks can have the following status:

- Good (NC)-Non specific
- Good (NC)-Active Block Alarm
- Good (NC)-Unacknowledged Block Alarm
- Bad-Sensor Failure: The sensor value exceeds the values defined by Primary Value. A sensor range or sensor error (wiring error, lead breakage) is detected for the sensor inputs. The substatus "Hi-limited" or "Low-limited" define in which direction the sensor range has been exceeded. The substatus "Not limited" indicates a sensor error.
- Bad-Device Error: The internal diagnostics of the device has detected a hardware fault.
- Bad-OOS: The actual mode of the block is OOS.

5.2 Body Temperature Status

The body temperature status in the concentrator block is BAD if the block is in OOS mode. In AUTO mode, the value is always GOOD, as long as there is no integrated diagnostics error detected.

5.3 Device-Integrated Diagnostics

The Pepperl+Fuchs TM-I device continuously monitors its internal hardware and body temperature. If an error occurs the following happens:

- The status of all primary values switches to BAD
- The resource block "BLOCK_ERR" error parameter sets the bit "Device needs maintenance now" to generate an alarm

5.4 Alarms

If an error occurs, the corresponding transducer block issues a block alarm ("BLOCK_ALM"). It is a summary alarm for all alarms of this block and is asserted, as long as the fault is still valid. For information on the reason of the block alarm, read the following parameters and see chapter 6 for troubleshooting:

- "BLOCK_ERR"
- "Transducer error"

If the control system supports alarms, the "Alarm Occur" and "Alarm Clear" conditions are conveyed via the bus to the system. Since not all control systems support this mechanism, the temperature multi-input device supports an alternative method for error detection: All errors are shown in the "BLOCK_ERR" parameter of the transducer block. Usually, this parameter is cyclically read by the control system. For a list of errors reported by "BLOCK_ERR", see chapter 6.

Tip

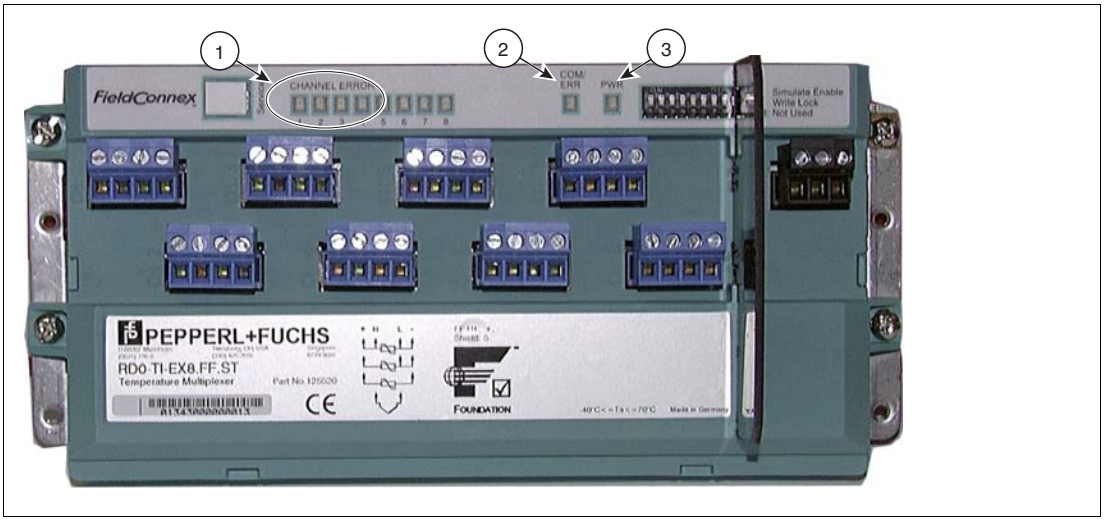
If the control system does not support alarms, proceed as follows:

- In the resource block, choose the parameter "FEATURES_SEL"
- Deactivate "Reports"

6 Troubleshooting

The following chapter offers explanations on the LED information statuses, possible fault error causes and remedies.

LED Status and Error Indication



1. Sensor-specific red LEDs: Indicate the status of the related sensor input channels
2. Red LED COM ERR: Indicates the communication status
3. Green LED PWR: Indicates the status of the bus power

6.1 LED Indications

LED	Statuses	Cause	Remedy
PWR (green)	OFF	No power supply	■ Check power supply ■ Check fieldbus cable wiring
	Permanently ON	Power available	-
COM (red)	OFF	Communication active	-
	Permanently ON	Hardware error	Send device to Pepperl+Fuchs for repair
	Flashing ON/OFF	No communication Communication errors	■ Check LAS ■ Check wiring
Sensor (red) Channel 1–8	OFF	No sensor errors detected	-
	Flashing ON/OFF	Sensor error (over / under range, wiring error, lead breakage)	Check sensor wiring. Refer to diagnostic messages in the respective sensor transducer block for details.

6.2 Resource Block

Problem		**Remedy**	
Parameter	**Message**	**Cause**	**Procedure**
BLOCK_ERR	Lost Static Data	Parameterization data stored in the device was faulty and was replaced by default settings	Repeat parameterization. If this error occurs repeatedly, send the device to Pepperl+Fuchs for repair
	Device needs maintenance now	Hardware error	Send device to Pepperl+Fuchs for repair
	Simulate active	Simulation enabled by setting switch 1	Check whether simulation is permitted
	OOS	The target mode of the block is OOS	Set block to "Auto" mode
RS_STATE	Online	No error	-
	Stand–by	The target mode of the block is OOS	Set block into "Auto" mode

Table 6.1 Resource block errors

6.3 Sensor Block

Problem		Remedy	
Parameter	**Message**	**Cause**	**Procedure**
BLOCK_ERR	Block configuration error	■ "Sensor Type" is set to "Undefined" ■ "Sensor Range.Unit" is set to a value not supported by sensor (e.g., "mV" for a resistance based sensor) ■ User calibration is turned on at "Calibration Mode", but "Calibration State" shows no valid user calibration exists	Correct parameterization
	Input failure	Several	See table "Common Sensor Block Problems" below
	OOS	The target mode of the block is OOS	Set block to "Auto" mode
Transducer Error (XD_ERROR)	Configuration error	See above at "BLOCK_ERR"	See above at "BLOCK_ERR"
	I/O failure	The sensor value exceeds the HI or LO sensor limits	See table "Common Sensor Block Problems" below
	Lead breakage / sensor connection error	Sensor wiring fault	See table "Common Sensor Block Problems" below
Sensor Status	Sensor connection error	See "Transducer Error"	See "Transducer Error"
	Over range	Sensor high measurement limit exceeded	See table "Common Sensor Block Problems" below
	Under range	Sensor low measurement limit exceeded	See table "Common Sensor Block Problems" below

Table 6.2 Sensor block errors

Common Sensor Block Problems

Problem	Remedy	
	Cause	**Procedure**
Block does not leave OOS mode	A configuration error is reported	Clear configuration error cause, see above
	Resource block is in OOS mode	Set resource block to AUTO mode
Sensor failure	Sensor error (overrange, underrange, lead breakage)	■ Check wiring ■ Use sensor with a greater input range
	Wrong sensor type selected	Configure correct sensor type
	RTD3 / RTD4 wires mixed up	Check cabling,
Wrong measurement values	Thermocouple polarity reversed	Check thermocouple polarity
Unable to write to parameters	Write protection is enabled	Set write protection DIP switch to OFF. See chapter 3.2.6
	Block is in AUTO mode	Set "MODE_BLK.Target" to "OOS"

Table 6.3 Common sensor block problems

6.4 Concentrator Block

Problem		Remedy	
Parameter	**Message**	**Cause**	**Procedure**
BLOCK_ERR	Body temperature out of range	Body temperature of device too high / too low	■ Choose another mounting location ■ Adjust ambient temperature of mounting location
	OOS	The target mode of the block is OOS	Set block to "Auto" mode
Transducer error (XD_ERROR)	Body temperature out of range	See "BLOCK_ERR"	See "BLOCK_ERR"

Table 6.4 Concentrator block errors

Common Concentrator Block Problems

Problem	Remedy	
	Cause	**Procedure**
Block does not leave OOS mode	Resource block is in OOS mode	Set resource block to AUTO mode
Unable to write to parameters	Write protection is enabled	Set write protection DIP switch to OFF, see chapter 3.2.6
	Corresponding sensor block is in AUTO mode	Set sensor block to OOS mode
	Block is in AUTO mode	Set "MODE_BLK.Target" to "OOS"

Table 6.5 Common concentrator problems

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6.5 AI Function Block

Problem		Remedy	
Parameter	**Message**	**Cause**	**Procedure**
BLOCK_ERR	Block configuration error	The channel parameter contains an invalid value	Set valid value, see chapter 4.2
		The function block does not have a schedule downloaded	Include block into application and download schedule to device
		"L_TYPE" parameter is set to an incorrect value	Set "L_TYPE" to correct value
	Input failure	Transducer block reports BAD "Primary Value.Status"	Check transducer block diagnostics (see "Sensor Block Errors", above)
	Simulate active	Simulation for block is activated	Check simulation activation
	Out-of-service	Actual block mode is OOS	■ Choose suitable target mode· ■ Check block configuration

Table 6.6 AI function block errors

Common AI Block Problems

Problem	Remedy	
	Cause	**Procedure**
Function block does not leave OOS mode	A "BLOCK_ERR" is reported	Clear block error cause
	The function block does not have a schedule downloaded	Include block into application and download schedule to device
	Resource block is in OOS mode	Set resource block to AUTO mode
OUT does not show transducer block value	Simulation activated	Disable simulation
Simulation does not activate	Simulation DIP switch set to OFF	Set simulation DIP switch to ON, see chapter 3.2.6
Unable to write to parameters	Write protection is enabled	Set write protection DIP switch to OFF, see chapter 3.2.6
	Block is in AUTO mode	Set "MODE_BLK.Target" to "OOS"

Table 6.7 Common AI block problems

6.6 MAI Function Block Errors

Problem		Remedy	
Parameter	**Message**	Cause	**Procedure**
BLOCK_ERR	Block configuration error	The channel parameter contains an invalid value	Set valid value, see chapter 4.2
		The function block does not have a schedule downloaded	Include block into application and download to device

Table 6.8 MAI function block errors

Common MAI Problems

Problem	Remedy	
	Cause	**Procedure**
Function block does not leave OOS mode	A "BLOCK_ERR" is reported	Clear block error cause, see above
	Resource block is in OOS mode	Set resource block to AUTO mode
	The function block does not have a schedule downloaded	Include block into application and download schedule to device
Unable to write to parameters	Write protection is enabled	Set write protection DIP switch to OFF, see chapter 3.2.6
	Block is in AUTO mode	Set "MODE_BLK.Target" to "OOS"

Table 6.9 Common MAI problems

6.7 Diagnostic Summary

Diagnostic Alarm	Description	Alarm Indication
Communication failure	H1 segment communication is not established	LED
EEPROM failure	The device configuration database is corrupted	RB Alarm, RB BLOCK_ERR
Program storage failure	The firmware of the device is corrupted	LED
Memory failure	The memory inside the device is defective	LED
Body temperature too high/low	The body temperature of the device exceeds its specification	RB Alarm, Concentrator BLOCK_ERR
Resource block is in out-of-service mode	The actual mode of the RB is OOS	RB Alarm, RB BLOCK_ERR
Block is in out-of-service mode	The actual mode of the block is OOS. This is the same for all function and transducer blocks.	Block Alarm, BLOCK_ERR
Block configuration error	One or more parameters of the block contain invalid or conflicting values. This is the same for all function and transducer blocks.	Block Alarm, BLOCK_ERR
Sensor error (wiring, lead break)	A cable of the sensor is broken, incorrect sensor wiring	Block Alarm, BLOCK_ERR of all TBs
Sensor over/ underrange	Measured sensor value exceeds its high or low range limit	Block Alarm, BLOCK_ERR of all TBs
Simulation active	The simulation is enabled for a function block	Block Alarm, BLOCK_ERR of all TBs
Device HW failure (ADC, CJC measurement, etc.)	The device detected an internal HW failure at the measurement unit	Block Alarm, BLOCK_ERR of RB, status of affected values, LED

Table 6.10 Device diagnostic summary

6.8 Recommended Action for Field Diagnostics according to NE 107

Alarm Type	Diagnostic Event	Cause	Recommended Action
Maintenance required	Configuration error		Check blocks for configuration errors.
Failed	Device failure	Body temperature > +95°C	Send the device to Pepperl+Fuchs for repair.
		Body temperature > -50°C	
		NV storage verification failed	
		NV storage write failed	
		Hardware error detected	
	Channel 8 input failure	Over-/underrange of measured value. Wiring error.	Check transducer block for more details, see manual.
	Channel 7 input failure		
	Channel 6 input failure		
	Channel 5 input failure		
	Channel 4 input failure		
	Channel 3 input failure		
	Channel 2 input failure		
	Channel 1 input failure		
Function check	Check		Check block modes according to normal mode.
Out of specification	Body temperature off range.	Body temperature > +90 °C	Adjust ambient temperature of mounting locations
		Body temperature < -40 °C	

7 Function Block Descriptions

7.1 Resource Block (RB)

Rel. Index	Parameter	Description
01	ST_REV	The revision level of the static data associated with the resource block. The revision value is incremented each time a static parameter value in the block is changed.
02	TAG_DESC	The user description of the intended application of the block.
03	STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
04	ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
05	MODE_BLK	The actual, target, permitted, and normal modes of the block:· ■ Target: The mode to "go to" ■ Actual: The mode the "block is currently in" ■ Permitted: Allowed modes that target may take on ■ Normal: Most common mode for actual
06	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string so that multiple errors may be shown. Supported values are:· ■ Simulate Active: Hardware switch is set to "simulation possible" ■ Lost Static Data: The database used for storing the NV parameters within the device is corrupt ■ Device Needs Maintenance Now: The hardware of the device failed in some way (e.g., body temperature too high) ■ Out-of-Service: The RB is in OOS mode
07	RS_STATE	State of the resource block application state machine.
08	TEST_RW	Read/write test parameter. Used only for conformance testing.
09	DD_RESOURCE	String identifying the tag of the resource that contains the device description for this resource.
10	MANUFAC_ID	Manufacturer identification number. Used by an interface device to locate the DD file for the resource. The Pepperl+Fuchs ID is 0x502B46.
11	DEV_TYPE	Manufacturer model number associated with the resource. Used by interface devices to locate the DD file for the resource. The P+F TI Mux is device type 3.
12	DEV_REV	Manufacturer revision number associated with the resource. Used by an interface device to locate the DD file for the resource.
13	DD_REV	Revision of the DD associated with the resource - used by an interface device to locate the DD file for the resource.
14	GRANT_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.
15	HARD_TYPES	The types of hardware available as channel numbers. Only scalar types are supported.

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Rel. Index	Parameter	Description
16	RESTART	Allows a manual restart to be initiated. Several degrees of restart are possible: 1. Run - nominal state when not restarting 2. Restart resource - not used 3. Restart with defaults - set parameters to default values 4. Restart processor - does a warm restart of CPU
17	FEATURES	Used to show supported resource block options.
18	FEATURES_SEL	Used to select resource block options. Supported values are: ■ Unicode: Tells host to use Unicode for string values ■ Reports: Enables alarms, must be set for alarms to work ■ Hardware Lock: Hardware write locking enabled but not active WRITE_LOCK follows the status of the security switch
19	CYCLE_TYPE	Identifies the block execution methods available for this resource. Supported values are: ■ Schedule ■ Completion of block execution
20	CYCLE_SEL	Used to select the block execution method for this resource. Supported values are: ■ Scheduled: Blocks are only executed based on the schedule in FB_START_LIST. ■ Block Execution: A block may be executed by linking it to another blocks completion.
21	MIN_CYCLE_T	Time duration of the shortest cycle interval, of which the resource is capable. The Pepperl+Fuchs TM-I device supports 100 ms.
22	MEMORY_SIZE	Available configuration memory in the empty resource.
23	NV_CYCLE_T	Interval between writing copies of NV parameters to non–volatile memory. Zero means none.
24	FREE_SPACE	Percent of memory available for further configuration. Not supported by Pepperl+Fuchs TM–I device.
25	FREE_TIME	Percent of the block processing time that is free to process additional blocks. Not supported by Pepperl+Fuchs TM-I device.
26	SHED_RCAS	Time duration at which to give up on computer writes to function block RCas locations.
27	SHED_ROUT	Time duration at which to give up on computer writes to function block ROut locations.
28	FAULT_STATE	Condition set by loss of communication to an output block, failure promoted to an output block or a physical contact. When a fault state condition is set, the output function blocks will perform their FSTATE actions. The Pepperl+Fuchs TI Mux does not support output blocks.
29	SET_FSTATE	Allows the fault state condition to be manually initialized by selecting Set. The Pepperl+Fuchs TI Mux does not support this function.
30	CLR_FSTATE	Writing a Clear to this parameter will clear the device fault state if any field condition has cleared. The Pepperl+Fuchs TI Mux does not support this function.
31	MAX_NOTIFY	Maximum number of unconfirmed alert notifications messages possible. This number cannot be changed. The Pepperl+Fuchs TI Mux supports a maximum of 42.

Rel. Index	Parameter	Description
32	LIM_NOTIFY	Maximum number of unconfirmed alert notification messages allowed. Pepperl+Fuchs TI Mux supports a maximum of 42.
33	CONTIRM_TIME	The minimum time between retries of alert reports. Retries are not possible when parameter is set to 0.
34	WRITE_LOCK	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs will continue to be updated.
35	UPDATE_EVT	This alert is generated by any change to the static data.
36	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the ALARM_STATE subcode.
37	ALARM_SUM	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
38	ACK_OPTION	Selection of whether alarms associated with the function block will be automatically acknowledged.
39	WRITE_PRI	Priority of the alarm generated by clearing the write lock.
40	WRITE_ALM	This alert is generated if the write lock parameter is cleared.
41	ITK_VER	Major revision number of the interoperability test case used to register the device with Fieldbus FOUNDATION.
42	SERIAL_NUM	Unit specific serial number to identify production and release information. Set by manufacturer.
43	SW_REV	The software revision of the firmware within the device.

Table 7.1 Resource block parameter list

7.2 Analog Input Function Block (AI)

Rel. Index	Parameter	Units	Description
01	ST_REV		The revision level of the static data associated with the resource block. The revision value is incremented, each time a static parameter value in the block is changed.
02	TAG_DESC		The user description of the intended application of the block.
03	STRATEGY		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
04	ALERT_KEY		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
05	MODE_BLK		The actual, target, permitted, and normal modes of the block:· ■ Actual: The mode the "block is currently in" ■ Target: The mode to "go to" ■ Permitted: Allowed modes that target may take on ■ Normal: Most common mode for target
06	BLOCK_ERR		This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string so that multiple errors may be shown.
07	PV	EU of XD_SCALE	The primary analog process variable used in block execution.
08	OUT	EU of OUT_SCALE or XD_SCALE if in direct L_TYPE	The primary analog block output value and status.
09	SIMULATE		A data structure that contains the current transducer output value and status, the simulated transducer value and status, and the enable/disable bit.
10	XD_SCALE		A data structure that contains the high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the channel input value.
11	OUT_SCALE		A data structure that contains the high and low scale values, engineering units code, and number of digits to the right of the decimal point displaying the OUT parameter.
12	GRANT_DENY		Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by device.
13	IO_OPTS		Allows the selection of input/output options used to alter the input block processing (PV).
14	STATUS_OPTS		Allows selecting options for status handling and processing. The following options are supported in the AI block: ■ Propagate fault forward ■ Uncertain if limited ■ Bad if limited ■ Uncertain if manual mode

Rel. Index	Parameter	Units	Description
15	CHANNEL		The CHANNEL value is the number of the physical input (transducer output) that is used as input for the function block. Supported values are: ■ 1-8: physical input from Channel 1 to Channel 8 ■ 10: physical input from concentrator block that is the internal device temperature
16	L_TYPE		Determines in which of the following ways the field value is used: ■ Directly (Direct) ■ Linearly converted (Indirect) ■ Converted with the square root (Indirect Square Root)
17	LOW_CUT	%	If transducer input percentage value falls below this value, then PV is set to 0
18	PV_FTIME	Seconds	Time constant of the first-order filter for the PV. It is the time required for a 63 % change in the PV or OUT value. Used for filtering the response time.
19	FIELD_VAL	%	The value (in percent of the PV range) and status from the transducer block or from the simulated input before signal characterization.
20	UPDATE_EVT		This alert is generated by any change to the static data.
21	BLOCK_ALM		Block alarm used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the ALARM_STATE subcode. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
22	ALARM_SUM		The current alert status, unacknowledged states, and disabled states of the alarm associated with the function block.
23	ACK_OPTION		Used to set auto acknowledgement of alarms.
24	ALARM_HYS	%	Span (in percent of the PV span) in which a PV must return before an alarm condition is cleared.
25	HI_HI_PRI		The priority of the HI-HI alarm.
26	HI_HI_LIM	EU of PV_SCALE	The setting for the alarm limit used to detect the HI-HI alarm condition.
27	HI_PRI		The priority of the HI alarm.
28	HI_LIM	EU of PV_SCALE	The setting for the alarm limit used to detect the HI alarm condition.
29	LO_PRI		The priority of the LO alarm.
30	LO_LIM	EU of PV_SCALE	The setting for the alarm limit used to detect the LO alarm condition.
31	LO_LO_PRI		The priority of the LO-LO alarm.
32	LO_LO_LIM	LO_LO_PRI	The setting for the alarm limit used to detect the LO-LO alarm condition.
33	HI_HI_ALM		HI-HI alarm data including a value of the alarm, a time stamp of occurrence, and the state of the alarm.
34	HI_ALM		HI alarm data including a value of the alarm, a time stamp of occurrence, and the state of the alarm.
35	LO_ALM		LO alarm data including a value of the alarm, a time stamp of occurrence, and the state of the alarm.

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Rel. Index	Parameter	Units	Description
36	LO_LO_ALM		LO-LO alarm data including a value of the alarm, a time stamp of occurrence, and the state of the alarm.

Table 7.2 Analog input function block (AI) parameter list

7.3 Multiple Analog Input Function Block (MAI)

Rel. Index	Parameter	Units	Description
01	ST_REV		The revision level of the static data associated with the resource block. The revision value is incremented each time a static parameter value in the block is changed.
02	TAG_DESC		The user description of the intended application of the block.
03	STRATEGY		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
04	ALERT_KEY		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
05	MODE_BLK		The actual, target, permitted, and normal modes of the block:· ■ Actual: The mode the "block is currently in" ■ Target: The mode to "go to" ■ Permitted: Allowed modes that target may take on ■ Normal: Most common mode for target
06	BLOCK_ERR		This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string so that multiple errors may be shown.
07	CHANNEL		Allows for custom channel setting. Valid values: ■ 0: Uninitialized ■ 9: Physical channels 1 to 8 will be set to the corresponding sensors
08–15	OUT_(1–8)	EU of OUT_SCALE	The block output value and status.
16	UPDATE_E VT		This alert is generated by any change to the static data.
17	BLOCK_ALM		The block alarm is used for all configuration, hardware connection feature, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block may be reported without clearing the Active status, if the subcode has changed.

Table 7.3 Multiple analog input function block (MAI) parameter list

7.4 TI_SENS Sensor Blocks (TIS)

The properties column contains the following parameter properties:

- S: Static (a write access to this parameter increments ST_REV)
- W: Writeable parameter
- OOS: Parameter is writeable in out-of-service (OOS) mode only
- SP: Special (see description column)
- NF: Non-functional parameter (does not change block behavior)

Rel. Index	Parameter	Units	Description
01	ST_REV		The revision level of the static data associated with the resource block. The revision value is incremented each time a static parameter value in the block is changed.
02	TAG_DESC		The user description of the intended application of the block.
03	STRATEGY		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
04	ALERT_KEY		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
05	MODE_BLK		The actual, target, permitted, and normal modes of the block:· ■ Actual: The mode the "block is currently in" ■ Target: The mode to "go to" ■ Permitted: Allowed modes that target may take on ■ Normal: Most common mode for target
06	BLOCK_ERR		This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string so that multiple errors may be shown. Supported values are: ■ Block Configuration Error: Target block mode is different than OOS and one of the following conditions is true: - Sensor type is set to undefined - "Sensor Range.Unit" is set to a value not supported by the sensor (e.g., "mV" for a resistance based sensor) - User calibration is turned on at "Calibration Mode", but Calibration State shows no valid user calibration exists ■ Input Failure: "Primary Value.Status" is BAD, but not BAD/OOS ■ Out-of-Service: Actual mode of the block is OOS
07	UPDATE_EVT		This alert is generated by any change to the static data

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Rel. Index	Parameter	Units	Description
08	BLOCK_ALM		The block alarm is used for all configuration, hardware connection feature, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter.
09	Transducer Error (XD_ERROR)		Stores the actual transducer block error with the highest priority. Supported values are: ■ Configuration Error: A block configuration error exists. See "BLOCK_ERR" for details ■ I/O Failure: The sensor value exceeds the HI or LO sensor Limits ■ Sensor Connection Error: Sensor cabling error detected
10	Primary Value Type	S, W, NF	Defines the type of the Primary Value. The following values are valid: ■ Process temperature ■ Non-process temperature ■ mV ■ Ohm
11	Primary Value		The value and status of the sensor input, see chapter 5
12	Primary Value Filtertime	S, OOS	Time constant in seconds of a first order lag filter applied to "Primary value". Valid values are 0 ... 255 s. A value of 0 disables filtering.
13	Sensor Type	S, OOS	Type of the attached sensor. For a list of supported sensors, see datasheet. If "Sensor Type" is written some other parameters will be set automatically for convenience: ■ If voltage mode or a TC is selected, "SENSOR_CONNECTION" is set to 2-wire ■ If voltage mode is selected, Primary Value unit is set to mV ■ If resistance input is selected the Primary Value unit is set to Ohm ■ If a TC or RTD sensor is selected and the Primary Value Unit is mV or Ohm it is set to °C
14	Sensor Range	S, OOS	Defines the absolute maximum ends of the sensor range, the units of those limits and the number of digits to the right of the decimal point to be used to display these values. Supported units: mV, Ohm, °C, °F, K, °R
15	Sensor Connection	S, OOS	Number of wires used to connect the sensor. This parameter is only used if a resistance-based sensor is configured. Supported values are: ■ Two wires ■ Three wires ■ Four wires
16	Sensor Diagnostics	S, W	Enables sensor diagnostics.

Rel. Index	Parameter	Units	Description
17	Sensor Status		Shows failures of the attached sensor, it is a bit string so multiple errors can be shown. Supported values are: ■ Sensor connection error ■ Over range: The measured value is too high for current sensor ■ Under range: The measured value is too low for current sensor
18	Sensor Serial No.	S, W, NF	The serial number of the attached sensor.
19	Sensor Calibration Method	S, W, NF	Last calibration method used for the attached sensor: ■ Factory trim standard calibration ■ User trim standard calibration ■ Factory trim special calibration ■ User trim special calibration ■ Other
20	Sensor Calibration Location	S, W, NF	Shows location of the last calibration for the attached sensor.
21	Sensor Calibration Data	S, W, NF	Shows date of the last calibration for the attached sensor.
22	Sensor Calibration Who	S, W, NF	Shows name of person responsible for the last calibration for the attached sensor.
23	RTD 2 Wire Resistance	S, OOS	Specifies an offset subtracted from the measured resistance if a two-wire RTD or Ohm sensor is attached. The value is specified as a positive floating point number.
24	CJC Select	S, OOS	Selects the method used to do a CJC: ■ Internal: use the internally measured value ■ Constant: use the value of parameter "Constant CJC"
25	CJC Constant	S, OOS	Value used for CJ compensation if "CJC select" is set to Constant. Uses the Unit of "Sensor Range.Units Index". The value is converted automatically if "Sensor Range.Units Index" is changed.
26	Calibration Highest Point	S, SP	Upper value for calibration of the input. Writeable only during calibration.
27	Calibration Lowest Point	S, SP	Lower value for calibration of the input. Writeable only during calibration.
28	Calibration Highest Point Limit		Highest value allowed to calibrate the input.
29	Calibration Lowest Point Limit		Lowest value allowed to calibrate the input.
30	Calibration Minimum Span		Minimum allowed difference between "Calibration Highest Point" and "Calibration Lowest Point".

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Rel. Index	Parameter	Units	Description
31	Calibration Units		Unit used to calibrate the input. It is set automatically when a calibration starts. Valid values: mV and Ohm
32	Calibration Mode	S, OOS	Stipulates the validity of user calibration and turns the calibration mode on for the input. Supported values are: ■ User calibration off ■ User calibration on: A calibration error ("Calibration State" reads "Failure") will be reported as a block configuration error so the block will not switch to AUTO mode. ■ Execute user calibration
33	Calibration State		Shows the state of the user calibration for the input. Supported values are: ■ Not initialized: No user calibration was carried out yet. The user calibration cannot be turned on. ■ Executing: User calibration is being started. ■ OK: A valid user calibration has been executed. ■ Failure: The last user calibration failed. The values are invalid. The user-calibrated measurement cannot be turned on. The block will report a configuration error if "Calibration Mode" is set to "User calibration on". ■ Wait first: Device is waiting for write on "Calibration Highest Point" or "Calibration Lowest Point" as first calibration point. ■ Wait second HI: Device is waiting for write on "Calibration Highest Point" as second calibration point. ■ Wait second LO: Device is waiting for write on "Calibration Lowest Point" as second calibration point. ■ Sampling HI: Device is measuring HI calibration value. ■ Sampling LO: Device is measuring LO calibration value.
34	Calibration Location	S, W, NF	Shows location of the last calibration for the input.
35	Calibration Date	S, W, NF	Shows date of the last calibration for the input.
36	Calibration Who	S, W, NF	Shows name of person responsible for the last calibration for the input.

Table 7.4 TI_SENS block (AI) parameter list

7.5 Concentrator Block (TIC)

The properties column contains the following parameter properties:

- S: Static (a write access to this parameter increments ST_REV)
- W: Writeable parameter
- OOS: Parameter is writeable in out-of-service (OOS) mode only
- SP: Special (see description column)
- NF: Non-functional parameter (does not change block behavior)

Rel. Index	Parameter	Units	Description
01	ST_REV		The revision level of the static data associated with the resource block. The revision value is incremented each time a static parameter value in the block is changed.
02	TAG_DESC	S, W, NF	The user description of the intended application of the block.
03	STRATEGY	S, W, NF	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
04	ALERT_KEY	S, W, NF	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
05	MODE_BLK	S, W	The actual, target, permitted, and normal modes of the block:· ■ Actual: The mode the "block is currently in" ■ Target: The mode to "go to" ■ Permitted: Allowed modes that target may take on ■ Normal: Most common mode for target
06	BLOCK_ERR		This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string so that multiple errors may be shown. Supported values are: ■ 15: Out-of-Service = Actual Mode of the Block is OOS ■ 129: Body temperature too high or too low
07	UPDATE_EVT		This alert is generated by any change to the static data
08	BLOCK_ALM		The block alarm is used for all configuration, hardware connection feature, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block may be reported without clearing the Active status, if the subcode has changed.
09	Transducer Error (XD_ERROR)		Stores the actual transducer block error with the highest priority. Supported values are: ■ 129: Body temperature too high or too low

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Rel. Index	Parameter	Units	Description
10	Block Mode Channel 1	S, W	Mode block of sensor input 1.
11	Primary Value		The value and status of sensor input 1.
12	Primary Value Filtertime Channel 1	S, SP	The damping value for sensor input 1. Parameter is writeable if corresponding sensor block is in OOS mode.
13	Sensor Unit Channel 1	S, SP	The unit used for sensor input 1. Parameter is writeable if corresponding sensor block is in OOS mode.
14	Sensor Type Channel 1	S, SP	The type of sensor input 1. Parameter is writeable if corresponding sensor block is in OOS mode.
15	Sensor Connection Channel 1	S, SP	The connection type of sensor input 1. Parameter is writeable if corresponding sensor block is in OOS mode.
16	Sensor Diagnostics Channel 1	S, W	Allows to enable/disable the sensor diagnostics for sensor 1.
18–73	The sensor specific values above are repeated for the sensor inputs 2–8: ■ 18 - 24 channel 2 ■ 25 - 31 channel 3 ■ 32 - 38 channel 3 ■ 39 - 45 channel 4 ■ 46 - 52 channel 5 ■ 53 - 59 channel 6 ■ 60 - 66 channel 7 ■ 67 - 73 channel 8		
74	Body Temperature		Value and status of the body temperature.
75	Body Temperature Unit	S, OOS	The unit used to display body temperature. Valid units: °C, °F, °R, K
76	ASIC Rejection	S, W	Used to set the electrical noise filter, depending on the power line frequency of the installation. Valid values are 50 Hz and 60 Hz.
77	Status Summary		Overview of the sensor status of all sensors. The parameter is a bit string, so multiple errors can be displayed. Supported values: "Bad sensor 1" to "Bad sensor 8"

Table 7.5 Concentrator block parameter list

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