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Products　　　　　　　Solutions　　　　　　　Services

Operating Instructions
iTEMP TMT162

Dual-input temperature transmitter with PROFIBUS® PA protocol

Endress+Hauser

People for Process Automation

Table of contents

1 About this document

1.1 Function of document and how to use

1.1.1 Document function

These Operating Instructions contain all the information required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to installation, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.

1.1.2 Safety Instructions (XA)

When using in hazardous areas, the relevant national standards must be observed. Separate Ex-specific documentation is provided for measuring systems that are used in hazardous areas. This documentation is an integral part of these Operating Instructions. The installation specifications, connection data and safety instructions contained therein must be strictly observed! Make sure that you use the right Ex-specific documentation for the right device with approval for use in hazardous areas! The number of the specific Ex documentation (XA...) is provided on the nameplate. If the two numbers (on the Ex documentation and the nameplate) are identical, then you may use this Ex-specific documentation.

1.2 Symbols

1.2.1 Safety symbols

⚠ DANGER
This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

⚠ WARNING
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

⚠ CAUTION
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE
This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Electrical symbols

Symbol	Meaning
⎓	Direct current
∿	Alternating current
≂	Direct current and alternating current

Symbol	Meaning
![ground]	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
![PE]	**Potential equalization connection (PE: protective earth)** Ground terminals that must be connected to ground prior to establishing any other connections. The ground terminals are located on the interior and exterior of the device: • Interior ground terminal: potential equalization is connected to the supply network. • Exterior ground terminal: device is connected to the plant grounding system.

1.2.3 Symbols for certain types of information

Symbol	Meaning
✅	**Permitted** Procedures, processes or actions that are permitted.
✅✅	**Preferred** Procedures, processes or actions that are preferred.
❌	**Forbidden** Procedures, processes or actions that are forbidden.
ℹ️	**Tip** Indicates additional information.
📖	Reference to documentation
📄	Reference to page
🖼️	Reference to graphic
1. , 2. , 3. ...	Series of steps
↳	Result of a step
❓	Help in the event of a problem
👁️	Visual inspection

1.2.4 Tool symbols

Symbol	Meaning
A0011220	Flat-blade screwdriver
A0011219	Phillips screwdriver
A0011221	Allen key
A0011222	Open-ended wrench
A0013442	Torx screwdriver

1.3   Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

1.3.1   Document function

The following documentation may be available depending on the version ordered:

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	**Your reference document** The Operating Instructions contain all the information that is required in the various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety Instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. The Safety Instructions are an integral part of the Operating Instructions. Information on the Safety Instructions (XA) relevant to the device is provided on the nameplate.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is an integral part of the device documentation.

1.4   Registered trademarks

PROFIBUS®
Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

2 Safety instructions

2.1 Requirements for the personnel

NOTICE

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
▶ Trained, qualified specialists: must have a relevant qualification for this specific function and task
▶ Are authorized by the plant owner/operator
▶ Are familiar with federal/national regulations
▶ Before beginning work, the specialist staff must have read and understood the instructions in the manuals and supplementary documentation as well as in the certificates (depending on the application)
▶ Follow instructions and comply with basic conditions

The operating personnel must meet the following requirements:
▶ Be instructed and authorized according to the requirements of the task by the facility's owner-operator
▶ Follow the instructions in these Operating Instructions

2.2 Intended use

The device is a universal and configurable temperature field transmitter with either one or two temperature sensor inputs for resistance thermometers (RTD), thermocouples (TC) and resistance and voltage transmitters. The device is designed for mounting in the field.

The manufacturer is not liable for damage caused by improper or non-intended use.

2.3 Workplace safety

When working on and with the device:
▶ Wear the required personal protective equipment as per national regulations.

2.4 Operational safety

• Operate the device only if it is in proper technical condition, free from errors and faults.
• The operator is responsible for the interference-free operation of the device.

Power supply
▶ PROFIBUS® PA U_b = 9 to 32 V, polarity-independent, maximum voltage U_b = 35 V. According to IEC 60079-27, FISCO/FNICO

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:
▶ If modifications are nevertheless required, consult with Endress+Hauser.

Repair

To ensure continued operational safety and reliability:
▶ Carry out repairs on the device only if they are expressly permitted.
▶ Observe national regulations pertaining to the repair of an electrical device.
▶ Use original spare parts and accessories from Endress+Hauser only.

Hazardous area

To eliminate a danger for persons or for the facility when the device is used in the hazardous area (e.g. explosion protection or safety equipment):

▶ Based on the technical data on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area. The nameplate can be found on the side of the transmitter housing.

▶ Observe the specifications in the separate supplementary documentation included as an integral part of these instructions.

Electromagnetic compatibility

The measuring system complies with the general safety requirements as per EN 61010-1, the EMC requirements as per the IEC/EN 61326 series and the NAMUR recommendations NE 21 and NE 89.

2.5 Product safety

This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU Declaration of Conformity. The manufacturer confirms this by affixing the CE mark to the device.

2.6 IT security

Our warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

3 Incoming acceptance and product identification

3.1 Incoming acceptance

Proceed as follows on receipt of the device:

1. Check whether the packaging is intact.

2. If damage is discovered:
   Report all damage immediately to the manufacturer.

3. Do not install damaged components, as the manufacturer cannot otherwise guarantee the material resistance or compliance with the original safety requirements, and can also not be held responsible for the consequences that may result.

4. Compare the scope of delivery against the contents of your order.

5. Remove all the packaging material used for transportation.

6. Do the data on the nameplate match the ordering information on the delivery note?

7. Are the technical documentation and all other necessary documents provided, e.g. certificates?

If one of the conditions is not satisfied, contact your Sales Center.

3.2 Product identification

The device can be identified in the following ways:
- Nameplate specifications
- Enter the serial number from the nameplate in the *Device Viewer* (www.endress.com/deviceviewer): all data relating to the device and an overview of the Technical Documentation supplied with the device are displayed.
- Enter the serial number on the nameplate into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations App*: all the information about the device and the technical documentation pertaining to the device is displayed.

3.2.1 Nameplate

The right device?

The nameplate provides you with the following information on the device:
- Manufacturer identification, device designation
- Order code
- Extended order code
- Serial number
- Tag name (TAG)
- Technical values: supply voltage, current consumption, ambient temperature, communication-specific data (optional)
- Degree of protection
- Approvals with symbols

▸ Compare the information on the nameplate with the order.

3.2.2 Name and address of manufacturer

Name of manufacturer:	Endress+Hauser Wetzer GmbH + Co. KG
Address of manufacturer:	Obere Wank 1, D-87484 Nesselwang or www.endress.com

3.3 Certificates and approvals

For certificates and approvals valid for the device: see the data on the nameplate

Approval-related data and documents: www.endress.com/deviceviewer → (enter the serial number)

3.3.1 PROFIBUS® PA certification

- Certified according to PROFIBUS® PA Profile 3.02 + Profile 3.01 Amendment 2, Amendment 3. The device can also be operated with certified devices of other manufacturers (interoperability).
- An overview of other approvals and certifications is provided in the Operating Instructions.

3.4 Storage and transport

Storage temperature	Without display –40 to +100 ℃ (–40 to +212 ℉)
	With display –40 to +80 ℃ (–40 to +176 ℉)

Maximum relative humidity: < 95 % as per IEC 60068-2-30

Pack the device for storage and transportation in such a way that it is reliably protected against impact and external influences. The original packaging provides the best protection.

Avoid the following environmental influences during storage:
• Direct sunlight
• Proximity to hot objects
• Mechanical vibration
• Aggressive media

4 Mounting

If stable sensors are used, the device can be fitted directly to the sensor. For remote mounting to a wall or stand pipe, two mounting brackets are available. The illuminated display can be mounted in four different positions.

4.1 Mounting requirements

4.1.1 Dimensions

The dimensions of the device are provided in the "Technical data" section.→ 🕮 47

4.1.2 Installation point

Information about the conditions (such as the ambient temperature, degree of protection, climate class etc.) that must be present at the installation point so that the device can be mounted correctly is provided in the "Technical data" section → 🕮 47.

For use in hazardous areas, the limit values specified on the certificates and approvals must be observed (see Ex Safety Instructions).

4.2 Mounting the transmitter

> **NOTICE**
>
> **Do not over-tighten the mounting screws, as this could damage the field transmitter.**
> ▸ Maximum torque = 6 Nm (4.43 lbf ft)

4.2.1 Direct sensor mounting
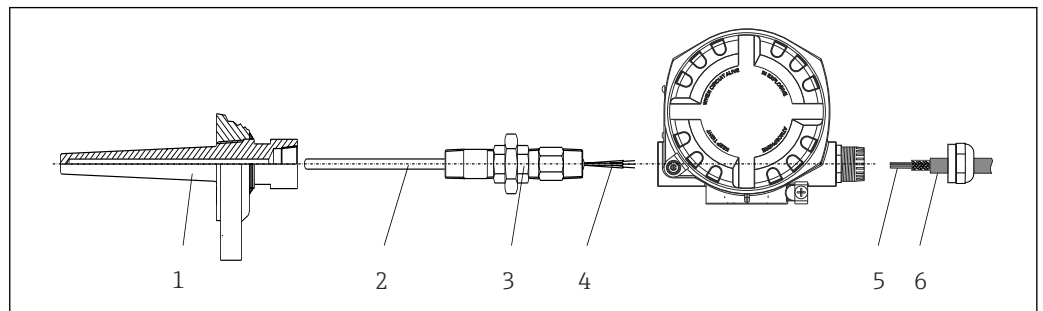
A0024817

🖼 *1 Direct field transmitter mounting on sensor*

1 Thermowell
2 Insert
3 Neck tube nipple and adapter
4 Sensor cables
5 Fieldbus cables
6 Fieldbus shielded cable

1. Mount the thermowell and screw down (1).

2. Screw the insert with the neck tube nipple and adapter into the transmitter (2). Seal the nipple and adapter thread with silicone tape.

3. Connect the sensor cables (4) to the terminals for the sensors, see the terminal assignment.

4. Fit the field transmitter with the insert on the thermowell (1).

5. Mount the fieldbus shielded cable or fieldbus connector (6) on the other cable gland.

6. Guide the fieldbus cables (5) through the cable gland of the fieldbus transmitter housing into the connection compartment.

7. Screw the cable gland tight as described in the *Ensuring the degree of protection* section→ 🕮 19. The cable gland must meet explosion protection requirements.

4.2.2 Remote mounting
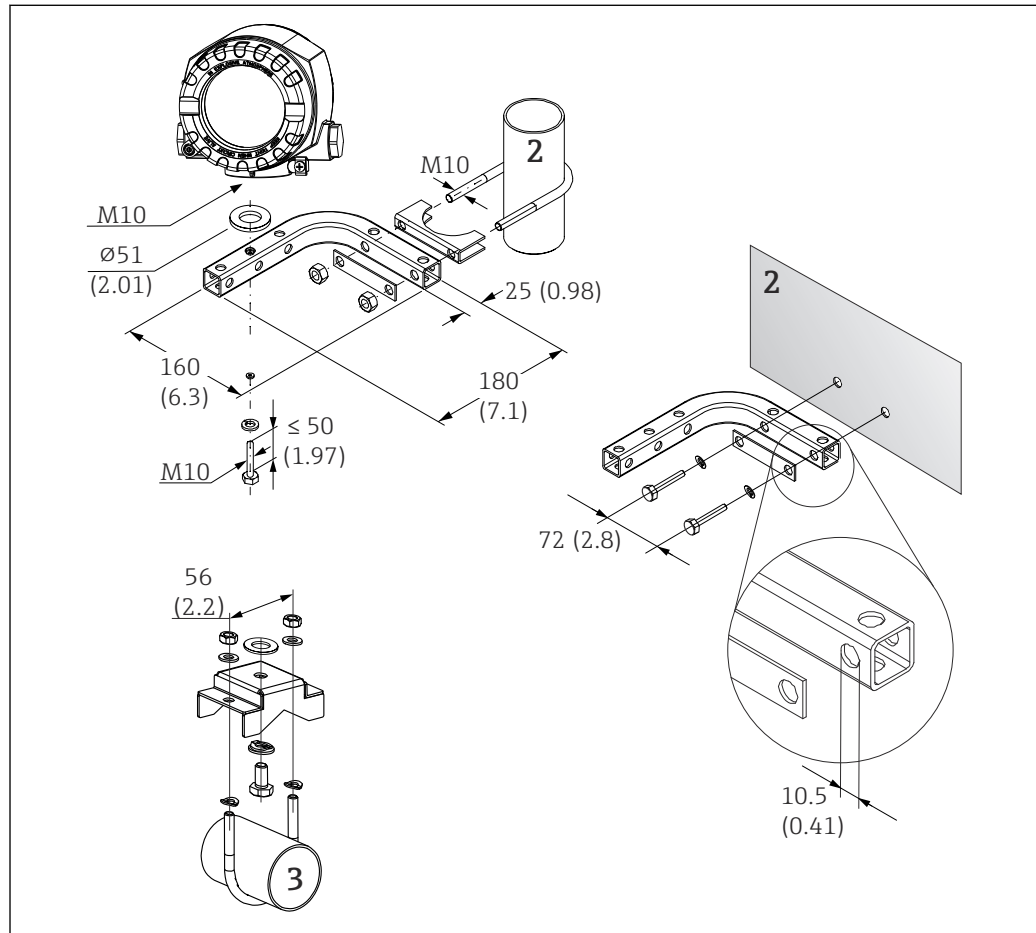
🖻 *2*   *Installation of the field transmitter using the mounting bracket, see 'Accessories' section. Dimensions in mm (in)*

2   *Combined wall/pipe mounting bracket 2", L-shaped, material 304*
3   *Pipe mounting bracket 2", U-shaped, material 316L*

4.3   Display mounting
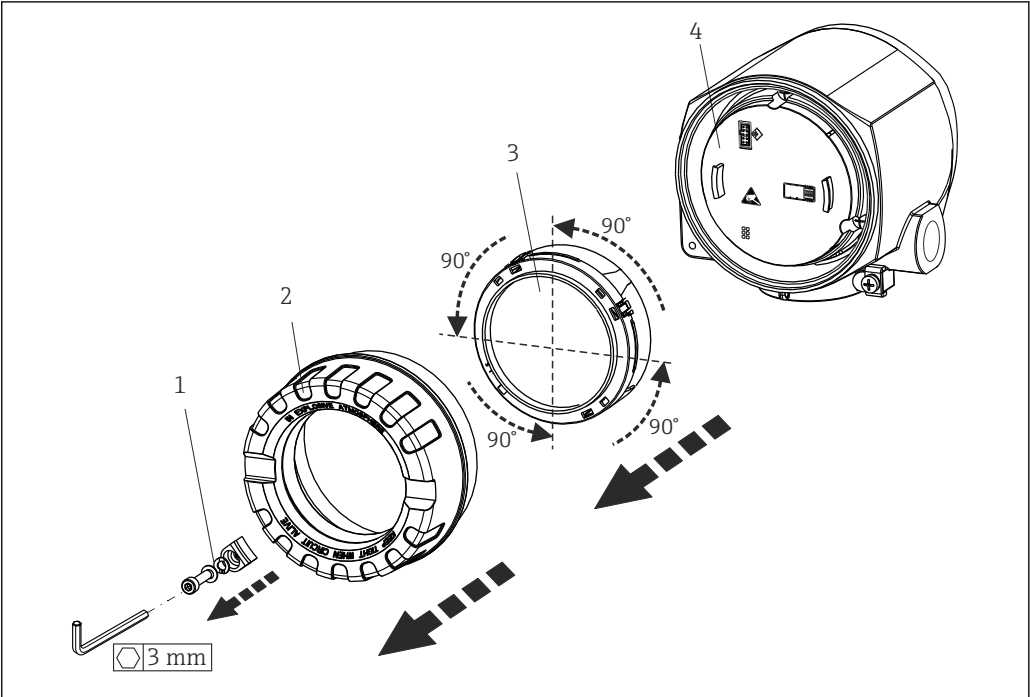
⊡ 3   4 display installation positions, attachable in 90° stages

1   Cover clamp
2   Housing cover with O-ring
3   Display with retainer and twist protection
4   Electronics module

1. Remove the cover clamp (1).

2. Unscrew the housing cover together with the O-ring (2).

3. Remove the display with twist protection (3) from the electronics module (4). Fit the display with retainer in the desired position in 90° stages and plug it into the correct slot on the electronics module.

4. Clean the thread in the housing cover and housing base and lubricate if necessary. (Recommended lubricant: Klüber Syntheso Glep 1)

5. Then screw the housing cover together with the O-ring.

6. Fit the cover clamp (1) back on.

4.4   Post-mounting check

After installing the device, always perform the following checks:

Device condition and specifications	Notes
Is the device undamaged (visual inspection)?	-
Do the ambient conditions match the device specification (e.g. ambient temperature, measuring range, etc.)?	→ 🖺 47

5 Electrical connection

5.1 Connecting requirements

⚠ CAUTION

The electronics could be destroyed

▶ Switch off power supply before installing or connecting the device. Failure to observe this may result in the destruction of parts of the electronics.

▶ When connecting Ex-certified devices, please take special note of the instructions and connection schematics in the Ex-specific supplement to these Operating Instructions. Contact the supplier if you have any questions.

A Phillips head screwdriver is required to wire the field transmitter at the terminals.

NOTICE

Do not over-tighten the screw terminals, as this could damage the transmitter.

▶ Maximum torque = 1 Nm ($\frac{3}{4}$ lbf ft).

Proceed as follows to wire the device:

1. Remove the cover clamp. → 🖾 3, 🕮 13

2. Unscrew the housing cover on the connection compartment together with the O-ring → 🖾 3, 🕮 13. The connection compartment is opposite the electronics module.

3. Open the cable glands of the device.

4. Route the appropriate connecting cables through the openings of the cable glands.

5. Wire the cables in accordance with → 🖾 4, 🕮 15 and as described in the sections: "Connecting the sensor" → 🕮 14 and "Connecting the measuring device" → 🕮 16.

6. On completion of the wiring, screw the screw terminals tight. Tighten the cable glands again. Refer to the information provided in the 'Ensuring the degree of protection' section.

7. Clean the thread in the housing cover and housing base and lubricate if necessary. (Recommended lubricant: Klüber Syntheso Glep 1)

8. Screw the housing cover tight again and fit the cover clamp back on. → 🕮 13

In order to avoid connection errors always follow the instructions in the post-connection check section before commissioning!

5.2 Connecting the sensor

NOTICE

▶ ⚠ ESD - Electrostatic discharge. Protect the terminals from electrostatic discharge. Failure to observe this may result in the destruction or malfunction of parts of the electronics.

Terminal assignment
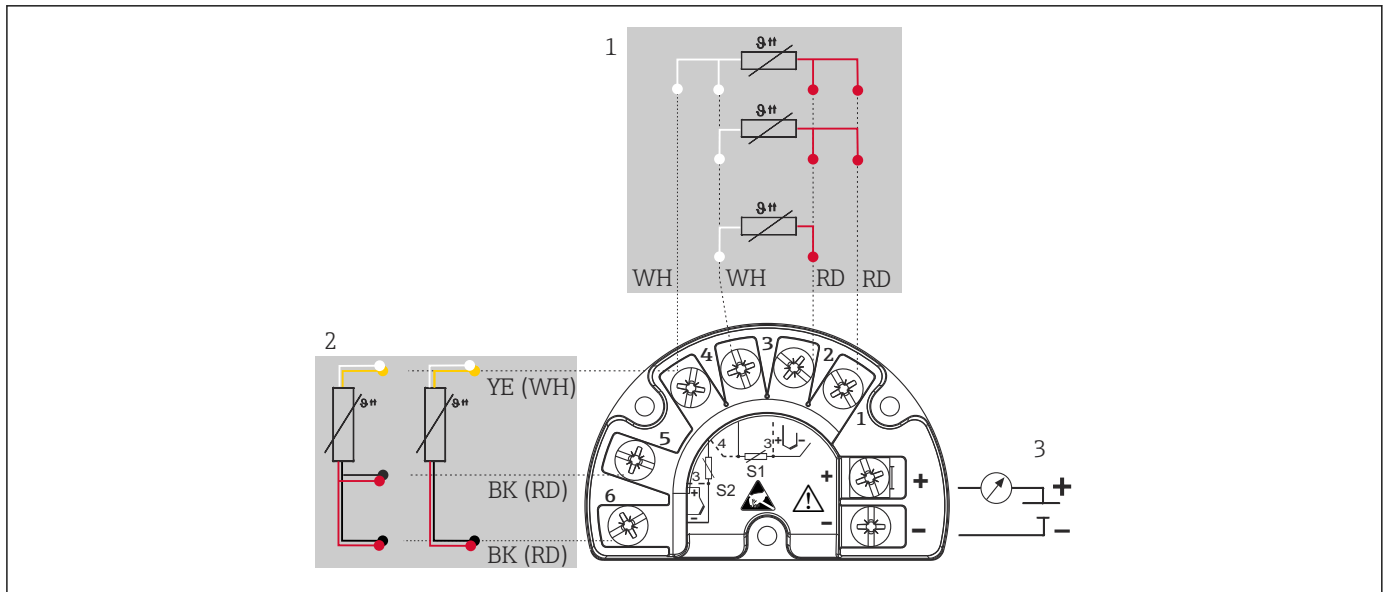
A0045944

🖼 4   *Wiring of the field transmitter, RTD, dual sensor input*

1   Sensor input 1, RTD, : 2-, 3- and 4-wire
2   Sensor input 2, RTD: 2-, 3-wire
3   Field transmitter power supply and analog output 4 to 20 mA or fieldbus connection
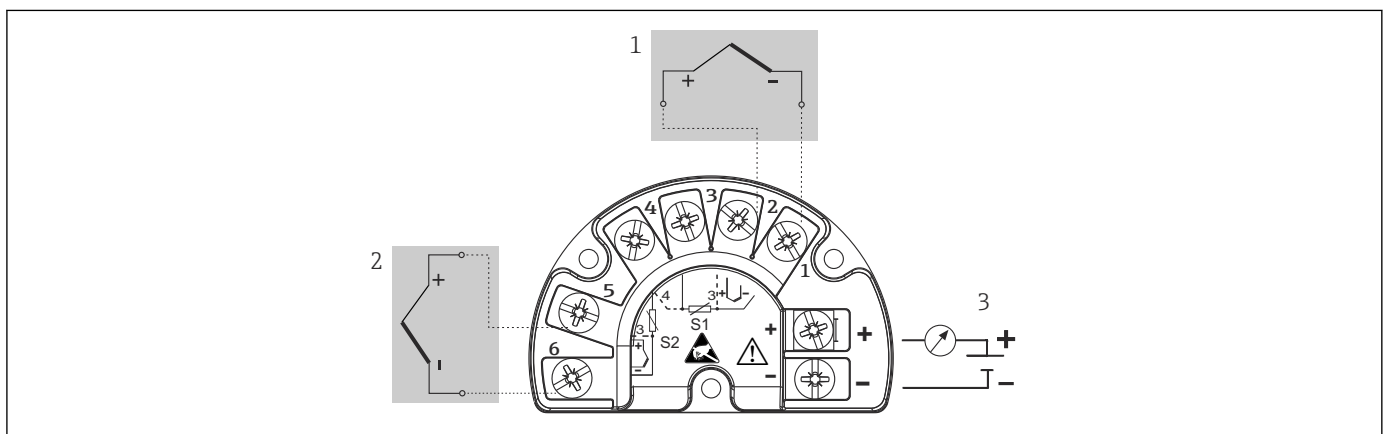
A0045949

🖼 5   *Wiring of the field transmitter, TC, dual sensor input*

1   Sensor input 1, TC
2   Sensor input 2, TC
3   Field transmitter power supply and analog output 4 to 20 mA or fieldbus connection

NOTICE

When connecting 2 sensors ensure that there is no galvanic connection between the sensors (e.g. caused by sensor elements that are not isolated from the thermowell). The resulting equalizing currents distort the measurements considerably.

▸ The sensors must remain galvanically isolated from one another by connecting each sensor separately to a transmitter. The transmitter provides sufficient galvanic isolation (> 2 kV AC) between the input and output.

The following connection combinations are possible when both sensor inputs are assigned:

		Sensor input 1			
		RTD or resistance transmitter, 2-wire	RTD or resistance transmitter, 3-wire	RTD or resistance transmitter, 4-wire	Thermocouple (TC), voltage transmitter
Sensor input 2	RTD or resistance transmitter, 2-wire	❑	❑	-	❑
	RTD or resistance transmitter, 3-wire	❑	❑	-	❑
	RTD or resistance transmitter, 4-wire	-	-	-	-
	Thermocouple (TC), voltage transmitter	❑	❑	❑	❑

5.3   Connecting the measuring device

5.3.1   Cable gland or cable entry

⚠ CAUTION

Risk of damage

▶ Switch off power supply before installing or connecting the device. Failure to observe this may result in the destruction of parts of the electronics.

▶ If the device has not been grounded as a result of the housing being installed, we recommended grounding it via one of the ground screws. Observe the grounding concept of the plant! Keep the cable shield between the stripped fieldbus cable and the ground terminal as short as possible! Connection of the functional grounding may be needed for functional purposes. Compliance with the electrical codes of individual countries is mandatory.

▶ If the shielding of the fieldbus cable is grounded at more than one point in systems without additional potential matching, mains frequency equalizing currents can occur that damage the cable or the shielding. In such cases, the shielding of the fieldbus cable is to be grounded on one side only, i.e. it must not be connected to the ground terminal of the housing. The shield that is not connected should be insulated!

▶ We recommend that the fieldbus not be looped using conventional cable glands. If you later replace even just one device, the bus communication will have to be interrupted.

🛈   • The terminals for the fieldbus connection have integrated reverse polarity protection.
   • Cable cross-section: max. 2.5 mm²
   • A shielded cable must be used for the connection.

Follow the general procedure. → 🔖 14.
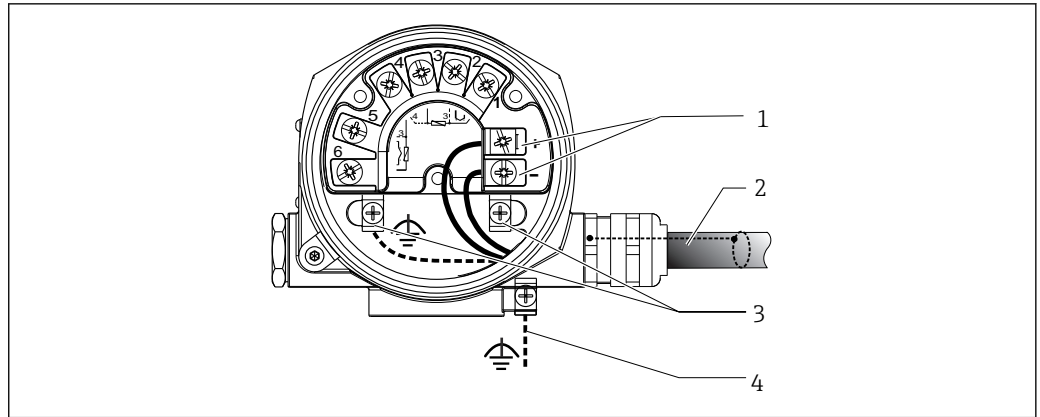
☑ 6   *Connecting the device to the fieldbus cable*

1   Fieldbus terminals - fieldbus communication and power supply
2   Shielded fieldbus cable
3   Ground terminals, internal
4   Ground terminal (external, relevant for remote version)

5.3.2   Fieldbus connector

The connection technology of PROFIBUS® PA allows devices to be connected to the fieldbus via uniform mechanical connections such as T-boxes, junction boxes etc.

This connection technology using prefabricated distribution modules and plug-in connectors offers substantial advantages over conventional wiring:
- Field devices can be removed, replaced or added at any time during normal operation. Communication is not interrupted.
- Installation and maintenance are significantly easier.
- Existing cable infrastructures can be used and expanded instantly, e.g. when constructing new star distributors using 4-channel or 8-channel distribution modules.

Optionally, the device can already be ordered with a fieldbus connector. If the transmitter has been ordered with the option of a fieldbus connector (order code → cable entry: position A and B), the fieldbus connector is ready mounted and wired upon delivery. Fieldbus connectors for retrofitting can be ordered from Endress+Hauser as an accessory (see the 'Accessories' section).

Supply line/T-box shielding

Always use cable glands with good EMC properties, if possible with all-round contact of the cable shielding (Iris spring). This requires minimum differences in potential, and possibly potential equalization.

- The shielding of the PA cable may not be interrupted.
- The shielding connection must always be kept as short as possible.

Ideally, cable glands with Iris springs should be used to connect the shielding. The shielding is connected to the T-box housing by means of the Iris spring located inside the gland. The shielding braid is located under the Iris spring.

When the armored thread is tightened, the Iris spring is pressed against the shielding, thereby creating a conductive connection between the shielding and the metal housing.

A terminal box or a plug-in connection must be considered part of the shielding (Faraday shield). This applies, in particular, to remote boxes if these are connected to a PROFIBUS® PA device by means of a pluggable cable. In such a case, a metal connector must be used whereby the cable shielding is positioned at the connector housing (e.g. prefabricated cables).
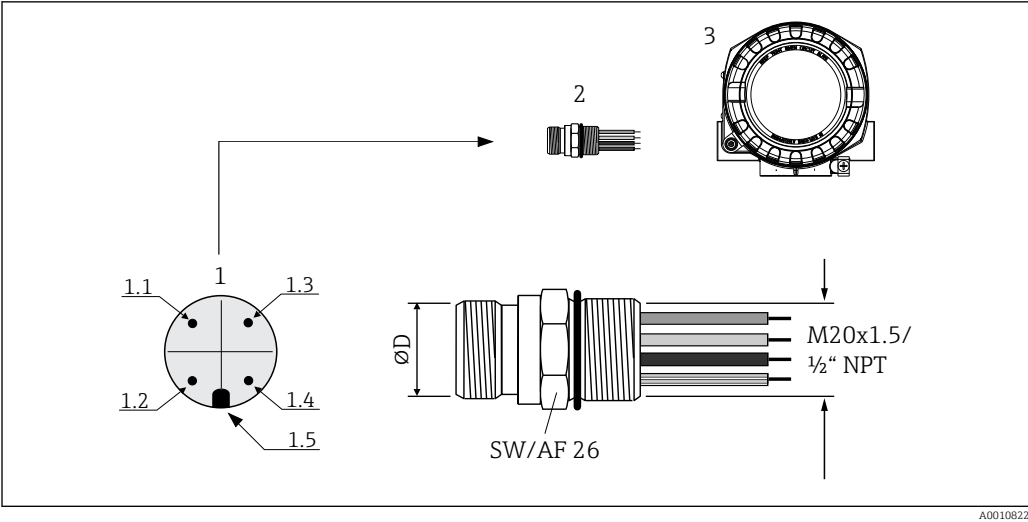
7   *Connectors for connecting to the PROFIBUS® PA fieldbus*

		Pin assignment/color codes			
	D	7/8" connector:	D	M12 plug:	
1 Connector on housing (male)	*1.1*	*Brown wire: PA+ (terminal 1)*	*1.1*	*Gray wire: shield*
	1.2	*Green-yellow wire: ground*	*1.2*	*Brown wire: PA+ (terminal 1)*
2 Fieldbus connector	*1.3*	*Blue wire: PA- (terminal 2)*	*1.3*	*Blue wire: PA- (terminal 2)*
	1.4	*Gray wire: shield*	*1.4*	*Green-yellow wire: ground*
3 Field housing	*1.5*	*Positioning key*	*1.5*	*Positioning key*

Connector technical data:

Wire cross-section	4 x 0.8 mm
Connection thread	M20x1.5/NPT ½"
Degree of protection	IP 67 according to DIN 40 050 IEC 529
Contact plating	CuZn, gold-plated
Housing material	1.4401 (316)
Flammability	V - 2 according to UL - 94
Ambient temperature	−40 to 105 ℃ (−40 to 221 ℉)
Current carrying capacity	9 A
Rated voltage	Max. 600 V
Contact resistance	≤ 0.005 Ω
Insulation resistance	≥ 10^9 Ω

5.3.3   Shielding and grounding

The specifications of the PROFIBUS User Organization for device installation must be observed during installation.
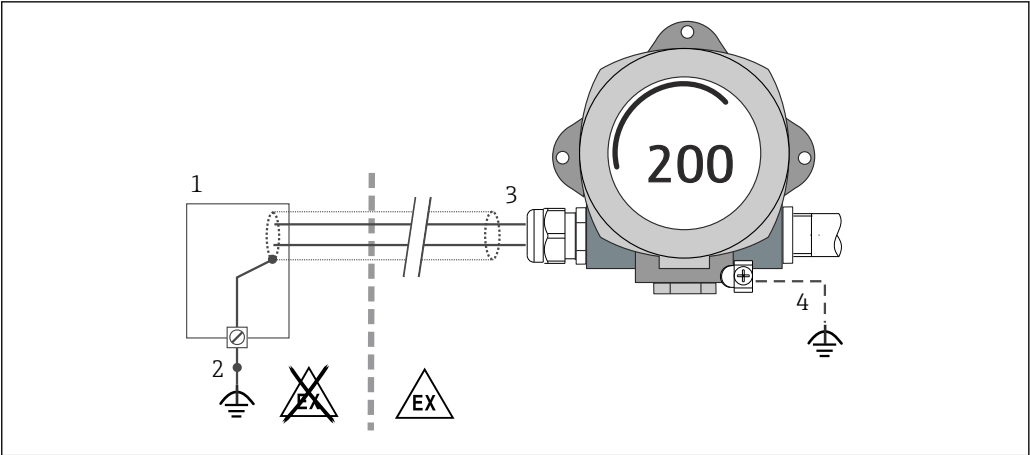
8   *Shielding and grounding the signal cable at one end with PROFIBUS® PA communication*

1   *Supply unit*
2   *Grounding point for PROFIBUS® PA communication cable shield*
3   *Grounding of the cable shield at one end*
4   *Optional grounding of the field device, isolated from cable shielding*

5.4   Ensuring the degree of protection

The device meets all the requirements of IP66/IP67 protection. Compliance with the following points is mandatory following installation in the field or servicing in order to ensure that IP66/IP67 protection is maintained:
• The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
• All housing screws and screw caps must be firmly tightened.
• The connecting cables used must have the specified external diameter (e.g. M20x1.5, cable diameter 8 to 12 mm).
• Firmly tighten the cable gland. → ☒ 9, ☞ 19
• The cables must loop down before they enter the cable glands ("water trap"). This means that any moisture that may form cannot enter the gland. Install the device so that the cable glands are not facing upwards. → ☒ 9, ☞ 19
• Replace unused cable glands with dummy plugs.
• Do not remove the grommet from the cable gland.
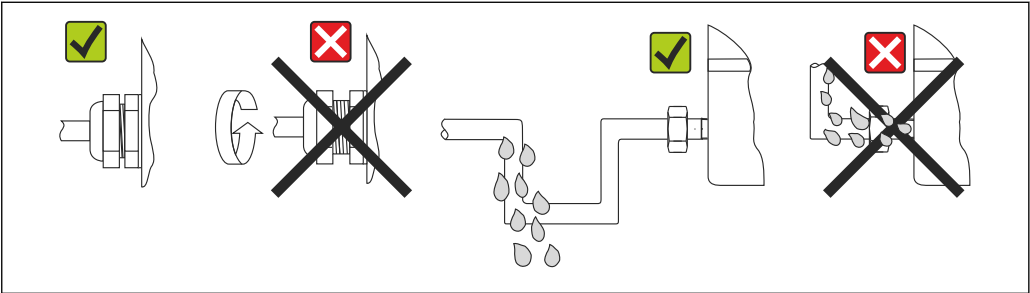
9   *Connection tips to retain IP66/IP67 protection*

5.5   Post-connection check

Device condition and specifications	Notes
Are the device and cables undamaged (visual check)?	--
Electrical connection	**Notes**

Device condition and specifications	Notes
Does the supply voltage match the information on the nameplate?	9 to 32 V_{DC}
Do the cables used meet the necessary specifications?	Fieldbus cable → 🖹 14 Sensor cables → 🖹 14
Are the mounted cables relieved of tension?	--
Are the power supply and fieldbus cables correctly connected?	See the wiring diagram inside the cover of the terminal compartment
Are all screw terminals well tightened?	--
Are all cable glands installed, securely tightened and leak-tight? Cable run with "water trap"?	→ 🖹 19
Are all housing covers installed and securely tightened?	--

Electrical connection of the fieldbus system	Notes
Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected with each other correctly?	--
Has each fieldbus segment been terminated at both ends with a bus terminator?	--
Does the max. length of the fieldbus cable comply with the fieldbus specifications?	Fieldbus cable, see specification
Has the max. length of the spurs been observed in accordance with the fieldbus specifications?	
Is the fieldbus cable fully shielded and correctly grounded?	

6   Operation options

6.1   Overview of operation options

A0053801
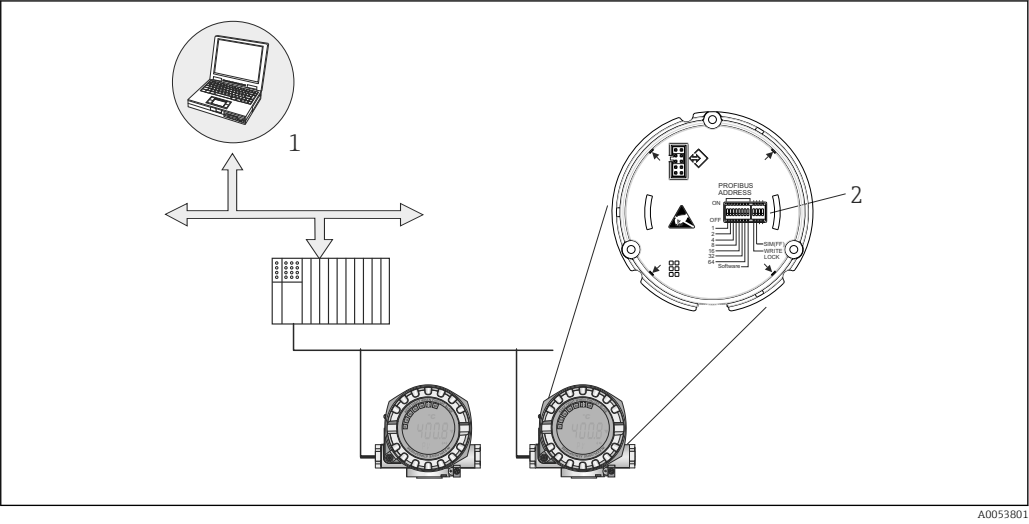
🖼 *10   Operation options of the device via the PROFIBUS® PA interface*

1   Configuration/operating programs for operation via PROFIBUS® PA (fieldbus functions, device parameters)
2   DIP switches for hardware settings (write protection, simulation mode)

6.2   Measured value display and operating elements

6.2.1   Display elements

A0024547
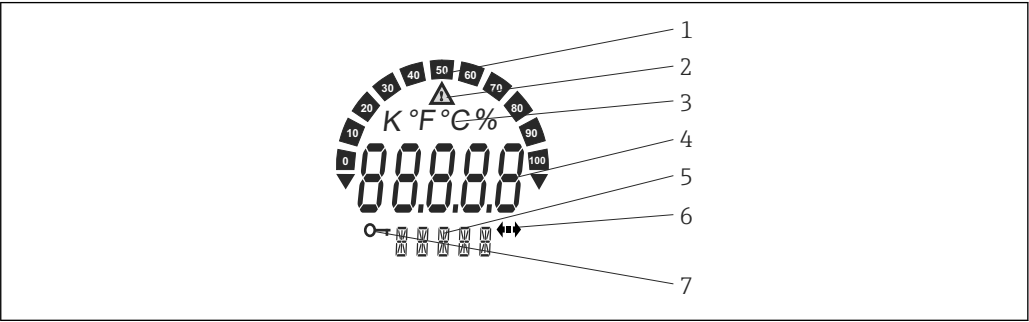
🖼 *11   LC display of the field transmitter (illuminated, can be plugged in in 90° steps)*

Item no.	Function	Description
1	Bar graph display	In increments of 10% with indicators for underranging and overranging. The bar graph display flashes when an error occurs.
2	'Caution' symbol	This is displayed when an error or warning occurs.
3	Unit display K, °F, °C or %	Unit display for the internal measured value shown.
4	Measured value display, digit height 20.5 mm	Displays the current measured value. In the event of an error or warning, the corresponding diagnostics information is displayed.

Item no.	Function	Description
5	Status and information display	Indicates which value is currently shown on the display. A special text can be entered for every measured value to be displayed. In the event of a warning or an error, the associated channel information is displayed where available. The field remains empty if the channel information is not available.
6	'Communication' symbol	The communication symbol appears when bus communication is active.
7	'Configuration locked' symbol	The 'configuration locked' symbol appears when configuration is locked via the hardware

6.2.2   Local operation

NOTICE

▶   ⚠ ESD - Electrostatic discharge. Protect the terminals from electrostatic discharge. Failure to observe this may result in the destruction or malfunction of parts of the electronics.

Settings (a bus address and a write lock) for the PROFIBUS® PA interface can be made via DIP switches on the electronics module.
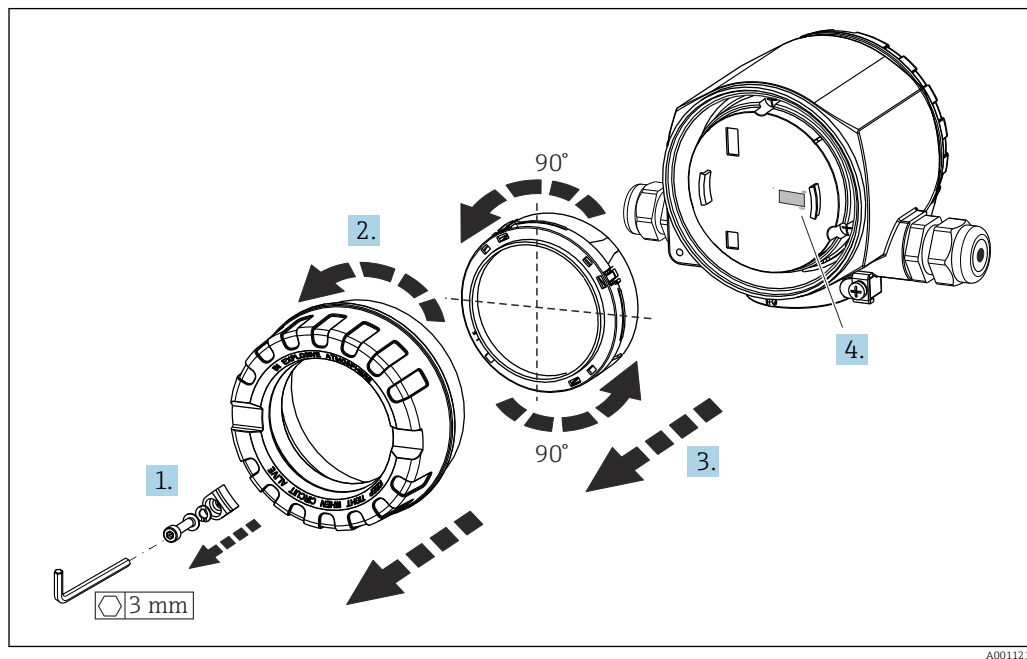
A0011211

Procedure for setting the DIP switch:

1.   Remove the cover clamp.

2.   Unscrew the housing cover together with the O-ring.

3.   If necessary, remove the display with retainer from the electronics module.

4.   Configure the hardware write protection **WRITE LOCK** accordingly using the DIP switch. In general, the following applies: switch to ON = function enabled, switch to OFF = function disabled.

Once the hardware setting has been made, re-assemble the housing cover in the reverse order.

A0010841
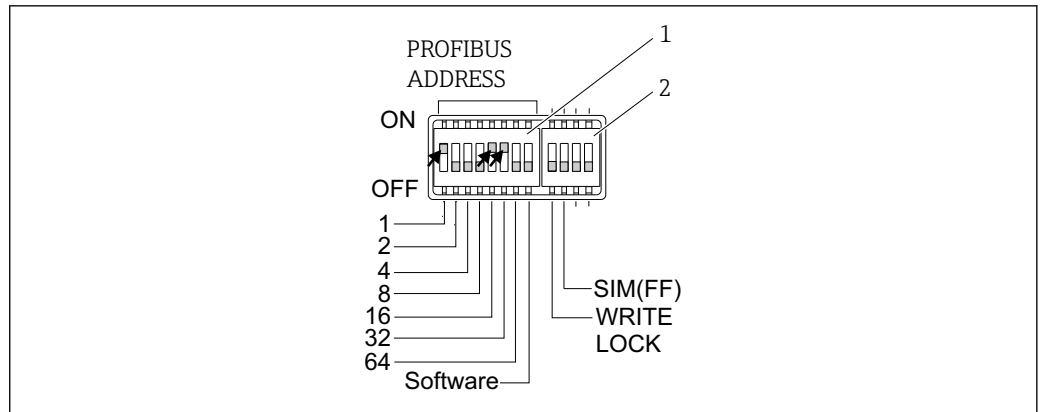
🖾 *12   Hardware configuration via DIP switches*

1   Configuring the device address taking the example of bus address 49: DIP switches 32, 16, 1 to "ON" (32 + 16 + 1 = 49). 'Software' DIP switch to "OFF".
2   SIM DIP switch = simulation mode (no function for PROFIBUS® PA communication); WRITE LOCK = write protection

Note the following points:
- The address must always be configured for a PROFIBUS® PA device. Valid device addresses are in the range between 0 and 125. In a PROFIBUS® PA network, each address can only be assigned once. If an address is not configured correctly, the device is not recognized by the master. The address 126 is reserved for initial commissioning and servicing.
- On leaving the factory, all devices are delivered with the default address 126 and software addressing (DIP switch set to "ON").

The bus address is configured as follows:
- 'Software' DIP switch set from "ON" to "OFF": The device restarts after 10 seconds and adopts the valid bus address configured with DIP switches 1 to 64. The bus address cannot be changed by software via a DDLM_SLAVE_ADD telegram.
- 'Software' DIP switch set from "OFF" to "ON": The device restarts after 10 seconds and adopts the default bus address 126. The bus address can be changed by software via a DDLM_SLAVE_ADD telegram.

🛈 The step-by-step procedure for configuring the device address is described in detail in the comprehensive Operating Instructions.

6.2.3   Access to the operating menu via the operating tool

PROFIBUS® PA functions and device-specific parameters are configured via fieldbus communication. The following configuration systems, among others, are available for this purpose:

Operating tools

FieldCare (Endress+Hauser)	SIMATIC PDM (Siemens)

🛈 The step-by-step procedure for commissioning the fieldbus functions for the first time is described in detail in the comprehensive Operating Instructions, as is the configuration of device-specific parameters.

7   System integration

The device is ready for system integration after commissioning using the class 2 master. In order to integrate the field devices into the bus system, the PROFIBUS® PA system needs a description of the device parameters, such as output data, input data, data format, data volume and supported transmission rate.

These data are contained in a so-called device master file (GSD file), which is made available to the PROFIBUS® PA master during commissioning of the communication system.

In addition, device bitmaps, that appear as icons in the network structure, can also be integrated. With the Profile 3.02 device master file (GSD), it is possible to exchange field devices made by different manufacturers without having to reconfigure. Generally speaking two different GSD versions are possible with Profile 3.02 (factory setting: manufacturer-specific GSD):

- **Manufacturer-specific GSD:**
  This GSD ensures unrestricted functionality of the field device. Device-specific process parameters and functions are therefore available.
- **Profile GSD:**
  Varies with regard to the number of Analog Input blocks (AI). If a system is configured with the profile GSD, devices of different manufacturers can be exchanged. However, it is essential to ensure that the order of the cyclic process values is correct.

1. Manufacturer-specific GSD, EH021549.gsd or EH3x1549.gsd (→ Section "Overview of device description files" → 📄 25) Ident number = 1549 (hex) Ident number selector = 1
2. Profile GSD, PA139703.gsd (4 analog inputs) Ident number = 9703 (Hex) Ident number selector = 0
3. Profile GSD, PA139700.gsd (1 analog input) Ident number = 9700 (hex) Ident number selector = 129
4. Profile GSD, PA139701.gsd (2 analog inputs) Ident number = 9701 (hex) Ident number selector = 130
5. Profile GSD, PA139702.gsd (3 analog inputs) Ident number = 9702 (hex) Ident number selector = 131

ℹ️ Before configuring, it is essential to decide which GSD should be used to operate the plant. The setting can be changed using a Class 2 master. The TMT162 field transmitter supports the following GSD files (see table under → "Overview of device description files" section → 📄 25).

Every device is assigned an identification number (ID) by the PROFIBUS User Organization (PNO). The name of the GSD file is derived from this number. For Endress+Hauser, this ID number starts with the manufacturer ID 15xx. For better classification and clarity of the respective GSD, Endress+Hauser GSD names are as follows:

EH0215xx	EH = Endress+Hauser 02 = GSD revision 15xx = ID no.

The GSD files for all Endress+Hauser devices can be requested as follows:

- Internet (Endress+Hauser) → http://www.endress.com (Downloads → Software)
- Internet (PNO) → http://www.profibus.com (GSD library)
- On a CD-ROM from Endress+Hauser. Please contact an Endress+Hauser sales office.

7.1   Overview of device description files

The following table indicates the suitable device description file for the individual operating tools and specifies where these files can be obtained.

PROFIBUS PA protocol (IEC 61158-2, MBP):

Valid for firmware/ software:	1.00.zz	1.01.zz	See the DEVICE SOFTWARE parameter
PROFIBUS® PA device data Profile version:	3.01	3.02	See the PROFILE VERSION parameter
TMT162 device ID: Profile ID:	1549$_{hex}$ Depending on the Profile GSD file used: 0x9703, 0x9702, 0x9701 or 0x9700		See the DEVICE ID parameter
GSD information			
TMT162 GSD:	Extended		Compatibility matrix:
Profile GSD:	PA139700.gsd PA139701.gsd PA139702.gsd PA139703.gsd		| EH3x1549.gsd | EH021549.gsd 1.00.zz | OK | STOP [1] 1.01.zz | OK | OK
Bitmaps	EH1549_D.bmp EH1549_N.bmp EH1549_S.bmp		

Operating program/ device driver:	Sources for obtaining device descriptions/program updates, free on the Internet:
GSD	• www.endress.com (→ Downloads → Software → Device driver: Select type, product root and process communication) • www.profibus.com
FieldCare/DTM	www.endress.com (→ Downloads → Device driver: Select type, product root and process communication)

1)   Can be used if the entry "C1_Read_Write_supp = 1" in the GSD file is set to "C1_Read_Write_supp = 0".

7.2   Extended formats

There are some GSD files whose modules are transferred using an extended identification (e.g. 0x42, 0x84, 0x08, 0x05). These GSD files are located in the "Extended" folder.

7.3   Contents of the download file

- All Endress+Hauser GSD files
- Endress+Hauser bitmap files
- Useful information on the devices

7.4   Working with the device master files (GSD)

The GSD files must be integrated into the automation system. Depending on the firmware/ software used, the GSD files can either be copied to the program-specific directory or read into the database via an import function within the configuration software.

Example:

The subdirectory is …\siemens\step7\s7data\gsd for the Siemens STEP 7 configuration software from Siemens PLC S7-300/400.

The GSD files also include bitmap files. These bitmap files are required to illustrate the measuring points. The bitmap files must be loaded into the directory: ...\siemens \step7\s7data\nsbmp.

For other configuration software, ask the manufacturer of your PLC for the correct directory.

7.5   Cyclic data exchange

In PROFIBUS® PA, the analog values are cyclically transmitted to the automation system in data blocks of 5 bytes. The measured value is represented in the first 4 bytes in the form of floating point numbers in accordance with IEEE 754 standard (see IEEE floating point number). The 5th byte contains status information relating to the measured value, which is implemented as per profile 3.02 [1] specification. The status is displayed as a symbol on the device display if available. Refer to Section 11 "Operation via PROFIBUS® PA" for a detailed description of the data types.

7.5.1   IEEE floating point number

Conversion of a hexadecimal value to an IEEE floating point number for measured value acquisition. The measured values are represented as follows in the IEEE-754 number format and transmitted to the Class 1 master:

Byte n			Byte n+1		Byte n+2		Byte n+3	
Bit 7	Bit 6	Bit 0	Bit 7	Bit 6 Bit 0	Bit 7 Bit 0		Bit 7 Bit 0	
Sign	2^7 2^6 2^5 2^4 2^3 2^2 2^1		2^0	2^{-1} 2^{-2} 2^{-3} 2^{-4} 2^{-5} 2^{-6} 2^{-7}	2^{-8} 2^{-9} 2^{-10} 2^{-11} 2^{-12} 2^{-13} 2^{-14} 2^{-15}		2^{-16}...2^{-23}	
	Exponent		Mantissa		Mantissa		Mantissa	

Sign = 0: positive number

Sign = 1: negative number $Number = -1^{sign} \cdot (1 + M) \cdot 2^{E-127}$

E = exponent; M = mantissa

Example: 40 F0 00 00 h   = 0100 0000 1111 0000 0000 0000 0000 0000 b

Value $= -1^0 \cdot 2^{129-127} \cdot (1 + 2^{-1} + 2^{-2} + 2^{-3})$

$= 1 \cdot 2^2 \cdot (1 + 0.5 + 0.25 + 0.125)$

$= 1 \cdot 4 \cdot 1.875 = 7.5$

7.5.2   Block model

The field transmitter supports a maximum of 5 slots for cyclic data exchange. A maximum of 4 values can be selected and transmitted. Elements of cyclic communication:

Slot	Data block	Access
1	Analog Input 1	Read access
2	Analog Input 2	Read access
3	Analog Input 3	Read access

---

1)   According to Profile 3.01: GSD files used or IDENT_NUMBER_SELECTOR set to {0, 129, 130 or 131} or device GSD file used or IDENT_NUMBER_SELECTOR set to 1 and "CondensedStatus" parameter set to OFF. According to Profile 3.02: Device GSD file used or IDENT_NUMBER_SELECTOR set to 1 and "CondensedStatus" parameter set to ON. If IDENT_NUMBER_SELECTOR = 127, the GSD file used to establish cyclic data exchange determines whether diagnosis occurs according to Profile 3.01 or Profile 3.02.)

Slot	Data block	Access
4	Analog Input 4	Read access
5	Display value	Write access

General description of blocks:

Block name	Short description	Slot
Physical Block	General device data	0
Transducer Block 1	Sensor settings channel 1	1
Transducer Block 2	Sensor settings channel 2	2
Analog Input Block 1	Output of a measured value	1
Analog Input Block 2	Output of a measured value	2
Analog Input Block 3	Output of a measured value	3
Analog Input Block 4	Output of a measured value	4

The block model displayed shows the input and output data the field transmitter makes available for cyclic data exchange.
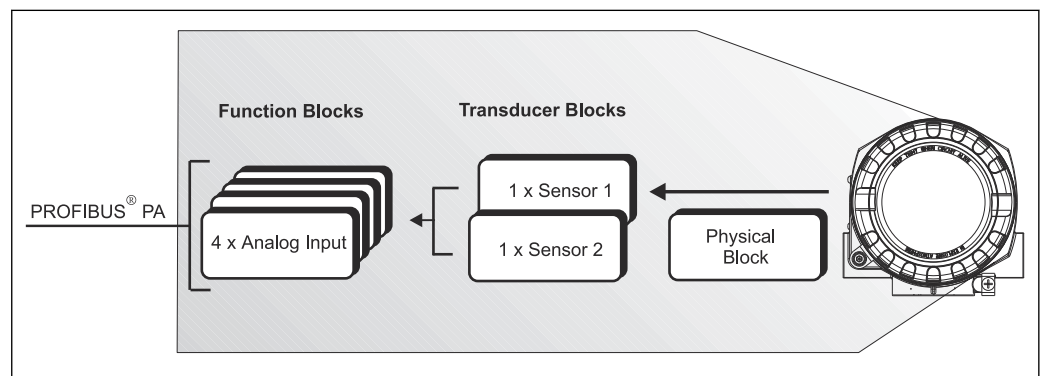
 13   *Field transmitter block model, Profile 3.02*

7.5.3 Display value

The display value contains 4 bytes with the measured value and 1 byte with the status. This value can only be displayed. For the indication on the onsite display, the relevant setting must be made in the SOURCE DISPLAY VALUE parameter.

7.5.4 Input data

Input data are process temperature and internal reference temperature.

7.5.5 Data transfer from the transmitter to the automation system

The order of the input and output bytes is fixed. If addressing is done automatically using the configuration program, the numerical values of the input and output bytes can differ from the values in the following table.

Input byte	Process parameter	Access type	Comment/data format	Default value unit
0, 1, 2, 3	*Temperature [1]	Read	32-bit floating point number (IEEE-754) Representation → 🖺 26	℃
4	*Status temperature [1]		Status code	-
Possible settings: • Primary value of the transducer • Measured value of sensor at sensor input • Measured value of the internal reference measuring point		→ Select in the AI N CHANNEL parameter → Primary Value TB1 → Select in the AI N CHANNEL parameter → Secondary Value TB1 → Select in the AI N CHANNEL parameter → Internal temperature		

[1] Depends on the selection of the Analog Input function block in the AI N CHANNEL parameter

The system units in the table correspond to the preset scalings transferred during cyclic data exchange. However, in the case of customer-specific configuration, the units can differ from the default value.

7.5.6 Output data

The display value provides the possibility to transmit a measured value calculated in the automation system directly to the field transmitter. This measured value is purely a display value, displayed by the local display of the transmitter or PROFIBUS® PA Display RID16 for example. The display value contains 4 bytes with the measured value and 1 byte with the status.

Input byte	Process parameter	Access type	Comment/data format
0, 1, 2, 3	Display value	Write	32-bit floating point number (IEEE-754) representation → 🖺 26
4	Status display value	Write	-

Only activate the data blocks that are processed in the automation system. This improves the data throughput rate of a PROFIBUS® PA network. A flashing, double-headed arrow symbol is shown on the optional display to indicate that the device is communicating with the automation system.

7.5.7 System units

The measured values are transmitted to the automation system via cyclic data exchange in the system units as described in the "Group Setup" section (UNIT N parameter).

7.5.8 Configuration example

Generally, a PROFIBUS® DP/PA system is configured as follows:

1. The field devices to be configured are integrated into the configuration program of the automation system via the PROFIBUS® DP network using the GSD file. Required measured variables can be configured offline with the configuration software.

2. The application program of the automation system should now be programmed. The input and output data are controlled in the application program and the location of the measured variables is specified so that they can be processed further.

3. If necessary, an additional measured value conversion component must be used for an automation system that does not support the IEEE-754 floating point number format.

4. Depending on the data processing type in the automation system (little-endian or big-endian format), it may be necessary to change the byte order (byte swapping).

5. Once configuration has been completed, this is transferred to the automation system as a binary file.

6. The system can now be started. The automation system establishes a connection to the configured devices. The process-related device parameters can now be set using a Class 2 master, e.g. with the help of FieldCare.

7.6   Acyclic data exchange

Acyclic data exchange is used to transfer parameters during commissioning, maintenance or for the display of further measured variables that are not contained in cyclic data communication. Parameters for identification, control or adjustment can thus be changed in the various blocks (physical block, transducer block, function block) while the device is in cyclic data exchange with a PLC.

The device supports the MS2AC communication with 2 available SAPs (Service Access Point) during acyclic data transfer.

With regard to acyclic communication, a distinction must be made between two types:

7.6.1   Acyclic communication with a Class 2 master (MS2AC)

MS2AC refers to acyclic communication between a field device and a Class 2 master (e.g. Fieldcare, PDM, etc.). Here, the master opens a communication channel via an SAP (Service Access Point) to access the device.

All parameters to be exchanged with a device using PROFIBUS® must be communicated to a Class 2 master. This assignment is done either in a device description (DD), a DTM (device type manager) or within a software component in the master via slot and index addressing for each individual parameter.

The slot and index, details on length (byte) and the data record are transferred in addition to the field device address when parameters are written using a Class 2 master. The slave acknowledges this write request on completion. The blocks can be accessed with a Class 2 master. The parameters that can be used in the E+H operating program (FieldCare) are shown in the tables in Section 13.

Note the following for MS2AC communication:

• As already explained, a Class 2 master accesses a device via special SAPs. Therefore, the number of Class 2 masters that can communicate simultaneously with a device will depend on the number of SAPs made available for this communication.
• The use of a Class 2 master increases the cycle time of the bus system. This must be taken into account when programming the control system or controller used.

7.6.2   Acyclic communication with a Class 1 master (MS1AC)

In the case of MS1AC, a cyclic master, which is already reading the cyclic data from the device or writing the data to the device, opens the communication channel via the SAP 0x33 (special service access point for MS1AC) and can then, like a Class 2 master, acyclically read or write a parameter by means of the slot and the index (if supported).

Note the following for MS1AC communication:

- Currently, there are few PROFIBUS masters on the market that support this kind of communication.
- Not all PROFIBUS devices support MS1AC.
- In the user program, you must be aware that constant parameter writing (e.g. with every program cycle) can drastically reduce the operating life of a device. Parameters written acyclically are saved as persistent data to the memory modules (e.g. EEPROM, Flash). These memory modules are only designed for a limited number of writes. This number of writes is not even nearly reached in normal operation without MS1AC (during configuration). This maximum figure can be quickly reached as a result of incorrect programming and thus the operating time of a device can be drastically reduced.

The device supports MS2AC communication with two available SAPs. MS1AC communication is supported by the device. The memory module is designed for 10^6 writes.

8 Commissioning

8.1 Post-installation check

Before commissioning the measuring point, make sure that all final checks have been carried out:
- "Post-mounting check" checklist
- "Post-connection check" checklist

ℹ The functional data of the PROFIBUS® PA interface as per IEC 61158-2 (MBP) must be observed.

A standard multimeter can be used to check the bus voltage of 9 to 32 V and the current consumption of approx. 11 mA at the measuring device.

8.2 Switching on the device

Once you have completed the post-connection checks, switch on the supply voltage. The transmitter performs a number of internal test functions after power-up. During this process, the following sequence of messages appears on the display:

Step	Display
1	All segments on
2	All segments off
3	Initialization: Company logo and device name are displayed
4	Current firmware/software version
5	Current bus address in use by device
6	Current identification number in use by device
7a	Current measured value. Bar graph displays the % value within the set bar graph range or
7b	Current status message. Bar graph displays all segments. ℹ If the switch-on procedure is not successful, the relevant diagnostic event is displayed, depending on the cause. A detailed list of diagnostic events and the corresponding troubleshooting instructions can be found in the "Diagnostics and troubleshooting" section .

The device works after approx. 18 seconds! Normal measuring mode commences as soon as the switch-on procedure is completed. Measured values and status values appear on the display.

8.3 Commissioning the PROFIBUS® PA interface

Procedure:

Check hardware write protection
▼
Configuration of bus address
▼
Enter tag name
▼
Configure the measuring inputs (see Section 14 for detailed description)
▼
Configure the Analog Input parameters (see Section 14 for detailed description)

1. Check hardware write protection.
   ↳ The HW WRITE PROTECTION parameter shows whether write access to the device is possible using PROFIBUS® (acyclic data transfer, e.g. using the "FieldCare" operating program): SETUP → ADVANCED SETUP → HW WRITE PROTECTION One of the following options is displayed:
   - OFF (factory setting) = write access possible using PROFIBUS®
   - ON = write access not possible using PROFIBUS®

2. Disable the write protection if necessary,

3. Enter the tag name (optional). DIAGNOSTICS → SYSTEM INFORMATION → TAG

4. Configure the bus address. Hardware addressing using DIP switch,

5. Configure the transducer blocks.
   ↳ The individual transducer blocks cover various settings such as unit, sensor type etc. The parameter groups are grouped together in blocks as follows:
   – Temperature sensor 1 → Transducer Block 1 (Slot 1)
   – Temperature sensor 2 → Transducer Block 2 (Slot 2)

6. Configure the Analog Input function blocks 1-4. The device has four analog input function blocks (AI modules). They are used to transmit different measured variables to the PROFIBUS® master (Class 1) cyclically. The allocation of a measured variable to the analog input function block is shown below using the example of Analog Input Function Block 1 (AI module, slot 1). Using the AI N CHANNEL function, you can specify the measured variable that should be transferred cyclically to the PROFIBUS® master (Class 1) (e.g. Primary Value Transducer 1):

7. Call up the AI N CHANNEL function.
   Select the "PV Transducer 1" option. The following settings are possible: AI N CHANNEL (n: number of the AI block) → – Primary Value Transducer 1 – Secondary Value 1 Transducer 1 – Reference Junction Temperature – Primary Value Transducer 2 – Secondary Value 1 Transducer 2

8.4 Protecting settings from unauthorized access

If the device is locked against configuration, it must first be enabled via the hardware lock. The device is write-protected if the lock symbol is shown on the display.

To unlock, switch the write protection switch located on the electronics module to the "OFF" position (hardware write protection), .

When hardware write protection is active (write protection switch set to the "ON" position), write protection cannot be disabled via the operating tool.

9   Diagnostics and troubleshooting

9.1   General troubleshooting

Always start troubleshooting with the checklists below if faults occur after commissioning or during operation. The checklists take you directly (via various queries) to the cause of the problem and the appropriate remedial measures.

In the event of a serious fault, a device might have to be returned to the manufacturer for repair. Follow the instructions in the "Return" section. → 🖺 44

Check local display	
No display visible - No connection to the fieldbus host system	1. For fault elimination, see below: 'Faulty connection to the fieldbus host system'
	2. Other possible causes of errors:
	3. Electronics module defective → Test with spare electronics module → Order spare part
	4. Housing (internal electronics) defective → Test with spare housing → Order spare part
No display visible - However, connection has been established to the fieldbus host system	1. Check whether the retainers and the connection of the display module are correctly seated on the electrical module, → 🖺 13.
	2. Display defective → Test with spare display → Order spare part
	3. Electronics module defective → Test with spare electronics module → Order spare part

⊞

Onsite error messages on the display
→ 🖺 35

⊞

Faulty connection to the fieldbus host system	
No connection can be made between the fieldbus host system and the device. Check the following points:	
Fieldbus connection	Check the data cable
Fieldbus connector (optional)	Check pin assignment/wiring, → 🖺 14
Fieldbus voltage	Check whether a min. bus voltage of 9 V_{DC} is present at the +/- terminals. Permitted range: 9 to 32 V_{DC}
Network structure	Check permissible fieldbus cable length and number of spurs → 🖺 14
Basic current	Is there a basic current of min. 11 mA?
Terminating resistors	Has the PROFIBUS® PA segment been terminated correctly? Each bus segment must always be terminated with a bus terminator at both ends (start and finish). Otherwise there may be interference in data transmission.
Current consumption, permissible feed current	Check the current consumption of the bus segment: The current consumption of the bus segment in question (= total of basic currents of all bus users) must not exceed the max. permitted feed current of the bus power supply unit.
Error messages in the PROFIBUS® PA configuration system	
→ 🖺 35	

⊞

Other errors (application errors without messages)	
Some other error has occurred.	Possible causes and remedial measures, see Section 11.4 → 🗐 40

9.2 Diagnostic information via communication interface

9.2.1 Display in the operating program (acyclic data transfer)

The device status can be queried via an operating program, see Section 13.2.3: EXPERT → DIAGNOSTICS → STATUS).

9.2.2 Display in the FieldCare diagnostic module (acyclic data transfer)

The general device status as per NAMUR NE 107 can be quickly determined using the start screen of an online connection to the device. All diagnostic messages for the measuring point have been classified into four categories (Failure, Function Check, Out of Specification, Maintenance Required), thereby providing the user with information on the cause and possible corrective measures. If there is no diagnostic message, the status signal "OK" appears.

The graphic shows a failure caused by a open circuit at sensor 1:
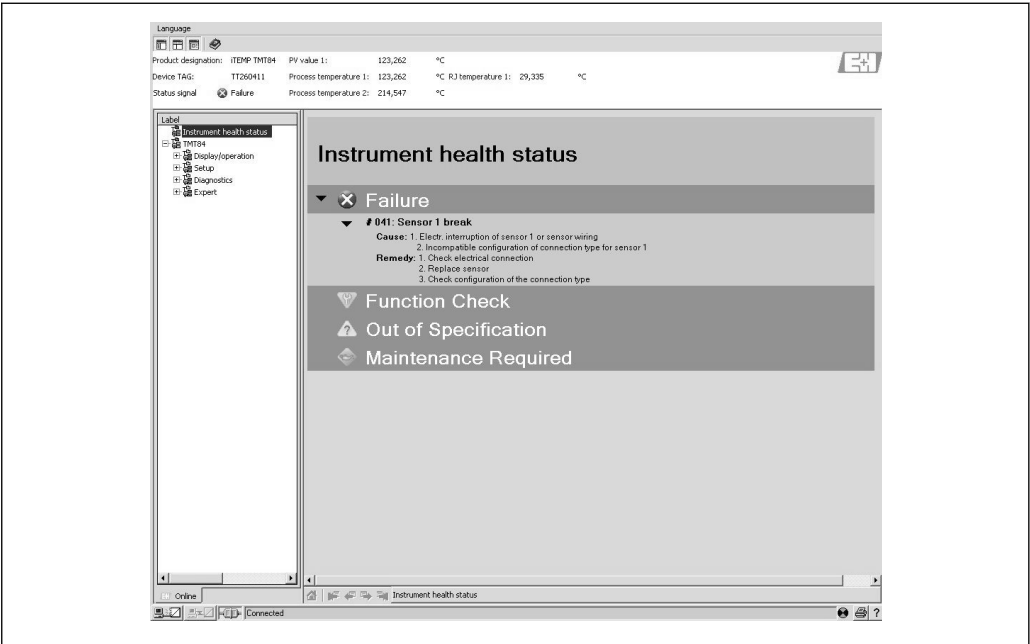
A0042284

9.2.3 Display in the PROFIBUS® master system (cyclic data transfer)

If the AI module is configured for cyclic data transfer, the device status is coded according to PROFIBUS Profile Specification 3.02 [2] and transmitted together with the measured value via the quality byte (byte 5) to the PROFIBUS master (Class 1). The quality byte is divided into the segments quality status, quality substatus and limits (limit values).

---

2)   According to Profile 3.01: Profile GSD files used or IDENT_NUMBER_SELECTOR set to {0, 129, 130 or 131} or GSD file used or IDENT_NUMBER_SELECTOR set to 1 and "CondensedStatus" parameter to OFF. According to Profile 3.02: Device GSD file used or IDENT_NUMBER_SELECTOR set to 1 and "CondensedStatus" parameter set to ON. If IDENT_NUMBER_SELECTOR = 127, the GSD file used for establishing cyclic data exchange determines whether diagnosis occurs according to Profile 3.01 or Profile 3.02.

A0048878
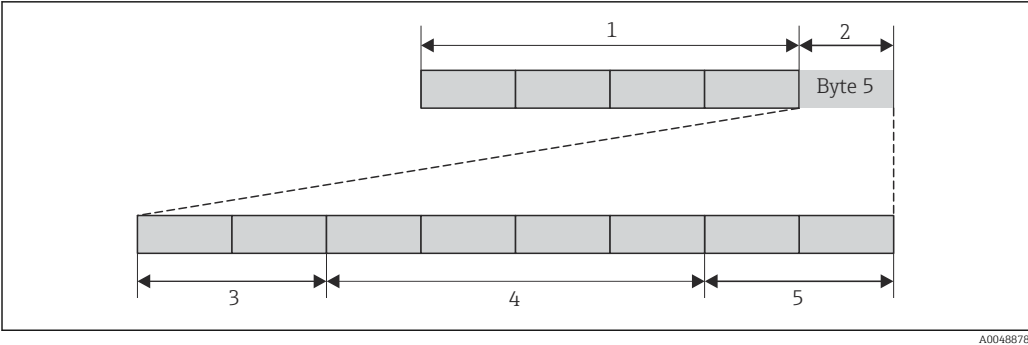
1   Measured value
2   Quality code
3   Quality status
4   Quality substatus
5   Limits

The content of the quality byte of an Analog Input function block depends on its configured failsafe mode. Depending on the failsafe mode configured in the FAILSAFE MODE function, the following status information is transferred to the PROFIBUS master (Class 1) via the quality byte:

FAILSAFE MODE as per Profile 3.01

When you select FAILSAFE MODE → FAILSAFE VALUE:

Quality code (HEX)	Quality status	Quality substatus	Limits
0x48 0x49 0x4A 0x4B	UNCERTAIN	Substitute set	OK Low High Const

When you select FAILSAFE MODE → FAILSAFE VALUE:

Valid output value before error				No valid output value before error			
Quality code (hex)	Quality status	Quality substatus	Limits	Quality code (hex)	Quality status	Quality substatus	Limits
0x44 0x45 0x46 0x47	UNCERTAIN	Last usable value	OK Low High Const	0x4C 0x4D 0x4E 0x4F	UNCERTAIN	Initial value	OK Low High Const

When you select FAILSAFE MODE → WRONG VALUE: status messages (→ 🖺 35).

The FAILSAFE MODE function can be configured via an operating program (e.g. FieldCare) in the respective Analog Input function block (1 to 4).

FAILSAFE MODE as per Profile 3.02

Input	Result		
State before Fail Safe Mechanism (FB input)	FSAFE_TYPE 0 (Failsafe Value)	FSAFE_TYPE 1 (Last usable value)	FSAFE_TYPE 2 (Wrong calculated value)
BAD - non specific (Not generated by the device)	-	-	-
BAD - passivated	BAD - passivated	BAD - passivated	BAD - passivated
BAD - maintenance alarm	UNCERTAIN - substitute set	UNCERCTAIN - substitute set	BAD - maintenance alarm

Input	Result		
BAD - process related	UNCERTAIN - process related	UNCERTAIN - process related	BAD - process related
BAD - function check	UNCERTAIN - substitute set	UNCERTAIN - substitute set	BAD - function check

9.3 Overview of diagnostic information

The device displays warnings or alarms as status messages. If errors occur during commissioning or measuring operation, these errors are displayed immediately. This is done in the configuration program via the parameter in the physical block or on the display. A distinction is made here between the following 4 status categories:

Status category	Description	Error category
F	Fault detected ('Failure')	ALARM
M	Maintenance required ('Maintenance')	WARNING
C	Device is in the service mode (check) ('Service mode')	
S	Specifications not observed ('Out of specification')	

WARNING error category:

With "M", "C" and "S" status messages, the device tries to continue measuring (uncertain measurement!). Alternating with the main measured value, the status is displayed onsite in the form of the letter in question plus the defined error number (7-segment display). The '#' symbol is also displayed.

ALARM error category:

The device does not continue measuring with the "F" status message. Depending on the setting of the Fail Safe Type parameter (FSAFE_TYPE), the last valid measured value, the incorrect measured value or the value configured under Fail Safe Value (FSAFE_VALUE) is transmitted via the fieldbus with the status "BAD" or "UNCERTAIN" for the measured value. The display alternates between the last valid measured value and the status - indicated by the letter "F" - plus a defined number (7-segment display) and the '#' symbol.

In both cases, the sensor which generates the status, e.g. "SENS1", "SENS2", is output on the 14-segment display. If the name of a sensor is not displayed, the status message does not refer to a sensor but refers to the device itself.

Abbreviations for output variables:

- SV1 = Secondary value 1 = Sensor value 1 in Temperature Transducer Block 1 = Sensor value 2 in Temperature Transducer Block 2
- SV2 = Secondary value 2 = Sensor value 2 in Temperature Transducer Block 1 = Sensor value 1 in Temperature Transducer Block 2
- PV1 = Primary value 1
- PV2 = Primary value 2
- RJ1 = Reference junction 1
- RJ2 = Reference junction 2

9.4 Diagnostic list

9.4.1 Category F diagnostics code messages

Category	No.	Status messages
		• In the Physical Block
		  • Diagnostic code
		  • Advanced diagnostics
		• Local display
			Sensor Transducer Block measured value status
			1 = Status (Profile 3.01/3.02)
			2 = Quality
			3 = Substatus (Profile 3.01/3.02)
			4 = Limits
				Cause of error/remedy	Output variables affected

F-	041	Device status message (PA): Sensor open circuit F-041 Local display: F041	1 = 0x10 [1]1/0x24 [2] 2 = BAD 3 = Sensor Failure/Maintenance alarm, more diagnosis available 4 = OK	Cause of error: 1. Electr. interruption of sensor or sensor wiring. 2. Incorrect setting for type of connection in the CONNECTION TYPE parameter. Remedy: Re 1.) Reestablish electr. connection or replace sensor. Re 2.) Configure correct type of connection.	SV1, SV2, also PV1, PV2 depending on the configuration
F-	042	Device status message (PA): Sensor corrosion F-042 Local display: F042	1 = 0x10x24 [1] 2 = BAD 3 = Sensor Failure/Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Corrosion detected on the sensor terminals. Remedy: Check wiring and replace if necessary.	SV1, SV2, also PV1, PV2 depending on the configuration
F-	043	Device status message (PA): Sensor short circuit F-043 Local display: F043	1 = 0x10x24 [1] 2 = BAD 3 = Sensor Failure/Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Short circuit detected at the sensor terminals. Remedy: Check the sensor and sensor wiring.	SV1, SV2, also PV1, PV2 depending on the configuration
F-	103	Device status message (PA): Sensor drift F-103 local display: F103	1 = 0x10x24 [1] 2 = BAD 3 = Sensor Failure/Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Sensor drift has been detected (in accordance with the settings in the Transducer Blocks). Remedy: Check the sensor, depending on the application.	PV1, PV2 SV1, SV2
F-	221	Device status message (PA): Reference temperature measurement F-221 local display: F221	1 = 0x0C/0x24 [1] 2 = BAD 3 = Sensor Failure/Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Internal reference junction defective. Remedy: Device defective, replace	SV1, SV2, PV1, PV2, RJ1, RJ2
F-	261	Device status message (PA): Electronics Error F-261 Local display: F261	1 = 0x0C/0x24 [1] 2 = BAD 3 = Sensor Failure/Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Electronics error. Remedy: Device defective, replace	SV1, SV2, PV1, PV2, RJ1, RJ2
F-	283	Device status message (PA): Memory error F-283 Local display: F283	1 = 0x0C/0x24 [1] 2 = BAD 3 = Sensor Failure/Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Error in memory. Remedy: Device defective, replace	SV1, SV2, PV1, PV2, RJ1, RJ2
F-	431	Device status message (PA): Calibration Incorrect F-431 Local display: F431	1 = 0x0C/0x24 [1] 2 = BAD 3 = Sensor Failure/Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Error in calibration parameters. Remedy: Device defective, replace	SV1, SV2, PV1, PV2, RJ1, RJ2

Category	No.	Status messages
		• In the Physical Block
		  • Diagnostic code
		  • Advanced diagnostics
		• Local display
			Sensor Transducer Block measured value status
			1 = Status (Profile 3.01/3.02)
			2 = Quality
			3 = Substatus (Profile 3.01/3.02)
			4 = Limits
				Cause of error/remedy	Output variables affected

F-	437	Device status message (PA): Configuration incorrect F-437 Local display: F437	1 = 0x0C/0x24 [1] 2 = BAD 3 = Sensor Failure/Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Incorrect configuration in Transducer Blocks "Sensor 1 and 2". Remedy: Check the configuration of the sensor types used, the units and the settings of PV1 and/or PV2.	SV1, SV2, PV1, PV2, RJ1, RJ2
F-	502	Device status message (PA): Linearization error F-502 Local display: F502	1 = 0x0C/0x24 [1] 2 = BAD 3 = Sensor Failure/Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Linearization error. Remedy: Select valid type of linearization (sensor type).	SV1, SV2, PV1, PV2, RJ1, RJ2

1) → 🕮 39
2) → 🕮 39

9.4.2 Category M diagnostics code messages

Category	No.	Status messages
		• In the Physical Block
		  • Diagnostic code
		  • Advanced diagnostics
		• Local display
			Sensor Transducer Block measured value status
			1 = Status (Profile 3.01/3.02)
			2 = Quality
			3 = Substatus (Profile 3.01/3.02)
			4 = Limits
				Cause of error/remedy	Output variables affected

M-	042	Device status message (PA): Corrosion M-042 Local display: M042	1 = 0x50 [1]/0xA4 [1] 2 = UNCERTAIN/GOOD 3 = Sensor conversion not accurate/Maintenance required/demanded 4 = OK	Cause of error: Corrosion detected on the sensor terminals. **Corrosion detection = off** Remedy: Check wiring and replace if necessary.	SV1, SV2, also PV1, PV2 depending on the configuration
M-	103	Device status message (PA): Drift M-103 Local display: M103	1 = 0x10 [1]/0xA4 [1] 2 = UNCERTAIN/GOOD 3 = non specific/Maintenance required/demanded 4 = OK	Cause of error: Sensor drift has been detected (in accordance with the settings in the Transducer Blocks). Remedy: Check the sensor, depending on the application.	PV1, PV2 SV1, SV2

1) See note → 🕮 39

9.4.3 Category S diagnostics code messages

Category	No.	Status messages
		• In the Physical Block
		  • Diagnostic code
		  • Advanced diagnostics
		• Local display
			Sensor Transducer Block measured value status
			1 = Status (Profile 3.01/3.02)
			2 = Quality
			3 = Substatus (Profile 3.01/3.02)
			4 = Limits
				Cause of error/remedy	Output variables affected

S-	101	Device status message (PA): Sensor measuring range undershot S-101 Local display: S101	1 = 0x50 [1]/0x78 [1] 2 = UNCERTAIN 3 = Sensor conversion not accurate/Process related, no maintenance 4 = OK	Cause of error: Physical measuring range undershot. Remedy: Select suitable sensor type.	SV1, SV2, also PV1, PV2 depending on the configuration
S-	102	Device status message (PA): Sensor measuring range overshot S-102 Local display: S102	1 = 0x50 [1]/0x78 [1] 2 = UNCERTAIN 3 = Sensor conversion not accurate/Process related, no maintenance 4 = OK	Cause of error: Physical measuring range overshot. Remedy: Select suitable sensor type.	SV1, SV2, also PV1, PV2 depending on the configuration
S-	901	Device status message (PA): Ambient temperature too low S-901 Local display: S901	1 = 0x40 [1]/0x78 [1] 2 = UNCERTAIN 3 = Non specific/Process related, no maintenance 4 = OK	Cause of error: Reference temperature < −40 ℃ (−40 ℉): parameter **Ambient alarm = On.** Remedy: Observe ambient temperature in accordance with specification.	SV1, SV2, PV1, PV2, RJ1, RJ2
S-	902	Device status message (PA): Ambient temperature too high S-902 Local display: S902	1 = 0x40 [1]/0x78 [1] 2 = UNCERTAIN 3 = Non specific/Process related, no maintenance 4 = OK	Cause of error: Reference temperature < +85 ℃ (+185 ℉): parameter **Ambient alarm = On.** Remedy: Observe ambient temperature in accordance with specification.	SV1, SV2, PV1, PV2, RJ1, RJ2

1) See note → 🖹 39

9.4.4   Category C diagnostics code messages

Category	No.	Status messages
		• In the Physical Block
		  • Diagnostic code
		  • Advanced diagnostics
		• Local display
			Sensor Transducer Block measured value status
			1 = Status (Profile 3.01/3.02)
			2 = Quality
			3 = Substatus (Profile 3.01/3.02)
			4 = Limits
				Cause of error/remedy	Output variables affected

C-	402	Device status message (PA): Startup initialization C-402 Local display: C402 ↔ Measured value	1 = 0x4C [1]/0x3C [1] 2 = UNCERTAIN/BAD 3 = Init value/function check/local override 4 = OK	Cause of error: Device starting/initializing. Remedy: Message is only displayed during power-up.	SV1, SV2, PV1, PV2, RJ1, RJ2
C-	482	Device status message (PA): Simulation active C-482 Local display: C482 ↔ Measured value	1 = 0x70 [1]/0x73(0x74) 2 = UNCERTAIN/BAD 3 =Init value/simulated value, start (end) 4 = OK	Cause of error: Simulation is active. Remedy: -	
C-	501	Device status message (PA): Device reset C-501 Local display: C501 ↔ Measured value	1 = 0x4C [1]/0x7F 2 = UNCERTAIN 3 = Init value/- - 4 = OK	Cause of error: Device reset is performed. Remedy: Message is only displayed during a reset.	SV1, SV2, PV1, PV2, RJ1, RJ2

1)   See note → 🕮 39

> ℹ The specified status can increase by the value 1 (low limit), 2 (high limit) or 3 (constant) due to a limit violation. The status value can increase as a result of a limit violation of the error directly displayed, or can be transferred from a low-priority error when more than one status occurs simultaneously.

Example:

	Quality (BAD)		Quality substatus				Limits		
Fault (F)	0	0	1	0	0	1	x	x	= 0x24 0x27

9.5   Corrosion monitoring

Sensor connection cable corrosion can lead to false measured value readings. Therefore the unit offers the possibility of detecting corrosion before a measured value is affected.

> ℹ Corrosion monitoring is only possible for RTDs with a 4-wire connection and thermocouples.

2 different levels can be selected in the CORROSION_DETECTION parameter (see Section 14) depending on the application requirements:

- Off (No corrosion monitoring)
- On (Warning is displayed before the alarm value is reached - see table below. This allows preventive maintenance/troubleshooting to be performed. An alarm message is displayed after the alarm limit is reached.)

The following table describes how the device behaves when the resistance in a sensor connection cable changes, depending on whether on or off is selected for the parameter.

RTD	< ≈ 2 kΩ	2 kΩ ≈ < x ≈ 3 kΩ	> ≈ 3 kΩ
off	---	No alarm	No alarm
on	---	WARNING (M-042)	ALARM (F-042)

TC	< ≈ 10 kΩ	10 kΩ ≈ < x ≈ 15 kΩ	> ≈ 15 kΩ
off	---	No alarm	No alarm
on	---	WARNING (M-042)	ALARM (F-042)

The sensor resistance can affect the resistance data in the table. If all the sensor connection cable resistances are increased at the same time, the values given in the table are halved.

The corrosion detection system presumes that this is a slow process with a continuous increase in the resistance.

9.6   Application errors without messages

9.6.1   Application errors for RTD connection

Sensor types, see → 🖹 47.

Symptoms	Cause	Action/remedy
Measured value is incorrect/ inaccurate	Incorrect sensor orientation	Install the sensor correctly
	Heat conducted by sensor	Observe the installed length of the sensor
	Device programming is incorrect (number of wires)	Change the **Connection type** device function
	Device programming is incorrect (scaling)	Change scaling
	Incorrect RTD configured	Change the **Characterization type** device function
	Sensor connection (2-wire), incorrect connection configuration compared to actual connection	Check the sensor connection/configuration of the transmitter
	The cable resistance of the sensor (2-wire) was not compensated	Compensate the cable resistance
	Offset incorrectly set	Check offset
	Sensor, sensing element defective	Check the sensor, sensing element
	RTD connection incorrect	Connect the connecting cables correctly (see the "Electrical connection" section)
	Programming	Incorrect sensor type set in the **Characterization type** device function. Set the correct sensor type
	Device defective	Replace device

9.6.2   Application errors for TC connection

Sensor types, see → 🖹 47.

Symptoms	Cause	Action/remedy
Measured value is incorrect/ inaccurate	Incorrect sensor orientation	Install the sensor correctly
	Heat conducted by sensor	Observe the installed length of the sensor
	Device programming is incorrect (scaling)	Change scaling

Symptoms	Cause	Action/remedy
	Incorrect thermocouple type (TC) configured	Change the **Characterization type** device function
	Incorrect reference junction set	See Section 13
	Offset incorrectly set	Check offset
	Interference via the thermocouple wire welded in the thermowell (coupling of interference voltages)	Use a sensor where the thermocouple wire is not welded
	Sensor connected incorrectly	Connect the connecting cables correctly (see the "Electrical connection" section)
	Sensor, sensing element defective	Check the sensor, sensing element
	Programming	Incorrect sensor type set in the **Characterization type** device function; set the correct thermocouple (TC)
	Device defective	Replace device

9.7   Firmware history

Revision history

The firmware version (FW) on the nameplate and in the Operating Instructions indicates the device release: XX.YY.ZZ (example 01.02.01).

XX	Change to main version. No longer compatible. The device and Operating Instructions change.
YY	Change to functions and operation. Compatible. The Operating Instructions change.
ZZ	Fixes and internal changes. No changes to the Operating Instructions.

Date	Firmware version	Modifications	Documentation
01/2009	1.00.05	Original firmware/software	BA275R/09/en/0209
06/2011	1.01.zz	Update to PROFIBUS Profile 3.02	BA00275R/09/en/01.11
06/2011	1.01.zz	-	BA00275R/09/EN/02.12
07/2023	1.01.zz	-	BA00275R/09/EN/03.23

10   Maintenance

No special maintenance work is required for the temperature transmitter.

10.1   Cleaning

A clean, dry cloth can be used to clean the device.

11   Repair

11.1   General notes

ℹ️ Repairs that are not described in these Operating Instructions must only be carried out directly by the manufacturer or by the service department.

11.2   Spare parts

Spare parts currently available for the product can be found online at: http://www.products.endress.com/spareparts_consumables. Always quote the serial number of the device when ordering spare parts!
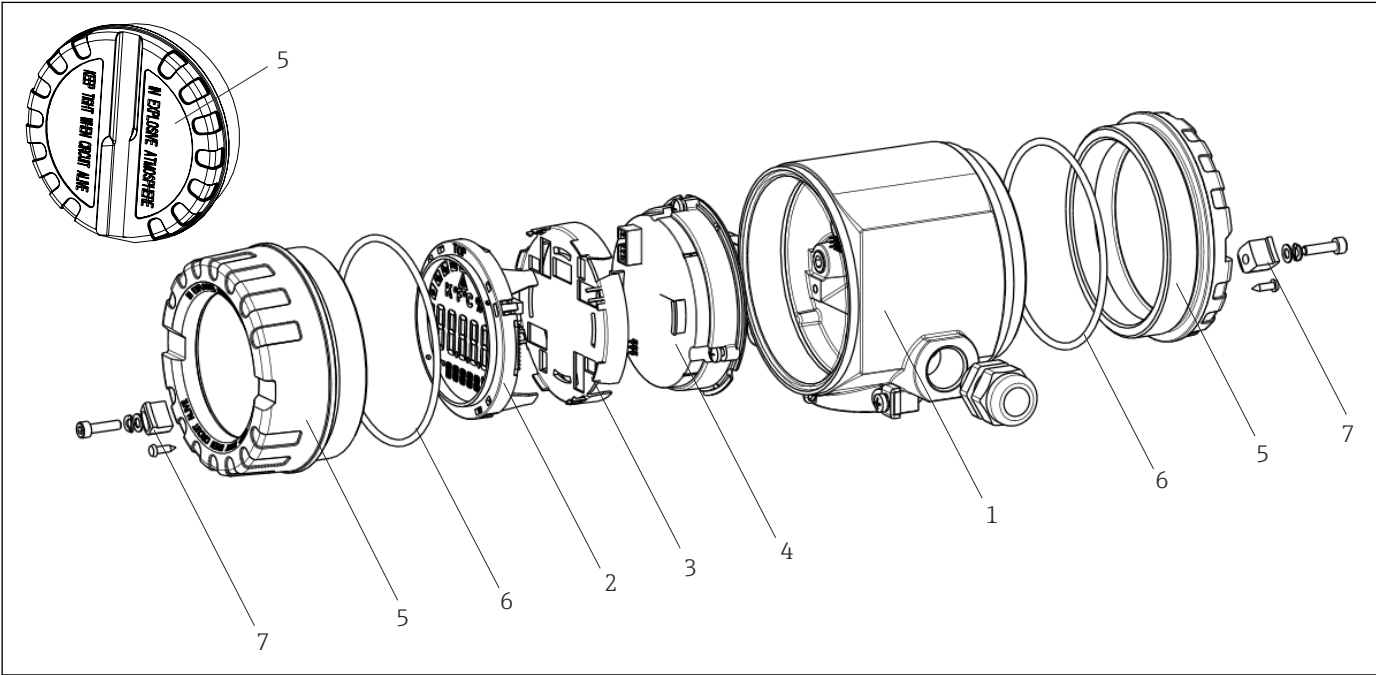
A0024557

🖼 *14   Field transmitter spare parts*

Item no. 1	Housing	
	Certificates:	
	A	Non-hazardous area + Ex ia
	B	ATEX Ex d
	Material:	
	A	Aluminum, HART 5
	B	Stainless steel 316L, HART 5
	F	Aluminum, FF/PA
	G	Stainless steel 316L, FF/PA
	K	Aluminum, HART 7
	L	Stainless steel 316L, HART 7
	Cable entry:	
	1	2 x thread NPT ½" + terminal block + 1 dummy plug
	2	2 x thread M20x1.5 + terminal block + 1 dummy plug

Item no. 1	Housing			
			4	2 x thread G ½" + terminal block + 1 dummy plug
			Version:	
			A	Standard
TMT162G-			A	← order code

Item no. 4	Electronics module	
	Certificates:	
	A	Non-hazardous area
	B	ATEX Ex ia, FM IS, CSA IS
	Sensor input; communication:	
	A	1x; HART 5, FW 01.03.zz, DevRev02
	B	2x; HART 5, FW 01.03.zz, DevRev02, config. output sensor 1
	C	2x; FOUNDATION Fieldbus Device Revision 1
	D	2x; PROFIBUS PA, DevRev02
	E	2x; FOUNDATION Fieldbus FW 01.01.zz, Device Revision 2
	F	2x; FOUNDATION Fieldbus FW 02.00.zz, Device Revision 3
	G	1x; HART7, Fw 04.01.zz, DevRev04
	H	2x; HART7, Fw 04.01.zz, DevRev04, config. output sensor 1
	Configuration:	
	A	50 Hz mains filter
	B	Produced as per original order (quote serial number) 50 Hz mains filter
	K	60 Hz mains filter
	L	Produced as per original order (quote serial number) 60 Hz mains filter
TMT162E-		← order code

Item no.	Order code	Spare parts
2.3	TMT162X-DA	Display HART 5 + retainer + twist protection
2.3	TMT162X-DB	Display PA/FF + retainer + twist protection
2.3	TMT162X-DC	Display retainer + twist protection
2.3	TMT162X-DD	Display HART 7 + retainer + twist protection
5	TMT162X-HH	Housing cover blind, aluminum Ex d, FM XP with seal, CSA approval, only as cover of connection compartment
5	TMT162X-HI	Housing cover blind, aluminum + seal
5	TMT162X-HK	Housing cover cpl. display, aluminum Ex d with seal
5	TMT162X-HL	Housing cover cpl. display, aluminum with seal
5	TMT162X-HA	Housing cover blind, stainless steel 316L Ex d, ATEX Ex d, FM XP with seal, CSA approval, only as cover of connection compartment
5	TMT162X-HB	Housing cover blind, stainless steel 316L, with seal
5	TMT162X-HC	Housing cover cpl. display, Ex d, stainless steel 316L, ATEX Ex d, FM XP, CSA XP, with seal
5	TMT162X-HD	Housing cover cpl. display, stainless steel 316L, with seal
5	TMT162X-HF	Housing cover cpl. display, polycarbonate, 316L

Item no.	Order code	Spare parts
6	71439499	O-ring 88x3 HNBR 70˚ Shore PTFE coating
7	51004948	Cover clamp spare part set: screw, disk, spring washer

11.3 Return

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the website for more information:
   http://www.endress.com/support/return-material

2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

11.4 Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

12 Accessories

Various accessories, which can be ordered with the device or subsequently from Endress +Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Always quote the serial number of the device when ordering accessories!

12.1 Device-specific accessories

Accessories	Description	
Dummy plugs	• M20x1.5 EEx-d/XP • G ½" EEx-d/XP • NPT ½" ALU • NPT ½" V4A	
Cable glands	• M20x1.5 • NPT ½" cable gland 2 x D0.5 cable for 2 sensors • M20x1.5 cable gland 2 x D0.5 cable for 2 sensors	
Adapter for cable gland	M20x1,5/NPT ½" cable entry	
Wall and pipe mounting bracket	Stainless steel wall/2" pipe Stainless steel 2" pipe V4A	
Fieldbus device connector (FF)	**Threaded connection:**	**Cable connection thread:**
	M20	7/8"
	NPT ½"	7/8"

Accessories	Description	
Fieldbus device connector (PA)	Threaded connection:	Cable connection thread:
	M20x1.5	M12
	NPT ½"	M12
	M20x1.5	7/8"

12.2   Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: • Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections. • Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: Via the Internet: https://portal.endress.com/webapp/applicator

Accessories	Description
Configurator	Product Configurator - the tool for individual product configuration • Up-to-the-minute configuration data • Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language • Automatic verification of exclusion criteria • Automatic creation of the order code and its breakdown in PDF or Excel output format • Ability to order directly in the Endress+Hauser Online Shop The Product Configurator is available on the Endress+Hauser website: www.endress.com-> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
FieldCare SFE500	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. 📖 For details, see Operating Instructions BA00027S and BA00065S
DeviceCare SFE100	Configuration tool for devices via fieldbus protocols and Endress+Hauser service protocols. DeviceCare is the tool developed by Endress+Hauser for the configuration of Endress+Hauser devices. All smart devices in a plant can be configured via a point-to-point or point-to-bus connection. The user-friendly menus enable transparent and intuitive access to the field devices. 📖 For details, see Operating Instructions BA00027S

12.3   System products

Accessories	Description
Graphic Data Manager Memograph M	The Advanced Data Manager Memograph M is a flexible and powerful system for organizing process values. The measured process values are clearly presented on the display and logged safely, monitored for limit values and analyzed. Via common communication protocols, the measured and calculated values can be easily communicated to higher-level systems or individual plant modules can be interconnected. 📖 For details, see Technical Information TI01180R/09
RN22	Single- or two-channel active barrier for safe separation of 0/4 to 20 mA standard signal circuits with bidirectional HART® transmission. In the signal duplicator option, the input signal is transmitted to two galvanically isolated outputs. The device has one active and one passive current input; the outputs can be operated actively or passively. The RN22 requires a supply voltage of 24 V_{DC}. 📖 For details, see Technical Information TI01515K
RN42	Single-channel active barrier for safe separation of 0/4 to 20 mA standard signal circuits with bidirectional HART® transmission. The device has one active and one passive current input; the outputs can be operated actively or passively. The RN42 can be powered with a wide range voltage of 24 to 230 $V_{AC/DC}$. 📖 For details, see Technical Information TI01584K

RID14/RID16	Field indicator with 8 input channels and FOUNDATION Fieldbus™ or PROFIBUS® PA protocol for displaying process values and calculated values. Onsite display of process parameters in fieldbus systems.
	
	📖 For details:
	  • Technical Information RID16: TI00146R
	  • Technical Information RID14: TI00145R

13   Technical data

13.1   Input

Measured variable	Temperature (temperature-linear transmission behavior), resistance and voltage.

Measuring range	The transmitter provides different measuring ranges depending on the sensor connection and input signals:

Resistance thermometer (RTD) as per standard	Description	α	Measuring range limits	Min. measuring span
IEC 60751:2008	Pt100 (1) Pt200 (2) Pt500 (3) Pt1000 (4)	0.003851	−200 to +850 ℃ (−328 to +1 562 ℉) −200 to +850 ℃ (−328 to +1 562 ℉) −200 to +250 ℃ (−328 to +482 ℉) −200 to +250 ℃ (−328 to +482 ℉)	10 K (18 ℉)
JIS C1604:1984	Pt100 (5)	0.003916	−200 to +649 ℃ (−328 to +1 200 ℉)	10 K (18 ℉)
DIN 43760 IPTS-68	Ni100 (6) Ni1000 (7)	0.006180	−60 to +250 ℃ (−76 to +482 ℉) −60 to +150 ℃ (−76 to +302 ℉)	10 K (18 ℉)
to Edison Copper Winding No. 15	Cu10	0.004274	−100 to +260 ℃ (−148 to +500 ℉)	10 K (18 ℉)
to Edison Curve	Ni120	0.006720	−70 to +270 ℃ (−94 to +518 ℉)	10 K (18 ℉)
to GOST	Pt50 (8) Pt100 (9)	0.003910	−200 to +1 100 ℃ (−328 to +2 012 ℉) −200 to +850 ℃ (−328 to +1 562 ℉)	10 K (18 ℉)
to GOST	Cu50 (10) Cu100 (11)	0.004280	−200 to +200 ℃ (−328 to +392 ℉)	10 K (18 ℉)
-	Pt100 (Callendar-Van Dusen)	-	10 to 400 Ω 10 to 2 000 Ω	10 Ω 100 Ω
	Nickel polynomial	-	10 to 400 Ω 10 to 2 000 Ω	10 Ω 100 Ω
	Copper polynomial	-	10 to 400 Ω 10 to 2 000 Ω	10 Ω 100 Ω
	• Connection type: 2-wire, 3-wire or 4-wire connection, sensor current: ≤ 0.3 mA • With 2-wire circuit, compensation of the wire resistance possible (0 to 30 Ω) • With 3-wire and 4-wire connection, sensor wire resistance up to max. 50 Ω per wire			
Resistance transmitter	Resistance Ω		10 to 400 Ω 10 to 2 000 Ω	10 Ω 100 Ω

Thermocouples as per standard	Description	Measuring range limits		Min. measuring span
to IEC 584 part 1	Type B (PtRh30-PtRh6) (31) [1] [2] Type E (NiCr-CuNi) (34) Type J (Fe-CuNi) (35) Type K (NiCr-Ni) (36) Type N (NiCrSi-NiSi) (37) Type R (PtRh13-Pt) (38) Type S (PtRh10-Pt) (39) Type T (Cu-CuNi) (40)	+40 to +1 820 ℃ (+104 to +3 308 ℉) −270 to +1 000 ℃ (−454 to +1 832 ℉) −210 to +1 200 ℃ (−346 to +2 192 ℉) −270 to +1 372 ℃ (−454 to +2 501 ℉) −270 to +1 300 ℃ (−454 to +2 372 ℉) −50 to +1 768 ℃ (−58 to +3 214 ℉) −50 to +1 768 ℃ (−58 to +3 214 ℉) −260 to +400 ℃ (−436 to +752 ℉)	Recommended temperature range: +500 ℃ (+900 ℉) +50 ℃ (+90 ℉) +50 ℃ (+90 ℉) +50 ℃ (+90 ℉) +50 ℃ (+90 ℉) +500 ℃ (+900 ℉) +500 ℃ (+900 ℉) +50 ℃ (+90 ℉)	
ASTM E988-96	Type C (W5Re-W26Re) (32)	0 to +2 315 ℃ (+32 to +4 199 ℉)	+500 ℃ (+900 ℉)	

Thermocouples as per standard	Description	Measuring range limits		Min. measuring span
	Type D (W3Re-W25Re) (33)	0 to +2 315 ℃ (+32 to +4 199 ℉)	+500 ℃ (+900 ℉)	
DIN 43710	Type L (Fe-CuNi) (41) Type U (Cu-CuNi) (42)	−200 to +900 ℃ (−328 to +1 652 ℉) −200 to +600 ℃ (−328 to +1 112 ℉)	+50 ℃ (+90 ℉) +50 ℃ (+90 ℉)	
	• Internal reference junction (Pt100) • External reference junction: configurable value −40 to +85 ℃ (−40 to +185 ℉) • Maximum sensor wire resistance 10 kΩ (if the sensor wire resistance is greater than 10 kΩ, an error message as per NAMUR NE 89 is output) [3]			
Voltage transmitter (mV)	Millivolt transmitter (mV)	−20 to 100 mV		5 mV

1) Significant measuring error increase for temperatures lower than 300 ℃ (572 ℉).
2) When operating conditions are based on a large temperature range, the TMT162 offers the ability to split the range. For example, a Type S or R thermocouple can be used for the lower range and a Type B can be used for the upper range. The TMT162 is then programmed to switch at a predetermined temperature. This allows for utilization of the best performance from each individual thermocouple and provides 1 output that represents the process temperature. Note: the option for two sensor inputs must be included in the order code for the HART® protocol. Two sensor inputs are already provided as standard if the FF and PA protocol are selected.
3) Basic requirements of NE 89: detection of increased wire resistance (e.g. corrosion of contacts and wires) of TC or RTD/4-wire.

| Type of input | *The following connection combinations are possible when both sensor inputs are assigned:* |

		Sensor input 1			
		RTD or resistance transmitter, 2-wire	RTD or resistance transmitter, 3-wire	RTD or resistance transmitter, 4-wire	Thermocouple (TC), voltage transmitter
Sensor input 2	RTD or resistance transmitter, 2-wire	☑	☑	-	☑
	RTD or resistance transmitter, 3-wire	☑	☑	-	☑
	RTD or resistance transmitter, 4-wire	-	-	-	-
	Thermocouple (TC), voltage transmitter	☑	☑	☑	☑

13.2   Output

Output signal	Signal encoding	PROFIBUS® PA in accordance with EN 50170 Volume 2, IEC 61158-2, Manchester Bus Powered (MBP)
	Data transmission rate	31.25 kbit/s, voltage mode
	Galvanic isolation	U = 2 kV AC (input/output)

| Failure information | Status messages and alarms in accordance with PROFIBUS® PA Profile 3.01/3.02 specification |

| Linearization/transmission behavior | Temperature-linear, resistance-linear, voltage-linear |

| Filter | 1st order digital filter: 0 to 60 s |

Protocol-specific data	Profile	3.02
	Manufacturer-specific ID no.:	1549 (hex)
	Device or bus address	126 (default) The device address or bus address is configured using either the configuration software, e.g. FieldCare, or the DIP switches on the electronics module.
	Device description files (GSD)	Sources for GSD files and device drivers: • GSD file and FieldCare DTM: www.de.endress.com • Profile GSD file: www.profibus.com
	Write protection	Write protection activated by hardware setting (DIP switch)
	Cyclic data exchange	
	Output data	Display value
	Input data	Process temperature, internal reference temperature
	Brief description of the blocks	
	Physical Block	The Physical Block contains all the data that clearly identify and distinguish the device. It is an electronic version of a nameplate on the device. In addition to parameters needed to operate the device on the fieldbus, the Physical Block provides information such as order code, device ID, hardware revision, software revision, device release etc. The Physical Block can also be used to configure the display.
	Transducer Block "Sensor 1" and "Sensor 2"	The Transducer Blocks of the field transmitter contain all the measurement-specific and device-specific parameters which are relevant for the measurement of the input variables.
	Analog Input (AI)	In the AI Function Block, the process variables from the Transducer Blocks are processed for subsequent automation functions in the control system (e.g. scaling, limit value processing).

Switch-on delay	8 s

13.3   Power supply

Supply voltage	U_b= 9 to 32 V, polarity-independent, maximum voltage U_b = 35 V. According to IEC 60079-27, FISCO/FNICO

The device may only be powered by a power unit with an energy-limited circuit in accordance with UL/EN/IEC 61010-1, Section 9.4 and the requirements of Table 18.

Current consumption	Current consumption (device basic current)	≤ 11 mA
	Error current FDE (Fault Disconnection Electronic)	0 mA

Terminals	2.5 mm² (12 AWG) plus ferrule

Cable entries	**Version**	**Type**
	Thread	2x thread ½" NPT
		2x thread M20
		2x thread G½"
	Cable gland	2x coupling M20

Device plugs	Version	Type
	Thread and fieldbus connector	2x thread ½" NPT 1x connector 7/8" FF
		2x thread M20x1.5 1x connector 7/8" FF

13.4   Performance characteristics

Response time	Measured value update < 1 s per channel, depending on the type of sensor and connection method

Reference operating conditions	• Calibration temperature: +25 ℃ ±3 K (77 ℉ ±5.4 ℉) • Supply voltage: 24 V DC • 4-wire circuit for resistance adjustment

Maximum measured error	The data relating to the measured error are typical values and correspond to a standard deviation of ±3 σ (normal distribution), i.e. 99.8% of all measured values achieve the specified values or better values.

	Designation	Accuracy
Resistance thermometer (RTD)	Cu100, Pt100, Ni100, Ni120 Pt500 Cu50, Pt50, Pt1000, Ni1000 Cu10, Pt200	0.1 ℃ (0.18 ℉) 0.3 ℃ (0.54 ℉) 0.2 ℃ (0.36 ℉) 1 ℃ (1.8 ℉)
Thermocouples (TC)	Type: K, J, T, E, L, U Type: N, C, D Type: S, B, R	typ. 0.25 ℃ (0.45 ℉) typ. 0.5 ℃ (0.9 ℉) typ. 1.0 ℃ (1.8 ℉)
	Measuring range	**Accuracy**
Resistance transmitter (Ω)	10 to 400 Ω 10 to 2 000 Ω	±0.04 Ω ±0.08 Ω
Voltage transmitter (mV)	−20 to 100 mV	±10 µV

Physical input measuring range of sensors	
10 to 400 Ω	Cu10, Cu50, Cu100, polynomial RTD, Pt50, Pt100, Ni100, Ni120
10 to 2 000 Ω	Pt200, Pt500, Pt1000, Ni1000
−20 to 100 mV	Thermocouples type: C, D, E, J, K, L, N, U
−5 to 30 mV	Thermocouples type: B, R, S, T

Sensor adjustment	**Sensor-transmitter-matching** RTD sensors are one of the most linear temperature measuring elements. Nevertheless, the output must be linearized. To significantly improve temperature measurement accuracy, the device allows the use of two methods:

- Customized linearization
  The transmitter can be programmed with sensor-specific curve data with the PC configuration software. As soon as the sensor-specific data have been entered, the transmitter uses these to create a customized curve.
- Callendar-Van-Dusen coefficients
  The Callendar-Van Dusen equation is described as:
  $R_T = R_0[1+AT+BT^2+C(T-100)T^3]$

  where A, B and C are constant. They are commonly referred as Callendar-Van-Dusen coefficients. The precise values of A, B and C are derived from the calibration data for the RTD and are specific for each RTD sensor. The process involves programming the transmitter with the curve data for a certain RTD instead of using a standardized curve. Sensor transmitter matching using one of the methods explained above significantly improves the temperature measurement accuracy of the entire system. This is a result of the transmitter using the sensor's actual resistance vs. temperature curve data instead of the ideal curve data.

Resolution	Resolution of A/D converter = 18 bit

Non-repeatability	*According to EN 61298-2*

Physical input measuring range of sensors		Non-repeatability
10 to 400 Ω	Cu10, Cu50, Cu100, polynomial RTD, Pt50, Pt100, Ni100, Ni120	15 mΩ
10 to 2 000 Ω	Pt200, Pt500, Pt1000, Ni1000	100 ppm x measured value
−20 to 100 mV	Thermocouples type: C, D, E, J, K, L, N, U	4 µV
−5 to 30 mV	Thermocouples type: B, R, S, T	3 µV

Long-term drift	≤ 0.1 ℃/year (≤ 0.18 ℉/year) under reference operating conditions or ≤ 0.05 %/year. Data under reference operating conditions. % refers to the set span. The larger value applies.

Influence of ambient temperature	

Impact on accuracy when ambient temperature changes by 1 ℃ (1.8 ℉):	
Input 10 to 400 Ω	15 ppm of measured value, min. 1.5 mΩ
Input 10 to 2 000 Ω	15 ppm of measured value, min. 15 mΩ
Input −20 to 100 mV	30 ppm of measured value, min. 0.3 µV
Input −5 to 30 mV	30 ppm of measured value, min. 0.15 µV

Typical sensitivities of resistance thermometers		
Pt: 0.00385 * R_{nom}/K	Cu: 0.0043 * R_{nom}/K	Ni: 0.00617 * R_{nom}/K

Example of Pt100: 0.00385 x 100 Ω/K = 0.385 Ω/K

Typical sensitivities of thermocouples					
B: 10 µV/K at 1000 ℃ (1832 ℉)	C: 20 µV/K at 1000 ℃ (1832 ℉)	D: 20 µV/K at 1000 ℃ (1832 ℉)	E: 75 µV/K at 500 ℃ (932 ℉)	J: 55 µV/K at 500 ℃ (932 ℉)	K: 40 µV/K at 500 ℃ (932 ℉)
L: 55 µV/K at 500 ℃ (932 ℉)	N: 35 µV/K at 500 ℃ (932 ℉)	R: 12 µV/K at 1000 ℃ (1832 ℉)	S: 12 µV/K at 1000 ℃ (1832 ℉)	T: 50 µV/K at 1000 ℃ (1832 ℉)	U: 60 µV/K at 500 ℃ (932 ℉)

Examples of calculating the measured error with ambient temperature drift

Example 1:

Input temperature drift Δθ = 10 K (18 ℉), Pt100, measuring range 0 to +100 ℃ (+32 to +212 ℉)
Maximum process temperature: 100 ℃ (212 ℉)
Measured resistance value: 138.5 Ω (IEC 60751) at maximum process temperature

Typical temperature drift in Ω: (0.0015% of 138.5 Ω) * 10 = 0.0208 Ω
Conversion to Kelvin: 0.0208 Ω/0.385 Ω/K = 0.05 K (0.09 ℉)

Example 2:

Input temperature drift Δθ = 10 K (18 ℉), thermocouple type K, measuring range 0 to +600 ℃ (+32 to +1 112 ℉)
Maximum process temperature: 600 ℃ (1 112 ℉)
Measured thermoelectric voltage: 24 905 V (see IEC 60584)

Typical temperature drift in μV: (0.001% of 24 095 μV) * 10 = 2.5 μV
Conversion to Kelvin: 2.5 μK/40 μV/K/K = 0.06 K (0.11 ℉)

Total uncertainty of measurement of the measuring point

According to the Guide to the Expression of Uncertainty in Measurement (GUM), the uncertainty of measurement can be calculated as follows:

$$\text{Total measurement accuracy} = k\sqrt{\frac{(\text{Basic measured error transmitter})^2}{3} + \frac{(\text{Measured error ambient temperature})^2}{3} + \frac{(\text{Measured error sensor})^2}{3}}$$

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Example of calculating the total uncertainty of measurement of a thermometer:

Ambient temperature drift Δθ = 10 K (18 ℉), Pt100 Class A, measuring range 0 to +100 ℃ (+32 to +212 ℉), maximum process temperature: 100 ℃ (212 ℉), k = 2

- Basic measured error: **0.1 K (0.18 ℉)**
- Measured error caused by ambient temperature drift: **0.04 K (0.072 ℉)**
- Measured error of the sensor: 0.15 K (0.27 ℉) + 0.002 * 100 ℃ (212 ℉) = **0.35 K (0.63 ℉)**

$$\text{Total measurement accuracy} = 2\sqrt{\frac{(0.1\text{ K})^2}{3} + \frac{(0.04\text{ K})^2}{3} + \frac{(0.35\text{ K})^2}{3}} = 0.42\text{ K (0.76 ℉)}$$

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Influence of the reference junction	Pt100 DIN IEC 60751 Cl. B (internal reference junction with thermocouples TC)

13.5 Environment

Ambient temperature	• −40 to +85 ℃ (−40 to +185 ℉), see Ex documentation for hazardous areas • Without display: −40 to +85 ℃ (−40 to +185 ℉) • With display: −40 to +80 ℃ (−40 to +176 ℉) ℹ The display may react slowly at temperatures < −20 ℃ (−4 ℉). The readability of the display cannot be guaranteed at temperatures < −30 ℃ (−22 ℉).
Storage temperature	• Without display: −40 to +100 ℃ (−40 to +212 ℉) • With display: −40 to +80 ℃ (−40 to +176 ℉)
Relative humidity	Permitted: 0 to 95 %

Altitude	Up to 2 000 m (6 560 ft) above mean sea level
Climate class	As per IEC 60654-1, Class C
Degree of protection	Die-cast aluminum or stainless steel housing: IP66/67, Type 4X

Shock and vibration resistance

Shock resistance as per KTA 3505 (section 5.8.4 Shock test)

IEC 60068-2-6 test

Fc: Vibration (sinusoidal)

Vibration resistance according to DNV GL Guideline, Vibration: B

ℹ️ The use of L-shaped mounting brackets can cause resonance (see wall/pipe 2" mounting bracket in the 'Accessories' section). Caution: vibrations at the transmitter may not exceed specifications.

Electromagnetic compatibility (EMC)

CE conformity

Electromagnetic compatibility in accordance with all the relevant requirements of the IEC/EN 61326 series and NAMUR Recommendation EMC (NE21). For details, refer to the Declaration of Conformity.

Maximum measured error <1% of measuring range.

Interference immunity as per IEC/EN 61326 series, industrial requirements

Interference emission as per IEC/EN 61326 series, Class B equipment

ℹ️ A shielded cable that is grounded on both sides must be used for sensor cable lengths of 30 m (98.4 ft) and more. The use of shielded sensor cables is generally recommended.

Connection of the functional grounding may be needed for functional purposes. Compliance with the electrical codes of individual countries is mandatory.

Overvoltage category	II
Pollution degree	2

13.6   Mechanical construction

Design, dimensions   Dimensions in mm (in)
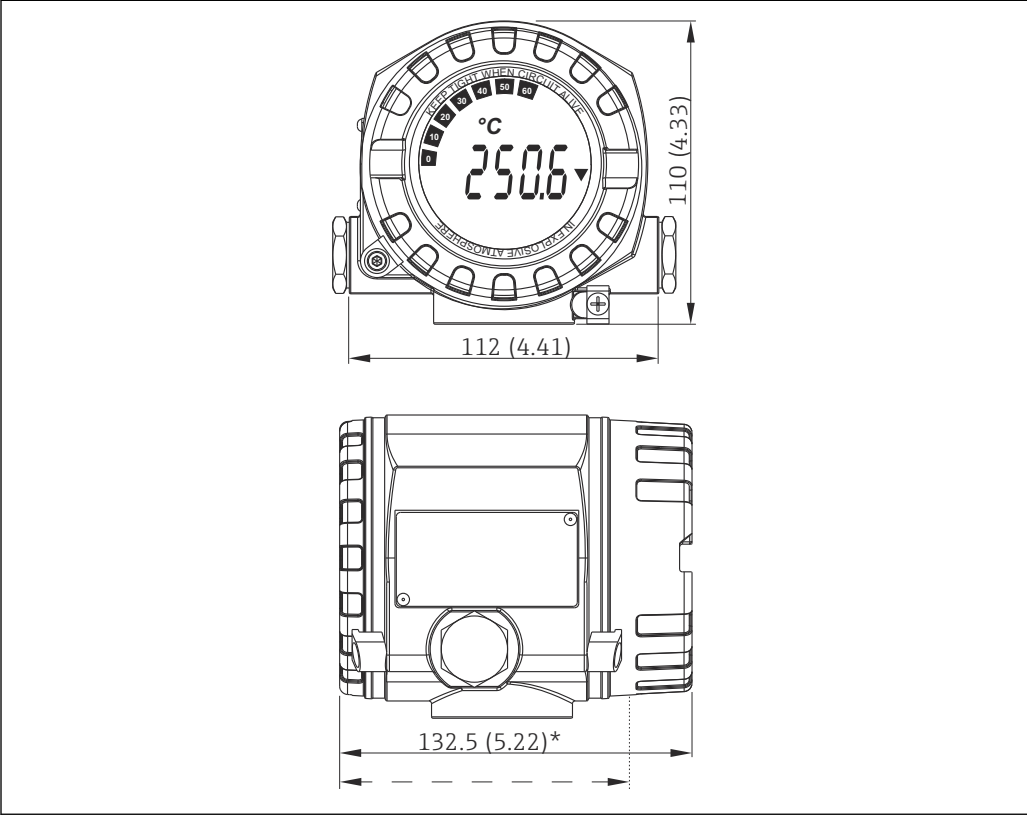
▣ 15   *Die-cast aluminum housing for general applications, or optional stainless steel housing (316L)*

ℹ️   * Dimensions without display = 112 mm (4.41")

- Separate electronics module and connection compartment
- Display attachable in 90° stages

Weight   - Aluminum housing approx. 1.4 kg (3 lb), with display
                            - Stainless steel housing approx. 4.2 kg (9.3 lb), with display

Materials

Housing	Sensor terminals	Nameplate
Die-cast aluminum housing AlSi10Mg/ AlSi12 with powder coating on polyester base	Nickel-plated brass0.3 µm gold flashed/cpl., corrosion-free	Aluminum AlMgl, anodized in black
316L		1.4404 (AISI 316L)
		-
Display O-ring 88x3: HNBR 70° Shore PTFE coating	-	-

Cable entries

Version	Type
Thread	2x thread ½" NPT
	2x thread M20

Version	Type
	2x thread G½"
Cable gland	2x coupling M20

13.7 Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

MTTF	PROFIBUS® PA: **126 a**
PROFIBUS® PA certification	The temperature transmitter is certified and registered by the PNO (PROFIBUS® Nutzerorganisation e.V., PROFIBUS User Organization). The measuring system meets all the requirements of the following specifications: • Certified in accordance with PROFIBUS® PA Profile 3.02 • The device can also be operated with certified devices of other manufacturers (interoperability).

14 Operation using PROFIBUS® PA

The operation is geared towards the user role of the operator and groups the operating parameters into appropriate operating menus.

Two setup modes are available in this user-oriented operating system: The "Standard" setup and the "Expert" setup.

All the basic settings that are needed to operate the device can be made in the "Standard" setup mode.

The "Expert" setup is reserved for experienced users or service staff. All the configuration options of the "Standard" setup are available in the "Expert" setup mode. In addition, it is possible to make special device settings in this mode with additional parameters. Besides these two main menu items, the Display/Operation menu is available for configuring the optional display and the Diagnostics menu is available for system and diagnostics information.

The device parameters are explained in the following section using the user-oriented operating system. All the device parameters that are not listed in this operating structure can only be modified with the aid of appropriate tools and the information in the slot index lists (→ Section 14.4 → 🖺 86).

14.1 Operating structure

→ **Display/operation** → 🖺 57

→ **Setup** → 🖺 58	→ Advanced setup → 🖺 62	→ Sensor 1
		→ Sensor 2
		→ Security settings

→ **Diagnostics** → 🖺 64	→ System information → 🖺 65	
	→ Measured value → 🖺 65	→ Min./ max. values
	→ Device test/reset → 🖺 66	

→ **Expert** → 🖺 67	→ System → 🖺 68	→ Display	
	→ Sensory mechanism → 🖺 69	→ Sensor 1	→ Special linearization 1
		→ Sensor 2	→ Special linearization 2
	→ Communication → 🖺 74	→ Analog Input 1	
		→ Analog Input 2	
		→ Analog Input 3	
		→ Analog Input 4	
	→ Diagnostics → 🖺 84	→ System information	
		→ Measured value	→ Min./ max. values
		→ Device test/reset	

14.2 Standard setup

The following parameter groups are available in the standard setup. These parameters are used for basic device configuration. The field transmitter can be put into operation with this limited parameter set.

14.2.1   Group Display/Operation

The settings for displaying the measured value on the optional TID10 plug-in display are made in the Display/Operation menu. The following parameters can be found in the **Display/Operation** group and under Expert → System → Display.

These settings do not have any effect on the output values of the transmitter. They are only used to configure how information is shown on the display.

Display/operation

Menu item	Parameter name	Parameter access	Description
Expert → System → Display	Alternating time	Read/write	Entry (in s) as to how long a value should be shown on the display. Setting from 4 to 60 s. **Factory setting:** 6 s
	Display source n	Read/write	Use this function to select the value to be displayed. Possible settings: ▪ Off ▪ Primary Value 1 ▪ Sensor Value 1 ▪ Primary Value 2 ▪ Sensor Value 2 ▪ RJ Value **Factory setting:** Primary Value 1 If all 3 display channels are switched off ('Off' option), the value for primary value 1 automatically appears on the display. If this value is not available (e.g. 'No Sensor' option selected in the Sensor Transducer Block 1, parameter 'Characterization Type 1'), primary value 2 is displayed.
	Display value description n	Read/write	Description of the display value displayed. **Factory setting:** "P1 " Maximum 16 letters. The value is not shown on the display.
	Display format n	Read/write	Use this function to select the number of decimal places displayed. Configuration option from 0 to 4. The option 4 means 'AUTO'. The maximum number of decimal places possible always appears on the display. Possible settings: ▪ 0 - xxxxx ▪ 1 - xxxx.x ▪ 2 - xxx.xx ▪ 3 - xx.xxx ▪ 4 - Auto **Factory setting:** 1 - xxxx.x

n = Number of display channels (1 to 4)

Configuration example:

The following measured values should be shown on the display:

Value 1

Measured value to be displayed:	Primary Value 1 of Sensor Transducer 1 (PV1)
Measured value unit:	° C
Decimal places:	2

Value 2

Measured value to be displayed:	RJ Value
Measured value unit:	˚ C
Decimal places:	1

Value 3

Measured value to be displayed:	Sensor Value 2 (measured value) of Sensor Transducer 2 (SV2)
Measured value unit:	˚ C
Decimal places:	2

Every measured value should be visible on the display for 12 seconds. For this purpose, the following settings should be made in the **Display/Operation** operating menu

Parameter	Value
Alternating time	12
Display source 1	'Primary Value 1'
Display value description 1	TEMP PIPE 11
Display format 1	'xxx.xx'
Display source 2	'RJ Value'
Display value description 2	INTERN TEMP
Display format 2	'xxxx.x'
Display source 3	'Sensor value 2'
Display value description 3	PIPE 11 BACK
Display format 3	'xxx.xx'

14.2.2 Group Setup

Information on the device mode, such as the target mode, and parameters for the basic configuration of the measuring inputs, such as the sensor type. All the settings that are needed to operate the device can be made in the "Standard" setup mode. The individual parameters are summarized in the Setup menu:

Standard setup	Basic settings for the measuring inputs that are needed to commission the device.
Advanced setup	Configuration of special diagnostics functions such as drift or corrosion detection.

→ Setup	→ Advanced setup → 🖹 62	→ Sensor 1
		→ Sensor 2
		→ Security settings

Selecting the operating mode

The operating mode is set by means of the **Physical Block - target mode** parameter group (→ 🖹 59). The Physical Block supports the following operating modes:

- AUTO (automatic mode)
- Out of Service (OOS)

ℹ️ OOS can only be configured if the Condensed Status and Diagnostics (as per Profile 3.01 Am2) are activated. Otherwise, only AUTO is supported.

Procedure for configuring a measuring input:

1. Start
▼
2. Select sensor type (linearization type) e.g. Pt100
▼
3. Select unit (℃)
▼
4. Select type of connection e.g. 3-wire
▼
5. Configure the type of measurement e.g. PV=SV1
▼
6. Enter the offset (optional)
▼
7. Select the reference measuring point and enter the value in the event of external reference measurement (only for TC measurement)
▼
8. If a second measuring channel is used, repeat steps 2 to 5
▼
9. End

Setup

Menu position	Parameter name	Parameter access	Description

	Block Mode		**General information on Block Mode:**
			The Block Mode contains three elements:
			
			• the block's current operating mode (Actual Mode)
			• the modes supported by the block (Permitted Mode):
			  Analog Input (AI): AUTO, MAN, OOS
			  Physical Block: AUTO, OOS
			  Transducer Block: AUTO
			• the normal operating mode (Normal Mode)
			
			Only the current Block Mode is displayed in the menu. Generally, you can select from several operating modes in a function block, while other block types only operate in the AUTO operating mode for example.

	Physical Block - Actual Mode	Read	Displays the current operating mode of the Physical Block.
	Physical Block - Target Mode	Read/write	Use this function to select the required operating mode. Only automatic operation mode can be selected in the Physical Block. The Physical Block can also be set to OOS if diagnosis according to Profile 3.01 Am2 is enabled (Physical Block parameter "COND_STATUS_DIAG" = 1). **Options:** • 0x08 - AUTO • 0x80 - Out of Service (OOS) **Factory setting:** AUTO

Menu position	Parameter name	Parameter access	Description
	Characterization Type n [1]	Read/write	Configuration of the sensor type. • Characterization Type 1: settings for sensor input 1 • Characterization Type 2: settings for sensor input 2 **Factory setting:** Channel 1: Pt100 IEC751 Channel 2: No sensor ℹ Please observe the terminal assignment in Section 5.2 when connecting the individual sensors. In the case of 2-channel operation, the possible connection options in Section 5.2.1 also have to be observed.
	Input Range and Mode n	Read/write	Configuration of the input measurement range. • 0: mV, range 1: −5 to 30 mV; range: −5 to 30 mV; min. span: 1 mV • 1: mV, range 2: −20 to 100 mV; min. span: 1 mV • 128: Ω, range 1: 10 to 400 Ω; min. span: 10 Ω • 129: Ω, range 2: 10 to 2 000 Ω; min. span: 10 Ω **Factory setting:** 128: Ω, range 1: 10 to 400 Ω; min. span: 10 Ω
	Unit n	Read/write	Configuration of the temperature unit for PV value n • 1000 - K • 1001 - ℃ • 1002 - ℉ • 1003 - Rk • 1281 - Ohm • 1243 - mV • 1342 - % **Factory setting:** ℃
	Connection type n	Read/write	Sensor connection type: Sensor Transducer 1 (connection type 1): • 0 - 2-wire connection • 1 - 3-wire connection • 2 - 4-wire connection **Factory setting:** 3-wire Sensor Transducer 2 (connection type 2): • 0 - 2-wire connection • 1 - 3-wire connection **Factory setting:** 3-wire

Menu position	Parameter name	Parameter access	Description
	Measuring type n	Read/write	Displays the calculation process for Primary Value 1. **Options:** Sensor Transducer 1 (measuring type 1): • PV = SV1: Secondary value 1 • PV = SV1-SV2: Difference • PV = 0.5 x (SV1+SV2): Average • PV = 0.5 x (SV1+SV2) Redundancy: Average or Secondary Value 1 or Secondary Value 2 in the event of a sensor error in the other sensor. • PV = SV1 (OR SV2): Backup function: If sensor 1 fails, the value of sensor 2 automatically becomes the Primary Value. • PV = SV1 (OR SV2 if SV1>T): PV changes from SV1 to SV2 if SV1 > value T (parameter: **Threshold value n**) • PV =ABS(SV1-SV2) if PV> drift value: PV is the drift value between sensor 1 and sensor 2. If PV exceeds the configured drift value (sensor drift detection limit value), a drift alarm is output. • PV =ABS(SV1-SV2) if PV< drift value: PV is the drift value between sensor 1 and sensor 2. If PV undershoots the configured drift value (sensor drift detection limit value), a drift alarm is output. **Factory setting:** PV = SV1 Sensor Transducer 2 (measuring type 2): • PV = SV2: Secondary value 2 • PV = SV2-SV1: Difference • PV = 0.5 x (SV2+SV1): Average • PV = 0.5 x (SV2+SV1) Redundancy: Average or Secondary Value 1 or Secondary Value 2 in the event of a sensor error in the other sensor. • PV = SV2 (OR SV1): Backup function: If sensor 2 fails, the value of sensor 1 automatically becomes the Primary Value. • PV = SV2 (OR SV 1 if SV2>T): PV changes from SV2 to SV1 if SV2 > value T (parameter: **Threshold value n**) • PV =ABS(SV1-SV2) if PV> drift value: PV is the drift value between sensor 1 and sensor 2. If PV exceeds the configured drift value (sensor drift detection limit value), a drift alarm is output. • PV =ABS(SV1-SV2) if PV< drift value: PV is the drift value between sensor 1 and sensor 2. If PV undershoots the configured drift value (sensor drift detection limit value), a drift alarm is output. **Factory setting:** PV = SV1 = Sensor 2
	2-wire compensation n	Read/write	Two-wire compensation for RTDs. The following values are permitted: 0 to 30 Ω **Factory setting:** 0
	Offset n	Read/write	Offset for Primary Value 1 The following values are permitted: • -10 to +10 for Celsius, Kelvin, mV and Ohm • -18 to +18 for Fahrenheit, Rankine **Factory setting:** 0.0
	Threshold value n	Read/write	Value for switching in PV mode for sensor switching. Entry in the range from −270 to 2 200 ℃ (−454 to 3 992 ℉). **Factory setting:** 0

Menu position	Parameter name	Parameter access	Description
	Reference Junction Type n	Read/write	Configuration of reference junction measurement for temperature compensation in thermocouples: • 0 - no reference: no temperature compensation is used. • 1 - internally measured reference junction temperature: internal reference junction temperature is used for temperature compensation. • 2 - external fixed value: "Ext. Reference Junction Temperature" is used for temperature compensation. **Factory setting:** 1 - internally measured reference junction temperature
	Ext. Reference Junction Temperature n	Read/write	Value for temperature compensation (see the **Reference Junction Type n**) parameter. **Factory setting:** 0.0

1)   Number of the Transducer Block (1-2) or the sensor input (1 or 2)

Submenu Setup - Advanced setup

Corrosion monitoring

Sensor connection cable corrosion can lead to false measured value readings. Therefore the unit offers the possibility of recognizing any corrosion before a measured value is affected. Corrosion monitoring is only possible for RTDs with a 4-wire connection and thermocouples.

Sensor drift detection

If two sensors are connected and the measured values differ by a specified value, an error or a maintenance prompt (sensor drift detection) is sent to the distributed control system. The drift detection function can be used to verify the correctness of the measured values and for mutual monitoring of the connected sensors.

The drift detection can be activated with the **Measuring type** parameter. A distinction is made between two specific modes. For the measuring type **PV =(|SV1-SV2|) if PV < sensor drift detection limit value**, a status message is output if the limit value is undershot or, in the case of **PV =(|SV1-SV2|) if PV> sensor drift detection limit value**, if the limit value is overshot.

Procedure for configuring drift detection for sensor 1:

1. Start
▼
2. Select measure type **PV =ABS(SV1-SV|) if PV < sensor drift detection limit value** or **PV =ABS(SV1-SV2) if PV > sensor drift detection limit value**
▼
3. Set sensor drift detection limit value 1 to the desired value.
▼
4. Where necessary, set the sensor drift detection to **Warning** or **Failure**.
▼
5. End
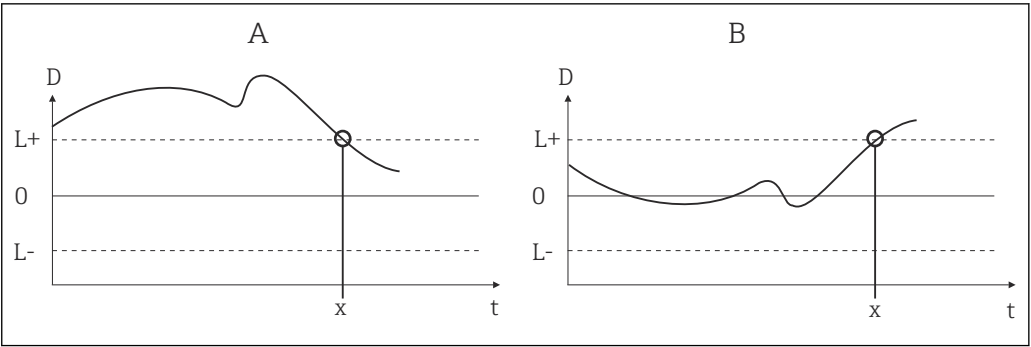
🖼 *16   Drift detection*

A   'Undershooting' mode
B   'Overshooting' mode
D   Drift
L+,   Upper (+) or lower (-) set point
L-
t   Time
x   Error (failure) or need for maintenance (warning), depending on the setting

Write protection

Hardware write protection for the device parameters is enabled and disabled by means of a DIP switch on the rear of the optional display.

The **Hardware write protection** parameter (→ 🗎 63) shows the status of the hardware write protection. The following statuses are possible:

1 → Hardware write protection enabled, device data cannot be overwritten

0 → Hardware write protection disabled, device data can be overwritten

ℹ️ No software write protection is available to prevent all parameters being written acyclically. n: Number of the Transducer Block (1-2) or the sensor input (1 or 2)

Setup

Menu position	Parameter name	Parameter access	Description
Advanced setup	Hardware write protection	Read	Displays the status of hardware write protection. **Display:** • 0 - Off → write protection disabled, parameters can be changed. • 1 - On → write protection enabled, parameters **cannot** be changed. **Factory setting:** 0
	Ambient alarm	Read/write	Status message in the event of the operating temperature of the transmitter being undershot or overshot, < −40 ℃ (−40 ℉) or > +85 ℃ (185 ℉): • 0 - Maintenance: Int. temperature overshoot/ undershoot results in warning. • 1 - Failure: Int. temperature overshoot/undershoot results in alarm. **Factory setting:** 0 - Maintenance

Menu position	Parameter name	Parameter access	Description
	Sensor drift monitoring	Read/write	Deviation between SV1 and SV2 is identified as an error (Failure) or as need for maintenance (Warning): • 1- FAILURE: (sensor deviation > sensor drift detection limit value n) → Failure. Sensor drift is displayed as error • 0 - Warning: (sensor deviation > sensor drift detection limit value n) → Warning. Sensor drift is displayed as warning **Factory setting:** 0 - Warning
	Sensor drift detection limit value n	Read/write	Configuration of the max. permitted measured value deviation between sensor 1 and sensor 2. This value is relevant if **"PV =ABS(SV1- SV2) if PV< Drift value"** was selected for the measuring type. Permitted deviation from 0.1 to 999. **Factory setting:** 999
	Corrosion detection n	Read/write	• 0 - OFF: Corrosion detection off • 1 - ON: Corrosion detection on **Factory setting:** 0 - OFF ⓘ Only possible for RTD 4-wire connection and thermocouples (TC).

14.2.3   Group Diagnostics

All the information that describes the device, the device status and the process conditions can be found in this group. The individual parameters are summarized in the Diagnostics (→ 🖺 64) menu:

→ **Diagnostics**	→System information → 🖺 65	
	→ Measured value → 🖺 65	→ Min./ max. values
	→ Device test/reset → 🖺 66	

System information	Standard Setup/Expert	Basic settings that are needed to operate the device.
Measured values → Min./ max. values	Standard Setup/Expert	Settings for the measuring input of channel 1 and channel 2.
Device test/reset	Standard Setup/Expert	Settings for special diagnostic functions such as drift or corrosion detection.

Diagnostics menu

Diagnostics

Menu item	Parameter name	Parameter access	Description
Expert → Diagnostics	Current diagnostics	Read	Displays the diagnostic code. The diagnostic code consists of the "Current status" and the "Current error code". **Example:** F041 (Failure + sensor failure)
	Description of current diagnostics	Read	Displays the status information as description text, see Section 11.3 → 🖺 35

Menu item	Parameter name	Parameter access	Description
	Channel information status	Read	Displays where in the device the highest priority error occurs. • 0: Device • 1: Sensor 1 • 2: Sensor 2
	Number status	Read	The number of status messages currently pending in the device.
	Bus address	Read	Displays the device bus address. **Factory setting:** 126

Submenu Diagnostics - System information

Diagnostics

Menu item	Parameter name	Parameter access	Description
Submenu System information	Firmware version	Read	Revision status of device firmware.
	Serial number	Read [1]	Displays the serial number of the device.
	Order code	Read [1]	Displays the device order code.
	Order identifier	Read [1]	Displays the order ident number as a description for the device delivery status
	Tag name (TAG)	Read/write	Use this function to enter a user-specific text (max. 32 characters) for the unique identification and assignment of the block. **Factory setting:** "– – – – – – – –" no text
	ENP version	Read	Displays the ENP (electronic name plate) version
	Profile	Read	0x4002 - PROFIBUS PA, Compact Class B
	Profile revision	Read	Displays the profile version implemented in the device.
	Manufacturer	Read	Displays the manufacturer ID number. **Display:** 0x11(hex);17 (decimal): Endress+Hauser
	Product name	Read	Displays the manufacturer-specific device identification. **Display:** Device name
	PROFIBUS Ident Number	Read	Displays the Profibus User Organization identification number of the device. • 0x1549 → TMT162 • 0x9700 → Profile Ident Number 1x AI Block • 0x9701 → Profile Ident Number 2x AI Block • 0x9702 → Profile Ident Number 3x AI Block • 0x9703 → Profile Ident Number 4x AI Block factory setting: 0x1551 **Factory setting:** 0x1549

1)   These parameters can be changed if the "Service locking" parameter is configured accordingly in the Expert system menu.

Submenu Diagnostics - Measured values

This menu is only visible in the online mode.

n: Number of the Transducer Block (1-2) or the sensor input (1 or 2)

Diagnostics

Menu item	Parameter name	Parameter access	Description
Submenu Measured values	PV value n	Read	Displays the primary output value of the Transducer Block. ⓘ The PV value n can be made available to an AI Block for further processing.
	Process temperature n	Read	Displays the measured value of sensor n
	RJ temperature	Read	Internal reference temperature measurement

Submenu Diagnostics - Measured values - Min/max value

This menu is only visible in the online mode.

In this menu, you can view the maximum indicators of the PV values, the two measuring inputs and the internal reference measurement. In addition, the PV values saved can be reset.

ⓘ n: Number of the Transducer Block (1-2) or the sensor input (1 or 2)

Diagnostics

Menu item	Parameter name	Parameter access	Description
Submenu Measured values - Min/max value	PV n min.	Read/write	Min. indicator for PV is stored in the nonvolatile memory in intervals of 10 minutes. Can be reset.
	PV n max.	Read/write	Max. indicator for PV is stored in the nonvolatile memory in intervals of 10 minutes. Can be reset.
	Measured value n min.	Read	Displays the minimum sensor value. Is stored in the nonvolatile memory in intervals of 10 minutes. Can be reset.
	Measured value n max.	Read	Displays the maximum sensor value. Is stored in the nonvolatile memory in intervals of 10 minutes. Can be reset.
	RJ min.	Read	Indicator for the minimum value to occur at the internal reference temperature measuring point.
	RJ max.	Read	Indicator for the maximum value to occur at the internal reference temperature measuring point.

Submenu Diagnostics - Device test/reset

This menu is only visible in the online mode.

By means of a reset, the device can be set to a defined state depending on the reset code.

Diagnostics

Menu item	Parameter name	Parameter access	Description
Submenu Device test/reset	Reset to delivery status	Read/write	Resets or restarts the device. **User input:** 0 → No function/No action 1 → Standard configuration/resets all bus-specific parameters to factory settings with the exception of the configured station address. The device displays the next cold start for 10 seconds in the corresponding bit of the DIAGNOSTICS parameter group. 2506 → Warm start/execution of a warm start. The device displays the next warm start for 10 seconds in the corresponding bit of the DIAGNOSTICS parameter group. 2712 → Resets address to '126'/resets the station address to the usual PROFIBUS default address of 126. 32769 → Configuration ordered/resets to delivery status. **Factory setting:** 0 ℹ If you select 1, the units are reset according to the factory setting not delivery status. After resetting, check the units and configure the unit you require. Then run the **Set Unit To Bus** parameter (→ 🖹 75).

14.3   Setup Expert

The parameter groups for the Expert setup contain all the parameters of the Standard setup and other parameters that are solely reserved for experts.

→ **Expert**	→ System → 🖹 68 Settings and description of the measuring point	→ Display → 🖹 57	
	→ Sensory mechanism → 🖹 69 Settings of the two measuring inputs	→ Sensor 1	→ Special linearization 1
		→ Sensor 2	→ Special linearization 2
	→ Communication → 🖹 74 Settings of the Profibus address and setup of the 4 Analog Input Blocks	→ Analog Input 1	
		→ Analog Input 2	
		→ Analog Input 3	
		→ Analog Input 4	
	→ Diagnostics → 🖹 84 Displays device information and status for service and maintenance purposes.	→ System information → 🖹 65	
		→ Measured value	→ Min./ max. values
		→ Device test/reset → 🖹 66	

14.3.1   Group System

All the parameters that describe the measuring point in greater detail can be viewed and configured in the "System" group.

System

Menu item	Parameter name	Parameter access	Description
	Target mode	Read/write	Use this function to select the required operating mode. Only automatic operation mode can be selected in the Physical Block. The Physical Block can also be set to OOS if diagnostics according to Profile 3.02 is enabled (Physical Block parameter "COND_STATUS_DIAG" = 1). **Options:** • 0x08 - AUTO • 0x80 - Out of Service (OOS) **Factory setting:** AUTO
	Block Mode		**General information on Block Mode:** Block Mode contains three elements: • the block's current operating mode (Actual Mode) • the modes supported by the block (Permitted Mode): Analog Input (AI): AUTO, MAN, OOS Physical Block: AUTO, OOS Transducer Block: AUTO • the normal operating mode (Normal Mode) Only the current Block Mode is displayed in the menu. Generally, you can select from several operating modes in a function block, while other block types only operate in the AUTO operating mode for example.
	Current mode	Read	Displays the current operating mode. **Display:** AUTO
	PROFIBUS Ident Number Selector	Read/write	Use this function to select the configuration behavior. ℹ Every PROFIBUS device must check an identification number assigned by the PROFIBUS User Organization during the configuration phase. As well as these device-specific identification numbers, there are also PROFILE identification numbers that must be accepted during the configuration phase for the purpose of compatibility with products from other manufacturers. In this case, it is possible that the device restricts the functionality relating to the cyclical data to a profile-defined level. **Options:** • 0 → Profile-specific Ident Number 9703 (1xAI) • 1 → Manuf.-specific Ident Number 1549 (Device name) • 127 → Automatic (0x9700, 0x9701, 0x9702, 0x9703, 0x1549) • 129 → Profile-specific Ident Number 9700 (1xAI) • 130 → Profile-specific Ident Number 9701 (2xAI) • 131 → Profile-specific Ident Number 9702 (3xAI) **Factory setting:** 127
	Description	Read/write	Use this function to enter a description of the application for which the device is used. **Factory setting:** No description (32 space characters)
	Message	Read/write	Use this function to enter a message about the application for which the device is used. **Factory setting:** No message (32 space characters)

Menu item	Parameter name	Parameter access	Description
	Installation date	Read/write	Use this function to enter the device installation date. **Factory setting:** No date (16 space characters)
	TAG Location	Read/write	I&M Parameter TAG_LOCATION
	Signature	Read/write	I&M Parameter SIGNATURE
only visible in online mode	Hardware write protection	Read	Displays the status of hardware write protection. **Display:** • 0 → write protection disabled, parameters can be changed. • 1 → write protection enabled, parameters cannot be changed. **Factory setting:** 0 🛈　Write protection is enabled/disabled using a DIP switch (see Section 6.2.2).
	System alarm delay		Alarm hysteresis: Value as to the time a device status (Failure or Maintenance) and measured value status (Bad or Uncertain) is delayed until the status is output. Can be configured between 0 and 10 seconds. **Factory setting:** 2 s 🛈　This setting does not affect the display.
	Mains frequency filter	Read/write	Mains filter for the A/D converter. **Options:** • 0 to 50 Hz • 1 to 60 Hz **Factory setting:** 0 to 50 Hz
	Ambient alarm	Read/write	Status message in the event of the operating temperature of the transmitter being undershot or overshot, < −40 ℃ (−40 ℉) or > +85 ℃ (185 ℉): • 0 - Maintenance: Int. temperature overshoot/ undershoot results in warning. • 1 - Failure: Int. temperature overshoot/undershoot results in alarm. **Factory setting:** 0 - Maintenance

14.3.2　Group Sensory mechanism

Procedure for configuring a sensor input → 🖹 58

🛈　n: Number of the Transducer Block (1-2) or the sensor input (1 or 2)

Sensory mechanism

Menu item	Parameter name	Parameter access	Description
Submenu "Sensor 1" or "Sensor 2"	Characteristic type n	Read/write	Configuration of the sensor type. Characteristic type 1: Settings for Sensor input 1 sensor Characteristic type 2: Settings for Sensor input 2 **Factory setting:** Channel 1: Pt100 IEC751 Channel 2: No sensor ℹ Please observe the terminal assignment in Section 5.2 when connecting the individual sensors. In the case of 2-channel operation, the possible connection options in Section 5.2.1 also have to be observed.
	Input Range and Mode n	Read/write	Configuration of the input measurement range. • 0: mV, range 1: −5 to 30 mV; range: −5 to 30 mV; min. span: 1 mV • 1: mV, range 2: −20 to 100 mV; min. span: 1 mV • 128: Ω, range 1: 10 to 400 Ω; min. span: 10 Ω • 129: Ω, range 2: 10 to 2 000 Ω; min. span: 10 Ω **Factory setting:** 128: Ω, range 1: 10 to 400 Ω; min. span: 10 Ω
	Unit n	Read/write	Configuration of the temperature unit for PV value n • 1000 - K • 1001 - ℃ • 1002 - ℉ • 1003 - Rk • 1281 - Ohm • 1243 - mV • 1342 - % **Factory setting:** ℃
	Connection type n	Read/write	Sensor connection type: Sensor Transducer 1 (connection type 1): • 0 - 2-wire connection • 1 - 3-wire connection • 2 - 4-wire connection **Factory setting:** 3-wire Sensor Transducer 2 (connection type 2): • 0 - 2-wire connection • 1 - 3-wire connection **Factory setting:** 3-wire

Menu item	Parameter name	Parameter access	Description
	Measuring type n	Read/write	Displays the calculation process for Primary Value 1. See also → 🕮 58 ℹ️ SV1 = Secondary Value 1 = Sensor value 1 in temperature Transducer Block 1 = Sensor value 2 in temperature Transducer Block 2 SV2 = Secondary Value 2 = Sensor value 2 in temperature Transducer Block 1 = Sensor value 1 in temperature Transducer Block 2 **Options:** Sensor Transducer 1 (measuring type 1): • PV = SV1: Secondary value 1 • PV = SV1-SV2: Difference • PV = 0.5 x (SV1+SV2): Average • PV = 0.5 x (SV1+SV2) Redundancy: Average or Secondary Value 1 or Secondary Value 2 in the event of a sensor error in the other sensor. • PV = SV1 (OR SV2): Backup function: If sensor 1 fails, the value of sensor 2 automatically becomes the Primary Value. • PV = SV1 (OR SV2 if SV1>T): PV changes from SV1 to SV2 if SV1 > value T (Parameter: **Sensor switching threshold value n**) • PV =(|SV1-SV2|) if PV > drift value: PV is the drift value between sensor 1 and sensor 2. If PV exceeds the configured drift value (**Sensor drift alert value**), a drift alarm is output. • PV =(|SV1-SV2|) If PV undershoots the configured drift value: PV is the drift value between sensor 1 and sensor 2. If PV falls below the configured drift value (**Sensor drift alert value**), a drift alarm is output. **Factory setting:** PV = SV1 Sensor Transducer 2 (measuring type 2): • PV = SV1: Secondary value 1 (= Sensor 2) • PV = SV1-SV2: Difference • PV = 0.5 x (SV1+SV2): Average • PV = 0.5 x (SV1+SV2) Redundancy: Average or Secondary Value 1 or Secondary Value 2 in the event of a sensor error in the other sensor. • PV = SV1 (OR SV2): Backup function: If sensor 2 fails, the value of sensor 1 automatically becomes the Primary Value. • PV = SV1 (OR SV2 if SV1>T): PV changes from sensor 2 value to sensor 1 value if sensor 2 value > value T (Parameter **Sensor switching threshold value n**) • PV =(|SV1-SV2|) if PV > drift value: PV is the drift value between sensor 1 and sensor 2. If PV exceeds the configured drift value (**Sensor drift alert value**), a drift alarm is output. • PV =(|SV1-SV2|) If PV undershoots the configured drift value: PV is the drift value between sensor 1 and sensor 2. If PV falls below the configured drift value (**Sensor drift alert value**), a drift alarm is output. **Factory setting:** PV = SV1 = Sensor 2
	2-wire compensation n	Read/write	Two-wire compensation for RTDs. The following values are permitted: 0 to 30 Ω

Menu item	Parameter name	Parameter access	Description
	Offset n	Read/write	Offset for Primary Value 1 The following values are permitted: • -10 to +10 for Celsius, Kelvin, mV and Ohm • -18 to +18 for Fahrenheit, Rankine **Factory setting:** 0.0
(Only visible in online mode)	Sensor n lower limit	Read	Displays the lower physical sensor range.
(Only visible in online mode)	Sensor n upper limit	Read	Displays the upper physical sensor range.
	Threshold value n	Read/write	Value for switching in PV mode for sensor switching. Entry in the range from –270 to 2 200 °C (–454 to 3 992 °F).
	Reference Junction Type n	Read/write	Configuration of reference junction measurement for temperature compensation in thermocouples: • 0 - no reference: no temperature compensation is used. • 1 - internally measured reference junction temperature: internal reference junction temperature is used for temperature compensation. • 2 - external fixed value: "Ext. Reference Junction Temperature" is used for temperature compensation. **Factory setting:** 1 - internally measured reference junction temperature
	Ext. Reference Junction Temperature n	Read/write	Value for temperature compensation (see **Reference junction**) parameter. **Factory setting:** 0.0
	Sensor drift monitoring	Read/write	Deviation between SV1 and SV2 is identified as an error (Failure) or as need for maintenance (Warning): • 1 - FAILURE: (sensor deviation > Sensor drift alert value n) → Failure. Sensor drift is displayed as error • 0 - Warning: (sensor deviation > sensor drift detection limit value n) → Warning. Sensor drift is displayed as warning **Factory setting:** 0 - Warning
	Sensor drift detection limit value n	Read/write	Configuration of the max. permitted measured value deviation between sensor 1 and sensor 2. This value is relevant if **"PV =ABS(SV1– SV2) if PV< Drift value"** was selected for the measuring type. Permitted deviation from 0.1 to 999. **Factory setting:** 999
	Corrosion detection n	Read/write	• 0 - OFF: Corrosion detection off • 1 - ON: Corrosion detection on **Factory setting:** 0 - OFF ⓘ Only possible for RTD 4-wire connection and thermocouples (TC).

Submenu "Special linearization 1" or "Special linearization 2"

Procedure for configuring a special linearization using Callendar-Van Dusen coefficients from a calibration certificate:

1. Start
▼

2. Configure the type of measurement e.g. PV=SV1
▼
3. Select unit (℃)
▼
4. Select the sensor type (linearization type) "RTD platinum (Callendar-Van Dusen)"
▼
5. Select type of connection e.g. 4-wire
▼
6. Enter the four coefficients A, B, C and R0
▼
7. If special linearization is also used for a second sensor, repeat steps 2 to 6
▼
8. End

Sensory mechanism

Menu item	Parameter name	Parameter access	Description
Submenu "Special linearization n"	Call.-V. Dusen start of range	Read/write	Lower calculation limit for Callendar-Van Dusen linearization. **Factory setting:** 0.0
	Call.-V. Dusen end of range	Read/write	Upper calculation limit for Callendar-Van Dusen linearization. **Factory setting:** 100.0
	Call.-V. Dusen coeff. R0	Read/write	ℹ The values for the R0 value must be in the range of 40 to 1050 Ω. **Factory setting:** 100
	Call.-V. Dusen coeff. A	Read/write	Sensor linearization based on the Callendar-Van Dusen method.
	Call.-V. Dusen coeff. B	Read/write	ℹ The Call.-V. Dusen coeff. X parameters are used for calculating the sensor characteristic curve if "RTD - Callendar-Van Dusen" is set in the Characteristic type 1 parameter.
	Call.-V. Dusen coeff. C	Read/write	**Factory setting Call.-V. Dusen coeff. A:** 3.9083E-03 **Factory setting Call.-V. Dusen coeff. B:** -5.775E-07 **Factory setting Call.-V. Dusen coeff. C:** 0
(Only visible in online mode)	Sensor trimming	Read/write	• Factory trim standard calibration: Sensor linearization with factory calibration values • User trim standard calibration: Sensor linearization with the values "Calibration Highest Point" and "Calibration Lowest Point" ℹ The original linearization can be established by resetting this parameter to 'Factory trim standard calibration'.
	Sensor trimming lower value	Read/write	Lower point for linear characteristic calibration (this affects offset and slope). ℹ To write to this parameter, "Sensor trimming" must be set to "User trim standard calibration".

Menu item	Parameter name	Parameter access	Description
	Sensor trimming upper value	Read/write	Upper point for linear characteristic calibration (this affects offset and slope). ⓘ To write to this parameter, "Sensor calibration method" must be set to "User trim standard calibration".
	Sensor trimming min. span	Read	Span of the measuring range, depending on the sensor type set
	Polynomial start of range	Read/write	Lower calculation limit for the RTD polynomial (nickel/copper) linearization. **Factory setting:** for sensor type = copper: 0 for sensor type = nickel: -60
	Polynomial end of range	Read/write	Upper calculation limit for the RTD polynomial (nickel/copper) linearization. **Factory setting:** for sensor type = copper: 200 for sensor type = nickel: 100
	Polynomial coeff. R0	Read/write	ⓘ The values for the R0 value must be in the range of 40 to 1050 Ω. **Factory setting:** for sensor type = copper: 100 for sensor type = nickel: 100
	Polynomial coeff. A	Read/write	Sensor linearization of copper/nickel resistance thermometers (RTD). ⓘ The POLY_COEFF_XX parameters are used for calculating the sensor characteristic curve if 'RTD polynomial nickel' or 'RTD polynomial copper' is set in the **Characteristic type n** parameter. **Factory setting:** **Polynomial coeff. A** Copper = 0.00428 Nickel = 5.4963E-03 **Polynomial coeff. B** Copper = 6.2032E-07 Nickel = 6.7556E-06 **Polynomial coeff. C** Copper = 8.5154E-10 Nickel = 0
	Polynomial coeff. B	Read/write	
	Polynomial coeff. C	Read/write	
	Sensor serial number	Read/write	Serial number of the connected sensor.

14.3.3 Group Communication

Changing the unit

The system unit for the temperature can be changed in the Sensor 1 or Sensor 2 menu for the relevant channel.

Changing the unit does not initially have any effect on the measured value transmitted to the automation system. This ensures that no sudden change in the measured value can have an effect on the subsequent control routine.

Communication

Menu item	Parameter name	Parameter access	Description
	Bus address	Read	Displays the device bus address. **Factory setting:** 126
(Only visible in online mode)	Set unit to bus	Read/write	Transfers configured system units to the automation system. During the transfer, the scaling of the OUT SCALE value in the Analog Input Block is automatically overwritten with the configured PV SCALE and the unit from the Transducer Block is copied to the "Out Scale - Unit" (output unit). **Options:** • 0 - OFF • 1 - ON **Factory setting:** 0 - OFF ℹ️ Activating this parameter can result in an erratic change of the output value "Out value" and thus affect subsequent control loops.

Submenus "Analog Input 1" to "Analog Input 4"

The standard parameters for the "Security settings" menu can be found in the submenu Setup → Advanced setup → 🗒 62. The expert parameters are listed in the following table.

Status of the Output value

The status of the **Output value** parameter group communicates the status of the Analog Input function block and the validity of the **Output value** to the downstream function blocks.

Status of the OUT output value:	Meaning of the output value:
GOOD NON CASCADE	→ OUT is valid and can be used for further processing.
UNCERTAIN	→ OUT can only be used for further processing to a limited extent.
BAD	→ OUT is not valid.
ℹ️ The BAD status value occurs when the Analog Input function block is switched to the OOS mode (out-of-service) or in the event of serious errors (see status code and system/process error messages, → 🗒 35).	

Simulation of input/output

It is possible to simulate the input and output of the function block via various parameters of the Analog Input 1-4 menus:

• **Simulating the input of the Analog Input function block:**
The input value (measured value and status) can be specified by means of the "AI Simulation/AI Simulation value/AI Simulation status" parameters. Since the simulation value runs through the entire function block, all the parameter settings of the block can be checked.

• **Simulating the output of the Analog Input function block:**
Set the operating mode to MAN with the **Current mode** (→ 🗒 58) parameter and directly specify the desired output value in the **Output value** (→ 🗒 77) parameter.

Failsafe mode

If an input or simulation value has the status BAD, the Analog Input function block uses the failsafe mode defined in the "Failsafe mode" parameter. The following options are available in the "Failsafe mode; → 🖺 77" parameter:

Options in the FAILSAFE TYPE parameter (failsafe mode):	Failsafe mode:
FSAFE VALUE	The value specified in the "Failsafe default value" parameter is used for further processing.
LAST GOOD VALUE	The last good value is used for further processing.
WRONG VALUE	The current value is used for further processing, despite the BAD status.
ℹ The factory setting is WRONG VALUE.	

ℹ The failsafe behavior is only effective in the "Auto" operating mode! In the "Out of Service" operating mode, the measured value is set to NAN (Not a Number = 0x7FC00000L) and the status to "Bad - Passivated" (for Profile 3.02) or to "Bad - Out of Service" (for Profile 3.01/3.0). The limit bits are set to "Const".

- "Bad - Passivated" = 0x23
- "Bad - Out of Service" = 0x1F

Limit values

The user can set two warning limits and two alarm limits to monitor the process. The status of the measured value and the parameters of the limit value alarms are indicative of the measured value's relative situation. It is also possible to define an alarm hysteresis in order to avoid frequent changes of the limit value flags and frequent switching between active and inactive alarm settings (see → 🖺 77).

The limit values are based on the output value OUT. If the output value OUT exceeds or undershoots the defined limit values, an alarm is sent to the automation system via the limit value process alarms.

Process alarms provide information about certain block statuses and block events. The following process alarms can be defined and generated in the Analog Input function block:

HI HI LIM	→ 🖺 77	LO LO LIM	→ 🖺 77
HI LIM	→ 🖺 77	LO LIM	→ 🖺 77

Limit value process alarms

If a limit value is infringed, the priority specified for the limit value alarm is checked before the limit value violation is communicated to the fieldbus host system.

Rescaling the input value

In the Analog Input function block, the input value or input range can be scaled in accordance with the automation requirements.

Example:

- The system unit in the Transducer Block is ℃.
- The sensor measuring range is -200 to 850℃.
- The process-relevant measuring range is 0 to 200℃.
- The output range to the process control system should be 0 to 100%.

The measured value from the Transducer Block (input value) is rescaled linearly via the input scaling PV SCALE to the desired output range OUT SCALE:

Parameter group PV SCALE (→ 🕮 74)		Parameter group OUT SCALE (→ 🕮 74)	
PV SCALE MIN	→ 0	OUT SCALE MIN	→ 0
PV SCALE MAX	→ 200	OUT SCALE MAX	→ 100
		OUT UNIT	→ %

The result is that with an input value of, for example, 100℃ (212 ℉), a value of 50% is output via the OUT parameter.
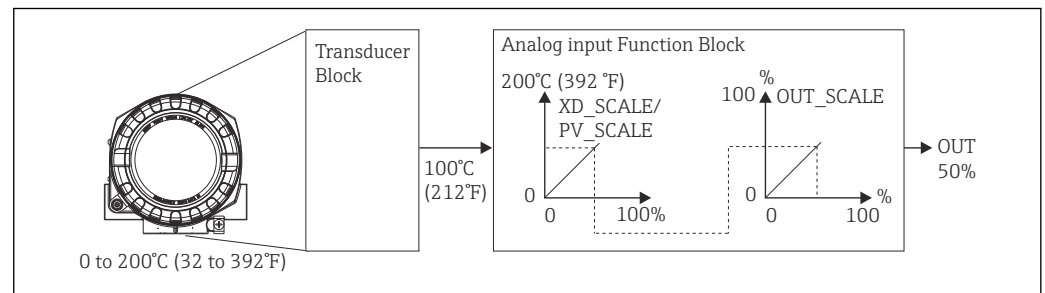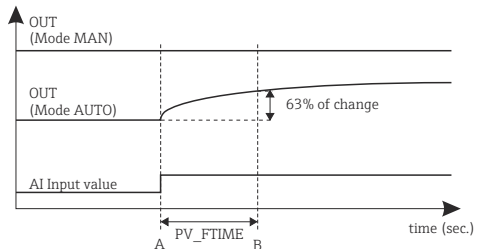
🖳 *17   Scaling procedure in the Analog Input function block*

Communication
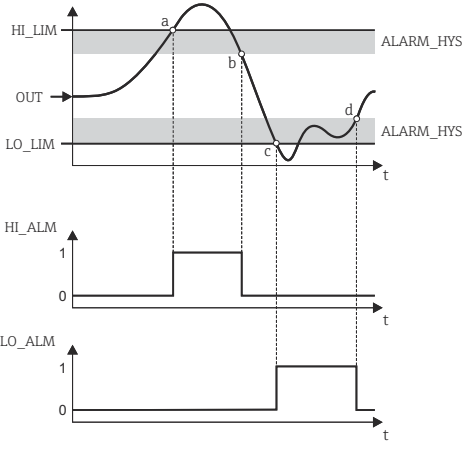
Menu item	Parameter name	Parameter access	Description
Analog Input	Static Rev. No.	Read	A block operates static parameters (Static attribute) that are not changed by the process. Static parameters, whose values change during optimization or configuration, cause the ST REV parameter to increase by 1. This supports parameter version management. If several parameters change within a very short time, e.g. due to loading of parameters from FieldCare, PDM, etc. in the device, the static revision counter can show a higher value. This counter can never be reset and is not reset to a default value after a device reset. If the counter overflows, (16 bit), it starts again at 1.
	TAG	Read/write	Use this function to enter a user-specific text (max. 32 characters) for the unique identification and assignment of the block. **User input:** Max. 32-character text, options: A-Z, 0-9, +,−, punctuation marks **Factory setting:** "– – – – – – – –" no text
	Target mode	Read/write	Use this function to select the required operating mode. **Options:** 0x08 AUTO 0x10 MAN 0x80 OOS **Factory setting:** 0x08 AUTO

Menu item	Parameter name	Parameter access	Description
	BLOCK MODE		**General information on the BLOCK MODE parameter group:** This parameter group contains three elements: • the block's current operating mode (Actual Mode) • the modes supported by the block (Permitted Mode) • the normal operating mode (Normal Mode) A distinction is made between "Automatic mode" (AUTO), manual intervention by the user (MAN) and the "Out of service" (O/S) mode. Generally, you can select from several operating modes in a function block, while other block types only operate in the AUTO operating mode for example.
	Current mode	Read	Displays the current operating mode. **Options:** 0x08 AUTO 0x10 MAN 0x80 OOS **Factory setting:** 0x08 AUTO
	AI n channel	Read/write	Assignment between the logical hardware channel of the Transducer Block and the input of the Analog Input function block. The Transducer Block of the device makes five different measured values available to the input channel of the Analog Input function block. **Options:** • 0x0108 (264) → Primary Value Transducer 1 • 0x010A (266) → Secondary Value 1 Transducer 1 • 0x015D (349) → Reference Junction Temperature • 0x0208 (520) → Primary Value Transducer 2 • 0x020A (522) → Secondary Value 1 Transducer 2 **Factory setting:** AI1 Primary Value Transducer 1 → 1 AI2 Secondary Value Transducer 1 → 2 AI3 Primary Value Transducer 2 → 2 AI4 Secondary Value Transducer 2 → 3
	Alarm sum		**General information on the "Alarm sum" parameter group:** The Active Block Alarm is supported, which indicates a change to a parameter with static parameters (Static attribute) for 10 sec. and displays that a warning or alarm limit was violated in the Analog Input function block. **Display values:** 0x0000 No alarm 0x0200 Upper alarm limit value 0x0400 Upper warning limit value 0x0800 Lower alarm limit value 0x1000 Lower warning limit value 0x8000 Parameter set changed
(Only visible in online mode)	Current alarm sum	Read	Displays the device's current alarms.
	Unacknowledged state alarm sum	Read	Displays the device's unacknowledged alarms.
	Unreported state alarm sum	Read	
	Disabled state alarm sum	Read	Displays the device's acknowledged alarms.
	Out unit text	Read/write	Use this function to enter ASCII text if the required unit is not available in the OUT UNIT (output unit) parameter.
(Only visible in online mode)	Output value	Read	Displays the OUT (output) value of the process variable selected in the CHANNEL parameter

Menu item	Parameter name	Parameter access	Description
(Only visible in online mode)	Quality	Read	Displays the quality (measured value status) for the "Output value". 0x80 - Good 0x84 - Good: Parameters changed 0x88 - Good: Warning limit 0x8C - Good: Alarm limit 0x90 - Good: Unacknowledged block alarm (Pr. 3.0/ 3.01) 0x94 - Good: Unacknowledged warning (Pr. 3.0/3.01) 0x98 - Good: Unacknowledged alarm (Pr. 3.0/3.01) 0xA0 - Good: Go to failsafe mode 0xA4 - Good: Maintenance required 0xA8 - Good: Request for maintenance (Pr. 3.02) 0xBC - Good: Function check/local overrride (3.02) 0x40 - Uncertain (Pr. 3.0/3.01) 0x44 - Uncertain: Last usable value (Pr. 3.0/3.01) 0x48 - Uncertain: Substitute value (0x4B in Pr. 3.02) 0x4C - Uncertain: Initial value (0x4F in Pr. 3.02) 0x50 - Uncertain: Value inaccurate (Pr. 3.0/3.01) 0x54 - Uncertain: Outside value range (Pr. 3.0/3.01) 0x58 - Uncertain: Abnormal (Pr. 3.0/3.01) 0x5C - Uncertain: Configuration error (Pr. 3.0/ 3.01) 0x60 - Uncertain: Simulation value (Pr. 3.0/3.01) 0x64 - Uncertain: Simulated value, start 0x68 - Uncertain: Request for maintenance (Pr. 3.02) 0x73 - Uncertain: Simulated value, start (Pr. 3.02) 0x74 - Uncertain: Simulated value, end (Pr. 3.02) 0x78 - Uncertain: Process fault/no maintenance required (Pr. 3.02) 0x00 - Bad (Pr. 3.0/3.01) 0x04 - Bad: Configuration error (Pr. 3.0/ 3.01) 0x08 - Bad: No connection (Pr. 3.0/3.01) 0x0C - Bad: Device error (Pr. 3.0/3.01) 0x10 - Bad: Sensor error (Pr. 3.0/3.01) 0x14 - Bad: Last usable value (no comm., Pr. 3.0/3.01) 0x18 - Bad: No usable value (no comm., (Pr. 3.0/3.01) 0x1C - Bad: Out of service (Pr. 3.0/3.01) 0x23 - Bad: Passive (Pr. 3.02) 0x24 - Bad: Maintenance alarm (Pr. 3.02) 0x2B - Bad: Process fault/no maintenance required (Pr. 3.02) 0x3C - Bad: Function check/local override (Pr. 3.02)
	Status	Read	Displays the limit (measured value status) for the "Output value" 0x00 - OK 0x01 - Limit undershot 0x02 - Limit overshot 0x03 - Value constant

Menu item	Parameter name	Parameter access	Description
	Filter time constant	Read/write	Use this function to enter the filter time constant (in seconds) of the 1st order digital filter. This time is required in order for 63% of a change in the Analog Input (input value) to have an effect on OUT (output value). The diagram shows the time-dependent signal characteristics of the Analog Input function block: A → The Analog Input changes. B → OUT has reacted 63% to the change of the Analog Input. **Factory setting:** 0 s
	PV SCALE		In the PV SCALE parameter group, the process variable is standardized to one value by means of the "Lower Value" and "Upper Value" parameters using the unit of the connected Transducer Block. For an example of rescaling the input value, see → 🕮 74
	PV SCALE lower value	Read/write	This parameter is used to enter the lower value for input scaling. **Factory setting:** 0
	PV SCALE upper value	Read/write	This parameter is used to enter the upper value for input scaling. **Factory setting:** 100
	OUT SCALE		In the OUT SCALE parameter group, the measuring range (lower and upper limit) and the physical unit for the output value (Out value) are defined. The following parameters are available in this parameter group: • Out Scale - lower value • Out Scale - upper value • Unit • Decimal point ℹ Defining the measuring range in this parameter group does not restrict the output value "Out value". If the output value "Out value" is outside the measuring range, it is transferred nonetheless.
	Out Scale - upper value	Read/write	Use this function to enter the upper value for output scaling. **Factory setting:** 100
	Out Scale - lower value	Read/write	Use this function to enter the lower value for output scaling. **Factory setting:** 0
	Unit	Read/write	Use this function to select the output unit. **Factory setting:** Analog Input function block = 0x07CD (1997) = none ℹ OUT UNIT (output unit) does not affect measured value scaling.

Menu item	Parameter name	Parameter access	Description
	Decimal point	Read/write	Specifies the number of places after the decimal point for the output value "Out value". ℹ This parameter is not supported by the device.
	Upper limit alarm	Read/write	Use this function to enter the alarm limit value for the upper warning (HI ALM). If the output value OUT exceeds this limit value, the HI ALM alarm status parameter is output. **User input:** Unit from OUT SCALE **Factory setting:** Max value
	Upper limit warning	Read/write	Use this function to enter the alarm limit value for the upper alarm (HI HI ALM). If the output value OUT exceeds this limit value, the HI HI ALM alarm status parameter is output. **User input:** Unit from OUT SCALE **Factory setting:** Max value
	Lower limit warning	Read/write	Use this function to enter the alarm limit value for the lower warning (LO ALM). If the output value OUT is below this limit value, the LO ALM alarm status parameter is output. **User input:** Unit from OUT SCALE **Factory setting:** Min value
	Lower limit alarm	Read/write	Use this function to enter the alarm limit value for the lower alarm (LO LO ALM). If the output value OUT is below this limit value, the LO LO ALM alarm status parameter is output. **User input:** Unit from OUT SCALE **Factory setting:** Min value

Menu item	Parameter name	Parameter access	Description
	Limit value hysteresis	Read/write	Use this function to enter the hysteresis value for the upper and lower warning or alarm limit values. The alarm conditions remain active as long as the measured value is within the hysteresis. The hysteresis value affects the following warning and alarm limit values of the Analog Input function block: HI HI ALM → Upper limit alarm HI ALM → Upper limit warning LO LO ALM → Lower limit alarm LO ALM → Lower limit warning **User input:** 0 to 50% **Factory setting:** 0.5% of measuring range • The hysteresis value refers to a percentage of the range of the OUT SCALE parameter group in the Analog Input function block. • If the limit values are entered in FieldCare, ensure that absolute values can be displayed and entered. **Example:** • The top diagram shows the defined limit values for the warnings LO LIM and HI LIM with their respective hystereses (gray background) and the signal characteristics of the output value OUT. • The two bottom diagrams show the behavior of the associated alarms HI ALM and LO ALM on the changing signal characteristics (0 = no alarm, 1 = alarm is output). A0042011 *a Output value OUT exceeds the limit value HI LIM, HI ALM is active.* *b Output value OUT drops below the hysteresis value of HI LIM, HI ALM is inactive.* *c Output value OUT drops below the limit value LO LIM, LO ALM is active.* *d Output value OUT exceeds the hysteresis value of LO LIM, LO ALM is inactive.*

Menu item	Parameter name	Parameter access	Description
	Fail safe mode	Read/write	Use this function to select the failsafe mode in the event of a device error or bad measured value. ACTUAL MODE (current operating mode of the block) remains in AUTO MODE (automatic operating mode). ℹ The status information only applies to diagnostics according to Profile 3.0/3.01. For Profile 3.02, see Section 11.2.2 → 🔖 33. **Options:** • FSAFE VALUE (The substitute value is adopted in the output value) When this option is selected, the value entered in the "Fail Safe Default Value" parameter is displayed in OUT (output value). The status changes to UNCERTAIN - SUBSTITUTE VALUE. • LAST GOOD VALUE (The last valid output value saved is adopted in the output value) The output value valid before the failure is used. The status is set to UNCERTAIN – LAST USABLE VALUE. If there was no valid value previously, the initial value is provided with the status UNCERTAIN – INITIAL VALUE (for values not saved during a device reset). The initial value of the Profibus PA device is "0". • WRONG VALUE (Incorrect measured value at the output value) The value is still used for further calculation despite the bad status. **Factory setting:** WRONG VALUE
	Failsafe default value	Read/write	This parameter is used to enter a default value to be displayed when there is an error in OUT (output value) **Factory setting:** 0
	AI(n) simulation quality	Read/write	Simulation of Analog Input function block quality. For the list of options, see → 🔖 74 **Factory setting:** Bad
	AI(n) simulation status	Read/write	Simulation of Analog Input function block status. 0x00 - OK 0x01 - Limit undershot 0x02 - Limit overshot 0x03 - Value constant
	AI(n) simulation value	Read/write	Simulation of the input value. Since this value runs through the entire algorithm, the behavior of the Analog Input function block can be checked. **Factory setting:** 0.0
	AI(n) simulation	Read/write	Enable/disable simulation. **Options:** Simulation not active Simulation active **Factory setting:** Simulation not active

14.3.4   Group Diagnostics

All the information that describes the device, the device status and the process conditions can be found in this group. The individual parameters are summarized in the Diagnostics menu in this section:

Diagnostics

Menu item	Parameter name	Parameter access	Description
	Current diagnostics	Read	Displays the diagnostic code. The diagnostic code consists of the "Current status" and the "Current error code". **Example:** F041 (Failure + sensor failure)
	Description of current diagnostics	Read	Displays the status information as a description text, → 🖺 35
	Channel information status	Read	Displays where in the device the highest priority error occurs. • 0: Device • 1: Sensor 1 • 2: Sensor 2
	Number status	Read	The number of status messages currently pending in the device.
	Diagnostics	Read	Diagnostics information of the device encoded in bits. **Current status number:** • 0 - Status OK • 0x01000000 - Hardware failure electronics. • 0x02000000 - Hardware failure mechanics. • 0x08000000 - Electronics temperature too high. • 0x10000000 - Memory checksum error. • 0x20000000 - Failure in measurement. • 0x80000000 - Self-calibration failed. • 0x00040000 - Configuration not valid. • 0x00080000 - New start-up (warm start-up) carried out. • 0x00100000 - Restart (cold start-up) carried out. • 0x00200000 - Maintenance required. • 0x00800000 - Ident number violation. • 0x00000100 - Failure of the device. • 0x00000200 - Maintenance demanded. • 0x00000400 - Function check or simulation mode. • 0x00000800 - Out of specification. • 0x00000080 - More information available.
	Last diagnostics	Read	Displays the last diagnostic code. The diagnostic code consists of the "Current status" and the "Last error code". Example: F041 (Failure + sensor failure)
	Last channel information status	Read	Displays where in the device the last priority error occurs. 0: Device 1: Sensor 1 2: Sensor 2
	Delete last diagnostics	Read/write	The last diagnostics information can be deleted. 0: Show last error 1: Delete last error **Factory setting:** 0
	Advanced diagnostics	Read	Manufacturer-specific diagnostics information encoded in bits. Several messages are possible. See "Status diagnostics bits" at the end of these instructions.
	Advanced diagnostics screen	Read	Displays the bit mask that outputs the manufacturer-specific diagnostic messages

Menu item	Parameter name	Parameter access	Description
(only visible in online mode)	Enabled functions	Read	FEATURE.Enabled: X=0 → Accumulative status and diagnostics supported/ diagnostics as per Profile 3.01/3.0. X=1 → Diagnostics as per Profile 3.02/extended status/ diagnostics are supported. **Factory setting:** X=1
	Supported functions	Read	FEATURE.Enabled: X=0 → Accumulative status and diagnostics supported/ diagnostics as per Profile 3.01/3.0. X=1 → Diagnostics as per Profile 3.02/extended status/ diagnostics are supported. **Factory setting:** X=1
	Configuration for accumulative status and diagnostics	Read/write	Displays whether "Condensed Status & Diagnostic Messages" is used. 0=Status and diagnostics as described in Profile 3.01 1=Support for accumulative status and diagnostics 2-255=Reserved for the Profibus User Organization **Factory setting:** 1
(only visible in online mode)	Service locking	Read/write	Configuration for enabling ENP service parameters.

Submenu System information

In addition to the system information described from → 🕮 65 onwards, the following parameter is also available in the Expert setup.

Diagnostics

Menu item	Parameter name	Parameter access	Description
Submenu System information	UpDown Feature Supported	Read	0x00: Upload Supported 0x01: Parallel Upload Supported 0x02: Download Supported 0x03: Two Buffer Device **Factory setting:** Upload Supported

Submenu Measured values

This menu is only visible in the online mode.

All the measured values with their related status information are displayed in the "Measured values" Expert menu. Furthermore, the unscaled, unlinearized measured value of the sensor input in question can be read out by means of the "Raw value" parameter. For example, in the case of a Pt100, the actual Ohm value that can be used to calibrate and calculate Callendar-Van Dusen coefficients is displayed.

ℹ️ n: Number of the Transducer Block (1-2) or the sensor input (1 or 2)

Diagnostics

Menu item	Parameter name	Parameter access	Description
Submenu Measured values	PV value n	Read	Displays the primary output value of the Transducer Block. ℹ️ The PV value n can be made available to an AI Block for further processing. The quality of the measured value is displayed with the "Quality" and "Status" parameters.
	PV value n - quality	Read	Displays the quality (measured value status) for the PV value. For list of options, see → 📖 74
	PV value n - status	Read	Displays the limit (measured value status) for the PV value. 0x00 - OK 0x01 - Limit undershot 0x02 - Limit overshot 0x03 - Value constant
	Process temperature n	Read	Displays the measured value of sensor n
	Process temperature n - quality	Read	Displays the quality (measured value status) of the process temperature for sensor n. For value, see "PV value n - quality"
	Process temperature n - status	Read	Displays the limit (measured value status) of the process temperature for sensor n. For value, see "PV value n - status"
	RJ temperature	Read	Displays the internal reference temperature
	RJ temperature - quality	Read	Displays the quality (measured value status) of the internal reference temperature. For value, see "PV value n - quality"
	RJ temperature - status	Read	Displays the status (measured value status) of the internal reference temperature. For value, see "PV value n - status"
	Sensor value n (not linearized)	Read	Displays the non-linearized mV/Ohm of the corresponding sensor.

14.4 Slot/Index lists

14.4.1 General explanatory remarks

Abbreviations used in the Slot/Index lists:

Endress+Hauser matrix → The number of the page in which you will find the explanation of the parameter. Object Type:
- Record → Contains data structures (DS)
- Simple → Contains only single data types (e.g. float, integer, etc.)

Parameters:
- M → Mandatory parameter
- O → Optional parameter

Data Types:
- DS → Data structure, contains data types such as Unsigned8, OctetString, etc.
- Float → IEEE 754 format
- Integer → 8 (range of values -128 to 127), 16 (-327678 to 327678), 32 (-2^{31} to 2^{31})

- Octet String → Binary coded
- Unsigned → 8 (range of values 0 to 255), 16 (0 to 65535), 32 (0 to 4294967295)
- Visible String → ISO 646, ISO 2375

Storage Class:
- C → Calibration data
- Cst → Constant parameter
- D → Dynamic parameter
- N → Non-volatile parameter. Changing a parameter in this class does not affect the ST_REV parameter of the block in question
- S → Static parameter. Changing a parameter in this class increases the ST_REV parameter of the block in question
- V → Storage class V means that the altered parameter value is not saved in the device

14.4.2   Device management slot 1

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter	Default value
Device Management Slot 1									
Directory Header/ Composite Directory Entries	0	X		Record	Unsigned 16	12	Cst	M	
Composite Directory Entry/ Composite Directory Entries	1	X		Record	Unsigned 16	28	Cst	M	
Not used	2 - 15	-	-	-	-	-	-	-	

14.4.3   Physical Block slot 0

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
Physical Block Slot 0								
Not used	0 - 15	X	-	-	-	-	-	-
BLOCK_OBJECT	16	X	-	Record	DS-32	20	Cst	M
ST_REV	17	X	-	Simple	Unsigned16	2	N	M
TAG_DESC	18	X	X	Simple	Octet String	32	S	M
STRATEGY	19	X	X	Simple	Unsigned 16	2	S	M
ALERT_KEY	20	X	X	Simple	Unsigned 8	1	S	M
TARGET_MODE	21	X	X	Simple	Unsigned 8	1	S	M
MODE_BLK	22	X	-	Record	DS-37	3	D	M
ALARM_SUM	23	X	-	Record	DS-42	8	D	M
SOFTWARE_REVISION	24	X	-	Simple	Visible String	16	Cst	M
HARDWARE_REVISION	25	X	-	Simple	Visible String	16	Cst	M
DEVICE MAN_ID	26	X	-	Simple	Unsigned 16	2	Cst	M
DEVICE_ID	27	X	-	Simple	Visible String	16	Cst	M
DEVICE SER NUM	28	X	-	Simple	Visible String	16	Cst	M
DIAGNOSIS	29	X	-	Simple	Octet String	4	D	M
DIAGNOSIS_EXTENSION	30	X	-	Simple	Octet String	6	D	O

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
DIAGNOSIS_MASK	31	X	-	Simple	Octet String	4	Cst	M
DIAGNOSIS_MASK_EXTENSION	32	X	-	Simple	Octet String	6	Cst	O
DEVICE CERTIFICATION	33	X	-	Simple	Visible String	32	Cst	O
Not used	34	-	-	-	-	-	-	-
FACTORY_RESET	35	X	X	Simple	Unsigned 16	2	S	O
DESCRIPTOR	36	X	X	Simple	Octet String	32	S	O
DEVICE MESSAGE	37	X	X	Simple	Octet String	32	S	O
DEVICE INSTAL DATE	38	X	X	Simple	Octet String	16	S	O
Not used	39	-	-	-	-	-	-	-
IDENT_NUMBER_SELECTION	40	X	X	Simple	Unsigned 8	1	S	O
HW_WRITE_PROTECTION	41	X	-	Simple	Unsigned 8	1	D	O
FEATURE	42	X	-	Record	DS-68	8	N	M
COND_STATUS_DIAGNOSIS	43	X	X		Unsigned 8	1	S	M
Not used	44-53	-	-	-	-	-	-	-
ACTUAL_ERROR_CODE	54	X	-	Simple	Unsigned 16	2	D	M
LAST_ERROR_CODE	55	X	-	Simple	Unsigned 16	2	D/S	M
UPDOWN_FEAT_SUPP	56	X	-	Simple	Octet String	1	Const	M
Not used	57-58	-	-	-	-	-	-	-
DEVICE_BUS_ADDRESS	59	X	-	Simple	Unsigned 8	1	D	M
Not used	60	-	-	-	-	-	-	-
SET UNIT TO BUS	61	X	X	Simple	Unsigned 8	1	V	M
DISPLAY_VALUE	62	X	-	Record	LocalDispVal	6	D	O
Not used	63	-	-	-	-	-	-	-
PROFILE_REVISION	64	X	-	Simple	Octet String	32	Cst(D)	M
CLEAR_LAST_ERROR	65	X	X	Simple	Unsigned 8	1	V	M
IDENT_NUMBER	66	X	-	Simple	Unsigned 16	2	D	M
CHECK_CONFIGURATION	67	X	-	Simple	Unsigned 8	1	D	O
Not used	68	-	-	-	-	-	-	-

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
ORDER_CODE	69	X	-	Simple	Visible String	32	C	M
TAG_LOCATION	70	X	X	Simple	Visible String	22	C	O
SIGNATURE	71	X	X	Simple	Octet String	54	C	O
ENP_VERSION	72	X	-	Simple	Visible String	16	Cst	M
DEVICE_DIAGNOSIS	73	X	-	Simple	Octet String	10	D	M
EXTENDED_ORDER_CODE	74	X	-	Simple	Visible String	60	C	M
SERVICE_LOCKING	75	X	X	Simple	Unsigned 16	2	D	M
Not used	76 - 94	-	-	-	-	-	-	-
STATUS	95	X	-	Simple	Octet String	16	D	O
DIAGNOSTICS_CODE	96	X	-	Simple	Octet String	4	D	O
STATUS_CHANNEL	97	X	-	Simple	Unsigned 8	1	D	O
STATUS_COUNT	98	X	-	Simple	Unsigned 8	1	D	O
LAST_STATUS	99	X	-	Simple	Octet String	16	D/S	O
LAST_DIAGNOSTICS_CODE	100	X	-	Simple	Octet String	4	D/S	O
LAST_STATUS_CHANNEL	101	X	-	Simple	Unsigned 8	1	D/S	O
Not used	102 - 103	-	-	-	-	-	-	-
VERSIONINFO SWREV	104	X	-	Simple	Octet String	16	N	O
VERSIONINFO HWREV	105	X	-	Simple	Octet String	16	N	O
VERSIONINFO DEVREV	106	X	-	Simple	Octet String	16	N	O
ELECTRONICAL_SERIAL_NUMBER	107	X	-	Simple	Visible String	16	Cst	M
Not used	108 - 112	-	-	-	-	-	-	-
DEV_BUS_ADDR_CONFIG	113	X	X	Simple	Unsigned 8	1	N	O
CAL_IDENTNUMBER	114	X	-	Simple	Unsigned 16	2	C	O
Not used	115 - 118	-	-	-	-	-	-	-
SENSOR_DRIFT_MONITORING	118	X	X	Simple	Unsigned 8	1	S	MS
SYSTEM_ALARM_DELAY	119	X	X	Simple	Unsigned 8	1	S	O
MAINS_FILTER	120	X	X	Simple	Unsigned 8	1	S	O
AMBIENT_ALARM	121	X	X	Simple	Unsigned 8	1	S	O
Not used	122 - 125	-	-	-	-	-	-	-

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
DISP_ALTERNATING_TIME	126	X	X	Simple	Unsigned 8	1	S	O
DISP_SOURCE_1	127	X	X	Simple	Unsigned 16	2	S	O
DISP_VALUE_1_DESC	128	X	X	Simple	Octet String	16	S	O
DIS_VALUE_1_FORMAT	129	X	X	Simple	Unsigned 8	1	S	O
DISP_SOURCE_2	130	X	X	Simple	Unsigned 16	2	S	O
DISP_VALUE_2_DESC	131	X	X	Simple	Octet String	16	S	O
DISP_VALUE_2_FORMAT	132	X	X	Simple	Unsigned 8	1	S	O
DISP_SOURCE_3	133	X	X	Simple	Unsigned 16	2	S	O
DISP_VALUE_3_DESC	134	X	X	Simple	Octet String	16	S	O
DISP_VALUE_3_FORMAT	135	X	X	Simple	Unsigned 8	1	S	O
Not used	136 - 139	-	-	-	-	-	-	-
VIEW_PHYSICAL_BLOCK	140	X	X	Simple	Unsigned16, DS-37, DS- 42, OctetString[4]	17	D	M

14.4.4   Transducer Block slot 1

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
BLOCK_OBJECT	70	X	-	Record	DS-32	20	C	M
ST_REV	71	X	-	Simple	Unsigned16	2	S	M
TAG_DESC	72	X	X	Simple	Octet String	32	S	M
STRATEGY	73	X	X	Simple	Unsigned 16	2	S	M
ALERT_KEY	74	X	X	Simple	Unsigned 8	1	S	M
TARGET_MODE	75	X	X	Simple	Unsigned 8	1	S	M
MODE_BLK	76	X	-	Record	DS-37	3	D	M
ALARM_SUM	77	X	-	Record	DS-42	8	D	M
PRIMARY_VALUE	78	X	-	Record	101	5	D	M
PRIMARY_VALUE_UNIT	79	X	X	Simple	Unsigned 16	2	S	M
SECONDARY_VALUE_1	80	X	-	Record	101	5	D	M
SECONDARY_VALUE_2	81	X	-	Record	101	5	D	M
SENSOR_MEAS_TYPE	82	X	X	Simple	Unsigned 8	1	S	M

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
INPUT_RANGE	83	X	X	Simple	Unsigned 8	1	S	M
LIN_TAPE	84	X	X	Simple	Unsigned 8	1	S	M
Not used	85 - 88	-	-	-	-	-	-	-
BIAS_1	89	X	X	Simple	Float	4	S	M
Not used	90	-	-	-	-	-	-	-
UPPER_SENSOR_LIMIT	91	X		Simple	Float	4	N	M
LOWER_SENSOR_LIMIT	92	X		Simple	Float	4	N	M
Not used	93	-	-	-	-	-	-	-
INPUT_FAULT_GEN	94	X	-	Simple	Unsigned 8	1	D	M
INPUT_FAULT_1	95	X	-	Simple	Unsigned 8	1	D	M
Not used	96 - 98	-	-	-	-	-	-	-
MAX_SENSOR_VALUE_1	99	X	X	Simple	Float	4	N	O
MIN_SENSOR_VALUE_1	100	X	X	Simple	Float	4	N	O
Not used	101 - 102	-	-	-	-	-	-	-
RJ_TEMP	103	X	-	Simple	Float	4	D	O
RJ_TYPE	104	X	X	Simple	Unsigned 8	1	S	M
EXTERNAL_RJ_VALUE	105	X	X	Simple	Float	4	S	O
SENSOR_CONNECTION	106	X	X	Simple	Unsigned 8	1	S	M
COMP_WIRE1	107	X	-	Simple	Float	4	S	M
Not used	108 - 131	-	-	-	-	-	-	-
MAX_PV	132	X	X	Simple	Float	4	N	M
MIN_PV	133	X	X	Simple	Float	4	N	M
CVD_COEFF_A	134	X	X	Simple	Float	4	S	M
CVD_COEFF_B	135	X	X	Simple	Float	4	S	M
CVD_COEFF_C	136	X	X	Simple	Float	4	S	M
CVD_COEFF_R0	137	X	X	Simple	Float	4	S	M
CVD_MAX	138	X	X	Simple	Float	4	S	M
CVD_MIN	139	X	X	Simple	Float	4	S	M
Not used	140 - 144	-	-	-	-	-	-	-
CAL_POINT_HI	145	X	X	Simple	Float	4	S	M
CAL_POINT_LO	146	X	X	Simple	Float	4	S	M
CAL_POINT_SPAN	147	X	-	Simple	Float	4	S	M

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
CAL_POINT_TEMP_LO	148	X	X	Simple	Float	4	S	M
CAL_POINT_TEMP_HI	149	X	X	Simple	Float	4	S	M
CAL_METHOD	150	X	X	Simple	Unsigned 8	2	S	M
SENSOR_SERIAL_NUMBER	151	X	X	Simple	Octet String	32	S	M
POLY_COEFF_A	152	X	X	Simple	Float	4	S	M
POLY_COEFF_B	153	X	X	Simple	Float	4	S	M
POLY_COEFF_C	154	X	X	Simple	Float	4	S	M
POLY_COEFF_R0	155	X	X	Simple	Float	4	S	M
POLY_MEAS_RANGE_MAX	156	X	-	Simple	Float	4	S	M
POLY_MEAS_RANGE_MIN	157	X	-	Simple	Float	4	S	M
Not used	158 - 161	-	-	-	-	-	-	-
CORROSION_DETECTION	162	X	X	Simple	Unsigned 8	2	S	M
CORROSION_CYCLES	163	X	-	Simple	Unsigned 8	2	S	M
SENSOR_DRIFT_ALERT_VALUE	164	X	X	Simple	Float	4	S	M
Not used	165 - 168	-	-	-	-	-	-	-
RJ_MAX_SENSOR_VALUE	169	X	-	Simple	Float	4	N	M
RJ_MIN_SENSOR_VALUE	170	X	-	Simple	Float	4	N	M
Not used	171	-	-	-	-	-	-	-
TEMPERATURE_THRESHOLD	172	X	X	Simple	Float	4	S	M
RJ_OUT	173	X	-	Record	101	5	D	M
SENSOR_RAW_VALUE	174	X	-	Simple	Float	4	D	M
Not used	175 - 219	-	-	-	-	-	-	-
VIEW_TRANSDUCER_BLOCK	220	X	-	Simple	Unsigned16, DS-37, DS- 42, 101, Unsigned8, Unsigned8	20	D	M

14.4.5 Transducer Block slot 2

Transducer Block slot 2 contains the same parameters as Transducer Block slot 1. The settings in slot 2 affect sensor input 2.

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
All parameters → 🗎 90	70 - 220	-	-	-	-	-	-	-

14.4.6 Analog Input Block (AI 1) slot 1

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
Not used	2 - 15	X	-	-	-	-	-	-
BLOCK_OBJECT	16	X	-	Record	DS-32	20	C	M
ST_REV	17	X	-	Simple	Unsigned 16	2	N	M
TAG_DESC	18	X	X	Simple	Octet String	32	S	M
STRATEGY	19	X	X	Simple	Unsigned 16	2	S	M
ALERT_KEY	20	X	X	Simple	Unsigned 8	1	S	M
TARGET_MODE	21	X	X	Simple	Unsigned 8	1	S	M
MODE_BLK	22	X	-	Record	DS-37	3	D	M
ALARM_SUM	23	X	-	Record	DS-42	8	D	M
BATCH	24	X	X	Record	DS-67	10	S	M
Not used	25	X	-	-	-	-	-	-
OUT	26	X	-	Record	101	5	D	M
PV_SCALE	27	X	X	Array	Float	8	S	M
OUT_SCALE	28	X	X	Record	DS-36	11	S	M
LIN_TYPE	29	X	X	Simple	Unsigned 8	1	S	M
CHANNEL	30	X	X	Simple	Unsigned 16	2	S	M
Not used	31	X	-	-	-	-	-	-
PV_FTIME	32	X	X	Simple	Float	4	S	M
FSAFE_TYPE	33	X	X	Simple	Unsigned 8	1	S	O
FSAFE_VALUE	34	X	X	Simple	Float	4	S	O
ALARM_HYS	35	X	X	Simple	Float	4	S	M
Not used	36	X	-	-	-	-	-	-
HI_HI_LIM	37	X	X	Simple	Float	4	S	M
Not used	38	X	-	-	-	-	-	-
HI_LIM	39	X	X	Simple	Float	4	S	M
Not used	40	X	-	-	-	-	-	-
LO_LIM	41	X	X	Simple	Float	4	S	M
Not used	42	X	-	-	-	-	-	-
LO_LO_LIM	43	X	X	Simple	Float	4	S	M
Not used	44 - 45	-	-	-	-	-	-	-
HI_HI_ALM	46	X	-	Record	DS-39	16	D	O

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
HI_ALM	47	X	-	Record	DS-39	16	D	O
LO_ALM	48	X	-	Record	DS-39	16	D	O
LO_LO_ALM	49	X	-	Record	DS-39	16	D	O
SIMULATE	50	X	X	Record	DS-50	6	S	O
OUT UNIT TEXT	51	X	X	Simple	Octet String	16	S	O
Not used	52 - 64	-	-	-	-	-	-	-
VIEW_AI	65	X	-	Record	Unsigned16, DS- 37, DS-42, 101	18	D	M
Not used	66 - 69	-	-	-	-	-	-	-

14.4.7   Analog Input Block (AI 2) slot 2

Analog Input Block slot 2 contains the same parameters as Analog Input Block slot 1.

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
All parameters → 🕮 93	0 - 65	-	-	-	-	-	-	-
Not used	66 - 69	-	-	-	-	-	-	-

14.4.8   Analog Input Block (AI 3) slot 3

Analog Input Block slot 3 contains the same parameters as Analog Input Block slot 1.

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
All parameters → 🕮 93	0 - 65	-	-	-	-	-	-	-
Not used	66 - 225	-	-	-	-	-	-	-

14.4.9   Analog Input Block (AI 4) slot 4

Analog Input Block slot 4 contains the same parameters as Analog Input Block slot 1.

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
All parameters → 🕮 93	0 - 65	-	-	-	-	-	-	-
Not used	66 - 225	-	-	-	-	-	-	-

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