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Valid as of version
01.01 (device version)

Operating Instructions
L20221

Temperature transmitter
with 4-20 mA analog output

Table of contents

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 Safety instructions

When the device is used in hazardous areas, compliance with national regulations is mandatory. Separate Ex-specific documentation is provided for measuring systems that are used in hazardous areas. This documentation is an integral part of these Operating Instructions. The installation specifications, connection data and safety instructions contained therein must be strictly observed. Make sure that you use the right Ex-specific documentation for the right device with approval for use in hazardous areas.

1.3 Symbols used

1.3.1 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.

1.3.2 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 is connected to the supply network. ▪ Exterior ground terminal: device is connected to the plant grounding system.

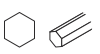
1.3.3 Symbols for certain types of information

Symbol	Meaning
	**Permitted** Procedures, processes or actions that are permitted.
	**Preferred** Procedures, processes or actions that are preferred.
	**Forbidden** Procedures, processes or actions that are forbidden.
	**Tip** Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Notice or individual step to be observed
1., 2., 3...	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

1.3.4 Symbols in graphics

Symbol	Meaning	Symbol	Meaning
1, 2, 3,...	Item numbers	1., 2., 3...	Series of steps
A, B, C, ...	Views	A-A, B-B, C-C, ...	Sections
	Hazardous area		Safe area (non-hazardous area)

1.4 Tool symbols

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

1.5 Registered trademarks

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2 Basic safety instructions

2.1 Requirements of the personnel

The personnel responsible for installation, commissioning, diagnostics and maintenance must fulfil the following requirements:
- Trained, qualified specialists: must have a relevant qualification for this specific function and task
- They must be authorized by the plant operator.
- They must be familiar with 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 fulfil the following requirements:
- 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).

If the device is used in a manner not specified by the manufacturer, the protection provided by the device may be impaired.

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

2.3 Workplace safety

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

2.4 Operational safety

- Operate the device only if it is in proper technical condition, free from errors and faults.
- The operator is responsible for ensuring that the device is in good working order.

Hazardous area

To eliminate a danger for persons or for the facility when the device is used in the hazardous area (e.g. explosion protection or safety 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.
- Observe the specifications in the separate supplementary documentation included as an integral part of these instructions.

Electromagnetic compatibility

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

NOTICE

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

2.5 Product safety

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

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

2.6 IT security

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

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
- Serial number
- Tag name (TAG) (optional)
- Technical values, e.g. supply voltage, current consumption, ambient temperature, communication-specific data (optional)
- Degree of protection
- Approvals with symbols

▶ Compare the information on the nameplate with the order.

3.2.2 Name and address of manufacturer

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

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 provides 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

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

4.1.2 Installation point

- Head transmitter:
  - in the terminal head, flat face, as per DIN EN 50446, direct installation on insert with cable entry (middle hole 7 mm)
  - in the field housing, separately from the process
- 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 accessory.

Information about the conditions (such as the ambient temperature, degree of protection, climate class etc.) that must be present at the installation point so that the device can be mounted correctly is provided in the "Technical data" section→ 44.

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

NOTICE

In cases where a DIN rail transmitter is installed and simultaneous thermocouple or mV measurements are performed, increased measurement errors may occur depending on the installation situation and ambient conditions.

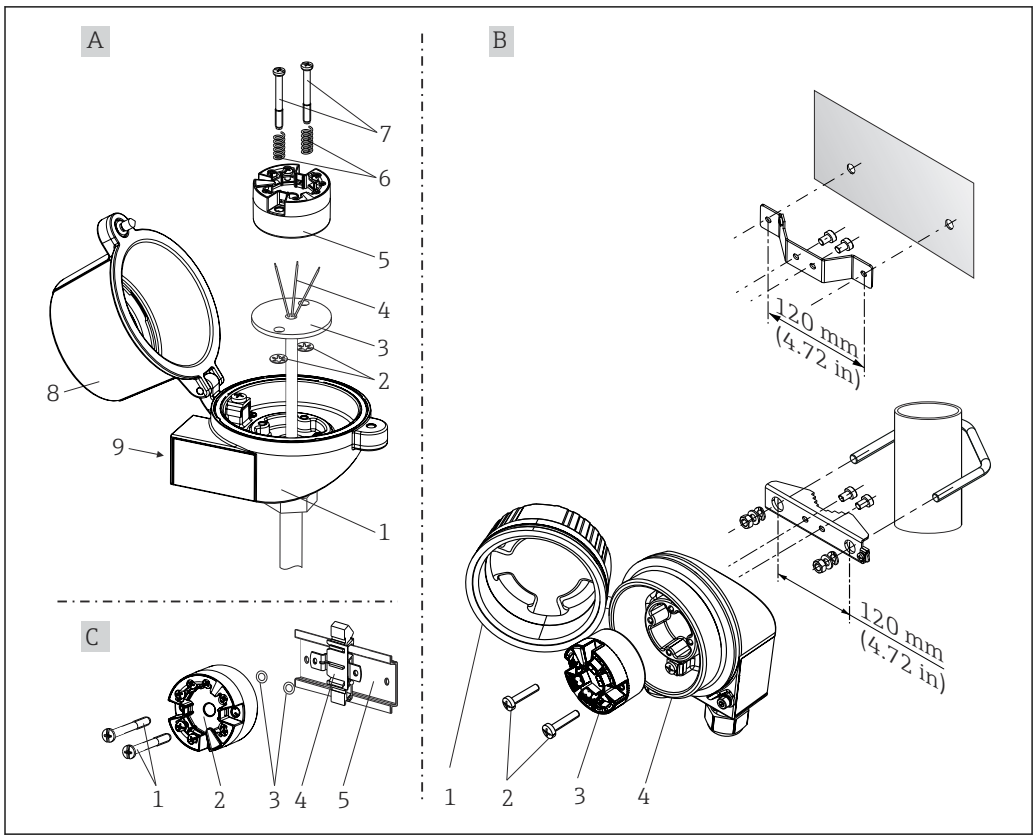
▶ If the DIN rail transmitter is mounted in series between other DIN rail devices (reference operating conditions: 24 V, 12 mA), deviations of up to + 2.9 °C may occur.

4.2 Installing the device

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

- Maximum torque for securing screws = 1 Nm (¾ foot-pound), screwdriver: Pozidriv Z2
- Maximum torque for screw terminals = 0.35 Nm (¼ foot-pound), screwdriver: Pozidriv Z1

4.2.1 Mounting the head transmitter



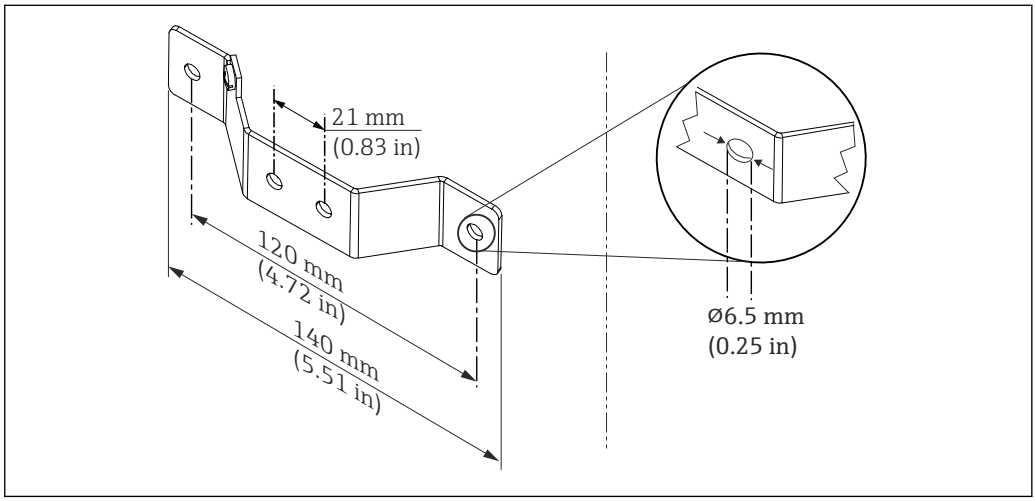
1 *Head transmitter mounting (three versions)*

A	Mounting in a terminal head (terminal head flat face as per DIN 43729)
1	Terminal head
2	Retaining rings
3	Insert
4	Connection wires
5	Head transmitter
6	Mounting springs
7	Mounting screws
8	Terminal head cover
9	Cable entry

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). Then fix both mounting screws with the snap rings (2).
5. Then tighten the head transmitter (5) along with the insert (3) in the terminal head.
6. After wiring, close the terminal head cover (8) tightly again. → 15

B	Mounting in a field housing
1	Field housing cover
2	Mounting screws
3	Head transmitter
4	Field housing



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

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

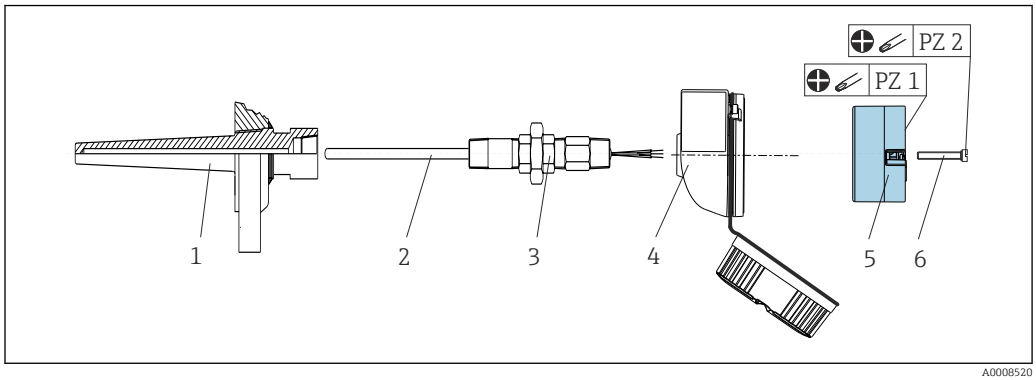
1. Open the cover (1) of the field housing (4).
2. Guide the mounting screws (2) through the lateral bores in the head transmitter (3).
3. Screw the head transmitter to the field housing.
4. After wiring, close the field housing cover (1) again. → 15

C	Mounting on DIN rail (DIN rail as per IEC 60715)
1	Mounting screws
2	Head transmitter
3	Retaining rings
4	DIN rail clip
5	DIN rail

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). Then fix both mounting screws with the snap rings (3).
3. Screw the head transmitter (2) onto the DIN rail clip (4).

Mounting for North America



3 *Head transmitter mounting*

1 *Thermowell*
2 *Insert*
3 *Adapter, coupling*
4 *Terminal head*
5 *Head transmitter*
6 *Mounting screws*

Thermometer design with thermocouples or RTD sensors and head transmitter:

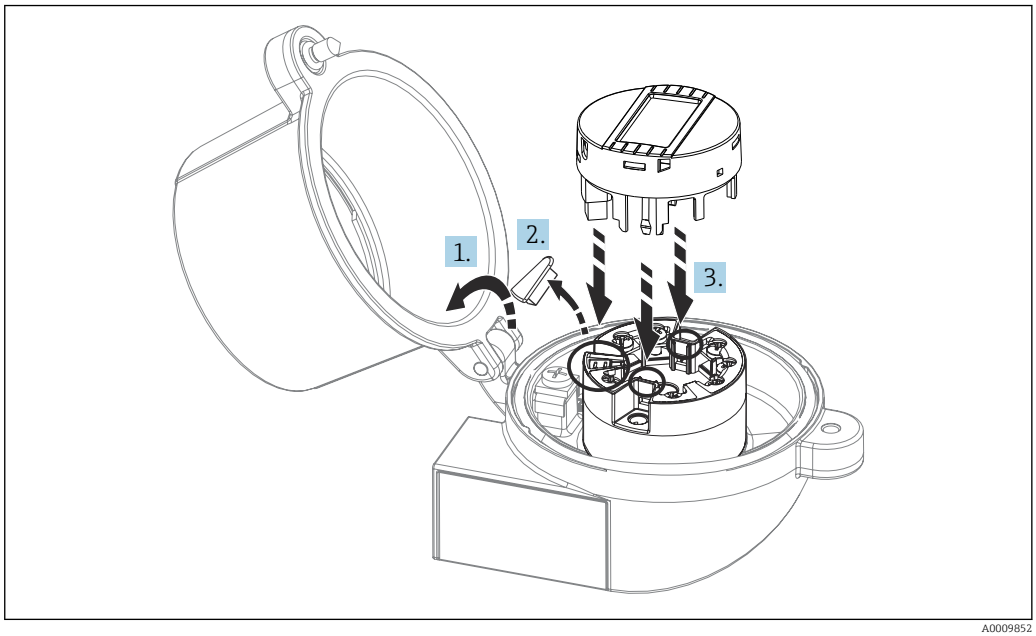
1. Fit the thermowell (1) on the process pipe or the container wall. Secure the thermowell according to the instructions before the process pressure is applied.
2. Fit the necessary neck tube nipples and adapter (3) on the thermowell.
3. Make sure sealing rings are installed if such rings are needed 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). Wire the connection wires up to the transmitter. → 16
8. 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 secured properly to meet the requirements for explosion protection.

▶ After wiring, securely screw the terminal head cover back on.

Mounting the display on the head transmitter



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4 *Mounting the display*

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

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

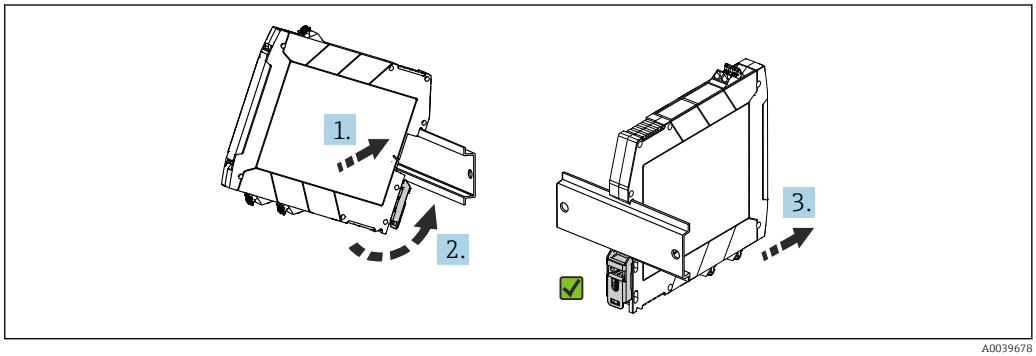
4.2.2 Mounting the DIN rail transmitter

NOTICE

Wrong orientation

Measurement deviates from the maximum measurement accuracy when a thermocouple is connected and the internal reference junction is used.

▶ Mount the device vertically and ensure it is correctly oriented.



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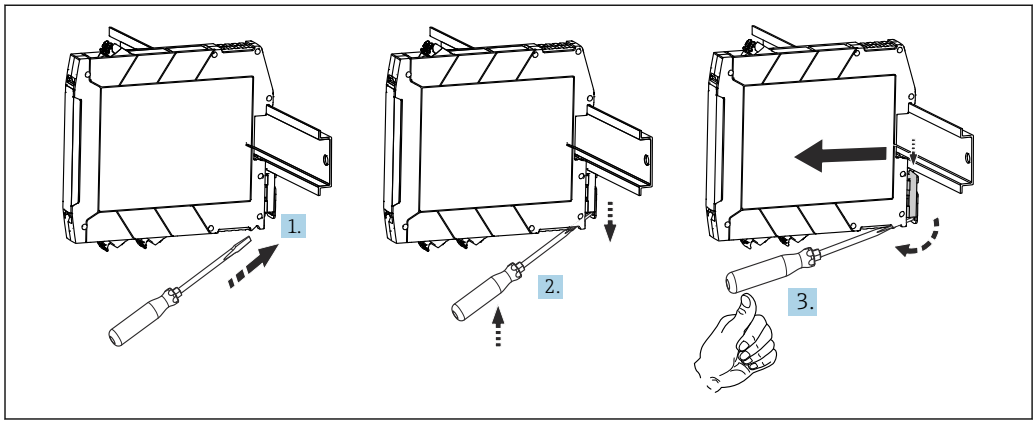
5 *Mounting the DIN rail transmitter*

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.



6 *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 inspection)?	-
Do the ambient conditions match the device specification (e.g. ambient temperature, measuring range, etc.)?	See the 'Technical data' section

5 Electrical connection

⚠ CAUTION

- Switch off the power supply before installing or connecting the device. Failure to observe this may result in the destruction of parts of the electronics.
- Do not occupy the display connection. An incorrect connection can destroy the electronics.

NOTICE

Do not overtighten the screw terminals, as this could damage the transmitter.

- Maximum torque = 0.35 Nm (¼ lbf ft), screwdriver: Pozidriv PZ1.

5.1 Connection requirements

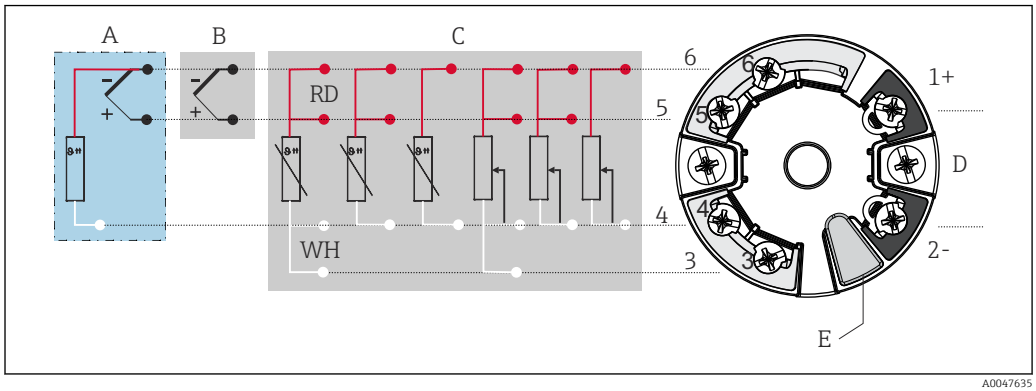
A Phillips head screwdriver is required to wire the head transmitter with screw terminals. A flat-blade screwdriver must be used for the DIN rail transmitter version with screw terminals. The push-in terminal version can be wired without any tools.

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 → 16. If the head transmitter is fitted with push-in terminals, pay particular attention to the information in the "Connecting to push-in terminals" section. → 17
4. Tighten the cable gland again and close the housing cover.

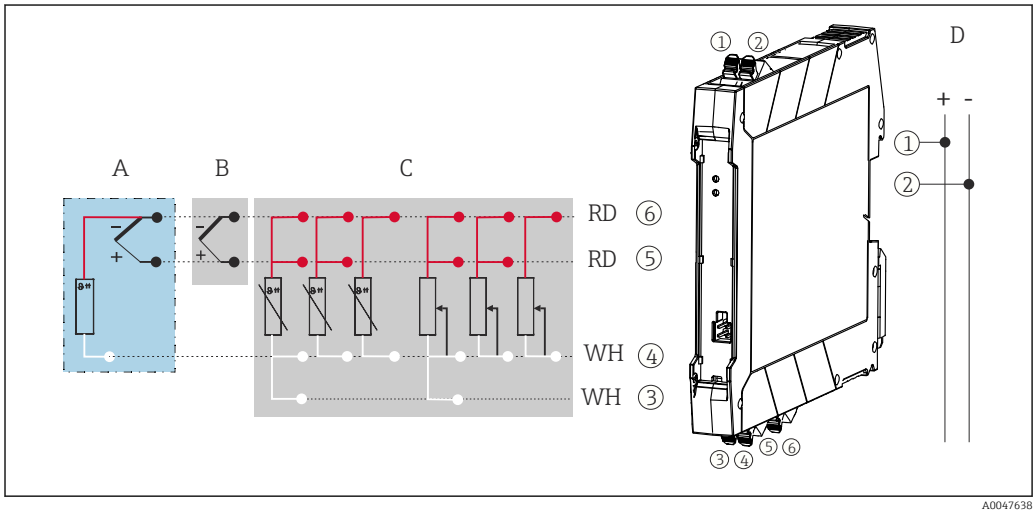
In order to avoid connection errors always follow the instructions in the post-connection check section before commissioning!

5.2 Quick wiring guide



7 *Assignment of terminal connections for head transmitter*

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



8 *Assignment of terminal connections for DIN rail transmitter*

A Sensor input, TC and mV, external reference junction (CJ), Pt100
B Sensor input, TC and mV, internal reference junction (CJ)
C Sensor input, RTD and Ω, 4-, 3- and 2-wire
D 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.

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

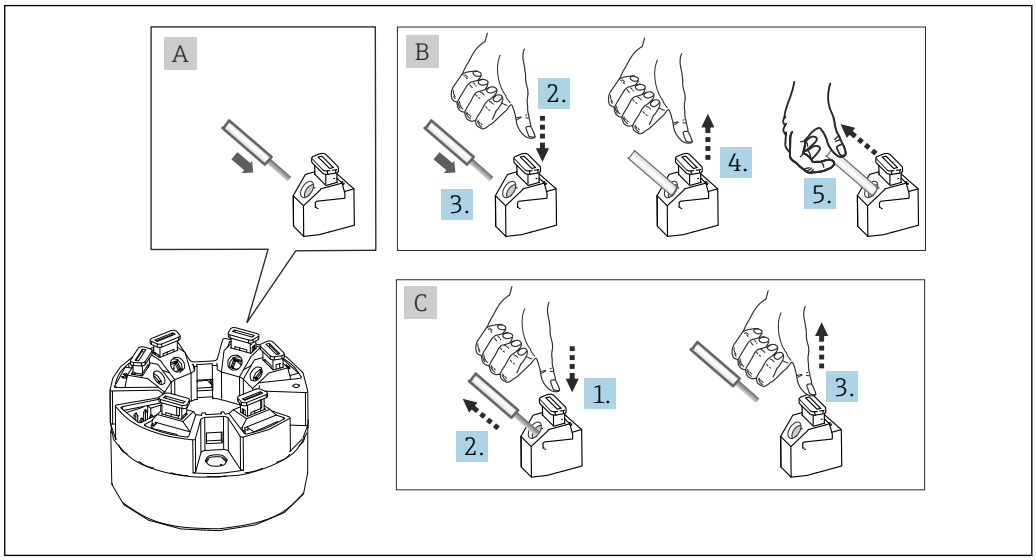
NOTICE

▶ 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 → 16.

5.3.1 Connecting to push-in terminals



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

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

1. Strip wire end. Minimum stripping length 10 mm (0.39 in).
2. Insert the wire end into the terminal.
3. Pull the wire gently to ensure it is connected correctly. Repeat starting from step 1 if necessary.

Fig. B, fine-strand wire without ferrule:

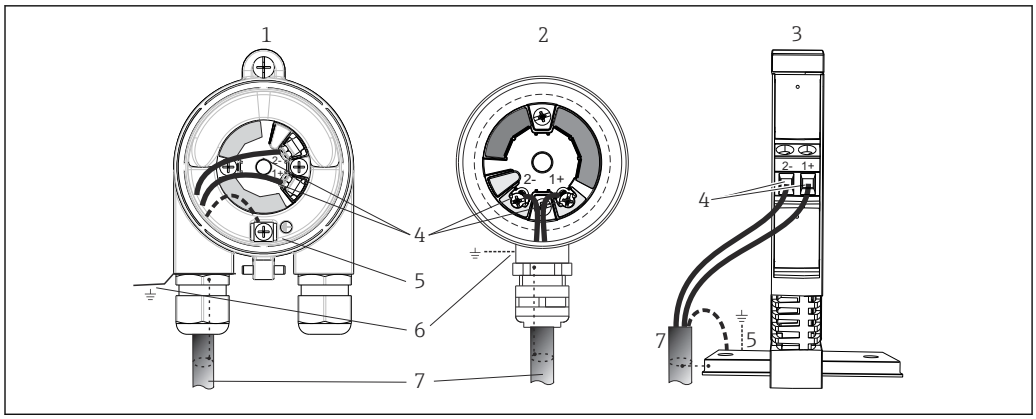
1. Strip wire end. Minimum stripping length 10 mm (0.39 in).
2. Press down on the lever opener.
3. Insert the wire end into the terminal.
4. Release lever opener.
5. Pull the wire gently to ensure it is connected correctly. Repeat starting from step 1 if necessary.

Pos. 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

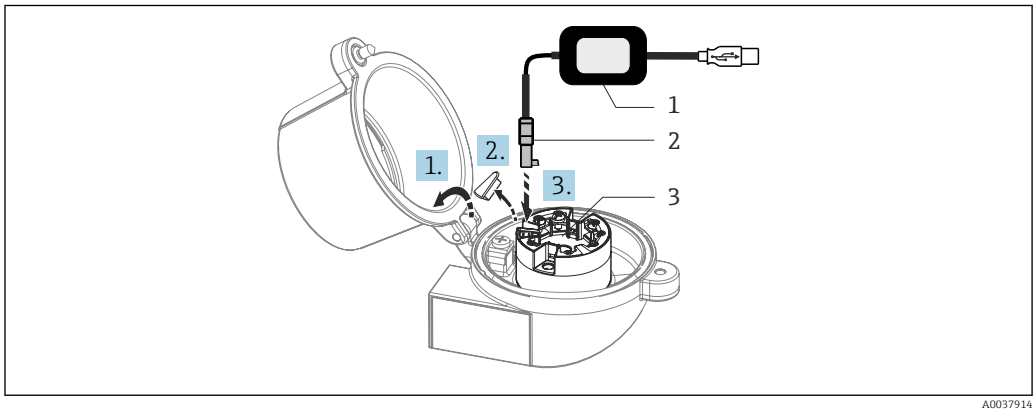
Also observe the general procedure on → 15.



10 *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 power supply*
5 *Internal ground connection*
6 *External ground connection*
7 *Shielded signal cable*

- The terminals for the power supply (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 push-in terminals Min. stripping length of wire 10 mm (0.39 in)



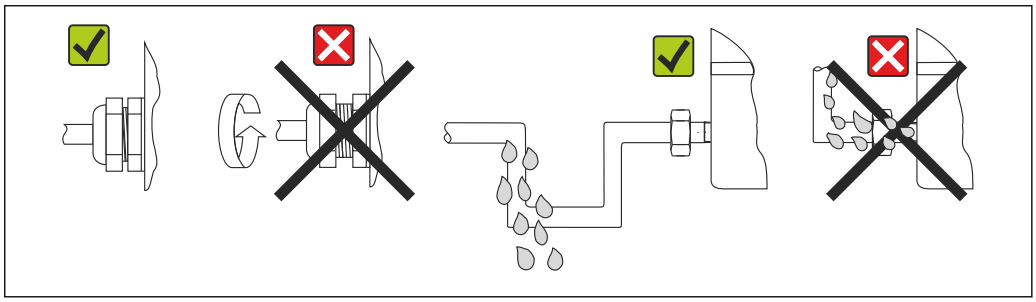
11 *Fitting the CDI connector of the configuration kit for configuration, visualization and maintenance of the head transmitter via PC and configuration software*

1 *Configuration kit with USB port*
2 *CDI connector*
3 *Installed head transmitter with CDI interface*

5.5 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:

- 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. The seals must be dried, cleaned or replaced if necessary.
- 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. → 12, 19
- The cables must loop down before they enter the cable glands ("water trap"). This means that any moisture that may form cannot enter the gland. Install the device in such a way that the cable glands are not facing upwards. → 12, 19
- Replace unused cable glands with dummy plugs.
- Do not remove the grommet from the cable gland.



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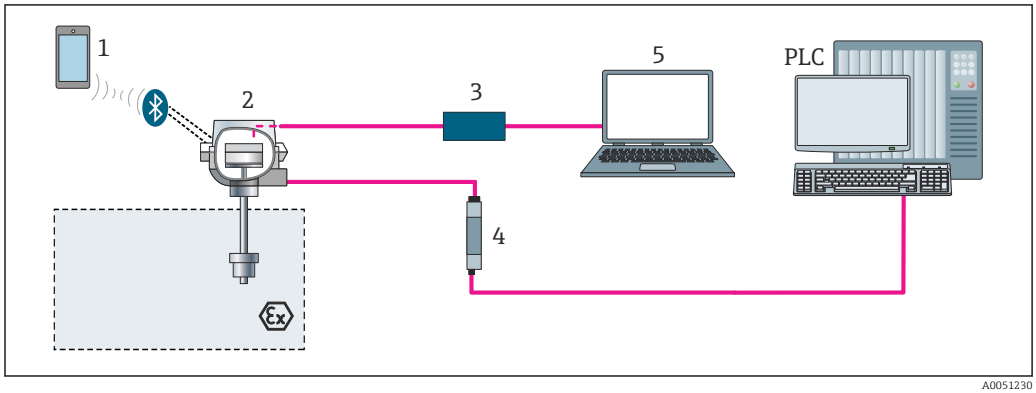
12 *Connection tips to retain IP67 protection*

5.6 Post-connection check

Device condition and specifications	Notes
Is the device or cable undamaged (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 relieved of tension?	--
Are the power supply and signal cables connected correctly?	→ 16
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 housing covers installed and securely tightened?	--

6 Operation options

6.1 Overview of operation options



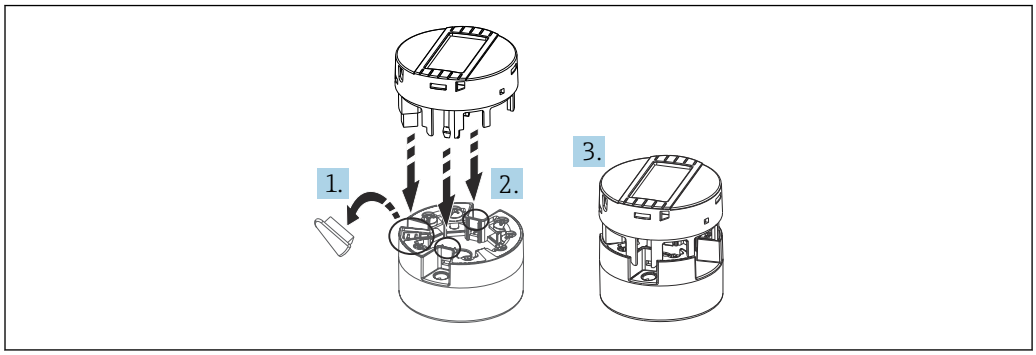
13 *Operation options for the transmitter via the CDI interface*

1 *Operation via Bluetooth*
2 *Transmitter*
3 *Configuration kit*
4 *Active barrier*
5 *Configuration software*

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

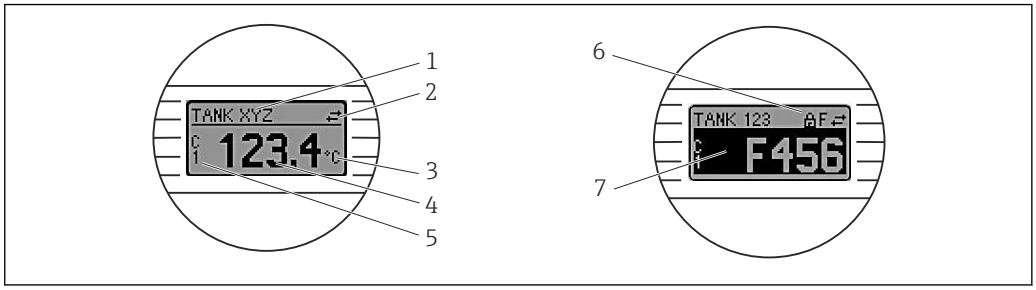
Option: display with transmitter



14 *Attach the display to the transmitter*

Display elements

Head transmitter



15 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 → 31. Detailed information on the error messages can be found in the Operating Instructions.
	C	**"Service mode"** The device is in 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 status message.

DIN rail transmitter

Two LEDs on the front indicate the device status.

Type	Function and characteristic
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 of 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 either.

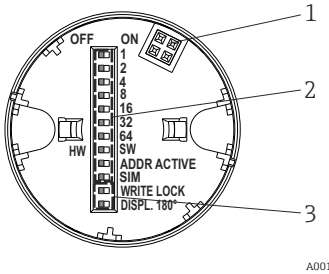
Local operation

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.

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.



16 *Hardware settings via DIP switches*

1: Connection to head transmitter

2: DIP switches (1 - 64, SW/HW, ADDR and SIM = simulation mode) have **no function** for this head transmitter

3: DIP switch (WRITE LOCK = write protection; DISPL. 180° = switch, turn the display monitor 180°)

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. In general: switch to ON = function enabled, 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

Write protection is switched on and off via a DIP switch on the rear of the optional attachable display. When write protection is active, parameters cannot be modified. A lock

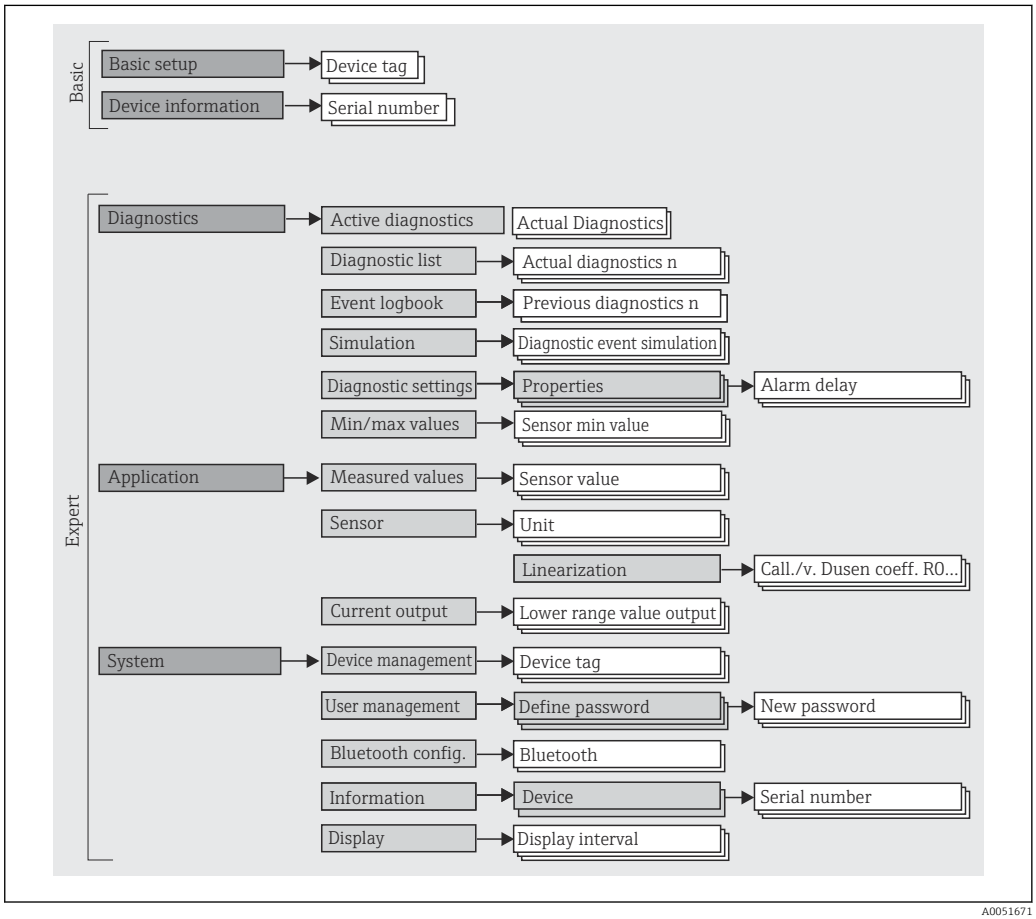
symbol on the display indicates that write protection is on. Write protection prevents any write access to the parameters. Write protection remains active even when the display is removed. To deactivate write protection, the display must be attached to the transmitter with the DIP switch switched off (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



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 pre-selected 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 the parameters for configuring error events ▪ **"Min/max values" submenu** Contains the minimum/maximum indicator 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
"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 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 authorization, 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 PC operating tool

6.3.1 Field Device Configurator (FDC) Tool

Range of functions


A0051704

The FDC Tool is a configuration tool that is available free of charge. The devices can be connected directly via a modem (point-to-point). DeviceCare is fast, easy and intuitive to use. It can run on a PC, laptop or tablet with a Windows operating system.
For more information, please contact your supplier.

6.4 Access to the operating menu via the Wireless Field Device Configurator App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The device, which is equipped with optional Bluetooth communication electronics, can be operated and configured via the Wireless Field Device Configurator (FDC) app. The connection is established via the Bluetooth interface.

Prerequisite:
A smartphone or tablet with the FDC 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 FDC app is available for free download for Android devices (Google Playstore) and iOS devices (iTunes Apple Shop): *Field Device Configurator*

Directly to the app with the QR code:

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Download the FDC app:

1. Install and start the FDC 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 Commissioning

7.1 Function check

Before commissioning the measuring point, make sure that all final checks have been carried out:
- "Post-mounting check" checklist → 14
- "Post-connection check" checklist → 19

7.2 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 type of connection) along with the configured measuring range
4a	Current measured value or
4b	Current status 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 → 29.

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.

7.3 Protecting settings from unauthorized access

7.3.1 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

7.3.2 Software locking

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

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 → 23

8 Diagnostics and troubleshooting

8.1 General troubleshooting

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

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 contacting of the cables and terminals and correct if necessary.
	Electronics module is defective.	Replace the device.
Output current < 3.6 mA	Signal line is not wired correctly.	Check wiring.
	Electronics module is defective.	Replace the device.
Status LED is lit or flashing red (DIN rail transmitter only).	Diagnostic events as per NAMUR NE107 → 31	Check diagnostic events: ▪ LED is lit: diagnostic display, category F ▪ LED flashing: diagnostic display of 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 (optional 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 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 is defective.	Replace the head transmitter.

Local error messages on the display
→ 31

Error messages in the configuration software
→ 31

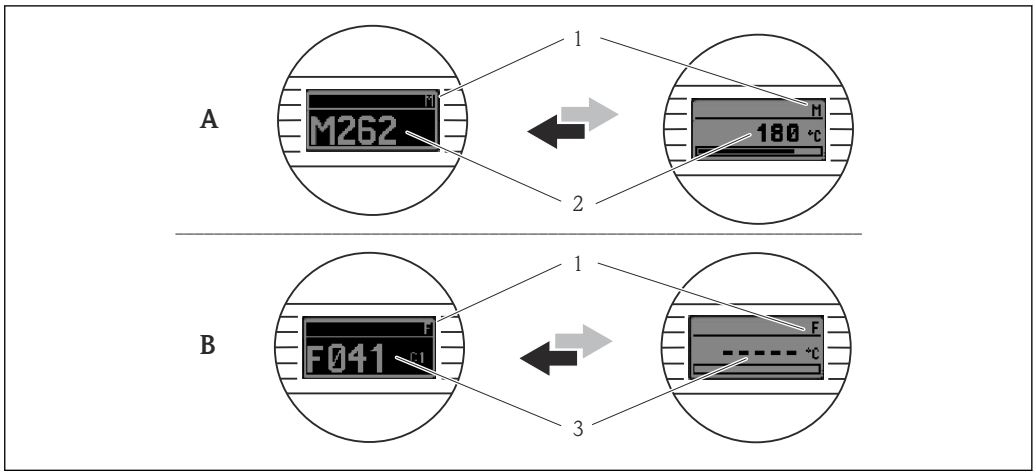
Application errors without status messages for RTD sensor connection

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.
	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.

8.2 Diagnostic information on local display



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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.

8.3 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 NE107

Diagnostic behavior

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

8.4 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 following order of priority applies: F, C, S, M. If several diagnostic events with the same status signal are pending at the same time, the numerical order of the event number dictates the order of priority in which the events are displayed, e.g. F042 appears before F044 and before S044.

8.5 Event logbook

Previous diagnostic messages are displayed in the **Event logbook** submenu. → 55

8.6 Overview of diagnostic events

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

Example:

		Settings		Device behavior			
Configuration examples	**Diagnostic number**	**Status signal**	**Diagnostic behavior from the factory**	**Status signal (output via communication)**	**Current output**	**status**	**Display**
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	**Short text**	**Remedial action**	**Status signal from the factory**	✓ **Customizable** [1] / ✗ **Not customizable**	**Diagnostic behavior from the factory**	✓ **Customizable** [2] / ✗ **Not customizable**
Diagnostics for the sensor						
041	Sensor interrupted	1. Check electrical wiring. 2. Replace sensor. 3. Check configuration of connection type.	F	✓	Alarm	✓
042	Sensor corroded	1. Check sensor. 2. Replace sensor.	M	✓	Warning	✓

Diagnostic number	Short text	Remedial action	Status signal from the factory	✓ Customizable [1] / ✗ Not customizable	Diagnostic behavior from the factory	✓ Customizable [2] / ✗ Not customizable
043	Short-circuit	1. Check electrical connection. 2. Check sensor. 3. Replace sensor or cable.	F	✓	Alarm	✓
047	Sensor limit reached, sensor n	1. Check sensor. 2. Check process conditions.	S	✓	Warning	✓
145	Compensation reference junction	1. Check terminal temperature. 2. Check external reference measuring 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 is active	Initialization in progress, please wait.	C	✗	Warning	✗
410	Data transfer failed	1. Check connection. 2. Repeat data transfer.	F	✗	Alarm	✗
411	Upload/download active	Upload/download in progress, please wait.	C	✗	Warning	✗
435	Linearization incorrect	Check linearization.	F	✗	Alarm	✗
485	Simulation of the process variable is active	Deactivate simulation.	C	✗	Warning	✗
491	Current output simulation	Deactivate simulation.	C	✓	Warning	✓
495	Diagnostic event simulation active	Deactivate simulation.	C	✓	Warning	✓
531	Factory calibration 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 configuration of analog output.)	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	Short text	Remedial action	Status signal from the factory	Customizable 1) / Not customizable	Diagnostic behavior from the factory	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 Maintenance and cleaning

No special maintenance work is required for the device.

9.1 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 (displays, housing, for example) 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.

10 Repair

10.1 General notes

Due to its design, the device cannot be repaired.

10.2 Spare parts

Ask your supplier for information on the spare parts available.

Type
Standard - DIN mounting set (2 screws and springs, 4 shaft lock-down rings, 1 plug for the display interface)
US - M4 mounting set (2 screws and 1 plug for the display interface)
Connecting cable for service interface, 40 cm

10.3 Return

The requirements for safe device return can vary depending on the device type and national legislation. Please contact your supplier for further information.

10.4 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.

11 Accessories

Various accessories, which can be ordered separately from your supplier, are available for the device. Contact your service organization for detailed information on the relevant order code. When ordering accessories, please quote the serial number of the device!

Accessories included in the scope of delivery:
- Brief Operating Instructions
- Supplementary ATEX documentation
- Mounting material for head transmitter, optional

Accessories
Attachable display unit
Field housing head transmitter (on request), aluminum, IP 66, dimensions B x H x D: 100 x 100 x 60 mm (3.94" x 3.94" x 2.36")
Adapter for DIN rail mounting, clip as per IEC 60715 (TH35)
Standard - DIN mounting set (2 screws + springs, 4 securing disks and 1 display connector cover)
US - M4 Mounting screws (2 M4 screws and 1 display connector cover)

12 Technical data

12.1 Input

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

Resistance thermometer (RTD) as per standard	Description	α	Measuring range limits	Min. 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)
	▪ Connection type: 2-wire, 3-wire or 4-wire connection, sensor current: ≤ 0.3 mA ▪ With 2-wire circuit, compensation of wire resistance possible (0 to 30 Ω) ▪ With 3-wire and 4-wire connection, sensor wire resistance up to max. 50 Ω per wire			
Resistance transmitter	Resistance Ω		10 to 400 Ω 10 to 2 000 Ω	10 Ω 10 Ω

Thermocouples as per standard	Description	Measuring range limits		Min. span
			Recommended temperature range:	
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)	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. 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

12.2 Output

Output signal

Analog output	4 to 20 mA, 20 to 4 mA (can be inverted)
Galvanic isolation	U = 2 kV AC for 1 minute (input/output)

Failure information

Failure information as per NAMUR NE43:

Failure 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.

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; 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

Load in Ω. U_b = supply voltage in V DC

Linearization/transmission behavior

Temperature-linear, resistance-linear, voltage-linear

Mains frequency filter

50/60 Hz

Filter

1st order digital filter: 0 to 120 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 measured value signal is present at the current output. While switch-on delay = I_a ≤ 3.8 mA

12.3 Power supply

Supply voltage

Values for non-hazardous areas, protected against polarity reversal:
- Head transmitter: 10 V ≤ Vcc ≤ 36 V
- Din rail transmitter: 11 V ≤ Vcc ≤ 36 V

Values for hazardous area; see Ex documentation.

Current consumption

- 3.6 to 23 mA
- Minimum current consumption 3.5 mA
- Current limit ≤ 23 mA

Terminals

Choice of screw terminals or push-in terminals for sensor and power supply cables:

Terminal design	Cable design	Cable cross-section
Screw terminals	Rigid or flexible	≤ 2.5 mm² (14 AWG)
Push-in terminals (cable version, stripping length = min. 10 mm (0.39 in)	Rigid or flexible	0.2 to 1.5 mm² (24 to 16 AWG)
	Flexible with wire end ferrules with/without plastic ferrule	0.25 to 1.5 mm² (24 to 16 AWG)

Ferrules must be used with push-in terminals and when using flexible cables with a cable cross-section of ≤ 0.3 mm². Otherwise, the use of ferrules when connecting flexible cables to push-in terminals is not recommended.

12.4 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.

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 DIN EN 60770 and the reference conditions specified above. The measurement error data corresponds to ±2 σ (Gaussian distribution). The data includes non-linearities and repeatability.

MV = measured value

LRV = lower range value of the sensor in question

MR = measuring range of the sensor in question

Typically

Standard	Description	Measuring range	Typical measurement error (±)
Resistance thermometer (RTD) as per standard			Value at current output
IEC 60751:2008	Pt100 (1)	0 to +200 °C (32 to +392 °F)	0.10 °C (0.18 °F)
IEC 60751:2008	Pt1000 (4)		0.08 °C (0.14 °F)
GOST 6651-94	Pt100 (9)		0.09 °C (0.16 °F)
Thermocouples (TC) as per standard			Value at current output
IEC 60584, Part 1	Type K (NiCr-Ni) (36)	0 to +800 °C (32 to +1472 °F)	0.35 °C (0.63 °F)

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

Measurement error for resistance thermometers (RTD) and resistance transmitters

Standard	Description	Measuring range	Measurement error (±)
			Based on measured value [1]
IEC 60751:2008	Pt100 (1)	−200 to +850 °C (−328 to +1 562 °F)	ME = ± √((0.05 °C (0.09 °F) + 0.006% * (MV - LRV))² + (0.03% * MR)²)
	Pt200 (2)		ME = ± √((0.08 °C (0.14 °F) + 0.011% * (MV - LRV))² + (0.03% * MR)²)
	Pt500 (3)	−200 to +510 °C (−328 to +950 °F)	ME = ± √((0.035 °C (0.063 °F) + 0.008% * (MV - LRV))² + (0.03% * MR)²)
	Pt1000 (4)	−200 to +250 °C (−328 to +482 °F)	ME = ± √((0.02 °C (0.04 °F) + 0.007% * (MV - LRV))² + (0.03% * MR)²)
JIS C1604:1984	Pt100 (5)	−200 to +510 °C (−328 to +950 °F)	ME = ± √((0.045 °C (0.08 °F) + 0.006% * (MV - LRV))² + (0.03% * MR)²)
GOST 6651-94	Pt50 (8)	−185 to +1 100 °C (−301 to +2 012 °F)	ME = ± √((0.08 °C (0.14 °F) + 0.008% * (MV - LRV))² + (0.03% * MR)²)
	Pt100 (9)	−200 to +850 °C (−328 to +1 562 °F)	ME = ± √((0.045 °C (0.08 °F) + 0.0055% * (MV - LRV))² + (0.03% * MR)²)
DIN 43760 IPTS-68	Ni100 (6)	−60 to +250 °C (−76 to +482 °F)	ME = ± √((0.042 °C (0.07 °F) - 0.004% * (MV - LRV))² + (0.03% * MR)²)
	Ni120 (7)		ME = ± √((0.04 °C (0.07 °F) - 0.004% * (MV - LRV))² + (0.03% * MR)²)
OIML R84: 2003 / GOST 6651-2009	Cu50 (10)	−180 to +200 °C (−292 to +392 °F)	ME = ± √((0.08 °C (0.14 °F) + 0.006% * (MV - LRV))² + (0.03% * MR)²)
	Cu100 (11)	−180 to +200 °C (−292 to +392 °F)	ME = ± √((0.04 °C (0.07 °F) + 0.003% * (MV - LRV))² + (0.03% * MR)²)
	Ni100 (12)	−60 to +180 °C (−76 to +356 °F)	ME = ± √((0.04 °C (0.07 °F) - 0.004% * (MV - LRV))² + (0.03% * MR)²)
	Ni120 (13)		
OIML R84: 2003, GOST 6651-94	Cu50 (14)	−50 to +200 °C (−58 to +392 °F)	ME = ± √((0.086 °C (0.15 °F) + 0.004% * (MV - LRV))² + (0.03% * MR)²)
Resistance transmitter	Resistance Ω	10 to 400 Ω	ME = ± √((17 mΩ + 0.0032 % * (MV² + (0.03% * MR)²)
		10 to 2 000 Ω	ME = ± √((60 mΩ + 0.006 % * (MV² + (0.03% * MR)²)

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

Measurement error for thermocouples (TC) and voltage transmitters

Standard	Description	Measuring range	Measurement error (±)
			Based on measured value [1]
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 - LRV))² + (0.03% * MR)²)
	Type B (31)	+500 to +1 820 °C (+932 to +3 308 °F)	ME = ± √((0.78 °C (1.4 °F) - 0.025% * (MV - LRV))² + (0.03% * MR)²)

Standard	Description	Measuring range	Measurement error (±)
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) + 0.0011% * (MV - LRV))² + (0.03% * MR)²)
ASTM E988-96	Type D (33)		ME = ± √ (((0.4 °C (0.72 °F) + (0.03% * MR)²)
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 - LRV))² + (0.03% * MR)²)
	Type J (35)	−150 to +1 200 °C (−238 to +2 192 °F)	ME = ± √ (((0.17 °C (0.31 °F) + (0.03% * MR)²)
	Type K (36)		ME = ± √((0.24 °C (0.43 °F) - 0.002% * (MV - LRV))² + (0.03% * MR)²)
	Type N (37)	−150 to +1 300 °C (−238 to +2 372 °F)	ME = ± √((0.27 °C (0.49 °F) - 0.003% * (MV - LRV))² + (0.03% * MR)²)
	Type R (38)	+200 to +1 768 °C (+392 to +3 214 °F)	ME = ± √((0.48 °C (0.86 °F) - 0.004% * (MV - LRV))² + (0.03% * MR)²)
	Type S (39)		ME = ± √((0.54 °C (0.97 °F) - 0.002% * (MV - LRV))² + (0.03% * MR)²)
	Type T (40)	−150 to +400 °C (−238 to +752 °F)	ME = ± √((0.24 °C (0.43 °F) - 0.02% * (MV - LRV))² + (0.03% * MR)²)
DIN 43710	Type L (41)	−150 to +900 °C (−238 to +1 652 °F)	ME = ± √((0.2 °C (0.36 °F) - 0.002% * (MV - LRV))² + (0.03% * MR)²)
	Type U (42)	−150 to +600 °C (−238 to +1 112 °F)	ME = ± √((0.27 °C (0.49 °F) - 0.019% * (MV - LRV))² + (0.03% * MR)²)
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 - LRV))² + (0.03% * MR)²)
Voltage transmitter (mV)		−20 to +100 mV	ME = ± √((10.0 µV + (0.03% * MR)²)

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

Total measurement error of transmitter at current output = √(Measurement error digital² + Measurement error D/A²)

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	0.09 °C (0.16 °F)
Influence of ambient temperature	0.08 °C (0.14 °F)
Influence of supply voltage	0.04 °C (0.07 °F)
Measurement error analog value (current output): √(Measurement error² + Influence of ambient temperature² + Influence of supply voltage²)	**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 the 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
		Based on measured value	Based on measured value
Pt100 (1)	IEC 60751:2008	√((0.013% * (MV))² + (0.003%*MR)²), at least 0.003 °C (0.005 °F)	√((0.007% * (MV - LRV))² + (0.003%*MR)²), at least 0.003 °C (0.005 °F)
Pt200 (2)		≤ 0.036 °C (0.064 °F)	≤ 0.033 °C (0.059 °F)
Pt500 (3)		√((0.013% * (MV))² + (0.003%*MR)²), at least 0.006 °C (0.011 °F)	√((0.007% * (MV - LRV))² + (0.003%*MR)²), at least 0.002 °C (0.004 °F)
Pt1000 (4)		≤ 0.017 °C (0.031 °F)	≤ 0.032 °C (0.057 °F)
Pt100 (5)	JIS C1604:1984	√((0.013% * (MV - LRV))² + (0.003%*MR)²), at least 0.003 °C (0.005 °F)	√((0.007% * (MV - LRV))² + (0.003%*MR)²), at least 0.001 °C (0.002 °F)
Pt50 (8)	GOST 6651-94	√((0.015% * (MV - LRV))² + (0.003%*MR)²), at least 0.01 °C (0.018 °F)	√((0.007% * (MV - LRV))² + (0.003%*MR)²), at least 0.004 °C (0.007 °F)
Pt100 (9)		√((0.013% * (MV - LRV))² + 0.003%*MR)²), at least 0.003 °C (0.005 °F)	√((0.007% * (MV - LRV))² + (0.003%*MR)²), at least 0.002 °C (0.004 °F)
Ni100 (6)	DIN 43760 IPTS-68	≤ 0.01 °C (0.018 °F)	≤ 0.032 °C (0.057 °F)

Description	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change	Supply voltage: Influence (±) per V change
Ni120 (7)			
Cu50 (10)	OIML R84: 2003 / GOST 6651-2009	≤ 0.012 °C (0.022 °F)	≤ 0.032 °C (0.057 °F)
Cu100 (11)			≤ 0.032 °C (0.057 °F)
Ni100 (12)		≤ 0.008 °C (0.014 °F)	≤ 0.032 °C (0.057 °F)
Ni120 (13)			
Cu50 (14)	OIML R84: 2003 / GOST 6651-94	≤ 0.009 °C (0.016 °F)	≤ 0.032 °C (0.057 °F)
Resistance transmitter (Ω)			
10 to 400 Ω		√((0.01% * MV)² + (0.003%*MR)²), at least 1 mΩ	√((0.005% * MV)² + (0.003%*MR)²), at least 1 mΩ
10 to 2 000 Ω		√((0.01% * MV)² + 0.003%*MR)²), at least 10 mΩ	√((0.005% * MV)² + (0.003%*MR)²), at least 5 mΩ

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

Description	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change	Supply voltage: Influence (±) per V change
		Based on measured value	Based on measured value
Type A (30)	IEC 60584-1 ASTM E230-3	√((0.03% * (MV - LRV))² + (0.003%*MR)²), at least 0.01 °C (0.018 °F)	√((0.012% * (MV - LRV))² + (0.003%*MR)²), at least 0.013 °C (0.023 °F)
Type B (31)		≤ 0.08 °C (0.144 °F)	≤ 0.037 °C (0.067 °F)
Type C (32)	IEC 60584-1 ASTM E230-3 ASTM E988-96	√((0.021% * (MV - LRV))² + (0.003%*MR)²), at least 0.01 °C (0.018 °F)	√((0.012% * (MV - LRV))² + (0.003%*MR)²), at least 0.013 °C (0.023 °F)
Type D (33)	ASTM E988-96	√((0.019% * (MV - LRV))² + (0.003%*MR)²), at least 0.01 °C (0.018 °F)	√((0.011% * (MV - LRV))² + (0.003%*MR)²),
Type E (34)	IEC 60584-1 ASTM E230-3	√((0.014% * (MV - LRV))² + (0.003%*MR)²), at least 0.0 °C (0.0 °F)	√((0.008% * (MV - LRV))² + (0.003%*MR)²),
Type J (35)		√((0.014% * (MV - LRV))² + (0.003%*MR)²),	√((0.008% * MV)² + (0.003%*MR)²), at least 0.0 °C (0.0 °F)
Type K (36)		√((0.015% * (MV - LRV))² + (0.003%*MR)²),	√((0.009% * (MV - LRV))² + (0.003%*MR)²),
Type N (37)		√((0.014% * (MV - LRV))² + (0.003%*MR)²), at least 0.010 °C (0.018 °F)	√((0.008% * MV)² + (0.003%*MR)²),
Type R (38)		≤ 0.06 °C (0.107 °F)	≤ 0.037 °C (0.067 °F)
Type S (39)			
Type T (40)		≤ 0.019 °C (0.035 °F)	0.032 °C (0.057 °F)
Type L (41)	DIN 43710	≤ 0.033 °C (0.059 °F)	≤ 0.033 °C (0.059 °F)
Type U (42)		≤ 0.025 °C (0.044 °F)	0.032 °C (0.057 °F)
Type L (43)	GOST R8.585-2001	≤ 0.032 °C (0.057 °F)	≤ 0.033 °C (0.059 °F)
Voltage transmitter (mV)			
−20 to 100 mV	-	√((0.015% * MV)² + (0.003%*MR)²)	√((0.008% * MV)² + (0.003%*MR)²)

MV = measured value

LRV = lower range value of the sensor in question

MR = measuring range of the sensor in question

Total measurement error of transmitter at current output = √(Measurement error digital² + Measurement error D/A²)

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 - LRV) + 0.03% or 0.02 °C (0.04 °F)	≤ 0.0093% * (MV - LRV) + 0.036% or 0.03 °C (0.05 °F)	≤ 0.0102% * (MV - LRV) + 0.038% 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 - LRV) + 0.03% or 0.03 °C (0.06 °F)	≤ 0.011% * (MV - LRV) + 0.036% or 0.03 °C (0.05 °F)	≤ 0.0124% * (MV - LRV) + 0.038% or 0.04 °C (0.07 °F)
Pt1000 (4)		≤ 0.0088% * (MV - LRV) + 0.03% or 0.02 °C (0.04 °F)	≤ 0.0114% * (MV - LRV) + 0.036% or 0.03 °C (0.05 °F)	≤ 0.013% * (MV - LRV) + 0.038% or 0.03 °C (0.05 °F)
Pt100 (5)	JIS C1604:1984	≤ 0.007% * (MV - LRV) + 0.03% or 0.02 °C (0.04 °F)	≤ 0.0093% * (MV - LRV) + 0.036% or 0.03 °C (0.05 °F)	≤ 0.0102% * (MV - LRV) + 0.038% or 0.03 °C (0.05 °F)
Pt50 (8)	GOST 6651-94	≤ 0.0076% * (MV - LRV) + 0.03% or 0.04 °C (0.08 °F)	≤ 0.01% * (MV - LRV) + 0.036% or 0.06 °C (0.11 °F)	≤ 0.011% * (MV - LRV) + 0.038% or 0.07 °C (0.12 °F)
Pt100 (9)		≤ 0.007% * (MV - LRV) + 0.03% or 0.02 °C (0.04 °F)	≤ 0.0093% * (MV - LRV) + 0.036% or 0.03 °C (0.05 °F)	≤ 0.0102% * (MV - LRV) + 0.038% or 0.03 °C (0.05 °F)
Ni100 (6)	DIN 43760 IPTS-68	0.02 °C (0.04 °F)	0.02 °C (0.04 °F)	0.02 °C (0.04 °F)
Ni120 (7)				
Cu50 (10)	OIML R84: 2003 / GOST 6651-2009	0.04 °C (0.07 °F)	0.05 °C (0.09 °F)	0.05 °C (0.09 °F)
Cu100 (11)		0.02 °C (0.04 °F)	0.03 °C (0.05 °F)	0.04 °C (0.07 °F)
Ni100 (12)		0.02 °C (0.04 °F)	0.02 °C (0.04 °F)	0.02 °C (0.04 °F)
Ni120 (13)				
Cu50 (14)	OIML R84: 2003 / GOST 6651-94	0.04 °C (0.07 °F)	0.05 °C (0.09 °F)	0.05 °C (0.09 °F)
Resistance transmitter				
10 to 400 Ω		≤ 0.0055% * MV + 0.03% or 7 mΩ	≤ 0.0073% * MV + 0.036% or 10 mΩ	≤ 0.008% * (MV - LRV) + 0.038% or 11 mΩ
10 to 2 000 Ω		≤ 0.007% * (MV - LRV) + 0.03% or 47 mΩ	≤ 0.009% * (MV - LRV) + 0.036% or 60 mΩ	≤ 0.0067% * (MV - LRV) + 0.038% or 67 mΩ

1) Whichever is greater

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

Description	Standard	Long-term drift (±) [1]		
		after 1 year	after 3 years	after 5 years
		Based on measured value		
Type A (30)	IEC 60584-1 ASTM E230-3	≤ 0.044% * (MV - LRV) + 0.03% or 0.70 °C (1.26 °F)	≤ 0.058% * (MV - LRV) + 0.036% or 0.93 °C (1.67 °F)	≤ 0.063% * (MV - LRV) + 0.038% or 1.01 °C (1.82 °F)
Type B (31)		1.66 °C (2.99 °F)	2.19 °C (3.94 °F)	2.39 °C (4.30 °F)
Type C (32)	IEC 60584-1 ASTM E230-3 ASTM E988-96	0.70 °C (1.26 °F)	0.92 °C (1.66 °F)	1.00 °C (1.80 °F)
Type D (33)	ASTM E988-96	0.87 °C (1.57 °F)	1.15 °C (2.07 °F)	1.26 °C (2.27 °F)
Type E (34)	IEC 60584-1 ASTM E230-3	0.26 °C (0.47 °F)	0.34 °C (0.61 °F)	0.37 °C (0.67 °F)
Type J (35)		0.31 °C (0.56 °F)	0.41 °C (0.74 °F)	0.44 °C (0.79 °F)

Description	Standard	Long-term drift (±) [1]		
Type K (36)		0.36 °C (0.65 °F)	0.47 °C (0.85 °F)	0.51 °C (0.92 °F)
Type N (37)		0.52 °C (0.94 °F)	0.69 °C (1.24 °F)	0.75 °C (1.35 °F)
Type R (38)		1.28 °C (2.30 °F)	1.69 °C (3.04 °F)	1.85 °C (3.33 °F)
Type S (39)		1.29 °C (2.32 °F)	1.70 °C (3.06 °F)	
Type T (40)		0.38 °C (0.68 °F)	0.50 °C (0.90 °F)	0.54 °C (0.97 °F)
Type L (41)	DIN 43710	0.25 °C (0.45 °F)	0.33 °C (0.59 °F)	0.36 °C (0.65 °F)
Type U (42)		0.37 °C (0.67 °F)	0.49 °C (0.88 °F)	0.53 °C (0.95 °F)
Type L (43)	GOST R8.585-2001	0.31 °C (0.56 °F)	0.41 °C (0.74 °F)	0.44 °C (0.79 °F)
Voltage transmitter (mV)				
−20 to 100 mV		≤ 0.025% * MV + 0.03% or 8 µV	≤ 0.033% * MV + 0.036% or 11 µV	≤ 0.036% * MV + 0.038% or 12 µV

1) The larger value is valid

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 also needs to be added.

12.5 Ambient conditions

Ambient temperature

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)

Operating altitude

Up to 4,000 m (4,374.5 yards) above sea level

Humidity

- Condensation:
  - Head transmitter permitted
  - DIN rail transmitter not permitted
- Max. rel. humidity: 95% as per IEC 60068-2-30

Climate class

- Head transmitter: climate class C1 as per EN 60654-1
- DIN rail transmitter: climate class B2 as per IEC 60654-1

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

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)

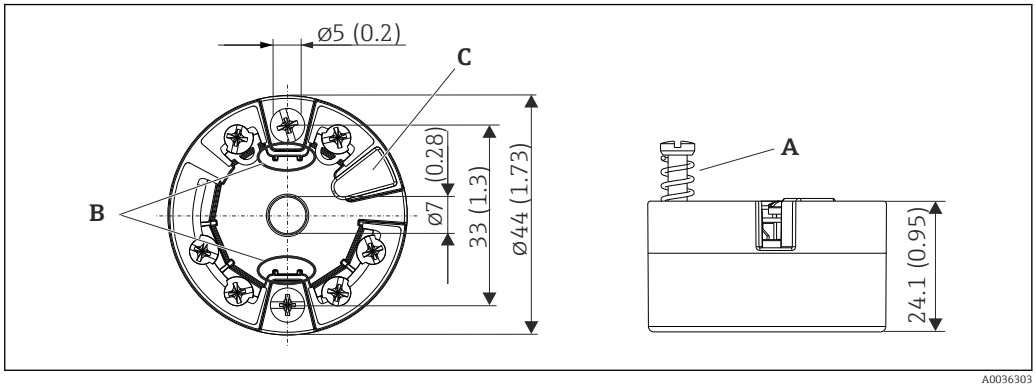
Electromagnetic compatibility (EMC)	**CE conformity** Electromagnetic compatibility in accordance with all the relevant requirements of the IEC/EN 61326 series and NAMUR Recommendation EMC (NE21). For details, refer to the Declaration of Conformity. All tests were passed both with and without ongoing communication. Maximum measurement error <1% of measuring range. Interference immunity as per IEC/EN 61326 series, industrial requirements Interference emission as per IEC/EN 61326 series, Class B equipment
Overvoltage category	Overvoltage category II
Pollution degree	Pollution degree 2
Protection class	Protection class III

12.6 Mechanical construction

Design, dimensions

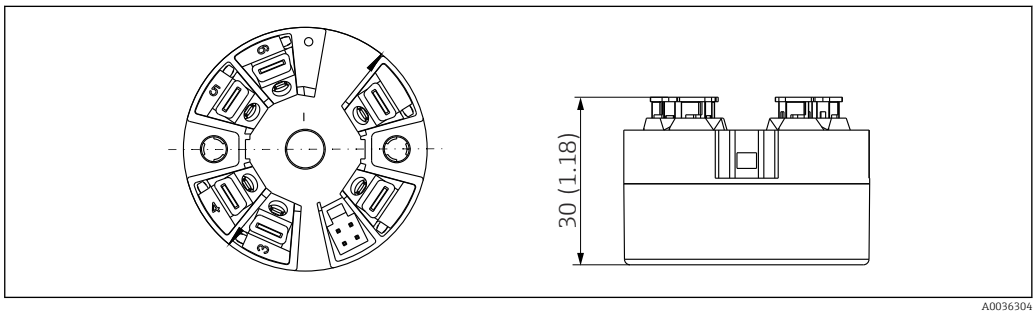
Dimensions in mm (in)

Head transmitter



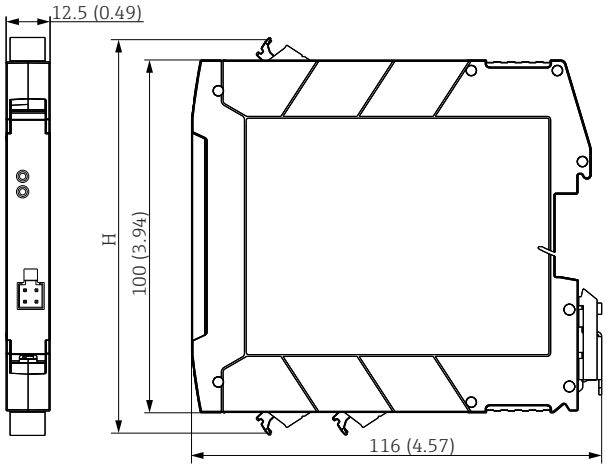
17 *Version with screw terminals*

A Spring travel L ≥ 5 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



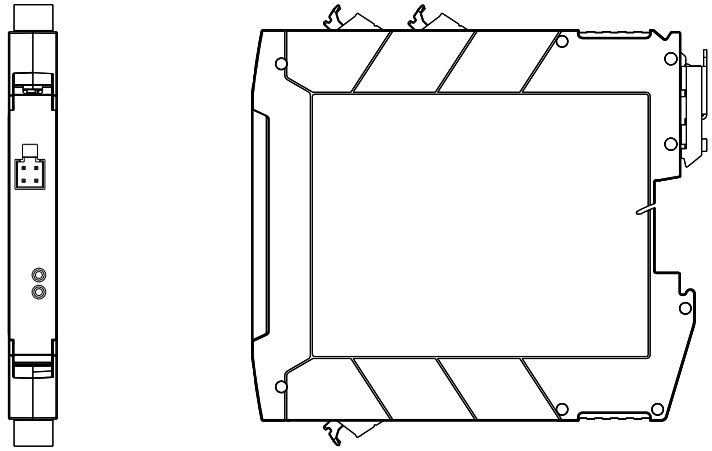
18 *Version with push-in terminals. Dimensions are identical to the version with screw terminals, apart from housing height.*

DIN rail device/version with power supply source at bottom



Height of housing H varies depending on the terminal version:
- Screw terminals: H = 114 mm (4.49 in)
- Push-in terminals: H = 111.5 mm (4.39 in)

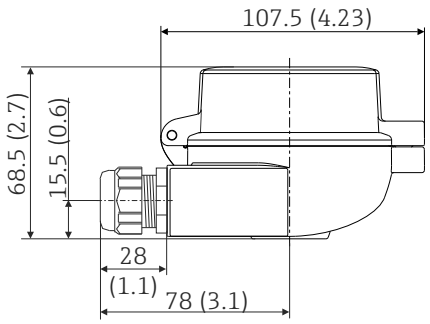
DIN rail device/version with power supply source at top

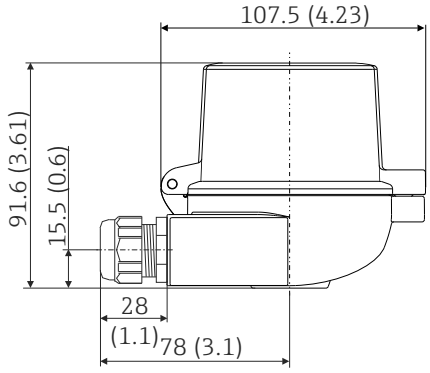


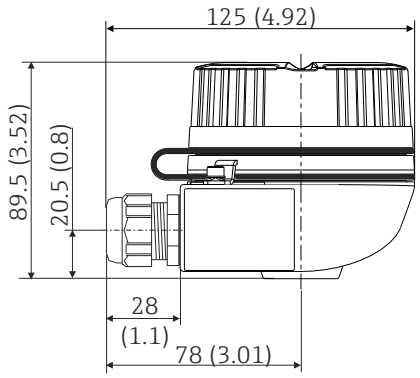
Field housing

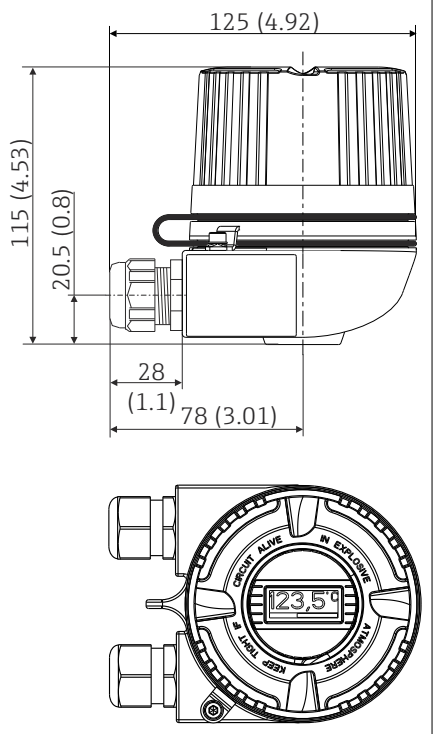
All field housings have an internal geometry in accordance with DIN EN 50446, Form B (flat face). Cable glands in the diagrams: M20x1.5

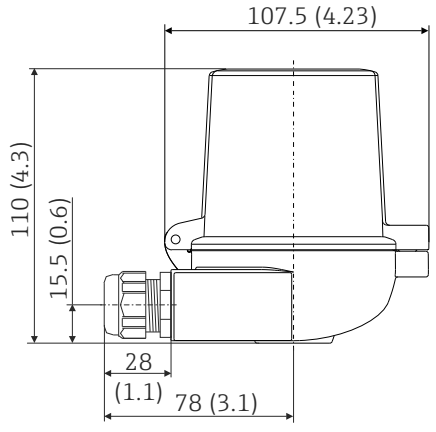
Maximum ambient temperatures for cable glands	
Type	**Temperature range**
Polyamide cable gland ½" NPT, M20x1.5 (non-Ex)	−40 to +100 °C (−40 to 212 °F)
Polyamide cable gland M20x1.5 (for dust ignition-proof area)	−20 to +95 °C (−4 to 203 °F)
Brass cable gland ½" NPT, M20x1.5 (for dust ignition-proof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

OTA30A	Specification
	▪ 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: ½" NPT and M20x1.5 ▪ Color: Gray ▪ Weight: 330 g (11.64 oz)

OTA30A with display window in cover	Specification
	▪ 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: ½" NPT and M20x1.5 ▪ Color: Gray ▪ 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

OTA30H	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: ½" NPT, M20x1.5 ▪ Color of aluminum head: Gray ▪ Weight: ▪ Aluminum approx. 640 g (22.6 oz) ▪ Stainless steel approx. 2 400 g (84.7 oz) 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).

OTA30H with display window in cover	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 ▪ Display window: single-pane safety glass according to DIN 8902 ▪ Cable entry glands: ½" NPT, M20x1.5 ▪ Color of aluminum head: Gray ▪ Weight: ▪ Aluminum approx. 860 g (30.33 oz) ▪ Stainless steel approx. 2 900 g (102.3 oz) ▪ For display TID10 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).

OTA30D	Specification
	▪ 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: ½" NPT 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. ▪ Color: Gray ▪ Weight: 390 g (13.75 oz)

Weight

- Head transmitter: approx. 40 to 50 g (1.4 to 1.8 oz)
- DIN rail device: approx. 100 g (3.53 oz)
- Field housing: see specifications

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

12.7 Certificates and approvals

Currently available certificates and approvals for the product are available from the supplier.

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 United States	
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 minimum distance 20cm 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 Operating menu and parameter description

The following tables list all the parameters in the Expert mode that are contained in the "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.

Diagnostics →	**Actual diagnostics →**	Actual diagnostics 1		→ 54
		Operating time		→ 54

Diagnostics →	**Diagnostic list →**	Actual diagnostics 1, 2, 3		→ 54
		Actual diag channel 1, 2, 3		→ 54
		Time stamp 1, 2, 3		→ 55

Diagnostics →	**Event logbook →**	Previous diagnostics n		→ 55
		Previous diag n channel		→ 55
		Time stamp n		→ 56

Diagnostics →	**Simulation →**	Diagnostic event simulation		→ 56
		Current output simulation		→ 56
		Value current output		→ 56
		Sensor simulation		→ 57
		Sensor simulation value		→ 57

Diagnostics →	**Diagnostic settings →**	**Properties →**	Alarm delay	→ 57
			Limit corrosion detection	→ 58
			Sensor line resistance	→ 58
			Thermocouple diagnostic	→ 58
		Diagnostic behavior → Sensor, electronics, process, configuration		→ 58
		Status signal → Sensor, electronics, process, configuration		→ 59

Diagnostics →	**Min/max values →**	Sensor min value		→ 59
		Sensor max value		→ 59
		Reset sensor min/max values		→ 59
		Device temperature min.		→ 60
		Device temperature max.		→ 60
		Reset device temp. min/max values		→ 60

Application →	**Measured values →**	Sensor value		→ 60
		Sensor raw value		→ 60

		Output current		→ 60
		Percent of range		→ 60
		Device temperature		→ 60

Application →	**Sensor →**	Unit		→ 61
		Sensor type		→ 62
		Connection type		→ 62
		2-wire compensation		→ 62
		Reference junction		→ 63
		RJ preset value		→ 63
		Sensor offset		→ 63

Application →	**Sensor →**	**Linearization →**	Call./v. Dusen coeff. R0, A, B, C	→ 64
			Polynomial coeff. R0, A, B	→ 64
			Sensor lower limit	→ 65
			Sensor upper limit	→ 65

Application →	**Current output →**	4mA value		→ 66
		20mA value		→ 66
		Failure mode		→ 66
		Failure current		→ 66
		Current trimming 4 mA		→ 67
		Current trimming 20 mA		→ 67
		Damping		→ 68

System →	**Device management →**	Device tag		→ 68
		Mains filter		→ 68
		Locking status		→ 69
		Device reset		→ 69

System →	**User management →**	**Define password →**	New password	→ 70
			Confirm new password	→ 70
			Status password entry	→ 71
		Change user role →	Password [1]	→ 71
			Status password entry	→ 71
		Reset password →	Reset password	→ 72
			Status password entry	→ 72
		Change password →	Old password	→ 72
			New password	→ 72
			Confirm new password	→ 72

		Status password entry	→ 73
	Delete password →	Delete password	→ 73

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

System →	**Bluetooth configuration →**	Bluetooth	→ 73
		Change Bluetooth password [1]	→ 73

1) Function is only visible in the Configuration app

System →	**Information →**	**Device →**	Serial number	→ 74
			Order code	→ 74
			Firmware version	→ 74
			Hardware revision	→ 75
			Extended order code (n) [1]	→ 75
			Device name	→ 75
			Manufacturer	→ 75

1) n = 1, 2, 3

System →	**Information →**	**Device location →**	Latitude	→ 75
			Longitude	→ 76
			Altitude	→ 76
			Location method	→ 76
			Location description	→ 77
			Process unit TAG	→ 77

System →	**Display →**	Display interval	→ 77
		Format display	→ 77
		Value 1 display	→ 78
		Decimal places 1	→ 78
		Value 2 display	→ 78
		Decimal places 2	→ 78
		Value 3 display	→ 78
		Decimal places 3	→ 78

13.1 Menu: Diagnostics

13.1.1 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)

13.1.2 "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

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)

13.1.3 "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)

13.1.4 "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 → 32. 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 $+1.0 \cdot 10^{20}$ ℃

Factory setting 0.00 ℃

13.1.5 "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. → 62

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. → 62

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. → 32

Selection
- Alarm
- Warning
- Disabled

Factory setting See the list of diagnostic events → 32

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. → 32

Selection
- Failure (F)
- Function check (C)
- Out of specification (S)
- Maintenance required (M)
- No effect (N)

Factory setting See the list of diagnostic events → 32

13.1.6 "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.

13.2 Menu: Application

13.2.1 Submenu: Measured values

Sensor value

Navigation Application → Measured values → Sensor value

Description Displays the current measured value at the sensor input.

Sensor raw value

Navigation Application → Measured values → Sensor raw value

Description Displays the non-linearized mV/Ohm value at the specific sensor input.

Output current

Navigation Application → Measured values → Output current

Description Displays the calculated output current in mA.

Percent of range

Navigation Application → Measured values → Percent of range

Description Displays the measured value in percentage of the span

Device temperature

Navigation Application → Measured values → Device temperature

Description Displays the current electronics temperature.

13.2.2 Submenu: Sensor

Unit

Navigation Application → Sensor → Unit

Description Use this function to select the engineering unit for all the measured values.

Selection
- ℃
- ℉
- K
- Ω
- mV

Factory setting ℃

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

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. → 16

Selection A list of all the possible sensor types is provided in the 'Technical data' section. → 36

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 Use this function to specify the resistance value for two-wire compensation in RTDs.

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 Use this function to select reference junction measurement for temperature compensation of thermocouples (TC).

If **Preset 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 **Preset value** parameter must be set if the **Reference junction** option is selected.

Description Use this function to define the fixed preset value for temperature compensation.

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

13.2.3 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 Use this function to set the R0 Value only for linearization with the Callendar/Van Dusen polynomial.

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 only 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.

13.2.4 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 an alarm condition.

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.

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.

13.3 Menu: System

13.3.1 Submenu: Device management

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

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

13.3.2 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 → 71

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 → 71

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: → 69
- Confirm new password: → 69

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 → 71

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.

13.3.3 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.

13.3.4 Information submenu

Device submenu

Serial number

Navigation System → Information → Device → Serial number

Description Displays the serial number of the device. It can also be found on the nameplate.

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.

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 '?'

13.3.5 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

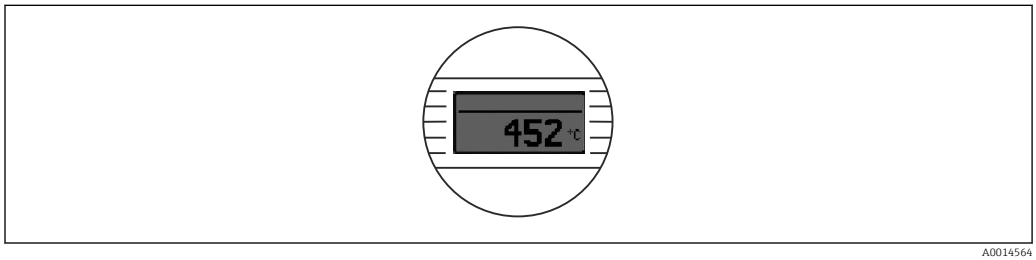
Navigation System → Display → Format display

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*



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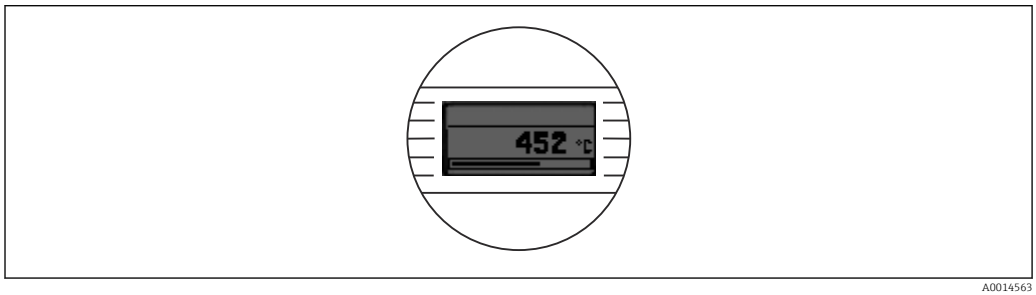
Value + bar graph



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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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