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Valid as of version
04.01 (device version)

Operating Instructions
iTEMP TMT162

Temperature field transmitter

Endress+Hauser
People for Process Automation

Table of contents

1 Important document information

1.1 Function of document and how to use

1.1.1 Document function

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

1.1.2 Safety Instructions (XA)

When using in hazardous areas, the national safety requirements must be met. Separate Ex documentation is contained in these Operating Instructions for measurement systems that are to mounted in hazardous areas. Strict compliance with the installation instructions, ratings and safety instructions as listed in this supplementary documentation is mandatory. Make sure that you use the right Ex-specific documentation for the right device with approval for use in hazardous areas! The number of the specific Ex documentation (XA...) is provided on the nameplate. If the two numbers (on the Ex documentation and the nameplate) are identical, then you may use this Ex-specific documentation.

1.1.3 Functional safety

Please refer to Safety Manual SD01632T/09 for the use of approved devices in protective systems according to IEC 61508.

1.2 Symbols used

1.2.1 Safety symbols

Symbol	Meaning
DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
CAUTION	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE	**NOTE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Electrical symbols

Symbol	Meaning
⎓	Direct current
~	Alternating current
⎓ ~	Direct current and alternating current

Symbol	Meaning
	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.
	Equipotential connection A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

1.2.3 Symbols for certain types of information

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

1.2.4 Tool symbols

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

1.3 Documentation

Document	Purpose and content of the document
Technical Information TI01344T/09	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions KA00250R/09	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Functional safety manual (SIL) SD01632T/09	**Functional Safety Manual** This manual applies in addition to the Operating Instructions, Technical Information and ATEX Safety Instructions. The requirements specific for the protection function are described in this Safety Manual.

The document types listed are available:
In the Download Area of the Endress+Hauser Internet site: www.endress.com → Downloads

1.4 Registered trademarks

HART®
Registered trademark of the HART® FieldComm Group

2 Basic safety instructions

2.1 Requirements for the personnel

NOTICE

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- Trained, qualified specialists must have a relevant qualification for this specific function and task
- Are authorized by the plant owner/operator
- Are familiar with federal/national regulations
- Before beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- Following instructions and basic conditions

The operating personnel must fulfill the following requirements:

- Being instructed and authorized according to the requirements of the task by the facility's owner-operator
- Following the instructions in these Operating Instructions

2.2 Designated use

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

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

2.3 Workplace safety

For work on and with the device:

- Wear the required personal protective equipment according to federal/national regulations.

2.4 Operational safety

⚠ CAUTION

Risk of injury!

- Operate the device in proper technical condition and fail-safe condition only.
- The operator is responsible for interference-free operation of the device.

Power supply

- The device must only be powered by a 11.5 to 42 V_{DC} voltage supply according to NEC class 02 (low voltage / current) with short circuit power limitation to 8 A / 150 VA.

Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.

- If, despite this, modifications are required, consult with Endress+Hauser.

Repair

To ensure continued operational safety and reliability:

- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to repair of an electrical device.

- Use original spare parts and accessories from Endress+Hauser only.

Hazardous area

To eliminate a danger for persons or for the facility when the device is used in the hazardous area (e.g. explosion protection or safety equipment):
- Based on the technical data on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area. The nameplate can be found on the side of the transmitter housing.
- Observe the specifications in the separate supplementary documentation that is an integral part of these Instructions.

Electromagnetic compatibility
The measuring system complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326 and NAMUR Recommendation NE 21 and NE 89.

2.5 Product safety

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

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

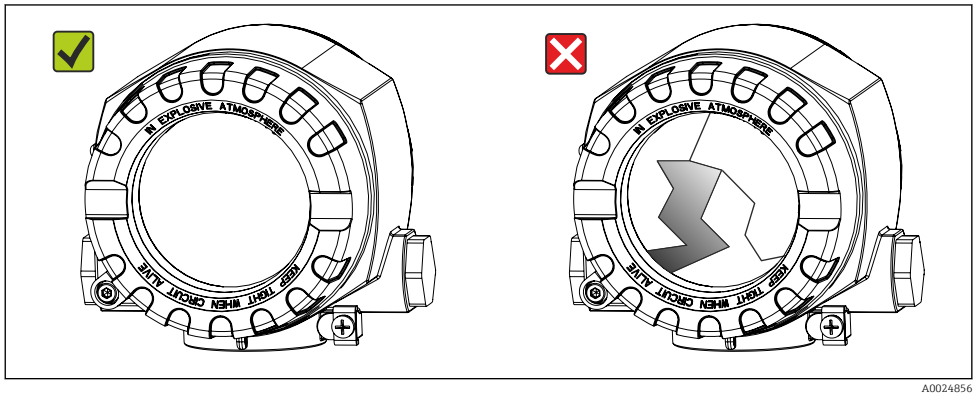
2.6 IT security

We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

3 Incoming acceptance and product identification

3.1 Incoming acceptance

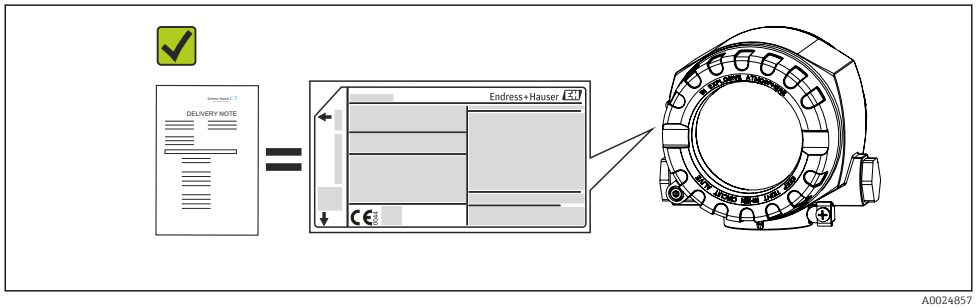
1. 

A0024856

Unpack the temperature transmitter carefully. Is the packaging or content damaged?

↳ Damaged components may not be installed as the manufacturer can otherwise not guarantee compliance with the original safety requirements or the material resistance, and can therefore not be held responsible for any resulting damage.

2. Is the delivery complete or is anything missing? Check the scope of delivery against your order.

3. 

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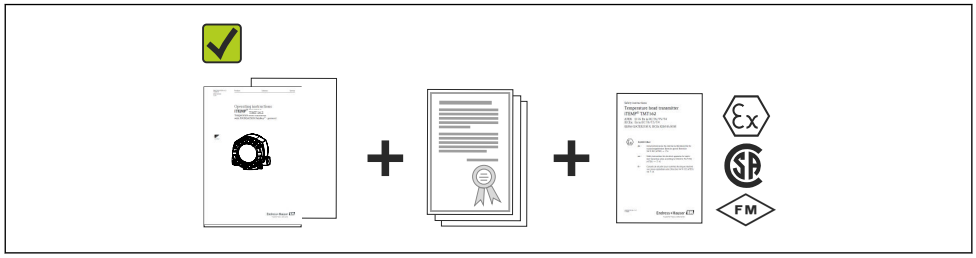
Does the nameplate match the ordering information on the delivery note?

4. 

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Are the technical documentation and all other necessary documents provided?

3.2 Product identification

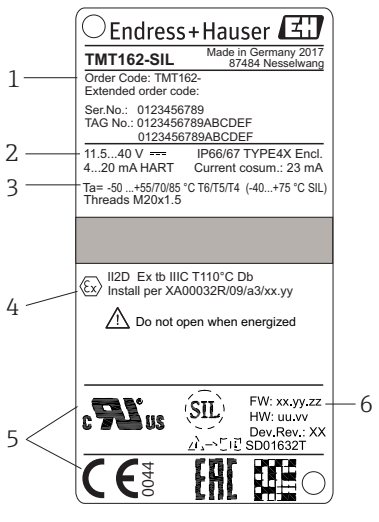
The following options are available for identification of the device:

- Nameplate specifications
- Enter the serial number from the nameplate in the *W@M Device Viewer* (**www.endress.com/deviceviewer**): All data relating to the device and an overview of the Technical Documentation supplied with the device are displayed.

3.2.1 Nameplate

Is this the correct device?

Check the data on the nameplate of the device and compare them against the requirements of the measuring point:



1 *Nameplate of the field transmitter (example, Ex version)*

1	Order code, serial number and TAG of device
2	Power supply, degree of protection, etc.
3	Ambient temperature range
4	Approvals in hazardous area with numbers of the relevant Ex documentation (XA...)
5	Approvals with symbols
6	Device revision and firmware version

3.2.2 Scope of delivery

The scope of delivery of the device comprises:
- Temperature transmitter
- Wall or pipe mounting bracket, optional
- Dummy plugs
- Hard copy of multi-language Brief Operating Instructions
- Additional documentation for devices which are suitable for use in the hazardous area (Ex, FM, SE), such as Safety Instructions (XA), Control or Installation Drawings (ZD).
- Hard copy of Functional Safety Manual (if SIL mode option selected)

3.2.3 Certificates and approvals

An overview of other approvals and certifications is provided in the "Technical data" section
→ 60

CE mark

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EC directives. The manufacturer confirms successful testing of the product by affixing to it the CE-mark.

EAC mark

The product meets the legal requirements of the EEU guidelines. The manufacturer confirms the successful testing of the product by affixing the EAC mark.

UL approval

UL recognized component (see www.ul.com/database, search for Keyword "E225237")

HART® protocol certification

The temperature transmitter is registered by the HART® FieldComm Group. The device meets the requirements of the HART Communication Protocol Specifications, Revision 7 (HCF 7.6).

3.3 Transport and storage

Carefully remove all the packaging material and protective covers that are part of the transported package.

Dimensions and operating conditions: → 🖹 59

Pack the device so that it is reliably protected against impact when it is stored (and transported). The original packaging offers the best protection.

Storage temperature	Without display –40 to +100 °C (–40 to +212 °F)
	With display –40 to +80 °C (–40 to +176 °F)

4 Installation

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

4.1 Installation conditions

4.1.1 Dimensions

The dimensions of the device are provided in the "Technical data" section.→ 59

4.1.2 Installation point

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

When using in hazardous areas, the limit values of the certificates and approvals must be observed (see Ex Safety Instructions).

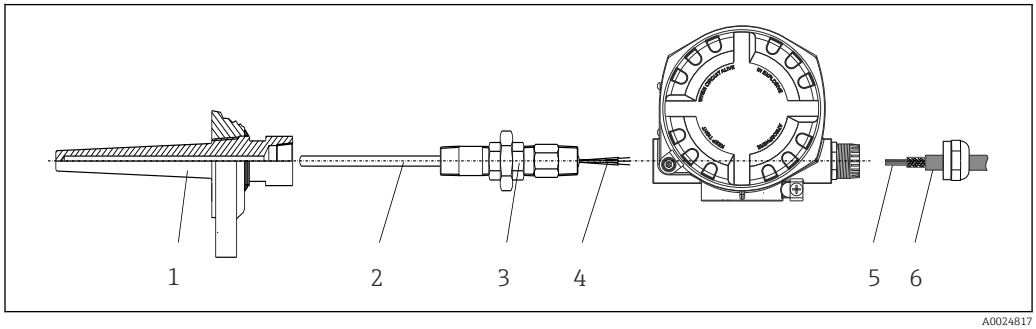
4.2 Mounting the transmitter

NOTICE

Do not overtighten the mounting screws, as this could damage the field transmitter.

► Maximum torque = 6 Nm (4.43 lbf ft)

4.2.1 Direct sensor mounting



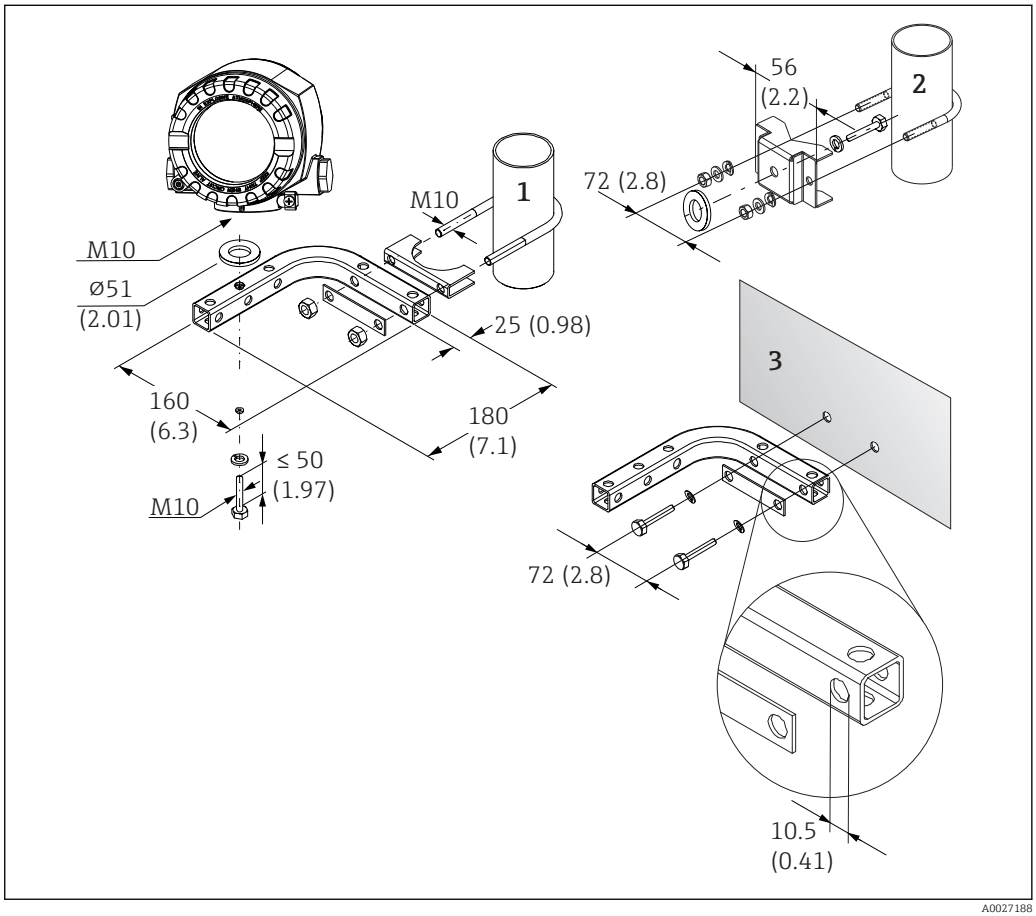
2 *Direct field transmitter mounting on sensor*

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

1. Mount the thermowell and screw down (1).
2. Screw the insert with the neck tube nipple and adapter into the transmitter (2). Seal the nipple and adapter thread with silicone tape.
3. Connect the sensor cables (4) to the terminals for the sensors, see the terminal assignment.
4. Fit the field transmitter with the insert on the thermowell (1).
5. Mount the fieldbus shielded cable or fieldbus connector (6) on the other cable gland.

6. Guide the fieldbus cables (5) through the cable gland of the fieldbus transmitter housing into the connection compartment.
7. Screw the cable gland tight as described in the *Ensuring the degree of protection* section→ 🖹 20. The cable gland must meet explosion protection requirements.

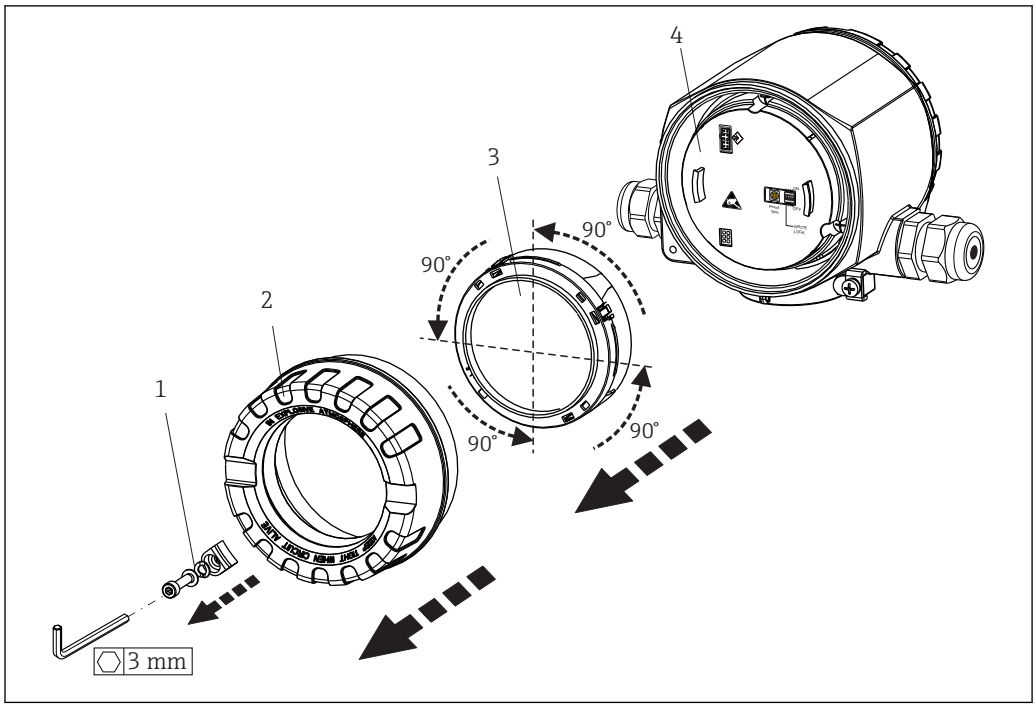
4.2.2 Remote mounting



3 Installation of the field transmitter using the mounting bracket, see chapter 'Accessories'. Dimensions in mm (in)

1 Mounting with combined wall/pipe mounting bracket
2 Mounting with pipe mounting bracket 2"/V4A
3 Mounting with wall mounting bracket

4.3 Display mounting



4 4 display installation positions, attachable in 90° stages

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

1. Remove the cover clamp (1).
2. Unscrew the housing cover together with the O-ring (2).
3. Remove the display with twist protection (3) from the electronics module (4). Fit the display with the fitting kit in the desired position in 90° stages and plug it into the correct slot on the electronics module.
4. Then screw the housing cover together with the O-ring.
5. Fit the cover clamp (1) back on.

4.4 Post-installation check

After installing the device, always run the following final 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.)?	→ 🖹 46

5 Wiring

5.1 Connection conditions

⚠ CAUTION

The electronics could be destroyed

- Switch off power supply before installing or connecting the device. Failure to observe this may result in destruction of parts of the electronics.
- When connecting Ex-certified devices, please take special note of the instructions and connection schematics in the Ex-specific supplement to these Operating Instructions. Contact the supplier if you have any questions.

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

NOTICE

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

- Maximum torque = 1 Nm (¾ lbf ft).

Proceed as follows to wire the device:

1. Remove the cover clamp. → 24
2. Unscrew the housing cover on the connection compartment together with the O-ring. → 24. The connection compartment is opposite the electronics module.
3. Open the cable glands of the device.
4. Route the appropriate connecting cables through the openings of the cable glands.
5. Wire the cables in accordance with → 5, 16 and as described in the sections: "Connecting the sensor" → 15 and "Connecting the measuring device" → 17.

On completion of the wiring, screw the screw terminals tight. Tighten the cable glands again. Refer to the information provided in the 'Ensuring the degree of protection' section. Screw the housing cover tight again and fit the cover clamp back on. → 24

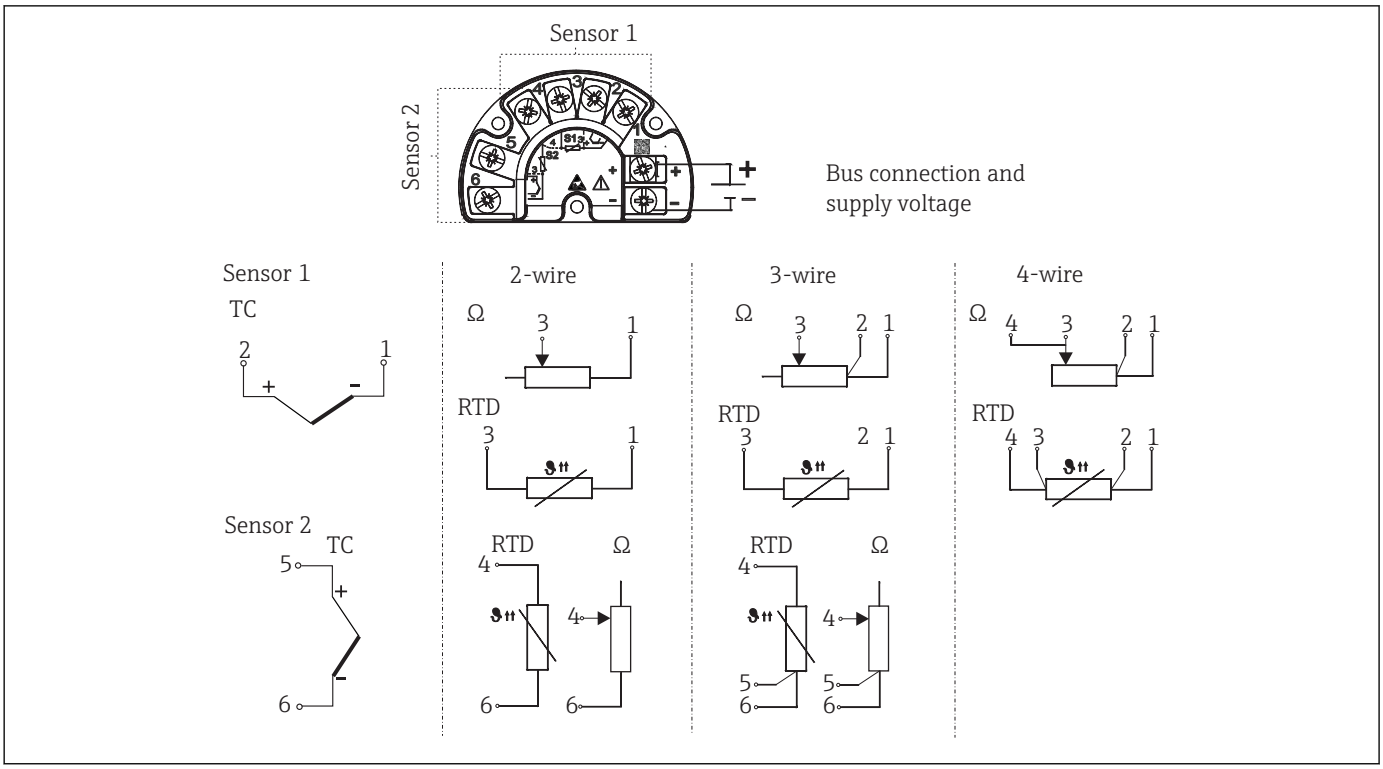
In order to avoid connection errors always follow the instructions in the post-connection check section before commissioning!

5.2 Connecting the sensor

NOTICE

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

Terminal assignment



5 *Wiring the field transmitter*

NOTICE

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

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

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

		Sensor input 1			
		RTD or resistance transmitter, two-wire	RTD or resistance transmitter, three-wire	RTD or resistance transmitter, four-wire	Thermocouple (TC), voltage transmitter
Sensor input 2	RTD or resistance transmitter, two-wire	☑	☑	-	☑
	RTD or resistance transmitter, three-wire	☑	☑	-	☑
	RTD or resistance transmitter, four-wire	-	-	-	-
	Thermocouple (TC), voltage transmitter	☑	☑	☑	☑

5.3 Connecting the measuring device

5.3.1 Cable glands or entries

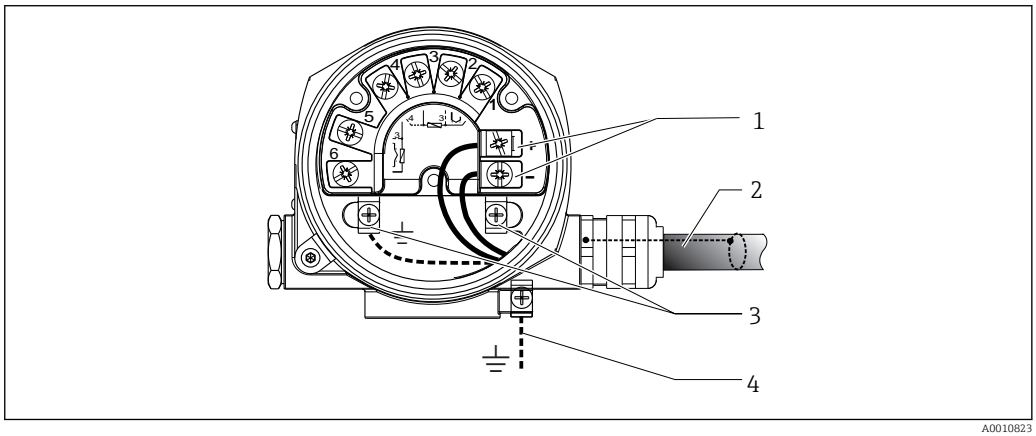
⚠ CAUTION

Risk of damage

- Switch off power supply before installing or connecting the device. Failure to observe this may result in destruction of parts of the electronics.
- If the device has not been grounded as a result of the housing being installed, we recommended grounding it via one of the ground screws. Observe the grounding concept of the plant! Keep the cable shield between the stripped fieldbus cable and the ground terminal as short as possible! Connection of the functional grounding may be needed for functional purposes. Compliance with the electrical codes of individual countries is mandatory.
- If the shielding of the fieldbus cable is grounded at more than one point in systems that do not have additional potential equalization, mains frequency equalizing currents can occur that damage the cable or the shielding. In such cases the shielding of the fieldbus cable is to be grounded on one side only, i.e. it must not be connected to the ground terminal of the housing. The shield that is not connected should be insulated!

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

Follow the general procedure. → 15.

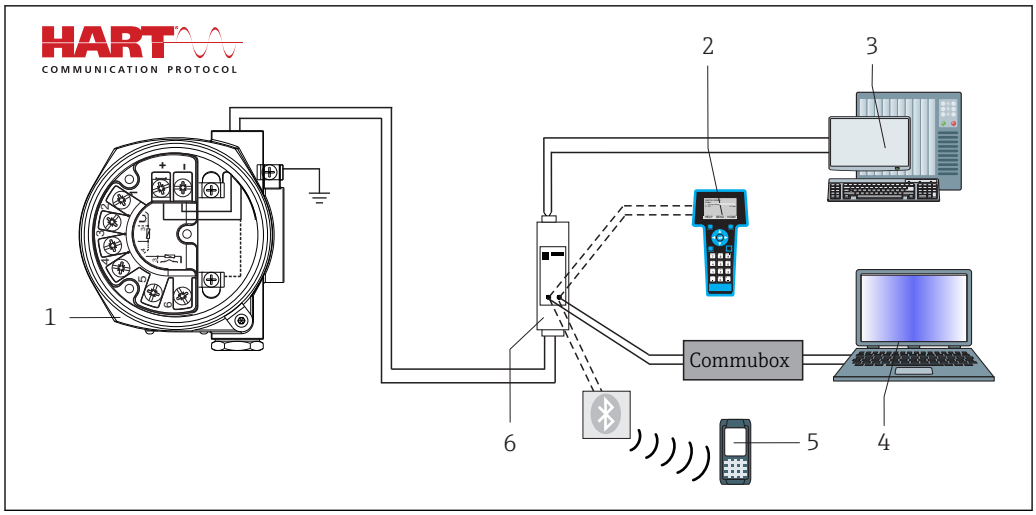


6 Connecting the device to the fieldbus cable

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

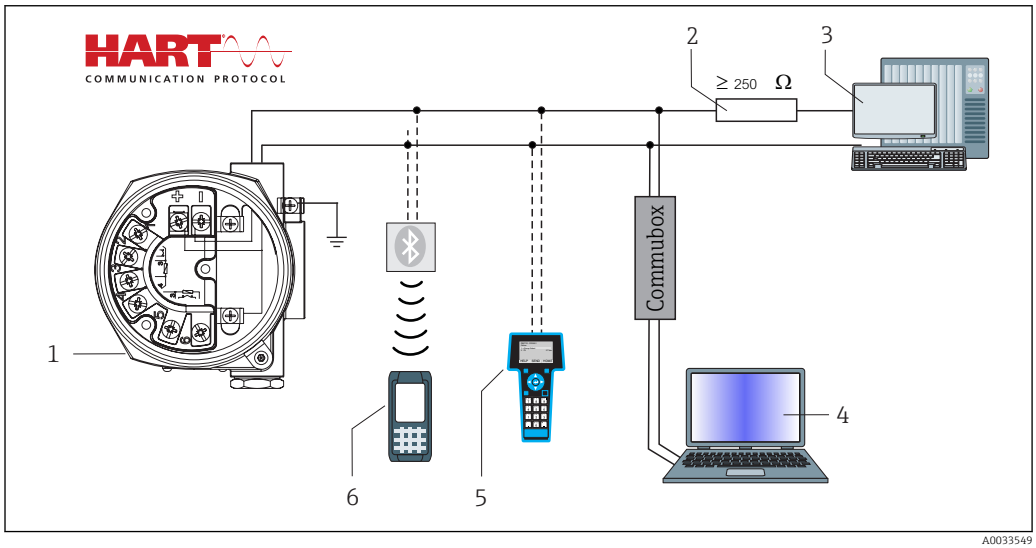
5.3.2 Connecting the HART® communication resistor

If the HART® communication resistor is not integrated into the power supply unit, it is necessary to incorporate a communication resistor of 250 Ω into the 2-wire cable. For the connection, also refer to the documentation published by the HART® FieldComm Group, particularly HCF LIT 20: “HART, a technical summary”.



7 *HART® connection with Endress+Hauser power supply unit, including integrated communication resistor*

1 *Temperature field transmitter*
2 *HART® handheld communicator*
3 *PLC/DCS*
4 *Configuration software, e.g. FieldCare*
5 *Configuration via Field Xpert SFX350/370*
6 *Power supply unit, e.g. RN221 from Endress+Hauser*

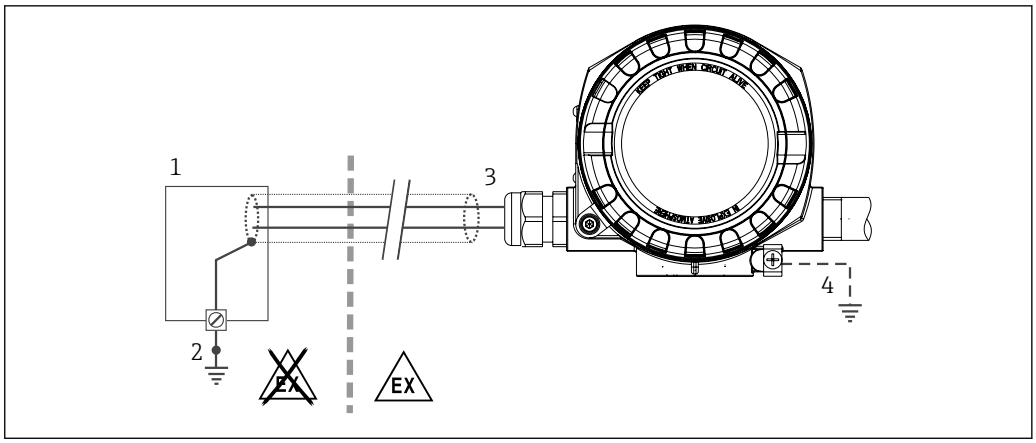


8 *HART® connection with other power supply units that do not have a built-in HART® communication resistor*

1 *Temperature field transmitter*
2 *HART® communication resistor*
3 *PLC/DCS*
4 *Configuration software, e.g. FieldCare*
5 *HART® handheld communicator*
6 *Configuration via Field Xpert SFX350/370*

5.3.3 Shielding and grounding

The specifications of the HART FieldComm Group must be observed during installation.

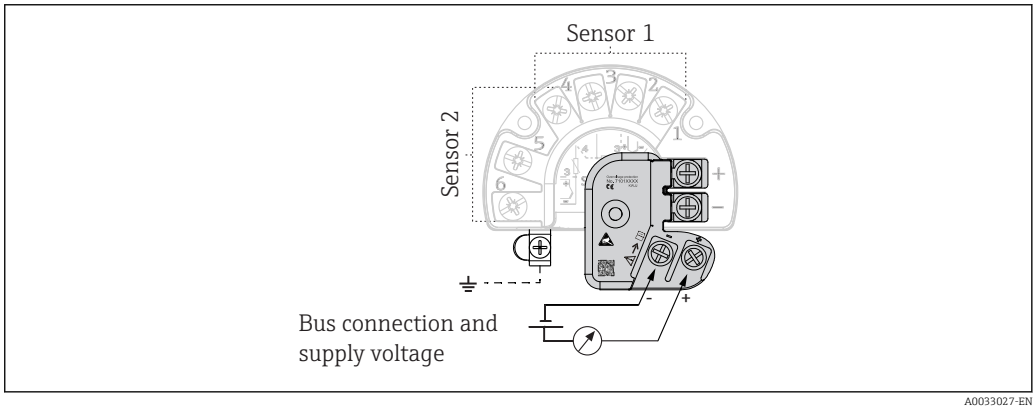


9 *Shielding and grounding the signal cable at one end with HART® communication*

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

5.4 Special connection instructions

If the device is fitted with a surge arrester module, the bus is connected and the power is supplied via the screw terminals on the surge arrester module.



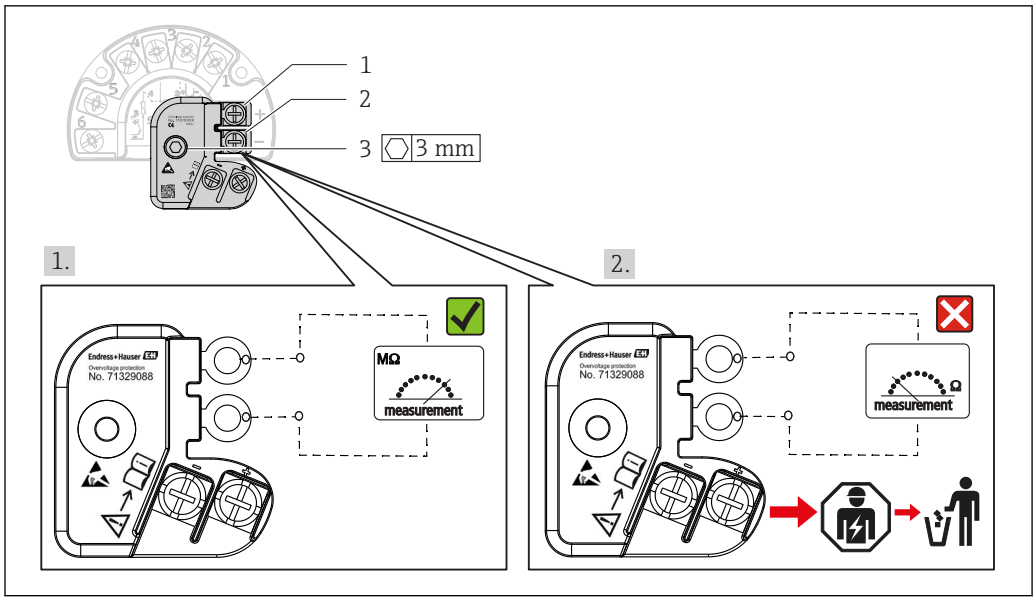
10 *Electrical connection of surge arrester*

5.4.1 Surge arrester function test

NOTICE

To perform the function test on the surge arrester module correctly:

- Remove the surge arrester module before performing the test.
- To do so, release screws (1) and (2) with a screwdriver as well as securing screw (3) with an allen key.
- The surge arrester module can be lifted off easily.
- Perform the function test as shown in the following graphic.



11 *Surge arrester function test*

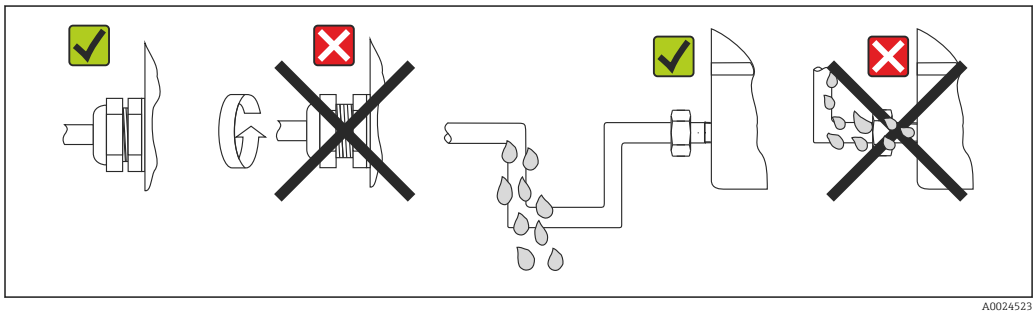
Ohmmeter in high-impedance range = surge arrester working ☑.

Ohmmeter in low-impedance range = surge arrester defective ☒. Notify Endress +Hauser Service. Dispose of the defective surge arrester module as electronic waste. For information on device disposal, see the Operating Instructions for the device. → 43

5.5 Ensuring the degree of protection

The measuring system meets all the requirements of 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 housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- All housing screws and screw caps must be firmly tightened.
- The cables used for connection must be of the specified outside diameter (e.g. M20x1.5, cable diameter 8 to 12 mm).
- Firmly tighten the cable gland. → 12, 20
- The cables must loop down before they enter the cable glands ("water trap"). This means that any moisture that may form cannot enter the gland. Install the device so that the cable glands are not facing upwards. → 12, 20
- Cable glands not used are to be blanked off using the dummy plugs provided.
- Do not remove the grommet from the cable gland.



12 *Connection tips to retain IP67 protection*

5.6 Post-connection check

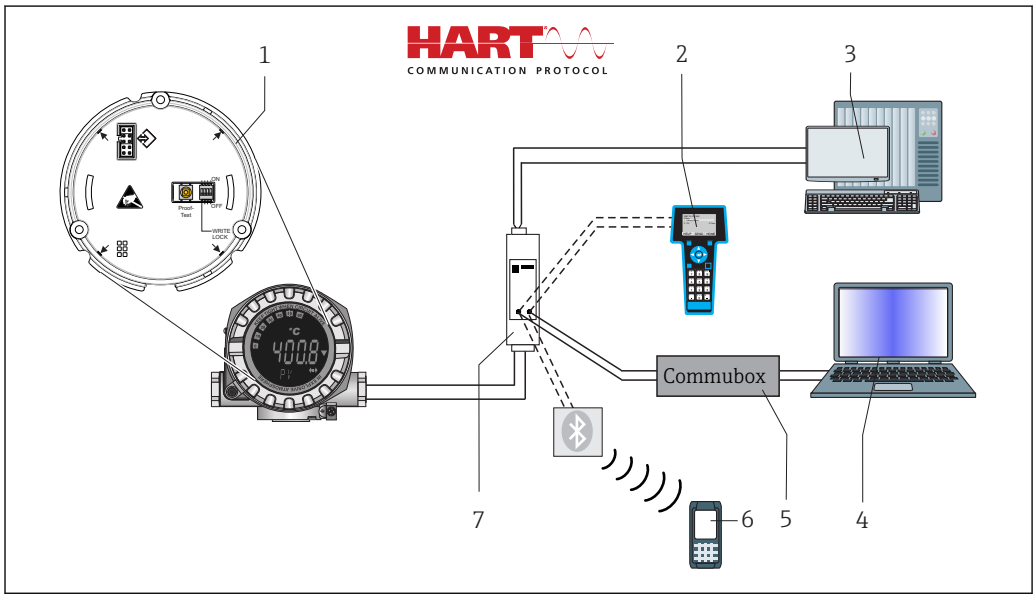
Device condition and specifications	Notes
Is the device or cable undamaged (visual inspection)?	--
Electrical connection	**Notes**
Does the supply voltage match the specifications on the nameplate?	Standard mode and SIL mode: U = 11.5 to 42 V_{DC}
Do the mounted cables have adequate strain relief?	Visual inspection
Are the power supply and signal cables correctly connected?	→ 17
Are all the screws terminals sufficiently tightened?	→ 15
Are all the cable entries installed, tightened and sealed?	→ 20
Are all the housing covers installed and tightened?	→ 24

6 Operating options

6.1 Overview of operation options

Operators have a number of options for configuring and commissioning the device:

- **Configuration software** → 27
  HART® functions and device-specific parameters are primarily configured via the Fieldbus interface. Special configuration and operating programs are available from various manufacturers for this purpose.
- **Miniature switch (DIP switch) and proof-test button for various hardware settings**
  - Hardware write protection is activated and deactivated via a miniature switch (DIP switch) on the electronics module.
  - Proof-test button for testing in SIL mode without HART operation. Pressing the button triggers a device restart. The proof test checks the functional integrity of the transmitter in the SIL mode during commissioning, in the event of changes to safety-related parameters or generally at appropriate intervals.

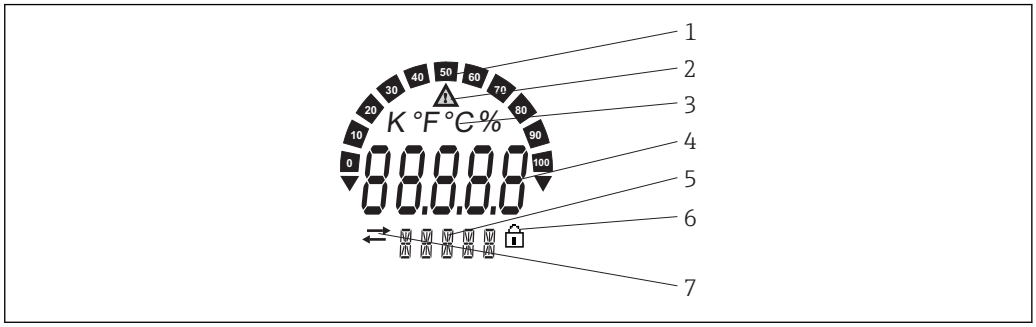


13 *Operating options of device*

1 *Hardware settings via DIP switch and proof-test button*
2 *HART® handheld communicator*
3 *PLC/DCS*
4 *Configuration software, e.g. FieldCare*
5 *Commubox: Power supply and modem for field devices with HART® protocol*
6 *Configuration via Field Xpert SFX350/370*
7 *Power supply unit and active barrier, .e.g. RN221 from Endress+Hauser*

6.1.1 Display and operating elements

Display elements



14 *LC display of the field transmitter (backlit, attachable in 90° stages)*

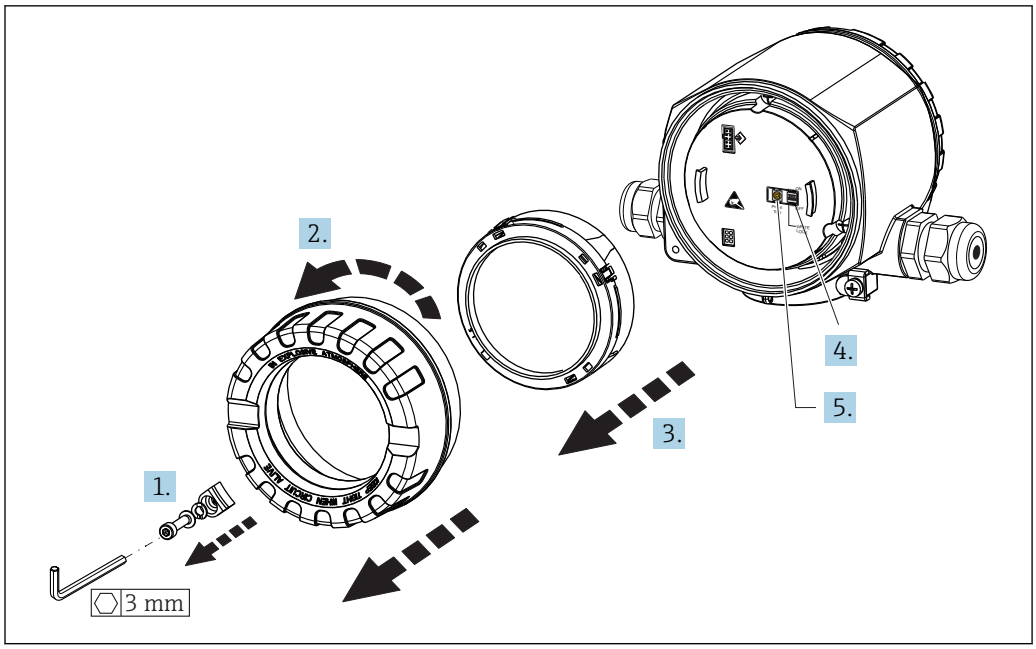
Item No.	Function	Description
1	Bar graph display	In increments of 10% with indicators for underranging and overranging.
2	'Caution' symbol	This is displayed when an error or warning occurs.
3	Unit display K, °F, °C or %	Unit display for the internal measured value displayed.
4	Measured value display, digit height 20.5 mm	Displays the current measured value. In the event of an error or warning, the corresponding diagnostics information is displayed. → 36
5	Status and information display	Indicates which value is currently shown on the display. Text can be entered for every value. In the event of an error or a warning, the sensor input that triggered the error/warning is also displayed where applicable, e.g. **SENS1**
6	'Configuration locked' symbol	The 'configuration locked' symbol appears when configuration is locked via the hardware or software
7	'Communication' symbol	The communication symbol appears when HART® communication is active.

Local operation

NOTICE

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

Hardware write protection and the proof test can be activated via a DIP switch or button on the electronics module. When write protection is active, parameters cannot be modified. A key symbol on the display indicates that the write protection is on. Write protection prevents any write access to the parameters.



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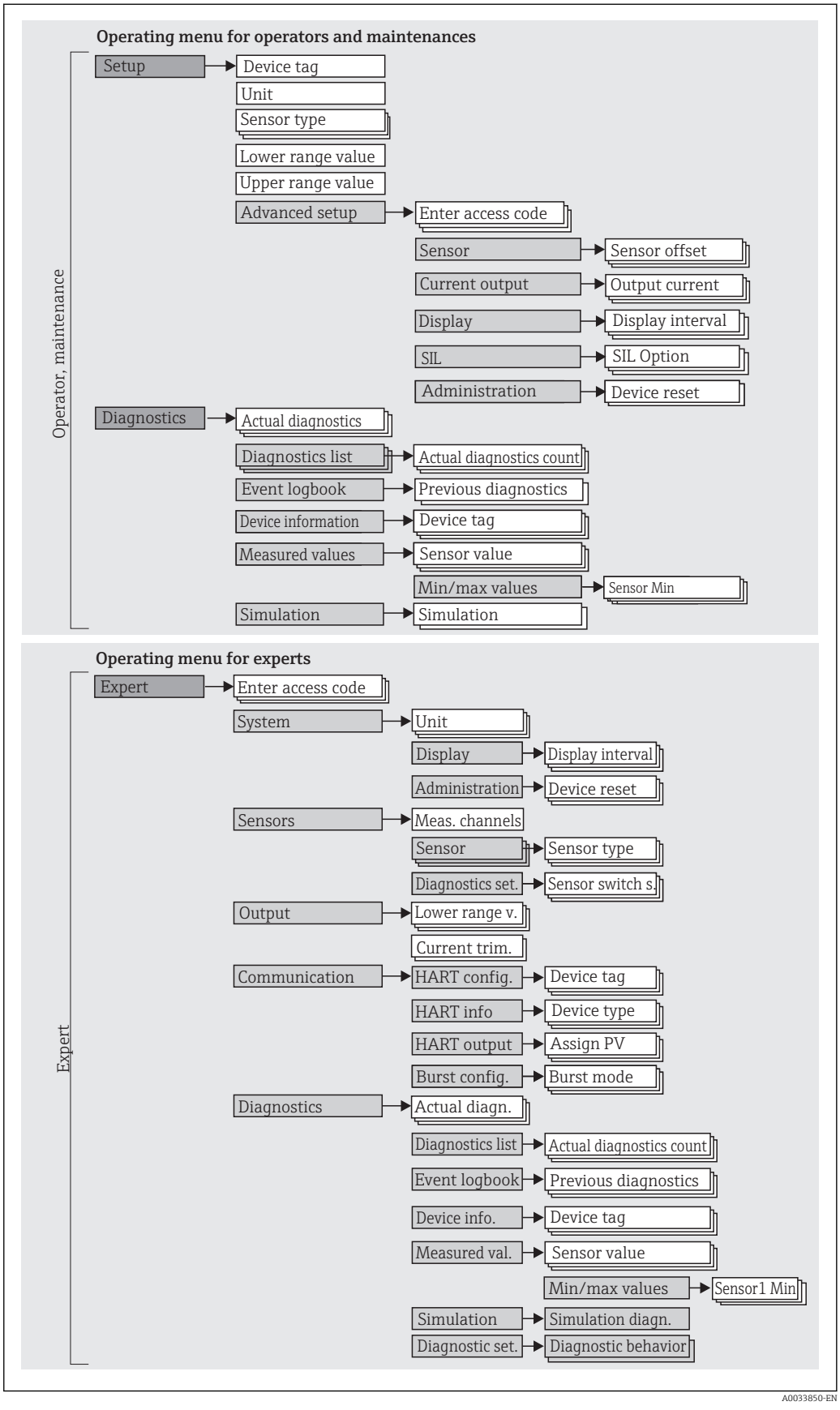
Procedure for setting the DIP switch or activating the proof test:

1. Remove the cover clamp.
2. Unscrew the housing cover together with the O-ring.
3. If necessary, remove the display with the fitting kit from the electronics module.
4. Configure the hardware write protection **WRITE LOCK** accordingly using the DIP switch. In general, the following applies: switch to ON = function enabled, switch to OFF = function disabled.
5. If performing a SIL commissioning test and a proof test, make a device restart using the button.

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

6.2 Structure and function of the operating menu

6.2.1 Structure of the operating menu



The configuration in the SIL mode is different from the configuration in the standard mode. For more detailed information please refer to the Functional Safety Manual (SD01632T/09).

Submenus and user roles

Certain parts of the menu are assigned to certain user roles. Each user role corresponds to typical tasks within the lifecycle of the device.

User role	Typical tasks	Menu	Content/meaning
Maintenance Operator	Commissioning: ▪ Configuration of the measurement. ▪ Configuration of data processing (scaling, linearization, etc.). ▪ Configuration of the analog measured value output. Tasks during operation: ▪ Configuration of the display. ▪ Reading measured values.	"Setup"	Contains all parameters for commissioning: ▪ **Setup parameters** Once values have been set for these parameters, the measurement should generally be completely configured. ▪ **"Advanced setup" submenu** Contains additional submenus and parameters: – For more accurate configuration of the measurement (adaptation to special measuring conditions). – For converting the measured value (scaling, linearization). – For scaling the output signal. – Required in ongoing operation: configuration of the measured value display (displayed values, display format, etc.).
	Fault elimination: ▪ Diagnosing and eliminating process errors. ▪ Interpretation of device error messages and correcting associated errors.	"Diagnostics"	Contains all parameters for detecting and analyzing errors: ▪ **Diagnostic list** Contains up to 3 currently active error messages. ▪ **Event logbook** Contains the last 5 error messages (no longer active). ▪ **"Device information" submenu** Contains information for identifying the device. ▪ **"Measured values" submenu** Contains all current measured values. ▪ **"Simulation" submenu** Used to simulate measured values, output values or diagnostic messages. ▪ **"Device reset" submenu**
Expert	Tasks that require detailed knowledge of the function of the device: ▪ Commissioning measurements under difficult conditions. ▪ Optimal adaptation of the measurement to difficult conditions. ▪ Detailed configuration of the communication interface. ▪ Error diagnostics in difficult cases.	"Expert"	Contains all parameters of the device (including those that are already in one of the other menus). The structure of this menu is based on the function blocks of the device: ▪ **"System" submenu** Contains all higher-level device parameters that do not pertain either to measurement or the measured value communication. ▪ **"Sensor" submenu** Contains all parameters for configuring the measurement. ▪ **"Output" submenu** Contains all parameters for configuring the analog current output. ▪ **"Communication" submenu** Contains all parameters for configuring the digital communication interface. ▪ **"Diagnostics" submenu** Contains all parameters for detecting and analyzing errors.

6.3 Access to the operating menu via the operating tool

6.3.1 FieldCare

Function range

FDT/DTM-based plant asset management tool from Endress+Hauser. It can configure all smart field devices in a system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. Access is via the HART® protocol or CDI (= Endress+Hauser Common Data Interface).

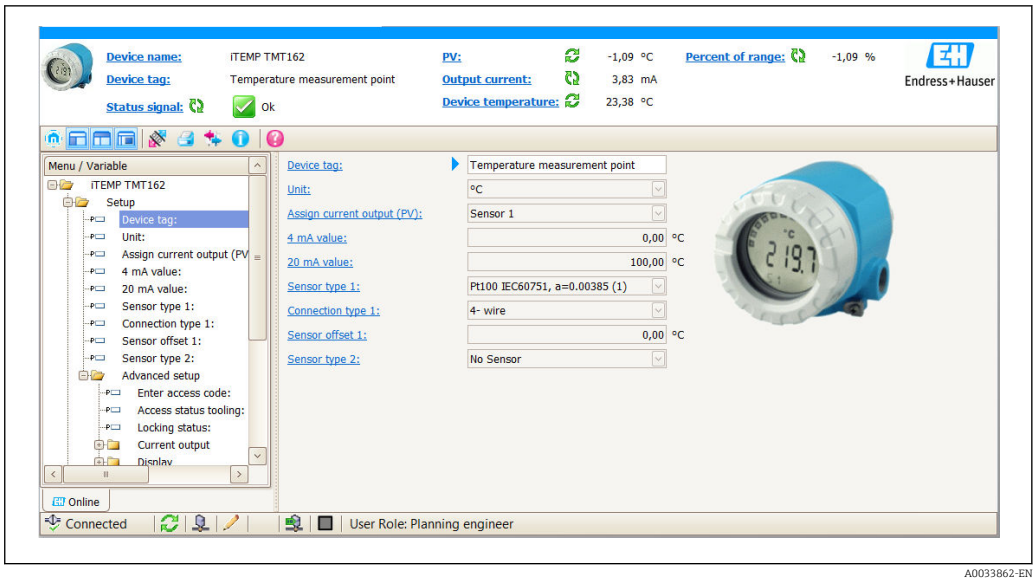
Typical functions:
- Parameterization of transmitters
- Loading and saving device data (upload/download)
- Documentation of the measuring point
- Visualization of the measured value memory (line recorder) and event logbook

For details, see Operating Instructions BA00027S/04/xx and BA00059AS/04/xx

Source for device description files

See information → 29

User interface



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6.3.2 DeviceCare

Function range

The fastest way to configure Endress+Hauser field devices is with the dedicated DeviceCare tool. DeviceCare's user-friendly design enables transparent and intuitive device connection and configuration. Intuitive menus and step-by-step instructions with status information ensure optimum transparency.

Quick and easy to install, connects devices in a single click (one-click connection). Automatic hardware identification and driver catalog update. The devices are configured using DTMs (Device Type Manager). Multilingual support, the tool is touch-enabled for tablet use. Hardware interfaces for modems : (USB/RS232), TCP/IP, USB and PCMCIA.

Source for device description files

See data → 29

6.3.3 Field Xpert

Function range

Field Xpert is an industrial PDA with integrated touchscreen for commissioning and maintaining field devices in explosion hazardous and safe areas. It enables the efficient configuration of FOUNDATION fieldbus, HART and WirelessHART devices. Communication is wireless via Bluetooth or WiFi interfaces.

Source for device description files

See data → 29

6.3.4 AMS Device Manager

Function range

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

Source for device description files

See data → 29

6.3.5 SIMATIC PDM

Function range

SIMATIC PDM is a standardized, vendor-independent program from Siemens for the operation, configuration, maintenance and diagnosis of smart field devices via the HART ® protocol.

Source for device description files

See data → 29

6.3.6 Field Communicator 475

Function range

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

Source for device description files

See data → 29

7 System integration

Version data for the device

Firmware version	04.01.zz	▪ On the title page of the Operating instructions ▪ On the nameplate ▪ **Firmware version** parameter Diagnostics → Device info→ Firmware Version
Manufacturer ID	0x0011	**Manufacturer ID** parameter Diagnostics → Device info→ Manufacturer ID
Device type ID	0x11CE	**Device type** parameter Diagnostics → Device info → Device type
HART protocol revision	7.6	---
Device revision	4	▪ On the transmitter nameplate ▪ **Device revision** parameter Diagnostics → Device info → Device revision

The suitable device description file (DD or DTM) for the individual operating tools is listed in the table below, along with information on where the file can be acquired.

Operating tools

Operating tool	Sources for obtaining device descriptions (DD) or device type managers (DTM)
FieldCare (Endress+Hauser)	▪ www.endress.com → Download Area → Software ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
DeviceCare (Endress+Hauser)	www.endress.com → Download Area → Software
AMS Device Manager (Emerson Process Management)	Please ask the operating tool manufacturer for information on where to obtain the DD/DTM.
SIMATIC PDM (Siemens)	
Field Communicator 475 (Emerson Process Management)	Use update function of handheld terminal
FieldXpert SFX350, SFX370 (Endress+Hauser)	Use update function of handheld terminal

7.1 HART device variables and measured values

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

Device variables for temperature measurement

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

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

7.2 Device variables and measured values

The following measured values are assigned to the individual device variables:

Device variable code	Measured value
0	Sensor 1
1	Sensor 2
2	Device temperature
3	Average of sensor 1 and sensor 2
4	Difference between sensor 1 and sensor 2
5	Sensor 1 (backup sensor 2)
6	Sensor 1 with switchover to sensor 2 if a limit value is exceeded
7	Average of sensor 1 and sensor 2 with backup

The device variables can be queried by a HART® master using HART® command 9 or 33.

7.3 Supported HART® commands

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

There are three different types of command
- Universal commands:
  All HART® devices support and use universal commands. These are associated with the following functionalities for example:
  – Recognition of HART® devices
  – Reading digital measured values
- Common practice commands:
  Common practice commands offer functions which are supported and can be executed by many but not all field devices.
- Device-specific commands:
  These commands allow access to device-specific functions which are not HART® standard. Such commands access individual field device information, among other things.

Command No.	Designation
Universal commands	
0, Cmd0	Read unique identifier
1, Cmd001	Read primary variable
2, Cmd002	Read loop current and percent of range
3, Cmd003	Read dynamic variables and loop current
6, Cmd006	Write polling address
7, Cmd007	Read loop configuration
8, Cmd008	Read dynamic variable classifications
9, Cmd009	Read device variables with status
11, Cmd011	Read unique identifier associated with TAG

Command No.	Designation
12, Cmd012	Read message
13, Cmd013	Read TAG, descriptor, date
14, Cmd014	Read primary variable transducer information
15, Cmd015	Read device information
16, Cmd016	Read final assembly number
17, Cmd017	Write message
18, Cmd018	Write TAG, descriptor, date
19, Cmd019	Write final assembly number
20, Cmd020	Read long TAG (32-byte TAG)
21, Cmd021	Read unique identifier associated with long TAG
22, Cmd022	Write long TAG (32-byte TAG)
38, Cmd038	Reset configuration changed flag
48, Cmd048	Read additional device status
Common practice commands	
33, Cmd033	Read device variables
34, Cmd034	Write primary variable damping value
35, Cmd035	Write primary variable range values
36, Cmd036	Set primary variable upper range value
37, Cmd037	Set primary variable lower range value
40, Cmd040	Enter/Exit fixed current mode
42, Cmd042	Perform device reset
44, Cmd044	Write primary variable units
45, Cmd045	Trim loop current zero
46, Cmd046	Trim loop current gain
50, Cmd050	Read dynamic variable assignments
51, Cmd051	Write dynamic variable assignments
54, Cmd054	Read device variable information
59, Cmd059	Write number of response preambles
72, Cmd072	Squawk
95, Cmd095	Read device communications statistics
100, Cmd100	Write primary variable alarm code
103, Cmd103	Write burst period
104, Cmd104	Write burst trigger
105, Cmd105	Read burst mode configuration
107, Cmd107	Write burst device variables
108, Cmd108	Write burst mode command number
109, Cmd109	Burst mode control
516, Cmd516	Read device location
517, Cmd517	Write device location
518, Cmd518	Read location description
519, Cmd519	Write location description
520, Cmd520	Read process unit tag
521, Cmd521	Write process unit tag

Command No.	Designation
523, Cmd523	Read condensed status mapping array
524, Cmd524	Write condensed status mapping
525, Cmd525	Reset condensed status map
526, Cmd526	Write status simulation mode
527, Cmd527	Simulate status bit

8 Commissioning

8.1 Post-installation check

Before commissioning the measuring point make sure that all final checks have been carried out:
- "Post-installation check" checklist, → 12
- "Post-connection check" checklist, → 15

8.2 Switching on the transmitter

Once the final checks have been successfully completed, it is time to switch on the supply voltage. The transmitter performs a number of internal test functions after power-up. As this procedure progresses, the following sequence of messages appears on the display:

Step	Display
1	"Display" text and firmware version of the display
2	Firm logo
3	Device name (scrolling text)
4	Firmware, hardware version, device version and device address
5	For devices in SIL mode: SIL-CRC is displayed
6a	Current measured value or
6b	Current status message If the switch-on procedure is not successful, the relevant diagnostic event, depending on the cause, is displayed. A detailed list of diagnostic events and the corresponding troubleshooting instructions can be found in the "Diagnostics and troubleshooting" section .

The device operates in normal mode after approx. 30 seconds! Normal measuring mode commences as soon as the switch-on procedure is completed. Measured values and status values appear on the display.

8.3 Enabling configuration

If the device is locked and the parameter settings cannot be changed, it must first be enabled via the hardware or software lock. The device is write-protected if the lock symbol is shown on the display.

To unlock the device
- either switch the write protection switch on the electronics module to the "OFF" position (hardware write protection), or
- deactivate the software write protection via the operating tool. See the description for the **'Define device write protection'** parameter. → 83

  When hardware write protection is active (write protection switch set to the "ON" position), write protection cannot be disabled via the operating tool. Hardware write protection must always be disabled before software write protection can be enabled or disabled via the operating tool.

9 Diagnostics and troubleshooting

9.1 Troubleshooting

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

In the event of a serious fault, a device might have to be returned to the manufacturer for repair. Refer to the "Return" section before returning the device to Endress+Hauser. → 🖹 43

Check display (local display)	
Display is blank - no connection to the HART host system.	1. Check the supply voltage → terminals + and - 2. Measuring electronics defective → order spare part, → 🖹 41
Display is blank - however, connection has been established to the HART host system.	1. Check whether the display module fitting kit is correctly seated on the electronics module → 🖹 14 2. Display module defective → order spare part, → 🖹 41 3. Measuring electronics defective → order spare part, → 🖹 41

Local error messages on the display
→ 🖹 36

Faulty connection to the fieldbus host system		
Problem	**Possible cause**	**Solution**
Device is not responding.	Supply voltage does not match the value indicated on the nameplate.	Apply correct voltage
	Connecting cables are not in contact with the terminals.	Check the connection of the cables and correct if necessary.
Output current < 3.6 mA	Signal line is not wired correctly.	Check wiring.
	Electronics unit is defective.	Replace the device.
HART communication is not working.	Communication resistor missing or incorrectly installed.	Install the communication resistor (250 Ω) correctly.
	Commubox is connected incorrectly.	Connect Commubox correctly.

Error messages in the configuration software
→ 🖹 37

Application errors without status messages for RTD sensor connection		
Problem	**Possible cause**	**Solution**
Measured value is incorrect/ inaccurate	Incorrect sensor orientation.	Install the sensor correctly.
	Heat conducted by sensor.	Observe the face-to-face length of the sensor.

Application errors without status messages for RTD sensor connection		
Problem	**Possible cause**	**Solution**
	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 (two-wire) was not compensated.	Compensate the cable resistance.
	Offset incorrectly set.	Check offset.
Failure current (≤ 3.6 mA or ≥ 21 mA)	Faulty sensor.	Check the sensor.
	Incorrect sensor connection.	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		
Problem	**Possible cause**	**Solution**
Measured value is incorrect/ inaccurate	Incorrect sensor orientation.	Install the sensor correctly.
	Heat conducted by sensor.	Observe the face-to-face length of the sensor.
	Device programming is incorrect (scaling).	Change scaling.
	Incorrect thermocouple type (TC) configured.	Change the **Sensor type** device function.
	Incorrect comparison measuring point set.	Set the correct comparison measuring point .
	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)	Faulty sensor.	Check the sensor.
	Sensor is connected incorrectly.	Connect the connecting cables correctly (terminal diagram).
	Incorrect programming.	Incorrect sensor type set in the **Sensor type** device function. Set the correct sensor type.

9.2 Diagnostic events

9.2.1 Displaying diagnostic events

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

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

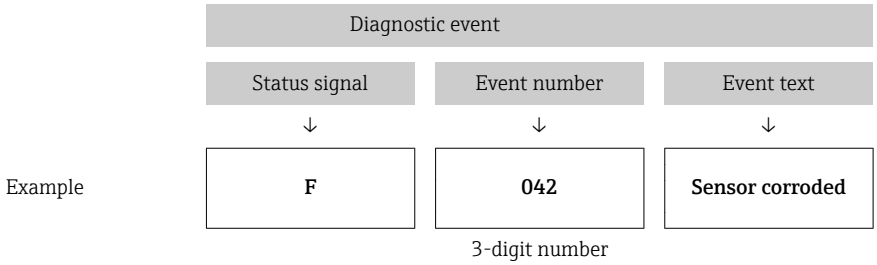
- If a valid measured value is not available, the display alternates between "- - -- -" and the error message plus the defined error number and the '⚠' symbol.
- If a valid measured value is present, the display alternates between the status plus the defined error number (7-segment display) and the primary measured value (PV) with the '⚠' symbol.

Diagnostic behavior

Alarm	Measurement is interrupted. The signal outputs assume the specified 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.

Diagnostic event and event text

The fault can be identified by means of the diagnostic event. The event text helps you by providing information on the fault.



If two or more diagnostic events are pending simultaneously, only the diagnostic message with the highest priority is shown. Additional pending diagnostic messages are shown in the **Diagnostic list** submenu → 📄 85. The status signal dictates the priority in which the diagnostic messages are displayed. The following order of priority applies: F, C, S, M. If two or more diagnostic events with the same status signal are active simultaneously, 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.

Past diagnostic messages that are no longer pending are shown in the **Event logbook** submenu→ 📄 86.

9.2.2 Overview of diagnostic events

Each diagnostic event is assigned a certain event behavior at the factory. 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 HART® communication)**	**Current output**	**PV, 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 error 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 error current is output if no valid measured value is available.

The relevant sensor input for these diagnostic events can be identified with the **Actual diag channel** parameter or on the display.

Diagnostic number	Short text	Corrective measure	Status signal from the factory	☑ Customizable [1)] / ☒ Not customizable	Diagnostic behavior from the factory	☑ Customizable [2)] / ☒ Not customizable
Diagnostics for the sensor						
001	Device failure - sensor n [3)] (sensor RJ)	1. Restart device 2. Replace electronics	F	☒	Alarm	☒
041	Sensor interrupted - sensor n	1. Check electrical wiring. 2. Replace sensor. 3. Check connection type.	F	☑	Alarm	☑
042	Sensor n corroded	1. Check sensor. 2. Replace sensor.	M	☑	Warning	☑
043	Short-circuit sensor n	1. Check electrical connection. 2. Check sensor. 3. Replace sensor or cable.	F	☑	Alarm	☑
044	Sensor drift detected	1. Check sensor or main electronics. 2. Replace sensor or main electronics.	M	☑	Warning	☑
047	Sensor limit reached sensor n (sensor RJ)	1. Check sensor. 2. Check process conditions.	S	☑	Warning	☑
048	Drift detection not possible	1. Check electrical connection. 2. Check sensor. 3. Replace sensor.	M	☑	Warning	☑
062	Sensor connection faulty sensor n (sensor RJ)	Check sensor connection.	F	☑	Alarm	☑
105	Calibration interval	1. Execute calibration and reset calibration interval. 2. Switch off calibration counter.	M	☑	Warning	☑
145	Compensation reference point sensor n	1. Check terminal temperature. 2. Check external reference point.	F	☑	Alarm	☑
Diagnostics for the electronics						
201	Electronics faulty	1. Restart device. 2. Replace electronics.	F	☑	Alarm	☑
221	Reference sensor defective sensor RJ	Replace device.	M	☑	Alarm	☑
241	Firmware faulty	1. Restart device. 2. Power cycle device. 3. Replace electronics.	F	☑	Alarm	☑
242	Firmware incompatible	1. Check firmware version. 2. Flash or replace main electronics.	F	☑	Alarm	☑
261	Electronics module defective	1. Restart device. 2. Replace main electronics module.	F	☑	Alarm	☑
283	Memory content inconsistent	1. Restart device. 2. Replace electronics.	F	☑	Alarm	☑
286	Data storage inconsistent	1. Repeat safe parameterization. 2. Replace electronics.	F	☑	Alarm	☑
Diagnostics for the configuration						
401	Factory reset active	Factory reset active, please wait.	C	☒	Warning	☒
402	Initialization active sensor n (sensor RJ)	Initialization active, please wait.	C	☒	Warning	☒

Diagnostic number	Short text	Corrective measure	Status signal from the factory	✓ Customizable [1] / ✗ Not customizable	Diagnostic behavior from the factory	✓ Customizable [2] / ✗ Not customizable
410	Data transfer failed	1. Check connection. 2. Retry data transfer.	F	✗	Alarm	✗
411	Up-/download active	Up-/download active, please wait.	C	✗	Warning	✗
412	Download active	Download active, please wait	C	✓	Warning	✓
435	Linearization faulty sensor n (sensor RJ)	Check linearization.	F	✗	Alarm	✗
438	Dataset different	1. Check data set file. 2. Check device parameterization. 3. Download new device parameterization.	M	✗	Warning	✗
439	Data set	Repeat the safe parameterization	F	✗	Alarm	✗
485	Process variable simulation active sensor n (device temperature)	Deactivate simulation.	C	-	Warning	-
491	Current output simulation	Deactivate simulation.	C	✓	Warning	✓
495	Diagnostic event simulation active	Deactivate simulation.	C	✓	Warning	✓
531	Factory adjustment missing sensor n (current output)	1. Contact service. 2. Replace device.	F	✗	Alarm	✗
537	Configuration sensor n (current output)	1. Check device configuration 2. Upload and download new configuration. (In case of current output: check configuration of analog output.)	F	✗	Alarm	✗
583	Input simulation sensor n	Deactivate simulation.	C	✓	Warning	✓
Diagnostics for the process						
801	Supply voltage too low [4]	Increase supply voltage.	S	✓	Alarm	✗
825	Operating temperature	1. Check ambient temperature. 2. Check process temperature.	S	✓	Warning	✓
844	Process value out of specification-current output	1. Check process value. 2. Check application. Check sensor.	S	✓	Warning	✓

1) Can be set to F, C, S, M, N
2) Can be set to 'Alarm', 'Warning' and 'Disabled'
3) n = number of sensor inputs (1 and 2)
4) In the case of this diagnostic event, the device always outputs a "low" alarm status (output current ≤ 3.6 mA).

9.3 Software history and overview of compatibility

Revision history

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

XX Change to main version. No longer compatible. The device and Operating Instructions change.

YY Change to functions and operation. Compatible. The Operating Instructions change.

ZZ Fixes and internal changes. No changes to the Operating Instructions.

Date	Firmware version	Modification	Documentation
07/2017	04.01.zz	HART protocol version 7.6 and addition of operating parameters for functional safety (SIL3)	BA01801T/09/en/01.17

10 Maintenance

No special maintenance work is required for the temperature transmitter.

10.1 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as recalibration, maintenance service or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

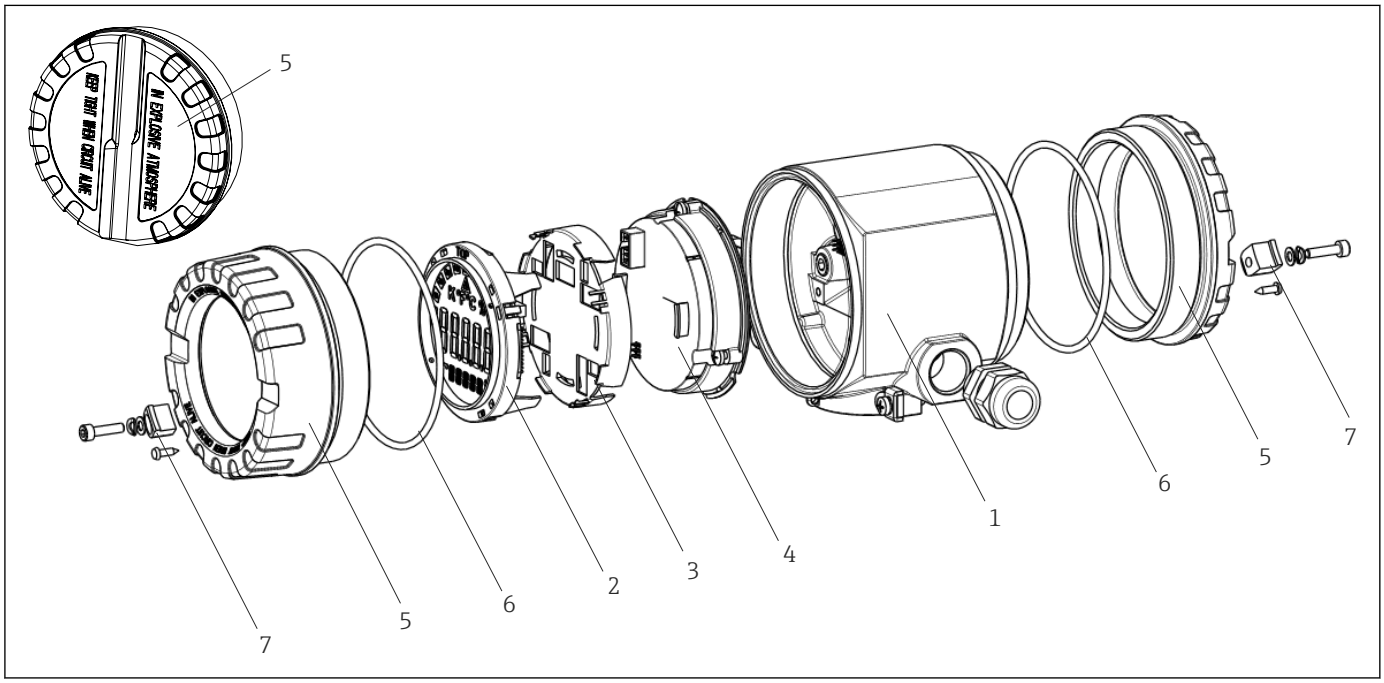
11 Repair

11.1 General notes

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

11.2 Spare parts

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



15 *Field transmitter spare parts*

Item No. 1	Housing		
	Certificates:		
	A	Non-hazardous area + Ex ia	
	B	ATEX Ex d	
		Material:	
		A	Aluminum, HART 5
		B	Stainless steel 316L, HART 5
		C	T17, HART 5
		F	Aluminum, FF/PA
		G	Stainless steel 316L, FF/PA
		H	T17, FF/PA
		K	Aluminum, HART 7
		L	Stainless steel 316L, HART 7
		M	T17, HART 7

Item No. 1	Housing				
			Cable entry:		
			1	2 x thread NPT ½" + terminal block + 1 dummy plug	
			2	2 x thread M20x1.5 + terminal block + 1 dummy plug	
			4	2 x thread G ½" + terminal block + 1 dummy plug	
				Version:	
				A	Standard
TMT162G-				**A**	**← order code**

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

Item No.	Order code	Spare parts
2,3	TMT162X-DA	Display HART 5 + fitting kit + twist protection
2,3	TMT162X-DB	Display PA/FF + fitting kit + twist protection
2,3	TMT162X-DC	Display fitting kit + twist protection
2,3	TMT162X-DD	Display HART 7 + fitting kit + twist protection
5	TMT162X-HH	Housing cover blind, aluminum Ex d, FM XP with seal, CSA approval, only as cover of connection compartment
5	TMT162X-HI	Housing cover blind, aluminum + seal
5	TMT162X-HK	Housing cover cpl. display, aluminum Ex d with seal
5	TMT162X-HL	Housing cover cpl. display, aluminum with seal
5	TMT162X-HA	Housing cover blind, stainless steel 316L Ex d, ATEX Ex d, FM XP with seal, CSA approval, only as cover of connection compartment
5	TMT162X-HB	Housing cover blind, stainless steel 316L, with seal
5	TMT162X-HC	Housing cover cpl. display, Ex d, stainless steel 316L, ATEX Ex d, FM XP, CSA XP, with seal

Item No.	Order code	Spare parts
5	TMT162X-HD	Housing cover cpl. display, stainless steel 316L, with seal
5	TMT162X-HE	Housing cover blind, T17, 316L
5	TMT162X-HF	Housing cover cpl. display, polycarbonate, T17 316L
5	TMT162X-HG	Housing cover cpl. display, glass, T17 316L
6	71158816	O-ring 88x3 EPDM70 PTFE slide coating
7	51004948	Cover clamp spare part set: screw, disk, spring washer

11.3 Return

The measuring device must be returned if it is need of repair or a factory calibration, or if the wrong measuring device has been delivered or ordered. Legal specifications require Endress+Hauser, as an ISO-certified company, to follow certain procedures when handling products that are in contact with the medium.

To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at http://www.endress.com/support/return-material

11.4 Disposal

The device contains electronic components and must, therefore, be disposed of as electronic waste in the event of disposal. Please pay particular attention to the local regulations governing waste disposal in your country.

12 Accessories

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

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

12.1 Device-specific accessories

Accessories	Description
Dummy plugs	▪ M20x1.5 EEx-d/XP ▪ G ½" EEx-d/XP ▪ NPT ½" ALU ▪ NPT ½" V4A
Cable glands	▪ M20x1.5 ▪ NPT ½" D4-8.5, IP68 ▪ NPT ½" cable gland 2 x D0.5 cable for 2 sensors ▪ M20x1.5 cable gland 2 x D0.5 cable for 2 sensors
Adapter for cable gland	M20x1.5 outside/M24x1.5 inside
Wall and pipe mounting bracket	Stainless steel wall/2" pipe Stainless steel 2" pipe V4A
Surge arrester	The module protects the electronics from overvoltage. Not available for T17 stainless steel housing.

12.2 Communication-specific accessories

Accessories	Description
Field Xpert SFX350	Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area**. For details, see Operating Instructions BA01202S
Field Xpert SFX370	Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area and the Ex area**. For details, see Operating Instructions BA01202S

12.3 Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections. ▪ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: ▪ Via the Internet: https://wapps.endress.com/applicator ▪ On CD-ROM for local PC installation.
W@M	Life cycle management for your plant W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress +Hauser also takes care of maintaining and updating the data records. W@M is available: ▪ Via the Internet: www.endress.com/lifecyclemanagement ▪ On CD-ROM for local PC installation.
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. For details, see Operating Instructions BA00027S and BA00059S
DeviceCare	Configuration tool for devices via fieldbus protocols and Endress+Hauser service protocols. DeviceCare is the tool developed by Endress+Hauser for the configuration of Endress+Hauser devices. All smart devices in a plant can be configured via a point-to-point or point-to-bus connection. The user-friendly menus enable transparent and intuitive access to the field devices. For details, see Operating Instructions BA00027S

12.4 System products

Accessories	Description
Graphic Data Manager Memograph M	The Advanced Data Manager Memograph M is a flexible and powerful system for organizing process values. The measured process values are clearly presented on the display and logged safely, monitored for limit values and analyzed. Via common communication protocols, the measured and calculated values can be easily communicated to higher-level systems or individual plant modules can be interconnected. For details, see Technical Information TI01180R/09
RN221N	Active barrier with power supply for safe separation of 4 to 20 mA standard signal circuits. Has bidirectional HART® transmission and optional HART® diagnostics if transmitters are connected with monitoring of 4 to 20 mA signal or HART® status byte analysis and an E+H-specific diagnostic command. For details, see Technical Information TI00073R/09
RIA15	Process display, digital loop-powered display for 4 to 20 mA circuit, panel mounting, with optional HART® communication. Displays 4 to 20 mA or up to 4 HART® process variables For details, see Technical Information TI01043K/09

13 Technische Daten

13.1 Input

Measured variable	Temperature (temperature-linear transmission behavior), resistance and voltage.
Measuring range	It is possible to connect two sensors that are independent of one another [1]. The measuring inputs are not galvanically isolated from each other.

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)
	▪ Type of connection: 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
IEC 60584, Part 1	Type A (W5Re-W20Re) (30)	0 to +2 500 °C (+32 to +4 532 °F)	Recommended temperature range: 0 to +2 500 °C (+32 to +4 532 °F)	50 K (90 °F)
	Type B (PtRh30-PtRh6) (31)	+40 to +1 820 °C (+104 to +3 308 °F)	+500 to +1 820 °C (+932 to +3 308 °F)	50 K (90 °F)
	Type E (NiCr-CuNi) (34)	−270 to +1 000 °C (−454 to +1 832 °F)	−150 to +1 000 °C (−238 to +1 832 °F)	50 K (90 °F)
	Type J (Fe-CuNi) (35)	−210 to +1 200 °C (−346 to +2 192 °F)	−150 to +1 200 °C (−238 to +2 192 °F)	50 K (90 °F)
	Type K (NiCr-Ni) (36)	−270 to +1 372 °C (−454 to +2 501 °F)	−150 to +1 200 °C (−238 to +2 192 °F)	50 K (90 °F)
	Type N (NiCrSi-NiSi) (37)	−270 to +1 300 °C (−454 to +2 372 °F)	−150 to +1 300 °C (−238 to +2 372 °F)	50 K (90 °F)
	Type R (PtRh13-Pt) (38)	−50 to +1 768 °C (−58 to +3 214 °F)	+50 to +1 768 °C (+122 to +3 214 °F)	50 K (90 °F)
	Type S (PtRh10-Pt) (39)	−50 to +1 768 °C (−58 to +3 214 °F)	+50 to +1 768 °C (+122 to +3 214 °F)	50 K (90 °F)
	Type T (Cu-CuNi) (40)	−260 to +400 °C (−436 to +752 °F)	−150 to +400 °C (−238 to +752 °F)	50 K (90 °F)
IEC 60584, Part 1; 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)

1) In the case of 2-channel measurement the same measuring unit must be configured for the two channels (e.g. both °C or F or K). Independent 2-channel measurement of a resistance transmitter (Ohm) and voltage transmitter (mV) is not possible.

Thermocouples as per standard	Description	Measuring range limits		Min. span
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 R8.8585-2001	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)
	▪ Internal cold junction (Pt100) ▪ External cold junction: 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

Type of input

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

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

13.2 Output

Output signal

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

Failure information

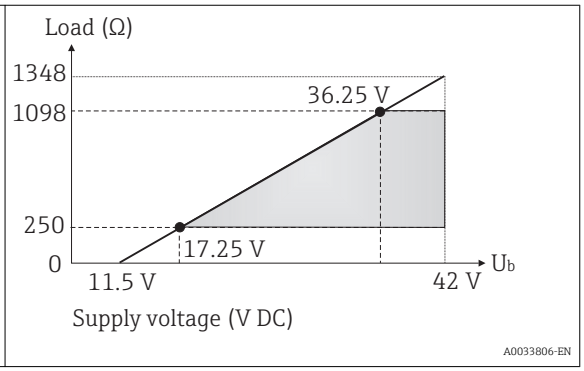
Failure information as per NAMUR NE43:

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 drop 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

$R_{b\ max.}$ = ($U_{b\ max.}$ - 11.5 V) / 0.023 A (current output)



Linearization/transmission behavior

Temperature-linear, resistance-linear, voltage-linear

Mains filter

50/60 Hz

Filter

1st order digital filter: 0 to 120 s

Protocol-specific data

Manufacturer ID	17 (0x11)
Device type ID	0x11CE
HART® specification	7.6
Device address in the multi-drop mode [1]	Software setting addresses0 to 63
Device description files (DTM, DD)	Information and files can be found: www.endress.com www.fieldcommgroup.org
HART load	min. 250 Ω
HART device variables	The measured values can be freely assigned to the device variables. Measured values for PV, SV, TV and QV (first, second, third and fourth device variable) ▪ Sensor 1 (measured value) ▪ Sensor 2 (measured value) ▪ Device temperature ▪ Average of the two measured values: 0.5 x (SV1+SV2) ▪ Difference between sensor 1 and sensor 2: SV1-SV2 ▪ Sensor 1 (backup sensor 2): If sensor 1 fails, the value of sensor 2 automatically becomes the primary HART® value (PV): sensor 1 (OR sensor 2) ▪ Sensor switching: If the value exceeds the configured threshold value T for sensor 1, the measured value of sensor 2 becomes the primary HART® value (PV). The system switches back to sensor 1 if the measured value of sensor 1 is at least 2 K below T: sensor 1 (sensor 2, if sensor 1 > T) ▪ Average: 0.5 x (SV1+SV2) with backup (measured value of sensor 1 or sensor 2 in the event of a sensor error in the other sensor)
Supported functions	▪ Burst mode [1] ▪ Squawk ▪ Condensed status

1) Not possible in the SIL mode, see Functional Safety Manual SD01632T/09

Wireless HART data

Minimum starting voltage	11.5 V_{DC}
Start current	3.58 mA
Starting time	▪ Normal operation: 6 s ▪ SIL mode: 29 s

Minimum operating voltage	11.5 V_{AC}
Multidrop current	4.0 mA [1]
Time for connection setup	▪ Normal mode: 9 s ▪ SIL mode: 10 s

1) No Multidrop current in SIL mode

Write protection for device parameters
- Hardware: Write protection using DIP switch on electronics module in the device
- Software: Write protection using password

Switch-on delay
- Until the start of HART® communication, approx. 10 s, during switch-on delay = I_a ≤ 3.6 mA
- Until the first valid measured value signal is present at the current output, approx. 28 s, during switch-on delay = I_a ≤ 3.6 mA

13.3 Power supply

Supply voltage

Values for non-hazardous areas, protected against polarity reversal:
- 11.5 V ≤ Vcc ≤ 42 V (standard)
- I ≤ 23 mA

Values for hazardous areas, see Ex documentation → 🖹 61

The transmitter must be powered by an 11.5 to 42 V_{DC} power supply in accordance with NEC Class 02 (low voltage/low current) with restricted power limited to 8 A/ 150 VA in the event of a short-circuit (in accordance with IEC 61010-1, CSA 1010.1-92).

Current consumption

Current consumption	3.6 to 23 mA
Minimum current consumption	≤ 3.5 mA, Multidrop mode 4 mA (not possible in SIL mode)
Current limit	≤23 mA

Terminals

2.5 mm^2 (12 AWG) plus ferrule

Cable entries

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

Cable specification

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Residual ripple

Perm. residual ripple U_{SS} ≤ 3 V at U_b ≥ 13.5 V, $f_{max.}$ = 1 kHz

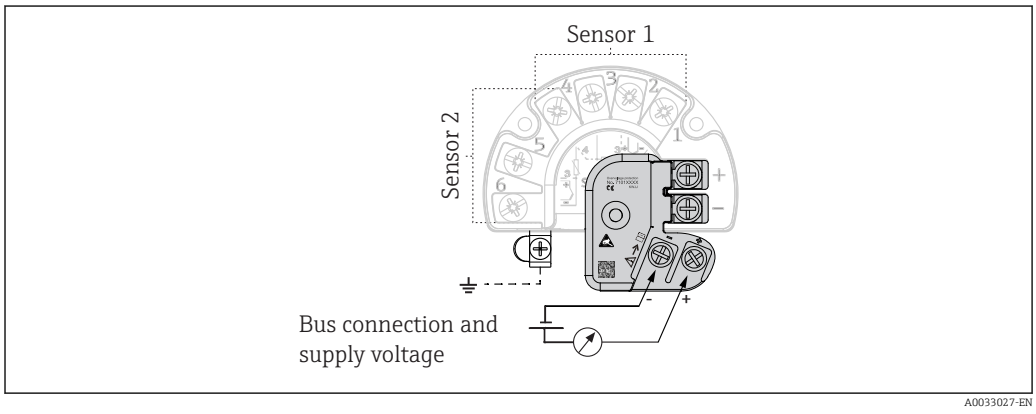
Surge arrester

The surge arrester can be ordered as an optional extra. The module protects the electronics from damage from overvoltage. Overvoltage occurring in signal cables (e.g. 4 to 20 mA,

communication lines (fieldbus systems) and power supply is diverted to ground. The functionality of the transmitter is not affected as no problematic voltage drop occurs.

Connection data:

Maximum continuous voltage (rated voltage)	U_C = 42 V_{DC}
Nominal current	I = 0.5 A at $T_{amb.}$ = 80 °C (176 °F)
Surge current resistance ▪ Lightning surge current D1 (10/350 µs) ▪ Nominal discharge current C1/C2 (8/20 µs)	 ▪ I_{imp} = 1 kA (per wire) ▪ I_n = 5 kA (per wire) I_n = 10 kA (total)
Temperature range	–40 to +80 °C (–40 to +176 °F)
Series resistance per wire	1.8 Ω, tolerance ±5 %



16 *Electrical connection of surge arrester*

Grounding

The device must be connected to the potential equalization. The connection between the housing and the local ground must have a minimum cross-section of 4 mm² (13 AWG) . All ground connections must be secured tightly.

13.4 Performance characteristics

Response time

The measured value update depends on the type of sensor and connection method and moves within the following ranges:

Resistance thermometer (RTD)	0.9 to 1.3 s (depends on the connection method 2/3/4-wire)
Thermocouples (TC)	0.8 s
Reference temperature	0.9 s

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

Reference operating conditions

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

Maximum measured error

In accordance with DIN EN 60770 and the reference conditions specified above. The measured error data correspond to ±2 σ (Gaussian distribution), i.e. 95.45%. The data include non-linearities and repeatability.

Typical

Standard	Designation	Measuring range	Typical measured error (±)	
Resistance thermometer (RTD) as per standard			Digital value [1]	Value at current output
IEC 60751:2008	Pt100 (1)	0 to +200 °C (32 to +392 °F)	0.08 °C (0.14 °F)	0.1 °C (0.18 °F)
IEC 60751:2008	Pt1000 (4)		0.06 °C (0.11 °F)	0.1 °C (0.18 °F)
GOST 6651-94	Pt100 (9)		0.07 °C (0.13 °F)	0.09 °C (0.16 °F)
Thermocouples (TC) as per standard			Digital value	Value at current output
IEC 60584, Part 1	Type K (NiCr-Ni) (36)	0 to +800 °C (32 to +1 472 °F)	0.22 °C (0.4 °F)	0.24 °C (0.43 °F)
IEC 60584, Part 1	Type S (PtRh10-Pt) (39)		1.17 °C (2.1 °F)	1.33 °C (2.4 °F)
GOST R8.8585-2001	Type L (NiCr-CuNi) (43)		2.0 °C (3.6 °F)	2.4 °C (4.32 °F)

1) Measured value transmitted via HART®.

Measured error for resistance thermometers (RTD) and resistance transmitters

Standard	Designation	Measuring range	Measured error (±)		
			Digital [1]		D/A [2]
			Maximum [3]	Based on measured value [4]	
IEC 60751:2008	Pt100 (1)	−200 to +850 °C (−328 to +1 562 °F)	≤ 0.11 °C (0.2 °F)	ME = ± (0.06 °C (0.11 °F) + 0.005% * (MV - LRV))	0.03 % (≙ 4.8 µA)
	Pt200 (2)		≤ 0.18 °C (0.32 °F)	ME = ± (0.05 °C (0.09 °F) + 0.012% * (MV - LRV))	
	Pt500 (3)	−200 to +500 °C (−328 to +932 °F)	≤ 0.11 °C (0.2 °F)	ME = ± (0.03 °C (0.05 °F) + 0.012% * (MV - LRV))	
	Pt1000 (4)	−200 to +250 °C (−328 to +482 °F)	≤ 0.07 °C (0.13 °F)	ME = ± (0.02 °C (0.04 °F) + 0.012% * (MV - LRV))	
JIS C1604:1984	Pt100 (5)	−200 to +510 °C (−328 to +950 °F)	≤ 0.09 °C (0.16 °F)	ME = ± (0.05 °C (0.09 °F) + 0.006% * (MV - LRV))	
GOST 6651-94	Pt50 (8)	−185 to +1 100 °C (−301 to +2 012 °F)	≤ 0.20 °C (0.36 °F)	ME = ± (0.1 °C (0.18 °F) + 0.008% * (MV - LRV))	
	Pt100 (9)	−200 to +850 °C (−328 to +1 562 °F)	≤ 0.11 °C (0.2 °F)	ME = ± (0.05 °C (0.09 °F) + 0.006% * (MV - LRV))	
DIN 43760 IPTS-68	Ni100 (6)	−60 to +250 °C (−76 to +482 °F)	≤ 0.05 °C (0.09 °F)	ME = ± (0.05 °C (0.09 °F) - 0.006% * (MV - LRV))	
	Ni120 (7)				
OIML R84: 2003 / GOST 6651-2009	Cu50 (10)	−180 to +200 °C (−292 to +392 °F)	≤ 0.11 °C (0.2 °F)	ME = ± (0.10 °C (0.18 °F) + 0.006% * (MV - LRV))	
	Cu100 (11)	−180 to +200 °C (−292 to +392 °F)	≤ 0.06 °C (0.11 °F)	ME = ± (0.05 °C (0.09 °F) + 0.003% * (MV - LRV))	
	Ni100 (12)	−60 to +180 °C (−76 to +356 °F)		ME = ± (0.06 °C (0.11 °F) - 0.005% * (MV - LRV))	
	Ni120 (13)		≤ 0.05 °C (0.09 °F)	ME = ± (0.05 °C (0.09 °F) - 0.005% * (MV - LRV))	
OIML R84: 2003, GOST 6651-94	Cu50 (14)	−50 to +200 °C (−58 to +392 °F)	≤ 0.11 °C (0.2 °F)	ME = ± (0.1 °C (0.18 °F) + 0.004% * (MV - LRV))	

Standard	Designation	Measuring range	Measured error (±)		
Resistance transmitter	Resistance Ω	10 to 400 Ω	33 mΩ	ME = ± (21 mΩ + 0.003% * (MV - LRV))	0.03 % (≙ 4.8 µA)
		10 to 2 000 Ω	235 mΩ	ME = ± (35 mΩ + 0.010% * (MV - LRV))	

1) Measured value transmitted via HART®.
2) Percentages based on the configured span of the analog output signal.
3) Maximum measured error for the specified measuring range.
4) Deviations from maximum measured error due to rounding is possible.

Measured error for thermocouples (TC) and voltage transmitters

Standard	Designation	Measuring range	Measured error (±)		
			Digital [1]		D/A [2]
			Maximum [3]	Based on measured value [4]	
IEC 60584-1	Type A (30)	0 to +2 500 °C (+32 to +4 532 °F)	≤ 1.25 °C (2.25 °F)	ME = ± (0.08 °C (0.14 °F) + 0.018% * (MV - LRV))	0.03 % (≙ 4.8 µA)
	Type B (31)	+500 to +1 820 °C (+932 to +3 308 °F)	≤ 1.23 °C (2.21 °F)	ME = ± (1.23 °C (2.14 °F) - 0.05% * (MV - LRV))	
IEC 60584-1 / ASTM E988-96	Type C (32)	0 to +2 000 °C (+32 to +3 632 °F)	≤ 0.6 °C (1.08 °F)	ME = ± (0.5 °C (0.9 °F) + 0.005% * MV - LRV))	
ASTM E988-96	Type D (33)		≤ 0.63 °C (1.13 °F)	ME = ± (0.63 °C (1.13 °F) - 0.007% * MV - LRV))	
IEC 60584-1	Type E (34)	−150 to +1 000 °C (−238 to +1 832 °F)	≤ 0.19 °C (0.34 °F)	ME = ± (0.19 °C (0.3 °F) - 0.006% * (MV - LRV))	
	Type J (35)	−150 to +1 200 °C (−238 to +2 192 °F)	≤ 0.23 °C (0.41 °F)	ME = ± (0.23 °C (0.4 °F) - 0.005% * (MV - LRV))	
	Type K (36)		≤ 0.30 °C (0.54 °F)	ME = ± (0.3 °C (0.5 °F) - 0.002% * (MV - LRV))	
	Type N (37)	−150 to +1 300 °C (−238 to +2 372 °F)	≤ 0.40 °C (0.72 °F)	ME = ± (0.4 °C (0.7 °F) - 0.01% * (MV - LRV))	
	Type R (38)	+50 to +1 768 °C (+122 to +3 214 °F)	≤ 0.95 °C (1.71 °F)	ME = ± (0.95 °C (1.7 °F) - 0.025% * (MV - LRV))	
	Type S (39)		≤ 0.98 °C (1.76 °F)	ME = ± (0.98 °C (1.8 °F) - 0.02% * (MV - LRV))	
	Type T (40)	−150 to +400 °C (−238 to +752 °F)	≤ 0.31 °C (0.56 °F)	ME = ± (0.31 °C (0.56 °F) - 0.034% * (MV - LRV))	
DIN 43710	Type L (41)	−150 to +900 °C (−238 to +1 652 °F)	≤ 0.26 °C (0.47 °F)	ME = ± (0.26 °C (0.47 °F) - 0.008% * (MV - LRV))	
	Type U (42)	−150 to +600 °C (−238 to +1 112 °F)	≤ 0.27 °C (0.49 °F)	ME = ± (0.27 °C (0.49 °F) - 0.022% * (MV - LRV))	
GOST R8.8585-2001	Type L (43)	−200 to +800 °C (−328 to +1 472 °F)	≤ 2.13 °C (3.83 °F)	ME = ± (2.13 °C (3.83 °F) - 0.012% * (MV - LRV))	
Voltage transmitter (mV)		−20 to +100 mV	8.9 µV	ME = ± (6.5 µV + 0.002% * (MV - LRV))	4.8 µA

1) Measured value transmitted via HART®.
2) Percentages based on the configured span of the analog output signal.
3) Maximum measured error for the specified measuring range.
4) Deviations from maximum measured error due to rounding is possible.

MV = Measured value

LRV = Lower range value of relevant sensor

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

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

Measured error digital = 0.06 °C + 0.006% * (200 °C - (-200 °C)):	0.084 °C (0.151 °F)
Measured error D/A = 0.03 % * 200 °C (360 °F)	0.06 °C (0.108 °F)
Measured error digital value (HART):	0.084 °C (0.151 °F)
Measured error analog value (current output): √(Measured error digital² + Measured error D/A²)	0.103 °C (0.185 °F)

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

Measured error digital = 0.06 °C + 0.006% * (200 °C - (-200 °C)):	0.084 °C (0.151 °F)
Measured error D/A = 0.03 % * 200 °C (360 °F)	0.06 °C (0.108 °F)
Influence of ambient temperature (digital) = (35 - 25) * (0.002% * 200 °C - (-200 °C)), min. 0.005 °C	0.08 °C (0.144 °F)
Influence of ambient temperature (D/A) = (35 - 25) * (0.001% * 200 °C)	0.02 °C (0.036 °F)
Influence of supply voltage (digital) = (30 - 24) * (0.002% * 200 °C - (-200 °C)), min. 0.005 °C	0.048 °C (0.086 °F)
Influence of supply voltage (D/A) = (30 - 24) * (0.001% * 200 °C)	0.012 °C (0.022 °F)
Measured error digital value (HART): √(Measured error digital² + Influence of ambient temperature (digital)² + Influence of supply voltage (digital)²	**0.126 °C (0.227 °F)**
Measured error analog value (current output): √(Measured error digital² + Measured error D/A² + Influence of ambient temperature (digital)² + Influence of ambient temperature (D/A)² + Influence of supply voltage (digital)² + Influence of supply voltage (D/A)²	**0.141 °C (0.254 °F)**

The measured error data correspond to ±2 σ (Gaussian distribution).

MV = Measured value

LRV = Lower range value of relevant sensor

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

Other measured errors apply in SIL mode.

For more detailed information please refer to the Functional Safety Manual SD01632T/09.

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 explained 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

2-point adjustment (sensor trimming)

Correction (slope and offset) of the measured sensor value at transmitter input

Current output adjustment — Correction of 4 or 20 mA current output value (not possible in SIL mode)

Operating influences — The measured error data correspond to ±2 σ (Gaussian distribution), i.e. 95.45%.

Influence of ambient temperature and supply voltage on operation for resistance thermometers (RTD) and resistance transmitters

Designation	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change			Supply voltage: Influence (±) per V change		
		Digital [1]		D/A [2]	Digital		D/A
		Maximum	Based on measured value		Maximum	Based on measured value	
Pt100 (1)	IEC 60751:2008	≤ 0.02 °C (0.036 °F)	0.002% * (MV - LRV), at least 0.005 °C (0.009 °F)	0.001 %	≤ 0.02 °C (0.036 °F)	0.002% * (MV - LRV), at least 0.005 °C (0.009 °F)	0.001 %
Pt200 (2)		≤ 0.026 °C (0.047 °F)	-		≤ 0.026 °C (0.047 °F)	-	
Pt500 (3)		≤ 0.013 °C (0.023 °F)	0.002% * (MV - LRV), at least 0.009 °C (0.016 °F)		≤ 0.013 °C (0.023 °F)	0.002% * (MV - LRV), at least 0.009 °C (0.016 °F)	
Pt1000 (4)		≤ 0.01 °C (0.018 °F)	0.002% * (MV - LRV), at least 0.004 °C (0.007 °F)		≤ 0.008 °C (0.014 °F)	0.002% * (MV - LRV), at least 0.004 °C (0.007 °F)	
Pt100 (5)	JIS C1604:1984	≤ 0.013 °C (0.023 °F)	0.002% * (MV - LRV), at least 0.005 °C (0.009 °F)		≤ 0.013 °C (0.023 °F)	0.002% * (MV - LRV), at least 0.005 °C (0.009 °F)	
Pt50 (8)	GOST 6651-94	≤ 0.03 °C (0.054 °F)	0.002% * (MV - LRV), at least 0.01 °C (0.018 °F)		≤ 0.01 °C (0.018 °F)	0.002% * (MV - LRV), at least 0.01 °C (0.018 °F)	
Pt100 (9)		≤ 0.02 °C (0.036 °F)	0.002% * (MV - LRV), at least 0.005 °C (0.009 °F)		≤ 0.02 °C (0.036 °F)	0.002% * (MV - LRV), at least 0.005 °C (0.009 °F)	

Designation	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change			Supply voltage: Influence (±) per V change		
Ni100 (6)	DIN 43760 IPTS-68	≤ 0.004 °C (0.007 °F)	-		≤ 0.005 °C (0.009 °F)	-	
Ni120 (7)			-			-	
Cu50 (10)	OIML R84: 2003 / GOST 6651-2009	≤ 0.007 °C (0.013 °F)	-		≤ 0.008 °C (0.014 °F)	-	
Cu100 (11)			0.002% * (MV - LRV), at least 0.004 °C (0.007 °F)		≤ 0.004 °C (0.007 °F)	0.002% * (MV - LRV), at least 0.004 °C (0.007 °F)	
Ni100 (12)		≤ 0.004 °C (0.007 °F)	-			-	
Ni120 (13)			-			-	
Cu50 (14)	OIML R84: 2003 / GOST 6651-94	≤ 0.007 °C (0.013 °F)	-		≤ 0.008 °C (0.014 °F)	-	
Resistance transmitter (Ω)							
10 to 400 Ω		≤ 6 mΩ	0.0015% * (MV - LRV), at least 1.5 mΩ	0.001 %	≤ 6 mΩ	0.0015% * (MV - LRV), at least 1.5 mΩ	0.001 %
10 to 2000 Ω		≤ 30 mΩ	0.0015% * (MV - LRV), at least 15 mΩ		≤ 30 mΩ	0.0015% * (MV - LRV), at least 15 mΩ	

1) Measured value transmitted via HART®.
2) Percentages based on the configured span of the analog output signal

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

Designation	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change			Supply voltage: Influence (±) per V change		
		Digital [1]		D/A [2]	Digital		D/A
		Maximum	Based on measured value		Maximum	Based on measured value	
Type A (30)	IEC 60584-1	≤ 0.13 °C (0.23 °F)	0.0055% * (MV - LRV), at least 0.03 °C (0.054 °F)	0.001 %	≤ 0.07 °C (0.13 °F)	0.0054% * (MV - LRV), at least 0.02 °C (0.036 °F)	0.001 %
Type B (31)		≤ 0.06 °C (0.11 °F)	-		≤ 0.06 °C (0.11 °F)	-	
Type C (32)	IEC 60584-1 / ASTM E988-96	≤ 0.08 °C (0.14 °F)	0.0045% * (MV - LRV), at least 0.03 °C (0.054 °F)		≤ 0.04 °C (0.07 °F)	0.0045% * (MV - LRV), at least 0.03 °C (0.054 °F)	
Type D (33)	ASTM E988-96		0.004% * (MV - LRV), at least 0.035 °C (0.063 °F)			0.004% * (MV - LRV), at least 0.035 °C (0.063 °F)	
Type E (34)	IEC 60584-1	≤ 0.03 °C (0.05 °F)	0.003% * (MV - LRV), at least 0.016 °C (0.029 °F)		≤ 0.02 °C (0.04 °F)	0.003% * (MV - LRV), at least 0.016 °C (0.029 °F)	
Type J (35)		≤ 0.04 °C (0.07 °F)	0.0028% * (MV - LRV), at least 0.02 °C (0.036 °F)			0.0028% * (MV - LRV), at least 0.02 °C (0.036 °F)	
Type K (36)			0.003% * (MV - LRV), at least 0.013 °C (0.023 °F)			0.003% * (MV - LRV), at least 0.013 °C (0.023 °F)	
Type N (37)			0.0028% * (MV - LRV), at least 0.020 °C (0.036 °F)			0.0028% * (MV - LRV), at least 0.020 °C (0.036 °F)	
Type R (38)		≤ 0.05 °C (0.09 °F)	0.0035% * (MV - LRV), at least 0.047 °C (0.085 °F)		≤ 0.05 °C (0.09 °F)	0.0035% * (MV - LRV), at least 0.047 °C (0.085 °F)	
Type S (39)			-			-	
Type T (40)		≤ 0.01 °C (0.02 °F)	-		≤ 0.01 °C (0.02 °F)	-	
Type L (41)	DIN 43710	≤ 0.02 °C (0.04 °F)	-			-	
Type U (42)		≤ 0.01 °C (0.02 °F)	-			-	

Designation	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change			Supply voltage: Influence (±) per V change		
Type L (43)	GOST R8.8585-2001	≤ 0.02 °C (0.04 °F)	-			-	
Voltage transmitter (mV)							
20 to 100 mV	-	≤ 3 µV	-	0.001 %	≤ 3 µV	-	0.001 %

1) Measured value transmitted via HART®.
2) Percentages based on the configured span of the analog output signal.

MV = Measured value

LRV = Lower range value of relevant sensor

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

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

Designation	Standard	Long-term drift (±) 1)		
		after 1 year	after 3 years	after 5 years
		Based on measured value		
Pt100 (1)	IEC 60751:2008	≤ 0.016% * (MV - LRV) or 0.04 °C (0.07 °F)	≤ 0.025% * (MV - LRV) or 0.05 °C (0.09 °F)	≤ 0.028% * (MV - LRV) or 0.06 °C (0.10 °F)
Pt200 (2)		0.25 °C (0.44 °F)	0.41 °C (0.73 °F)	0.50 °C (0.91 °F)
Pt500 (3)		≤ 0.018% * (MV - LRV) or 0.08 °C (0.14 °F)	≤ 0.03% * (MV - LRV) or 0.14 °C (0.25 °F)	≤ 0.036% * (MV - LRV) or 0.17 °C (0.31 °F)
Pt1000 (4)		≤ 0.0185% * (MV - LRV) or 0.04 °C (0.07 °F)	≤ 0.031% * (MV - LRV) or 0.07 °C (0.12 °F)	≤ 0.038% * (MV - LRV) or 0.08 °C (0.14 °F)
Pt100 (5)	JIS C1604:1984	≤ 0.015% * (MV - LRV) or 0.04 °C (0.07 °F)	≤ 0.024% * (MV - LRV) or 0.07 °C (0.12 °F)	≤ 0.027% * (MV - LRV) or 0.08 °C (0.14 °F)
Pt50 (8)	GOST 6651-94	≤ 0.017% * (MV - LRV) or 0.07 °C (0.13 °F)	≤ 0.027% * (MV - LRV) or 0.12 °C (0.22 °F)	≤ 0.03% * (MV - LRV) or 0.14 °C (0.25 °F)
Pt100 (9)		≤ 0.016% * (MV - LRV) or 0.04 °C (0.07 °F)	≤ 0.025% * (MV - LRV) or 0.07 °C (0.12 °F)	≤ 0.028% * (MV - LRV) or 0.07 °C (0.13 °F)
Ni100 (6)	DIN 43760 IPTS-68	0.04 °C (0.06 °F)	0.05 °C (0.10 °F)	0.06 °C (0.11 °F)
Ni120 (7)				
Cu50 (10)	OIML R84: 2003 / GOST 6651-2009	0.06 °C (0.10 °F)	0.09 °C (0.16 °F)	0.11 °C (0.20 °F)
Cu100 (11)		≤ 0.015% * (MV - LRV) or 0.04 °C (0.06 °F)	≤ 0.024% * (MV - LRV) or 0.06 °C (0.10 °F)	≤ 0.027% * (MV - LRV) or 0.06 °C (0.11 °F)
Ni100 (12)		0.03 °C (0.06 °F)	0.05 °C (0.09 °F)	0.06 °C (0.10 °F)
Ni120 (13)		0.03 °C (0.06 °F)	0.05 °C (0.09 °F)	0.06 °C (0.10 °F)
Cu50 (14)	OIML R84: 2003 / GOST 6651-94	0.06 °C (0.10 °F)	0.09 °C (0.16 °F)	0.10 °C (0.18 °F)
Resistance transmitter				
10 to 400 Ω		≤ 0.0122% * (MV - LRV) or 12 mΩ	≤ 0.02% * (MV - LRV) or 20 mΩ	≤ 0.022% * (MV - LRV) or 22 mΩ
10 to 2 000 Ω		≤ 0.015% * (MV - LRV) or 144 mΩ	≤ 0.024% * (MV - LRV) or 240 mΩ	≤ 0.03% * (MV - LRV) or 295 mΩ

1) Whichever is greater

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

Designation	Standard	Long-term drift (±) [1]		
		after 1 year	after 3 years	after 5 years
		Based on measured value		
Type A (30)	IEC 60584-1	≤ 0.048% * (MV - LRV) or 0.46 °C (0.83 °F)	≤ 0.072% * (MV - LRV) or 0.69 °C (1.24 °F)	≤ 0.1% * (MV - LRV) or 0.94 °C (1.69 °F)
Type B (31)		1.08 °C (1.94 °F)	1.63 °C (2.93 °F)	2.23 °C (4.01 °F)
Type C (32)	IEC 60584-1 / ASTM E988-96	≤ 0.038% * (MV - LRV) or 0.41 °C (0.74 °F)	≤ 0.057% * (MV - LRV) or 0.62 °C (1.12 °F)	≤ 0.078% * (MV - LRV) or 0.85 °C (1.53 °F)
Type D (33)	ASTM E988-96	≤ 0.035% * (MV - LRV) or 0.57 °C (1.03 °F)	≤ 0.052% * (MV - LRV) or 0.86 °C (1.55 °F)	≤ 0.071% * (MV - LRV) or 1.17 °C (2.11 °F)
Type E (34)	IEC 60584-1	≤ 0.024% * (MV - LRV) or 0.15 °C (0.27 °F)	≤ 0.037% * (MV - LRV) or 0.23 °C (0.41 °F)	≤ 0.05% * (MV - LRV) or 0.31 °C (0.56 °F)
Type J (35)		≤ 0.025% * (MV - LRV) or 0.17 °C (0.31 °F)	≤ 0.037% * (MV - LRV) or 0.25 °C (0.45 °F)	≤ 0.051% * (MV - LRV) or 0.34 °C (0.61 °F)
Type K (36)		≤ 0.027% * (MV - LRV) or 0.23 °C (0.41 °F)	≤ 0.041% * (MV - LRV) or 0.35 °C (0.63 °F)	≤ 0.056% * (MV - LRV) or 0.48 °C (0.86 °F)
Type N (37)		0.36 °C (0.65 °F)	0.55 °C (0.99 °F)	0.75 °C (1.35 °F)
Type R (38)		0.83 °C (1.49 °F)	1.26 °C (2.27 °F)	1.72 °C (3.10 °F)
Type S (39)		0.84 °C (1.51 °F)	1.27 °C (2.29 °F)	2.23 °C (4.01 °F)
Type T (40)		0.25 °C (0.45 °F)	0.37 °C (0.67 °F)	0.51 °C (0.92 °F)
Type L (41)	DIN 43710	0.20 °C (0.36 °F)	0.31 °C (0.56 °F)	0.42 °C (0.76 °F)
Type U (42)		0.24 °C (0.43 °F)	0.37 °C (0.67 °F)	0.50 °C (0.90 °F)
Type L (43)	GOST R8.8585-2001	0.22 °C (0.40 °F)	0.33 °C (0.59 °F)	0.45 °C (0.81 °F)
Voltage transmitter (mV)				
−20 to 100 mV		≤ 0.027% * (MV - LRV) or 5.5 µV	≤ 0.041% * (MV - LRV) or 8.2 µV	≤ 0.056% * (MV - LRV) or 11.2 µV

1) Whichever is greater

Long-term drift analog output

Long-term drift D/A [1] (±)		
after 1 year	after 3 years	after 5 years
0.021%	0.029%	0.031%

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

Influence of reference junction

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

13.5 Environment

Ambient temperature range

- Without display: −40 to +85 °C (−40 to +185 °F)
- With display and/or surge arrester module: −40 to +80 °C (−40 to +176 °F)
- SIL mode: −40 to +75 °C (−40 to +167 °F)

For hazardous areas see Ex documentation → 61

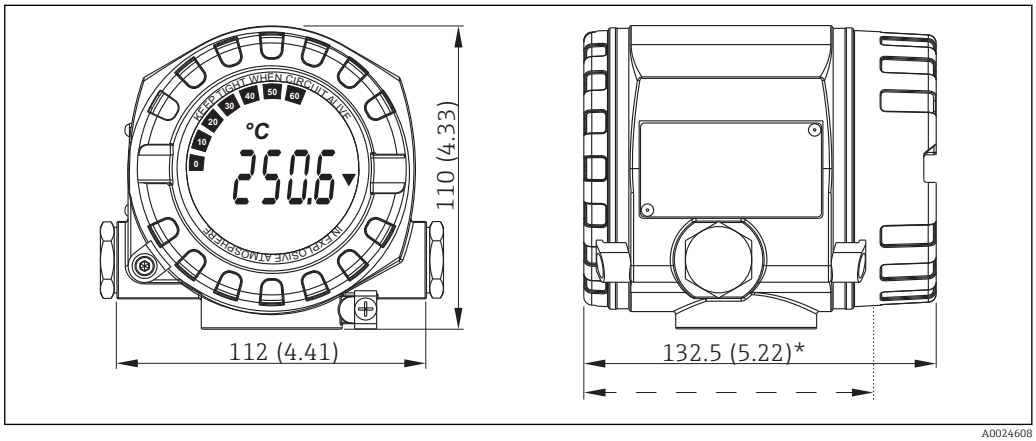
The display can react slowly at temperatures < −20 °C (−4 °F). The legibility of the display cannot be guaranteed at temperatures < −30 °C (−22 °F).

Storage temperature	▪ Without display: −40 to +100 °C (−40 to +212 °F) ▪ With display: −40 to +80 °C (−40 to +176 °F)
Humidity	Permitted: maximum 0 to 95 %
Altitude	Up to 2 000 m (6 560 ft) above mean sea level in accordance with IEC 61010-1, CSA 1010.1-92
Climate class	As per IEC 60654-1, Class Dx
Degree of protection	▪ Die-cast aluminum or stainless steel housing: IP67, NEMA 4X ▪ Stainless steel housing for hygienic applications (T17 housing): IP66 / IP68 (1.83 m H2O for 24 h), NEMA 4X, NEMA 6P
Shock and vibration resistance	Shock resistance as per KTA 3505 (section 5.8.4 Shock test) IEC 60068-2-6 test Fc: Vibration (sinusoidal) Vibration resistance as per German Lloyd approval, environmental category: D The use of L-shaped mounting brackets can cause resonance (see wall/pipe 2" mounting bracket in the 'Accessories' section). Caution: vibrations at the transmitter may not exceed specifications.
Electromagnetic compatibility (EMC)	**CE compliance** Electromagnetic compatibility in accordance with all the relevant requirements of the IEC/EN 61326 series and NAMUR Recommendation EMC (NE21). For details, refer to the Declaration of Conformity. All tests were passed both with and without ongoing digital HART® communication. Maximum measured error <1% of measuring range. Interference immunity as per IEC/EN 61326 series, industrial requirements Interference emission as per IEC/EN 61326 series, Class B equipment SIL conformity according to IEC 61326-3-1 or IEC 61326-3-2 A shielded cable that is grounded on both sides must be used for sensor cable lengths of 30 m (98.4 ft) and more. The use of shielded sensor cables is generally recommended. Connection of the functional grounding may be needed for functional purposes. Compliance with the electrical codes of individual countries is mandatory.
Measuring category	Measuring category II as per IEC 61010-1. The measuring category is provided for measuring on power circuits that are directly connected electrically with the low-voltage network.
Degree of contamination	Pollution degree 2 as per IEC 61010-1.

13.6 Mechanical construction

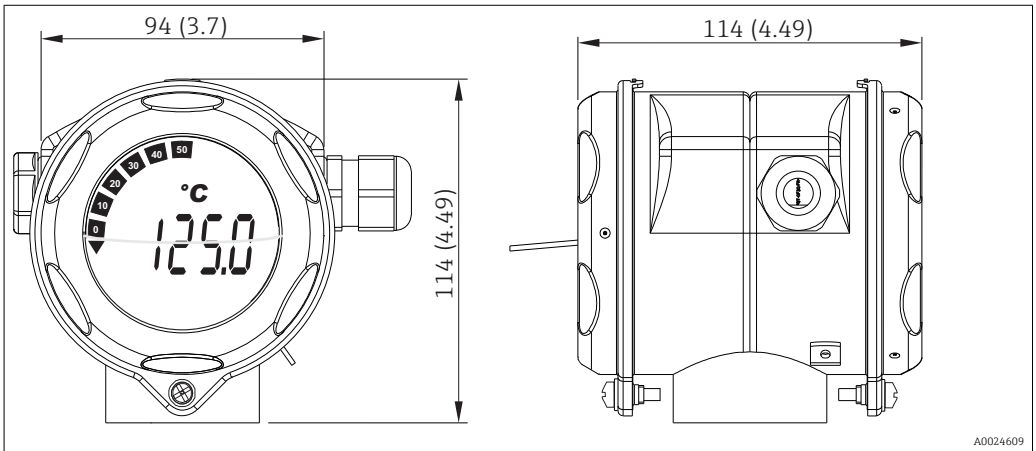
Design, dimensions

Dimensions in mm (in)



17 *Die-cast aluminum housing for general applications, or optional stainless steel housing (316L)*

* Dimensions without display = 112 mm (4.41")



18 *Option: T17 stainless steel housing for hygienic applications*

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

Weight

- Aluminum housing approx. 1.4 kg (3 lb), with display
- Stainless steel housing approx. 4.2 kg (9.3 lb), with display
- T17 housing approx. 1.25 kg (2.76 lb), with display

Materials

Housing	Sensor terminals	Nameplate
Die-cast aluminum housing AlSi10Mg/ AlSi12 with powder coating on polyester base	Nickel-plated brass 0.3 µm gold flashed / cpl., corrosion-free	Aluminum AlMgl, anodized in black
316L		1.4404 (AISI 316L)
Stainless steel 1.4435 (AISI 316L) for hygienic applications (T17 housing)		-
Display O-ring 88x3: EPDM70, PTFE anti-friction coating	-	-

Cable entries

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

13.7 Certificates and approvals

CE mark

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EC directives. The manufacturer confirms successful testing of the product by affixing to it the CE-mark.

EAC mark

The product meets the legal requirements of the EEU guidelines. The manufacturer confirms the successful testing of the product by affixing the EAC mark.

Ex approval

Information about currently available Ex versions (ATEX, FM, CSA, etc.) can be supplied by your E+H Sales Center on request. All explosion protection data are given in separate documentation which is available upon request.

MTBF

HART®: **142 a**

according to Siemens Standard SN29500

UL approval

UL recognized component (see www.ul.com/database, search for Keyword "E225237")

CSA

The product meets the requirements as per "CLASS 2252 05 - Process Control Equipment"

Maritime guidelines

For the type approval certificates (GL, BV etc.) currently available, please contact your Endress+Hauser Sales Center for information. All data relating to shipbuilding can be found in separate type approval certificates which can be requested as needed.

Functional safety

SIL 2/3 (hardware/software) certified to:
- IEC 61508-1:2010 (Management)
- IEC 61508-2:2010 (Hardware)
- IEC 61508-3:2010 (Software)

For more detailed information please refer to the 'Functional Safety Manual'. → 61

HART® certification

The temperature transmitter is registered by the HART® FieldComm Group. The device meets the requirements of the FieldComm Group HART® Specifications, Revision 7.6.

Other standards and guidelines

- IEC 60529:
  Degree of protection provided by housing (IP code)
- IEC/EN 61010-1:
  Safety requirements for electrical equipment for measurement, control and laboratory use
- IEC/EN 61326 Series:
  Electromagnetic compatibility (EMC requirements)

13.8 Documentation

Supplementary ATEX documentation:
- ATEX/IECEx II 2G Ex d IIC T6...T4 Gb: XA00031R/09/a3
- ATEX/IECEx II 2D Ex tb IIIC T110 °C Db: XA00032R/09/a3
- ATEX/IECEx II 1G Ex ia IIC T6/T5/T4: XA00033R/09/a3
- ATEX II 3G Ex nA IIC T6...T4 Gc: XA00035R/09/a3
- ATEX/IEC Installation type Ex ia + Ex d: XA01025R/09/a3
-

14 Operating menu and parameter description

The following tables list all the parameters in the "Setup", "Diagnostics" and "Expert" 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". The parameter groups for the Expert setup contain all the parameters of the "Setup" and "Diagnostics" operating menus, as well as other parameters that are solely reserved for experts.

This symbol indicates how to navigate to the parameter using operating tools (e.g. FieldCare).

Configuration in the SIL mode differs from the standard mode and is described in the Functional Safety Manual.

For more information please refer to the Functional Safety Manual SD1632T/09.

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Setup →	**Advanced setup→**	**SIL →**	SIL option	→ 80
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Setup →	**Advanced setup→**	**Administration →**	Device reset	→ 82
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Diagnosis →	**Diagnostic list→**	Actual diagnostics count		→ 85
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Diagnosis →	**Device information →**	Device tag		→ 69
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1) n = number of sensor inputs (1 and 2)

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1) n = number of sensor inputs (1 and 2)

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			Actual diag channel		→ 85

Expert →	**Diagnosis →**	**Event logbook →**	Previous diagnostics n		→ 86
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Expert →	**Diagnosis →**	**Device information →**	Device tag		→ 69
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14.1 "Setup" menu

This menu contains all the parameters that are needed to configure the basic settings of the device. The transmitter can be put into operation with this limited parameter set.

n = Stands for the number of sensor inputs (1 and 2)

Device tag

Navigation
Setup → Device tag
Diagnostics → Device information → Device tag
Expert → Diagnostics → Device information → Device tag

Description
Use this function to enter a unique name for the measuring point so it can be identified quickly within the plant. This name is shown on the display.

User entry
Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /)

Factory setting
32 x '?'

Unit

Navigation
Setup → Unit
Expert → System → Unit

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

Options
- °C
- °F
- K
- °R
- Ohms
- mV

Factory setting
°C

Sensor type n

Navigation
Setup → Sensor type n
Expert → Sensor → Sensor n → Sensor type n

Description
Use this function to select the sensor type for the sensor input in question.
- Sensor type 1: settings for sensor input 1
- Sensor type 2: settings for sensor input 2

Please observe the terminal assignment when connecting the individual sensors. In the case of 2-channel operation, the possible connection options must also be observed.

User entry A list of all the possible sensor types is provided in the "Technical data" section.→ 46

Factory setting Sensor type 1: Pt100 IEC751
Sensor type 2: No sensor

Connection type n

Navigation Setup → Connection type n
Expert → Sensor → Sensor n → Connection type n

Prerequisite: An RTD sensor must be specified as the sensor type.

Description Use this function to select the connection type for the sensor.

User entry
- Sensor 1 (connection type 1): 2-wire, 3-wire, 4-wire
- Sensor 2 (connection type 2): 2-wire, 3-wire

Factory setting
- Sensor 1 (connection type 1): 4-wire
- Sensor 2 (connection type 2): none

2-wire compensation n

Navigation Setup → 2-wire compensation n
Expert → Sensor → Sensor n → 2-wire compensation n

Prerequisite: An RTD sensor 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 Ohm

Factory setting 0

Reference junction n

Navigation Setup → Reference junction n
Expert → Sensor → Sensor n → Reference junction n

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.
- Temperature measured must be configured for channel 2 if **Measured value sensor 2** is selected

Options

- No compensation: no temperature compensation is used.
- Internal measurement: the internal reference junction temperature is used.
- Preset value: a fixed preset value is used.
- Measured value sensor 2: the measured value of sensor 2 is used.

It is not possible to selected the **Measured value sensor 2** option for the **Reference junction 2** parameter.

Factory setting Internal measurement

RJ preset value n

Navigation Setup → RJ preset value
Expert → Sensor → Sensor n →RJ preset value

Prerequisite: The **Preset value** parameter must be set if the **Reference junction n** option is selected.

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

User entry −50 to +87 °C

Factory setting 0.00

Assign current output (PV)

Navigation Setup → Assign current output (PV)
Expert → Communication → HART output → Assign current output (PV)

Description Use this function to assign a measured variable to the primary HART® value (PV).

Options

- Sensor 1 (measured value)
- Sensor 2 (measured value)
- Device temperature
- Average of the two measured values: 0.5 x (SV1+SV2)
- Difference between sensor 1 and sensor 2: SV1-SV2
- Sensor 1 (backup sensor 2): If sensor 1 fails, the value of sensor 2 automatically becomes the primary HART® value (PV): sensor 1 (OR sensor 2)
- Sensor switching: If the value exceeds the configured threshold value T for sensor 1, the measured value of sensor 2 becomes the primary HART® value (PV). The system switches back to sensor 1 if the measured value of sensor 1 is at least 2 K below T: sensor 1 (sensor 2, if sensor 1 > T)
- Average: 0.5 x (SV1+SV2) with backup (measured value of sensor 1 or sensor 2 in the event of a sensor error in the other sensor)

The threshold value can be configured using the **Sensor switch set point** → 76parameter . With temperature-dependent switching, it is possible to combine 2 sensors that offer advantages in different temperature ranges.

Factory setting

Sensor 1

Lower range value

Navigation

Setup → Lower range value
Expert → Output → Lower range value

Description

Use this function to assign a measured value to the current value 4 mA.

The limit value that can be set depends on the sensor type used in the **Sensor type** → 69 parameter and the measured variable assigned in the **Assign current output (PV)** parameter.

User entry

Depends on the sensor type and the setting for "Assign current output (PV)".

Factory setting

0

Upper range value

Navigation

Setup → Upper range value
Expert → Output → Upper range value

Description

Use this function to assign a measured value to the current value 20 mA.

The limit value that can be set depends on the sensor type used in the **Sensor type** → 69 parameter and the measured variable assigned in the **Assign current output (PV)** parameter.

User entry

Depends on the sensor type and the setting for "Assign current output (PV)".

Factory setting

100

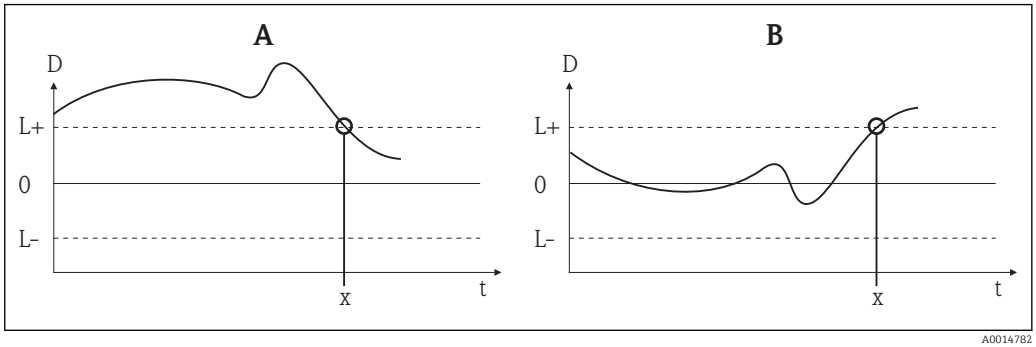
14.1.1 "Advanced setup" submenu

Drift/difference mode

If two sensors are connected and the measured values differ by a specified value, a status signal is generated as a diagnostic event. The drift/difference monitoring function can be used to verify the correctness of the measured values and for mutual monitoring of the connected sensors. Drift/difference monitoring is enabled with the **Drift/difference mode** parameter. A distinction is made between two specific modes. If the **In band** option is selected (ISV1-SV2I < drift/difference set point), a status message is issued if the value drops below the set point, or if the value exceeds the set point if the **Out band (drift)** option is selected (ISV1-SV2I > drift/difference set point).

Procedure for configuring the drift/difference mode

1. Start
⇓
2. For drift/difference monitoring, select **Out band** for drift detection and **In band** for difference monitoring.
⇓
3. Set the set point for drift/difference monitoring to the desired value.
⇓
4. End



19 Drift/difference mode

A Value under range
B Value over range
D Drift
L+, L- Upper (+) or lower (-) set point
t Time
x Diagnostic event, status signal is generated

Enter access code

Navigation

Setup → Advanced setup → Enter access code
Expert → Enter access code

Description

Use this function to enable the service parameters via the operating tool. If an incorrect access code is entered, the user retains his current access authorization.

If a value is entered that is not to equal to the access code, the parameter is automatically set to **0**. The service parameters should only be modified by the service organization.

Additional information Software device write protection is also switched on and off with this parameter.

Software device write protection in conjunction with download from an operating tool with offline capabilities
- Download, the device does not have a defined write protection code:
  The download is performed as normal.
- Download, defined write protection code, device is not locked.
  - The **Enter access code** parameter (offline) contains the correct write protection code: the download is carried out, and the device is not locked following the download. The write protection code in the **Enter access code** parameter is set to **0**.
  - The **Enter access code** parameter (offline) does not contain the correct write protection code: the download is carried out, and the device is locked following the download. The write protection code in the **Enter access code** parameter is reset to **0**.
- Download, defined write protection code, device is locked.
  - The **Enter access code** parameter (offline) contains the correct write protection code: the download is carried out, and the device is locked following the download. The write protection code in the **Enter access code** parameter is reset to **0**.
  - The **Enter access code** parameter (offline) does not contain the correct write protection code: the download is not carried out. No values are changed in the device. The value of the **Enter access code** parameter (offline) also remains unchanged.

User entry 0 to 9 999

Factory setting 0

Access status tooling

Navigation Setup → Advanced setup → Access status tooling
Expert → Access status tooling

Description Use this function to show access authorization to the parameters.

Additional information If additional write protection is active, this restricts the current access authorization even further. The write protection status can be viewed via the **Locking status** parameter .

User entry
- Operator
- Service

Factory setting Operator

Locking status

Navigation Setup → Advanced setup → Locking status
Expert → Locking status

Description Displays the device locking status (software, hardware or SIL-locked). The DIP switch for hardware locking is fitted on the electronics module. When write protection is activated, write access to the parameters is disabled.

"Sensor" submenu

Sensor offset n

n = Stands for the number of sensor inputs (1 and 2)

Navigation
Setup → Advanced setup → Sensor → Sensor offset n
Expert → Sensor → Sensor n → Sensor offset n

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
-10.0 to +10.0

Factory setting
0.0

Drift/difference mode

Navigation
Setup → Advanced setup → Sensor → Drift/difference mode
Expert → Sensor → Diagnostic settings → Drift/difference mode

Description
Use this function to choose whether the device reacts to the drift/difference limit value being exceeded or undershot.

Can only be selected for 2-channel operation.

Additional information
- If the **Out band (drift)** option is selected, a status signal is displayed if the absolute value for the differential value exceeds the drift/difference set point
- If the **In band** option is selected, a status signal is displayed if the absolute value for the differential value drops below the drift/difference set point.

User entry
- Off
- Out band (drift)
- In band

Factory setting
Off

Drift/difference alarm delay

Navigation
Setup → Advanced setup → Sensor → Drift/difference alarm delay
Expert → Sensor → Diagnostic settings → Drift/difference alarm delay

Prerequisite
The **Drift/difference mode** parameter must be activated with the **Out band (drift)** or **In band** option. → 75

Description Alarm delay for drift detection monitoring.

Useful for example in the event of different thermal mass ratings for the sensors in conjunction with a high temperature gradient in the process.

User entry 5 to 255 s

Factory setting 5 s

Drift/difference set point

Navigation Setup → Advanced setup → Sensor → Drift/difference set point
Expert → Sensor → Diagnostic settings → Drift/difference set point

Prerequisite The **Drift/difference mode** parameter must be activated with the **Out band (drift)** or **In band** option.

Description Use this function to configure the maximum permissible measured value deviation between sensor 1 and sensor 2 which results in drift/difference detection.

User entry 0.1 to 999.0 K (0.18 to 1 798.2 °F)

Factory setting 999.0

Sensor switch set point

Navigation Setup → Advanced setup → Sensor → Sensor switch set point
Expert → Sensor → Diagnostic settings → Sensor switch set point

Description Use this function to set the threshold value for sensor switching.→ 72

Additional information The threshold value is relevant if the sensor switching function is assigned to a HART® variable (PV, SV, TV, QV).

User entry Depends on the sensor types selected.

Factory setting 850 °C

"Current output" submenu

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 must be adapted so that it suits the value expected at the higher-level system.

NOTICE

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

- The digital measured values can be adapted with the sensor trimming parameter in the menu Expert → Sensor → Sensor trimming.

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. End

Output current

Navigation Setup → Advanced setup → Current output→ Output current

Description Use this function to view the calculated output current in mA.

Failure mode

Navigation Setup → Advanced setup → Current output→ Failure mode
Expert → Output → Failure mode

Description Use this function to select the signal on alarm level of the current output in the event of an error.

Additional information If **Max.** is selected, the signal on alarm level is specified using the **Failure current** parameter.

User entry
- Min.
- Max.

Factory setting Min.

Failure current

Navigation Setup → Advanced setup → Current output→ Failure current
Expert → Output → Failure current

Prerequisite The **Max.** 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 23.0 mA

Factory setting 22.5

Current trimming 4 mA

Navigation Setup → Advanced setup → Current output→ Current trimming 4 mA
Expert → 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.→ 76

User entry 3.85 to 4.15 mA

Factory setting 4 mA

Current trimming 20 mA

Navigation Setup → Advanced setup → Current output→ Current trimming 20 mA
Expert → 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.→ 76

User entry 19.850 to 20.15 mA

Factory setting 20.000 mA

Reset trim

Navigation Setup → Advanced setup → Current output → Reset trim
Expert → Output → Reset trim

Description The Wizard resets the 4 to 20 mA values for trimming to the default value.

User entry Activate the button

"Display" submenu

The settings for displaying the measured value on the optional display are made in the "Display" menu.

These settings do not affect the output values of the transmitter, and are only used to specify the display format on the screen.

Display interval

Navigation Setup → Advanced setup → Display → Display interval
Expert → System → Display → Display interval

Description Use this function to set the length of time the measured values are displayed if the values alternate on the display. 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 → 79.

User entry 4 to 20 s

Factory setting 4 s

Value 1 display (Value 2 or 3 display)

Navigation Setup → Advanced setup → Display → Value 1 display (Value 2 or 3 display)
Expert → System → Display → Value 1 display (Value 2 or 3 display)

Description Use this function to select one of the measured values to be shown on the local display.

User entry
- Process value
- Sensor 1
- Sensor 2
- Output current
- Percent of range
- Device temperature

Factory setting Process value

Display text n [1)]

1) 1, 2 or 3 - depends on the display value set

Navigation Setup → Advanced setup → Display → Display text n
Expert → System → Display → Display text n

Description Display text for this channel that appears on the screen in the 14-segment display.

User entry Enter the display text: the maximum text length is 8 characters.

Factory setting PV

Decimal places 1 (decimal places 2 or 3)

Navigation Setup → Advanced setup → Display → Decimal places 1 (decimal places 2 or 3)
Expert → System → 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) → 79.

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.

Options
- x
- x.x
- x.xx
- x.xxx
- x.xxxx
- Automatic

Factory setting x.x

"SIL" submenu

This menu only appears if the device was ordered with the 'SIL mode' option. The **SIL option** parameter indicates whether the device can be operated in the SIL mode. To enable the SIL mode for the device, it is necessary to perform menu-guided operation for **Expert mode**.

For more detailed information please refer to the Functional Safety Manual **SD01632T/09**.

SIL option

Navigation Setup → Advanced setup → SIL → SIL option

Description Indicates whether the device has been ordered with SIL certification.

The SIL option is required to operate the device in the SIL mode.

User entry
- No
- Yes

Factory setting No

Operational state

Navigation Setup → Advanced setup → SIL → Operational state

Description Displays the device operational state in the SIL mode.

Display
- Checking SIL option
- Startup normal mode
- Wait for checksum
- Self diagnostic
- Normal mode
- Download active
- SIL mode active
- Safe para start
- Safe param running
- Save parameter values
- Parameter check
- Reboot pending
- Reset checksum
- Safe state - Active
- Download verification
- Upload active
- Safe state - Passive
- Safe state - Panic
- Safe state - Temporary

Factory setting Normal mode

Enter SIL checksum

Navigation Setup → Advanced setup → SIL → Enter SIL checksum

Description If the value '0' is entered in the SIL checksum, the device switches from the SIL mode to the normal mode. Users can also quit the SIL mode using the **Deactivate SIL** parameter.

User entry 0 to 65535

Factory setting 0

SIL checksum

Navigation Setup → Advanced setup → SIL → SIL checksum

Description Displays the calculated SIL checksum.

The **SIL checksum** displayed can be used to check the device configuration. If 2 devices have identical configurations, the SIL checksum is also identical. This can make for easy device replacement because if the checksum is the same, the device configuration is guaranteed to be identical too.

Force safe state

Navigation Setup → Advanced setup → SIL → Force safe state

Prerequisite: The **Operational state** parameter displays **SIL mode active**.

Description During SIL proof testing this parameter can be used to test error detection of the device current readback.

User entry
- On
- Off

Factory setting Off

Deactivate SIL

Navigation Setup → Advanced setup → SIL → Deactivate SIL

Description Use this button to quit the SIL operating mode.

Restart device

Navigation Setup → Advanced setup → SIL → Restart device

Description Use this button to restart the device.

"Administration" submenu

Device reset

Navigation Setup → Advanced setup → Administration → Device reset
Expert → System → Device reset

Description Use this function to reset the device configuration - either entirely or in part - to a defined state.

User entry
- **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 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

Define device write protection code

Navigation Setup → Advanced setup → Administration → Define device write protection code
Expert → System → Define device write protection code

Description Sets a write protection code for the device.

If the code is programmed into the device firmware it is saved in the device and the operating tool displays the value **0** so that the defined write protection code is not openly displayed for viewing.

User entry 0 to 9 999

Factory setting 0

If the device is delivered with this factory setting the device write protection is not active.

Additional information
- Activating device write protection: To do so, enter a value in the **Enter access code** parameter that does not correspond to the write protection code defined here.
- Deactivating device write protection: If device write protection is activated, enter the defined write protection code in the **Enter access code** parameter.
- Once the device has been reset to the factory setting or the order configuration, the defined write protection code is no longer valid. The code adopts the factory setting (= 0).
- Hardware write protection (DIP switches) is active:
  – Hardware write protection has priority over the software write protection described here.
  – No value can be entered in the **Enter access code** parameter. The parameter is a read only parameter.
  – Device write protection via software can only be defined and activated if hardware write protection via the DIP switches is disabled .→ 23

If the write protection code has been forgotten, it can be deleted or overwritten by the service organization.

14.2 "Diagnostics" menu

All the information that describes the device, the device status and the process conditions can be found in this group.

Actual diagnostics

Navigation Diagnostics → Actual diagnostics
Expert → Diagnostics → Actual diagnostics

Description Use this function to display the current diagnostics message. If two or more messages occur simultaneously, the message with the highest priority is shown on the display.

Display Symbol for event behavior and diagnostic event.

Additional information Example for display format:
F261-Electronics modules

Previous diagnostics 1

Navigation Diagnostics → Previous diagnostics 1
Expert → Diagnostics → Previous diagnostics 1

Description Use this function to display the last diagnostics message with the highest priority.

Display Symbol for event behavior and diagnostic event.

Additional information Example for display format:
F261-Electronics modules

Operating time

Navigation Diagnostics → Operating time
Expert → Diagnostics → Operating time

Description Use this function to display the length of time the device has been in operation.

Display Hours (h)

14.2.1 "Diagnose list" submenu

Up to 3 diagnostic messages currently pending are displayed in this submenu. If more than 3 messages are pending, the messages with the highest priority are shown on the display. Information on diagnostics measures in the device and an overview of all the diagnostics messages → 36.

Actual diagnostics count

Navigation Diagnostics → Diagnostic list → Actual diagnostics count
Expert → Diagnostics → Diagnostic list → Actual diagnostics count

Description Use this function to display the number of diagnosis messages currently pending in the device.

Current diagnostics

Navigation Diagnostics → Diagnostic list → Actual diagnostics
Expert → Diagnostics → Diagnostic list → Actual diagnostics

Description Use this function to display the current diagnostics messages with the highest priority to the third-highest priority.

Display Symbol for event behavior and diagnostic event.

Additional information Example for display format:
F261-Electronics modules

Actual diag channel

Navigation Diagnostics → Diagnostic list → Actual diag channel
Expert → Diagnostics → Diagnostic list → Actual diag channel

Description Use this function to display the sensor input to which the diagnostics message refers.

Display
- - - - - - -
- Sensor 1
- Sensor 2
- Device temperature
- Current output
- Terminal temperature

14.2.2 "Event logbook" submenu

Previous diagnostics n

n = Number of diagnostics messages (n = 1 to 5)

Navigation
Diagnostics → Diagnostic list → Previous diagnostics n
Expert → Diagnostics → Diagnostic list → Previous diagnostics n

Description
Use this function to display the diagnostics messages that occurred in the past. The last 5 messages are listed in chronological order.

Display
Symbol for event behavior and diagnostic event.

Additional information
Example for display format:
F261-Electronics modules

Previous diag n channel

Navigation
Diagnostics → Diagnostic list → Previous diag channel
Expert → Diagnostics → Diagnostic list → Previous diag channel

Description
Use this function to display the possible sensor input to which the diagnostics message refers.

Display
- - - - - -
- Sensor 1
- Sensor 2
- Device temperature
- Current output
- Terminal temperature

14.2.3 "Device information" submenu

Device tag

Navigation
Setup → Device tag
Diagnostics → Device information → Device tag
Expert → Diagnostics → Device information → Device tag

Description
Use this function to enter a unique name for the measuring point so it can be identified quickly within the plant. This name is shown on the display. → 23

User entry
Max. 32 characters such as letters, numbers or special characters (e.g. @, %, /)

Factory setting
32 x '?'

Serial number

Navigation
Diagnostics → Device information → Serial number
Expert → Diagnostics → Device information → Serial number

Description
Use this function to display the serial number of the device. It can also be found on the nameplate.

Uses of the serial number
- To identify the measuring device quickly, e.g. when contacting Endress+Hauser.
- To obtain specific information on the measuring device using the Device Viewer: www.endress.com/deviceviewer

Display
Max. 11-digit character string comprising letters and numbers

Firmware version

Navigation
Diagnostics → Device information→ Firmware version
Expert → Diagnostics → Device information → Firmware version

Description
Use this function to view the device firmware version installed.

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

Device name

Navigation
Diagnostics → Device info. → Device name
Expert → Diagnostics → Device information → Device name

Description
Displays the device name. It can also be found on the nameplate.

Order code

Navigation
Diagnostics → Device information → Order code
Expert → Diagnostics → Device information→ Order code

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

Uses of the order code
- To order an identical spare device.
- To identify the device quickly and easily, e.g. when contacting the manufacturer.

Configuration counter

Navigation
Diagnostics → Device info. → Configuration counter
Expert → Diagnostics → Device info. → Configuration counter

Description
Use this function to display the counter reading for changes to device parameters.

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

14.2.4 "Measured values" submenu

Sensor n value

n = Stands for the number of sensor inputs (1 and 2)

Navigation
Diagnostics → Measured values → Sensor n value
Expert → Diagnostics → Measured values → Sensor n value

Description
Use this function to display the current measured value at the sensor input.

Device temperature

Navigation

n = Stands for the number of sensor inputs (1 and 2)

Navigation
Diagnostics → Measured values → Min/max values → Sensor n min value
Expert → Diagnostics → Measured values → Min/max values → Sensor n min value

Description Use this function to display the minimum temperature measured in the past at sensor input 1 or 2 (peakhold indicator).

Sensor n max value

n = Stands for the number of sensor inputs (1 and 2)

Navigation Diagnostics → Measured values → Min/max values → Sensor n max value
Expert → Diagnostics → Measured values → Min/max values → Sensor n max. value

Description Use this function to display the maximum temperature measured in the past at sensor input 1 or 2 (peakhold indicator).

Device temperature min.

Navigation Diagnostics → Measured values → Min/max values → Device temperature min.
Expert → Diagnostics → Measured values → Min/max values → Device temperature min.

Description Use this function to display the minimum electronics temperature measured in the past (peakhold indicator).

Device temperature max.

Navigation Diagnostics → Measured values → Min/max values → Device temperature max.
Expert → Diagnostics → Measured values → Min/max values → Device temperature max.

Description Use this function to display the maximum electronics temperature measured in the past (peakhold indicator).

14.2.5 "Simulation" submenu

Current output simulation

Navigation Diagnostics → Simulation → Current output simulation
Expert → Diagnostics → Simulation → Current output simulation

Description Use this function to switch simulation of the current output on and off. The display alternates between the measured value and a diagnostics message of the "function check" category (C) while simulation is in progress.

Display Measured value display ↔ C491 (current output simulation)

User entry
- Off
- On

Factory setting Off

Additional information The simulation value is defined in the **Value current output** parameter.

Value current output

Navigation Diagnostics → Simulation → Value current output
Expert → Diagnostics → Simulation → Value current output

Additional information The **Current output simulation** parameter must be set to **On**.

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 3.59 to 23.0 mA

Factory setting 3.58 mA

14.3 "Expert" menu

The parameter groups for the Expert setup contain all the parameters of the "Setup" and "Diagnostics" operating menus, as well as other parameters that are solely reserved for experts. Descriptions of the additional parameters can be found in this section. All the fundamental parameter settings for transmitter commissioning and diagnostic evaluation are described in the "Setup menu"→ 🖹 69 and "Diagnostics menu"→ 🖹 84 sections .

Enter access code→ 🖹 73

Navigation Setup → Advanced setup → Enter access code
Expert → Enter access code

Access status tooling→ 🖹 74

Navigation Setup → Advanced setup → Access status tooling
Expert → Access status tooling

Locking status→ 🖹 74

Navigation Setup → Advanced setup → Locking status
Expert → Locking status

14.3.1 "System" submenu

Unit

Navigation Setup → Unit
Expert → System → Unit

Damping

Navigation Expert → System → Damping

Description Use this function to set the time constant for current output damping.

User entry 0 to 120 s

Factory setting 0.00 s

Additional information The current output reacts with an exponential delay to fluctuations in the measured value. The time constant of this delay is specified by this parameter. If a low time constant is entered, the current output follows the measured value quickly. On the other hand, if a high time constant is entered, the current output reaction is delayed.

Alarm delay

Navigation Expert → System → 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

Mains filter

Navigation Expert → System → Mains filter

Description Use this function to select the mains filter for A/D conversion.

User entry
- 50 Hz
- 60 Hz

Factory setting 50 Hz

"Display" submenu

Detailed information → 79

"Administration" submenu

Detailed information → 82

14.3.2 "Sensor" submenu

Measurement channels

Navigation Expert → Sensors → Measurement channels

Description Displays information on the connected and configured measurement channels

User entry
- Not initiated
- 1-channel device
- 2-channel device

"Sensor 1/2" submenu

n = Stands for the number of sensor inputs (1 and 2)

Sensor type n → 69

Navigation Setup → Sensor type n
Expert → Sensor → Sensor n → Sensor type n

Connection type n → 70

Navigation Setup → Connection type n
Expert → Sensor → Sensor n → Connection type n

2-wire compensation n → 70

Navigation Setup → 2-wire compensation n
Expert → Sensor → Sensor n → 2-wire compensation n

Reference junction n → 70

Navigation Setup → Reference junction n
Expert → Sensor → Sensor n → Reference junction n

RJ preset value n → 71

Navigation Setup → RJ preset value
Expert → Sensor → Sensor n →RJ preset value

Sensor offset n → 75

n = Stands for the number of sensor inputs (1 and 2)

Navigation Setup → Advanced setup → Sensor → Sensor offset n
Expert → Sensor → Sensor n → Sensor offset n

Sensor n lower limit

Navigation Expert → Sensor → Sensor n → Sensor n lower limit

Description Displays the minimum physical full scale value.

Sensor n upper limit

Navigation Expert → Sensor → Sensor n → Sensor n upper limit

Description Displays the maximum physical full scale value.

Sensor serial number

Navigation Expert → Sensor → Sensor n → Serial no. sensor

Description Use this function to enter the serial number of the connected sensor.

User entry String with up to 12 characters consisting of numbers and/or text

Factory setting "" (no text)

"Sensor trimming" submenu

Sensor error adjustment (sensor trimming)

Sensor trimming is used to adapt the actual sensor signal to the linearization of the selected sensor type stored in the transmitter. Compared to sensor transmitter matching, sensor trimming only takes place at the start and end value and does not achieve the same level of accuracy.

Sensor trimming does not adapt the measuring range. It is used to adapt the sensor signal to the linearization stored in the transmitter.

Procedure

1. Start
⇓
2. Set the **Sensor trimming** parameter to the **Customer-specific** setting.
⇓
3. Using a water/oil bath, bring the sensor connected to the transmitter to a known and stable temperature. A temperature which is close to the set start of the measuring range is recommended.
⇓

4. Enter the reference temperature for the value at the start of the measuring range for the **Sensor trimming lower value** parameter. Based on the difference between the specified reference temperature and the temperature actually measured at the input, the transmitter internally calculates a correction factor which is now used to linearize the input signal.
⇓
5. Using a water/oil bath, bring the sensor connected to the transmitter to a known and stable temperature close to the set end of the measuring range.
⇓
6. Enter the reference temperature for the value at the end of the measuring range for the **Sensor trimming upper value** parameter.
⇓
7. End

Sensor trimming

Navigation Expert → Sensor → Sensor n → Sensor trimming → Sensor trimming

Description Use this function to select the linearization method to be used for the connected sensor.

The original linearization can be restored by resetting this parameter to the **Factory setting** option.

Options
- Factory setting
- Customer-specific

Factory setting Factory setting

Sensor trimming lower value

Navigation Expert → Sensor → Sensor n → Sensor trimming → Sensor trimming lower value

Prerequisite: The **Customer-specific** option is enabled in the **Sensor trimming** parameter→ 94 .

Description Lower point for linear characteristic calibration (this affects offset and slope).

User entry Depends on the selected sensor type and the assignment of the current output (PV).

Factory setting -200 °C

Sensor trimming upper value

Navigation Expert → Sensor → Sensor n → Sensor trimming → Sensor trimming upper value

Prerequisite: The **Customer-specific** option is enabled in the **Sensor trimming** parameter.

Description Upper point for linear characteristic calibration (this affects offset and slope).

User entry Depends on the selected sensor type and the assignment of the current output (PV).

Factory setting + 850 °C

Sensor trimming min span

Navigation Expert → Sensor → Sensor n → Sensor trimming → Sensor trimming min span

Prerequisite: The **Customer-specific** option is enabled in the **Sensor trimming** parameter.

Description Use this function to view the minimum possible span between the sensor trimming upper and lower value.

Reset trim

Navigation Expert → Sensor → Sensor n → Sensor trimming → Reset trim

Description The Assistant resets the values for sensor trimming to the default value.

User entry Activate the button

"Linearization" submenu

Procedure for configuring a linearization using Callendar/Van Dusen coefficients from a calibration certificate.

1. Start
⇓
2. **Assign current output (PV)** = set sensor 1 (measured value)
⇓
3. Select unit (°C).
⇓
4. Select the sensor type (linearization type) "RTD platinum (Callendar/Van Dusen)".
⇓
5. Select connection mode e.g. 3-wire.
⇓
6. Set the lower and upper sensor limits.
⇓
7. Enter the four coefficients A, B, C and R0.
⇓
8. If special linearization is also used for a second sensor, repeat steps 2 to 6.
⇓
9. End

Call./v. Dusen coeff. R0

Navigation Expert → Sensor → Sensor n → Linearization → Call./v. Dusen coeff. R0

Prerequisite: The RTD platinum (Callendar/Van Duse) 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 40.000 to 1 050.000

Factory setting 100.000 Ohm

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

Navigation Expert → Sensor → Sensor n → Linearization → Call./v. Dusen coeff. A, B, C

Prerequisite: The RTD platinum (Callendar/Van Duse) 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.

Factory setting
- A: 3.910000e-003
- B: -5.780000e-007
- C: -4.180000e-012

Polynomial coeff. R0

Navigation Expert → Sensor → Sensor n → 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 40.000 to 1 050.000 Ohm

Factory setting 100.00 Ohm

Polynomial coeff. A, B

Navigation Expert → Sensor → Sensor n → Linearization → 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.

Factory setting Polynomial coeff. A = 5.49630e-003

Polynomial coeff. B = 6.75560e-006

Sensor n lower limit

Navigation Expert → Sensor→ Sensor n → Linearization → Sensor n 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 n upper limit

Navigation Expert → Sensor→ Sensor n → Linearization → Sensor n 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.

"Diagnostic settings" submenu

Sensor switch set point → 76

Navigation Setup → Advanced setup → Sensor → Sensor switch set point
Expert → Sensor → Diagnostic settings → Sensor switch set point

Drift/difference mode → 🖹 75

Navigation Setup → Advanced setup → Sensor → Drift/difference mode
Expert → Sensor → Diagnostic settings → Drift/difference mode

Drift/difference alarm delay → 🖹 75

Navigation Setup → Advanced setup → Sensor → Drift/difference alarm delay
Expert → Sensor → Diagnostic settings → Drift/difference alarm delay

Drift/difference set point → 🖹 76

Navigation Setup → Advanced setup → Sensor → Drift/difference set point
Expert → Sensor → Diagnostic settings → Drift/difference set point

Control

Navigation Expert → Sensor → Diagnostic settings → Control

Description Option to control the calibration counter.
The countdown duration (in days) is specified with the **Start value** parameter.

Options
- **Off:** Stops the calibration counter
- **On:** Starts the calibration counter
- **Reset + run:** Resets to the set start value and starts the calibration counter

Factory setting Off

Start value

Navigation Expert → Sensor → Diagnostic settings → Start value

Description Use this function to set the start value for the calibration counter.

User entry 0 to 1826 d (days)

Factory setting 1826

Calibration countdown

Navigation Expert → Sensor → Diagnostic settings → Calibration countdown

Description Use this function to view the time remaining until the next calibration.

Calibration countdown only runs when the device is active. Example: If the calibration counter is set to 365 days on January 1, 2011 and no electricity is supplied to the device for 100 days, the alarm for the calibration appears on April 10, 2012.

14.3.3 "Output" submenu

Lower range value→ 72

Navigation Setup → Lower range value
Expert → Output → Lower range value

Upper range value → 72

Navigation Setup → Upper range value
Expert → Output → Upper range value

Failure mode→ 77

Navigation Setup → Advanced setup → Current output→ Failure mode
Expert → Output → Failure mode

Failure current → 78

Navigation Setup → Advanced setup → Current output→ Failure current
Expert → Output → Failure current

Current trimming 4 mA → 78

Navigation Setup → Advanced setup → Current output→ Current trimming 4 mA
Expert → Output → Current trimming 4 mA

Current trimming 20 mA → 78

Navigation Setup → Advanced setup → Current output→ Current trimming 20 mA
Expert → Output → Current trimming 20 mA

Reset trim → 78

Navigation Setup → Advanced setup → Current output → Reset trim
Expert → Output → Reset trim

14.3.4 "Communication" submenu

"HART configuration" submenu

Device tag → **86**

Navigation Diagnostics → Device information → Device tag
Expert → Communication → HART configuration → Device tag

HART short tag

Navigation Expert → Communication → HART configuration → HART short tag

Description Use this function to define a short tag for the measuring point.

User entry Up to 8 alphanumeric characters (letters, numbers and special characters)

Factory setting 8 x '?'

HART address

Navigation Expert → Communication → HART configuration → HART address

Description Use this function to define the HART address of the device.

User entry 0 to 63

Factory setting 0

Additional information The measured value can only be transmitted via the current value is the address is set to "0". The current is fixed at 4.0 mA for all other addresses (Multidrop mode).

No. of preambles

Navigation Expert → Communication → HART configuration → No. of preambles

Description Use this function to define the number of preambles in the HART telegram

User entry 2 to 20

Factory setting 5

Configuration changed

Navigation Expert → Communication → HART configuration → Configuration changed

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

Reset configuration changed

Navigation Expert → Communication → HART configuration → Reset configuration changed

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

User entry Activate the button

"HART info" submenu

Device type

Navigation Expert → Communication → HART info → Device type

Description Use this function to view the device type with which the device is registered with the HART FieldComm Group. The device type is specified by the manufacturer. It is needed to assign the appropriate device description file (DD) to the device.

Display 4-digit hexadecimal number

Factory setting 0x11CE

Factory setting 0x11CE

Device revision

Navigation Expert → Communication → HART info → Device revision

Description Use this function to view the device revision with which the device is registered with the HART® FieldComm Group. It is needed to assign the appropriate device description file (DD) to the device.

Display 4

Factory setting 4 (0x04)

Device ID

Navigation Expert → Communication → HART info → Device ID

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

Display **ID generated for specific serial number**

Manufacturer ID

Navigation Expert → Communication → HART info → Manufacturer ID
Expert → Diagnostics → Device information → Manufacturer ID

Description Use this function to view the manufacturer ID under which the device is registered with the HART FieldComm Group.

Display 2-digit hexadecimal number

Factory setting 0x0011

HART revision

Navigation Expert → Communication → HART info → HART revision

Description Use this function to display the HART revision of the device.

HART descriptor

Navigation Expert → Communication → HART info → HART descriptor

Description Use this function to define a description for the measuring point.

User entry Up to 16 alphanumeric characters (letters, numbers and special characters)

Factory setting The device name

HART message

Navigation Expert → Communication → HART info → HART message

Description Use this function to define a HART message which is sent via the HART protocol when requested by the master.

User entry Up to 32 alphanumeric characters (letters, numbers and special characters)

Factory setting The device name

Hardware revision

Navigation Expert → Diagnostics → Device information → Hardware revision
Expert → Communication → HART info → Hardware revision

Description Use this function to display the hardware revision of the device.

Software revision

Navigation Expert → Communication → HART info → Software revision

Description Use this function to display the software revision of the device.

HART date code

Navigation Expert → Communication → HART info → HART date code

Description Use this function to define date information for individual use.

User entry Date in the format year-month-day (YYYY-MM-DD)

Factory setting 2010-01-01

Process unit tag

Navigation Expert → Communication → HART info → 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 '?'

Location description

Navigation Expert → Communication → HART info → 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 '?'

Longitude

Navigation Expert → Communication → HART info → 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

Latitude

Navigation Expert → Communication → HART info → 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

Altitude

Navigation Expert → Communication → HART info → 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 Expert → Communication → HART info → 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.

Options
- 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

"HART output" submenu

Assign current output (PV) → 69

Navigation Setup → Assign current output (PV)
Expert → Communication → HART output → Assign current output (PV)

PV

Navigation Expert → Communication → HART output→ PV

Description Use this function to display the primary HART value

Assign SV

Navigation Expert → Communication → HART output → Assign SV

Description Use this function to assign a measured variable to the secondary HART value (SV).

Options See **Assign current output (PV)** parameter → 69

Factory setting Device temperature

SV

Navigation Expert → Communication → HART output→ SV

Description Use this function to display the secondary HART value

Assign TV

Navigation Expert → Communication → HART output → Assign TV

Description Use this function to assign a measured variable to the tertiary HART value (TV).

Options See **Assign current output (PV)** parameter, → 69

Factory setting Sensor 1

TV

Navigation Expert → Communication → HART output→ TV

Description Use this function to display the tertiary HART value

Assign QV

Navigation Expert→ Communication → HART output → Assign QV

Description Use this function to assign a measured variable to the quaternary (fourth) HART value (QV).

Options See **Assign current output (PV)** parameter, → 69

Factory setting Sensor 1

QV

Navigation Expert → Communication → HART output→ QV

Description Use this function to display the quaternary HART value

"Burst configuration" submenu

Up to 3 burst modes can be configured.

Burst mode

Navigation Expert → Communication → Burst configuration → Burst mode

Description Activation of the HART burst mode for burst message X. Message 1 has the highest priority, message 2 the second-highest priority, etc.

User entry
- **Off**
  The device only sends data to the bus at the request of a HART master
- **On**
  The device regularly sends data to the bus without being requested to do so.

Factory setting Off

Burst command

Navigation Expert → Communication → Burst configuration → Burst command

Prerequisite: This parameter can only be selected if the **Burst mode** option is enabled.

Description Use this function to select the command whose answer is sent to the HART master in the activated burst mode.

User entry

- Command 1
  Read out the primary variable
- Command 2
  Read out the current and the main measured value as a percentage
- Command 3
  Read out the dynamic HART variables and the current
- Command 9
  Read out the dynamic HART variables including the related status
- Command 33
  Read out the dynamic HART variables including the related unit
- Command 48
  Read additional device status

Factory setting

Command 2

Additional information

Commands 1, 2, 3, 9 and 48 are universal HART commands.
Command 33 is a "Common-Practice" HART command.
More details on this are provided in the HART specifications.

Burst variable n

n = Number of burst variables (0 to 3)

Navigation

Expert → Communication → Burst configuration → Burst variable n

Prerequisite:

This parameter can only be selected if the **Burst mode** option is enabled.

Description

Use this function to assign a measured variable to slots 0 to 3.

This assignment is **only** relevant for the burst mode. The measured variables are assigned to the 4 HART variables (PV, SV, TV, QV) in the **HART output** menu .

User entry

- Sensor 1 (measured value)
- Sensor 2 (measured value)
- Device temperature
- Average of the two measured values: 0.5 x (SV1+SV2)
- Difference between sensor 1 and sensor 2: SV1-SV2
- Sensor 1 (backup sensor 2): If sensor 1 fails, the value of sensor 2 automatically becomes the primary HART® value (PV): sensor 1 (OR sensor 2)
- Sensor switching: If the value exceeds the configured threshold value T for sensor 1, the measured value of sensor 2 becomes the primary HART® value (PV). The system switches back to sensor 1 if the measured value of sensor 1 is at least 2 K below T: sensor 1 (sensor 2, if sensor 1 > T)

The threshold value can be set with the **Sensor switching limit value** parameter. With temperature-dependent switching, it is possible to combine 2 sensors that offer advantages in different temperature ranges.

Average: 0.5 x (SV1+SV2) with backup (measured value of sensor 1 or sensor 2 in the event of a sensor error in the other sensor)

Factory setting

- Burst variable slot 0: sensor 1
- Burst variable slot 1: device temperature
- Burst variable slot 2: sensor 1
- Burst variable slot 3: sensor 1

Burst trigger mode

Navigation Expert → Communication → Burst configuration → Burst trigger mode

Prerequisite: This parameter can only be selected if the **Burst mode** option is enabled.

Description Use this function to select the event that triggers burst message X.

- Continuous:
  The message is triggered in a time-controlled manner, at least observing the time interval defined in the **Min. update period** parameter.
- Window:
  The message is triggered if the specified measured value has changed by the value defined in the **Burst trigger level** X parameter.
- Rising:
  The message is triggered if the specified measured value exceeds the value in the **Burst trigger level** X parameter.
- Falling:
  The message is triggered if the specified measured value falls below the value in the **Burst trigger level** X parameter.
- On change:
  The message is triggered if a measured value of the message changes.

User entry
- Continuous
- Window
- Rising
- Falling
- On change

Factory setting Continuous

Burst trigger level

Navigation Expert → Communication → Burst configuration → Burst trigger level

Prerequisite: This parameter can only be selected if the **Burst mode** option is enabled.

Description Use this function to enter the value which, together with the trigger mode, determines the time of burst message 1. This value determines the time of the message.

User entry $-1.0e^{+20}$ to $+1.0e^{+20}$

Factory setting -10.000

Min. update period

Navigation Expert → Communication → Burst configuration → Min. update period

Prerequisite: This parameter can only be selected if the **Burst mode** option is enabled.

Description Use this function to enter the minimum time span between two burst commands of burst message X. The value is entered in the milliseconds unit.

User entry 500 to [value entered for the maximum time span in the **Max. update period**] parameter as integers

Factory setting 1000

Max. update period

Navigation Expert → Communication → Burst configuration → Max. update period

Prerequisite: This parameter can only be selected if the **Burst mode** option is enabled.

Description Use this function to enter the maximum time span between two burst commands of burst message X. The value is entered in the milliseconds unit.

User entry [Value entered for the minimum time span in the **Min. update period**] parameter to 3600000 as integers

Factory setting 2000

14.3.5 "Diagnostics" submenu

Detailed description → 84

"Diagnose list" submenu

Detailed description → 84

"Event logbook" submenu

Detailed description → 86

"Device information" submenu

Device tag→ 86

Navigation Setup → Device tag
Diagnostics → Device information → Device tag
Expert → Diagnostics → Device information → Device tag

Squawk

Navigation Expert → Diagnostics → Device information → Squawk

Description This function can be used locally to facilitate the identification of the device in the field. Once the Squawk function has been activated, all the segments flash on the display.

Options
- **Squawk once**: Display of device flashes for 60 seconds and then returns to normal operation.
- **Squawk on**: Display of device flashes continuously.
- **Squawk off**: Squawk is switched off and the display returns to normal operation.

User entry Activate the relevant button

Serial number → 87

Navigation Diagnostics → Device information → Serial number
Expert → Diagnostics → Device information → Serial number

Firmware version → 87

Navigation Diagnostics → Device information→ Firmware version
Expert → Diagnostics → Device information → Firmware version

Device name → 87

Navigation Diagnostics → Device info. → Device name
Expert → Diagnostics → Device information → Device name

Order code → 87

Navigation Diagnostics → Device information → Order code
Expert → Diagnostics → Device information→ Order code

Extended order code 1-3

Navigation Expert → Diagnostics → Device information → Extended order code 1-3

Description Use this function to display 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.

Manufacturer ID→ 103

Navigation Expert → Communication → HART info → Manufacturer ID
Expert → Diagnostics → Device information → Manufacturer ID

Manufacturer

Navigation Expert → Diagnostics → Device information → Manufacturer

Description Displays the manufacturer name.

Hardware revision

Navigation Expert → Diagnostics → Device information → Hardware revision
Expert → Communication → HART info → Hardware revision

Description Use this function to display the hardware revision of the device.

Configuration counter → 88

Navigation Diagnostics → Device info. → Configuration counter
Expert → Diagnostics → Device info. → Configuration counter

"Measured values" submenu

Sensor n value → 88

n = Stands for the number of sensor inputs (1 and 2)

Navigation Diagnostics → Measured values → Sensor n value
Expert → Diagnostics → Measured values → Sensor n value

Sensor n raw value

n = Stands for the number of sensor inputs (1 and 2)

Navigation Expert→ Diagnostics → Measured values → Sensor n raw value

Description Use this function to display the non-linearized mV/Ohm value at the specific sensor input.

Device temperature → 88

Navigation Diagnostics → Measured values → Device temperature
Expert → Diagnostics → Measured values → Device temperature

"Min/max values" submenu

Detailed description → 88

The following section provides a description of the additional parameters in this submenu that only appear in the Expert mode.

Reset sensor min/max values

Navigation Expert → Diagnostics → Measured values → Min/max values → Reset sensor min/max values

Description Reset the peakhold indicators for the minimum and maximum temperatures measured at the sensor inputs.

Options
- No
- Yes

Factory setting No

Reset device temp. min/max values

Navigation Expert → Diagnostics → Measured values → Min/max values → Reset device temp. min/max values

Description Reset the peakhold indicators for the minimum and maximum electronic temperatures measured.

Options
- No
- Yes

Factory setting No

"Simulation" submenu

Diagnostic simulation

Navigation Expert → Diagnostics → Simulation → Diagnostic simulation

Description Use this function to switch diagnostics simulation on and off.

Display If simulation is active, the relevant diagnostic event is displayed with the configured status signal. → 36

User entry Off,
or a diagnostic event from the defined list of diagnostic events → 36

Factory setting Off

Current output simulation → 89

Navigation Diagnostics → Simulation → Current output simulation
Expert → Diagnostics → Simulation → Current output simulation

Value current output → 90

Navigation Diagnostics → Simulation → Value current output
Expert → Diagnostics → Simulation → Value current output

"Diagnostic settings" submenu

Diagnostic behavior

Navigation Expert → Diagnostics → Diagnostic settings → Diagnostic behavior

Description A certain event behavior is assigned at the factory to each diagnostic event in the categories: **sensor, electronics, process and configuration**. The user can change this assignment for certain diagnostic events via the diagnostic settings. → 37

User entry
- Alarm
- Warning
- Disabled

Factory setting For detailed information see the 'Overview of diagnostic events' → 37

Status signal

Navigation Expert → Diagnostics → Diagnostic settings → Status signal

Description A certain status signal is assigned at the factory to each diagnostic event in the categories: **sensor, electronics, process and configuration** [1]. The user can change this assignment for certain diagnostic events via the diagnostic settings. → 37

1) Digital information available via HART® communication

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

Factory setting For detailed information see the 'Overview of diagnostic events' → 37

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