

Operating Instructions

iTEMP TMT72

HART® temperature transmitter as head, field or DIN rail device with one universal sensor input suitable for use in hazardous areas

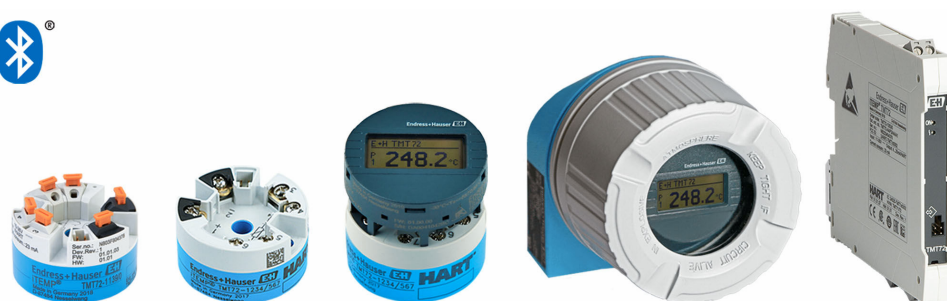


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1 About this document

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.

1.2 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 potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

CAUTION

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

NOTICE

This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Electrical symbols

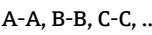
Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Potential equalization connection (PE: Protective earth) Ground terminals that must be connected 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 connection 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.

Symbol	Meaning
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Notice or individual step to be observed
	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

1.2.4 Symbols in graphics

Symbol	Meaning	Symbol	Meaning
	Item numbers		Series of steps
	Views		Sections
	Hazardous area		Safe area (non-hazardous area)

1.3 Tool symbols

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

1.4 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.

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the product configuration:

Document type	Purpose and content of the document
Technical Information (TI)	Planning aid This document contains all the technical data on the product and provides an overview of everything that can be ordered with the product.
Brief Operating Instructions (KA)	Quick guide to obtaining the first measured value The Operating Instructions contain all the essential information about the product from incoming acceptance to initial commissioning.
Operating Instructions (BA)	Reference The Operating Instructions contain the information that is required in the various phases of the life cycle of the product: 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 parameters The document contains detailed explanations of readable or configurable parameters in the product. The description is aimed at those who work with the product over its entire life cycle and perform specific configurations.
Safety Instructions (XA)	Safety Instructions for electrical equipment in hazardous areas are supplied with the product depending on the approval. These are an integral part of the Operating Instructions.  The nameplate indicates the Safety Instructions (XA) that are relevant to the product.
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 product documentation.

1.5 Change 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	Bug fixes and internal changes. No changes to the Operating Instructions.

Date	Firmware version	Changes	Documentation
02.2018	01.01.zz	Original firmware	BA01854T/01.18
12.2018	01.01.zz	Bluetooth® optimization	BA01854T/02.18
05.2019	01.01.zz	DIN rail housing and push-in terminals	BA01854T/03.19
10.2020	01.01.zz	Update time added	BA01854T/04.20

Date	Firmware version	Changes	Documentation
05.2022	01.01.zz	Design changes	BA01854T/05.22
04.2024	01.01.zz	Field housing with 3 cable entries added	BA01854T/06.24
05.2026	01.01.zz	Measurement errors adjusted	BA01854T/07.26

1.6 Registered trademarks

Bluetooth®

The *Bluetooth*® word mark and logos are registered trademarks owned by the Bluetooth SIG, Inc. and any use of such marks by Endress+Hauser is under license. Other trademarks and trade names are those of their respective owners.

HART®

Registered trademark of the FieldComm Group, Austin, Texas, USA

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel responsible for installation, commissioning, diagnostics, and maintenance must meet the following conditions:

- ▶ Trained, qualified specialists must have a relevant qualification for this specific function and task
- ▶ They must be authorized by the plant owner/operator
- ▶ They must be 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)
- ▶ They must follow instructions and comply with general policies

The operating personnel must meet the following conditions:

- ▶ They must be instructed and authorized according to the requirements of the task by the plant operator
- ▶ They must follow the instructions in these Operating Instructions

2.2 Intended use

The device is a universal and user-configurable temperature transmitter with one sensor input for resistance thermometers (RTD), thermocouples (TC), resistance and voltage transmitters. The head transmitter version of the device is intended for mounting in a terminal head (flat face) as per DIN EN 50446. It is also possible to mount the device on a DIN rail using the optional DIN rail clip. The device is also optionally available in a version suitable for DIN rail mounting as per IEC 60715 (TH35).

The manufacturer is not liable for harm caused by improper or unintended use.

2.3 Workplace safety

For work on and with the device:

- ▶ Wear the required personal protective equipment according to federal/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 ensuring that the device is in good working order.

Hazardous area

To eliminate any risks for persons or for the facility when the device is used in the hazardous area (e.g., explosion protection or safety instrumented system):

- ▶ 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.
- ▶ Comply with the instructions in the separate supplementary documentation, which is an integral part of this manual.

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 recommendation NE 21.

NOTICE

- ▶ The device must only be powered by a power unit that operates using an energy-limited electric circuit according to UL/EN/IEC 61010-1, Section 9.4 and the requirements in Table 18.

2.5 Product safety

This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It 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.

2.6 IT security

The manufacturer 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

On receipt of the delivery:

1. Check the packaging for damage.
 - ↳ Report all damage immediately to the manufacturer.
Do not install damaged components.

2. Check the scope of delivery using the delivery note.
3. Compare the data on the nameplate with the order specifications on the delivery note.
4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.



If one of the conditions is not satisfied, contact the manufacturer.

3.2 Product identification

The following options are available for identification of the device:

- Nameplate specifications
- Enter the serial number from the nameplate into *Device Viewer* (www.endress.com/deviceviewer): all the information about the device and an overview of the technical documentation supplied with the device are displayed.
- Enter the serial number from 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

Do you have the correct 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) (optional)
- Technical values such as supply voltage, current consumption, ambient temperature, communication-specific data (optional)
- Degree of protection
- Approvals with symbols
- Reference to Safety Instructions (XA) (optional)

- 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 Storage and transport

Storage temperature

Head transmitter	-50 to 100 °C (-58 to 212 °F)
DIN rail transmitter	-50 to 100 °C (-58 to 212 °F)

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 offers the best protection.

Avoid the following environmental influences during storage:

- Direct sunlight
- Vibration
- Aggressive media

4 Installation

4.1 Installation requirements

4.1.1 Dimensions

For device dimensions, see "Technical data" →  59.

4.1.2 Installation location

- Head transmitter:
 - In terminal head in accordance with DIN EN 50446 (flat face), direct mounting on insert with cable entry (middle hole 7 mm (0.28 in))
 - In the field housing, separated from the process →  44
- DIN rail transmitter:
 - Designed for mounting on a DIN rail (IEC 60715 TH35).

 It is also possible to mount the head transmitter on a DIN rail as per IEC 60715 using the DIN rail clip →  44 accessory.

For 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, see the 'Technical data' →  58 section.

For use in hazardous areas, the limit values specified in the certificates and approvals must be observed (see Safety Instructions for explosion-proof devices).

NOTICE

When using DIN rail transmitters with a thermocouple/mV measurement, increased measurement errors may occur depending on the installation situation and ambient conditions.

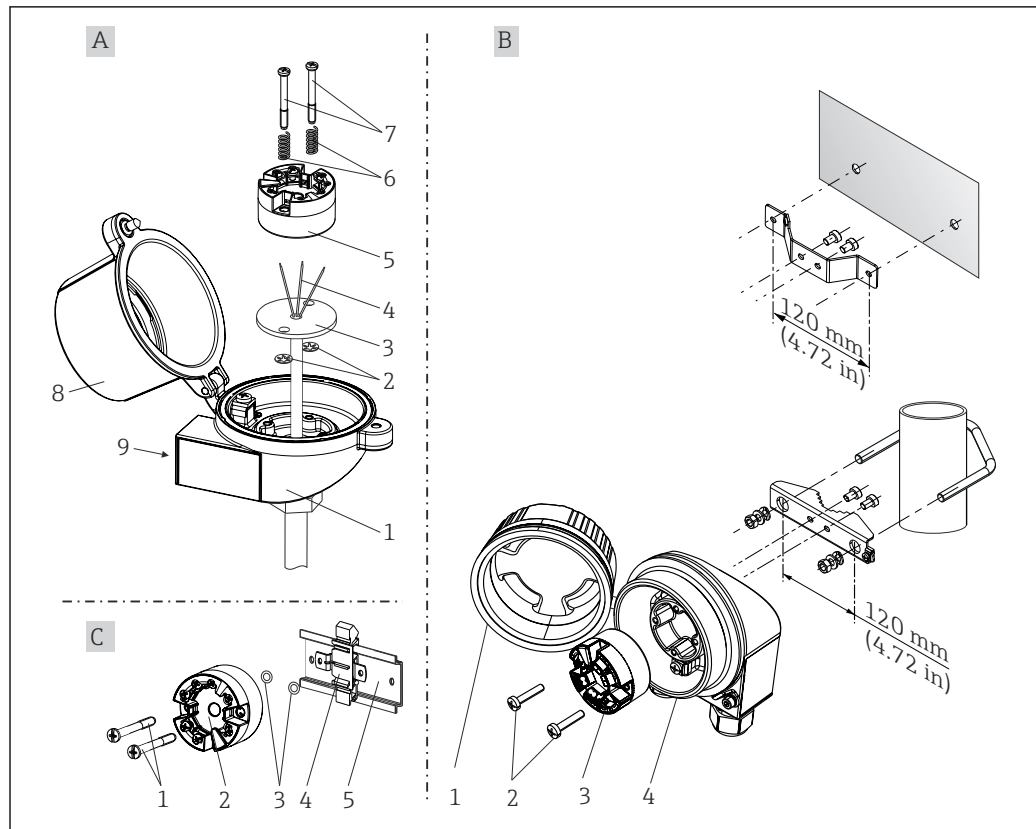
- ▶ If the DIN rail transmitter is mounted in series between other DIN rail devices (reference operating conditions: 24 V, 12 mA), deviations of up to + 2.9 °C may occur.

4.2 Installing the device

A Phillips head screwdriver is required to mount the head transmitter:

- Maximum torque for securing screws = 1 Nm ($\frac{3}{4}$ foot-pound), screwdriver: Pozidriv Z2
- Maximum torque for screw terminals = 0.35 Nm ($\frac{1}{4}$ foot-pound), screwdriver: Pozidriv Z1

4.2.1 Installing the head transmitter

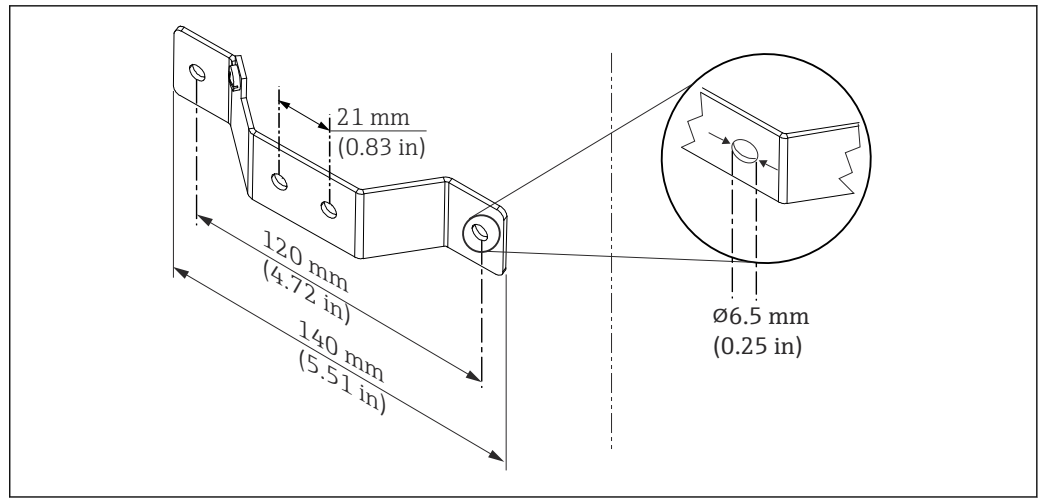


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1 Head transmitter mounting (three versions)

Procedure for mounting in a terminal head, pos. A:

1. Open the terminal head cover (8) on the terminal head.
2. Guide the connection wires (4) of the insert (3) through the center hole in the head transmitter (5).
3. Fit the mounting springs (6) on the mounting screws (7).
4. Guide the mounting screws (7) through the side boreholes of the head transmitter and the insert (3).
5. Fix both mounting screws with the snap rings (2).
6. Then tighten the head transmitter (5) along with the insert (3) in the terminal head.
7. After wiring, close the terminal head cover (8) again. → 16



 2 Dimensions of angle bracket for wall mount (complete wall mounting set available as accessory)

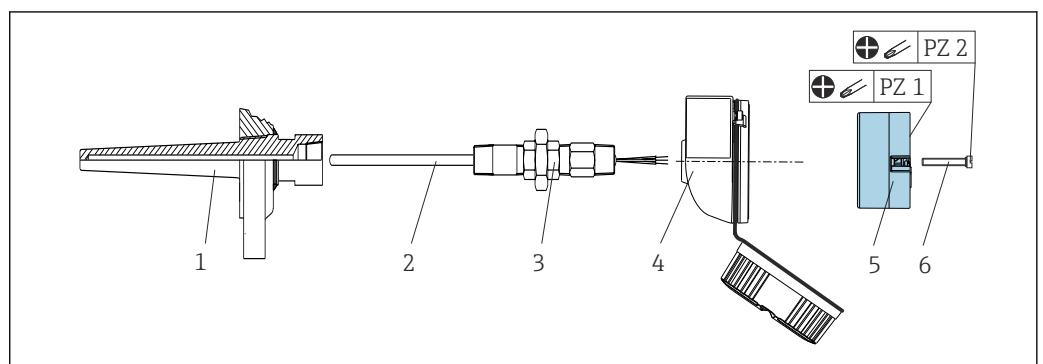
Procedure for mounting in a field housing, pos. B:

1. Open the cover (1) of the field housing (4).
2. Guide the mounting screws (2) through the lateral bores in the head transmitter (3).
3. Screw the head transmitter to the field housing.
4. After wiring, close the field housing cover (1) again. →  16

Procedure for mounting on a DIN rail, pos. C:

1. Press the DIN rail clip (4) onto the DIN rail (5) until it engages with a click.
2. Guide the mounting screws (1) through the lateral bores in the head transmitter (2).
3. Fix both mounting screws with the snap rings (3).
4. Screw the head transmitter (2) onto the DIN rail clip (4).

Installation with central spring insert



 3 Head transmitter mounting

Thermometer design with head transmitter and thermocouple or RTD sensor:

1. Before the process pressure is applied:
Secure the thermowell (1) on the process pipe or container wall in accordance with instructions.
2. Fit the necessary neck tube nipples and adapter (3) on the thermowell.
3. Make sure sealing rings are installed if such rings are needed for harsh environmental conditions or special regulations.

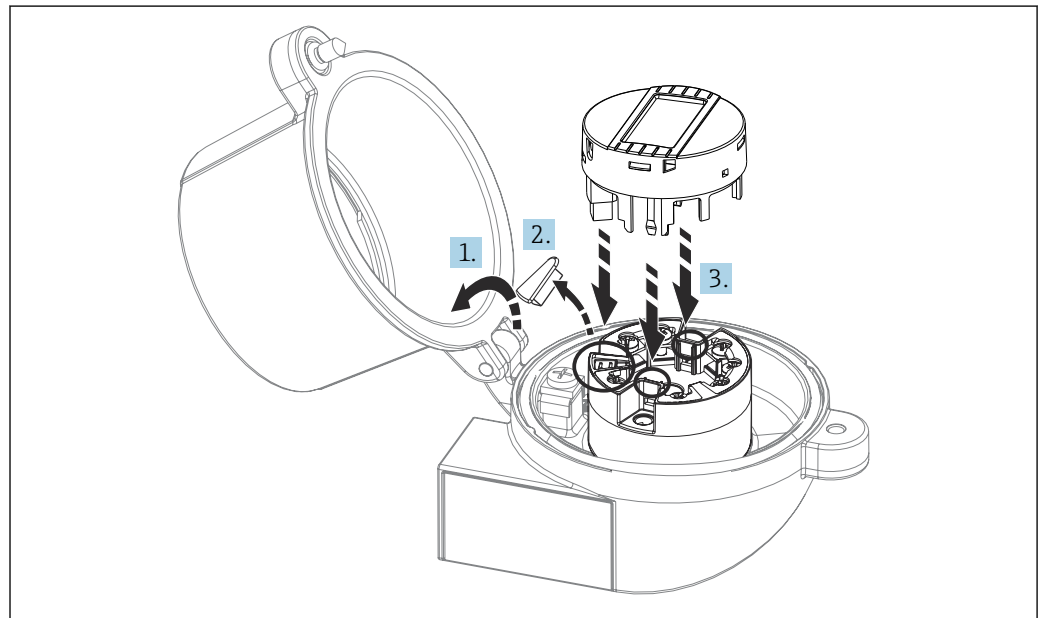
4. Guide the mounting screws (6) through the lateral bores of the head transmitter (5).
5. Position the head transmitter (5) in the terminal head (4) in such a way that the bus cable (terminals 1 and 2) point to the cable entry.
6. Using a screwdriver, screw down the head transmitter (5) in the terminal head (4).
7. Guide the connection wires of the insert (3) through the lower cable entry of the terminal head (4) and through the middle hole in the head transmitter (5).
8. Wire the connection wires up to the transmitter. → 17
9. Screw the terminal head (4), with the integrated and wired head transmitter, onto the ready-mounted nipple and adapter (3).

NOTICE

The terminal head cover must be sealed to meet explosion protection requirements in the process.

- After wiring, screw the terminal head cover back on.

Mounting the display on the head transmitter



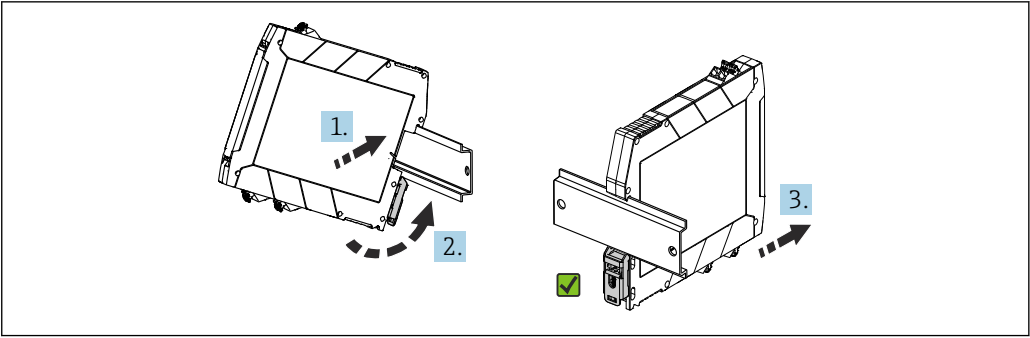
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1. Loosen the screw on the terminal head cover.
2. Flip back the terminal head cover.
3. Remove the cover of the display connection area.
4. Fit the display module onto the mounted and wired head transmitter.
 - ↳ The fastening pins must click securely into place on the head transmitter.
5. After mounting, securely tighten the terminal head cover.

i The display can be used only with the appropriate terminal heads - cover with viewing window.

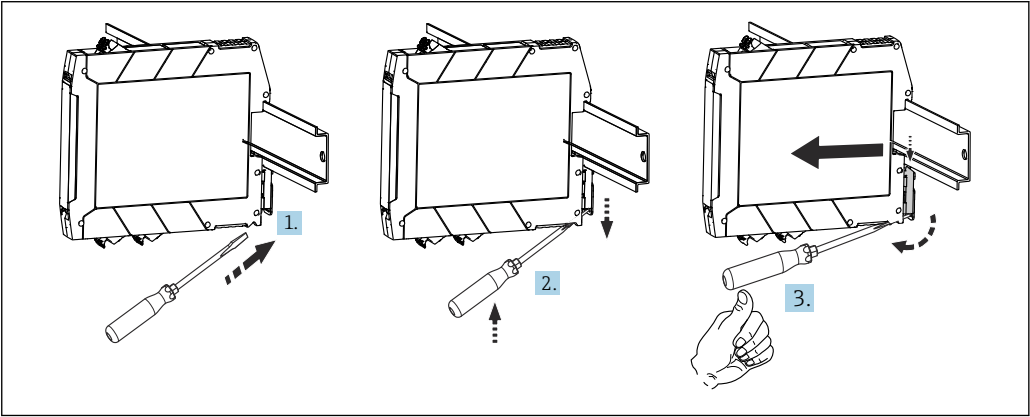
4.2.2 Installing the DIN rail transmitter

i Mount the device vertically, ensuring the correct orientation.



4 Installing the DIN rail transmitter

1. Position the top DIN rail groove at the top end of the DIN rail.
 2. Slide the bottom of the device over the bottom end of the DIN rail until you can hear the lower DIN rail clip click into place on the DIN rail.
 3. Pull gently on the device to check if it is correctly mounted on the DIN rail.
- If it doesn't move, the DIN rail transmitter is correctly mounted.



5 Dismantling the DIN rail transmitter

Dismantling the DIN rail transmitter:

1. Insert a screwdriver into the tab of the DIN rail clip.
2. Use the screwdriver to pull down on the DIN rail clip as shown in the diagram.
3. Hold down the screwdriver to remove the device from the DIN rail.

4.3 Post-installation check

After installing the device, always perform the following checks:

Device condition and specifications	Notes
Is the device undamaged (visual check)?	-
Do the ambient conditions match the device specification (e.g. ambient temperature, measuring range, etc.)?	See the 'Technical data' section

5 Electrical connection

CAUTION

Destruction of parts of the electronics

- ▶ Do not install or wire the device when it is connected to the operating voltage.
- ▶ Do not occupy the display connection.

NOTICE

Tighten the screw terminals in accordance with the torque as this could damage the transmitter.

- ▶ Maximum tightening torque = 0.35 Nm ($\frac{1}{4}$ lbf ft), screwdriver: Pozidriv PZ1.

5.1 Connecting requirements

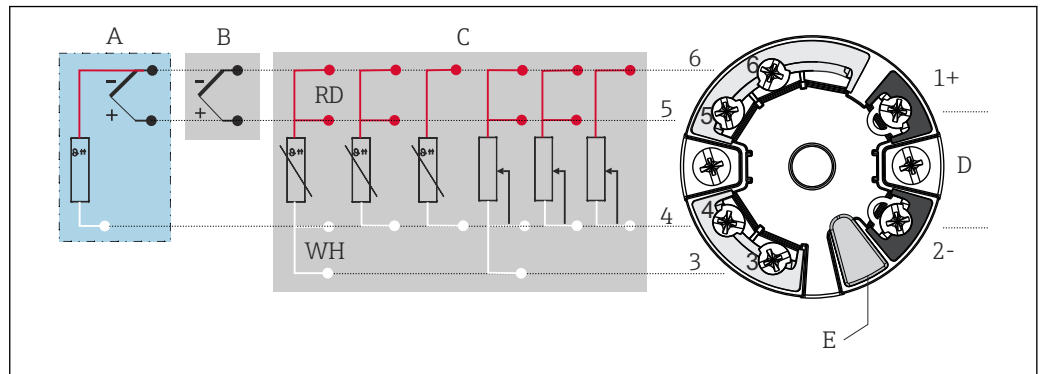
A Phillips head screwdriver is required to wire the head transmitter with screw terminals. Use a flat blade screwdriver for the DIN rail transmitter version with screw terminals. The version with push-in terminals can be wired without any tools.

Proceed as follows to wire a head transmitter mounted in the terminal head or field housing:

1. Open the cable gland and the housing cover on the terminal head or the field housing.
2. Feed the cables through the opening in the cable gland.
3. Connect the cables as shown in →  17. If the head transmitter is fitted with push-in terminals, pay particular attention to the "Connecting to push-in terminals" section. →  18
4. Tighten the cable gland again.
5. Close the housing cover.

 Before commissioning, refer to the information in the "Post-connection check" section to prevent connection errors.

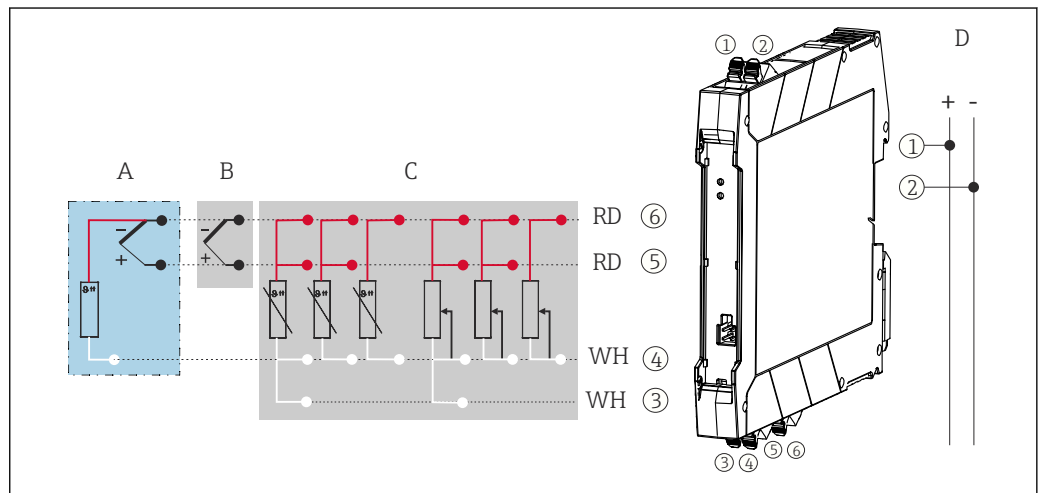
5.2 Quick wiring guide



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6 Assignment of terminal connections for head transmitter

- A Sensor input, TC and mV, external reference junction (RJ) Pt100
- B Sensor input, TC and mV, internal reference junction (RJ)
- C Sensor input, RTD and Ω , 4-, 3- and 2-wire
- D Bus connection and power supply 4 to 20 mA
- E Display connection and CDI interface



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7 Assignment of terminal connections for DIN rail transmitter

- A Sensor input, TC and mV, external reference junction (RJ), Pt100
- B Sensor input, TC and mV, internal reference junction (RJ)
- C Sensor input, RTD and Ω , 4-, 3- and 2-wire
- D Bus connection and power supply 4 to 20 mA

An unshielded installation cable is sufficient for using the analog signal. In case of increased EMC influences, the use of shielded cables is recommended. For the DIN rail transmitter, a shielded cable must be used for sensor cable lengths of 30 m (98.4 ft) or more.

A shielded cable is recommended for HART communication. Observe grounding concept of the plant. A minimum load of 250 Ω is required in the signal circuit in order to operate the HART transmitter via the HART protocol (terminals 1 and 2).

In the case of a thermocouple (TC) measurement, a Pt100, 2-wire RTD can be connected to measure the reference junction temperature. This is connected to terminals 4 and 6.

NOTICE

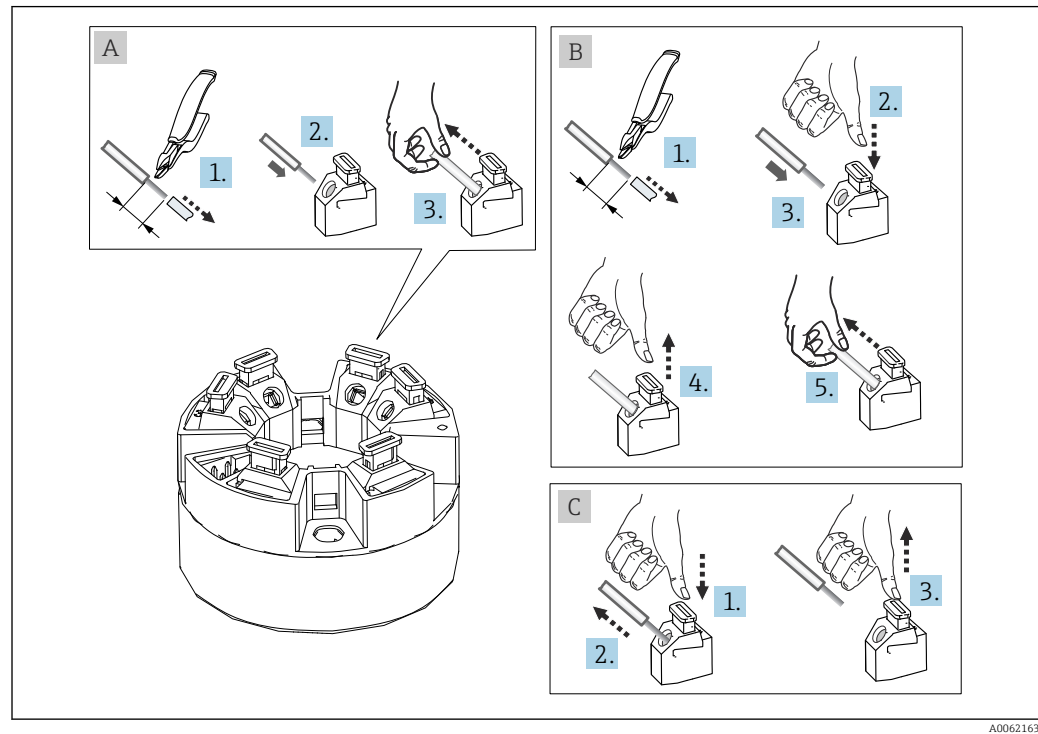
ESD - Electrostatic discharge

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

5.3 Connecting the sensor

Terminal assignment of the sensor connections → 17.

5.3.1 Connecting the sensor to push-in terminals



8 Push-in terminal connection, using the example of a head transmitter

Fig. A, solid wire, fine-strand wire with ferrule:

1. Strip wire end to length of at least 10 mm (0.39 in).
2. Insert the wire end into the terminal.
3. Pull the wire gently to ensure it is connected correctly. If the wire is not secure, repeat from step 1.

Fig. B, fine-strand wire without ferrule:

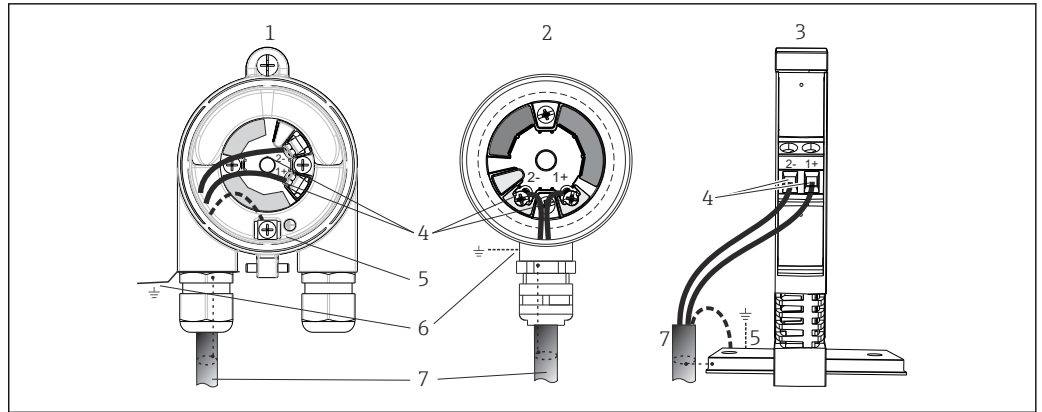
1. Strip wire end to length of at least 10 mm (0.39 in).
2. Press down on the lever opener.
3. Insert the wire end into the terminal.
4. Release lever opener.
5. Pull the wire gently to ensure it is connected correctly. If the wire is not secure, repeat from step 1.

Fig. C, releasing the connection:

1. Press down on the lever opener.
2. Remove the wire from the terminal.
3. Release lever opener.

5.4 Connecting the transmitter

Please also observe the procedure on → 16.



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9 Connecting the signal cables and power supply

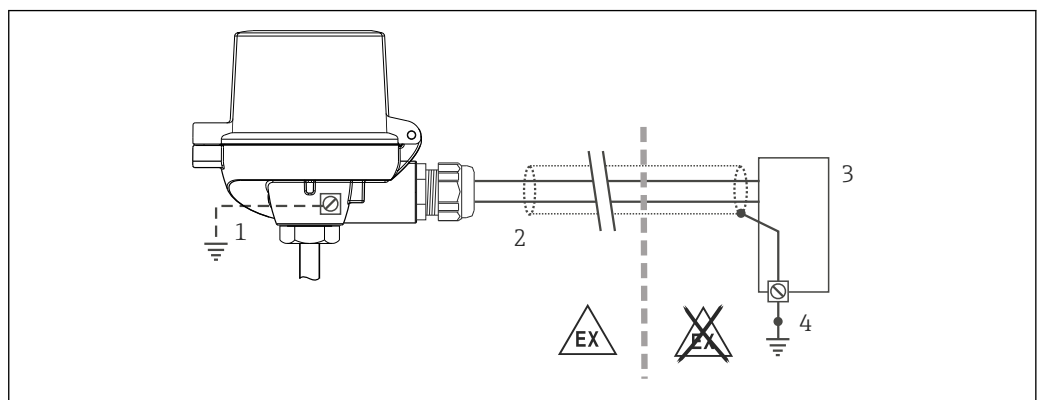
- 1 Head transmitter installed in field housing
- 2 Head transmitter installed in terminal head
- 3 DIN rail transmitter mounted on DIN rail
- 4 Terminals for HART protocol and power supply
- 5 Internal ground connection
- 6 External ground connection
- 7 Shielded signal cable (recommended for HART protocol)

- The terminals for the signal cable connection (1+ and 2-) are protected against reverse polarity.
- Conductor cross-section:
 - Max. 2.5 mm² (13 AWG) for screw terminals
 - Max. 1.5 mm² (15 AWG) for screw terminals. Stripping length of wire at least 10 mm (0.39 in).

5.5 Special connection instructions

Shielding and grounding

The specifications of the FieldComm Group must be observed when installing the HART transmitter.



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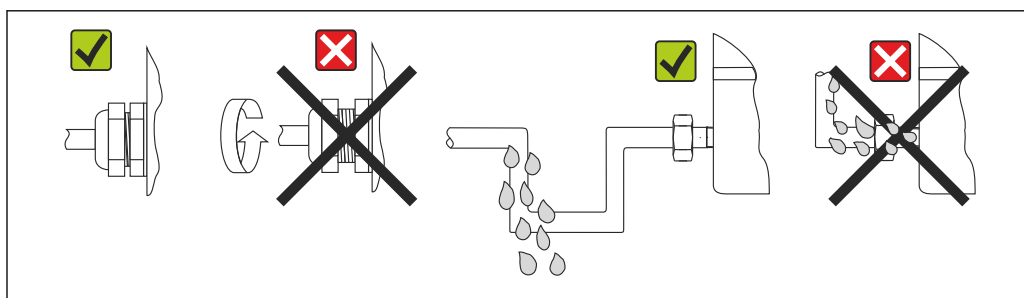
10 Shielding and grounding the signal cable at one end with HART communication

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

5.6 Ensuring the degree of protection

The device meets the requirements for IP67 protection. Compliance with the following points is mandatory following installation in the field or servicing in order to ensure that IP67 protection is maintained:

1. The transmitter must be mounted in a terminal head with the appropriate degree of protection.
The housing seals must be clean and undamaged when inserted into the sealing groove. Dry, clean or replace the seals for this purpose if necessary.
2. 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. →  11,  20
3. 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.
4. Install the device in such a way that the cable glands are not facing upwards.
→  11,  20
5. Replace unused cable glands with dummy plugs.
6. The grommet used must remain in the cable gland.



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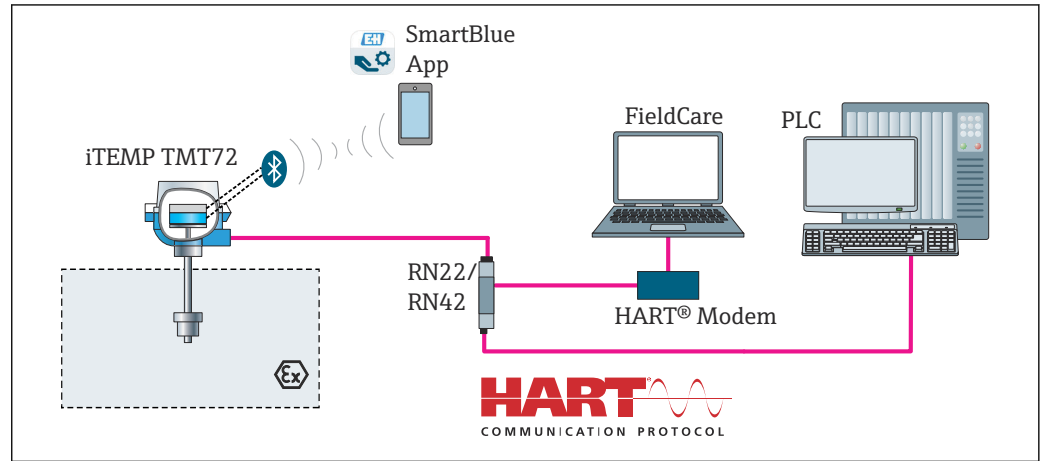
 11 Connection tips to retain IP67 protection

5.7 Post-connection check

Device condition and specifications	Notes
Are the device and cables free from damage (visual check)?	--
Electrical connection	Notes
Does the supply voltage match the specifications on the nameplate?	■ Head transmitter: $U = 10$ to $36 V_{DC}$ ■ DIN rail transmitter: $U = 11$ to $36 V_{DC}$ ■ Other values apply in the hazardous area, see the corresponding Ex Safety Instructions.
Are the mounted cables strain-relieved?	--
Are the power supply and signal cables connected correctly?	→  17
Are all the screw terminals firmly tightened and have the push-in terminal connections been checked?	--
Are all the cable entries installed, tightened and leak-tight?	--
Are all the housing covers installed and firmly tightened?	--

6 Operation options

6.1 Overview of operation options



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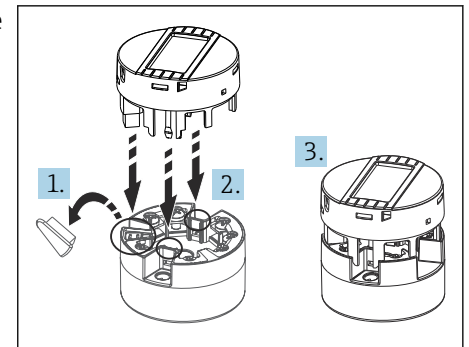
12 Operation options for the transmitter via HART communication

i The transmitter's optional Bluetooth® interface is only active if a display unit is not attached or the CDI interface is not used for device configuration.

6.1.1 Measured value display and operating elements

Option: Display TID10 for head transmitter

i The display can be ordered subsequently, see the 'Accessories' section in the Operating Instructions for the device.

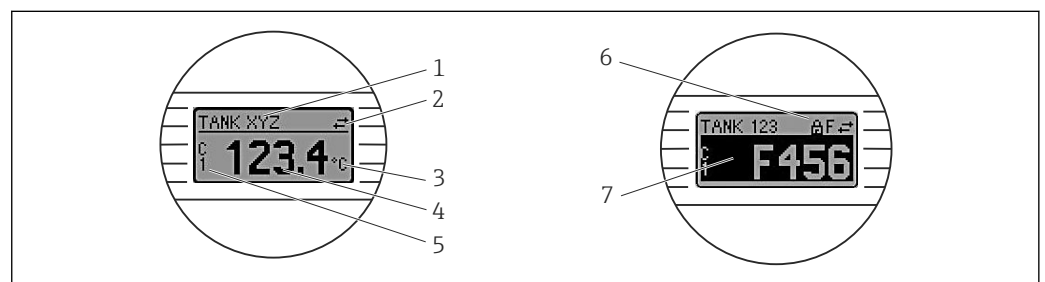


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13 Attach the display to the transmitter

Display elements

Head transmitter



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14 Optional LC display for head transmitter

Item no.	Function	Description
1	Displays the TAG	TAG, 32 characters long.
2	'Communication' symbol	The communication symbol appears when read and write-accessing via the fieldbus protocol.
3	Unit display	Unit display for the measured value displayed.
4	Measured value display	Displays the current measured value.
5	Value/channel display DT, PV, I, %	E.g., PV for a measured value from channel 1 or DT for the device temperature
6	'Configuration locked' symbol	The 'configuration locked' symbol appears when configuration is locked via the hardware.
7	Status signals	
	Symbols	Meaning
	F	Error message "Failure detected" An operating error has occurred. The measured value is no longer valid. The display alternates between the error message and "- - -" (no valid measured value present), see "Diagnostics events" section → 40. Detailed information on the error messages can be found in the Operating Instructions.
	C	"Service mode" The device is in the service mode (e.g., during a simulation).
	S	"Out of specification" The device is being operated outside its technical specifications (e.g., during startup or cleaning processes).
	M	"Maintenance required" Maintenance is required. The measured value remains valid. The display alternates between the measured value and the diagnostic message.

DIN rail transmitter

Two LEDs on the front indicate the device status.

Type	Function and properties
Status LED (red)	When the device is operating without errors, the device status is displayed. This function can no longer be guaranteed in the event of an error. - LED off: without diagnostic message - LED is lit: diagnostic display, category F - LED flashing: diagnostic display, categories C, S or M
Power LED (green) 'ON'	When the device is operating without errors, the operating status is displayed. This function can no longer be guaranteed in the event of an error. - LED off: Power failure or insufficient supply voltage - LED is lit: Supply voltage is OK (either via CDI or via supply voltage, terminals 1+, 2-)

 The DIN rail transmitter version does not have an interface to the LC display and therefore does not have a local display.

Local operation

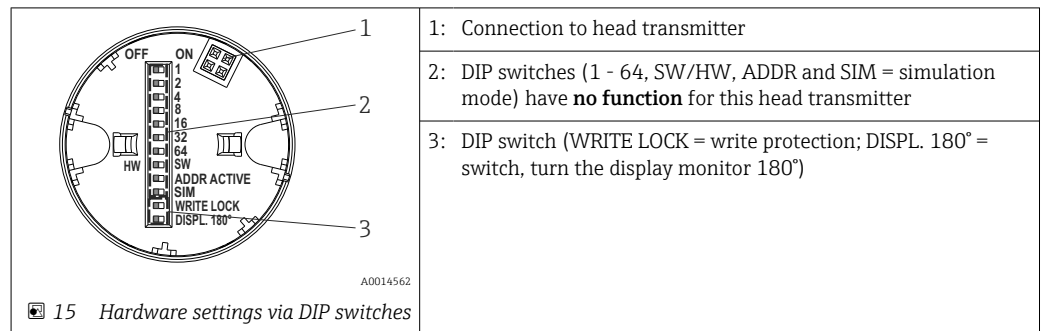
You can make various hardware settings using miniature switches (DIP switches) on the rear of the optional display.

 Optionally, the display can be ordered with the head transmitter, or as an accessory for subsequent mounting. → 44

NOTICE

ESD – Electrostatic discharge. Destruction or malfunction of parts of the electronics.

- Protect the terminals from electrostatic discharge.



Procedure for setting the DIP switch:

1. Open the cover of the terminal head or field housing.
2. Remove the attached display from the head transmitter.
3. Configure the DIP switch on the rear of the display accordingly.
 - ↳ Switch to ON = function active, switch to OFF = function disabled.
4. Fit the display onto the head transmitter in the correct position.
 - ↳ The head transmitter accepts the settings within one second.
5. Secure the cover back onto the terminal head or field housing.

Switching write protection on/off

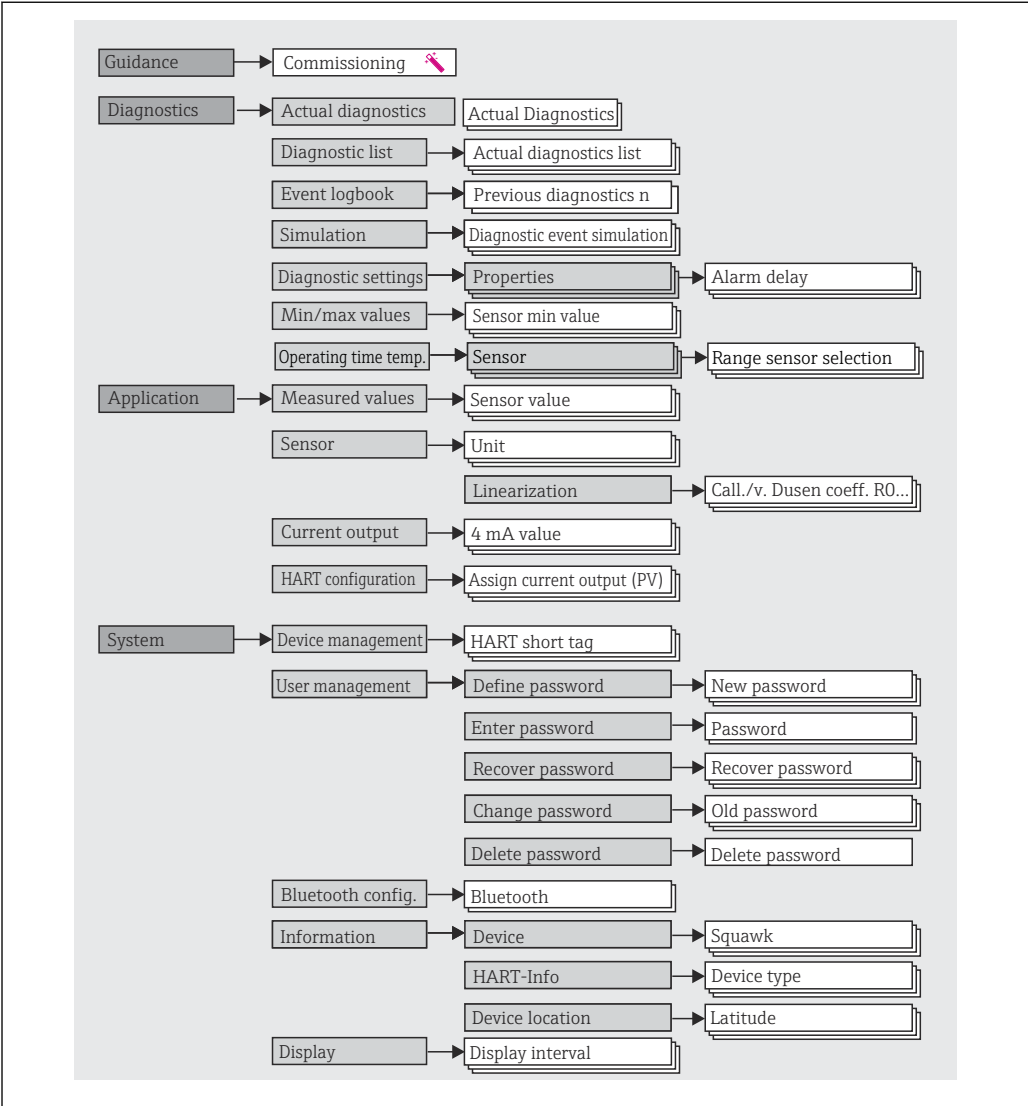
- Switch on/off via DIP switches on the rear of the optional plug-in display.
- When write protection is active, parameters cannot be modified.
A lock symbol on the display indicates that write protection is active.
Active write protection prevents any write access to the software parameters.
- Write protection remains active even when the display is removed.
- To deactivate write protection, the display must be attached to the transmitter with the DIP switch disabled (WRITE LOCK = OFF).
The transmitter adopts the setting during operation and does not need to be restarted.

Turning the display

The display can be rotated 180° using the "DISPL. 180°" DIP switch.

6.2 Structure and function of the operating menu

6.2.1 Structure of the operating menu



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User roles

The role-based access concept consists of two hierarchical levels for the user and presents the various user roles with defined read/write authorizations derived from the NAMUR shell model.

- **Operator**

The plant operator can only change settings that do not affect the application - and particularly the measuring path - and simple, application-specific functions that are used during operation. The operator is able to read all the parameters, however.

- **Maintenance**

The **Maintenance** user role refers to configuration situations: commissioning and process adaptations as well as troubleshooting. It allows the user to configure and modify all available parameters. In contrast to the **Operator** user role, in the **Maintenance** role the user has read and write access to all the parameters.

- **Changing the user role**

A user role - and therefore existing read and write authorization - is changed by selecting the desired user role (already preselected depending on the operating tool) and entering the correct password when subsequently prompted. When a user logs out, system access always returns to the lowest level in the hierarchy. A user is logged out either by actively selecting the logout function when operating the device or is logged out automatically if the device is not operated for a period of over 600 seconds. Irrespective of this, actions that are already in progress (e.g., active upload/download, data logging, etc.) continue to be executed in the background.

- **As-delivered state**

The **Operator** user role is not enabled when the device is delivered from the factory, i.e. the **Maintenance** role is the lowest level in the hierarchy ex-works. This state makes it possible to commission the device and make other process adaptations without having to enter a password. Afterwards, a password can be assigned for the **Maintenance** user role to protect this configuration. The **Operator** user role is not visible when the device is delivered from the factory.

- **Password**

The **Maintenance** user role can assign a password in order to restrict access to device functions. This activates the **Operator** user role, which is now the lowest hierarchy level where the user is not asked to enter a password. The password can only be changed or disabled in the **Maintenance** user role. A password can be defined at different points in the operation of the device:

In the menu: System → User management

Submenus

Menu	Typical tasks	Content/meaning
"Diagnostics"	Troubleshooting: ■ Diagnosing and eliminating process errors. ■ Error diagnostics in difficult cases. ■ Interpretation of device error messages and correcting associated errors.	Contains all parameters for detecting and analyzing errors: ■ Diagnostic list Contains up to 3 error messages currently pending ■ Event logbook Contains the last 10 error messages ■ "Simulation" submenu Used to simulate measured values, output values or diagnostic messages ■ "Diagnostic settings" submenu Contains all parameters for configuring error events ■ "Min/max values" submenu Contains the minimum/maximum indicators and the reset option
"Application"	Commissioning: ■ Configuration of the measurement. ■ Configuration of data processing (scaling, linearization, etc.). ■ Configuration of the analog measured value output. Tasks during operation: Reading measured values.	Contains all parameters for commissioning: ■ "Measured values" submenu Contains all the current measured values ■ "Sensor" submenu Contains all the parameters for configuring the measurement ■ "Output" submenu Contains all the parameters for configuring the analog current output ■ "HART configuration" submenu Contains the settings and the most important parameters for HART communication
"System"	Tasks that require detailed knowledge of the system administration of the device: ■ Optimum adaptation of the measurement for system integration. ■ Detailed configuration of the communication interface. ■ User and access administration, password control ■ Information for device identification, HART info and display configuration	Contains all the higher-level device parameters that are assigned for system, device and user management, including Bluetooth configuration. ■ "Device management" submenu Contains parameters for general device management ■ "Bluetooth® configuration" submenu (option) Contains the function for enabling/disabling the Bluetooth® interface ■ "Device and user management" submenus Parameters for access status, password assignment, etc. ■ "Information" submenu Contains all the parameters for the unique identification of the device ■ "Display" submenu Configuration of the display

6.3 Access to the operating menu via the operating tool

6.3.1 DeviceCare

Range of functions

DeviceCare is a free configuration tool for Endress+Hauser devices. It supports devices with the following protocols, provided a suitable device driver (DTM) is installed: HART, PROFIBUS, FOUNDATION Fieldbus, EtherNet/IP, Modbus, CDI, ISS, IPC and PCP. The target group comprises customers without a digital network in plants and workshops as well as Endress+Hauser service technicians. The devices can be connected directly via a modem (point-to-point) or a bus system. DeviceCare is fast, easy and intuitive to use. It can run on a PC, laptop or tablet with a Windows operating system.

Source for device description files

For details, see →  32

6.3.2 FieldCare

Range of functions

FDT/DTM-based plant asset management tool from Endress+Hauser. It can configure all intelligent field units in a plant and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. Access is via the HART protocol, CDI (= Endress+Hauser Common Data Interface). It also supports devices with the following protocols, provided a suitable device driver (DTM) is installed: PROFIBUS, FOUNDATION Fieldbus.

Typical functions:

- Configuration of transmitters
- Loading and saving of device data (upload/download)
- Documentation of the measuring point
- Visualization of the measured value memory (line recorder) and event logbook



For details refer to the Operating Instructions

NOTICE

The following applies if using the device in hazardous areas: Electronic components can be damaged if the supply voltage remains connected when accessing the device via the CDI (Endress+Hauser Common Data Interface).

- ▶ Disconnect the transmitter from the power supply, terminals (1+) and (2-), before accessing the device via the CDI (Endress+Hauser Common Data Interface) using the Commubox FXA195.

Source for device description files

For details, see → 32

Establishing the connection

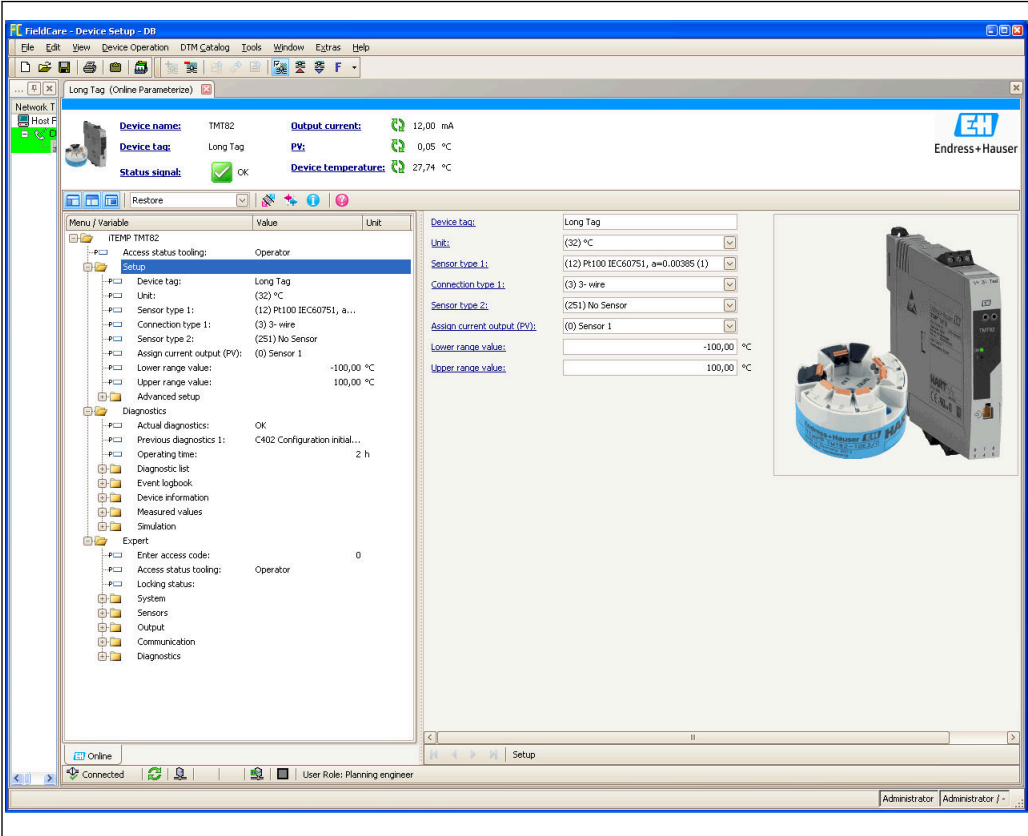
Example: HART modem Commubox FXA195 (USB)

1. Make sure that the DTM library is updated for all the connected devices (e.g. FXA19x, TMTxy).
2. Start FieldCare and create a project.
3. Go to View --> Network: right-click **Host PC** Add device...
 - ↳ The **Add new device** window opens.
4. Select the **HART Communication** option from the list and press **OK** to confirm.
5. Double-click **HART communication** DTM instance.
 - ↳ Check whether the correct modem is connected to the serial interface connection and press **OK** to confirm.
6. Right-click **HART communication** and select the **Add device...** option in the context menu that opens.
7. Select the desired device from the list and press **OK** to confirm.
 - ↳ The device now appears in the network list.
8. Right-click the device and select the **Connect** option in the context menu.
 - ↳ The CommDTM is displayed in green.
9. Double-click the device in the network to establish the online connection to the device.
 - ↳ Online configuration is available.

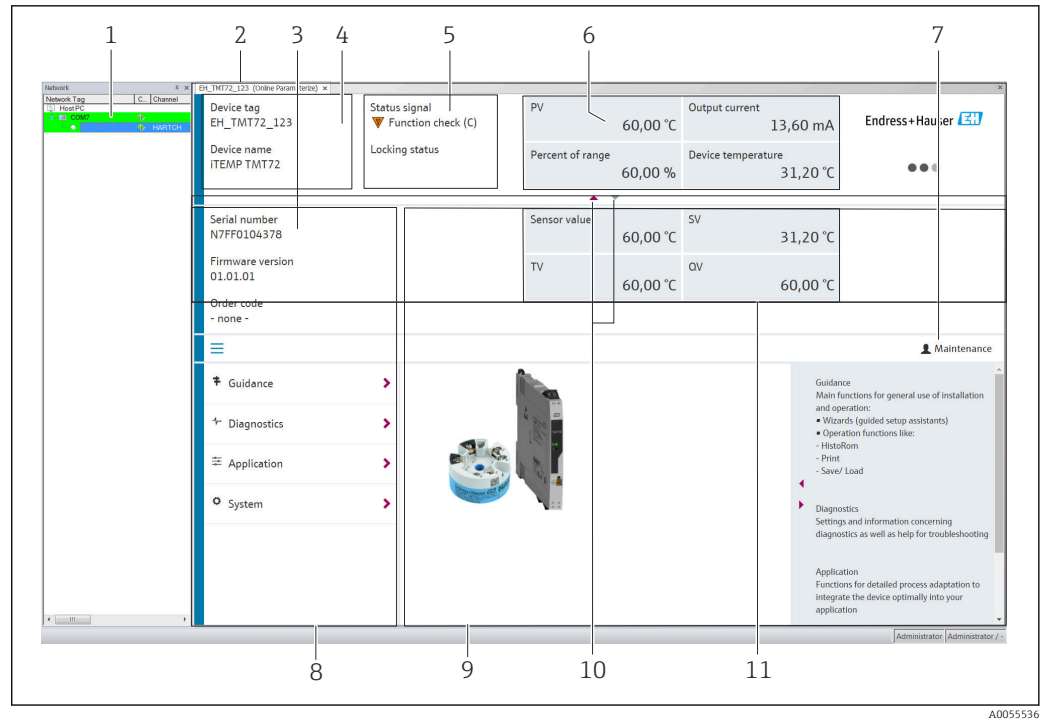


If transferring the device parameters following an offline configuration, the password for **Maintenance** - if assigned - must first be entered in the "User management" menu.

User interface



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16 FieldCare user interface with device information

- 1 Network view
- 2 Header
- 3 Extended header
- 4 Device tag and device name
- 5 Status signal
- 6 Measured values with device and measured value status information, simple presentation, e.g. PV, output current, percent of range, device temperature
- 7 Current user role (with direct link to user management)
- 8 Navigation area with operating menu structure
- 9 Work area and help section that can be shown/hidden
- 10 Navigation arrow to show/hide the extended header
- 11 Extended display of device and measured value information, e.g. sensor value, SV (TV, QV)

6.3.3 Field Xpert

Range of functions

Field Xpert for mobile plant asset management is available as both a tablet PC and an industrial PDA with an integrated touch screen for the commissioning and maintenance of field devices in hazardous and non-hazardous areas. It enables efficient configuration of FOUNDATION Fieldbus, HART and WirelessHART devices. Communication is wireless via Bluetooth® or WiFi interfaces.

Source for device description files

See information → 32.

6.3.4 AMS Device Manager

Range of functions

Program from Emerson Process Management for operating and configuring measuring instruments via the HART protocol.

Source for device description files

See information → 32.

6.3.5 SIMATIC PDM

Range of functions

SIMATIC PDM is a standardized, manufacturer-independent program from Siemens for the operation, configuration, maintenance and diagnostics of intelligent field devices via HART protocol.

Source for device description files

See information →  32.

6.3.6 AMS Trex Device Communicator

Range of functions

Industrial handheld terminal from Emerson Process Management for remote configuration and measured value display via HART protocol.

Source for device description files

See information →  32.

6.4 Access to the operating menu via the SmartBlue app

The device can be operated and configured using the SmartBlue app. The connection is established via the Bluetooth® interface.

Prerequisite(s):

- The device has the optional Bluetooth® interface: order code "Communication; output signal; operation", option P: "HART; 4-20 mA; HART/Bluetooth (app) configuration"
- A smartphone or tablet with the SmartBlue app installed.

Supported functions

- Device selection in Live List and access to the device (login)
- Configuration of the device
- Access to measured values, device status and diagnostic information

The SmartBlue app is available for free download for Android devices (Google Playstore) and iOS devices (iTunes Apple Shop) : *Endress+Hauser SmartBlue*



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 17 Directly to the app with the QR code

System requirements

- Devices with iOS:
 - iPhone 4S or higher, from iOS13.0
 - iPad2 or higher, from iOS13.0
 - iPod Touch 5th generation or higher, from iOS13.0
- Devices with Android:
 - Android 4.4 KitKat or higher

Downloading the SmartBlue app:

1. Install and start the SmartBlue app.
 - ↳ A Live List shows all the devices available.
2. Select the device from the Live List.
 - ↳ The Login dialog box opens.

Logging in:

3. Enter the user name: **admin**
4. Enter the initial password: serial number of the device.
5. Confirm your entry.
 - ↳ The device information opens.



Navigate through the various items of information about the device: swipe the screen to the side.

- The range under reference conditions is:
 - 10 m (33 ft) when installed in the terminal head or field housing with a display window or DIN rail transmitter
 - 5 m (16.4 ft) when installed in the terminal head or field housing
- Incorrect operation by unauthorized persons is prevented by means of encrypted communication and password encryption
- The Bluetooth® interface can be deactivated



The transmitter's optional Bluetooth® interface is only active if a display unit is not attached or the CDI interface is not used for device configuration.

7 System integration

7.1 Overview of device description files

Version data for the device

Firmware version	01.01.zz	- On the title page of the manual - On the nameplate Firmware version parameter System → Information → Device → Firmware version
Manufacturer ID	0x11	Manufacturer ID parameter System → Information → HART info → Manufacturer ID
Device type ID	0x11D0	Device type parameter System → Information → HART info → Device type
HART protocol revision	7	---
Device revision	1	- On the transmitter nameplate Device revision parameter System → Information → HART info → Device revision

The appropriate device driver software (DD/DTM) for the individual operating tools can be obtained from different sources:

- www.endress.com → Downloads → Search field: Software → Software type: Device driver
- www.endress.com → Products: individual product page, e.g. TMTxy --> Documents/Manuals/Software: Electronic Data Description (EDD) or Device Type Manager (DTM).

Endress+Hauser supports all common operating tools from a variety of manufacturers (e.g. Emerson Process Management, ABB, Siemens, Yokogawa, Honeywell and many others). The FieldCare and DeviceCare operating tools are available for download in the software portal (<https://www.software-products.endress.com> → Download).

7.2 Measured variables via HART protocol

The following measured values are assigned to the device variables at the factory:

Device variable	Measured value
Primary device variable (PV)	Sensor 1
Secondary device variable (SV)	Device temperature
Tertiary device variable (TV)	Sensor 1
Quaternary device variable (QV)	Sensor 1

 It is possible to change the assignment of device variables to process variables in the menu **Expert → Communication → HART output**.

7.3 Supported HART commands

 The HART protocol enables the transfer of measuring data and device data between the HART master and the field device for configuration and diagnostics purposes. HART masters such as the handheld terminal or PC-based operating programs need device description files (DD = Device Descriptions, DTM) which are used to access all the information in a HART device. This information is transmitted exclusively via "commands".

There are three different types of command

- Universal commands:

All HART devices support and use universal commands. These are associated with the following functionalities for example:

- Recognition of HART devices
- Reading digital measured values

- Common practice commands:

Common practice commands offer functions which are supported and can be executed by many but not all field devices.

- Device-specific commands:

These commands allow access to device-specific functions which are not HART standard. Such commands access individual field device information, among other things.

Command No.	Description
Universal commands	
0, Cmd0	Read unique identifier
1, Cmd001	Read primary variable
2, Cmd002	Read loop current and percent of range
3, Cmd003	Read dynamic variables and loop current
6, Cmd006	Write polling address
7, Cmd007	Read loop configuration
8, Cmd008	Read dynamic variable classifications
9, Cmd009	Read device variables with status
11, Cmd011	Read unique identifier associated with TAG
12, Cmd012	Read message
13, Cmd013	Read TAG, descriptor, date
14, Cmd014	Read primary variable transducer information
15, Cmd015	Read device information
16, Cmd016	Read final assembly number
17, Cmd017	Write message
18, Cmd018	Write TAG, descriptor, date
19, Cmd019	Write final assembly number
20, Cmd020	Read long TAG (32-byte TAG)
21, Cmd021	Read unique identifier associated with long TAG
22, Cmd022	Write long TAG (32-byte TAG)
38, Cmd038	Reset configuration changed flag
48, Cmd048	Read additional device status
Common practice commands	
33, Cmd033	Read device variables
34, Cmd034	Write primary variable damping value
35, Cmd035	Write primary variable range values
40, Cmd040	Enter/Exit fixed current mode
42, Cmd042	Perform device reset
44, Cmd044	Write primary variable units
45, Cmd045	Trim loop current zero
46, Cmd046	Trim loop current gain
50, Cmd050	Read dynamic variable assignments

Command No.	Description
54, Cmd054	Read device variable information
59, Cmd059	Write number of response preambles
72, Cmd072	Squawk
95, Cmd095	Read device communication statistics
100, Cmd100	Write primary variable alarm code
516, Cmd516	Read device location
517, Cmd517	Write device location
518, Cmd518	Read location description
519, Cmd519	Write location description
520, Cmd520	Read process unit tag
521, Cmd521	Write process unit tag
523, Cmd523	Read condensed status mapping array
524, Cmd524	Write condensed status mapping array
525, Cmd525	Reset condensed status mapping array
526, Cmd526	Write simulation mode
527, Cmd527	Simulate status bit

8 Commissioning

8.1 Installation check

Before commissioning the measuring point, make sure that all final checks have been carried out:

- "Post-installation" checklist →  15
- "Post-connection" checklist →  20

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	Indication
1	Text "Display" and firmware version of the display
2	Device name with firmware version, hardware version and device revision
3	Displays the sensor configuration (sensor element and connection type) along with the configured measuring range
4a	Current measured value or
4b	Current diagnostic message  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 →  38.

The device works after approx. 7 seconds, including the attached display. Normal measuring mode commences as soon as the switch-on procedure is completed. Measured values and status values appear on the display.



If the display is attached when the Bluetooth® interface is activated, display initialization is performed twice and Bluetooth® communication is disabled simultaneously.

8.3 Configuring the device

Wizards

The starting point for device wizards is in the **Guidance** menu. Wizards not only query individual parameters but also guide the user through the configuration and/or verification of entire sets of parameters with step-by-step instructions, including questions, that are comprehensible for the operator. The "Start" button can be disabled for wizards that require specific access authorization (lock symbol appears on the screen).

The following five operating elements are supported for navigation in the wizards:

- **Start**

Only on the initial page: start the wizard and go to the first section

- **Next**

Go to the next page of the wizard. Is not enabled until parameters are entered or confirmed.

- **Back**

Return to the previous page

- **Cancel**

If Cancel is selected, the status before the wizard was started is restored

- **Finish**

Closes the wizard and possibility of making additional parameter settings on the device. Only enabled on the final page.

8.3.1 Commissioning wizard

Commissioning is the first step required in order to use a device for a specific application. The Commissioning wizard contains an introductory page (with the "Start" operating element) and a short description of the content. The wizard consists of several sections in which the user is guided step-by-step through the commissioning of the device.

"Device management" is the first section that appears when the user runs the wizard, and contains the following parameters. Its main purpose is to provide information about the device:

Navigation



Guidance → Commissioning → Start 🔒



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Device TAG

Device name

Serial number

Extended order code (n) ¹⁾

HART short tag

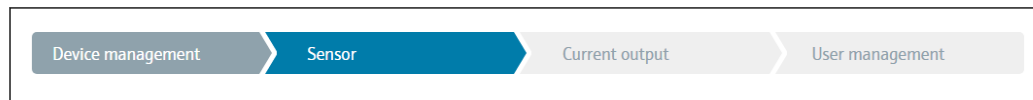
HART date code

HART descriptor

HART message

1) n = placeholder for 1, 2, 3

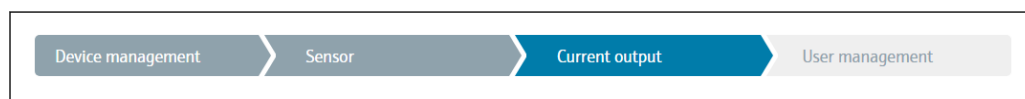
The second section, "Sensor", takes the user through all the relevant settings for the sensor. The number of parameters displayed depends on the corresponding settings. The following parameters can be configured:

Navigation**Guidance → Commissioning → Sensor**

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Unit
 Sensor type
 Connection type
 2-wire compensation
 Reference junction
 RJ preset value

In the third section, the settings are made for the analog output and the output's alarm response. The following parameters can be configured:

Navigation**Guidance → Commissioning → Current output**

A0053295

4 mA value
 20 mA value
 Failure mode
 Failure current

In the final section, a password can be defined for the "Maintenance" user role. This is strongly recommended to protect the device against unauthorized access. The following steps describe how to configure a password for the "Maintenance" role for the first time.

Navigation**Guidance → Commissioning → User management**

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Access status
 New password
 Confirm new password

1. The **Maintenance** role appears in the "Access status" picklist. When operating the device with the SmartBlue app, you must first select the **Maintenance** user role.
 ↳ Afterwards, the **New password** and **Confirm new password** input boxes appear.
2. Enter a user-defined password that meets the password rules indicated in the online help.
3. Enter the password again in the **Confirm new password** input box.

Once the password has been entered successfully, parameter changes, particularly those that are needed for commissioning, process adaptation/optimization and troubleshooting, can only be implemented in the **Maintenance** user role and if the password is entered successfully.

8.4 Protecting settings from unauthorized access

8.4.1 Hardware locking

The device can be protected against unauthorized access by hardware locking. In the locking and access concept, hardware locking always has top priority. The device is write-protected if the lock symbol appears in the header of the measured value display. To unlock, switch the write protection switch on the back of the display to the "OFF" position (hardware write protection). →  22

8.4.2 Software locking

By assigning a password for the **Maintenance** user role, it is possible to restrict access status and protect the device against unauthorized access.



See the Commissioning wizard →  35

The parameters are also protected against modification by logging out of the **Maintenance** user role and switching to the **Operator** role. No lock symbol appears, however.

To disable the write protection, the user must log on with the **Maintenance** user role via the relevant operating tool.



User role concept →  24

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 error and the appropriate remedial actions.

 Due to its design, the device cannot be repaired. However, it is possible to send the device in for examination. See the information in the "Return" section.

General errors

Error	Possible cause	Remedial action
Device is not responding.	Supply voltage does not match the voltage specified on the nameplate.	Check the voltage at the transmitter directly using a voltmeter and correct.
	Connecting cables are not in contact with the terminals.	Check the electrical contact between the cable and terminals and correct if necessary.
	Electronics unit is defective.	Replace the device.
Output current <3.6 mA	Signal cable is not wired correctly.	Check wiring.
	Electronics unit is defective.	Replace the device.
HART communication is not working.	Missing or incorrectly installed communication resistor.	Install the communication resistor (250 Ω) correctly.
	HART modem is not properly connected.	Connect HART modem correctly.
	HART modem is not set to "HART".	Set HART modem selector switch to "HART".
Status LED is lit or flashing red (DIN rail transmitter only).	Diagnostic events as per NAMUR NE 107 →  40	Check diagnostic events: ■ LED is lit: diagnostic display, category F ■ LED flashing: diagnostic display, categories C, S or M
Power LED is not lit green (DIN rail transmitter only).	Power failure or insufficient supply voltage	Check the supply voltage and check if wiring is correct.



Check display (optionally in conjunction with head transmitter)

Error	Possible cause	Remedial action
Display is blank	No supply voltage	■ Check the supply voltage at the head transmitter, terminals + and -. ■ Ensure that the display module holders are correctly seated and that the display module is properly connected to the head transmitter, see the "Mounting" section. ■ If possible, test the display module with other suitable head transmitters.
	The display module is defective.	Replace the module.
	The electronics of the head transmitter are defective.	Replace the head transmitter.



Local error messages on the display

→ 40



Faulty connection to the fieldbus host system

Error	Possible cause	Remedial action
HART communication is not working.	Missing or incorrectly installed communication resistor.	Install the communication resistor (250 Ω) correctly.
	Commubox is connected incorrectly.	Connect Commubox correctly.



Error messages in the configuration software

→ 40

Application errors without status messages for RTD sensor connection

Error	Possible cause	Remedial action
Measured value is incorrect/inaccurate	Incorrect sensor orientation.	Install the sensor correctly.
	Heat conducted by sensor.	Observe the installation 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 Sensor type device function.
	Sensor connection.	Check that the sensor is connected correctly.
	The cable resistance of the sensor (2-wire) was not compensated.	Compensate the cable resistance.
	Offset incorrectly set.	Check offset.
Failure current (≤ 3.6 mA or ≥ 21 mA)	Sensor defective.	Check the sensor.
	RTD connected incorrectly.	Connect the connecting cables correctly (terminal diagram).
	Device programming is incorrect (e.g., number of wires).	Change the Connection type device function.
	Incorrect programming.	Incorrect sensor type set in the Sensor type device function. Set the correct sensor type.

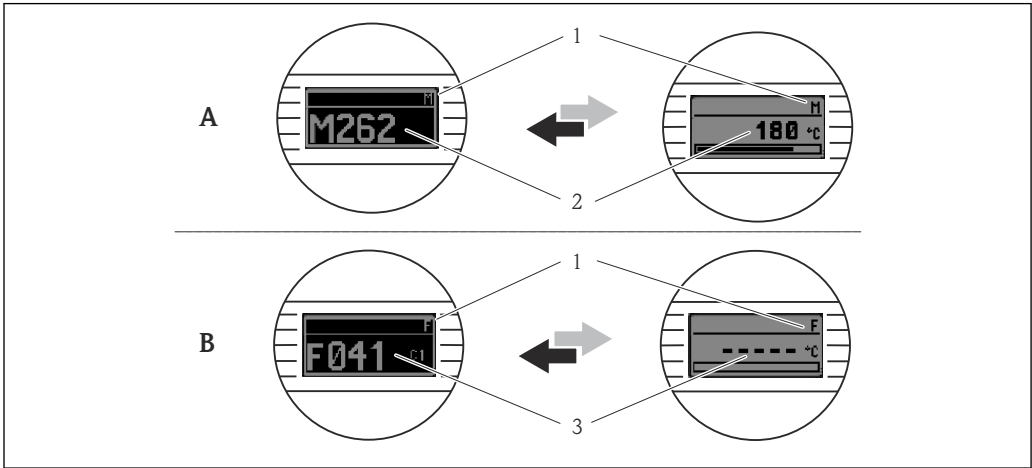


Application errors without status messages for TC sensor connection

Error	Possible cause	Remedial action
Measured value is incorrect/inaccurate	Incorrect sensor orientation.	Install the sensor correctly.
	Heat conducted by sensor.	Observe the installation length of the sensor.

Error	Possible cause	Remedial action
	Device programming is incorrect (scaling).	Change scaling.
	Incorrect thermocouple type (TC) configured.	Change the Sensor type device function.
	Incorrect reference junction set.	Set the correct reference junction .
	Interference via the thermocouple wire welded in the thermowell (interference voltage coupling).	Use a sensor where the thermocouple wire is not welded.
	Offset incorrectly set.	Check offset.
Failure current (≤ 3.6 mA or ≥ 21 mA)	Sensor defective.	Check the sensor.
	Sensor is connected incorrectly.	Connect the connecting cables correctly (terminal diagram).
	Incorrect programming.	Incorrect sensor type set in the Sensor type device function. Set the correct sensor type.

9.2 Diagnostic information on onsite display



A0014837

- A Display in the event of a warning
- B Display in the event of an alarm
- 1 Status signal in the header
- 2 The display alternates between the primary measured value and the status - indicated by the appropriate letter (M, C or S) - plus the defined error number.
- 3 The display alternates between "- - -" (no valid measured value) and the status - indicated by the appropriate letter (F) - plus the defined error number.

9.3 Diagnostic information via communication interface

NOTICE

Status signals and diagnostic behavior can be configured manually for certain diagnostic events. If a diagnostic event occurs, however, it is not guaranteed that the measured values are valid for the event and comply with the process for the status signals S and M and the diagnostic behavior: 'Warning' and Disabled'.
► Reset the status signal assignment to the factory setting.

Status signals

Letter/ symbol ¹⁾	Event category	Meaning
F 	Operating error	An operating error has occurred.
C 	Service mode	The device is in the service mode (e.g., during a simulation).
S 	Out of specification	The device is being operated outside its technical specifications (e.g., during startup or cleaning processes).
M 	Maintenance required	Maintenance is required.
N -	Not categorized	

1) As per NAMUR NE 107

Diagnostic behavior

Alarm	Measurement is interrupted. The signal outputs adopt the defined alarm status. A diagnostic message is generated.
Warning	The device continues to measure. A diagnostic message is generated.
Disabled	The diagnostic behavior is completely disabled even if the device is not recording a measured value.

9.4 Overview of diagnostic events

Each diagnostic event is assigned a specific diagnostic behavior ex works. The user can change this assignment for certain diagnostic events.

Example:

Configuration examples	Diagnostic number	Settings		Device behavior			
		Status signal	Diagnostic behavior from the factory	Status signal (output via HART communication)	Current output	PV, status	Indication
1. Default setting	047	S	Warning	S	Measured value	Measured value, UNCERTAIN	S047
2. Manual setting: status signal S changed to F	047	F	Warning	F	Measured value	Measured value, UNCERTAIN	F047
3. Manual setting: Warning diagnostic behavior changed to Alarm	047	S	Alarm	S	Configured failure current	Measured value, BAD	S047
4. Manual setting: Warning changed to Disabled	047	S ¹⁾	Disabled	- ²⁾	Last valid measured value ³⁾	Last valid measured value, GOOD	S047

1) Setting is not relevant.

2) Status signal is not displayed.

3) The failure current is output if no valid measured value is available.

Diagnostic number	Event text	Remedial action	Status signal from the factory		Diagnostic behavior from the factory	
				 Not customizable		 Not customizable
Diagnostics for the sensor						
041	Sensor interrupted	1. Check sensor, check electrical connection. 2. Check connection type. 3. Replace sensor.	F		Alarm	
042	Sensor corroded	1. Check sensor. 2. Replace sensor.	M		Warning	
043	Sensor short circuit	1. Check sensor cable and sensor. 2. Replace sensor cable and sensor.	F		Alarm	
047	Sensor limit reached, sensor n	1. Check sensor. 2. Check process conditions.	S		Warning	
145	Compensation reference point	1. Check terminal temperature. 2. Check external reference point.	F		Alarm	
Diagnostics for the electronics						
201	Electronics faulty	1. Restart device. 2. Replace electronics.	F		Alarm	
221	Reference sensor defective	Replace device.	M		Alarm	
Diagnostics for the configuration						
401	Factory reset active	Factory reset in progress, please wait.	C		Warning	
402	Initialization active	Initialization in progress, please wait.	C		Warning	
410	Data transfer failed	1. Check connection. 2. Repeat data transfer.	F		Alarm	
411	Up-/download active	Up-/download in progress, please wait.	C		Warning	
435	Linearization faulty	Check linearization.	F		Alarm	
485	Process variable simulation active	Deactivate simulation.	C		Warning	
491	Current output simulation	Deactivate simulation.	C		Warning	
495	Diagnostic event simulation active	Deactivate simulation.	C		Warning	
531	Factory adjustment missing	1. Contact service organization. 2. Replace device.	F		Alarm	
537	Configuration	1. Check device configuration 2. Upload and download new configuration. (In case of current output: Check current output configuration.)	F		Alarm	
582	Sensor diagnostics TC deactivated	Switch on diagnostics for thermocouple measurement	C		Warning	
Diagnostics for the process						
801	Supply voltage too low ³⁾	Increase supply voltage.	S		Alarm	

Diagnostic number	Event text	Remedial action	Status signal from the factory		Diagnostic behavior from the factory	
				Customizable ¹⁾  Not customizable		Customizable ²⁾  Not customizable
825	Operating temperature	1. Check ambient temperature. 2. Check process temperature.	S		Warning	
844	Process value out of specification	1. Check process value. 2. Check application. Check sensor. 3. Check scaling of analog output	S		Warning	

- 1) Can be set to F, C, S, M, N
 2) Can be set to 'Alarm', 'Warning' and 'Disabled'
 3) With this diagnostic event, the device always outputs a "low" alarm status (output current ≤ 3.6 mA).

9.5 Diagnostic list

If several diagnostic events are pending at the same time, only the diagnostic message with the highest priority is displayed. Additional pending diagnostic messages are shown in the **Diagnostic list** submenu. The main feature of the display priority is the status signal in the following order: F, C, S, M. If several diagnostic events with the same status signal are pending, the priority is defined in numerical order of the event number, e.g., F042 appears before F044 and before S044.

9.6 Event logbook

 Previous diagnostic messages are displayed in the **Event logbook** submenu. →  72

10 Maintenance and cleaning

10.1 Maintenance work

The device does not require specific maintenance work.

10.2 Cleaning of surfaces not in contact with the medium

- Recommendation: Use a lint-free cloth that is either dry or slightly dampened using water.
- Do not use any sharp objects or aggressive cleaning agents that corrode the surfaces (e.g. displays, housing) and seals.
- Do not use high-pressure steam.
- Observe the degree of protection of the device.

 The cleaning agent used must be compatible with the materials of the device configuration. Do not use cleaning agents with concentrated mineral acids, bases or organic solvents.

11 Repair

11.1 General information

Due to its design, the device cannot be repaired.

11.2 Spare parts

Product spare parts that are currently available can be found online at:
www.endress.com/onlinetools

Type	Order code
Standard - DIN securing set (2 screws and springs, 4 shaft lock-down rings, 1 plug for the display interface)	71044061
US - M4 securing set (2 screws and 1 plug for the display interface)	71044062

11.3 Return

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

1. Refer to the web page for information: <https://www.endress.com>
2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.

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

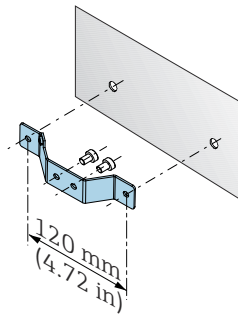
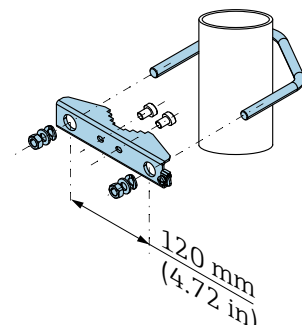
The accessories currently available for the product can be selected at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.

12.1 Device-specific accessories

Accessories for the head transmitter
Display unit TID10 for Endress+Hauser head transmitter iTEMP TMT8x or TMT7x, attachable
Field housing TA30x for Endress+Hauser head transmitter
Adapter for DIN rail mounting, DIN rail clip as per IEC 60715 (TH35) without securing screws

Accessories for the head transmitter
Standard – DIN terminal head mounting set (2 screws + springs, 4 securing disks and 1 display connector cover)
US mounting set – M4 screws (2 M4 screws and 1 display connector cover)

Accessories enclosed	
Wall mounting bracket, 316 L	 A technical drawing of a wall mounting bracket made of 316 L stainless steel. The bracket is L-shaped and designed to be mounted on a wall. A dimension line indicates a length of 120 mm (4.72 in) for the horizontal part of the bracket. A0061686
Pipe mounting bracket, 316 L	 A technical drawing of a pipe mounting bracket made of 316 L stainless steel. The bracket is designed to be mounted on a pipe. A dimension line indicates a length of 120 mm (4.72 in) for the horizontal part of the bracket. A0061687

12.2 Communication-Specific Accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface.  For details, see the Technical Information
WirelessHART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks.  For details, see the Technical Information
Field Xpert SMT70B	Universal, high-performance tablet PC for device configuration The tablet PC enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as a comprehensive, all-in-one solution. Field Xpert also uses the optimally secured Bluetooth® interface for its wireless connections. With a pre-installed driver library, it is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle.  For details, see the Technical Information

12.3 Service-specific accessories

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 Configurator is 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 **Configuration**.

DeviceCare SFE100

DeviceCare is an Endress+Hauser configuration tool for field devices using the following communication protocols: HART, PROFIBUS DP/PA, FOUNDATION Fieldbus, IO/Link, Modbus, CDI and Endress+Hauser Common Data Interfaces.

 www.endress.com/sfe100

FieldCare SFE500

FieldCare is a configuration tool for Endress+Hauser and third-party field devices based on DTM technology.

The following communication protocols are supported: HART, WirelessHART, PROFIBUS, FOUNDATION Fieldbus, Modbus, IO-Link, EtherNet/IP, PROFINET and PROFINET APL.

 www.endress.com/sfe500

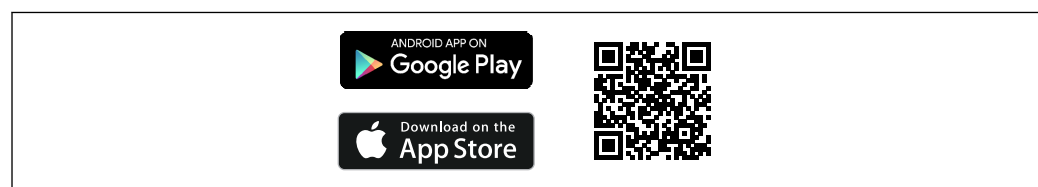
Netilion

With the Netilion IIoT ecosystem, Endress+Hauser enables the optimization of plant performance, digitization of workflows, sharing of knowledge and improved collaboration. Drawing upon decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem designed to effortlessly extract insights from data. These insights allow process optimization, leading to increased plant availability, efficiency, reliability and ultimately a more profitable plant.

 www.netilion.endress.com

SmartBlue app

SmartBlue from Endress+Hauser allows easy wireless field device configuration via Bluetooth® or WLAN. By providing mobile access to diagnostic and process information, SmartBlue saves time, even in hazardous and difficult-to-access environments.



A0033202

 18 QR code for free Endress+Hauser SmartBlue app

12.4 Online tools

Product information about the entire life cycle of the device is available at:
www.endress.com/onlinetools

12.5 System components

RN series active barrier

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.

For more information, please refer to: www.endress.com

Process indicators from the RIA product family

Easily readable process indicators with various functions: loop-powered indicators for displaying 4-20 mA values, display of up to four HART variables, process indicators with control units, limit value monitoring, sensor power supply, and galvanic isolation.

Universal application thanks to international hazardous area approvals, suitable for panel mounting or field installation..

For more information, please refer to: www.endress.com

Data Manager of the RSG product family

Data Managers are flexible and powerful systems to organize process values. Up to 20 universal inputs and up to 14 digital inputs for direct connection of sensors, optionally with HART, are available as an option. The measured process values are clearly presented on the display and logged safely, monitored for limit values and analyzed. The values can be forwarded via common communication protocols to higher-level systems and connected to one another via individual plant modules.

For more information, please refer to: www.endress.com

13 Technical data

13.1 Input

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

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 °C (-328 to 1 562 °F) -200 to 850 °C (-328 to 1 562 °F) -200 to 500 °C (-328 to 932 °F) -200 to 250 °C (-328 to 482 °F)	10 K (18 °F)
JIS C1604:1984	Pt100 (5)	0.003916	-200 to 510 °C (-328 to 950 °F)	10 K (18 °F)
DIN 43760 IPTS-68	Ni100 (6) Ni120 (7)	0.006180	-60 to 250 °C (-76 to 482 °F) -60 to 250 °C (-76 to 482 °F)	10 K (18 °F)
GOST 6651-94	Pt50 (8) Pt100 (9)	0.003910	-185 to 1 100 °C (-301 to 2 012 °F) -200 to 850 °C (-328 to 1 562 °F)	10 K (18 °F)
OIML R84: 2003, GOST 6651-2009	Cu50 (10) Cu100 (11)	0.004280	-180 to 200 °C (-292 to 392 °F) -180 to 200 °C (-292 to 392 °F)	10 K (18 °F)
	Ni100 (12) Ni120 (13)	0.006170	-60 to 180 °C (-76 to 356 °F) -60 to 180 °C (-76 to 356 °F)	10 K (18 °F)
OIML R84: 2003, GOST 6651-94	Cu50 (14)	0.004260	-50 to 200 °C (-58 to 392 °F)	10 K (18 °F)
-	Pt100 (Callendar Van Dusen) Nickel polynomial Copper polynomial	-	The measuring range limits are specified by entering the limit values that depend on the coefficients A to C and R0.	10 K (18 °F)
	- Type of connection: 2-wire, 3-wire or 4-wire connection, sensor current: ≤ 0.3 mA - With 2-wire circuit, compensation of the wire resistance is 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 10 Ω

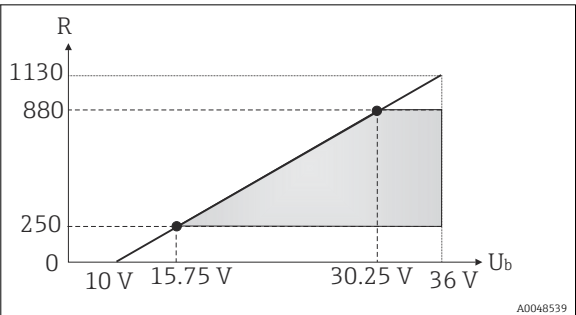
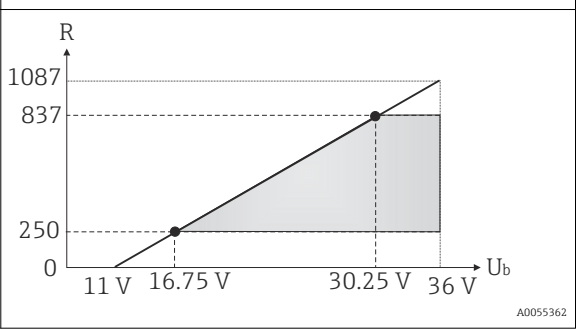
Thermocouples as per standard	Description	Measuring range limits		Min. measuring span
IEC 60584, Part 1 ASTM E230-3	Type A (W5Re-W20Re) (30) Type B (PtRh30-PtRh6) (31) Type E (NiCr-CuNi) (34) Type J (Fe-CuNi) (35) Type K (NiCr-Ni) (36) Type N (NiCrSi-NiSi) (37) Type R (PtRh13-Pt) (38) Type S (PtRh10-Pt) (39) Type T (Cu-CuNi) (40)	0 to 2 500 °C (32 to 4 532 °F) 40 to 1 820 °C (104 to 3 308 °F) -250 to 1 000 °C (-482 to 1 832 °F) -210 to 1 200 °C (-346 to 2 192 °F) -270 to 1 372 °C (-454 to 2 501 °F) -270 to 1 300 °C (-454 to 2 372 °F) -50 to 1 768 °C (-58 to 3 214 °F) -50 to 1 768 °C (-58 to 3 214 °F) -200 to 400 °C (-328 to 752 °F)	Recommended temperature range: 0 to 2 500 °C (32 to 4 532 °F) 500 to 1 820 °C (932 to 3 308 °F) -150 to 1 000 °C (-238 to 1 832 °F) -150 to 1 200 °C (-238 to 2 192 °F) -150 to 1 200 °C (-238 to 2 192 °F) -150 to 1 300 °C (-238 to 2 372 °F) 200 to 1 768 °C (392 to 3 214 °F) 200 to 1 768 °C (392 to 3 214 °F) -150 to 400 °C (-238 to 752 °F)	50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F)
IEC 60584, Part 1 ASTM E230-3 ASTM E988-96	Type C (W5Re-W26Re) (32)	0 to 2 315 °C (32 to 4 199 °F)	0 to 2 000 °C (32 to 3 632 °F)	50 K (90 °F)
ASTM E988-96	Type D (W3Re-W25Re) (33)	0 to 2 315 °C (32 to 4 199 °F)	0 to 2 000 °C (32 to 3 632 °F)	50 K (90 °F)
DIN 43710	Type L (Fe-CuNi) (41) Type U (Cu-CuNi) (42)	-200 to 900 °C (-328 to 1 652 °F) -200 to 600 °C (-328 to 1 112 °F)	-150 to 900 °C (-238 to 1 652 °F) -150 to 600 °C (-238 to 1 112 °F)	50 K (90 °F)
GOST R8.585-2001	Type L (NiCr-CuNi) (43)	-200 to 800 °C (-328 to 1 472 °F)	-200 to 800 °C (328 to 1 472 °F)	50 K (90 °F)

Thermocouples as per standard	Description	Measuring range limits	Min. measuring span
	■ Internal reference junction (Pt100) ■ External preset value: Configurable value -40 to 85 °C (-40 to 185 °F) ■ Maximum sensor wire resistance 10 kΩ (If the sensor wire resistance is greater than 10 kΩ, an error message is output in accordance with NAMUR NE89.)		
Voltage transmitter (mV)	Millivolt transmitter (mV)	-20 to 100 mV	5 mV

13.2 Output

Output signal	Analog output	4 to 20 mA, 20 to 4 mA (can be inverted)
	Signal encoding	FSK ±0.5 mA via current signal
	Data transmission rate	1200 baud
	Galvanic isolation	U = 2 kV AC for 1 minute (input/output)

Failure signal	Failure information as per NAMUR NE43: The information is created if the measuring information is missing or not valid. A complete list of all the errors occurring in the measuring system is created.						
	<table><tr><td>Underranging</td><td>Linear decrease from 4.0 to 3.8 mA</td></tr><tr><td>Overranging</td><td>Linear increase from 20.0 to 20.5 mA</td></tr><tr><td>Failure e.g. sensor failure or sensor short-circuit</td><td>≤ 3.6 mA ("low") or ≥ 21 mA ("high"), can be selected The "high" alarm setting can be set between 21.5 mA and 23 mA, thus providing the flexibility needed to meet the requirements of various control systems.</td></tr></table>	Underranging	Linear decrease from 4.0 to 3.8 mA	Overranging	Linear increase from 20.0 to 20.5 mA	Failure e.g. sensor failure or sensor short-circuit	≤ 3.6 mA ("low") or ≥ 21 mA ("high"), can be selected The "high" alarm setting can be set between 21.5 mA and 23 mA, thus providing the flexibility needed to meet the requirements of various control systems.
Underranging	Linear decrease from 4.0 to 3.8 mA						
Overranging	Linear increase from 20.0 to 20.5 mA						
Failure e.g. sensor failure or sensor short-circuit	≤ 3.6 mA ("low") or ≥ 21 mA ("high"), can be selected The "high" alarm setting can be set between 21.5 mA and 23 mA, thus providing the flexibility needed to meet the requirements of various control systems.						

Load	Head transmitter: $R_{b\ max.} = (U_{b\ max.} - 10\ V) / 0.023\ A$ (current output).	 A0048539
	DIN rail transmitter: $R_{b\ max.} = (U_{b\ max.} - 11\ V) / 0.023\ A$ (current output).	 A0055362

Load in Ω. U_b = supply voltage in V DC

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

Mains filter 50/60 Hz

Filter 1st order digital filter: 0 to 120 s

Protocol-specific data	Manufacturer ID	17 (0x11)
	Device type ID	0x11D0
	HART specification	7
	Device address in multi-drop mode	Software setting addresses 0 to 63
	Device description files (DTM, DD)	Information and files available at: www.endress.com www.fieldcommgroup.org
	HART load	Min. 250 Ω
	HART device variables	Measured value for primary value (PV) Sensor (measured value) Measured values for SV, TV, QV (secondary, tertiary and quaternary variable) - SV: device temperature - TV: sensor (measured value) - QV: sensor (measured value)
	Supported functions	- Squawk - Condensed status

Wireless HART data

Minimum starting voltage	10 V _{DC}
Starting current	3.58 mA
Starting time	7 s
Minimum operating voltage	10 V _{DC}
Multidrop current	4.0 mA
Time for connection setup	9 s

Write protection for device parameters

- Hardware: Write protection for head transmitter on optional display using DIP switch
- Software: User role concept (password assignment)

Switch-on delay ≤ 7 s, until the first valid measured value signal is present at the current output and until start of HART communication. While switch-on delay = $I_a \leq 3.8 \text{ mA}$

13.3 Electrical connection

Supply voltage Values for the non-hazardous area, protected against reverse polarity:

- Head transmitter: $10 \text{ V} \leq V_{cc} \leq 36 \text{ V}$
- DIN rail transmitter: $11 \text{ V} \leq V_{cc} \leq 36 \text{ V}$

 For values for hazardous areas, see safety instructions for electrical equipment for explosion-hazardous areas (XA).

Current consumption Current consumption ≤ 23 mA

Terminals	Terminal design for sensor and power supply cables	Cable version	Cable cross-section
	Screw terminals	Rigid or flexible	≤ 2.5 mm ² (14 AWG)
	Push-in terminals (cable version, stripping length = min. 10 mm (0.39 in))	Rigid or flexible	0.2 to 1.5 mm ² (24 to 16 AWG)
		Flexible with wire end ferrules with/without plastic ferrule	0.25 to 1.5 mm ² (24 to 16 AWG)

 Ferrules must be used when combining push-in terminals and flexible cables with a cable cross-section of ≤ 0.3 mm².

13.4 Performance characteristics

Response time	Resistance thermometer (RTD) and resistance transmitter (Ω measurement)	≤ 1 s
	Thermocouples (TC) and voltage transmitters (mV)	≤ 1 s
	Reference temperature	≤ 1 s

 When recording step responses, it must be taken into account that the times of the internal reference measuring point are added to the specified times where applicable.

Update time ≤ 100 ms

Reference conditions

- Calibration temperature: $+25$ °C ± 3 K (77 °F ± 5.4 °F)
- Supply voltage: 24 V DC
- 4-wire circuit for resistance adjustment

Maximum measurement error In accordance with EN IEC 62828 and the reference operating conditions specified above. The measurement error data corresponds to $\pm 2 \sigma$ (Gaussian distribution). The data includes non-linearities and repeatability.

MV = Measured value

LRL = Lower range limit of relevant sensor

MR = Measuring range of the relevant sensor

Typically

Standard	Description	Measuring range	Typical measurement error (±)	
Resistance thermometer (RTD) as per standard			Digital value ¹⁾	Value at current output
IEC 60751:2008	Pt100 (1)	0 to 200 °C (32 to 392 °F)	0.05 °C (0.09 °F)	0.08 °C (0.14 °F)
IEC 60751:2008	Pt1000 (4)		0.04 °C (0.072 °F)	0.07 °C (0.13 °F)
GOST 6651-94	Pt100 (9)		0.07 °C (0.13 °F)	0.09 °C (0.16 °F)
Thermocouples (TC) as per standard			Digital value ¹⁾	Value at current output
IEC 60584, Part 1	Type K (NiCr-Ni) (36)	0 to +800 °C (32 to +1472 °F)	0.26 °C (0.47 °F)	0.35 °C (0.63 °F)

Standard	Description	Measuring range	Typical measurement error (±)	
	Type R (PtRh13-Pt) (38)		0.46 °C (0.83 °F)	0.52 °C (0.94 °F)
	Type S (PtRh10-Pt) (39)		0.55 °C (0.99 °F)	0.60 °C (1.08 °F)

1) Measured value transmitted via HART.

Measurement error for resistance thermometers (RTD) and resistance transmitters

Standard	Description	Measuring range	Measurement error (±)	
			Digital ¹⁾	D/A ²⁾
			Based on measured value ³⁾	
IEC 60751:2008	Pt100 (1)	-200 to 850 °C (-328 to 1562 °F)	ME = ± (0.04 °C (0.07 °F) + 0.0036% * (MV - LRL))	0.03 % (≅ 4.8 µA)
	Pt200 (2)		ME = ± (0.08 °C (0.14 °F) + 0.011% * (MV - LRV))	
	Pt500 (3)	-200 to 510 °C (-328 to 950 °F)	ME = ± (0.035 °C (0.063 °F) + 0.006% * (MV - LRL))	
	Pt1000 (4)	-200 to 250 °C (-328 to 482 °F)	ME = ± (0.02 °C (0.04 °F) + 0.005% * (MV - LRL))	
JIS C1604:1984	Pt100 (5)	-200 to 510 °C (-328 to 950 °F)	ME = ± (0.04 °C (0.07 °F) + 0.004% * (MV - LRL))	0.03 % (≅ 4.8 µA)
GOST 6651-94	Pt50 (8)	-185 to 1100 °C (-301 to 2012 °F)	ME = ± (0.07 °C (0.13 °F) + 0.006% * (MV - LRL))	
	Pt100 (9)	-200 to 850 °C (-328 to 1562 °F)	ME = ± (0.045 °C (0.08 °F) + 0.004% * (MV - LRL))	
DIN 43760 IPTS-68	Ni100 (6)	-60 to 250 °C (-76 to 482 °F)	ME = ± (0.035 °C (0.06 °F) - 0.004% * (MV - LRL))	
	Ni120 (7)		ME = ± (0.035 °C (0.06 °F) - 0.004% * (MV - LRL))	
OIML R84: 2003 / GOST 6651-2009	Cu50 (10)	-180 to 200 °C (-292 to 392 °F)	ME = ± (0.07 °C (0.13 °F) + 0.004% * (MV - LRL))	0.03 % (≅ 4.8 µA)
	Cu100 (11)	-180 to 200 °C (-292 to 392 °F)	ME = ± (0.035 °C (0.06 °F) + 0.003% * (MV - LRL))	
	Ni100 (12)	-60 to 180 °C (-76 to 356 °F)	ME = ± (0.037 °C (0.07 °F) - 0.004% * (MV - LRL))	
	Ni120 (13)		ME = ± (0.035 °C (0.06 °F) - 0.004% * (MV - LRL))	
OIML R84: 2003, GOST 6651-94	Cu50 (14)	-50 to 200 °C (-58 to 392 °F)	ME = ± (0.07 °C (0.13 °F) + 0.004% * (MV - LRL))	
Resistance transmitter	Resistance Ω	10 to 400 Ω	ME = ± (15 mΩ + 0.0017% * (MV - LRL))	0.03 % (≅ 4.8 µA)
		10 to 2000 Ω	ME = ± 60 mΩ + 0.004% * (MV - LRL)	

1) Measured value transmitted via HART.

2) Percentages based on the configured measuring span of the analog output signal.

3) Deviations from maximum measurement error possible due to rounding.

Measurement error for thermocouples (TC) and voltage transmitters

Standard	Description	Measuring range	Measurement error (±)	
			Digital ¹⁾	D/A ²⁾
			Based on measured value ³⁾	
IEC 60584-1 ASTM E230-3	Type A (30)	0 to 2 500 °C (32 to 4 532 °F)	ME = ± (0.57 °C (1.03 °F) + 0.025% * (MV - LRL))	0.03 % (≅ 4.8 µA)
	Type B (31)	500 to 1 820 °C (932 to 3 308 °F)	ME = ± (0.78 °C (1.4 °F) - 0.025% * (MV - LRL))	
IEC 60584-1 ASTM E230-3 ASTM E988-96	Type C (32)	0 to 2 000 °C (32 to 3 632 °F)	ME = ± (0.28 °C (0.5 °F) + 0.011% * (MV - LRL))	
ASTM E988-96	Type D (33)		ME = ± (0.4 °C (0.72 °F) * (MV - LRL))	
IEC 60584-1 ASTM E230-3	Type E (34)	-150 to 1 000 °C (-238 to 1 832 °F)	ME = ± (0.13 °C (0.23 °F) - 0.001% * (MV - LRL))	0.03 % (≅ 4.8 µA)
	Type J (35)	-150 to 1 200 °C (-238 to 2 192 °F)	ME = ± (0.17 °C (0.31 °F) * (MV - LRL))	
	Type K (36)		ME = ± (0.24 °C (0.43 °F) - 0.002% * (MV - LRL))	
	Type N (37)	-150 to 1 300 °C (-238 to 2 372 °F)	ME = ± (0.27 °C (0.49 °F) - 0.003% * (MV - LRL))	
	Type R (38)	200 to 1 768 °C (392 to 3 214 °F)	ME = ± (0.48 °C (0.86 °F) - 0.004% * (MV - LRL))	
	Type S (39)		ME = ± (0.54 °C (0.97 °F) - 0.002% * (MV - LRL))	
	Type T (40)	-150 to 400 °C (-238 to 752 °F)	ME = ± (0.24 °C (0.43 °F) - 0.02% * (MV - LRL))	
DIN 43710	Type L (41)	-150 to 900 °C (-238 to 1 652 °F)	ME = ± (0.2 °C (0.36 °F) - 0.002% * (MV - LRL))	
	Type U (42)	-150 to 600 °C (-238 to 1 112 °F)	ME = ± (0.27 °C (0.49 °F) - 0.019% * (MV - LRL))	
GOST R8.585-2001	Type L (43)	-200 to 800 °C (-328 to 1 472 °F)	ME = ± (2.2 °C (3.96 °F) - 0.005% * (MV - LRL))	
Voltage transmitter (mV)		-20 to 100 mV	ME = ± 10.0 µV	4.8 µA

- 1) Measured value transmitted via HART.
 2) Percentages based on the configured span of the analog output signal.
 3) Deviations from maximum measurement error possible due to rounding.

Total measurement error of transmitter at current output = $\sqrt{(\text{Measurement error digital}^2 + \text{Measurement error D/A}^2)}$

Sample calculation with Pt100, measuring range 0 to 200 °C (32 to 392 °F), ambient temperature 25 °C (77 °F), supply voltage 24 V:

Measurement error digital = ±0.04 °C + 0.0036% x (200 °C - (-200 °C)):	0.05 °C (0.09 °F)
Measurement error D/A = 0.003 % x 200 °C (360 °F)	0.06 °C (0.108 °F)
Measurement error digital value (HART):	0.05 °C (0.09 °F)
Measurement error analog value (current output): $\sqrt{(\text{Measurement error digital}^2 + \text{measurement error D/A}^2)}$	0.08 °C (0.14 °F)

Sample calculation with Pt100, measuring range 0 to 200 °C (32 to 392 °F), ambient temperature 35 °C (95 °F), supply voltage 30 V:

Measurement error digital = $0.04\text{ °C} + 0.0036\% \times (200\text{ °C} - (-200\text{ °C}))$:	0.05 °C (0.09 °F)
Measurement error D/A = $0.03\% \times 200\text{ °C}$ (360 °F)	0.06 °C (0.108 °F)
Influence of ambient temperature (digital) = $(35 - 25) \times (0.0013\% \times 200\text{ °C} - (-200\text{ °C}))$, min. 0.003 °C	0.05 °C (0.09 °F)
Influence of ambient temperature (D/A) = $(35 - 25) \times (0.003\% \times 200\text{ °C})$	0.06 °C (0.108 °F)
Influence of supply voltage (digital) = $(30 - 24) \times (0.0007\% \times 200\text{ °C} - (-200\text{ °C}))$, min. 0.005 °C	0.02 °C (0.036 °F)
Influence of supply voltage (D/A) = $(30 - 24) \times (0.003\% \times 200\text{ °C})$	0.04 °C (0.72 °F)
Measurement error digital value (HART): $\sqrt{(\text{Measurement error digital})^2 + (\text{Influence of ambient temperature (digital)})^2 + (\text{Influence of supply voltage (digital)})^2}$	0.09 °C (0.16 °F)
Measurement error analog value (current output): $\sqrt{(\text{Measurement error digital})^2 + (\text{Measurement error D/A})^2 + (\text{Influence of ambient temperature (digital)})^2 + (\text{Influence of ambient temperature (D/A)})^2 + (\text{Influence of supply voltage (digital)})^2 + (\text{Influence of supply voltage (D/A)})^2}$	0.13 °C (0.23 °F)

The measurement error data corresponds to 2 σ (Gaussian distribution)

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

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:

- Callendar Van Dusen coefficients (Pt100 resistance thermometer)

The Callendar Van Dusen equation is described as:

$$R_T = R_0[1 + AT + BT^2 + C(T - 100)T^3]$$

The coefficients A, B and C are used to match the sensor (platinum) and transmitter in order to improve the accuracy of the measuring system. The coefficients for a standard sensor are specified in IEC 751. If no standard sensor is available or if greater accuracy is required, the coefficients for each sensor can be determined specifically with the aid of sensor calibration.

- Linearization for copper/nickel resistance thermometers (RTD)

The polynomial equation for copper/nickel is as follows:

$$R_T = R_0(1 + AT + BT^2)$$

The coefficients A and B are used for the linearization of nickel or copper resistance thermometers (RTD). The exact values of the coefficients derive from the calibration data and are specific to each sensor. The sensor-specific coefficients are then sent to the transmitter.

Sensor-transmitter matching using one of the methods mentioned above significantly improves the temperature measurement accuracy of the entire system. This is because the transmitter uses the specific data pertaining to the connected sensor to calculate the measured temperature, instead of using the standardized sensor curve data.

1-point adjustment (offset)

Shifts the sensor value

Current output adjustment Correction of 4 or 20 mA current output value.

Operating influences The measurement error data corresponds to 2 σ (Gaussian distribution).*Influence of ambient temperature and supply voltage on operation for resistance thermometers (RTD) and resistance transmitters*

Description	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change		Supply voltage: Influence (±) per V change	
		Digital ¹⁾	D/A ²⁾	Digital ¹⁾	D/A ²⁾
		Based on measured value		Based on measured value	
Pt100 (1)	IEC 60751:2008	0.0013% * (MV - LRV), at least 0.003 °C (0.005 °F)	0.003 %	0.0007% * (MV - LRV), at least 0.002 °C (0.004 °F)	0.003 %
Pt200 (2)		≤ 0.017 °C (0.031 °F)		≤ 0.009 °C (0.016 °F)	
Pt500 (3)		0.0013% * (MV - LRV), at least 0.006 °C (0.011 °F)		0.0007% * (MV - LRV), at least 0.002 °C (0.004 °F)	
Pt1000 (4)		≤ 0.005 °C (0.009 °F)		≤ 0.003 °C (0.005 °F)	
Pt100 (5)	JIS C1604:1984	0.0013% * (MV - LRV), at least 0.003 °C (0.005 °F)		0.0007% * (MV - LRV), at least 0.001 °C (0.002 °F)	
Pt50 (8)	GOST 6651-94	0.0015% * (MV - LRV), at least 0.01 °C (0.018 °F)		0.0007% * (MV - LRV), at least 0.004 °C (0.007 °F)	
Pt100 (9)		0.0013% * (MV - LRV), at least 0.003 °C (0.005 °F)		0.0007% * (MV - LRV), at least 0.002 °C (0.004 °F)	
Ni100 (6)	DIN 43760 IPTS-68	≤ 0.003 °C (0.005 °F)		0.003 %	
Ni120 (7)			≤ 0.002 °C (0.004 °F)		
Cu50 (10)	OIML R84: 2003 / GOST 6651-2009	≤ 0.005 °C (0.009 °F)	≤ 0.002 °C (0.004 °F)		
Cu100 (11)		≤ 0.004 °C (0.007 °F)	≤ 0.002 °C (0.004 °F)		
Ni100 (12)		≤ 0.003 °C (0.005 °F)	≤ 0.001 °C (0.002 °F)		
Ni120 (13)			≤ 0.002 °C (0.004 °F)		
Cu50 (14)	OIML R84: 2003 / GOST 6651-94	≤ 0.005 °C (0.009 °F)	≤ 0.002 °C (0.004 °F)		
Resistance transmitter (Ω)					
10 to 400 Ω		0.001% * MV, at least 1 mΩ	0.003 %	0.0005% * MV, at least 1 mΩ	0.003 %
10 to 2 000 Ω		0.001% * MV, at least 10 mΩ		0.0005% * MV, at least 5 mΩ	

1) Measured value transmitted via HART.

2) Percentages based on the configured measuring span of the analog output signal

Influence of ambient temperature and supply voltage on operation for thermocouples (TC) and voltage transmitters

Description	Standard	Ambient temperature: Influence ($\pm$) per 1 °C (1.8 °F) change		Supply voltage: Influence ($\pm$) per V change	
		Digital ¹⁾	D/A ²⁾	Digital	D/A ²⁾
		Based on measured value		Based on measured value	
Type A (30)	IEC 60584-1 ASTM E230-3	0.003% * (MV - LRV), at least 0.01 °C (0.018 °F)	0.003 %	0.0012% * (MV - LRV), at least 0.013 °C (0.023 °F)	0.003 %

Description	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change		Supply voltage: Influence (±) per V change	
		Digital ¹⁾	D/A ²⁾	Digital	D/A ²⁾
Type B (31)		≤ 0.04 °C (0.072 °F)	0.003 %	≤ 0.02 °C (0.036 °F)	0.003 %
Type C (32)	IEC 60584-1 ASTM E230-3 ASTM E988-96	0.0021% * (MV - LRV), at least 0.01 °C (0.018 °F)		0.0012% * (MV - LRV), at least 0.013 °C (0.023 °F)	
Type D (33)	ASTM E988-96	0.0019% * (MV - LRV), at least 0.01 °C (0.018 °F)		0.0011% * (MV - LRV), at least 0.0 °C (0.0 °F)	
Type E (34)	IEC 60584-1 ASTM E230-3	0.0014% * (MV - LRV), at least 0.0 °C (0.0 °F)		0.0008% * (MV - LRV), at least 0.0 °C (0.0 °F)	
Type J (35)		0.0014% * (MV - LRV), at least 0.0 °C (0.0 °F)		0.0008% * MV, at least 0.0 °C (0.0 °F)	
Type K (36)		0.0015% * (MV - LRV), at least 0.0 °C (0.0 °F)		0.0009% * (MV - LRV), at least 0.0 °C (0.0 °F)	
Type N (37)		0.0014% * (MV - LRV), at least 0.02 °C (0.036 °F)		0.0008% * MV, at least 0.0 °C (0.0 °F)	
Type R (38)		≤ 0.03 °C (0.054 °F)		≤ 0.02 °C (0.036 °F)	
Type S (39)	DIN 43710	≤ 0.03 °C (0.054 °F)		≤ 0.02 °C (0.036 °F)	
Type T (40)		≤ 0.01 °C (0.018 °F)		≤ 0.0 °C (0.0 °F)	
Type L (41)		≤ 0.01 °C (0.018 °F)		≤ 0.01 °C (0.018 °F)	
Type U (42)		≤ 0.01 °C (0.018 °F)		≤ 0.0 °C (0.0 °F)	
Type L (43)		GOST R8.585-2001		≤ 0.01 °C (0.018 °F)	
Voltage transmitter (mV)					
−20 to 100 mV	-	0.0015% * MV	0.003 %	0.0008% * MV	0.003 %

1) Measured value transmitted via HART.

2) Percentages based on the configured span of the analog output signal

MV = Measured value

LRL = Lower range limit of relevant sensor

MR = Measuring range of the relevant sensor

Total measurement error of transmitter at current output =
 $\sqrt{(\text{Measurement error digital}^2 + \text{Measurement error D/A}^2)}$

Long-term drift, resistance thermometers (RTD) and resistance transmitters

Description	Standard	Long-term drift (±) ¹⁾		
		after 1 year	after 3 years	after 5 years
		Based on measured value		
Pt100 (1)	IEC 60751:2008	≤ 0.007% * (MV - LRL) or 0.02 °C (0.04 °F)	≤ 0.0093% * (MV - LRL) or 0.03 °C (0.05 °F)	≤ 0.0102% * (MV - LRL) or 0.03 °C (0.05 °F)
Pt200 (2)		0.09 °C (0.17 °F)	0.12 °C (0.27 °F)	0.13 °C (0.24 °F)
Pt500 (3)		≤ 0.068% * (MV - LRL) or 0.03 °C (0.06 °F)	≤ 0.011% * (MV - LRL) or 0.03 °C (0.05 °F)	≤ 0.0124% * (MV - LRL) or 0.04 °C (0.07 °F)
Pt1000 (4)		≤ 0.0088% * (MV - LRL) or 0.02 °C (0.04 °F)	≤ 0.0114% * (MV - LRL) or 0.03 °C (0.05 °F)	≤ 0.013% * (MV - LRL) or 0.03 °C (0.05 °F)
Pt100 (5)	JIS C1604:1984	≤ 0.007% * (MV - LRL) or 0.02 °C (0.04 °F)	≤ 0.0093% * (MV - LRL) or 0.03 °C (0.05 °F)	≤ 0.0102% * (MV - LRL) or 0.03 °C (0.05 °F)
Pt50 (8)	GOST 6651-94	≤ 0.0076% * (MV - LRL) or 0.04 °C (0.08 °F)	≤ 0.01% * (MV - LRL) or 0.06 °C (0.11 °F)	≤ 0.011% * (MV - LRL) or 0.07 °C (0.12 °F)

Description	Standard	Long-term drift ($\pm$) ¹⁾		
Pt100 (9)	DIN 43760 IPTS-68	$\leq 0.007\% \text{ * (MV - LRL) or } 0.02 \text{ °C (0.04 °F)}$	$\leq 0.0093\% \text{ * (MV - LRL) or } 0.03 \text{ °C (0.05 °F)}$	$\leq 0.0102\% \text{ * (MV - LRL) or } 0.03 \text{ °C (0.05 °F)}$
Ni100 (6)		$0.02 \text{ °C (0.04 °F)}$	$0.02 \text{ °C (0.04 °F)}$	$0.02 \text{ °C (0.04 °F)}$
Ni120 (7)				
Cu50 (10)	OIML R84: 2003 / GOST 6651-2009	$0.04 \text{ °C (0.07 °F)}$	$0.05 \text{ °C (0.09 °F)}$	$0.05 \text{ °C (0.09 °F)}$
Cu100 (11)		$0.02 \text{ °C (0.04 °F)}$	$0.03 \text{ °C (0.05 °F)}$	$0.04 \text{ °C (0.07 °F)}$
Ni100 (12)		$0.02 \text{ °C (0.04 °F)}$	$0.02 \text{ °C (0.04 °F)}$	$0.02 \text{ °C (0.04 °F)}$
Ni120 (13)				
Cu50 (14)	OIML R84: 2003 / GOST 6651-94	$0.04 \text{ °C (0.07 °F)}$	$0.05 \text{ °C (0.09 °F)}$	$0.05 \text{ °C (0.09 °F)}$
Resistance transmitter				
10 to 400 Ω		$\leq 0.0055\% \text{ * MV or } 7.4 \text{ m}\Omega$	$\leq 0.0073\% \text{ * MV or } 9.7 \text{ m}\Omega$	$\leq 0.008\% \text{ * (MV - LRL) or } 10.7 \text{ m}\Omega$
10 to 2000 Ω		$\leq 0.007\% \text{ * (MV - LRL) or } 47 \text{ m}\Omega$	$\leq 0.009\% \text{ * (MV - LRL) or } 60 \text{ m}\Omega$	$\leq 0.0067\% \text{ * (MV - LRL) or } 67 \text{ m}\Omega$

1) The larger value is valid

Long-term drift, thermocouples (TC) and voltage transmitters

Description	Standard	Long-term drift ($\pm$) ¹⁾		
		after 1 year	after 3 years	after 5 years
		Based on measured value		
Type A (30)	IEC 60584-1 ASTM E230-3	$\leq 0.044\% \text{ * (MV - LRL) or } 0.70 \text{ °C (1.26 °F)}$	$\leq 0.058\% \text{ * (MV - LRL) or } 0.93 \text{ °C (1.67 °F)}$	$\leq 0.063\% \text{ * (MV - LRL) or } 1.01 \text{ °C (1.82 °F)}$
Type B (31)		$1.66 \text{ °C (2.99 °F)}$	$2.19 \text{ °C (3.94 °F)}$	$2.39 \text{ °C (4.30 °F)}$
Type C (32)	IEC 60584-1 ASTM E230-3 ASTM E988-96	$0.70 \text{ °C (1.26 °F)}$	$0.92 \text{ °C (1.66 °F)}$	$1.00 \text{ °C (1.80 °F)}$
Type D (33)	ASTM E988-96	$0.87 \text{ °C (1.57 °F)}$	$1.15 \text{ °C (2.07 °F)}$	$1.26 \text{ °C (2.27 °F)}$
Type E (34)	IEC 60584-1 ASTM E230-3	$0.26 \text{ °C (0.47 °F)}$	$0.34 \text{ °C (0.61 °F)}$	$0.37 \text{ °C (0.67 °F)}$
Type J (35)		$0.31 \text{ °C (0.56 °F)}$	$0.41 \text{ °C (0.74 °F)}$	$0.44 \text{ °C (0.79 °F)}$
Type K (36)		$0.36 \text{ °C (0.65 °F)}$	$0.47 \text{ °C (0.85 °F)}$	$0.51 \text{ °C (0.92 °F)}$
Type N (37)		$0.52 \text{ °C (0.94 °F)}$	$0.69 \text{ °C (1.24 °F)}$	$0.75 \text{ °C (1.35 °F)}$
Type R (38)		$1.28 \text{ °C (2.30 °F)}$	$1.69 \text{ °C (3.04 °F)}$	$1.85 \text{ °C (3.33 °F)}$
Type S (39)		$1.29 \text{ °C (2.32 °F)}$	$1.70 \text{ °C (3.06 °F)}$	
Type T (40)		$0.38 \text{ °C (0.68 °F)}$	$0.50 \text{ °C (0.90 °F)}$	$0.54 \text{ °C (0.97 °F)}$
Type L (41)		$0.25 \text{ °C (0.45 °F)}$	$0.33 \text{ °C (0.59 °F)}$	$0.36 \text{ °C (0.65 °F)}$
Type U (42)	DIN 43710	$0.37 \text{ °C (0.67 °F)}$	$0.49 \text{ °C (0.88 °F)}$	$0.53 \text{ °C (0.95 °F)}$
Type L (43)	GOST R8.585-2001	$0.31 \text{ °C (0.56 °F)}$	$0.41 \text{ °C (0.74 °F)}$	$0.44 \text{ °C (0.79 °F)}$
Voltage transmitter (mV)				
-20 to 100 mV		$\leq 0.025\% \text{ * MV or } 8.4 \text{ }\mu\text{V}$	$\leq 0.033\% \text{ * MV or } 11 \text{ }\mu\text{V}$	$\leq 0.036\% \text{ * MV or } 12 \text{ }\mu\text{V}$

1) The larger value is valid

Analog output long-term drift

Long-term drift D/A ¹⁾ (±)		
after 1 year	after 3 years	after 5 years
0.030%	0.036%	0.038%

1) Percentages based on the configured measuring span of the analog output signal.

Influence of the reference junction	Pt100 DIN IEC 60751 Cl. B (internal reference junction with thermocouples TC) If an external 2-wire Pt100 is used for the reference junction measurement, the measurement error caused by the transmitter is < 0.5 °C (0.9 °F). The measurement error of the sensor element must be taken into consideration.
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13.5 Environment

Ambient temperature range	<table> <tr> <td>Head transmitter/DIN rail transmitter</td><td>-40 to 85 °C (-40 to 185 °F); for hazardous areas, see Ex documentation.</td></tr> </table>	Head transmitter/DIN rail transmitter	-40 to 85 °C (-40 to 185 °F); for hazardous areas, see Ex documentation.
Head transmitter/DIN rail transmitter	-40 to 85 °C (-40 to 185 °F); for hazardous areas, see Ex documentation.		

Storage temperature	Head transmitter	-50 to +100 °C (-58 to +212 °F)
	DIN rail transmitter	-40 to +100 °C (-40 to +212 °F)

Relative humidity	■ Condensation: ■ Head transmitter permitted ■ DIN rail transmitter not permitted ■ Max. rel. humidity: 95% as per IEC 60068-2-30
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Operating altitude	Up to 4 000 m (13 123 ft) above sea level.
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Climate class	■ Head transmitter: climate class C1 as per EN 60654-1 ■ DIN rail transmitter: climate class B2 as per IEC 60654-1
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Degree of protection	■ Head transmitter with screw or push-in terminals: IP 20. In the installed state, it depends on the terminal head or field housing used. ■ DIN rail transmitter: IP 20
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Shock and vibration resistance	Vibration resistance as per DNVGL-CG-0339: 2015 and DIN EN 60068-2-27 ■ Head transmitter: 2 to 100 Hz at 4g (increased vibration stress) ■ DIN rail transmitter: 2 to 100 Hz at 0.7 g (general vibration stress) Shock resistance as per KTA 3505 (section 5.8.4 Shock test)
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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. All tests were passed both with and without ongoing digital HARTcommunication. Maximum measurement error <1% of measuring range. Interference immunity as per IEC/EN 61326 series, industrial requirements
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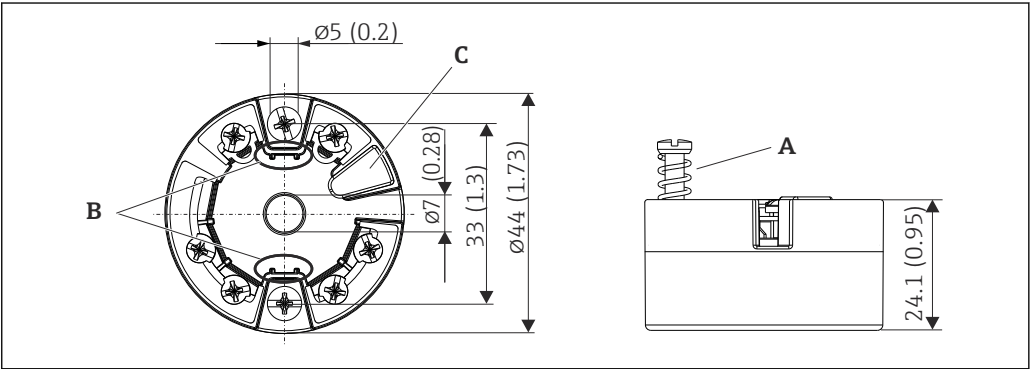
Interference emission as per IEC/EN 61326 series, Class B equipment

Overvoltage category	Overvoltage category II
Pollution degree	Pollution degree 2
Protection class	Protection class III

13.6 Mechanical construction

Design and dimensions	Dimensions in mm (in)
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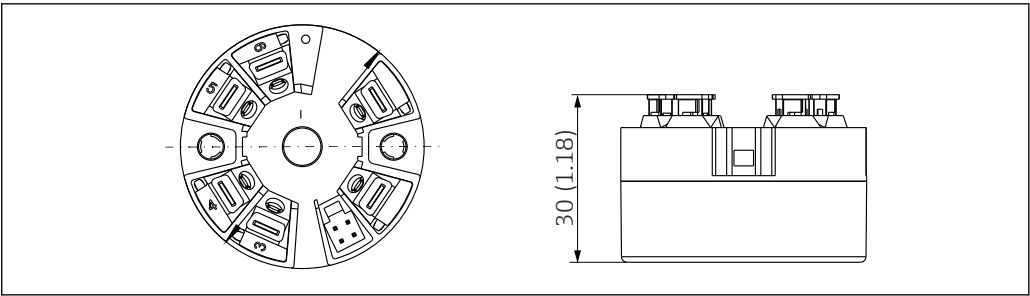
Head transmitter



A0036303

19 Version with screw terminals

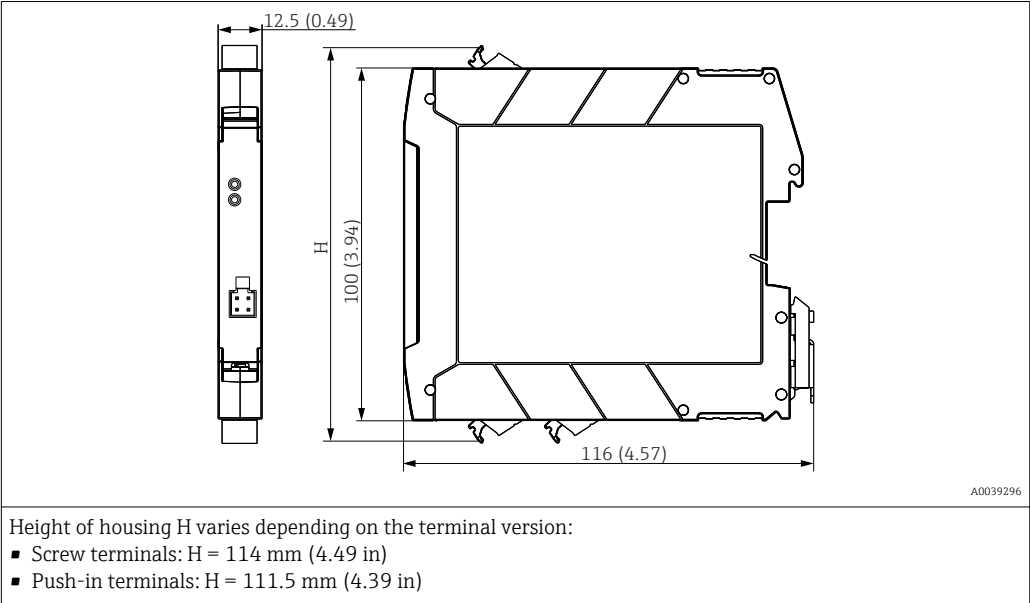
- A Spring travel $L \geq 5\text{ mm}$ (not for US - M4 securing screws)
- B Mounting elements for attachable measured value display TID10
- C Interface for connecting measured value display or configuration tool



A0036304

20 Version with push-in terminals. Dimensions are identical to the version with screw terminals, apart from housing height.

DIN rail transmitter/version with power supply source at the top

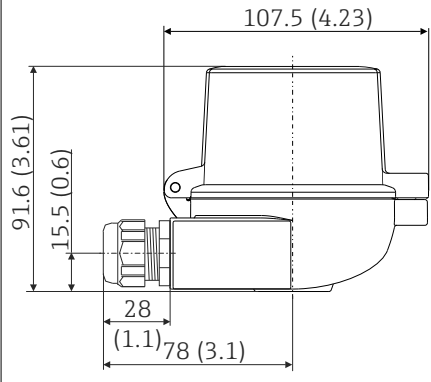


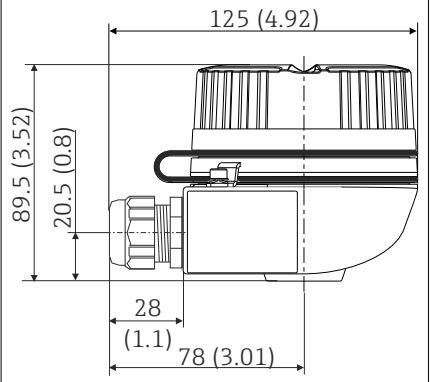
Field housing

All field housings have an internal geometry in accordance with DIN EN 50446, form B (flat face). Cable glands in the diagrams: M20x1.5

Maximum ambient temperatures for cable glands	
Type	Temperature range
Polyamide cable gland ½" NPT, M20x1.5 (non-Ex)	–40 to +100 °C (–40 to 212 °F)
Polyamide cable gland M20x1.5 (for dust ignition-proof area)	–20 to +95 °C (–4 to 203 °F)
Brass cable gland ½" NPT, M20x1.5 (for dust ignition-proof area)	–20 to +130 °C (–4 to +266 °F)

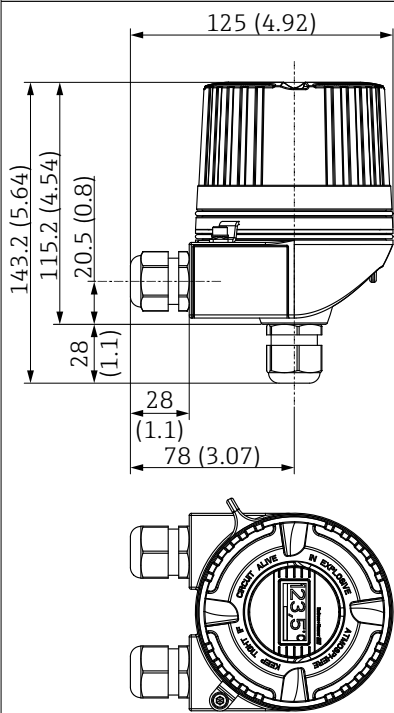
TA30A	Specification
Technical drawing of the TA30A field housing. The drawing shows a side view with dimensions: 107.5 (4.23) for the top width, 68.5 (2.7) for the total height, 15.5 (0.6) for the mounting bracket height, 28 (1.1) for the mounting bracket width, and 78 (3.1) for the base width.	■ Two cable entries ■ Material: aluminum, polyester powder coated - Seals: silicone ■ Degree of protection: ■ IP66/68 (NEMA Type 4x encl.) ■ For ATEX: IP66/67 ■ Cable entry glands: NPT ½" and M20x1.5 ■ Head color: blue, RAL 5012 ■ Cap color: gray, RAL 7035 ■ Weight: 330 g (11.64 oz)

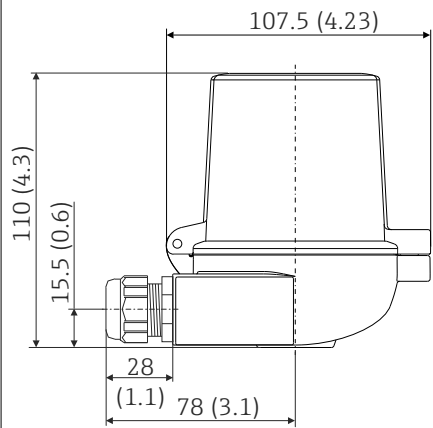
TA30A with display window in cover	Specification
	- Two cable entries - Material: aluminum, polyester powder coated - Seals: silicone - Protection degree: - IP66/68 (NEMA Type 4x encl.) - For ATEX: IP66/67 - Cable entry glands: NPT ½" and M20x1.5 - Head color: blue, RAL 5012 - Cap color: gray, RAL 7035 - Weight: 420 g (14.81 oz) - Display window: single-pane safety glass according to DIN 8902 - Display window in cover for head transmitter with TID10 display

TA30H	Specification
	- Flameproof (XP) version, explosion-protected, captive screw cap, with two cable entries - Degree of protection: IP 66/68, NEMA Type 4x Encl. Ex-version: IP 66/67 - Material: - Aluminum, with polyester powder coating - Stainless steel 316L without coating - Dry lubricant Klüber Syntheso Glep 1 - Cable entry glands: NPT ½", M20x1.5 - Color of aluminum head: blue, RAL 5012 - Color of aluminum cap: gray, RAL 7035 - Weight: - Aluminum approx. 640 g (22.6 oz) - Stainless steel approx. 2 400 g (84.7 oz) i When the housing cover is unscrewed: Before fastening, clean the threads in the cover and on the lower part of the housing and lubricate if necessary (recommended lubricant: Klüber Syntheso Glep 1).

TA30H with display window in cover	Specification
A0009831	■ Flameproof (XP) version, explosion-protected, captive screw cap, with two cable entries ■ Degree of protection: IP 66/68, NEMA Type 4x Encl. Ex-version: IP 66/67 ■ Material: ■ Aluminum with polyester powder coating ■ Stainless steel 316L without coating ■ Dry lubricant Klüber Syntheso Glep 1 ■ Display window: single-pane safety glass according to DIN 8902 ■ Cable entry glands: NPT ½", M20x1.5 ■ Color of aluminum head: blue, RAL 5012 ■ Color of aluminum cap: gray, RAL 7035 ■ Weight: ■ Aluminum approx. 860 g (30.33 oz) ■ Stainless steel approx. 2 900 g (102.3 oz) ■ For display TID10 i When the housing cover is unscrewed: Before fastening, clean the threads in the cover and on the lower part of the housing and lubricate if necessary (recommended lubricant: Klüber Syntheso Glep 1).

TA30H with three cable entries	Specification
A0055299	■ Flameproof (XP) version, explosion-protected, captive screw cap, with three cable entries (two at the front, one at the bottom) with grounding screw ■ Protection class: NEMA Type 4x Encl. ■ Material: ■ Aluminum, with polyester powder coating ■ Dry lubricant Klüber Syntheso Glep 1 ■ Cable entry glands: ½" NPT ■ Color of head: blue, RAL 5012 ■ Color of cap: gray, RAL 7035 ■ Weight: approx. 640 g (22.6 oz) i When the housing cover is unscrewed: Before screwing it on, clean the threads in the cover and on the lower part of the housing and lubricate if necessary (recommended lubricant: Klüber Syntheso Glep 1).

TA30H with three cable entries and display window in cover	Specification
 Technical drawing of the TA30H device. The side view shows a total height of 143.2 (5.64) mm, with a mounting bracket height of 115.2 (4.54) mm and a base height of 20.5 (0.8) mm. The base has a width of 28 (1.1) mm. The front view shows a total width of 125 (4.92) mm and a base width of 78 (3.07) mm. A bottom view shows a circular base with three cable entry points and a central display window. The drawing is labeled A0055300.	■ Flameproof (XP) version, explosion-protected, captive screw cap, with three cable entries (two at the front, one at the bottom), with grounding screw ■ Protection class: NEMA Type 4x Encl. ■ Material: ■ Aluminum with polyester powder coating ■ Stainless steel 316L without coating ■ Dry lubricant Klüber Syntheso Glep 1 ■ Display window: single-pane safety glass according to DIN 8902 ■ Cable entry glands: ½" NPT ■ Color of aluminum head: blue, RAL 5012 ■ Color of aluminum cap: gray, RAL 7035 ■ Weight: ■ Aluminum approx. 860 g (30.33 oz) ■ Stainless steel approx. 2 900 g (102.3 oz) ■ For display TID10 i When the housing cover is unscrewed: Before screwing it on, clean the threads in the cover and on the lower part of the housing and lubricate if necessary (recommended lubricant: Klüber Syntheso Glep 1).

TA30D	Specification
 Technical drawing of the TA30D device. The side view shows a total height of 110 (4.3) mm, with a mounting bracket height of 15.5 (0.6) mm. The base has a width of 28 (1.1) mm. The front view shows a total width of 107.5 (4.23) mm and a base width of 78 (3.1) mm. The drawing is labeled A0009822.	■ 2 cable entries ■ Material: aluminum, polyester powder coated ■ Seals: silicone ■ Degree of protection: ■ IP66/68 (NEMA Type 4x encl.) ■ For ATEX: IP66/67 ■ Cable entry glands: NPT ½" and M20x1.5 ■ Two head transmitters can be mounted. In the standard configuration one transmitter is mounted in the terminal head cover and an additional terminal block is installed directly on the insert. ■ Head color: blue, RAL 5012 ■ Cap color: gray, RAL 7035 ■ Weight: 390 g (13.75 oz)

Weight	■ Head transmitter: approx. 40 to 50 g (1.4 to 1.8 oz) ■ Field housing: see specifications ■ DIN rail transmitter: approx. 100 g (3.53 oz)
Materials	All the materials used are RoHS-compliant.

- Housing: polycarbonate (PC)
- Terminals:
 - Screw terminals: nickel-plated brass and gold-plated or tin-plated contacts
 - Push-in terminals: tin-plated brass, contact springs 1.4310, 301 (AISI)
- Potting compound:
 - Head transmitter: QSIL 553
 - DIN rail housing: Silgel612EH

Field housing: see specifications

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**.

HART certification	The temperature transmitter is registered by the FieldComm Group. The device meets the requirements of the FieldComm Group HART Specifications, Revision 7.	
Radio approval	The device has Bluetooth® radio approval in accordance with the Radio Equipment Directive (RED) and the Federal Communications Commission (FCC) 15.247 for the USA.	
	Europe	This device meets the requirements of the Radio Equipment Directive RED 2014/53/EU: ■ EN 300 328 ■ EN 301 489-1 ■ EN 301 489-17

Canada and USA	
English: This device complies with Part 15 of the FCC Rules and with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: ■ This device may not cause harmful interference, and ■ This device must accept any interference received, including interference that may cause undesired operation. Changes or modifications made to this equipment not expressly approved by the manufacturer may void the user's authorization to operate this equipment. This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: ■ Reorient or relocate the receiving antenna. ■ Increase the separation between the equipment and receiver. ■ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. ■ Consult the dealer or an experienced radio/TV technician for help. This equipment complies with FCC and IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.	Français: Le présent appareil est conforme aux CNR d'industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : ■ L'appareil ne doit pas produire de brouillage, et ■ L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement. Les changements ou modifications apportées à cet appareil non expressément approuvée par le fabricant peut annuler l'autorisation de l'utilisateur d'opérer cet appareil. Déclaration d'exposition aux radiations: Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

MTTF

- Without Bluetooth® wireless technology: 168 years
- With Bluetooth® wireless technology: 123 years

The mean time to failure (MTTF) denotes the theoretically expected time until the device fails during normal operation. The term MTTF is used for systems that cannot be repaired, e.g. temperature transmitters.

13.8 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.

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the product configuration:

Document type	Purpose and content of the document
Technical Information (TI)	Planning aid This document contains all the technical data on the product and provides an overview of everything that can be ordered with the product.
Brief Operating Instructions (KA)	Quick guide to obtaining the first measured value The Operating Instructions contain all the essential information about the product from incoming acceptance to initial commissioning.
Operating Instructions (BA)	Reference The Operating Instructions contain the information that is required in the various phases of the life cycle of the product: 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 parameters The document contains detailed explanations of readable or configurable parameters in the product. The description is aimed at those who work with the product over its entire life cycle and perform specific configurations.
Safety Instructions (XA)	Safety Instructions for electrical equipment in hazardous areas are supplied with the product depending on the approval. These are an integral part of the Operating Instructions.  The nameplate indicates the Safety Instructions (XA) that are relevant to the product.
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 product documentation.

14 Operating menu and parameter description

 The following tables list all the parameters in the "Guidance, Diagnostics, Application and System" operating menus. The page number refers to where a description of the parameter can be found.

Depending on the parameter configuration, not all submenus and parameters are available in every device. Information on this can be found in the parameter description under "Prerequisite".

This symbol  indicates how to navigate to the parameter using operating tools.

Guidance →	Commissioning →	 Commissioning wizard Start	→  35
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Guidance →	Create documentation ¹⁾		
	Save / restore ¹⁾		
	Compare ¹⁾		

1) These parameters only appear in FDT/DTM-based operating tools, such as Endress+Hauser's FieldCare and DeviceCare

Diagnostics →	Actual diagnostics →	Actual diagnostics 1	→  71
		Operating time	→  71

Diagnostics →	Diagnostic list →	Actual diagnostics 1, 2, 3	→  71
		Actual diag channel 1, 2, 3	→  71
		Timestamp 1, 2, 3	→  72

Diagnostics →	Event logbook →	Previous diagnostics n	→  72
		Previous diag n channel	→  72
		Timestamp n	→  73

Diagnostics →	Simulation →	Diagnostic event simulation	→  73
		Current output simulation	→  73
		Current output value	→  73
		Sensor simulation	→  74
		Sensor simulation value	→  74

Diagnostics →	Diagnostic settings →	Properties →	Alarm delay	→  74
			Limit corrosion detection	→  75
			Sensor line resistance	→  75
			Thermocouple diagnostic	→  75
		Diagnostic behavior →	Sensor, electronics, process, configuration	→  75
		Status signal →	Sensor, electronics, process, configuration	→  76

Diagnostics →	Min/max values →	Sensor min value	→  76
		Sensor max value	→  76
		Reset sensor min/max values	→  76
		Device temperature min.	→  77
		Device temperature max.	→  77
		Reset device temp. min/max values	→  77

Application →	Measured values →	Sensor value	→  77
		Sensor raw value	→  77
		Output current	→  77
		Percent of range	→  77
		Device temperature	→  77

Application →	Sensor →	Unit	→  79
		Sensor type	→  79
		Connection type	→  80
		2-wire compensation	→  80
		Reference junction	→  80
		RJ preset value	→  81
		Sensor offset	→  81

Application →	Sensor →	Linearization →	Call./v. Dusen coeff. R0, A, B, C	→  81
			Polynomial coeff. R0, A, B	→  82
			Sensor lower limit	→  82
			Sensor upper limit	→  83

Application →	Current output →	4 mA value	→  83
		20 mA value	→  83
		Failure mode	→  84
		Failure current	→  84
		Current trimming 4 mA	→  85
		Current trimming 20 mA	→  85
		Damping	→  85

Application →	HART configuration →	Assign current output (PV)	→  86
		Assign SV	→  86
		Assign TV	→  86
		Assign QV	→  86
		HART address	→  87
		No. of preambles	→  87

System →	Device management →	HART short tag	→  87
		Device tag	→  88
		Mains filter	→  88
		Locking status	→  88
		Device reset	→  88
		Configuration counter	→  89
		Configuration changed	→  89
		Reset configuration changed flag	→  89

System →	User management →	Define password →	New password	→  90
			Confirm new password	→  91
			Status password entry	→  91
		Change user role →	Password ¹⁾	→  91
			Status password entry	→  91
		Reset password →	Reset password	→  92
			Status password entry	→  92
		Change password →	Old password	→  93
			New password	→  93
			Confirm new password	→  93
			Status password entry	→  93
		Delete password →	Delete password	→  93

1) The required user role must first be selected here when operating the device via the Configuration app.

System →	Bluetooth configuration →	Bluetooth	→  93
		Change Bluetooth password ¹⁾	→  94

1) Function is only visible in the Configuration app

System →	Information →	Device →	Squawk	→  94
			Serial number	→  94
			Order code	→  95
			Firmware version	→  95
			Hardware revision	→  95
			Extended order code (n) ¹⁾	→  95
			Device name	→  96
			Manufacturer	→  96

1) n = 1, 2, 3

System →	Information →	Device location →	Latitude	→  96
			Longitude	→  96
			Altitude	→  96
			Location method	→  97

	Location description	→ ⓘ 97
	Process unit TAG	→ ⓘ 97

System →	Information →	HART info →	Device type	→ ⓘ 98
			Device revision	→ ⓘ 98
			HART revision	→ ⓘ 98
			HART descriptor	→ ⓘ 98
			HART message	→ ⓘ 99
			Hardware revision	→ ⓘ 99
			Software revision	→ ⓘ 99
			HART date code	→ ⓘ 99
			Manufacturer ID	→ ⓘ 99
			Device ID	→ ⓘ 100

System →	Display →	Display interval	→ ⓘ 100
		Format display	→ ⓘ 100
		Value 1 display	→ ⓘ 101
		Decimal places 1	→ ⓘ 101
		Value 2 display	→ ⓘ 101
		Decimal places 2	→ ⓘ 101
		Value 3 display	→ ⓘ 101
		Decimal places 3	→ ⓘ 101

14.1 Menu: Diagnostics

14.1.1 Submenu: Actual diagnostics

Actual diagnostics 1

Navigation	 Diagnostics → Actual diagnostics → Actual diagnostics 1
Description	Displays the current diagnostic message. If two or more messages occur simultaneously, the message with the highest priority is shown on the display.
Additional information	Example for display format: F041-Sensor interrupted

Operating time

Navigation	 Diagnostics → Actual diagnostics → Operating time
Description	Displays the length of time the device has been in operation.
User interface	Hours (h)

14.1.2 "Diagnostic list" submenu

 n = Number of diagnostic messages (n = 1 to 3)

Actual diagnostics n

Navigation	 Diagnostics → Actual diagnostics → Actual diagnostics n
Description	Displays the current diagnostic message. If two or more messages occur simultaneously, the message with the highest priority is shown on the display.
Additional information	Example for display format: F041-Sensor interrupted

Actual diag channel n

Navigation	 Diagnostics → Actual diagnostics → Actual diag channel n
Description	Displays the function module to which the diagnostic message refers.

User interface	■ Device ■ Sensor ■ Device temperature ■ Current output ■ Sensor RJ
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Time stamp n

Navigation	 Diagnostics → Actual diagnostics → Time stamp n
Description	Displays the time stamp of the current diagnostic message in relation to the operating time.
User interface	Hours (h)

14.1.3 "Event logbook" submenu

 n = Number of diagnostic messages (n = 1 to 10). The last 10 messages are listed in chronological order.

Previous diagnostics n

Navigation	 Diagnostics → Event logbook → Previous diagnostics n
Description	Displays the diagnostic messages that occurred in the past. The last 10 messages are listed in chronological order.
User interface	Symbol for event behavior and diagnostic event.
Additional information	Example for display format: F201-Electronics faulty

Previous diag n channel

Navigation	 Diagnostics → Event logbook → Previous diag n channel
Description	Displays the function module to which the diagnostic message refers.
User interface	■ Device ■ Sensor ■ Device temperature ■ Current output ■ Sensor RJ

Time stamp n

Navigation	 Diagnostics → Event logbook → Time stamp n
Description	Displays the time stamp of the current diagnostic message in relation to the operating time.
User interface	Hours (h)

14.1.4 "Simulation" submenu

Diagnostic event simulation

Navigation	 Diagnostics → Simulation → Diagnostic event simulation
Description	Switches diagnostic simulation on and off.
Selection	Enter one of the diagnostic events using the dropdown menu →  41. The assigned status signals and diagnostic behaviors are used in the simulation mode. Select 'Off' to quit the simulation. Example: x043 Short circuit
Factory setting	Off

Current output simulation

Navigation	 Diagnostics → Simulation → Current output simulation
Description	Use this function to switch simulation of the current output on and off. The status signal indicates a category "C" diagnostic message ("function check") while the simulation is running.
Selection	■ Off ■ On
Factory setting	Off

Value current output

Navigation	 Diagnostics → Simulation → Value current output
-------------------	---

Description	Use this function to set a current value for the simulation. In this way, users can verify the correct adjustment of the current output and the correct function of downstream switching units.
User entry	3.58 to 23 mA
Factory setting	3.58 mA

Sensor simulation

Navigation	 Diagnostics → Simulation → Sensor simulation
Description	Use this function to enable the simulation of the process variable. The simulation value of the process variable is defined in the Sensor simulation value parameter.
Selection	■ Off ■ On
Factory setting	Off

Sensor simulation value

Navigation	 Diagnostics → Simulation → Sensor simulation value
Description	Use this function to enter a simulation value for the process variable. Subsequent measured value processing and the signal output use this simulation value. In this way, users can verify whether the measuring device has been configured correctly.
User entry	$-1.0 \cdot 10^{20}$ to $+1.0 \cdot 10^{20}$ °C
Factory setting	0.00 °C

14.1.5 "Diagnostic settings" submenu

Submenu: Properties

Alarm delay

Navigation	 Diagnostics → Diagnostic settings → Properties → Alarm delay
Description	Use this function to set the delay time during which a diagnostics signal is suppressed before it is output.
User entry	0 to 5 s

Factory setting 2 s

Limit corrosion detection

Navigation  Diagnostics → Diagnostic settings → Properties → Limit corrosion detection

Prerequisite A 4-wire RTD or TC must be selected as the sensor type or connection type. →  79

Description Use this function to enter the limit value for corrosion detection. If this value is exceeded, the device behaves as defined in the diagnostic settings.

User entry 5 to 10 000 Ω

Factory setting

- 50.0 Ω for 4-wire RTD connection type
- 5 000 Ω for TC connection type

Sensor line resistance

Navigation  Diagnostics → Diagnostic settings → Properties → Sensor line resistance

Prerequisite A 4-wire RTD or TC must be selected as the sensor type or connection type. →  79

Description Displays the highest measured resistance value of the sensor lines.

User interface $-1.0 \cdot 10^{20}$ to $+1.0 \cdot 10^{20}$ Ω

Thermocouple diagnostic

Navigation  Diagnostics → Diagnostic settings → Properties → Thermocouple diagnostic

Description Use this function to switch off the "Sensor corrosion" and "Sensor break" diagnostic functions during thermocouple measurement.

 This may be necessary in order to connect electronic simulators (e.g. calibrators) during a thermocouple measurement. The accuracy of the transmitter is not influenced by either the activation or deactivation of the thermocouple diagnostics function.

Selection

- On
- Off

Factory setting On

Diagnostic behavior

Navigation	 Diagnostics → Diagnostic settings → Diagnostic behavior
Description	Each diagnostic event is assigned a certain diagnostic behavior. The user can change this assignment for certain diagnostic events. →  41
Selection	■ Alarm ■ Warning ■ Disabled
Factory setting	See the list of diagnostic events →  42

Status signal

Navigation	 Diagnostics → Diagnostic settings → Status signal
Description	Each diagnostic event is assigned a certain status signal at the factory. The user can change this assignment for certain diagnostic events. →  41
Selection	■ Failure (F) ■ Function check (C) ■ Out of specification (S) ■ Maintenance required (M) ■ No effect (N)
Factory setting	See the list of diagnostic events →  41

14.1.6 "Min/max values" submenu

Sensor min value

Navigation	 Diagnostics → Min/max values → Sensor min value
Description	Displays the minimum temperature measured in the past at the sensor input (minimum indicator).

Sensor max value

Navigation	 Diagnostics → Min/max values → Sensor max value
Description	Displays the maximum temperature measured in the past at the sensor input (maximum indicator).

Reset sensor min/max values

Navigation	 Diagnostics → Min/max values → Reset sensor min/max values
Description	Resets the min/max values of the sensor to their default values.
User entry	Clicking the Reset sensor min/max values button activates the reset function. As a result of this action, the min/max values of the sensor only display the reset, temporary values.

Device temperature min.

Navigation	 Diagnostics → Min/max values → Device temperature min.
Description	Displays the minimum electronics temperature measured in the past (minimum indicator).

Device temperature max.

Navigation	 Diagnostics → Min/max values → Device temperature max.
Description	Displays the maximum electronics temperature measured in the past (maximum indicator).

Reset device temp. min/max values

Navigation	 Diagnostics → Min/max values → Reset device temp. min/max values
Description	Resets the peakhold indicators for the minimum and maximum electronic temperatures measured.
User entry	Clicking the Reset device temperature min/max values button activates the reset function. As a result of this action, the min/max values for the device temperature only display the reset, temporary values.

14.2 Menu: Application

14.2.1 Submenu: Measured values

Sensor value

Navigation	 Application → Measured values → Sensor value
Description	Use this function to display the current measured value at the sensor input.

Sensor raw value

Navigation	 Application → Measured values → Sensor raw value
Description	Use this function to display the non-linearized mV/Ohm value at the specific sensor input.

Output current

Navigation	 Application → Measured values → Output current
Description	Use this function to view the calculated output current in mA.

Percent of range

Navigation	 Application → Measured values → Percent of range
Description	Indication of the measured value in percent of range

Device temperature

Navigation	 Application → Measured values → Device temperature
Description	Indication of the current temperature of the electronics.

PV

Navigation	 Application → Measured values → PV
Description	Displays the primary device variable.

SV

Navigation	 Application → Measured values → SV
Description	Displays the secondary device variable.

TV

Navigation  Application → Measured values → TV

Description Displays the tertiary device variable.

QV

Navigation  Application → Measured values → QV

Description Displays the quaternary (fourth) device variable.

14.2.2 Submenu: Sensor

Unit

Navigation  Application → Sensor → Unit

Description Selection of the unit for all measured values.

Selection

- °C
- °F
- K
- Ω
- mV

Factory setting °C

Additional information  Please note: If another unit has been selected instead of the factory setting (°C), all the set temperature values are converted to correspond to the configured temperature unit.
Example: 150 °C is set as the upper range value. Following the selection of °F as the engineering unit, the new (converted) upper range value = 302 °F.

Sensor type

Navigation  Application → Sensor → Sensor type

Description Use this function to select the sensor type for the sensor input

 Please observe the terminal assignment when connecting the sensors. →  17

Selection	A list of all the possible sensor types is provided in the 'Technical data' section. →  48
Factory setting	Pt100 IEC751

Connection type

Navigation	 Application → Sensor → Connection type
Prerequisite	An RTD sensor or a resistance transmitter must be specified as the sensor type.
Description	Use this function to select the connection type for the sensor.
Selection	2-wire, 3-wire, 4-wire
Factory setting	4-wire

2-wire compensation

Navigation	 Application → Sensor → 2-wire compensation
Prerequisite	An RTD sensor or a resistance transmitter with a 2-wire connection type must be specified as the sensor type.
Description	Setting of the resistance for the 2-wire RTD compensation.
User entry	0 to 30 Ω
Factory setting	0 Ω

Reference junction

Navigation	 Application → Sensor → Reference junction
Prerequisite	A thermocouple (TC) sensor must be selected as the sensor type.
Description	Selection of reference junction measurement for temperature compensation in thermocouples.  If Fixed Value is selected, the compensation value is specified via the RJ preset value parameter.
Selection	■ Internal measurement: the internal reference junction temperature is used. ■ Fixed Value: a fixed value is used. ■ Measured value of external sensor: The measured value of an RTD Pt100 2-wire sensor which is connected to terminals 4 and 6 is used.

Factory setting Internal measurement

RJ preset value

Navigation  Application → Sensor → RJ preset value

Prerequisite The **Fixed Value** parameter must be set if the **Reference junction** option is selected.

Description The Fixed Value parameter must be set if the Reference junction n option is selected.

User entry -58 to +360

Factory setting 0.00

Sensor offset

Navigation  Application → Sensor → Sensor offset

Description Use this function to set the zero point correction (offset) of the sensor measured value. The value indicated is added to the measured value.

User entry -18.0 to +18.0

Factory setting 0.0

14.2.3 Submenu: Linearization

Call./v. Dusen coeff. R0

Navigation  Application → Sensor → Linearization → Call./v. Dusen coeff. R0

Prerequisite The RTD Platinum (Callendar/van Dusen) option is enabled in the **Sensor type** parameter.

Description Setting of the R0 value for the linearization based on the Callendar-Van Dusen method.

User entry 10 to 2 000 Ω

Factory setting 100.000 Ω

Call./v. Dusen coeff. A, B and C

Navigation	 Application → Sensor → Linearization → Call./v. Dusen coeff. A, B and C
Prerequisite	The RTD platinum (Callendar/Van Dusen) option is enabled in the Sensor type parameter.
Description	Use this function to set the coefficients for sensor linearization based on the Callendar-Van Dusen method.
User entry	■ A: 3.0e-003 to 4.0e-003 ■ B: -2.0e-006 to 2.0e-006 ■ C: -1.0e-009 to 1.0e-009
Factory setting	■ A: 3.90830e-003 ■ B: -5.77500e-007 ■ C: -4.18300e-012

Polynomial coeff. R0

Navigation	 Application → Sensor → Linearization → Polynomial coeff. R0
Prerequisite	The RTD poly nickel or RTD copper polynomial option is enabled in the Sensor type parameter.
Description	Use this function to set the R0 value for linearization of nickel/copper sensors.
User entry	10 to 2 000 Ω
Factory setting	100.00 Ω

Polynomial coeff. A, B

Navigation	 Application → Sensor → Linearization → Polynomial coeff. Polynomial coeff. A, B
Prerequisite	The RTD poly nickel or RTD copper polynomial option is enabled in the Sensor type parameter.
Description	Use this function to set the coefficients for sensor linearization of copper/nickel resistance thermometers.
User entry	■ Polynomial coeff. A: 4.0e-003 to 6.0e-003 ■ Polynomial coeff. B: -2.0e-005 to 2.0e-005
Factory setting	Polynomial coeff. A = 5.49630e-003 Polynomial coeff. B = 6.75560e-006

Sensor lower limit

Navigation	 Application → Sensor → Linearization → Sensor lower limit
Prerequisite	The RTD platinum, RTD poly nickel or RTD copper polynomial option is enabled in the Sensor type parameter.
Description	Use this function to set the lower calculation limit for special sensor linearization.
User entry	Depends on the sensor type selected.
Factory setting	Depends on the sensor type selected.

Sensor upper limit

Navigation	 Application → Sensor → Linearization → Sensor upper limit
Prerequisite	The RTD platinum, RTD poly nickel or RTD copper polynomial option is enabled in the Sensor type parameter.
Description	Use this function to set the upper calculation limit for special sensor linearization.
User entry	Depends on the sensor type selected.
Factory setting	Depends on the sensor type selected.

14.2.4 Submenu: Current output

4mA value

Navigation	 Application → Current output → 4mA value
Description	Use this function to assign a measured value to the current value 4 mA.
Factory setting	0 °C

20mA value

Navigation	 Application → Current output → 20mA value
Description	Use this function to assign a measured value to the current value 20 mA.
Factory setting	100 °C

Failure mode	
Navigation	 Application → Current output → Failure mode
Description	Use this function to select the signal on alarm level of the current output in the event of an error.
Selection	■ High alarm ■ Low alarm
Factory setting	Low alarm

Failure current	
Navigation	 Application → Current output → Failure current
Prerequisite	The High alarm option is enabled in the “Failure mode” parameter.
Description	Use this function to set the value the current output adopts in the event of a failure.
User entry	21.5 to 23 mA
Factory setting	22.5 mA

Adjustment of the analog output (4 and 20 mA current trimming)

Current trimming is used to compensate the analog output (D/A conversion). Here, the output current of the transmitter can be adapted so that it suits the value expected at the higher-level system.



Current trimming does not affect the digital HART value. This can cause the measured value shown on the locally installed display to differ marginally from the value displayed in the higher-level system.

Procedure

1. Start
↓
2. Install an accurate ammeter (more accurate than the transmitter) in the current loop.
↓
3. Switch on current output simulation and set the simulation value to 4 mA.
↓
4. Measure the loop current with the ammeter and make a note of the value.
↓
5. Set the simulation value to 20 mA.
↓
6. Measure the loop current with the ammeter and make a note of the value.
↓
7. Enter the current values determined as adjustment values in the Current trimming 4 mA / 20 mA parameters

↓
8. Deactivate simulation
↓
9. End

Current trimming 4 mA

Navigation	 Application → Current output → Current trimming 4 mA
Description	Use this function to set the correction value for the current output at the start of the measuring range at 4 mA.
User entry	3.85 to 4.15 mA
Factory setting	4 mA
Additional information	The trimming only affects the current loop values from 3.8 to 20.5 mA. The failure mode with Low Alarm and High Alarm current values is not subject to trimming.

Current trimming 20 mA

Navigation	 Application → Current output → Current trimming 20 mA
Description	Use this function to set the correction value for the current output at the end of the measuring range at 20 mA.
User entry	19.85 to 20.15 mA
Factory setting	20.000 mA
Additional information	The trimming only affects the current loop values from 3.8 to 20.5 mA. The failure mode with Low Alarm and High Alarm current values is not subject to trimming.

Damping

Navigation	 Application → Current output → Damping
Description	Use this function to set the time constant for current output damping.
User entry	0 to 120 s
Factory setting	0 s

Additional information

The current output responds to fluctuations in the measured value with an exponential delay. The time constant of this delay is defined by this parameter. If a low time constant is entered, the current output responds quickly to the measured value. On the other hand, the response of the current output is delayed significantly if a high time constant is entered.

14.2.5 Submenu: HART configuration

Assign current output (PV)

Navigation	 Application → HART configuration → Assign current output (PV)
Description	Use this function to assign the measured variables to the primary HART value (PV).
Display	Sensor
Factory setting	Sensor (fixed assignment)

Assign SV

Navigation	 Application → HART configuration → Assign SV
Description	Use this function to assign the measured variable to the secondary HART value (SV).
Display	Device temperature (fixed assignment)
Factory setting	Device temperature (fixed assignment)

Assign TV

Navigation	 Application → HART configuration → Assign TV
Description	Use this function to assign the measured variable to the tertiary HART value (TV).
Display	Sensor (fixed assignment)
Factory setting	Sensor (fixed assignment)

Assign QV

Navigation	 Application → HART configuration → Assign QV
------------	--

Description	Use this function to assign the measured variable to the quaternary (fourth) HART value (QV).
Display	Sensor (fixed assignment)
Factory setting	Sensor (fixed assignment)

HART address

Navigation	 Application → HART configuration → HART address
Description	Use this function to define the HART address of the device.  It is not possible to write to the parameter. The HART address can be set in FDT/DTM-based operating tools using the communication DTM. ¹⁾
	1) However, it cannot be set using the configuration app.
Factory setting	0
Additional information	Only with address "0" a measured value transmission via the current value is possible.

No. of preambles

Navigation	 Application → HART configuration → No. of preambles
Description	Use this function to define the number of preambles in the HART telegram.
User entry	5 to 20
Factory setting	5

14.3 Menu: System

14.3.1 Submenu: Device management

HART short tag

Navigation	 System → Device management → HART short tag
Description	Use this function to define a short tag for the measuring point.
User entry	Up to 8 alphanumeric characters (letters, numbers and special characters).
Factory setting	8 x '?'

Device tag

Navigation	 System → Device management → Device tag
Description	Use this function to enter a unique name for the measuring point so it can be identified quickly within the plant.
User entry	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /)
Factory setting	Depends on the product root and serial number EH_TMT72_serial number (TMT72)

Mains filter

Navigation	 System → Device management → Mains filter
Description	Use this function to select the mains filter for A/D conversion.
Selection	■ 50 Hz ■ 60 Hz
Factory setting	50 Hz

Locking status

Navigation	 System → Device management → Locking status
Description	Displays the device locking status. When write protection is activated, write access to the parameters is disabled.
User interface	Enabled or disabled check box: Locked by hardware

Device reset

Navigation	 System → Device management → Device reset
Description	Use this function to reset the device configuration - either entirely or in part - to a defined state.

Selection■ **Not active**

No action is executed and the user exits the parameter.

■ **To factory defaults**

All the parameters are reset to the factory setting.

■ **To delivery settings**

All the parameters are reset to the order configuration. The order configuration can differ from the factory setting if customer-specific parameter values were defined when the device was ordered.

■ **Restart device**

The device is restarted but the device configuration remains unchanged.

Factory setting

Not active

Configuration counter

Navigation

System → Device management → Configuration counter

Description

Displays the counter reading for changes to device parameters.



Static parameters, whose values change during optimization or configuration, cause this parameter to increase by 1. This supports parameter version management. If several parameters change, e. g. due to loading of parameters from the operating software etc. in the device, the counter can show a higher value. The counter cannot be reset and is also not reset to the default value when the device is reset. If the counter overflows, (16 bit), it starts again at 1.

Configuration changed

Navigation

System → Device management → Configuration changed

Description

Displays whether the configuration of the device has been changed by a master (primary or secondary).

Reset configuration changed flag

Navigation

System → Device management → Reset configuration changed flag

Description

The **Configuration changed** information is reset by a master (primary or secondary).

14.3.2 User management submenu

Define password → Maintenance	New password
	Confirm new password
	Status password entry

Change user role → Operator	Password ¹⁾
	Status password entry
Reset password → Operator	Reset password
	Status password entry
Change password → Maintenance	Old password
	New password
	Confirm new password
	Status password entry
Delete password → Maintenance	Delete password

1) The required user role must be selected here when operating the device via the Configuration app.

Navigation in the submenu is supported by the following operating elements:

- **Back**
Return to the previous page
- **Cancel**
If Cancel is selected, the status before the submenu was started is restored

Define password

Navigation	 System → User management → Define password
Description	Use this function to start password definition
User entry	Activate the button

New password

Navigation	 System → User management → Define password → New password
Description	Use this function to enter a password for the Maintenance user role to gain access to the relevant functions.
Additional information	If the factory setting is not changed, the device is set to the Maintenance user role. This means that the device's configuration data are not write-protected and can be edited at all times. Once a password has been defined, devices can be switched to the Maintenance user role if the correct password is entered in the Password parameter. A new password becomes valid once it has been verified after being entered in the Confirm new password parameter.
	 The password must contain a minimum of 4 and a maximum of 16 characters and can consist of both letters and numbers. Leading and trailing spaces not used as part of the password. If you lose your password, please contact your supplier.
User entry	 (enter the password)

Confirm new password

Navigation	 System → User management → Define password → Confirm new password
Description	Use this function to confirm the new password that has been defined.
Additional information	A new password becomes valid once it has been verified after being entered in the Confirm new password parameter. The password must contain a minimum of 4 and a maximum of 16 characters and can consist of both letters and numbers. If you lose your password, please contact your supplier.
User entry	 (enter the password)

Status password entry

Navigation	 System → User management → Define password → Status password entry
Description	Displays the status of the password verification. ■ Password accepted ■ Wrong password ■ Password rules violated ■ Permission denied ■ Incorrect input sequence ■ Invalid user role ■ Confirm PW mismatch ■ Reset password accepted

Enter password

Navigation	 System → User management → Enter password
Prerequisite	The Operator user role is active and a password has been defined.
Description	Use this function to enter a password for the selected user role to gain access to the functions of this role.
User entry	Enter the defined password.

Status password entry

Navigation	 System → User management → Enter password → Status password entry
-------------------	---

Description →  91

Reset password

Navigation  System → User management → Reset password

Prerequisite The **Operator** user role is active and a password has already been defined.

Description Use this function to enter the reset code to reset the current password.

 CAUTION

Current password is lost.

► Only use the reset code if you have lost the current password. Contact supplier.

User entry Activate the text box and enter the reset code.

Status password entry

Navigation  System → User management → Reset password → Status password entry

Description →  91

Logout

Navigation  System → User management → Logout

Prerequisite The **Maintenance** user role must be active.

Description The **Maintenance** user role is exited and the system switches to the **Operator** user role.

User entry Activate the button.

Change password

Navigation  System → User management → Change password

Prerequisite The **Maintenance** user role must be active.

Description	■ Old password: Use this function to enter the current password to then be able to make changes to the existing password. ■ New password: →  89 ■ Confirm new password: →  89
User entry	■ (enter the old password) ■ (enter the new password) ■ (confirm the new password)

Status password entry

Navigation	 System → User management → Change password → Status password entry
Description	→  91

Delete password

Navigation	 System → User management → Delete password
Prerequisite	The Maintenance user role must be active.
Description	The password currently valid is deleted. The Define password button appears.
User entry	Activate the Delete password button.

14.3.3 Bluetooth configuration submenu

Bluetooth

Navigation	 System → Bluetooth configuration → Bluetooth
Description	Use this function to enable or disable the Bluetooth function. ■ Off: The Bluetooth interface is disabled immediately. ■ On: The Bluetooth interface is enabled and a connection to the device can be established.  Bluetooth communication is only possible if the CDI and display interface is not used.
Selection	■ Off ■ On
Factory setting	On

Change Bluetooth password ¹⁾

1) Function is only visible in the Configuration app

Navigation	 System → Bluetooth configuration → Change Bluetooth password
Description	Use this function to change the Bluetooth password. This function is visible in the Configuration app only.
Prerequisite	The Bluetooth interface is enabled (ON) and a connection to the device is established.
User entry	Enter: ■ User name ■ Current password ■ New password ■ Confirm new password Press OK to confirm your entries.

14.3.4 Information submenu

Device submenu

Squawk

Navigation	 System → Information → Device → Squawk
Description	This function can be used locally to facilitate the identification of the device in the field. Once the Squawk function has been activated, all the segments flash on the display.
Selection	■ Squawk once: Display of device flashes for 60 seconds and then returns to normal operation. ■ Squawk on: Display of device flashes continuously. ■ Squawk off: Squawk is switched off and the display returns to normal operation.
User entry	Activate the relevant button

Serial number

Navigation	 System → Information → Device → Serial number
Description	Displays the serial number of the device. It can also be found on the nameplate.  Uses of the serial number ■ To identify the measuring device quickly, e.g. when contacting Endress+Hauser. ■ To obtain specific information on the measuring device using the Device Viewer: www.endress.com/deviceviewer

User interface Max. 11-digit character string comprising letters and numbers.

Order code

Navigation  System → Information → Device → Order code

Description Displays the order code of the device. It can also be found on the nameplate. The order code is generated from the extended order code, which defines all the device features of the product structure. In contrast, the device features cannot be read directly from the order code.



Uses of the order code

- To order an identical spare device.
- To identify the device quickly and easily, e.g. when contacting Endress+Hauser.

Firmware version

Navigation  System → Information → Device → Firmware version

Description Displays the device firmware version that is installed.

User interface Max. 6-digit character string in the format xx.yy.zz

Hardware revision

Navigation  System → Information → Device → Hardware revision

Description Displays the hardware revision of the device.

Extended order code (n)



n = Number of parts of the extended order code (n = 1 to 3)

Navigation  System → Information → Device → Extended order code n

Description Displays the first, second and/or third part of the extended order code. On account of length restrictions, the extended order code is split into a maximum of 3 parameters. The extended order code indicates the version of all the features of the product structure for the device and thus uniquely identifies the device. It can also be found on the nameplate.

- Uses of the extended order code
- To order an identical spare device.
- To check the ordered device features using the delivery note.

Device name

Navigation	 System → Information → Device → Device name
Description	Displays the device name. It can also be found on the nameplate.

Manufacturer

Navigation	 System → Information → Device → Manufacturer
Description	Displays the name of the manufacturer.

Device location submenu

Latitude

Navigation	 System → Information → Device location → Latitude
Description	Use this function to enter the latitude coordinates that describe the device location.
User entry	−90.000 to +90.000 °
Factory setting	0

Longitude

Navigation	 System → Information → Device location → Longitude
Description	Use this function to enter the longitude coordinates that describe the device location.
User entry	−180.000 to +180.000 °
Factory setting	0

Altitude

Navigation	 System → Information → Device location → Altitude
------------	---

Description	Use this function to enter the altitude data that describe the device location.
User entry	$-1.0 \cdot 10^{+20}$ to $+1.0 \cdot 10^{+20}$ m
Factory setting	0 m

Location method

Navigation	 System → Information → Device location → Location method
Description	Use this function to select the data format for specifying the geographic location. The codes for specifying the location are based on the US National Marine Electronics Association (NMEA) Standard NMEA 0183.
Selection	■ No fix ■ GPS or Standard Positioning Service (SPS) fix ■ Differential PGS fix ■ Precise positioning service (PPS) ■ Real Time Kinetic (RTK) fixed solution ■ Real Time Kinetic (RTK) float solution ■ Estimated dead reckoning ■ Manual input mode ■ Simulation mode
Factory setting	Manual input mode

Location description

Navigation	 System → Information → Device location → Location description
Description	Use this function to enter a description of the location so that the device can be located in the plant.
User entry	Up to 32 alphanumeric characters (letters, numbers and special characters)
Factory setting	32 x '?'

Process unit tag

Navigation	 System → Information → Device location → Process unit tag
Description	Use this function to enter the process unit in which the device is installed.
User entry	Up to 32 alphanumeric characters (letters, numbers and special characters)
Factory setting	32 x '?'

HART info submenu

Device type

Navigation	 System → Information → HART info → Device type
Description	Displays the device type with which the device is registered with the HART FieldComm Group. The device type is specified by the manufacturer. It is needed to assign the appropriate device description file (DD) to the device.
User interface	4-digit hexadecimal number
Factory setting	0x11D0

Device revision

Navigation	 System → Information → HART info → Device revision
Description	Displays the device revision with which the device is registered with the HART FieldComm Group. It is needed to assign the appropriate device description file (DD) to the device.
User interface	Revision in hexadecimal format
Factory setting	0x01

HART revision

Navigation	 System → Information → HART info → HART revision
Description	Displays the HART revision of the device

HART descriptor

Navigation	 System → Information → HART info → HART descriptor
Description	Use this function to define a description for the measuring point.
User entry	Up to 16 alphanumeric characters (uppercase letters, numbers and special characters)
Factory setting	16 x '?'

HART message

Navigation	 System → Information → HART info → HART message
Description	Use this function to define a HART message which is sent via the HART protocol when requested by the master.
User entry	Up to 32 alphanumeric characters (uppercase letters, numbers and special characters)
Factory setting	32 x '?'

Hardware revision → 95

Navigation	 System → Information → HART info → Hardware revision
-------------------	--

Software revision

Navigation	 System → Information → HART info → Software revision
Description	Displays the software revision of the device.

HART date code

Navigation	 System → Information → HART info → HART date code
Description	Use this function to define date information for individual use.
User entry	Date in the format year-month-day (YYYY-MM-DD)
Factory setting	2010-01-01 ¹⁾

1) Also 01.01.2010 depending on the operating tool

Manufacturer ID

Navigation	 System → Information → HART info → Manufacturer ID
Description	Displays the manufacturer ID with which the device is registered with the HART FieldComm Group.

User interface 4-digit hexadecimal number

Factory setting 0x0011

Device ID

Navigation  System → Information → HART info → Device ID

Description A unique HART identifier is saved in the device ID and used by the control systems to identify the device. The device ID is also transmitted in command 0. The device ID is determined unambiguously from the serial number of the device.

User interface ID generated for specific serial number

14.3.5 Submenu: Display

Display interval

Navigation  System → Display → Display interval

Description Set the display duration of the measured values on the local display if they are displayed in alternation. This type of change is only generated automatically if several measured values are specified.



- The **Value 1 display - Value 3 display** parameters are used to specify which measured values are shown on the local display.
- The display format of the displayed measured values is specified using the **Format display** parameter.

User entry 4 to 20 s

Factory setting 4 s

Format display

Navigation  System → Display → Format display

Description Use this function to select how the measured value is shown on the local display. The display format **Measured value** or **Measured value with bar graph** can be configured.

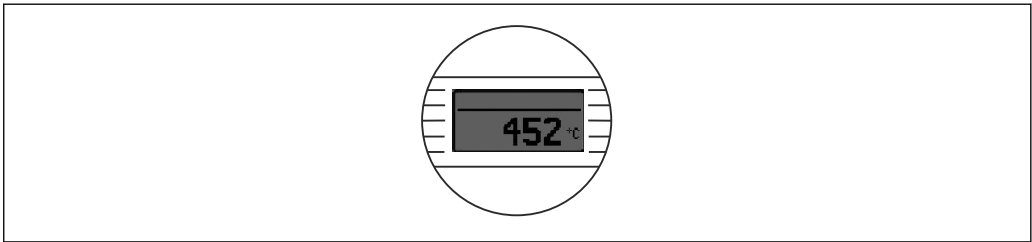
Selection

- Value
- Value + bar graph

Factory setting Value

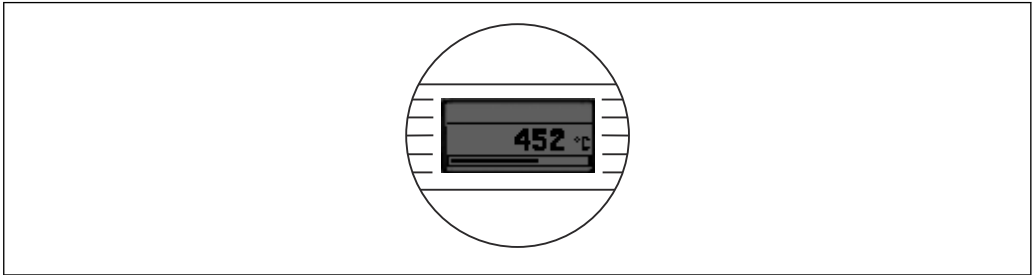
Additional information

Value



A0014564

Value + bar graph



A0014563

Value 1 display (Value 2 or 3 display)

Navigation

 System → Display → Format display → Value 1 display (Value 2 or 3 display)

Description

Use this function to select a measured value that is shown on the local display.

 The **Format display** parameter is used to specify how the measured values are displayed.

Selection

- Process value
- Device temperature
- Output current
- Percent of range
- Off

Factory setting

Process value

Decimal places 1 (decimal places 2 or 3)

Navigation

 System → Display → Format display → Decimal places 1 (Decimal places 2 or 3)

Prerequisite

A measured value is defined in the parameter **Value 1 display** (Value 2 or 3 display).

Description

Use this function to select the number of decimal places for the display value. This setting does not affect the accuracy of the device for measuring or calculating the value.

 If **Automatic** is selected, the maximum possible number of decimal places is always shown on the display.

- Selection

■ x

■ x.x

■ x.xx

■ x.xxx

■ x.xxxx

■ Automatic

Factory setting

Automatic

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