Operating Instructions iTHERM TrustSens TM372

Compact thermometer in US style with self-calibration HART communication



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1 About this document

1.1 Document function

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

1.2 Symbols

1.2.1 Safety symbols

DANGER

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

A WARNING

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

A CAUTION

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

NOTICE

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

1.2.2 Electrical symbols

Symbol	Meaning	
	Direct current	
\sim	Alternating current	
\sim	Direct current and alternating current	
<u> </u>	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.	
	Potential equalization connection (PE: protective earth) Ground terminals that must be connected to ground prior to establishing any other connections.	
	The ground terminals are located on the interior and exterior of the device:Interior ground terminal: potential equalization is connected to the supply network.Exterior ground terminal: device is connected to the plant grounding system.	

1.2.3 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.

Symbol	Meaning
i	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
►	Notice or individual step to be observed
1., 2., 3	Series of steps
L >	Result of a step
?	Help in the event of a problem
	Visual inspection

1.2.4 Tool symbols

Symbol	Meaning
Ŕ	Open-ended wrench
A0011222	

1.3 Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:

- Device Viewer (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

1.3.1 Document function

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

Document type	Purpose and content of the document	
Technical Information (TI)	Planning aid for your device The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.	
Brief Operating Instructions (KA)	Guide that takes you quickly to the 1st measured value The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.	
Operating Instructions (BA)	Your reference document The Operating Instructions contain all the information that is required in the various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.	
Description of Device Parameters (GP)	Reference for your parameters The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.	

Document type	Purpose and content of the document		
Safety Instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. The Safety Instructions are an integral part of the Operating Instructions.		
	Information on the Safety Instructions (XA) relevant to the device is provided on the nameplate.		
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is an integral part of the device documentation.		

2 Basic safety instructions

2.1 Requirements for the personnel

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 starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- ► Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- ▶ Follow the instructions in this manual.

2.2 Intended use

- The device is a hygienic compact thermometer, which features an automatic selfcalibration function. It is applied for the acquisition and conversion of temperature input signals for industrial temperature measurement.
- The manufacturer is not liable for damage caused by improper or non-intended use.

2.3 Operation safety

NOTICE

Operation safety

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

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

Due to its design, the device cannot be repaired.

- However, it is possible to send the device in for examination.
- ► To ensure continued operational safety and reliability, use original spare parts and accessories from Endress+Hauser only.

2.4 Product safety

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

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

2.5 IT security

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

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

3 Incoming acceptance and product identification

3.1 Incoming acceptance

Proceed as follows on receipt of the device:

- 1. Check whether the packaging is intact.
- 2. If damage is discovered:

Report all damage immediately to the manufacturer.

- 3. Do not install damaged components, as the manufacturer cannot otherwise guarantee the material resistance or compliance with the original safety requirements, and can also not be held responsible for the consequences that may result.
- 4. Compare the scope of delivery against the contents of your order.
- 5. Remove all the packaging material used for transportation.
- 6. Do the data on the nameplate match the ordering information on the delivery note?
- **7.** Are the technical documentation and all other necessary documents provided, e.g. certificates?

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

3.2 Product identification

The following options are available for identification of the device:

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

3.2.1 Nameplate

Is this the correct device?

Compare and check the data on the nameplate of the device against the requirements of the measuring point:



3.2.2 Name and address of manufacturer

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

3.2.3 Certificates and approvals

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

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

Hygiene standard

- EHEDG certification, type EL CLASS I. EHEDG certified/tested process connections $\rightarrow \cong 60$
- 3-A authorization no. 1144, 3-A Sanitary standard 74-07. Listed process connections $\rightarrow \ \textcircled{B} \ 60$
- ASME BPE, certificate of conformity can be ordered for indicated options
- FDA-compliant
- All surfaces in contact with the medium are free of animal derived ingredients (ADI/ TSE) and do not contain any materials derived from bovine or animal sources.

Materials in contact with food/product (FCM)

The materials of the thermometer in contact with food/product (FCM) comply with the following European regulations:

- (EC) No. 1935/2004, Article 3, paragraph 1, Articles 5 and 17 on materials and articles intended to come into contact with food.
- (EC) No. 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food.
- (EU) No. 10/2011 on plastic materials and articles intended to come into contact with food.

3.3 Storage and transport

Storage temperature: -40 to +85 °C (-40 to +185 °F)

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

Avoid the following environmental influences during storage and transport:

- Direct sunlight
- Vibration
- Aggressive media

4 Mounting

4.1 Mounting requirements

Information about the conditions, which have to be existent at the mounting location for a designated use, such as ambient temperature, degree of protection, climate class, etc., as well as device dimensions - see section Technical Data', → 🗎 48

The immersion length of the thermometer can influence the accuracy. If the immersion length is too small then errors in the measurement are caused by heat conduction via the process connection. If installing into a pipe then the immersion length should ideally be half of the pipe diameter. $\rightarrow \square 11$

- Installation possibilities: Pipes, tanks or other plant components
- Orientation: no restrictions. However, self-draining in the process must be guaranteed. If there is an opening to detect leaks at the process connection, this opening must be at the lowest possible point.

4.2 Mounting the measuring device

Required tools for mounting in an existing protection tube: Open-end wrench or mounting socket wrench SW/AF 32



Mounting process of the compact thermometer

AUU48874

- 1 Mounting of iTHERM QuickNeck connection to the existing protection tube with iTHERM QuickNeck bottom part no tools required
- 2 Hexagonal head SW/AF 32 for the mounting in an existing protection tube for M24-, G3/8"-thread
- 3 Protection tube



3 *Mounting possibilities in the process*

- 1, 2 Perpendicular to flow direction, installed at a min. angle of 3° to ensure self-draining
- 3 On elbows
- 4 Inclined installation in pipes with a small nominal diameter
- U Immersion length

The requirements of the EHEDG and the 3-A Sanitary Standard must be adhered to. Installation instructions EHEDG/cleanability: Lt ≤ (Dt-dt)

Installation instructions $3-A/cleanability: Lt \le 2(Dt-dt)$

In the case of pipes with a small nominal diameter, it is advisable for the tip of the thermometer to project well into the process so that it extends past the pipe axis. Installation at an angle (4) could be another solution. When determining the immersion length or installation depth all the parameters of the thermometer and of the medium to be measured must be taken into account (e.g. flow velocity, process pressure).



When connecting the device with the protection tube: only turn the hexagonal spanner flat on the bottom of the housing.



4 Process connections for thermometer installation in pipes with small nominal diameters

1 Elbow thermowell for weld-in as per DIN 11865 / ASME BPE 2012



- 🛃 5 Detailed installation instructions for hygiene-compliant installation (depends on the version ordered)
- Varivent process connection for VARINLINE housing Α
- Sensor with Varivent connection 1
- 2 Counterpart connection
- 3 0-ring
- В Clamp according to ISO 2852
- 4 Molded seal
- 5 Counterpart connection
- С Process connection Liquiphant-M G1", horizontal installation
- 6 Weld-in adapter
- 7 Vessel wall 8 0-rina
- 9 Thrust collar

NOTICE

The following actions must be taken if a sealing ring (O-ring) or seal fails:

- ▶ The thermometer must be removed.
- ▶ The thread and the O-ring joint/sealing surface must be cleaned.
- The sealing ring or seal must be replaced.
- CIP must be performed after installation.

The counterpieces for the process connections and the seals or sealing rings are not included in the scope of supply for the thermometer. Liquiphant M weld-in adapters with associated seal kits are available as accessories. $\rightarrow \square 44$

In the case of weld-in connections, exercise the necessary degree of care when performing the welding work on the process side:

- 1. Use suitable welding material.
- **2.** Flush-weld or weld with welding radius \geq 3.2 mm (0.13 in).
- 3. Avoid crevices, folds or gaps.
- 4. Ensure the surface is honed and polished, $Ra \le 0.76 \mu m$ (30 μin).
- 1. As a general rule, the thermometers should be installed in such a way that does not impact their ability to be cleaned (the requirements of the 3-A Sanitary Standard must be observed).
- 2. The Varivent[®] and Liquiphant-M weld-in adapter and Ingold (+ weld-in adapter) connections enable flush-mounted installation.

4.3 Post-mounting check

Is the device undamaged (visual inspection)?
Is the device fixed appropriately?
Does the device comply to the measurement point specifications, such as ambient temperature, etc.? $\rightarrow \square 48$
I

5 Electrical connection

5.1 Connecting requirements

According to the 3-A Sanitary Standard and EHEDG electrical connecting cables must be smooth, corrosion-resistant and easy to clean.

5.2 Connecting the measuring device

NOTICE

To prevent damage to the device

- To prevent any kind of damage from the device electronics, leave the pins 2 and 4 unconnected. They are reserved for the connection of the configuration cable.
- ► Do not tighten the M12 plug too much, in order to prevent damage to the device.



Cable plug M12x1 and PIN assignment of the connection socket at the device

If voltage supply is connected correctly and the measuring device is operational, the LED is illuminated green.

5.3 Ensuring the degree of protection

The specified degree of proctection is ensured when the M12x1 cable plug is tightened. In order to reach IP69 degree of protection, appropriate cord sets with straight or angle plugs are available as accessories.

5.4 Post-connection check

Is the device or cable undamaged (visual check)?
Do the cables have adequate strain relief?
Does the supply voltage match the specifications on the nameplate?

6 Operability

PLC FieldCare Fi

6.1 Overview of operation options

Ø 7 Operating options of the device

- 1 Installed iTHERM compact thermometer with HART communication protocol
- 2 RIA15 loop powered process display It is integrated in the current loop and displays the measuring signal or HART process variables in digital form. The process display unit does not require an external power supply. It is powered directly from the current loop.
- 3 Active barrier RN42 The active barrier is used for transmission and galvanic isolation of 4 to 20 mA/HART signals and supplying loop powered transmitters. The universal power supply works with an input supply voltage of 19.20 to 253 V DC/AC, 50/60 Hz, which means that it can be used in all international power grids.
- 4 Commubox FXA195 for intrinsically safe HART communication with FieldCare via the USB interface.
- 5 FieldCare is a FDT-based plant asset management tool from Endress+Hauser, more details see section 'accessories'. The acquired self-calibration data is stored in the device (1) and can be read using FieldCare. This also enables an auditable calibration certificate to be created and printed.

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6.2 Structure and function of the operating menu





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 (Measurement range, etc.). Reading measured values. Calibration: Configuration of the warning and alarm limit values as well as interval monitoring. Configuration and creation of a calibration report (wizard). 	"Setup" "Calibration"	 Contains all parameters for commissioning and calibration: Setup parameters Once values have been set for these parameters, the measurement should generally be completely configured. Calibration parameters Contains all information and parameters for the self-calibration, including a wizard for creating a calibration report. This wizard is available in the online parameterization.
	 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 pending diagnostic messages. Event logbook Contains the last 5 diagnostic messages (no longer pending). "Device information" submenu Contains information for identifying the device. "Measured values" submenu Contains all current measured values. "Simulation" submenu Is used to simulate measured values or output values. Diagnostic settings Configuration of diagnostic behavior and status signal according to NE107
	Heartbeat: Creation of a Heartbeat report (wizard)	"Heartbeat"	Contains a wizard for creating a calibration report. This wizard is available in the online parametrization.
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-order device parameters that do not pertain either to measurement or the measured value communication. "Output" submenu Contains all parameters for configuring the analog current output and the loop check. "Communication" submenu Contains all parameters for configuring the digital communication interface.

6.3 Access to the operating menu via an operating tool

6.3.1 FieldCare

Function scope

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

Typical functions:

- Configuring parameters of the device
- Loading and saving device data (upload/download)
- Documentation of the measuring point

For iTHERM TrustSens thermometers, FieldCare provides convenient access to automatically created self-calibration reports.

For details, see Operating Instructions BA00027S/04 and BA00065S/04 in the download area on www.endress.com.

Source for device description files

See data $\rightarrow \textcircled{2}$ 22

Establishing a connection

As example: via HART modem Commubox FXA191 (RS232) or FXA195 (USB)

- 1. Make sure to update the DTM library for all connected devices (e.g. FXA19x, iTHERM TrustSens TM371).
- 2. Start FieldCare and create a project.
- 3. Go to View --> Network: Right-click on Host PC Add Device...
 - The Add New Device window opens.
- 4. Select the **HART Communication** option from the list and press **OK** to confirm.
- 5. Double-click on **HART Communication** DTM instance.
 - ← Check the Serial Interface port for the correct modem and press **OK** to confirm.
- 6. Right-click on **HART Communication** and select the **Add Device...** option in the context menu that opens.
- 7. Select the desired device from the list and press **OK** to confirm. The device appears in the network list.
- 8. Right-click on this device and select the **Connect** option in the context menu that opens.
 - └ The CommDTM appears in green color.
- 9. Double-click on the device in the network list to establish the online connection to the device.
 - └ The online parameterization is available.



User interface

8 User interface with device information via HART[®]-communication

- 1 Device tag and device name
- 2 Status area for the status signal
- 3 Measured values with general device information: PV, output current, percent of range
- 4 Helping area/additional information
- 5 Display and input area
- 6 Navigation area with operating menu structure

6.3.2 DeviceCare

Function scope

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

Source for device description files

See data $\rightarrow \square 22$

6.3.3 Field Xpert

Function scope

Field Xpert is an industrial PDA (personal digital assistant) with integrated touchscreen for commissioning and maintaining field devices in explosion hazardous and non-hazardous areas. It allows efficient configuration of FOUNDATION fieldbus, HART and WirelessHART devices.

Source for device description files

See data $\rightarrow \square 22$

6.3.4 AMS Device Manager

Function scope

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

Source for device description files

See data $\rightarrow \square 22$

6.3.5 SIMATIC PDM

Function scope

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

Source for device description files

See data $\rightarrow \cong 22$

6.3.6 Field Communicator 375/475

Function scope

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 $\rightarrow \square 22$

7 System integration

7.1 Overview of device description files

Version data for the device

Firmware version	01.00.zz	 The firmware version can be found: on the nameplate →
		page.
Manufacturer ID	(17) 0x11	Operating menu: Diagnostics \rightarrow Device information \rightarrow Manufacturer ID
Device type	0x11CF	Operating menu: Expert \rightarrow Communication \rightarrow HART info \rightarrow Device type
HART protocol revision	7	Operating menu: Expert \rightarrow Communication \rightarrow HART info \rightarrow HART revision
Device revision	1	 On the nameplate → 9 Operating menu: Expert → Communication → HART info → Device revision

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

- www.endress.com --> Downloads --> Media Type: Software --> Software Type: Application Software
- www.endress.com --> Products: individual product page e.g. TM371 --> Documents / Manuals / Software: Electronic Data Description (EDD) or Device Type Manager (DTM).
- via DVD (contact your local Endress+Hauser sales center)

Endress+Hauser supports all common operating tools of different manufacturers (e.g. Emerson Process Management, ABB, Siemens, Yokogawa, Honeywell and many more). The Endress+Hauser operating tools FieldCare and Device care can also be obtained per download (www. endress.com --> Downloads --> Media Type: Software --> Application Software) or via optical data storage medium (DVD) from your local Endress+Hauser sales center.

7.2 Measured variables via HART protocol

The measured values (device variables) are assigned to the device variables as follows:

Dynamic variable	Device variable		
Primary value (PV)	Temperature		
Secondary value (SV)	Device temperature		
Tertiary value (TV)	Number of self-calibrations		
Quaternary value (QV)	Calibration deviation		

7.3 Supported HART[®] commands

The HART[®] protocol enables the transfer of measurement data and device data between the HART[®] master and the field device. HART[®] masters such as the above listed operating tools require an appropriate device driver software (DD or DTM) to establish the data exchange. The data exchange is initiated via commands.

There are three different types of commands.

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.

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

Command No.	Designation
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
54, Cmd054	Read device variable information
59, Cmd059	Write number of response preambles
95, Cmd095	Read Device Communication Statistics
100, Cmd100	Write Primary Variable Alarm Code
516, Cmd516	Read Device Location
517, Cmd517	Write Device Location
518, Cmd518	Read Location Description
519, Cmd519	Write Location Description
520, Cmd520	Read Process Unit Tag
521, Cmd521	Write Process Unit Tag
523, Cmd523	Read Condensed Status Mapping Array
524, Cmd524	Write Condensed Status Mapping Array
525, Cmd525	Reset Condensed Status Mapping Array
526, Cmd526	Write Simulation Mode
527, Cmd527	Simulate Status Bit

8 Commissioning

8.1 Function check

Before commissioning the device make sure that all final checks have been carried out:

- Checklist "Post-mounting check" , \rightarrow 🗎 14
- Checklist "Post-connection check", $\rightarrow \square 16$

8.2 Switching on the measuring device

Once the final checks have been successfully completed, it is time to switch on the supply voltage. The device performs a number of internal test functions after power-up. This is indicated by red LED-flashing. The device is operational after approx. 10 seconds in normal operating mode. The LED on the device is illuminated green.

8.2.1 Display elements



1 LED signals for device status indication.

Function description of the different LED signals, see \rightarrow \cong 37

8.3 Configuring the measuring device

See 'Operating menu and parameter description' $\rightarrow \oplus 67$

8.3.1 Defining the measurement range

To configure the measurement range, enter the **4 mA value** and the **20 mA value**.

Device tag Status EH_TM371_N4045004487 2 0k	signal	PV	Output current 23,40 °C	6,50 mA	Endress+Hauser 🔠
Device name Lockir TrustSens TM371	ig status	Percent of range	15,60 %		ו•
ଲ					
Setup	Device tag	87		?	
Calibration	>		1	Device tag	
Diagnostics	>		3	Min/Max cha	racters: 0 / 32
Expert	>				
Additional functions	>		Ť		
	Unit "C 4 mA value 0,00 °C 20 mA value 150,00 °C Falture mode Low alarm	•		< >	

Navigation

 \square "Setup" menu \rightarrow 4 mA value

- "Setup" menu → 20 mA value
- **1.** In the **4 mA value** input window, enter the lower range value of your process measurement range and press ENTER to confirm.
- 2. In the **20 mA value** input window, enter the upper range value of your process measurement range and press ENTER to confirm.

8.3.2 Defining the warning limits for the self-calibration



- *1 Values to be entered for the warning limits*
- 2 Values to be entered for the alarm limits

Use this function to define the lower and upper warning limit. As a result of each selfcalibration the deviation between the reference sensor and the Pt100 sensor is being determined. If this deviation exceeds the defined warning limit, the device will transmit the defined status signal and show the defined diagnostic behavior via the LED. (Factory setting = Warning - LED red flashes, diagnostic number 144. Measured value status = Uncertain / Not limited).

Navigation

 \square "Calibration" menu \rightarrow Limits \rightarrow Intervention limits

1. In the **Lower warning value** input window, enter the lower warning limit for the self-calibration deviation and press ENTER to confirm.

2. In the **Upper warning value** input window, enter the upper warning limit for the self-calibration deviation and press ENTER to confirm.

8.3.3 Defining the alarm limits for the self-calibration

Use this function to define the lower and upper alarm limit. As a result of each selfcalibration the deviation between the reference sensor and the Pt100 sensor is being determined. If this deviation exceeds the defined alarm limit, the device will transmit the defined status signal and show the defined diagnostic behavior via the LED. (Factory setting = Warning - LED red flashes, diagnostic number 143. Measured value status = Uncertain / Not limited.)

Navigation

 \square "Calibration" menu \rightarrow Limits \rightarrow Alarm limits

1. In the **Lower alarm value** input window, enter the lower limit for the self-calibration deviation and press ENTER to confirm.

2. In the **Upper alarm value** input window, enter the upper warning limit for the self-calibration deviation and press ENTER to confirm.

8.4 Creating a calibration report

The "calibration report" wizard guides you systematically through the process for creating a calibration report for a pre-selected calibration point.

Navigation

 \square "Calibration" menu \rightarrow Calibration report

At least one stored self-calibration point must be in the device to start the online wizard.

Configuration and creation of a calibration report

	Device name	Locking st	atus	Percent of range			/
	TrustSens TM371	-			15,38 %		000
	」 🔂 > Calibration						
1. —	Calibration		Number of self calil	brations		7	
	Limits		29			Number of	f salf calibrations
			Stored self calibrati	ion points		Min/Max:	0 / 4294967295
	Interval monitoring	>	29	<u>ش</u>			
2. —	Calibration report	30	Deviation				
			0,03 °C	命			
			Adjustment				
			0,05 °C			<	
						>	

Press CALIBRATION to enter the calibration menu.

2. Press CALIBRATION REPORT to open the calibration wizard.

	Device tag EH_TM371_N4045004487 Device name TrustSens TM371	Status signal Ök Locking status	PV Percent of range	0utput current 23,05 °C 15,36 %	6,46 mA	Endress+Hauser 🖾
	Select calibration p Pr	nt calibration p,		?		
3 —	Select calibration point	int rice	To read calibratio	1 point data from		
5.	1		device, enter calib (Index 1 reads the point)	ration point index latest calibration >		
	Stored self calibration points	£				
			Exit	Previous Read data		

To read the calibration point data from the device, enter the calibration point index. Index 1 reads the latest calibration point.

- 4. Press READ DATA to confirm.
 - ← An overview of device information and calibration point data appears. See table below for detailed information.

5				
٦.		Select calibration a Relat calibration a		
		Select calibration p Print calibration p.	· •	
			2	
		Calibration point data		
	E		Euro annihi an DDF	
	5.	Device information	Save results as PDF	
		Operating time		
		Stored self calibration points		
		29	A	
		Requested self calibration point		
		1	8	
		Calibration point data Calibration ID		
		29	8	
		Self calibration status		
		Good	<u>۵</u>	
			Exit Select calibration point Read older calibration point	
	-	I		
			A00	J4854

Press SAVE RESULTS AS PDF to confirm.

	« Marketing » ProductDocu	> BA >	Screenshots	~ Ö	♀ "Screenshots" du	urchsuchen
Organisieren 🔻	Neuer Ordner				8	- ()
Dieser PC		^	Name		Änderungsdatum	Тур
3D-Objekte			Calibration report.pdf		08.03.2022 11:08	Adobe A
Bilder						
E Desktop						
🗎 Dokumente						
👆 Downloads						
🁌 Musik						
Videos						
Name of Street S						
System (C:)						
🖆 System (C:) 👳 Data04 (X:)		5				
 System (C:) ■ Data04 (X:) ■ Data02 (Y:) 		l.				
System (C:) Data04 (X:) Data02 (Y:) Data03 (Z:)		~ <				
System (C:) Data04 (X:) Data02 (Y:) Data03 (Z:) Dateiname:	calibration report.pdf	~ <				
System (C:) Data04 (X:) Data02 (Y:) Data03 (Z:) Dateiname: Dateityp:	calibration report.pdf PDF File (*.pdf)	~ <			_	
 System (C:) Data04 (X:) Data02 (Y:) Data03 (Z:) Dateiname: Dateityp: 	calibration report.pdf PDF File (*,pdf)	~ <				

Your file system explorer window appears. You are asked to save the calibration report as a PDF file.

6. Enter a file name for the calibration report and select a memory location in your file system.

← The calibration report is just being saved on your file system.

7. Either press EXIT to end the calibration report wizard, press SELECT CALIBRATION POINT to select another stored self-calibration point or press READ OLDER CALIBRATION POINT to switch to the previous self-calibration point.

The creation of a self-calibration report is finished. The saved PDF-file can be opened to read or to print the calibration report.

Relevant self-co	alibration	data for	creating	a report

Device information	
Operating time	Use this function to display the total count of hours when the device was powered.
Stored self-calibration points	Displays the amount of all stored self-calibration points. This device is able to store 350 self-calibration points. As soon as the memory would reach its limit, the oldest self-calibration point will be overwritten.
Requested self-calibration point	Enter the number of the requested self-calibration point. The latest self-calibration point always has the number "1".
Calibration point data	
Calibration ID	Use this number to identify a self-calibration point. Each number is unique and is not editable.
Self-calibration status	This function shows the validity of the self-calibration point data.
Operating hours	This function displays the value of the operating hours counter of the shown self-calibration point.
Measured temperature value	This function displays the measured Pt100 temperature value at that specific time of the self-calibration.
Deviation	This function displays the measured Pt100 self-calibration deviation from the reference temperature. The deviation is calculated as follows: Self-calibration deviation = reference temperature - measured Pt100 temperature value + adjustment
Adjustment	This function displays the adjustment value added to the measured Pt100 value. This influences the self-calibration deviation. $\rightarrow \textcircled{B} 73$ New adjustment = Adjustment - deviation of last self-calibration point
Measurement uncertainty	This functions displays the maximum measurement uncertainty at the self-calibration temperature.
Lower alarm value	This function displays the defined lower alarm limit value. \rightarrow 🗎 74
Upper alarm value	This function displays the defined upper alarm limit value. $\rightarrow \square 74$
Device restart counter	Displays the device restarts between now and when the displayed self- calibration was executed.

8.5 Protecting settings from unauthorized access

Use this function to protect the device from unwanted changes.

Navigation

 \square Expert menu \rightarrow System \rightarrow Administration \rightarrow Define device write protection code

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 default: 0 = write protection is not active.

To activate the write protection please go through the following steps:

- **1.** Define a write protection in the **Enter access code** parameter.
- 2. Enter a code which does not correspond to the one which is defined in step 1.
 - └ The device is now write protected.

Deactivate the write protection

- Enter the defined code in the **Enter access code** parameter.
 - └ The device is not write protected.

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

8.6 Advanced settings

The section contains a description of the additional parameters and technical data that are available with the **Heartbeat Verification** and **Heartbeat Monitoring** application packages.

8.6.1 Heartbeat Technology modules

Overview



9 Heartbeat Technology modules

The modules are available in all the device versions. The Heartbeat Technology functionality is available with the revised device driver software (DTM, version 1.11.zz and higher).

Short description of the modules

Heartbeat Diagnostics

Function

- Continuous self-monitoring of the device.
- Diagnostic messages output to
 - a local display, optional
 - an asset management system (e.g. FieldCare/DeviceCare)
 - an automation system (e.g. PLC)

Advantages

- Device condition information is available immediately and processed in time.
- The status signals are classified in accordance with VDI/VDE 2650 and NAMUR recommendation NE 107 and contain information about the cause of the error and remedial action.

Detailed description

→ 🗎 31

Heartbeat Verification

Device functionality checked on demand

- Verification of the correct functioning of the measuring device within specifications.
- The verification result provides information about the condition of the device: "Passed" or "Failed".
- The results are documented in a verification report.
- The automatically generated report supports the obligation to demonstrate compliance with internal and external regulations, laws and standards.
- Verification is possible without interrupting the process.

Advantages

- No onsite presence is required to use the function.
- The DTM ¹⁾ triggers verification in the device and interprets the results. No specific knowledge is required on the part of the user.
- The verification report can be used to prove quality measures to a third party.
- Heartbeat Verification can replace other maintenance tasks (e.g. periodic check) or extend the test intervals.

Detailed description

→ 🗎 32

Heartbeat Monitoring

Function

Calibration information is logged in addition to the verification parameters. 350 calibration points are saved in the device (FIFO memory).

Advantages

- Early detection of changes (trends) to ensure plant availability and product quality.
- Use of information for the proactive planning of measures (e.g. maintenance).

Detailed description

→ 🗎 35

8.6.2 **Heartbeat Diagnostics**

Device diagnostic messages, along with remedial measures, are displayed in the operating tool (FieldCare/DeviceCare).



For information on using the diagnostic messages, see the "Diagnostics and troubleshooting" section. $\rightarrow \square 37$

¹⁾ DTM: Device Type Manager; controls device operation via DeviceCare, FieldCare, PACTware or a DTM-based control system.

Diagnostic message in the operating tool

- 1. Navigate to the **"Diagnostics**" menu.
 - └ The diagnostic event, along with the event text, is displayed in the Actual diagnostics parameter.
- 2. In the display area, hover the cursor over the "Actual diagnostics" parameter.



8.6.3 Heartbeat Verification

Verification report

Creating the verification report using the wizard

The wizard to create a verification report is only available if the device is operated via FieldCare, DeviceCare, PACTware or a DTM-based control system.

Navigation

-					
Device tag EH_TM371_N4045004487	Status signal 🜌 Ok	PV	Output current 23,15 °C	6,47 mA	Endress+Hauser 💷
Device name TrustSens TM371	Locking status	Percent of range	15,43 %		~
کی > Diagnostics > Hear	lbeat				
Heartbeat Verification	×			Actual dia	gnostics
				OK	
				,	
				>	

\square Menu "Diagnostics \rightarrow Heartbeat" \rightarrow Heartbeat Verification



. 1									
	Heartbeat Verificat	Device information	Verification inform	Mainboard module	Sensor	Sensor information	Monitoring param	Result	>
	\rightarrow					?			
	Heartbeat Verification								
				This wixin I is used intertionality. The documentation of the starting the write variant of the starting the several self-checks only be started if in in operation for at	to start an or of the denice ensuits can be emilication report. store: After clicking expansive transformer be verification can be verification ca	<			
									AC

The user-quided wizard appears.

- 2. Follow the instructions given by the wizard.
 - ← The wizard guides you through the entire process for creating the verification report. The verification report can be saved in PDF and XML format.



Content of the verification report

The verification report contains the results of the test objects: **Passed** or **Failed** is indicated as the result.

Parameter	Description/comments				
Device information					
System operator	Name of the system operator; is defined when the verification report is created.				
Location	Location of the device within the plant; is defined when the verification report is created.				
Device tag	Unique name for the measuring point so it can be identified quickly within the plant. Is defined when commissioning the device.				
Device name	Displays the device name. It can also be found on the nameplate. It cannot be changed.				
Serial number	Displays the serial number of the device. It can also be found on the nameplate It cannot be changed.				
Order code	Displays the order code of the device. It can also be found on the nameplate. It cannot be changed.				
Firmware version	Displays the device firmware version installed. It cannot be changed.				
Verification information					
Operating time	Indicates how long the device has been in operation up to this point.				
Date/time	Displays the current computer system time.				
Comments	Allows the user to enter optional comments, which appear in the verification report.				
Verification results					
The test result for all the test objects is given on the subsequent pages. The following results are possible:	 V: Passed Failed 				

Verification report: general information

Verification criteria for the test objects

Test object	Verification criterion			
Mainboard module				
Electronics	Checks the correct functioning of the electronics.			
Memory content	Checks the correct functioning of the data memory.			
Supply voltage	Checks the permitted supply voltage range.			
Electronics temperature	Checks the permitted electronics temperature range or device temperature range.			

Test object	Verification criterion			
Sensor module				
Sensor	Checks whether the sensor works as per the specifications.			
Reference temperature	Checks whether the reference sensor works as per the specifications.			
Sensor drift warning limit exceeded	Checks whether the configured warning limits are exceeded.			
Sensor drift alarm limit exceeded	Checks whether the configured alarm limits are exceeded.			
Sensor information				
Number of self-calibrations	Displays all the self-calibrations executed up to now. This value cannot be reset.			
Deviation	Displays the deviation of the measured value from the reference temperature.			
Adjustment of the measurement	Displays the adjustment of the calibration deviation.			
Monitoring parameters				
Device temperature min:	Displays the minimum electronics temperature measured in the past (peakhold indicator).			
Device temperature max:	Displays the maximum electronics temperature measured in the past (peakhold indicator).			
Sensor min value:	Displays the minimum temperature measured in the past at the sensor input (peakhold indicator).			
Sensor max. value:	Displays the maximum temperature measured in the past at the sensor input (peakhold indicator).			

Summary of results

Overall results	Displays the overall result of the verification. The verification report can be saved in PDF and XML format. To save the report, click the Save results as PDF button or the Save results as XML button.
	If the verification fails, try again or contact the Service Organization.

8.6.4 Heartbeat Monitoring

Calibration information is logged in addition to the verification parameters.

HART variable	Output	Unit
PV	Temperature	°C/°F
SV	Device temperature	°C/°F
TV	Calibration counter	-
QV	Calibration deviation	°C/°F

Monitoring information can be read out and analyzed as described below:

A higher-level controller is configured in such a way that calibration deviations and the calibration counter are saved when the calibration counter changes. This type of function is supported by Endress+Hauser's Advanced Data Manager Memograph M RSG45, for example. The following table provides a sample overview of the monitoring analysis using the Field Data Manager software MS20:

Time stamp	Device name	Category	Text
25.07.2018	TrustSens 1 (example)Self-calibration	EH_TM371_M7041504487: self-calibration (ID=183) Serial number: M7041504487 Device name: iTHERM TM371/372 Operating hours: 1626 h Reference temperature: 118.67 °C Measured temperature value: 118.68 °C Deviation: 0.01 °C Measuring uncertainty (k=2): 0.35 °C Max. permitted deviation: -0.80 / +0.80 °C Assessment
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.

Due to its design, the device cannot be repaired. However, it is possible to send the device back for examination. See the information in the "Return" section. $\rightarrow \square 43$

General	errors

Problem	Possible cause	Remedy
Device is not responding.	Supply voltage range does not match that specified on the nameplate.	Apply correct voltage, see nameplate.
	M12 plug is not connected correctly, wrong cable wiring.	Check the wiring.
Output current < 3.6 mA	Device is defective.	Replace the device.
HART communication is not working.	Missing or incorrectly installed communication resistor.	Install the communication resistor (250 Ω) correctly.
		 TrustSens compact thermometer HART[®] communication resistor, R = ≥ 250 Ω PLC/DCS Configuration examples: FieldCare with Commubox, HART[®] handheld communicator as well as via Field Xpert SFX350/370
	Commubox is not properly connected.	Connect Commubox correctly .

9.2 Diagnostic information via LEDs

Position	LEDs	Function description
	LED green (gn) is illuminated	Voltage supply is correct. The device is operational and the set limit values are met.
	LED green (gn) is flashing	With a frequency 1 Hz: self-calibration currently being performed. With a frequency 5 Hz for 5 s: self-calibration finished and valid, all process criteria were within specifications. Calibration data stored.
	LED red (rd) and green (gn) are flashing alternating	Self-calibration process finished but not valid, violation of necessary process criteria. Calibration data not stored.
LED for device status	LED red (rd) is flashing	Presence of a diagnostic event: "Warning"
indication	LED red (rd) is illuminated	Presence of a diagnostic event: "Alarm"

9.3 Diagnostic information

Status signal and diagnostic behavior can be configured manually.

Status signal - Digital information available via HART® communication

Letter/ symbol	Status signal	Meaning of the status signal ¹⁾
F 😸	Failure	The device or its periphery behaves in such a way that the measurement value is no longer valid. This includes faults/failures which are caused by the process being measured, but have an impact on the ability to perform a measurement e.g. "no process signal" detected.
С 🖤	Function check	The device is deliberately serviced, configured, parameterized or is in simulation mode. A situation exists where the output signal does not represent the process value and is therefore not valid.
S A	Out of specification	The device is operating outside of its technical specifications or internal diagnostic functions indicate that the current process conditions increase the measurement uncertainty (i.e. during plant start-up or cleaning processes).
M 🔶	Maintenance required	Deviation from normal operation, the device still works, but should be attended to soon to ensure continued operation, e.g. build-up, corrosion, zero point adjustment not possible or memory for data storage almost full.

1) Valid for the default mappings to the diagnostic numbers

Diagnostic behavior	- Analog inf	formation via	current output	t and LED

Diagnostic behavior	Meaning of the behavior
Alarm	Measurement is interrupted. Mostly the measured data is invalid and the configured failure current is set. A diagnostic message is generated.
Warning	Usually, the device continues to measure. A diagnostic message is generated.
Disabled	The diagnostic event is completely surpressed even if the device is not working properly.

Diagnostics event and event text



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

9.4 **Overview of diagnostics events**

Diagnostic events are assigned to a certain diagnostic number and a status signal. The user can change this assignment for certain diagnostic events.

Example:

		Settings		Device behavior			
Configuration example	Diagnostic number	Status signal	Diagnostic behavior (settings)	Status signal (output via HART® protocol)	Output current	PV, status	LED
Default setting	143	S	Warning	S	Measured value	Measured value, UNCERTAIN	Red is flashing
Manual configuration: Status signal S is switched to F	143	F	Warning	F	Measured value	Measured value, UNCERTAIN	Red is flashing
Manual configuration: diagnostic behavior Warning is switched to Alarm	143	S	Alarm	S	Configured failure current	Measured value, BAD	Red is illuminated
Manual configuration: Warning is switched to Disabled	143	S ¹⁾	Disabled	_ 2)	Last valid measured value ³⁾	Last valid measured value, GOOD	Green is illuminated

1)

Setting is not relevant. Status signal is not indicated. 2)

3) If there is no valid measured value, it is set to the failure current

Diagnostic number	Priority	Short text	Remedy	Status signal (factory default)	Configurable ¹⁾	Diagnostic behavior from the factory	Configurable ²⁾
			Diagnostics				
001	1	Device failure	1. Restart device. 2. Replace electronics.	F	×	Alarm	×
004	2	Sensor defective	Replace device.	F	\checkmark	Alarm	\checkmark
047	22	Sensor limit reached	 Check sensor. Check process conditions. 	S	\checkmark	Warning	
105	26	Manual calibration interval expired	 Execute calibration and reset calibration interval. Switch off calibration counter 	М	\checkmark	Warning	
143	21	Sensordrift Alarm limit exceeded	 Check self calibration alarm limits. Check value of adjustment. Replace device 	S		Warning	
144	27	Sensordrift warning limit exceeded	 Check self calibration warning limits. Check value of adjustment. Replace device 	М		Warning	
221	29	Reference sensor defective ³⁾	Replace device.	M	\checkmark	Warning	

Diagnostic number	Priority	Short text	Remedy	Status signal (factory default)	Configurable ¹⁾	Diagnostic - behavior from the factory	Configurable ²⁾
401	15	Factory reset active	Factory reset in progress, please wait.	С	\mathbf{X}	Warning	×
402	16	Initialization active	Initialization in progress, please wait.	С	×	Warning	×
410	3	Data transfer failed	 Check connection. Repeat data transfer. 	F	\mathbf{X}	Alarm	\mathbf{X}
411	17	Up-/download active	Up-/download in progress, please wait.	С	\mathbf{X}	Warning	×
435	5	Linearization faulty	Check linearization.	F	×	Alarm	×
437	4	Configuration incompatible	Execute factory reset.	F	\mathbf{X}	Alarm	X
438	30	Dataset different	 Check data set file. Check device parameterization. Download new device parameterization. 	М	×	Warning	×
485	18	Process variable simulation active- Sensor	Deactivate simulation.	С	\checkmark	Warning	
491	19	Output simulation - current output	Deactivate simulation.	С	\checkmark	Warning	
495	20	Diagnostic event simulation active	Deactivate simulation.	С	\checkmark	Warning	
501	6	Wiring error ⁴⁾	Check wiring.	F	X	Alarm	X
531	6	Factory adjustment missing					
	8	Factory adjustment missing-Sensor	-				
	9	Factory adjustment missing-Reference sensor	1. Contact service organization. 2. Replace device.	F		Alarm	×
	10	Factory adjustment missing-Current output	-				
537	11	Configuration	 Check device configuration Up- and download new configuration 				
	12	Configuration-Sensor	1. Check sensor configuration.				
	13	Configuration- Reference sensor	2. Check device configuration.	F		Alarm	
	14	Configuration-Current output	 Check application Check the current output parameterization 				
801	23	Supply voltage too low	Increase supply voltage.	S	\checkmark	Alarm	X
825	24	Operating temperature	 Check ambient temperature. Check process temperature. 	S		Warning	

Diagnostic number	Priority	Short text	Remedy	Status signal (factory default)	Configurable ¹⁾	Diagnostic behavior from the factory	Configurable ²⁾
844	25	Process value out of specification	 Check process value. Check application. Check sensor. 	S	\checkmark	Warning	
905	28	Self calibration interval expired	 Initiate self-calibration. Deactivate self-calibration interval monitoring. Replace device 	М		Warning	

1) F, C, S, M, N can be configured

2) 'Alarm', 'Warning' and 'Disabled' can be configured

3) Reference sensor defective if temperature range of -45 to +200 °C (-49 to +392 °F) is exceeded. Temperature measurement continues, but self-calibration is permanently disabled.

4) Leading error cause: CDI modem and loop are connected simultaneously, based on wrong connection (CDI modem or loop only) or defective cable plug.

9.5 Diagnostic list

If more than three diagnostic events occure simultaneously, only the messages with the highest priorities are shown in the **Diagnostics list**. $\rightarrow \blacksquare$ 77 Characteristic feature of the displayed priority is the status signal in the following order: F, C, S, M. If there are several diagnostic events with the same status signal, the priority values from the table above are used for ordering the diagnostic events, e.g.: F001 appears first, F501 appears second and S047 appears last.

9.6 Event logbook

Diagnostic events that are no longer pending are shown in the **Event logbook** submenu. $\rightarrow \cong 78$

9.7 Firmware history

Revision history

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

- XX Change to main version. No longer compatible. Changes in the device and Operating Instructions.
 YY Change to functions and operation. Compatible. Changes in the Operating Instructions.
- ZZ Bug fixing. No changes to the Operating Instructions.

Date	Firmware Version	Modifications	Documentation
09/17	01.00.zz	Original firmware	BA01581T/09

10 Maintenance

In general, no specific maintenance is required for this device.

10.1 Cleaning

The sensor has to be cleaned as required. The cleaning can also be proceeded when the device is installed (e.g. CIP Cleaning in Place / SIP Sterilization in Place). Care must be taken to ensure that the sensor is not damaged during the cleaning.

The housing is resistant to typical cleaning agents from the outside. It passed the Ecolab test.

11 Repair

Due to its design, the device cannot be repaired.

11.1 Spare parts

Currently available spare parts for your product can be found online at: http://www.products.endress.com/spareparts_consumables. When ordering spare parts, please quote the serial number of the device!

Туре	Order number
Plug screw fitting G1/2 1.4435	60022519
Spare Part Kit Press-Screw TK40 G1/4 d6	71215757
Spare Part Kit Press-Screw TK40 G1/2 d6	71217633
Weld-in adapter G3/4 d=50, 316L, 3.1	52018765
Weld-in adapter G3/4, d=29, 316L, 3.1	52028295
G1/2 metal to metal weld in adapter	60021387
Weld in adapter M12x1.5 316L&1.4435	71405560
O-ring 14.9x2.7 VMQ, FDA, 5 pieces	52021717
Weld-in adapter G3/4 d=55, 316L	52001052
Weld-in adapter G3/4, 316L, 3.1	52011897
O-ring 21.89x2.62 VMQ, FDA, 5 pcs.	52014473
Weld-in adapter G1, d=60, 316L	52001051
Weld-in adapter G1, d=60, 316L, 3.1	52011896
Weld-in adapter G1, d=53, 316L, 3.1	71093129
O-ring 28.17x3.53 VMQ, FDA, 5 pcs.	52014472
Adapter for Ingold connection	60017887
O-ring set for Ingold connection	60018911
Grip cap flexible yellow TPE	71275424
iTHERM TK40 compression fitting	ТК40-
Spare Part Kit sealing TK40	XPT0001-
iTHERM TT411 thermowell	TT411-

11.2 Return

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

- Refer to the web page for information: http://www.endress.com/support/return-material
 Select the region.
- 2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

11.3 Disposal

The device contains electronic components and must therefore be disposed of as electronic waste. Please pay particular attention to the national disposal regulations in your country. Please seperate the different components according to their material consistence.

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.

12.1 Device-specific accessories

Device-specific accessories





12.1.1 Weld-in adapter

For more information about order codes and hygienic compliance of the adapters and spare parts, see Technical Information (TI00426F).



Maximum process pressure for the weld-in adapters:

25 bar (362 PSI) at maximum 150 °C (302 °F)

■ 40 bar (580 PSI) at maximum 100 °C (212 °F)



12.2 Communication-specific accessories

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

12.4 System components

Advanced 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.

RN42	1-channel active barrier with wide range power supply for the safe separation of 0/4 to 20 mA standard signal circuits, HART-transparent For details, see Technical Information TI01584K
RNS221	Supply unit for powering two 2-wire measuring devices in the non-Ex area. Bidirectional communication is possible via the HART communication jacks. For details, see Technical Information TI00081R

13 Technical Data

13.1 Input

Measuring range Pt100 thin-film (TF): -40 to +160 °C (-40 to +320 °F)

Optional -40 to +190 °C (-40 to +374 °F)

13.2 Output

Output signal	Analog output	4 to 20 mA
	Digital output	HART protocol (revision 7)

Failure information

Failure information as per NAMUR NE43:

Failure information is created if the measuring information is missing or not valid. A complete list of all the errors occurring in the measuring system is created.

Underranging	Linear decrease from 4.0 to 3.8 mA
Overranging	Linear increase from 20.0 to 20.5 mA
Failure, e.g. sensor breakage, sensor short- circuit	\leq 3.6 mA ("low") or \geq 21.5 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

Maximum possible HART communication resistance



Linearization/transmission Temperature-linear behavior

Filter

1st order digital filter: 0 to 120 s, factory setting: 0 s (PV)

Protocol-specific data

HART	
Manufacturer ID	17 (0x11)
Device type ID	0x11CF
HART revision	7
Device description files (DTM, DD)	Information and files at: • www.endress.com/downloads • www.fieldcommgroup.org
HART load	Min. 250 Ω
HART device variables	Measured value for PV (primary value) Temperature Measured values for SV, TV, QV (secondary, tertiary and quaternary variable) • SV: Device temperature • TV: Calibration counter • QV: Calibration deviation
Supported functions	Additional transmitter statusNE107 diagnostics

Startup behavior / wireless HART data

Minimum start-up voltage	12 V _{DC}
Start-up current	3.58 mA
Start-up time	< 7 s, until the first valid measured value signal is present at the current output
Minimum operating voltage	12 V _{DC}
Multidrop current	4 mA
Lead time	0 s

	13.3 Wiring	
	According to the 3-A Sanitary Standard and EHEDG electrical connecting cables must be smooth, corrosion-resistant and easy to clean.	
Supply voltage	$U_b = 12 \text{ to } 30 \text{ V}_{DC}$	
	The device may only be powered by a power supply unit with a limited energy electric circuit in accordance with UL/EN/IEC 61010-1 chapter 9.4 or Class 2 according to UL 1310, "SELV or Class 2 cir-cuit".	
Current consumption	 I = 3.58 to 23 mA Minimum current consumption: I = 3.58 mA, multi-drop mode I =4 mA Maximum current consumption: I ≤ 23 mA 	
Overvoltage protection	To protect against overvoltage in the power supply and signal/communication cables for the thermometer electronics, Endress+Hauser offers the HAW562 surge arrester for DIN rail mounting.	
	For more information see the Technical Information 'HAW562 Surge arrester' TI01012K	
	13.4 Performance characteristics	
Reference operating conditions	 Ambient temperature: 25 °C ± 5 °C (77 °F ± 9 °F) Supply voltage: 24 V_{DC} 	
Internal calibration points	S 118 °C (244.4 °F) +1.2 K / –1.7 K	
	 Lowest possible calibration point = 116.3 °C (241.3 °F) Highest possible calibration point = 119.2 °C (246.6 °F) 	

The individual calibration point of each iTHERM TrustSens device is indicated in the ex-works calibration certificate enclosed with the shipment.

Measurement uncertainty

The given uncertainty values includ non-linearity and non-repeatability and correspond to 2Sigma (95% confidence level according to tha Gaussian distribution curve).

Each iTHERM TrustSens is calibrated and matched by default before shipment to guarantee the given accuracy.

Uncertainty of self-calibration at the calibration point: $^{1)}$	
Option: 118 °C (244 °F); self-calibration with excellent uncertainty 118 °C (244 °F); self-calibration with standard uncertainty	Uncertainty: < 0.35 K (0.63 °F) < 0.55 K (0.99 °F)
Uncertainty of the temperature sensor inclusive digital output (HART value) at reference conditions in delivery state:	

Process temperature:	
+20 to +135 °C (+68 to +275 °F)	< 0.22 K (0.4 °F)
+135 to +160 °C (+275 to +320 °F)	< 0.38 K (0.68 °F)
+160 to +170 °C (+320 to +338 °F)	< 0.5 K (0.90 °F)
+170 to +180 °C (+338 to +356 °F)	< 0.6 K (1.08 °F)
+180 to +190 °C (+356 to +374 °F)	< 0.8 K (1.44 °F)
0 to +20 °C (+32 to +68 °F)	< 0.27 K (0.49 °F)
-20 to 0 °C (-4 to +32 °F)	< 0.46 K (0.83 °F)
-40 to -20 °C (-40 to -4 °F)	< 0.8 K (1.44 °F)
Uncertainty of D/A converter (analog output current)	0.03 % of the measurement
	range

1) The uncertainty of the self-calibration can be compared to the uncertainty of a manual on-site calibration with a mobile dry-block-calibrator. Depending on the used equipment and the qualification of the person who is performing the calibration an uncertainty of > 0.3 K (0.54 $^{\circ}$ F) is standard.

Long-term drift	Pt100 sensing element	< 1000 ppm/1000 h ¹⁾
	A/D converter (digital output - HART)	< 500 ppm/1000 h ¹⁾
	D/A converter (analog output - current)	< 100 ppm/1000 h

1) This would be detected by the self-calibration

Long-term drift decreases at an exponential rate over time. So it may not be extrapolated in a linear way for time spans longer than the above given values.

Influence of ambient temperature	A/D converter (digital output - HART) at typical operating conditions	< 0.05 K (0.09 °F)
	A/D converter (digital output - HART) at maximum operating conditions	< 0.15 K (0.27 °F)
	D/A converter (analog output - current)	\leq 30 ppm/°C (2 σ), related to the deviation from the reference temperature

Typical operating conditions

- Ambient temperature: 0 to +40 °C (+32 to +104 °F)
- Process temperature: 0 to +140 °C (+32 to +284 °F)
- Power supply: 18 to 24 V_{DC}

According to IEC 61298-2:

A/D converter (digital output - HART) at typical operating conditions	< 15 ppm/V ¹⁾
D/A converter (analog output - current)	< 10 ppm/V ¹⁾

1) Related to the deviation from the reference supply voltage

Sample calculation with Pt100, measuring range +20 to +135 °C (+68 to +275 °F), ambient temperature +25 °C (+77 °F), supply voltage 24 V:

Measured error digital	0.220 K (0.396 °F)
Measured error D/A = 0.03 % x 150 °C (302 °F)	0.045 K (0.081 °F)
	-
Measured error digital value (HART):	0.220 K (0.396 °F)
Measured error analog value (current output): $\sqrt{(Measured error digital^2 + Measured error D/A^2)}$	0.225 K (0.405 °F)

Sample calculation with Pt100, measuring range +20 to +135 $^{\circ}$ C (+68 to +275 $^{\circ}$ F), ambient temperature +35 $^{\circ}$ C (+95 $^{\circ}$ F), supply voltage 30 V:

Measured error digital	0.220 K (0.396 °F)
Measured error D/A = 0.03 % x 150 °C (302 °F)	0.045 K (0.081 °F)
Influence of ambient temperature (digital)	0.050 K (0.090 °F)
Influence of ambient temperature (D/A) = (35 °C - 25 °C) x (30 ppm/°C x 150 °C)	0.045 K (0.081 °F)
Influence of supply voltage (digital) = (30 V - 24 V) x 15 ppm/V x 150 °C	0.014 K (0.025 °F)
Influence of supply voltage (D/A) = (30 V - 24 V) x 10 ppm/V x 150 °C	0.009 K (0.016 °F)
Measured error digital value (HART):	0.226 K (0.407 °F)
of supply voltage (digital) ²	

Response time

Tests in water at 0.4 m/s (1.3 ft/s), according to IEC 60751; 10 K temperature step change. t_{63} / t_{90} are defined as the time that passes until the instrument output reaches 63% / 90% of the new value.

*Response time with heat transfer paste*¹⁾

Protection tube	Shape of tip	Insert	t ₆₃	t ₉₀
ؼ in	in Reduced ³ / ₁₆ in x 0.79 in Ø3 mm (0.12 in)		2.9 s	5.4 s
a^{3} in	Straight	Ø6 mm (0.24 in)	9.1 s	17.9 s
Ø /8 III	Reduced $\frac{3}{16}$ in x 0.79 in	Ø3 mm (0.12 in)	2.9 s	5.4 s
ؼ in	Straight	Ø6 mm (0.24 in)	10.9 s	24.2 s

1) Between the insert and the protection tube.

Response time without heat transfer paste

Protection tube	Shape of tip	Insert	t ₆₃	t ₉₀
ؼ in	ؼ in Reduced ¾ 6 in x 0.79 in Ø3 mm (0.12 in)		7.4 s	17.3 s
(1) (in	Straight	Ø6 mm (0.24 in)	24.4 s	54.1 s
0 /8 111	Reduced $\frac{3}{16}$ in x 0.79 in	ø3 mm (0.12 in)	7.4 s	17.3 s
ؼ in	Straight	Ø6 mm (0.24 in)	30.7 s	74.5 s

Calibration

Calibration of thermometers

Calibration involves comparing the measured values of a device under test (DUT) with those of a more precise calibration standard using a defined and reproducible measurement method. The aim is to determine the deviation of the DUT's measured values from the true value of the measured variable. Two different methods are used for thermometers:

• Calibration at fixed-point temperatures, e.g. at the freezing point of water at 0 °C,

• Comparison calibration against a precise reference thermometer.

The thermometer to be calibrated must display the fixed point temperature or the temperature of the reference thermometer as accurately as possible. Temperature-controlled calibration baths or special calibration furnaces with homogeneous distribution of temperature are typically used for thermometer calibrations. The DUT and the reference thermometer are placed closely together into the bath or furnace at a sufficient depth.

The measurement uncertainty can increase due to heat conduction errors and short immersion lengths. The existing measurement uncertainty is listed on the individual calibration certificate.

For accredited calibrations according to IEC/ISO 17025, the measurement uncertainty must not be twice as high as the accredited measurement uncertainty of the laboratory. If the limit value is exceeded, only a factory calibration can be carried out.

For manual calibration in calibration baths the maximum immersion length of the device ranges from the sensor tip to the lower part of the electronic housing. Do not immerse the housing into the calibration bath!



Self-calibration

The self-calibration procedure uses the Curie temperature (Tc) of a reference material as a built-in temperature reference. A self-calibration is performed automatically, when the process temperature (Tp) falls below the nominal Curie Temperature (Tc) of the device. At the Curie temperature, a phase change of the reference material takes place, which is associated with a change in its electrical properties. The electronics automatically detects this change and simultaneously calculates the deviation of the measured Pt100-temperature to the known, physically fixed Curie temperature. The iTHERM TrustSens thermometer is calibrated. A green flashing LED light indicates the ongoing self-calibration process. Subsequently the thermometer electronics stores the results of this calibration. The calibration data can be read via an asset management software like FieldCare or DeviceCare. A self-calibration certificate can be created automatically. This insitu self-calibration allows a continuous and repeated monitoring of changes to the Pt100 sensor and to the electronics' characteristics. As the inline calibration is being performed under real ambient or process conditions (e.g. heating of electronics), the result is closer to reality than a sensor calibration under laboratory conditions.

Process criteria for self-calibration

To ensure a valid self-calibration within the given measurement accuracy, the process temperature characteristics needs to fulfil the criteria, which are checked by the device

automatically. Based on this, the device is ready to perform a self-calibration under the following conditions:



Calibration monitoring

Available in conjunction with Advanced Data Manager Memograph M (RSG45). $\rightarrow \square 48$

Application package:

- Up to 20 devices can be monitored via the HART interface
- Self-calibration data displayed on screen or via the Web server
- Generation of a calibration history
- Creation of a calibration protocol as an RTF file directly at the RSG45
- Evaluation, analysis and further processing of the calibration data using "Field Data Manager" (FDM) analysis software

Insulation resistance Insulation resistance $\geq 100 \text{ M}\Omega$ at ambient temperature, measured between the terminals and the outer jacket with a minimum voltage of 100 V_{DC} .

13.5 Environment

Ambient temperature range	Ambient temperature T _a	-40 to +60 °C (-40 to +140 °F)
	Maximum electronics temperature T	-40 to +85 °C (-40 to +185 °F)
Storage temperature range	T = -40 to +85 °C (-40 to	to +185 °F)
Climate class	As per IEC 60654-1, Cla	iss Dx

Degree of protection	 IP54 for the version without protection tube provided for installation in an existing protection tube IP65/67 for housing with LED status indication IP69 for housing without LED status indication and only if appropriate cord-set with M12x1 coupling is connected. →
	The specified rating IP65/67 or IP69 for the compact thermometer is only assured when an approved M12 connector with a suitable IP rating is installed according to its manual.
Shock and vibration resistance	Endress+Hauser temperature sensors meet the requirements of IEC 60751 which specify shock and vibration resistance of 3g in the range from 10 to 500 Hz. This also applies for the quick-fastening iTHERM QuickNeck.
Electromagnetic compatibility (EMC)	EMC to all 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 HART® communication. All EMC measurements were performed with a turn down (TD) = 5:1. Maximum
	Interference immunity to IEC/EN 61326 - series, requirements for industrial areas.
	Interference emission to IEC/EN 61326 - series, electrical equipment Class B.

Mechanical construction 13.6

Design, dimensions

The design of the thermometer depends on the protection tube version used:

- Thermometer without a protection tube
- Diameter ¹/₄ in
- Diameter ³/₈ in
 Diameter ¹/₂ in

Various dimensions, such as the immersion length U for example, are variable values A and are therefore indicated as items in the following dimensional drawings.

Variable dimensions:

Item	Description
E	Extension neck length, variable depending on the configuration or predefined for the version with iTHERM QuickNeck
L	Protection tube length (U+T)
В	Protection tube bottom thickness: predefined, depends on protection tube version (see also the individual table data)
Т	Length of protection tube shaft: variable or predefined, depends on protection tube version (see also the individual table data)
U	Immersion length: variable, depending on the configuration
ØID	Insert diameter 6 mm (0.24 in) or 3 mm (0.12 in)

Without protection tube

For installation in an existing protection tube.



- 1 Thermometer with thread NPT $\frac{1}{2}$ " and spring load to mount in existing protection tube
- 2 Thermometer with iTHERM QuickNeck top part and spring load for protection tube with iTHERM QuickNeck connection, ØID = 3 mm or 6 mm

Item	Description
$U_{(\text{protection}}$	Immersion length of the protection tube available at point of installation
T _{(protection} tube)	Shaft length of protection tube available at point of installation
E	Length of the extension neck at point of installation (provided one is available)
$B_{(protection}$	Base thickness of protection tube

Pay attention to the following equations when calculating the immersion length U for immersion into a protection tube TT412 already available:

Version 1	$U = U_{(protection tube)} + T_{(protection tube)} + 39.45 \text{ mm} (1.55 \text{ in}) - B_{(protection tube)}$
Version 2	$U = U_{(protection tube)} + T_{(protection tube)} + 20.45 \text{ mm} (0.8 \text{ in}) - B_{(protection tube)}$



Protection tube diameter (1/4, 3/8, 1/2 in)

- 🖻 11 Protection tube with neck connection NPT ½" and various process connection versions:
- 1 Tri-clamp
- Cylindrical weld-in adapter *ΦD ¾"* NPS Cylindrical weld-in adapter *ΦD 1"* NPS 2
- 3
- Varivent[®]
- 4 5 Liquiphant adapter with QuickNeck

Item	Version	Length
Protection tube length L	Independent of the version	Variable, depending on the configuration
Length of protection tube shaft T ¹⁾ Triclamp with NPT Varivent [®] with NPT Varivent [®] with QuickNeck Liquiphant with NPT Liquiphant with QuickNeck Weld-in with NPT Weld-in with QuickNeck		0-6" 1-6" 1-5" 1.5-6" 2-6" 2-6" 2-6"
Immersion length U	Independent of the version	Variable, depending on the configuration
Base thickness B	6.35 mm ($\frac{1}{4}$ in) Protection tube: Reduced tip ϕ 4.76 mm ($\frac{3}{16}$ in)	3.2 mm (0.13 in)
	9.53 mm ($\frac{3}{6}$ in) Protection tube: Reduced tip ϕ 4.76 mm ($\frac{3}{16}$ in) Straight tip	3.2 mm (0.13 in) 3 mm (0.12 in)
	12.7 mm ($\frac{1}{2}$ in) Protection tube: Reduced tip ϕ 4.76 mm ($\frac{3}{16}$ in) Straight tip	3.2 mm (0.13 in) 6.3 mm (0.25 in)

1) Variable, depending on the configuration





1 Thermometer with tee thermowell

2 Version with elbow thermowell

3 Thermometer with quick-fastening iTHERM QuickNeckVersion and tee thermowell

4 Thermometer with quick-fastening iTHERM QuickNeck and elbow thermowell

Item	Version	Length
	Without extension neck	-
Extension neck E	Replaceable extension neck, Ø9 mm (0.35 in)	Variable, depending on the configuration
	iTHERM QuickNeck	71.05 mm (2.79 in)
Bottom thickness B	Independent of the version	0.7 mm (0.03 in)
Immersion length U	G3/8" connection QuickNeck connection	82.7 mm (3.26 in)

• Pipe sizes according to DIN11865 series A (DIN), B (ISO) and C (ASME BPE)

- Nominal diameters > DN25, with 3-A symbol
- IP69 protection class
- Material 1.4435+316L, Delta ferrite content <0.5%
- Temperature measurement range: -60 to +200 °C (-76 to +392 °F)
- Pressure range: PN25 according to DIN11865

0.2 to 2.5 kg (0.44 to 5.5 lbs) for standard options.

Weight

Material

The temperatures for continuous operation specified in the following table are only intended as reference values for use of the various materials in air and without any significant compressive load. The maximum operating temperatures can be reduced considerably in cases where abnormal conditions such as high mechanical load occur or in aggressive media.

Designation	Short form	Recommended max. temperature for continuous use in air	Properties		
AISI 316L (corresponds to 1.4404 or 1.4435)	X2CrNiMo17-13-2, X2CrNiMo18-14-3	650 °C (1202 °F) ¹⁾	 Austenitic, stainless steel High corrosion resistance in general Particularly high corrosion resistance in chlorine-based and acidic, non-oxidizing atmospheres through the addition of molybdenum (e.g. phosphoric and sulfuric acids, acetic and tartaric acids with a low concentration) Increased resistance to intergranular corrosion and pitting The wetted part in a protective tube is made of 316L or 1.4435+316L passivated with 3% sulfuric acid. 		
1.4435+316L, delta ferrite < 1% or < 0.5%	With regard to analytical limits, the specifications of both materials (1.4435 and 316L) are met simultaneously. In addition, the delta ferrite content of the wetted parts is limited to $<1\%$ or $<0.5\%$ $\leq3\%$ at weldings (following Basel Standard II)				

1) Can be used to a limited extent up to 800 °C (1472 °F) for low compressive loads and in non-corrosive media. Contact your Endress+Hauser sales team for further information.

Surface roughness

Values for process/product contact surfaces:

Standard surface, mechanically polished 1)	$R_a \le 30 \ \mu in (0.76 \ mm)$
Mechanically polished, buffed ²⁾	$R_a \le 15 \ \mu in \ (0,38 \ mm)$
Mechanically polished, buffed and electropolished	$R_a \leq 15 \mu in (0,38 mm) + electropolished$

1) Or any other finishing method that meets the R_a max

2) Non-compliant with ASME BPE

Protection tube

Process connections

All dimensions in mm (in).

Туре	Version	Technical properties
Metal sealing system		

Туре				Technical properties	
Varivent [®] for VARINLINE [®] ho					
	 3-A marked and EHEDG certified ASME BPE compliance 				
Version		Dimensions	-	P	
	ΦD	Øi	Фа	- max.	
		DN40: 38 mm (1.5 in)	DN40: 41 mm (1.61 in)		
	68 mm (2.67 in)	DN50: 50 mm (1.97 in)	DN50: 53 mm (2.1 in)	DN40 to DN65: 16 bar (232 psi)	
		DN65: 66 mm (2.6 in)	DN65: 70 mm (2.76 in)		
Type N, according to DIN 11866, series A		DN80: 81 mm (3.2 in)	DN80: 85 mm (3.35 in)		
		DN100: 100 mm (3.94 in)	DN100: 104 mm (4.1 in)	DN80 to DN150: 10 bar (145 psi)	
		DN125: 125 mm (4.92 in)	DN125: 129 mm (5.08 in)		
		DN150: 150 mm (5.9 in)	DN150: 154 mm (6.06 in)		
		38.4 mm (1.51 in)	42.4 mm (1.67 in)	42 / mm (1 67 in) to	
		44.3 mm (1.75 in)	48.3 mm (1.9 in)	60.3 mm (2.37 in):	
Type N, according to EN		56.3 mm (2.22 in)	60.3 mm (2.37 in)	16 bar (232 psi)	
ISO 1127, series B	68 mm (2.67 in)	72.1 mm (2.84 in)	76.1 mm (3 in)	76.1 mm (3 in) to	
		82.9 mm (3.26 in)	42.4 mm (3.5 in)	114.3 mm (4.5 in):	
		108.3 mm (4.26 in)	114.3 mm (4.5 in)	10 bar (145 psi)	
		OD 1 ¹ / ₂ ": 34.9 mm (1.37 in)	OD 1½": 38.1 mm (1.5 in)		
Type N, according to DIN	68 mm (2.67 in)	OD 2": 47.2 mm (1.86 in)	OD 2": 50.8 mm (2 in)	OD 1½" to OD 2½": 16 har (232 nsi)	
11866, series C		OD 2½": 60.2 mm (2.37 in)	OD 2½": 63.5 mm (2.5 in)	10 bai (272 poi)	
Type N. according to DIN		OD 3": 73 mm (2.87 in)	OD 3": 76.2 mm (3 in)		
11866, series C	68 mm (2.67 in)	OD 4": 97.6 mm (3.84 in)	OD 4": 101.6 mm (4 in)	OD 3" to OD 4": 10 bar (145 ps	

The 316L compression fittings can only be used once due to deformation. This applies to all the components of the compression fittings! A replacement compression fitting must be attached in a different position (grooves in the protection pipe). PEEK compression fittings must never be used at a temperature that is lower than the temperature present when the compression fitting is secured. This is because the fitting would no longer be leak-tight as a result of heat contraction of the PEEK material.

SWAGELOCK or similar fittings are strongly recommended for higher requirements.

Process connections

All dimensions in mm (in).

For welding in

Туре	Version	Dimensions	Technical properties
Weld-in adapter	Cylindrical ½" NPS	$Ød = \frac{1}{2}$ " NPS, h = 38.1 mm (1.5 in), U = immersion length from lower edge, T = min. 50.8 mm (2 in)	
4.45+T	Cylindrical ¾" NPS	\emptyset d = ¾" NPS, h = 38.1 mm (1.5 in), U = immersion length from lower edge, T = min. 50.8 mm (2 in)	 P_{max.} depends on the weld-in process With 3-A symbol and EHEDC contribution
	Cylindrical 1" NPS		 ASME BPE compliance
A0033743			

Releasable process connection

Time	Version	Dimensions		Technical properties	Conformity
туре	ød: 1)	ØD	Øa	rechnical properties	Comorninty
øD M	Tri-clamp ¾" (DN18), Form A ²⁾	25 mm (0.98 in)	-	• P _{max.} = 16 bar (232 psi),	ASME BPE type A
	Clamp ISO 2852 ½" (DN12 - 21.3) Form B	34 mm (1.34 in)	16 to 25.3 mm (0.63 to 0. 99 in)	depends on clamp ring and suitable seal • 3-A marked	ISO 2852
	Tri-clamp 1" - 1½" (DN25 - 38) Form B	50.5 mm (1.99 in)	29 to 42.4 mm (1.14 to 1. 67 in)		
	Tri-clamp 2" (DN40 - 51) Form B	64 mm (2.52 in)	44.8 to 55. 8 mm (1.76 to 2. 2 in)	 P_{max.} = 16 bar (232 psi), depends on clamp ring and suitable seal 3-A marked and EHEDG 	ASME BPE type B
Form A	Tri-clamp 2½" (DN63.5) Form B	77.5 mm (3.05 in)	68.9 to 75. 8 mm (2.71 to 2. 98 in)	 certified (combined with Combifit seal) Can be used with 'Novaseptic Connect (NA Connect)' which enables fulsh-mount 	
Form B Form A: In compliance with ASME BPE Type A	Tri-clamp 3" (DN70-76. 5) Form B	91 mm (3.58 in)	> 75.8 mm (2.98 in)	installation	
Form B: In compliance with ASME BPE Type B and ISO 2852					

1) Pipes in accordance with ISO 2037 and BS 4825 Part 1

2) Tri-clamp $\frac{3}{4}$ " only possible with thermowell diameter 6.35 mm ($\frac{1}{4}$ in) or 9.53 mm ($\frac{3}{8}$ in)

			Dimensions			
Туре	Version G	L1 thread length	A	1 (SW/AF)	Technical properties	
Thread according to ISO 228 (for Liquiphant weld-in adapter)	G¾" for FTL20 adapter	16 mm	25.5 mm (1 in)	32	 P_{max.} = 25 bar (362 psi) at max. 150 °C (302 °F) P_{max.} = 40 bar (580 psi) at max. 100 °C (212 °F) 	
G L1 A	G¾" for FTL50 adapter	(0.63 in)			 In connection with FTL31/33/50 adapter, see TI00426F for details about 3-A conformity and EHEDG 	
40009572	G1" for FTL50 adapter	18.6 mm (0.73 in)	29.5 mm (1.16 in)	41	tested O-ring ■ Minimum extension neck lengths: ≥ 76.2 mm (3 in)	

Time	Version	Dimensions				Technical properties	
туре	Version	ØD	ØA	ØB	h	P _{max.}	
Varivent®	Туре В	31 mm (1.22 in)	105 mm (4.13 in)	-	22 mm (0.87 in)		
	Type F	50 mm (1.97 in)	145 mm (5.71 in)	135 mm (5.31 in)	24 mm (0.95 in)	10 bar	 3-A marked and EHEDG
	Туре N	68 mm (2.67 in)	165 mm (6.5 in)	155 mm (6.1 in)	24.5 mm (0.96 in)	(145 psi)	certifiedASME BPE compliance
A0021307							
The VARINLINE [®] housing connection flange is suitable for weld-in into the conical or torispherical head in tanks or containers with a small diameter ($\leq 1.6 \text{ m} (5.25 \text{ ft})$) and up to a wall thickness of 8 mm (0.31 in).							

Туре	Technical properties			
Varivent® for VARINLINE® ho	 3-A marked and EHEDG certified ASME BPE compliance 			
Vension		Dimensions		n
version	ØD	Øi	Øa	P _{max.}
		OD 1½": 34.9 mm (1.37 in)	OD 1½": 38.1 mm (1.5 in)	
Type N, according to DIN 11866. series C	68 mm (2.67 in)	OD 2": 47.2 mm (1.86 in)	OD 2": 50.8 mm (2 in)	OD 1½" to OD 2½": 16 bar (232 psi)
,		OD 2 ¹ /2": 60.2 mm (2.37 in)	OD 2½": 63.5 mm (2.5 in)	
Type N, according to DIN 11866, series C	68 mm (2.67 in)	OD 3": 73 mm (2.87 in)	OD 3": 76.2 mm (3 in)	OD 3" to OD 4": 10 bar (145 psi)

Туре				Technical properties
		OD 4": 97.6 mm (3.84 in)	OD 4": 101.6 mm (4 in)	
Type F, according to DIN 11866, series C	50 mm (1.97 in)	OD 1": 22.2 mm (0.87 in)	OD 1": 25.4 mm (1 in)	16 bar (232 psi)

Due to the small immersion length U, the use of iTHERM QuickSens inserts is recommended.

Type Version		•	Dimensions in mm (in)			Tochnical properties
туре	Version	1	ØD	L s ¹⁾		recinical properties
Tee thermowell for weld-in as per DIN 11865 (Part C)	Part C ²⁾	DN12.7 PN25 (½")	12.7 mm (0.5 in)			
1/2" NPT		DN19.05 PN25 (¾")	19.05 mm (0.75 in)			
<u>G3/8"</u>		DN25.4 PN25 (1")	19.05 mm (0.75 in)			
Ø18 Ø3.1 (0.12) Ø4.5 (0.18) 0 0 0 0 0 0 0 0 0 0 0 0 0		DN38.1 PN25 (1½")	38.1 mm (1.5 in)	48 mm (1.89 in)	1.65 mm (0.065 in)	 P_{max.} = 25 bar (362 psi) R_a ≤ 0.38 µm (15 µin)+ electropolished ³)

1) Wall thickness

2) Dimensions as per ASME BPE 2012

3) Exception: internal welded seams

Time	Type Version -			Dimen	nsions		Technical properties	
туре			ØD	L1	L2	s ¹⁾	reclinical properties	
Elbow thermowell for weld-in as per DIN 11865 (Part C)	Part C	DN12.7 PN25 (½") ²⁾	12.7 mm (0.5 in)	24 i (0.95	mm 5 in)			
<u>1/2" NPT</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u>G3/8</u> <u></u>		DN19.05 PN25 (¾")	19.05 mm (0.75 in)	25 r (0.98	mm 3 in)	1.65 mm (0.065 in)	 P_{max.} = 25 bar (362 psi) R_a ≤ 0.38 µm (15 µin)+ electropolished ³) 	

Time	Varcian		Dimensi	ions		Technical properties
Type	Version	ØD	L1	L2	s ¹⁾	rechnical properties
	DN25.4 PN 25 (1")	19.05 mm (0.75 in)	28 mr (1.1 in	m n)		
	DN38.1 PN25 (1½")	38.1 mm (1.5 in)	35 mr (1.38 ii	m in)		

Wall thickness 1)

2) Dimensions as per ASME BPE 2012

3) Exception: internal welded seams

•

Due to the small immersion length U, the use of iTHERM QuickSens inserts is recommended.

Tip shape

The thermal response time, the reduction of the flow cross-section and the mechanical load that occurs in the process are the criteria that matter when selecting the shape of the tip. Advantages of using reduced or tapered thermometer tips:

- A smaller tip shape has less impact on the flow characteristics of the pipe carrying the medium.
- The flow characteristics are optimized, thereby increasing the stability of the thermowell.
- Endress+Hauser offers users a range of thermowell tips to meet every requirement: • Reduced tip with Ø4.3 mm (0.17 in) and Ø5.3 mm (0.21 in): walls of lower thickness
 - significantly reduce the response times of the overall measuring point. • Reduced tip with Ø8 mm (0.31 in): walls of greater thickness are particularly well suited to applications with a higher degree of mechanical load or wear (e.g. pitting, abrasion etc.).



Item No.	Thermowell (ØD1)		Insert (ØID)
1	Ø 1/4 in	Reduced tip with Ø 3/16 in	Ø3 mm (¼ in)
2	Ø 3/8 in	 Reduced tip with Ø5.3 mm (0.21 in) Straight tip Tapered tip with Ø6.6 mm (0.26 in) 	 Ø6 mm (¹/₄ in) Ø3 mm (¹/₈ in)
3	Ø 1/2 in	Straight tip	Ø6 mm (¼ in)

It is possible to check the mechanical loading capacity as a function of the installation and process conditions online in the TW Sizing Module for thermowells in the Endress+Hauser Applicator software. See "Accessories" section.

13.7 Certificates and approvals

Current certificates and approvals that are available for the product can be selected via the Product Configurator at www.endress.com:

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

MTBF	For the transmitter: 180 years - according to Siemens Standard SN29500
Hygiene standard	 EHEDG certification, type EL CLASS I. EHEDG certified/tested process connections. ⇒ ≅ 60 3-A authorization no. 1144, 3-A Sanitary standard 74-07. Listed process connections. ⇒ ≅ 60 ASME BPE, certificate of conformity can be ordered for indicated options FDA-compliant All surfaces in contact with the medium are free of animal derived ingredients (ADI/TSE) and do not contain any materials derived from bovine or animal sources
Materials in contact with food/product (FCM)	 The materials of the thermometer in contact with food/product (FCM) comply with the following European regulations: (EC) No. 1935/2004, Article 3, paragraph 1, Articles 5 and 17 on materials and articles intended to come into contact with food. (EC) No. 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food. (EU) No. 10/2011 on plastic materials and articles intended to come into contact with food.
CRN approval	 The CRN approval is only available for certain options of protection tubes. These will be marked and shown during the configuration of this device. Detailed ordering information is available from the following sources: In the download area on the Endress+Hauser website: www.endress.com → Select your country → Downloads → Enter product code or device → Media type: Approvals & certificates → Select type of approval → Start search From your nearest Endress+Hauser sales organization: www.addresses.endress.com
Surface purity	Cleaned from oil and grease for O_2 applications, optional

Material resistance	Material resistance - including resistance of housing - to the following Ecolab cleaning/ disinfection agents: P3-topax 66 P3-topactive 200 P3-topactive 500 P3-topactive OKTO And demineralized water
Material certification	The material certificate 3.1 (according to standard EN 10204) can be requested separately. The "short form" certificate includes a simplified declaration with no enclosures of documents related to the materials used in the construction of the single sensor and guarantees the traceability of the materials through the identification number of the thermometer. The data related to the origin of the materials can subsequently be requested by the client if necessary.
Calibration	The "Factory calibration" is carried out according to an internal procedure in a laboratory of Endress+Hauser accredited by the European Accreditation Organization (EA) to ISO/IEC 17025. A calibration which is performed according to EA guidelines (SIT/Accredia) or (DKD/DAkkS) may be requested separately.
	The analog current output of the device is calibrated.
Protection tube testing and load capacity calculation	 Protection tube pressure tests are carried out in accordance with the specifications in DIN 43772. With regard to protection tubes with tapered or reduced tips that do not comply with this standard, these are tested using the pressure of corresponding straight protection tubes. Tests according to other specifications can be carried out on request. Load capacity calculation for the protection tube as per DIN43772



Operating menu and parameter description

The following tables list all the parameters in the "Setup", "Calibration", "Diagnostics" and "Expert" operating menus. The page reference indicates where a description of the parameter can be found in the manual.

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

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

Setup →	Device tag	→ 🗎 71
	Unit	→ 🗎 71
	4 mA value	→ 🗎 71
	20 mA value	→ 🗎 72
	Failure mode	→ 🗎 72

Calibration \rightarrow	Number of self-calibrations	→ 🗎 72
	Stored self calibration points	→ 🗎 72
	Deviation	→ 🗎 73
	Adjustment	→ 🖺 73

Calibration \rightarrow	Limits \rightarrow	Lower warning value	→ 🗎 73
		Upper warning value	→ 🗎 73
		Lower alarm value	→ 🗎 74
		Upper alarm value	→ 🗎 74

Calibration \rightarrow	Interval monitoring $^{1)} \rightarrow$	Control	→ 🖺 75
		Start value	→ 🗎 75
		Countdown value	→ 🖺 75

1) Same parameter settings both for self calibration monitoring and manual calibration reminder

Calibration \rightarrow	Calibration report	→ 🖺 76
	Online wizard	

Diagnostics \rightarrow	Diagnostics → Actual diagnostics	
	Previous diagnostics 1	→ 🗎 76
	Operating time	→ 🗎 77

Diagnostics \rightarrow	Diagnostic list \rightarrow	Actual diagnostics count	→ 🗎 77
		Actual diagnostics	→ 🗎 77
		Actual diag (n) channel ¹⁾	→ 🗎 77

1) n = 2, 3; diagnostics messages with the highest priority to the third-highest priority

Diagnostics →	Event logbook \rightarrow	Previous diagnostics n ¹⁾	→ 🖺 78
		Previous diag (n) channel	→ 🗎 78

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

Diagnostics \rightarrow	Device information \rightarrow	Device tag	→ 🗎 71
		Tagging (TAG)	→ 🖺 79
		Serial number	→ 🖺 79
		Firmware version	→ 🗎 79
		Device name	→ 🖺 79
		Order code	→ 🖺 79
		Extended order code (2, 3)	→ 🗎 80
		Manufacturer ID	→ 🗎 80
		Manufacturer	→ 🖺 80
		Hardware revision	→ 🖺 80
		Configuration counter	→ 🖺 81

Diagnostics → Measured values →		Sensor value	→ 🖺 81
		Sensor raw value	→ 🖺 81
		Device temperature	→ 🖺 81

Diagnostics →	Measured values \rightarrow	Min/max values →	Sensor min value	→ 🖹 82
			Sensor max value	→ 🖺 82
			Reset sensor min/max values	→ 🖺 82
			Device temperature min.	→ 🖺 82
			Device temperature max.	→ 🖺 82
			Reset device temp. min/max values	→ 🖺 83

Diagnostics \rightarrow	Simulation \rightarrow	Diagnostic simulation	→ 🗎 83
		Current output simulation	→ 🗎 83
		Value current output	→ 🗎 83
		Sensor simulation	→ 🗎 84
		Sensor simulation value	→ 🖺 84

Diagnostics \rightarrow	Diagnostic settings \rightarrow	Diagnostic behavior	→ 🖺 84
Diagnostics →	Diagnostic settings \rightarrow	Status signal	→ 🖺 85
Diagnostics \rightarrow	Heartbeat →	Heartbeat verification	→ 🖺 85
		1 Online wizard	

Expert →	Enter access code	→ 🖺 85
	Access status tooling	
	Locking status	→ 🖹 86

Expert →	System →	Unit	→ 🖹 71
		Damping	→ 🗎 87

Expert →	System →	Administration \rightarrow	Define device write protection code	→ 🖺 87
			Device reset	→ 🗎 88

Expert →	Output →	4 mA value	→ 🗎 71
		20 mA value	→ 🗎 72
		Failure mode	→ 🗎 88
		Failure current	→ 🗎 89
	Current trimming 4 mA	→ 🗎 89	
		Current trimming 20 mA	→ 🗎 90

Expert →	Output →	Loop check configuration \rightarrow	Loop check configuration	→ 🖺 90
			Simulation value 1	→ 🖺 91
			Simulation value 2	→ 🗎 91
			Simulation value 3	→ 🖺 91
			Loop check interval	→ 🗎 90

Expert →	Communication \rightarrow	HART configuration \rightarrow	Device tag	→ 🖺 71
			HART short tag	→ 🖺 92
			HART address	→ 🖺 92
			No. of preambles	→ 🖺 93
			Configuration changed	→ 🗎 93

Expert →	Communication \rightarrow	HART info \rightarrow	Device type	→ 🗎 93
			Device revision	→ 🗎 94
			Device ID	→ 🖺 94
			Manufacturer ID	→ 🖹 94
		HART revision	→ 🖺 94	
			HART descriptor	→ 🗎 94
		HART message	→ 🖺 95	
			Hardware revision	→ 🖺 95
			Software revision	→ 🗎 95
		HART date code	→ 🖺 95	
			Process unit tag	→ 🗎 95
			Location description	→ 🗎 96
			Longitude	→ 🖺 96

→ 🗎 98

→ 🗎 98

			Latitude	→ 🖺 96
			Altitude	→ 🖺 96
			Location method	→ 🗎 97
Expert →	Communication \rightarrow	HART output →	Assign current output (PV)	→ 🗎 97
			PV	→ 🖺 97
			Assign SV	→ 🖺 97
			SV	→ 🖺 98
			Assign TV	→ 🖺 98
			TV	→ 🖺 98

Assign QV

QV

14.1 Setup menu

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

Device tag	
Navigation	
Description	Use this function to enter a unique name for the measuring point so it can be identified quickly within the plant.
User entry	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /)
Factory setting	Depends on the product root and the serial number
Unit	
Navigation	$ \begin{array}{ c c c } & & \text{Setup} \rightarrow \text{Unit} \\ & & \text{Expert} \rightarrow \text{System} \rightarrow \text{Unit} \end{array} $
Description	Use this function to select the engineering unit for all the measured values.
Options	● ℃ ● ℉ ● K ● ℝ
Factory setting	°C
Additional information	Please note that if the factory setting (°C) is switched to another unit, all the temperature value settings will be converted to fit to the setted temperature unit. Example: Upper range value is set to 150 °C. After the unit was switched to °F, the new converted upper range value = 302 °F.
4 mA value	
Navigation	Setup \rightarrow Lower range value Expert \rightarrow Output \rightarrow 4 mA value
Description	Use this function to assign a measured value to the current value 4 mA.
Factory setting	0°C

20 mA value		
Navigation		
Description	Use this function to assign a measured value to the current value 20 mA.	
Factory setting	150 °C	
Failure mode		
Navigation		
Description	Use this function to select the signal on alarm level of the current output in an event of an error.	
Options	High alarmLow alarm	
Factory setting	Low alarm	
	14.2 Calibration menu	
	All the information that describes the self-calibration procedure as well as the online wizard creating a calibration report.	

Number of self-calibrations		
Navigation		Calibration \rightarrow Number of self-calibrations
Description	This	counter displays the amount of all executed self-calibrations. It cannot be reset.

Stored self-calibration points

Navigation		Calibration \rightarrow Stored self-calibration points
Description	Displa self-ca calibra	ys the amount of all stored self-calibration points. This device is able to store 350 libration points. As soon as the memory would reach its limit, the oldest self- ation point will be overwritten.
Display	0 to 3	50
Deviation		
---------------------	--	
Navigation	$\Box Calibration \rightarrow Deviation$	
Description	This function displays the measured Pt100 self-calibration deviation from the reference temperature. The deviation is calculated as follows: Self-calibration deviation = reference temperature - measured Pt100 temperature value + adjustment	
Display	°C	
Factory setting	0	
Adjustment		
Navigation	$\Box Calibration \rightarrow Adjustment$	
Description	Use this function to adjust the measured Pt100 value. This value will be added to the measured Pt100 value and therefore influences also the self-calibration deviation. Self-calibration deviation = reference temperature - measured Pt100 temperature value + adjustment	
User entry	$-1.0 \cdot 10^{20}$ to $+1.0 \cdot 10^{20}$	
Factory setting	0.000	
	14.2.1 "Limits" submenu	
Lower warning value		

Navigation	$\Box Calibration \rightarrow Limits \rightarrow Lower warning value$
Description	Enter the lower warning limit for the self-calibration deviation.
User entry	−1.0 · 10 ²⁰ to −0.5 °C
Factory setting	−0.5 °C
Additional information	Use this function to define the lower warning limit. If the self-calibration deviation exceeds the defined limit, the device will transmit the defined status signal and shows the defined diagnostic behavior via the LED (diagnostic event 144). (Factory setting = Warning - LED red flashes).

Upper warning value

Navigation	$\Box Calibration \rightarrow Limits \rightarrow Upper warning value$
Description	Enter the upper warning limit for the self calibration deviation.
User entry	+0.5 to +1.0 · 10 ²⁰ °C
Factory setting	+0.5 ℃
Additional information	Use this function to define the upper warning limit. If the self-calibration deviation exceeds the defined limit, the device will transmit the defined status signal and shows the defined diagnostic behavior via the LED. (Factory setting = Warning - LED red flashes).

Lower alarm value	
Navigation	\Box Calibration \rightarrow Limits \rightarrow Lower alarm value
Description	Enter the lower alarm limit for the self-calibration deviation.
User entry	−1.0 · 10 ²⁰ to −0.8 °C
Factory setting	−0.8 °C
Additional information	Use this function to define the lower alarm limit. If the self-calibration deviation exceeds the defined limit, the device will transmit the defined status signal and show the defined diagnostic behavior via the LED (diagnostic event 143). (Factory setting = Warning - LED red flashes).

Upper alarm value		
Navigation	$\Box Calibration \rightarrow Limits \rightarrow Upper alarm value$	
Description	Enter the upper alarm limit for the self-calibration deviation.	
User entry	+0.8 to +1.0 · 10 ²⁰ °C	
Factory setting	+0.8 °C	
Additional information	Use this function to define the upper alarm limit. If the self-calibration deviation exceeds the defined limit, the device will transmit the defined status signal and shows the defined diagnostic behavior via the LED. (Factory setting = Warning - LED red flashes).	

14.2.2 "Interval monitoring" submenu

The parameter configuration in this submenu is allocated into two calibration items: **Self-calibration monitoring:** Monitoring function for the start of the next self-calibration.

Manual calibration reminder: This function signalizes when the next manual calibration has to be performed.

Control	
Navigation	□ Calibration \rightarrow Interval monitoring \rightarrow Self-calibration monitoring / Manual calibration reminder \rightarrow Control
Description	Self-calibration monitoring: Use this function to activate the self-calibration countdown. This counter will count down from its start value until the next self-calibration is executed. A successful self-calibration will set the counter to its start value. If the calibration counter value reaches zero, the device will transmit the defined status signal and shows the defined diagnostic behavior via the LED (Factory default = Alarm - red). Manual calibration reminder: Use this function to set the start value for the calibration counter.
Options	 Off: Stops the calibration counter On: Starts the calibration counter Reset + run: Resets the calibration counter to the set start value and starts the calibration counter
Factory setting	Off
Start value	
Navigation	□ Calibration \rightarrow Interval monitoring \rightarrow Self-calibration monitoring / Manual calibration reminder \rightarrow Start value
Description	Self-calibration monitoring: Enter the maximum days until a self-calibration must be initiated. This function can be used to monitor the self-calibration interval (e.g. 1 year self-calibration interval corresponds to a start value of 365 days). Manual calibration reminder: Use this function to set the start value for the calibration counter.
User entry	0 to 1826 d (days)
Factory setting	1826 d
Countdown value	
Navigation	□ Calibration \rightarrow Interval monitoring \rightarrow Self-calibration monitoring / Manual

Description	Self-calibration monitoring: Displays the remaining time in days until a self-calibration must be initiated. A successful self-calibration will set the counter to its start value. If the countdown value reaches zero, the device will transmit the defined status signal and show the defined diagnostic behavior via the LED, Factory default = Alarm - LED red illuminated Manual calibration reminder: Indication of the remaining time up to the next calibration.
Display	Remaining time in days, from max. 1826 d to 0 d.
Additional information	Use this function to view the time remaining until the next calibration. The countdown of the calibration counter is only running if the device is switched on. Example: The calibration counter is set to 365 days on January 1st, 2011. If the device will be switched off for 100 days, the calibration counter alarm is displayed on April 10th, 2012.

Online wizard 'Calibration report'

Calibration report	
Navigation	$ Calibration \rightarrow Calibration report $
Description	Online wizard for creating a calibration report.
Additional information	For a detailed procedure description see $\rightarrow \cong 27$

14.3 Diagnostics menu

Actual diagnostics	
Navigation	□ Diagnostics \rightarrow Actual diagnostics
Description	Use this function to display the current diagnostic message. If two or more messages occur simultaneously, the message with the highest priority is shown.
Additional information	Example for display format: F001-Device failure

Previous diagnostics 1

Navigation		Diagnostics \rightarrow Previous diagnostics 1
Description	Use th	is function to display the last diagnostic message with the highest priority.
Additional information	Examı F001-	ble for display format: Device failure

Operating time				
Navigation	□ Diagnostics \rightarrow Operating time			
Description	Use this function to display the length of time the device has been in operation up to now.			
Display	Hours (h)			
	14.3.1 "Diagnostic 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. Overview of all the diagnostic messages and remedies $\rightarrow \cong$ 39.			
Actual diagnostics count				
Navigation	$\Box \text{Diagnostics} \rightarrow \text{Diagnostic list} \rightarrow \text{Actual diagnostics count}$			
Description	Use this function to display the number of diagnostic messages currently pending in the device.			
Actual diagnostics				
Navigation	$\Box \text{Diagnostics} \rightarrow \text{Diagnostics list} \rightarrow \text{Actual diagnostics}$			
Description	Use this function to display the current diagnostic messages with the highest priority to the third-highest priority.			
Additional information	Example for display format: F001-Device failure			
Actual diag channel				
Navigation	□ Diagnostics \rightarrow Diagnostic list \rightarrow Actual diag channel			
Description	Indication of the sensor input which this diagnostic message refers. Use this function to display the current diagnostic message. If two or more messages occur simultaneously, the message with the highest priority is shown.			

Display

Sensor

. -----

- Device temperature
- Reference sensor
- Current output

14.3.2 "Event logbook" submenu

Previous diagnostics n	
	n = Number of diagnostic messages (n = 1 to 5)
Navigation	□ Diagnostics \rightarrow Event logbook \rightarrow Previous diagnostics n
Description	Indication of the diagnostic messages appeared in the past. Use this function to display the diagnostic messages that occurred in the past. The last 5 messages are listed in chronological order.
Additional information	Example for display format: S844-Process value out of specification

Previous diag channel	
Navigation	□ Diagnostics \rightarrow Event logbook \rightarrow Previous diag channel
Description	Indication of the sensor input which this diagnostic message refers. Use this function to display the possible sensor input to which the diagnostic message refers.
Display	 Sensor Device temperature Reference sensor Current output

14.3.3 "Device information" submenu

Device tag $\rightarrow \square 71$

Navigation

Setup \rightarrow Device tag Diagnostics \rightarrow Device information \rightarrow Device tag Expert \rightarrow Communication \rightarrow HART configuration \rightarrow Device tag

Tagging (TAG), meta	1/RFID
Navigation	□ Diagnostics \rightarrow Device information \rightarrow Tagging (TAG), metal/RFID
Description	Use this function to enter a unique name for the measuring point so it can be identified quickly within the plant.
User entry	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /)
Factory setting	-none-
Serial number	
Navigation	$\Box \text{Diagnostics} \rightarrow \text{Device information} \rightarrow \text{Serial number}$
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	$\Box \qquad \text{Diagnostics} \rightarrow \text{Device information} \rightarrow \text{Firmware version}$
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	$\Box Diagnostics \rightarrow Device information \rightarrow Device name$
Description	Displays the device name. It can also be found on the nameplate.
Order code	

Navigation	$\Box \text{Diagnostics} \rightarrow \text{Device information} \rightarrow \text{Order code}$
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.
Extended order code n	
	n = Number of parts of the extended order code (n = 1 to 3)
Navigation	□ Diagnostics \rightarrow Device information \rightarrow Extended order code n
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 against the shipping note

Manufacturer ID	
Navigation	□ Diagnostics → Device information → Manufacturer ID Expert → Communication → HART info → Manufacturer ID
Description	Use this function to view the manufacturer ID with which the device is registered with the HART FieldComm Group.
Display	2-digit hexadecimal number
Factory setting	0x11

Manufacturer

Navigation

Diagnostics \rightarrow Device information \rightarrow Manufacturer

Description

Indication of the manufacturer name.

Hardware revision	
Navigation	□ Diagnostics \rightarrow Device information \rightarrow Hardware revision
Description	Indication of the hardware revision of the device.
Configuration counter	
Navigation	□ Diagnostics \rightarrow Device information \rightarrow 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 supports parameter version management. If several parameters change, e. g. due to loading of parameters from FieldCare, etc. in the device, the counter can show a higher value. The counter cannot be reset and is also not reset to the default value when the device is reset. If the counter overflows, (16 bit), it starts again at 1.

14.3.4 "Measured values" submenu

Sensor value	
Navigation	□ Diagnostics \rightarrow Measured values \rightarrow Sensor value
Description	Use this function to display the current measured value at the sensor input.
Sensor raw value	
Navigation	□ Diagnostics \rightarrow Measured values \rightarrow Sensor raw value
Description	Use this function to display the non-linearized mV/Ohm value at the specific sensor input.
Device temperature	
XY	
Navigation	$\square Diagnostics \rightarrow Measured values \rightarrow Device temperature$
Description	Use this function to display the current electronics temperature.

"Min/max values" submenu

Sensor min value	
Navigation	□ Diagnostics \rightarrow Measured values \rightarrow Min/max values \rightarrow Sensor min value
Description	Use this function to display the minimum temperature measured in the past at sensor input (peakhold indicator).
Sensor max value	
Navigation	□ Diagnostics \rightarrow Measured values \rightarrow Min/max values \rightarrow Sensor max value
Description	Use this function to display the maximum temperature measured in the past at sensor input (peakhold indicator).
Reset sensor min/max val	ues
Navigation	□ Diagnostics \rightarrow Measured values \rightarrow Min/max values \rightarrow Reset sensor min/max values
Description	Use this function to reset min/max values of the sensor to its default values.
User entry	By clicking the button Reset sensor min/max values the reset function is activated. As a result, the sensor min./max. values are just indicating the reset, temporary values.
Device temperature min.	
Navigation	□ Diagnostics \rightarrow Measured values \rightarrow Min/max values \rightarrow Device temperature min.
Description	Use this function to display the minimum electronics temperature measured in the past (maximum indicator).
Device temperature max.	
Navigation	□ Diagnostics \rightarrow Measured values \rightarrow Min/max values \rightarrow Device temperature max.
Description	Use this function to display the maximum electronics temperature measured in the past (peakhold indicator).

Reset device temp. min/max values	
Navigation	□ Diagnostics \rightarrow Measured values \rightarrow Min/max values \rightarrow Reset device temp. min/max values
Description	Use this function to reset the maximum indicators for the minimum and maximum electronic temperatures measured.
User entry	By clicking the button Reset device temp. min/max values the reset function is activated. As a result, the device temperature min/max values are just indicating the reset, temporary values.

14.3.5 "Simulation" submenu

Diagnostic simulation	
Navigation	□ Diagnostics \rightarrow Simulation \rightarrow Diagnostic simulation
Description	Use this function to switch diagnostic simulation on and off.
Options	Use the dropdown menu to enter one of the diagnostic events $\rightarrow \square$ 39. In the simulation mode the assigned status signals and diagnostic behaviors are applied. Example: x001-Device failure
Factory setting	Off

Current output simulation	
Navigation	□ Diagnostics \rightarrow Simulation \rightarrow Current output simulation
Description	Use this function to switch simulation of the current output on and off. The status signal indicates a diagnostic message of the "function check" category (C) while simulation is in progress.
Options	OffOn
Factory setting	Off
Value current output	

Navigation

Diagnostics \rightarrow Simulation \rightarrow Value current output

Description	Use this function to set a current value for the simulation. In this way, users can verify the correct adjustment of the current output and the correct function of downstream switching units.
User entry	3.58 to 23 mA
Factory setting	3.58 mA
Sensor simulation	
Navigation	□ Diagnostics \rightarrow Simulation \rightarrow Sensor simulation
Description	Use this function to switch simulation of the sensor temperature on and off. The status signal indicates a diagnostic message of the "function check" category (C) while simulation is in progress.
Options	OffOn
Factory setting	Off

Sensor simulation value	
Navigation	□ Diagnostics \rightarrow Simulation \rightarrow Sensor simulation value
Description	Use this function to set a sensor temperature for the simulation. In this way, users can verify the correct adjustment of the sensor temperature limits and the correct function of downstream switching units.
User entry	$-1.0 \cdot 10^{20}$ to $+1.0 \cdot 10^{20}$ °C
Factory setting	0.00 °C

14.3.6 "Diagnostic settings" submenu

Diagnostic behavior	
Navigation	□ Diagnostics \rightarrow Diagnostic settings \rightarrow Diagnostic behavior
Description	Each diagnostic event is assigned to a certain diagnostic behavior. The user can change this assignment for certain diagnostic events. $\rightarrow \square$ 39
Options	AlarmWarningDisabled

Factory setting	See overview of diagnostic events $\rightarrow \cong 39$		
Status signal			
Navigation	□ Diagnostics \rightarrow Diagnostic settings \rightarrow Status signal		
Description	Each diagnostic event is assigned to a certain status signal ¹⁾ from the factory. The user car change this assignment for certain diagnostic events. $\rightarrow \square 39$		
1) Digital information available v	ia HART [®] communication		
Options	 Failure (F) Function check (C) Out of specification (S) Maintenance required (M) No effect (N) 		
Factory setting	See overview of diagnostic events → 🗎 39		
	14.3.7 "Heartbeat" submenu		

Online wizard 'Heartbeat verification'

Heartbeat verification Navigation □ Diagnostics → Heartbeat → Heartbeat verification Description Online wizard for creating a Heartbeat verification report.

Additional information For a detailed procedure description $\rightarrow \cong 32$

14.4 Expert menu

organization.

Enter access code	
Navigation	$ Expert \rightarrow 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

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) is also not changed.
User entry	0 to 9 999
Factory setting	0

Access status tooling	
Navigation	$ Expert \rightarrow 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.
Options	OperatorService
Factory setting	Operator

Locking status

Navigation	$ Expert \rightarrow Locking status $
Description	Use this function to view the device locking status. When write protection is activated, write access to the parameters is disabled.
Display	Activated or de-activated box: Write protected by software

Unit → 🗎 71		
Navigation		
Damping		
Navigation	Expert \rightarrow System \rightarrow Damping	
Description	Use this function to set the time constant of the measured value.	
User entry	0 to 120 s	
Factory setting	0 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.	
	"Administration" submenu	
Define device write prote	ction code	
Navigation	$ \qquad \qquad$	
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.	
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.	

14.4.1 "System" submenu

Additional information

- Activating device write protection: A value must be entered in the **Enter access code** parameter, which is not corresponding to this defined device write protection code.
- 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).

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

Device reset	
Navigation	$\Box \text{Expert} \rightarrow \text{System} \rightarrow \text{Administration} \rightarrow \text{Device reset}$
Description	Use this function to reset the device configuration - either entirely or in part - to a defined state.
Options	 Restart device The device is restarted but the device configuration remains unchanged. To delivery settings All the parameters are reset to the order configuration. The order configuration can differ from the factory setting if customer-specific parameter values were defined when the device was ordered. To factory defaults All the parameters are reset to the factory setting.

14.4.2 "Output" submenu

$4 \text{ mA value} \Rightarrow \square 71$			
Navigation		Setup \rightarrow Lower range value Expert \rightarrow Output \rightarrow 4 mA value	
20 mA value → $$ 72			
Navigation		Setup \rightarrow 20 mA value Expert \rightarrow Output \rightarrow 20 mA value	
Failure mode $\rightarrow \square 72$			
Navigation		Setup → Failure mode Expert → Output → Failure mode	

Failure current

Navigation	$ Expert \rightarrow Output \rightarrow Failure current $
Prerequisite	The option High alarm is enabled in the failure mode.
Description	Use this function to set the value the current output adopts in an alarm condition.
User entry	21.5 to 23 mA
Factory setting	22.5

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-order system.

Current trimming does not affect the digital HART[®] value. This can cause the measured value shown on a locally installed display to differ from the value displayed in the higher-order system.

Procedure

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

Current trimming 4 mA

Navigation

 \Box Expert \rightarrow Output \rightarrow Current trimming 4 mA

Description

Use this function to set the correction value for the current output at the start of the measuring range at 4 mA.

User entry	3.5 to 4.25 mA
Factory setting	4 mA
Additional information	The trimming only affects current loop values from 3.8 to 20.5 mA. Failure mode with Low Alarm and High Alarm current values are not subjected to the trimming.

Current trimming 20 mA	
Navigation	Expert \rightarrow Output \rightarrow Current trimming 20 mA
Description	Use this function to set the correction value for the current output at the end of the measuring range at 20 mA.
User entry	19.50 to 20.5 mA
Factory setting	20.000 mA
Additional information	The trimming only affects current loop values from 3.8 to 20.5 mA. Failure mode with Low Alarm and High Alarm current values are not subjected to the trimming.

"Loop check configuration" submenu

Loop check configu	ration
Navigation	Expert \rightarrow Output \rightarrow Loop check configuration \rightarrow Loop check configuration
Description	This function is active when there is at least one value defined. The loop check function will run by each restart (power up) of the device. Measure the loop current with the amperemeter. If the measured values deviates from the simulation values, these current output values have to be adjusted.
	output values have to be adjusted. To activate the loopcheck, define and activate at least one of the following values.

Additional information

After the device has been started up the loop check starts and the activated simulation values will be checked. These loop current values can be measured with a accurate amperemeter. If the measured values deviates from the set simulation values, it is recommended to adjust these current output values. For **current trimming 4 mA/20 mA** see description above.



■ 12 Loop check curve

If there is one of the following diagnostic events active at the start up process, the device cannot perform a loop check: 001, 401, 411, 437, 501, 531 (channel "------" or "Current output"), 537 (channel "------" or "Current output"), 801, 825. If the device is operating in the multidrop mode, the loop check cannot be performed.

Options

Activation of the check values:

- Simulation value 1
- Simulation value 2
- Simulation value 3
- Low alarm
- High alarm

Simulation value n	
	n = number of simulation values (1 to 3)
Navigation	$ \qquad \qquad$
Description	Use this function to adjust the first, second or third value which will be simulated after each restart to check the current loop.
Options	Enter the current values to check the loop
	 Simulation value 1 User entry: 3.58 to 23 mA Simulation value 2 User entry: 3.58 to 23 mA Simulation value 3 User entry: 3.58 to 23 mA

Factory setting

- Simulation value 1: 4.00 mA, not activated
- Simulation value 2: 12.00 mA, not activated
- Simulation value 3: 20.00 mA, not activated
- Low alarm and High alarm not activated

Loop check interval	
Navigation	Expert \rightarrow Output \rightarrow Loop check configuration \rightarrow Loop check interval
Description	Displays the duration each single value is simulated.
User entry	4 to 255 s
Factory setting	4 s
	14.4.3 "Communication" submenu
	"HART configuration" submenu
Device tag $\rightarrow \square$ 71	
Navigation	□ Setup → Device tag Expert → Communication → HART configuration → Device tag
HART short tag	
Navigation	Expert \rightarrow Communication \rightarrow HART configuration \rightarrow 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	063

Factory setting	0
Additional information	The measured value can only be transmitted via the current value is the address is set to "O". 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	5 to 20
Factory setting	5
Configuration changed	
Navigation	\Box Expert \rightarrow Communication \rightarrow HART configuration \rightarrow Configuration changed
Description	Indicates whether the configuration of the device has been changed by a master (primary or secondary).
	"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	Ox11CF
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	2-digit hexadecimal number
Factory setting	0x01
Device ID	
Navigation	Expert \rightarrow Communication \rightarrow HART info \rightarrow 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 $\rightarrow \triangleq 78$	
Navigation	□ Diagnostics → Device information → Manufacturer ID Expert → Communication → HART info → Manufacturer ID
HART revision	
Navigation	□ Expert → Communication → HART info → HART revision
Description	Display of the HART revision of the device.
HART descriptor	
Navigation	□ Expert → Communication → HART info → HART descriptor
Description	Definition of a description for the measuring point.
User entry	Up to 16 alphanumeric characters (letters, numbers and special characters)
Factory setting	16 x '?'

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	32 x '?'
Hardware revision	
Navigation	□ Expert → Communication → HART info → Hardware revision
Description	Display of the hardware revision for the device.
Software revision	
Navigation	□ Expert → Communication → HART info → Software revision
Description	Display of the software revision of the device.
HART date code	
Navigation	□ Expert → Communication → HART info → HART date code
Description	Definition of a 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 define a tag description for the process unit.
User entry	Up to 32 alphanumeric characters (letters, numbers and special characters)

Factory setting 32 x '?'

Location description	
Navigation	Expert \rightarrow Communication \rightarrow HART info \rightarrow Location description
Description	Enter the location description to find the device 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)	
Navigation	Expert \rightarrow Communication \rightarrow HART output \rightarrow Assign current output (PV)
Description	Allocation of the measured variable to the primary $\mathrm{HART}^{\scriptscriptstyle (\! 0\!)}$ value (PV).
Display	Temperature
Factory setting	Temperature (Fixed assignment)
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	Allocation of a measured variable to the secondary HART value (SV).

Display	Device temperature (Fixed assignment)
SV	
Navigation	□ Expert → Communication → HART output → SV
Description	Use this function to display the secondary HART value
Assign TV	
Navigation	$ \blacksquare \text{Expert} \rightarrow \text{Communication} \rightarrow \text{HART output} \rightarrow \text{Assign TV} $
Description	Allocation of a measured variable to the tertiary HART value (TV).
Display	Number of self calibrations (fixed assignment)
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	Assignment of a measured variable to the quaternary (fourth) HART value (QV).
Display	Deviation (fixed assignment)
QV	
Navigation	□ Expert → Communication → HART output → QV
Description	Use this function to display the quaternary HART value



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