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01.01 (device version)

Operating Instructions
iTEMP TMT36

IO-Link temperature transmitter

IO-Link

Endress+Hauser
People for Process Automation

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1 About this document

1.1 Document function

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

1.2 Symbols

1.2.1 Safety symbols

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

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

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

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

1.2.2 Electrical symbols

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

1.2.3 Symbols for certain types of information

Symbol	Meaning
✓	**Permitted** Procedures, processes or actions that are permitted.
✓✓	**Preferred** Procedures, processes or actions that are preferred.

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

1.2.4 Symbols in graphics

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

1.2.5 Tool symbols

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

1.3 Documentation

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

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

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

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid** This document contains all the technical data on the product and provides an overview of everything that can be ordered with the product.
Brief Operating Instructions (KA)	**Quick guide to obtaining the first measured value** The Operating Instructions contain all the essential information about the product from incoming acceptance to initial commissioning.
Operating Instructions (BA)	**Reference** The Operating Instructions contain the information that is required in the various phases of the life cycle of the product: From product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	**Reference for parameters** The document contains detailed explanations of readable or configurable parameters in the product. The description is aimed at those who work with the product over its entire life cycle and perform specific configurations.
Safety Instructions (XA)	Safety Instructions for electrical equipment in hazardous areas are supplied with the product depending on the approval. These are an integral part of the Operating Instructions. The nameplate indicates the Safety Instructions (XA) that are relevant to the product.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is an integral part of the product documentation.

1.4 Firmware history

Revision history

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

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

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

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

Date	Firmware version	Changes	Documentation
02/2024	01.01.zz	Original firmware	BA02289T/09/EN/01.23

1.5 Registered trademarks

IO-Link®
Is a registered trademark. It may only be used in conjunction with products and services by members of the IO-Link Community or by non-members who hold an appropriate license. For more detailed information on the use of IO-Link, please refer to the rules of the IO-Link Community at: www.io.link.com.

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 universal and configurable temperature transmitter with a sensor input for resistance thermometers (RTD). The head transmitter version of the device is intended for mounting in a terminal head (flat face) as per DIN EN 50446. It is also possible to mount the device on a DIN rail using the optional DIN rail clip.

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

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

2.3 Workplace safety

For work on and with the device:
- Wear the required personal protective equipment according to federal/national regulations.

2.4 Operational safety

NOTICE

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

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers!
- If modifications are nevertheless required, consult with the manufacturer.

Repair

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

2.5 Product safety

This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It left the factory in a condition in which it is safe to operate.

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

2.6 IT security

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

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

3 Incoming acceptance and product identification

3.1 Incoming acceptance

On receipt of the delivery:

1. Check the packaging for damage.
   ↳ Report all damage immediately to the manufacturer.
   Do not install damaged components.
2. Check the scope of delivery using the delivery note.
3. Compare the data on the nameplate with the order specifications on the delivery note.
4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.

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

3.2 Product identification

The following options are available for identification of the device:
- Nameplate specifications
- Enter the serial number from the nameplate into *Device Viewer* (www.endress.com/deviceviewer): all the information about the device and an overview of the technical documentation supplied with the device are displayed.
- Enter the serial number from the nameplate into the *Endress+Hauser Operations app* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations app*: all the information about the device and the technical documentation pertaining to the device is displayed.

3.2.1 Nameplate

Do you have the correct device?

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

▶ Compare the information on the nameplate with the order.

3.2.2 Name and address of manufacturer

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

3.3 Storage and transport

Storage temperature: −50 to 100 °C (−58 to 212 °F)

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

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

Avoid the following environmental influences during storage and transport:
- Direct sunlight
- Proximity to hot objects
- Vibration
- Aggressive media

4 Installation

4.1 Installation requirements

In the terminal head, flat face, as per DIN EN 50446, direct mounting on insert with cable entry (center hole 7 mm (0.28 in).

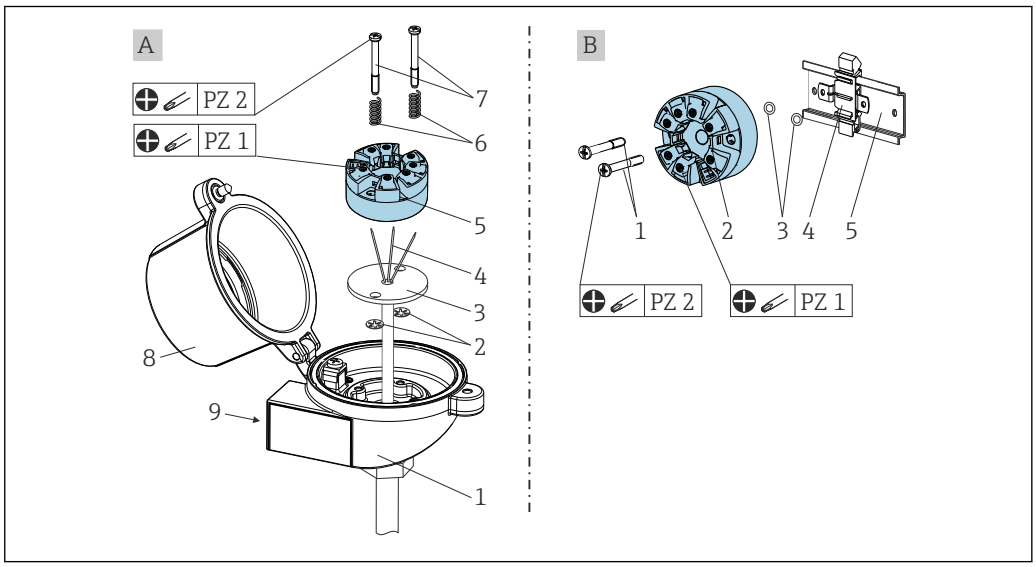
Make sure there is enough space in the terminal head.

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

Information about the conditions that must be present at the mounting location so that the device can be operated correctly is provided in the "Environment" section of the "Technical data".

4.2 Installing the device

A Phillips head screwdriver is required to mount the head transmitter:
- Maximum torque for securing screws = 1 Nm (¾ lbf ft), screwdriver: Pozidriv PZ2
- Maximum torque for screw terminals = 0.35 Nm (¼ lbf ft), screwdriver: Pozidriv PZ1



A Terminal head, flat face, as per DIN EN 50446, direct installation on insert with cable entry (center hole 7 mm (0.28 in)
B With DIN rail clip on DIN rail as per IEC 60715 (TH35)

A	Mounting in a terminal head (terminal head flat face as per DIN 50446)
1	Terminal head
2	Circlips
3	Insert
4	Connection wires
5	Head transmitter
6	Mounting springs
7	Mounting screws
8	Terminal head cover
9	Cable entry

Procedure for mounting in a terminal head, item A:

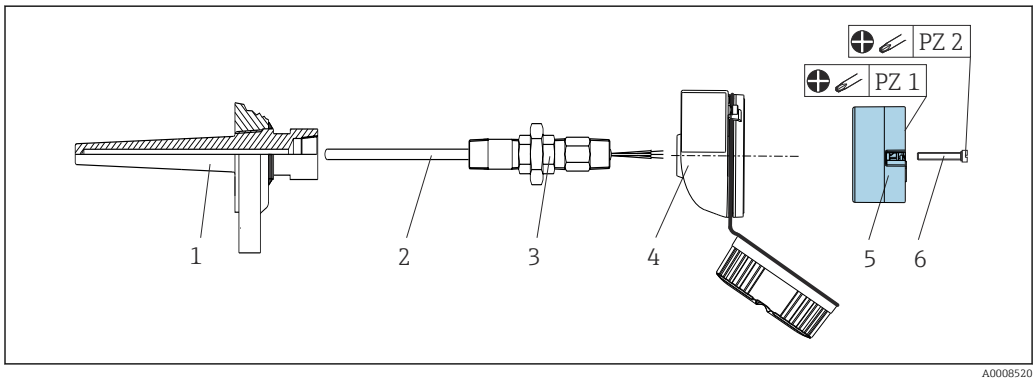
1. Open the terminal head cover (8) on the terminal head.
2. Guide the connection wires (4) of the insert (3) through the center hole in the head transmitter (5).
3. Fit the mounting springs (6) on the mounting screws (7).
4. Guide the mounting screws (7) through the side boreholes of the head transmitter and the insert (3). Then secure both mounting screws with the retaining rings (2).
5. Then tighten the head transmitter (5) along with the insert (3) in the terminal head.
6. After wiring (see 'Electrical connection' section), seal the terminal head cover (8) once again.

B	Mounting on DIN rail (DIN rail as per IEC 60715)
1	Mounting screws with springs
2	Head transmitter
3	Circlips
4	DIN rail clip
5	DIN rail

Procedure for mounting on a DIN rail, item B:

1. Press the DIN rail clip (4) onto the DIN rail (5) until it engages with a click
2. Guide the mounting screws (1) through the side boreholes of the head transmitter (2) and secure with the retaining rings (3).
3. Screw the head transmitter (2) onto the DIN rail clip (4).

4.2.1 Installing the device on a centrally spring-loaded insert



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

Structure of thermometer with RTD sensors and head transmitter:

1. Fit the thermowell (1) on the process pipe or on the process vessel wall. Secure the thermowell according to the instructions before the process pressure is applied.
2. Fit the necessary neck tube nipples and adapter (3) on the thermowell.
3. Make sure sealing rings are installed if they are required for harsh environmental conditions or compliance with special regulations.

4. Guide the mounting screws (6) through the lateral bores of the head transmitter (5).
5. Position the head transmitter (5) in the terminal head (4) so that the terminals for the power supply (terminals 1 and 2) point in the direction of the cable entry.
6. Using a screwdriver, screw down the head transmitter (5) in the terminal head (4).
7. Guide the connection wires of the insert (3) through the lower cable entry of the terminal head (4) and through the middle hole in the head transmitter (5). Wire together the connection wires and transmitter (see the 'Electrical connection' section).
8. Screw the terminal head (4), with the integrated and wired head transmitter, onto the ready-mounted nipple and adapter (3).

4.3 Post-installation check

Perform the following checks after installing the device:

Device condition and specifications	Notes
Are the device, the connections and connecting cables free of damage?	
Do the ambient conditions match the device specification (e.g., ambient temperature, measuring range)?	See 'Technical data' section
Have connections been established correctly and with the specified torque?	-

5 Electrical connection

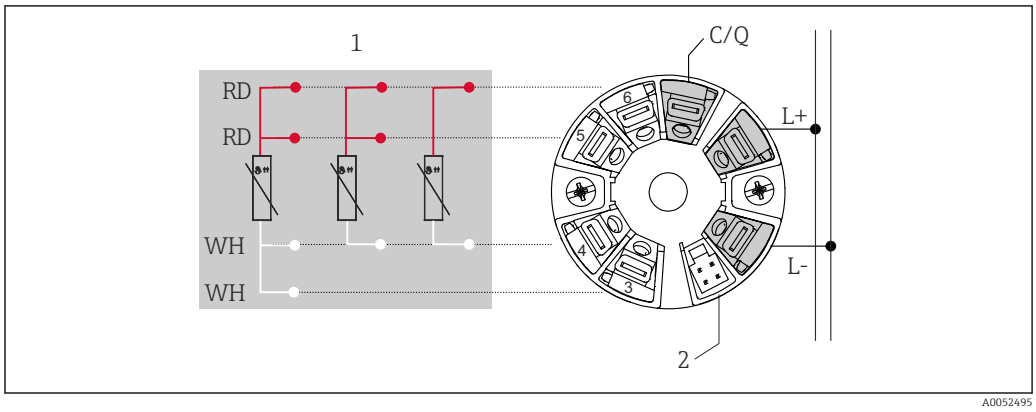
⚠ CAUTION

- Do not install or wire the device when it is connected to the operating voltage. Non-compliance may result in the destruction of electronics components.
- Mixing up the terminal connections L+, L- and C/Q does not cause damage to the electronics.

5.1 Quick wiring guide

NOTICE

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



1 Terminal assignment

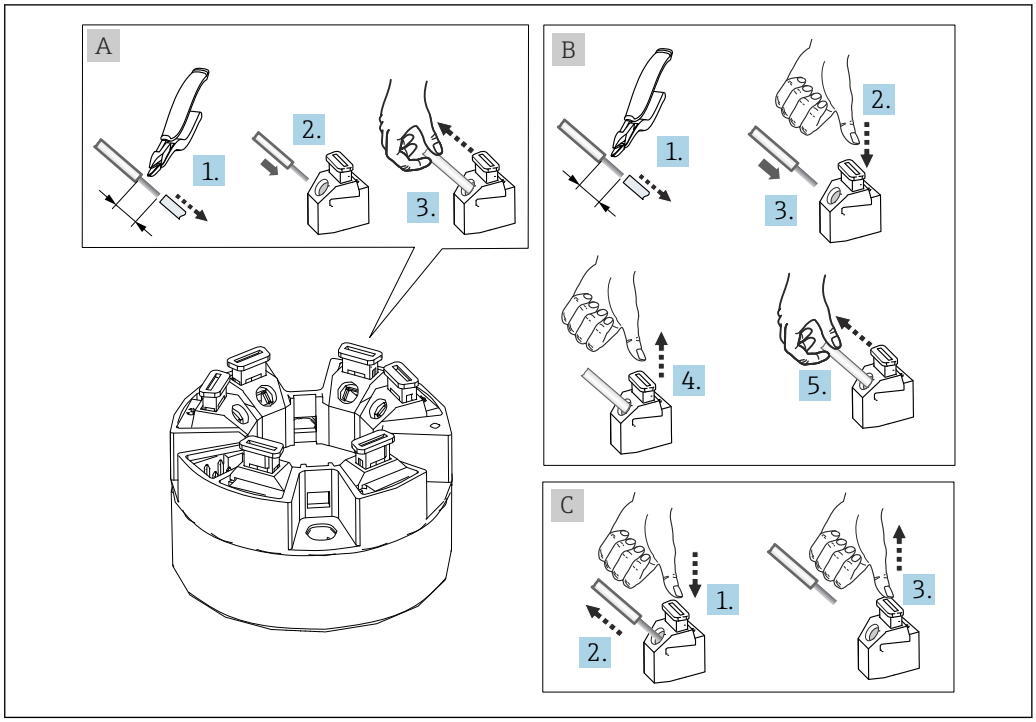
1 RTD sensor input: 4-, 3- and 2-wire
2 Display connection
L+ 18 to 30 V_{DC} power supply
L- 0 V_{DC} power supply
C/Q IO-Link or switch output

5.2 Connecting the sensor

5.2.1 Connecting to screw terminals

Maximum torque for screw terminals = 0.35 Nm (¼ lbf ft), screwdriver: Pozidriv Z1

5.2.2 Connecting the sensor to push-in terminals



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

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

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

Fig. B, fine-strand wire without ferrule:

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

Fig. C, releasing the connection:

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

5.3 Connecting the transmitter

Cable specification

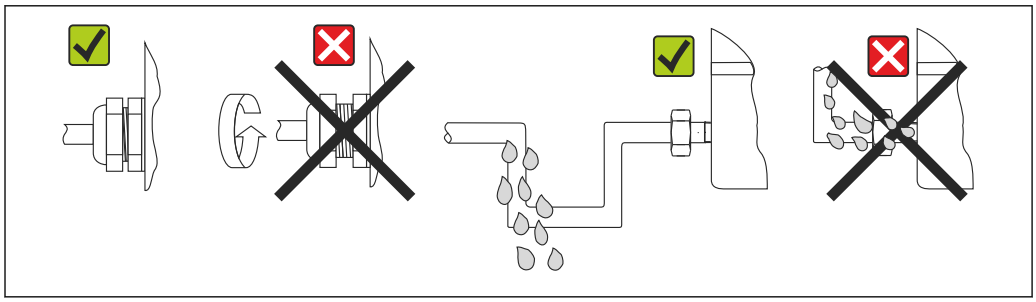
- Maximum cable length in IO-Link operation: ≤ 20 m (65.6 ft). There are no requirements with respect to shielding.
- Cable cross-section; see the "Technical data" → 38

Follow the general procedure for connecting terminals.→ 1, 14.

5.4 Ensuring the degree of protection

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

1. The transmitter must be mounted in a terminal head with the appropriate degree of protection.
   The housing seals must be clean and undamaged when inserted into the sealing groove. Dry, clean or replace the seals for this purpose if necessary.
2. The connecting cables used must have the specified external diameter (e.g., M20x1.5, cable diameter 8 to 12 mm).
   Firmly tighten the cable gland. → 3, 16
3. The cables must loop down before they enter the cable glands ("water trap").
   ↳ This means that any moisture that may form cannot enter the gland.
4. Install the device in such a way that the cable glands are not facing upwards. → 3, 16
5. Replace unused cable glands with dummy plugs.
6. The grommet used must remain in the cable gland.



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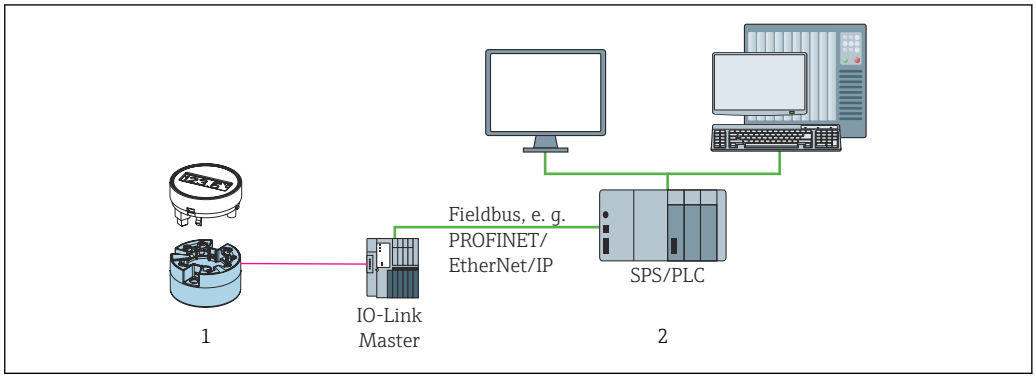
3 *Connection tips to retain IP67 protection*

5.5 Post-connection check

Device condition and specifications	Notes
Are the device and cable undamaged?	
Electrical connection	**Notes**
Does the supply voltage match the specifications on the nameplate?	Head transmitter: U = e.g. 18 to 30 V_{DC}
Are the mounted cables strain-relieved?	
Are the power supply and signal cables connected correctly?	→ 14
Are all the screw terminals well tightened and have the connections of the push-in terminals been checked?	--
Are all the cable entries installed, tightened and leak-tight?	--

6 Operation options

6.1 Overview of operation options



1 Temperature transmitter with attachable display unit
2 Remote operation in the automation system. e.g. PLC) via IO-Link interface

Configuration programs

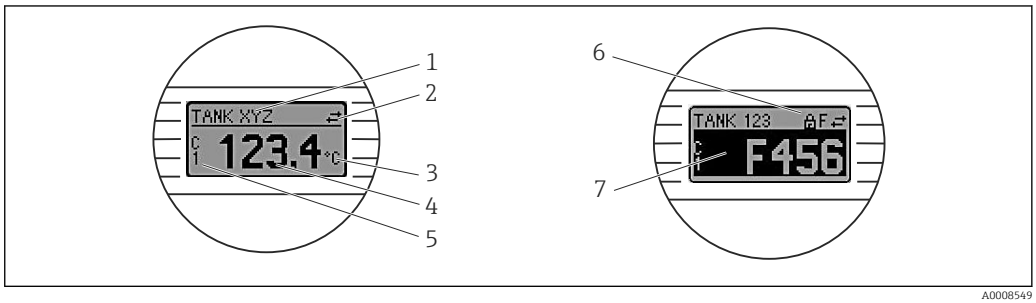
IO-Link functions and device-specific parameters are configured via the device's IO-Link communication. Special configuration kits are available, such as the FieldPort SFP20. Every IO-Link device can be configured with it. IO-Link devices are typically configured via the automation system (e.g. Siemens TIA Portal + Port Configuration Tool).

6.2 Measured value display and operating elements

For the head transmitter, display and operating elements are available locally only if the head transmitter was ordered with a display unit. The display can also be ordered at a later stage; see the "Accessories" section.

6.2.1 Display elements

Head transmitter



4 Optional LC display for head transmitter

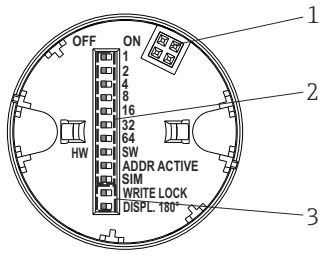
Item no.	Function	Description
1	Display device tag	Device tag, length 32 characters.
2	'Communication' symbol	The communication symbol appears in the event of read and write access via IO-Link.
3	Unit display	Unit display for the measured value displayed.
4	Measured value display	Displays the current measured value.

Item no.	Function	Description
5	Values/channel display	PV = process value P1 = switching signal channel SSC.1 P2 = switching signal channel SSC.2 DT = device temperature
6	'Configuration locked' symbol	The 'configuration locked' symbol appears when configuration is locked via the hardware.
7	Status signals	
	Symbols	Meaning
	F	**"Failure" error message** An operating error has occurred. The measured value is no longer valid. The display alternates between the error message and "- - - -" (no valid measured value present); see "Diagnostics and troubleshooting" section
	C	**"Function check"** The device is in the service mode (e.g., during a simulation).
	S	**"Out of specification"** The device is being operated outside its technical specifications (e.g., during startup or cleaning processes).
	M	**"Maintenance required"** Maintenance is required. The measured value remains valid. The display alternates between the measured value and the status message.

6.2.2 Local operation

NOTICE

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



5 *Hardware settings via DIP switches*

1: Connection to head transmitter

2: DIP switch

3: DIP switch functions:
1-64, HW/SW, ADDR ACTIVE (no function)
SIM = simulation mode (no function);
WRITE LOCK = write protection;
DISPL. 180° = rotate the display monitor 180°

Procedure for setting the DIP switch:

1. Open the cover of the terminal head or field housing.
2. Remove the attached display from the head transmitter.
3. Configure the DIP switch on the rear of the display accordingly. In general: switch to ON = function enabled, switch to OFF = function disabled.
4. Fit the display onto the head transmitter in the correct position.
5. Secure the cover back onto the terminal head or field housing.

Switching write protection on/off

Write protection is switched on and off via a DIP switch on the rear of the optional attachable display.

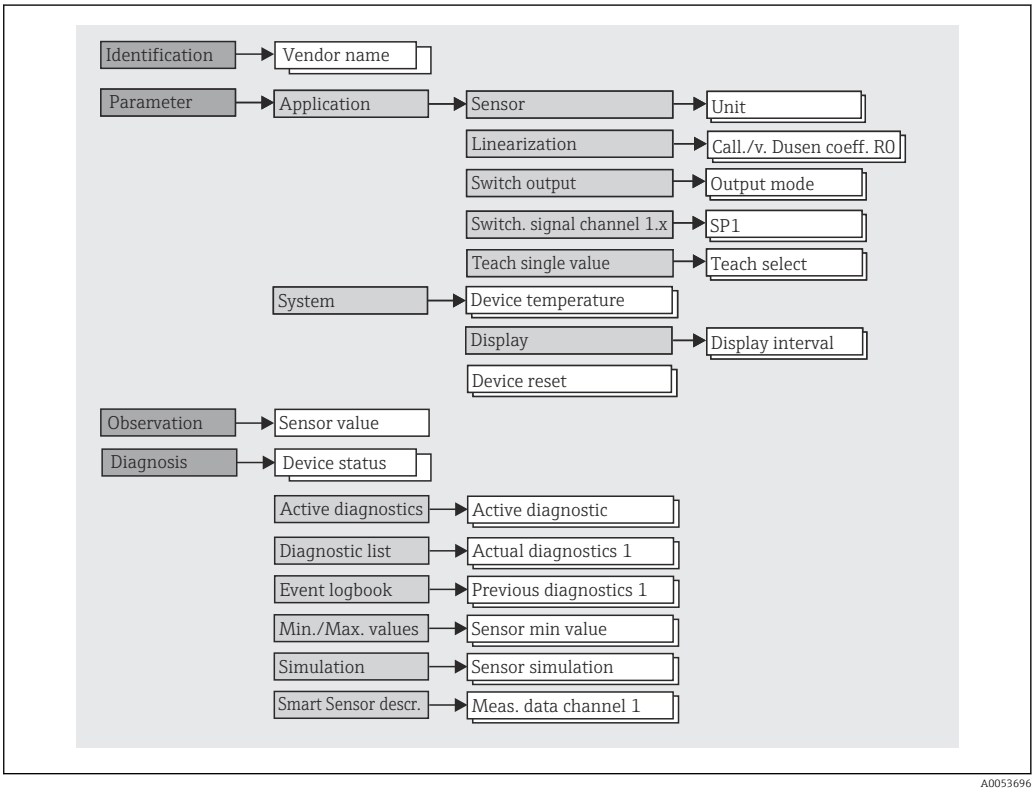
When write protection is active, parameters cannot be modified. A lock symbol on the display indicates that write protection is on. Write protection remains active even when the display is removed. To disable write protection, the display must be attached to the transmitter with the DIP switch deactivated (WRITE LOCK = OFF). The transmitter adopts the setting during operation and does not need to be restarted.

Turning the display

The display can be rotated 180° via the DIP switch.

6.3 Structure and function of the operating menu

6.3.1 Structure of the operating menu



If the measured value unit is switched to °F, the process data is retained in °C. Switching of the unit only applies to the measured value display.

Submenus

Menu	Typical tasks	Content/meaning
"Identification"	Information on manufacturer and device identification	Contains all the parameters for unique identification of the manufacturer and device.
"Parameter"	Commissioning, tasks and information on the device configuration: ▪ Configuration of the measurement ▪ Configuration of data processing (scaling, linearization) ▪ Configuration of the switching signal ▪ Display of device temperature and operating time ▪ Information about display configuration ▪ Resetting the device	Contains all parameters for commissioning: ▪ **"Sensor" submenu** Contains all the parameters for configuring the measurement ▪ **"Linearization" submenu** Contains all the parameters for linearization of the measurement ▪ **"Switching signal channel submenu"** Contains all the parameters for configuring the switch output, e.g. entering the switch points, defining the switch logic (high active, low active), switching mode (1-point, window or 2-point function), teach function. Contains all higher-level device parameters that are assigned to device information and adjustment. **"Display" submenu** Configuration of the display
"Observation"	Observation of process data	Contains all the parameters for displaying the process data: Current value at sensor input, extended device status and status at switching signal channel.
"Diagnostics"	Troubleshooting: ▪ Diagnosing and eliminating process errors. ▪ Error diagnostics in difficult cases. ▪ Interpretation of device error messages and correcting associated errors.	Contains all parameters for detecting and analyzing errors: ▪ **Active diagnostics, diagnostic list** Displays the currently pending and triggered error messages, sorted by priority. See 'Diagnostics and troubleshooting' section. ▪ **"Event logbook" submenu** Displays all diagnostic and information events in chronological order ▪ **"Minimum/maximum values" submenu** Displays all minimum and maximum measured process and device temperatures ▪ **"Simulation" submenu** Used to simulate input and output values

6.4 Access to the operating menu via the operating tool

The IO-Link interface allows direct access to process and diagnostics data and enables the user to configure the device during operation.

More information on IO-Link is available at: www.io-link.com

6.4.1 DeviceCare

Range of functions

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

Source for device description files

See details in the "System integration" section.

7 System integration

7.1 Overview of device description files

In order to integrate field devices into a digital communication system, the IO-Link system requires a description of the device parameters such as output data, input data, data format, quantity of data and supported IO-Link transfer rate. This data is available in the IODD (IO Device Description) which is provided to the IO-Link master via generic modules when the communication system is commissioned.

Download via endress.com

1. endress.com/download
2. Select **Device Driver** from the search options shown.
3. For **Type** select "IO Device Description (IODD)".
4. Select the **Product Code** or enter it as text.
   ↳ A list of search results is displayed.
5. Download the appropriate version.

Download via ioddfinder

1. ioddfinder.io-link.com
2. For **Manufacturer** select "Endress+Hauser".
3. Enter the **Product Name**.
   ↳ A list of search results is displayed.
4. Download the appropriate version.

The IODD device description is also required for the DeviceCare operating tool. This must be adapted for the operating tool using the IODD DTM Configurator. The IODD DTM Configurator is available for download at the following address: www.software-products.endress.com

Following successful registration via Download --> Device Configuration Software & Device Driver --> DTM/FDI Package Libraries, download and install the software: **IO-Link IODD Interpreter DTM**.

In the IODD DTM Configurator, open the IODD device description file (*.xml). This file is then adapted for use in DeviceCare and automatically added to the DTM library.

7.2 Integrating the device in the system

Device ID	0x93FE01
Manufacturer ID	0x0011 (17)

7.2.1 Process data

When the device is operated in digital mode, the state of the switch output and the temperature value are transmitted in the form of process data via IO-Link. The signal is initially transmitted in SIO mode (Standard IO mode). Digital IO-Link communication starts as soon as the IO-Link master sends the "Wake Up" command.

- In SIO mode, the switch output is switched at the C/Q terminal. In the IO-Link communication mode, this terminal is reserved exclusively for communication.
- The device's process data are transmitted cyclically in 48-bit chunks.

Name	Description	Data type	Value range	Unit	Bit offset
Sensor value	Indication of the measured value at the sensor input.	Float32T	$-1.0 \cdot 10^{+20}$ to $+1.0 \cdot 10^{+20}$ $3.3 \cdot 10^{+38}$ = No measurement data $-2.65 \cdot 10^{+38}$ = Out of range (-) $+2.65 \cdot 10^{+38}$ = Out of range (+)	°C	16
Extended device status	Displays the extended device status.	UIntegerT	0 = Not specified 36 = Failure 37 = Failure - simulation 60 = Function check 61 = Fuction check - simulation 120 = Out of specification 121 = Out of specification - simulation 128 = Good 129 = Good - simulation 164 = Maintenance required 165 = Maintenance required - simulation		8
Switching signal channel .2	Displays the state of the switching signal channel (SSC).	BooleanT	0 = Off 1 = On		1
Switching signal channel .1	Displays the state of the switching signal channel (SSC).	BooleanT	0 = Off 1 = On		0

7.3 Reading and writing device data

Device data are always exchanged acyclically and at the request of the IO-Link master via the ISDU communication channel. The IO-Link master can read the following parameter values or device conditions:

The default values apply to parameters which are not ordered with customer-specific settings.

7.3.1 Identification

Description (Identifier)	Index (hex)	Sub (dec)	Size (byte)	Data type	Access	Value range	Default value	Data storage
Vendor name	0x0010	0	32	StringT	r/-	-	Endress+Hauser	No
Vendor text	0x0011	0	32	StringT	r/-	-	People for Process Automation	No
Product name	0x0012	0	32	StringT	r/-	-	iTEMP TMT36	No
Product text	0x0014	0	32	StringT	r/-	-	Temperature transmitter	No
Product ID	0x0013	0	32	StringT	r/-	-	TMT36	No
Serial number	0x0015	0	16	StringT	r/-	-	-	No
Hardware revision	0x0016	0	16	StringT	r/-	-	-	No
Firmware version	0x0017	0	8	StringT	r/-	-	-	No
Application-specific tag	0x0018	0	32	StringT	r/w	-	***	Yes
Function tag	0x0019	0	32	StringT	r/w	-	***	Yes
Location tag	0x001a	0	32	StringT	r/w	-	***	Yes

Description (Identifier)	Index (hex)	Sub (dec)	Size (byte)	Data type	Access	Value range	Default value	Data storage
Order code	0x3057	0	20	StringT	r/-	-	-	No
Extended order code	0x0103	1	60	StringT	r/-	-	-	No
Extended order code 2	0x0103	2	20	StringT	r/-	-	-	No
Extended order code 3	0x0103	3	20	StringT	r/-	-	-	No

7.3.2 Parameter

Description (Identifier)	Index (hex)	Sub (dec)	Size (byte)	Data type	Access	Value range	Unit	Default value	Data storage
Unit	0x2052	0	1	UIntegerT	r/w	32 = °C 33 = °F		°C	Yes
Sensor type	0x2032	0	1	UIntegerT	r/w	3 = RTD platinum (Callendar/van Dusen) 12 = Pt100 IEC60751, a = 0.00385 (1) 15 = Pt1000 IEC60751, a = 0.00385 (4)		Pt100 IEC60751, a = 0.00385 (1)	Yes
Connection type	0x2038	0	1	UIntegerT	r/w	2 = 2-wire 3 = 3-wire 4 = 4-wire		4-wire	Yes
2-wire compensation	0x2039	0	4	Float32T	r/w	0.0 to 30.0	Ohm	0.0	Yes
Sensor offset	0x2037	0	4	Float32T	r/w	±10.0	°C	0.0	Yes
Damping	0x2049	0	1	UIntegerT	r/w	0 to 120	s	0	Yes
Call./v. Dusen coeff. R0	0x203d	0	4	Float32T	r/w	10 to 2 000	Ohm	100.0	Yes
Call./v. Dusen coeff. A	0x203a	0	4	Float32T	r/w	0.003 to 0.004		0.0039083	Yes
Call./v. Dusen coeff. B	0x203b	0	4	Float32T	r/w	$\pm 2 \cdot 10^{-06}$		$-5.775 \cdot 10^{-7}$	Yes
Call./v. Dusen coeff. C	0x203c	0	4	Float32T	r/w	$\pm 2 \cdot 10^{-06}$		$-4.183 \cdot 10^{-12}$	Yes
Sensor lower limit	0x2034	0	4	Float32T	r/w	−200 to 850	°C	−200.0	Yes
Sensor upper limit	0x2033	0	4	Float32T	r/w	−200 to 850	°C	850.0	Yes
Output mode	0x2047	0	2	UIntegerT	r/w	4951 = PNP 4952 = NPN 4953 = Push/Pull		PNP	Yes
Fail-safe value	0x2048	0	2	UIntegerT	r/w	4950 = High-Z 33192 = High 33193 = Low		High-Z	Yes
SSC .1 param									
SP1	0x003c	1	4	Float32T	r/w	$-1 \cdot 10^{+20}$ to $+1 \cdot 10^{-20}$	°C	90.0	Yes
SP2	0x003c	2	4	Float32T	r/w	$-1 \cdot 10^{+20}$ to $+1 \cdot 10^{-20}$	°C	100.0	Yes
SSC .1 config									
Logic	0x003d	1	1	UIntegerT	r/w	0 = High active 1 = Low active		High active	Yes

Description (Identifier)	Index (hex)	Sub (dec)	Size (byte)	Data type	Access	Value range	Unit	Default value	Data storage
Mode	0x003d	2	1	UIntegerT	r/w	0 = Deactivated 1 = Single point 2 = Window 3 = Two point		Two point	Yes
Hysteresis	0x003d	3	4	Float32T	r/w	$-1 \cdot 10^{+20}$ to $+1 \cdot 10^{-20}$ °C		0.0	Yes
SSC .2 param									
SP1	0x003e	1	4	Float32T	r/w	$-1 \cdot 10^{+20}$ to $+1 \cdot 10^{-20}$ °C		90.0	Yes
SP2	0x003e	2	4	Float32T	r/w	$-1 \cdot 10^{+20}$ to $+1 \cdot 10^{-20}$ °C		100.0	Yes
SSC .2 config									
Logic	0x003f	1	1	UIntegerT	r/w	0 = High active 1 = Low active		High active	Yes
Mode	0x003f	2	1	UIntegerT	r/w	0 = Deactivated 1 = Single point 2 = Window 3 = Two point		Two point	Yes
Hysteresis	0x003f	3	4	Float32T	r/w	$-1 \cdot 10^{+20}$ to $+1 \cdot 10^{-20}$ °C		0.0	Yes
Teach select	0x003a	0	1	UIntegerT	r/w	1 = SSC 1.1 2 = SSC 1.2		SSC 1.1	No
Teach result	0x003b	0	1	UIntegerT	r/-	0 = Idle 1 = SP 1 success 2 = SP 2 success 3 = SP 1, SP2 success 4 = Wait for command 5 = Busy 7 = Error		Idle	No
Device temperature	0x2079	0	4	Float32T	r/-	-		-	No
Operating time	0x2058	0	4	UIntegerT	r/-	-		-	No
Alarm delay	0x2057	0	1	UIntegerT	r/w	0 to 5 s		2	Yes
Display interval	0x2021	0	1	UIntegerT	r/w	4 to 20 s		4	Yes
Value 1 display	0x2022	0	1	UIntegerT	r/w	13 = Process value 20 = SSC.1 21 = SSC.2 1 = Device temperature		Process value	Yes
Decimal places 1	0x2023	0	1	UInteger8	r/w	255 = Automatic 0 = x 1 = x.x 2 = x.xx		x.x	Yes
Value 2 display	0x2024	0	1	UIntegerT	r/w	12 = Off 13 = Process value 20 = SSC.1 21 = SSC.2 1 = Device temperature		Off	Yes
Decimal places 2	0x2025	0	1	UIntegerT	r/w	255 = Automatic 0 = x 1 = x.x 2 = x.xx		x.x	Yes

Description (Identifier)	Index (hex)	Sub (dec)	Size (byte)	Data type	Access	Value range	Unit	Default value	Data storage
Value 3 display	0x2026	0	1	UIntegerT	r/w	12 = Off 13 = Process value 20 = SSC.1 21 = SSC.2 1 = Device temperature		Off	Yes
Decimal places 3	0x2027	0	1	UIntegerT	r/w	255 = Automatic 0 = x 1 = x.x 2 = x.xx		x.x	Yes

7.3.3 Observation

Description (Identifier)	Index (hex)	Sub (dec)	Size (byte)	Data type	Access	Value range	Unit	Default value	Bit offset	Data storage
Sensor value	0x0028	1	4	Float32T	r/-	$-1.0 \cdot 10^{+20}$ to $+1.0 \cdot 10^{+20}$ $3.3 \cdot 10^{+38}$ = No measurement data $-2.65 \cdot 10^{+38}$ = Out of range (-) $+2.65 \cdot 10^{+38}$ = Out of range (+)	°C	NaN	16	No
Extended device status	0x0028	2	1	UIntegerT	r/-	0 = Not specified 36 = Failure 37 = Failure - simulation 60 = Function check 61 = Function check - simulation 120 = Out of specification 121 = Out of specification - simulation 128 = Good 129 = Good - simulation 164 = Maintenance required 165 = Maintenance required - simulation		Not specified	8	No
Switching signal channel .2 - Temperature	0x0028	21	1	BooleanT	r/-	0 = Off 1 = On		On	1	No
Switching signal channel .1 - Temperature	0x0028	22	1	BooleanT	r/-	0 = Off 1 = On		On	0	No

7.3.4 Diagnosis

Description (Identifier)	Index (hex)	Sub (dec)	Size (byte)	Data type	Access	Value range	Unit	Default value	Data storage
Device status	0x0024	0	1	UIntegerT	r/-	0 = Device OK 1 = Maintenance required 2 = Out of specification 3 = Functional check 4 = Failure		Device OK	No
Detailed device status	0x0025	0	9	StringT	r/-	-		-	No
Detailed device status	0x0025	1	3	StringT	r/-	-		-	No
Detailed device status	0x0025	2	3	StringT	r/-	-		-	No
Actual diagnostics 1	0x205c	0	2	UIntegerT	r/-	-		0	No

Description (Identifier)	Index (hex)	Sub (dec)	Size (byte)	Data type	Access	Value range	Unit	Default value	Data storage
Actual diagnostics 2	0x205d	0	2	UIntegerT	r/-	-		0	No
Actual diagnostics 3	0x205e	0	2	UIntegerT	r/-	-		0	No
Previous diagnostics 1	0x2067	0	2	UIntegerT	r/-	-		0	No
Timestamp 1	0x2062	0	4	UIntegerT	r/-	-	h	0	No
Previous diagnostics 2	0x2068	0	2	UIntegerT	r/-	-		0	No
Timestamp 2	0x2063	0	4	UIntegerT	r/-	-	h	0	No
Previous diagnostics 3	0x2069	0	2	UIntegerT	r/-	-		0	No
Timestamp 3	0x2064	0	4	UIntegerT	r/-	-	h	0	No
Previous diagnostics 4	0x206a	0	2	UIntegerT	r/-	-		0	No
Timestamp 4	0x2065	0	4	UIntegerT	r/-	-	h	0	No
Previous diagnostics 5	0x206b	0	2	UIntegerT	r/-	-		0	No
Timestamp 5	0x2066	0	4	UIntegerT	r/-	-	h	0	No
Sensor min value	0x2036	0	4	Float32T	r/-	-	°C	-	No
Sensor max value	0x2035	0	4	Float32T	r/-	-	°C	-	No
Device temperature min value	0x207f	0	4	Float32T	r/-	-	°C	-	No
Device temperature max value	0x207e	0	4	Float32T	r/-	-	°C	-	No
Sensor simulation	0x2043	0	1	UIntegerT	r/w	0 = Off 1 = On		Off	No
Sensor simulation value	0x203e	0	4	Float32T	r/w	$\pm 1 \cdot 10^{+20}$	°C	0.0	No
Simulation switch output .2	0x2122	0	2	UIntegerT	r/w	4166 = Off 4167 = High 4168 = Low		Off	No
Simulation switch output .1	0x20e2	0	2	UIntegerT	r/w	4166 = Off 4167 = High 4168 = Low		Off	No
Measurement data channel 1 - Temperature									
Lower value	0x4080	1	4	Float32T	r/-	-	°C	0.0	No
Upper value	0x4080	2	4	Float32T	r/-	-	°C	0.0	No
Unit	0x4080	3	2	UIntegerT	r/-	1001 = °C		°C	No
Scale	0x4080	4	1	IntegerT	r/-	–128 to 127		0	No

8 Commissioning

8.1 Function check

Perform the following checks prior to commissioning the measuring point:

1. Perform the post-mounting check using the checklist.
2. Perform the post-connection check using the checklist.

8.2 Switching on the device

During the switch-on procedure, the transmitter runs through internal test functions. The following sequence of messages appears on the display:

Step	Display
1	Text "Display" and firmware version of the display
2	Device name with firmware, hardware version and the IO-Link device ID in hexadecimal format
3	Information on the sensor configuration (sensor element and type of connection)
4	Displays the switch points
5a	Current measured value or
5b	Current status message If the switch-on procedure is not successful, the relevant diagnostic event is displayed, depending on the cause. For a detailed list of diagnostic events and the corresponding troubleshooting instructions, see the "Diagnostics and troubleshooting" section.

The device works after approx. 5 seconds. Normal measuring mode commences as soon as the switch-on procedure is completed.

8.3 Configuring the device

IO-Link functions and device-specific parameters are configured via the device's IO-Link communication. Special configuration kits are available, e.g. the FieldPort SFP20. Every IO-Link device can be configured with it.

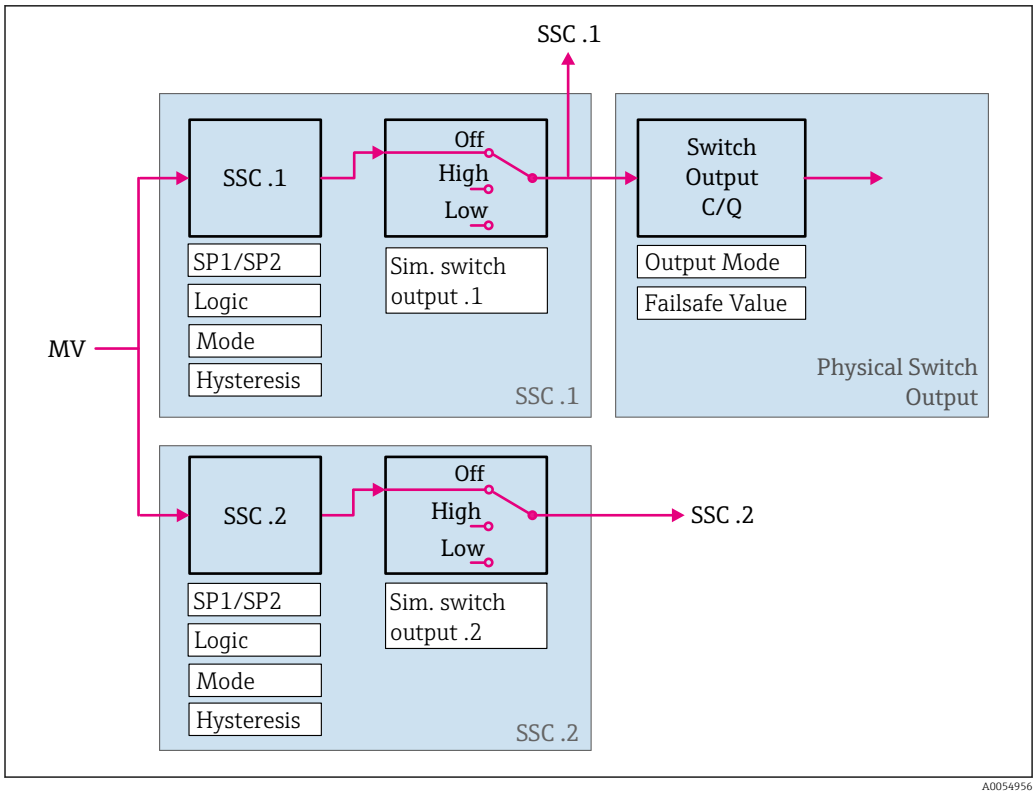
IO-Link devices are typically configured via the automation system (e.g. Siemens TIA Portal + Port Configuration Tool). The device supports IO-Link Data Storage, which enables easy device replacement.

8.3.1 Switching signal channels and switch output

IO-Link switching signal channels (SSC)

SSCs are specified by the IO-Link Smart Sensor Profile. The device has two independent SSCs (SSC. 1 and SSC. 2). Based on the measured process temperature, each of the two channels issues a binary switching signal (OFF or ON) which is transferred to the IO-Link process data as **Switching signal channel 1** and **Switching signal channel 2**. Both channels can be configured with the parameters: **SP1/SP2**, **Logic**, **Mode** and **Hysteresis**; see section on System Integration. In addition, the output values can be set to a fixed value using the **Simulation switch output .1/.2** parameter ('High' becomes ON and 'low' becomes OFF).

In addition to manual configuration for switch points **SP1/SP2**, a teach mechanism is also available in the Teach menu. This mechanism writes the current process value to the selected SSC via a system command.



Physical switch output

The C/Q output signal is generated based on the binary signal in the **Switching signal channel 1**. The output signal is only available at the C/Q terminal if the IO-Link communication is disabled (SIO mode). The voltage of the C/Q output signal is displayed according to the binary value of **Switching signal channel 1** and the **Output Mode** parameter as per the following table.

Assignment of binary switching signal and C/Q output signal

Output mode	Switching signal channel 1	C/Q switch output
PNP	OFF	Not connected (HighZ)
	ON	L+
NPN	OFF	Not connected (HighZ)
	ON	L-
PushPull	OFF	L-
	ON	L+

If the value of the **Logic** parameter is set to Low active, the binary switching signals are inverted compared to the values specified in the table.

OFF -> ON, ON -> OFF.

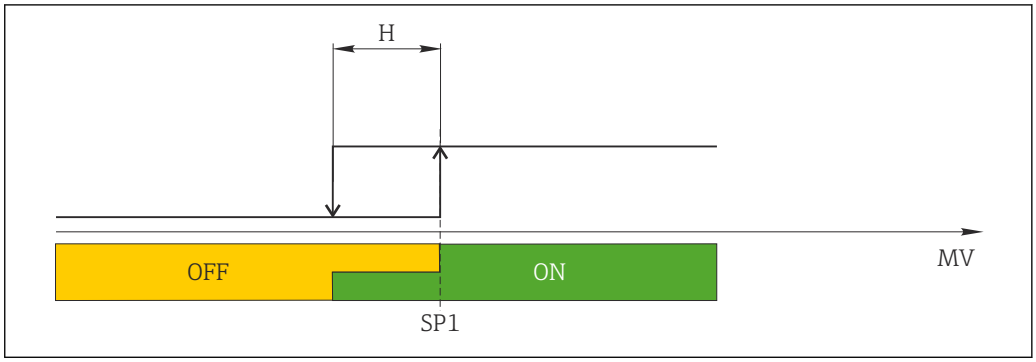
In the event of an error, the C/Q output signal can be defined using the **Fail-safe value** parameter: Low (L-), High (L+) and HighZ (not connected). This value applies, irrespective of the **Output Mode** parameter setting.

Switching signals

The switching signals offer a simple way of monitoring the measured values for limit violations. The following section illustrates the different switching behaviors of the modes available for selection.

Mode Single Point

SP2 is not used in this mode.

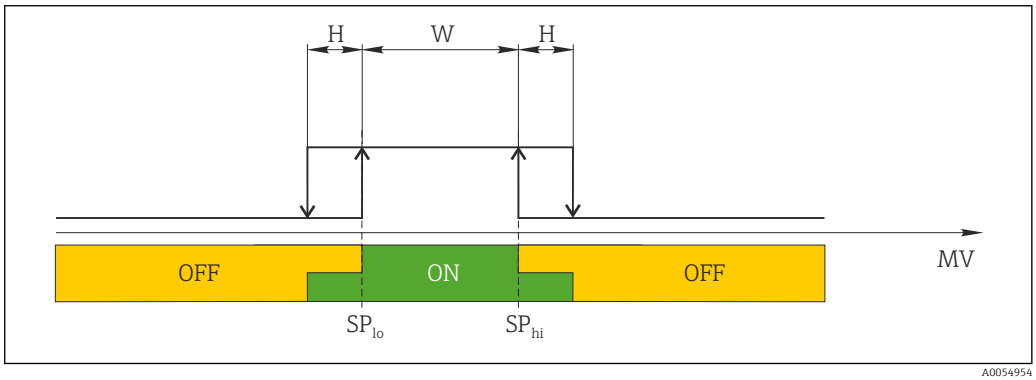


6 *SSC, Single Point*

H Hysteresis
SP1 Switch point 1
MV Measured value

Mode Window

SP_{hi} always corresponds to whichever value is higher, SP1 or SP2, while SP_{lo} always corresponds to whichever value is lower, SP1 or SP2.

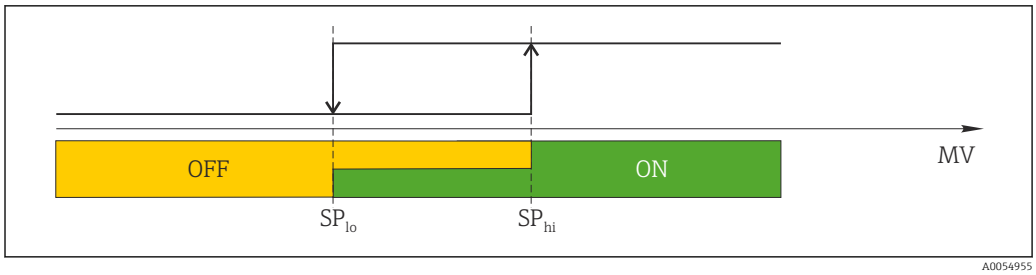


7 *SSC, Window*

H Hysteresis
W Window
SP_{lo} Switch point with lower measured value
SP_{hi} Switch point with higher measured value
MV Measured value

Mode Two-point

SP_{hi} always corresponds to whichever value is higher, SP1 or SP2, while SP_{lo} always corresponds to whichever value is lower, SP1 or SP2.
Hysteresis is not used.



8 *SSC, Two-Point*

SP_{lo} Switch point with lower measured value
SP_{hi} Switch point with higher measured value
MV Measured value

8.4 Protecting settings from unauthorized access

Write protection can be activated using A WRITE LOCK DIP switch on the back of the optional plug-on display. See also the 'Local operation' section.

When write protection is active, parameters cannot be modified. A lock symbol on the display indicates that write protection is on. Write protection remains active even when the display is removed. To disable write protection, the display must be attached to the transmitter with the DIP switch deactivated (WRITE LOCK = OFF). The transmitter adopts the setting during operation and does not need to be restarted.

9 Diagnostics and troubleshooting

9.1 General troubleshooting

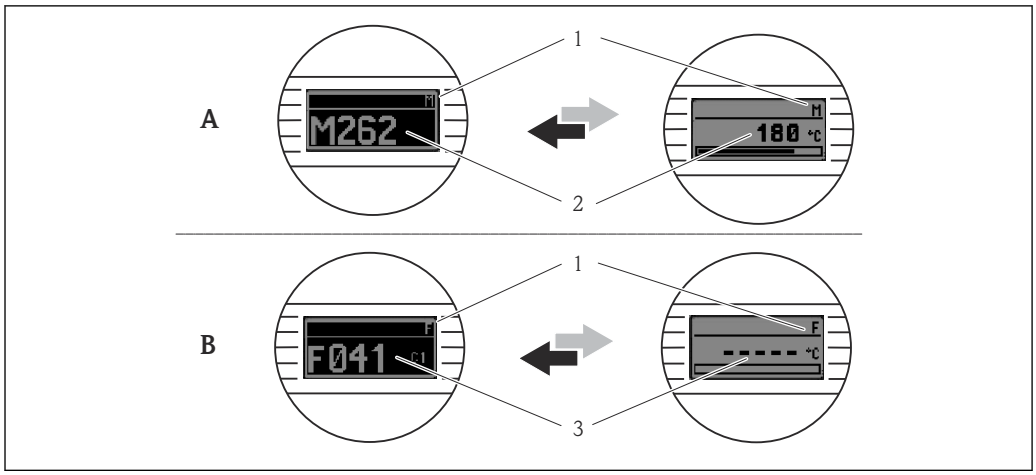
Always start troubleshooting with the checklists below if faults occur after startup or during operation. The checklists take you directly (via various queries) to the cause of the problem and the appropriate remedial actions.

Due to its design, the device cannot be repaired. However, it can be returned for inspection. See the section "Return".

General faults

Fault	Possible cause	Remedy
Device is not responding.	Supply voltage does not match the voltage specified on the nameplate.	Check the voltage at the transmitter directly using a voltmeter and correct.
	Connecting cables are not making contact with the terminals.	Check the electrical contact between the cable and terminals and correct if necessary.
	Electronics faulty.	Replace device.
Measured value is incorrect/ inaccurate.	Incorrect sensor orientation.	Install the sensor correctly.
	Heat conducted by sensor.	Observe the installed length of the sensor.
	Device configuration is incorrect (number of wires).	Change the **Connection type** device function.
	Incorrect RTD configured.	Change the **Sensor type** device function.
	Connection of the sensor (number of wires or incorrectly connected).	Check that the sensor is connected correctly.
	The cable resistance of the sensor (2-wire) was not compensated.	Compensate the cable resistance.
	Offset incorrectly set.	Check offset.
No communication	Communication cable is not connected.	Check wiring and cables.
	Communication cable is incorrectly attached to the IO-Link master.	

9.2 Diagnostic information on onsite display



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

9.3 Diagnostic information via communication interface

The **Device Status** parameter shows the event category of the active diagnostic message with the highest priority. This category is displayed in the diagnostic list.

Status signals

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event). The status signals are categorized according to NAMUR Recommendation NE 107: F = Failure, C = Function Check, S = Out of Specification, M = Maintenance Required

Alphabetic character	Symbol	Event category	Meaning
F	⊗	Operating error	An operating error has occurred.
C	▽	Service mode	The device is in the service mode (e.g., during a simulation).
S	⚠	Out of specification	The device is being operated outside its technical specifications (e.g., during startup or cleaning processes).
M	◈	Maintenance required	Maintenance is required.

9.3.1 Response to errors

All diagnostic messages are saved in the event logbook and can be called up there.

The device displays warnings and failures via IO-Link. All the device warnings and errors are for information purposes only and do not have a safety function. The faults diagnosed by the device are displayed via IO-Link in accordance with NE 107. A distinction must be made between the following types of diagnostic behavior in this context:

- Warning
  The device continues measuring in the event of warning-type diagnostic behavior. The output signal is not affected (exception: simulation of the process variable is active).
- Alarm
  - The device does **not** continue measuring if this type of fault occurs. The output signal assumes its error status (value in the event of an error - see section 'Overview of diagnostic information').
  - The PDValid Flag indicates that the process data are invalid.
  - The fault state is displayed via IO-Link.

9.3.2 Overview of diagnostic information

Diagnostic message	Diagnostic behavior	IO-Link Event Qualifier	IO-Link Event Code	Extended device status	Device status	Cause	Remedy
F041	Alarm	Error	0x8d3d	36 = Failure	0	Sensor breakage detected	1. Check electrical connection 2. Replace sensor 3. Check configuration of connection type
F043	Alarm	Error	0x8d00	36 = Failure		Sensor short circuit detected	1. Check electrical connection 2. Replace sensor 3. Check configuration of connection type
S047	Warning	Warning	0x1819			Sensor limit reached	1. Check sensor 2. Check process conditions
F201	Alarm	Error	0x8d02	36 = Failure		Electronics faulty	1. Restart device 2. Replace electronics
C401	Warning	Warning	0x181f			Factory reset active	▶ Factory reset in progress, please wait
C402	Warning	Warning	-			Initialization active	▶ Initialization in progress, please wait
F410	Alarm	Error	0x8d0a			Data transfer failed	1. Check connection 2. Repeat data transfer
C411	Warning	Warning	0x1808			Up-/download active	▶ Up-/download in progress, please wait
F419	Alarm	Error	0x1856			Power cycle required	▶ Power cycle device
C485	Warning	Warning	0x181a			Process variable simulation active	▶ Deactivate simulation
C494	Warning	Warning	0x181c			Switch output simulation active	▶ Deactivate switch output simulation
F537	Alarm	Error	0x181d			Configuration	1. Check device configuration 2. Up- and download new configuration
S801	Warning	Warning	0x181e			Supply voltage too low	▶ Increase supply voltage
S804	Warning	Warning	0x1801			Switch output overloaded	1. Increase load resistance at switch output 2. Check output 3. Replace device
S825	Warning	Warning	0x1812			Electronics temperature out of range	1. Check ambient temperature 2. Check process temperature

9.4 Diagnostic list

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

9.5 Event logbook

The diagnostic messages are shown in chronological order in the **Event logbook**. In addition, a timestamp is saved with every diagnostic message. This timestamp is referenced to the operating time counter.

10 Maintenance

10.1 Maintenance work

The device does not require specific maintenance work.

10.2 Cleaning of surfaces not in contact with the medium

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

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

11 Repair

11.1 General notes

Due to its design, the device cannot be repaired.

11.2 Spare parts

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

Type
DIN mounting set (2 screws and springs, 4 lock washers, 1 CDI connector cover)
US mounting set (2 M4 screws and 1 CDI connector cover)

11.3 Return

The requirements for safe device return in the event of service or disposal vary depending on the type of device and national legislation.

1. Refer to the web page for information: https://www.endress.com
2. Log in to the “My Endress+Hauser” customer portal, or register if you don’t have an account yet.
3. Enter the return request directly in the portal and submit all required information and documents.
4. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.
   ↳ Track the order's processing status online.

11.4 Disposal

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

12 Accessories

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

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

12.1 Device-specific accessories

Adapter for DIN rail mounting, clip as per IEC 60715 (TH35) without securing screws
Standard - DIN mounting set (2 screws + springs, 4 securing disks and 1 display connector cover)
US - M4 securing screws (2 M4 screws and 1 CDI connector cover)
Attachable display unit for head transmitter TID10

12.2 Communication-specific accessories

Accessory	Description
FieldPort SFP20	**Mobile configuration tool for all IO-Link devices:** ▪ The FieldPort SFP20 is a USB interface for the configuration of IO-Link devices. The FieldPort SFP20 can be connected to a laptop or tablet via a USB cable. ▪ A point-to-point connection between the laptop and IO-Link devices is possible with the FieldPort SFP20. ▪ M12 connection for IO-Link field devices

IO-Link master BL20	IO-Link master from Turck for DIN rails supports PROFINET, EtherNet/IP and Modbus TCP. With web server for easy configuration.
Field Xpert SMT50	Universal, high-performance tablet PC for device configuration in non-hazardous areas.

12.3 Service-specific accessories

DeviceCare SFE100
DeviceCare is an Endress+Hauser configuration tool for field devices using the following communication protocols: HART, PROFIBUS DP/PA, FOUNDATION Fieldbus, IO/Link, Modbus, CDI and Endress+Hauser Common Data Interfaces.

www.endress.com/sfe100

FieldCare SFE500
FieldCare is a configuration tool for Endress+Hauser and third-party field devices based on DTM technology.
The following communication protocols are supported: HART, WirelessHART, PROFIBUS, FOUNDATION Fieldbus, Modbus, IO-Link, EtherNet/IP, PROFINET and PROFINET APL.

www.endress.com/sfe500

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

www.netilion.endress.com

12.4 Online tools

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

13 Technical data

13.1 Input

Measured variable: Temperature

Measuring range

Resistance thermometer (RTD) as per standard	Description	α	Measuring range limits
IEC 60751:2022	Pt100 (1) Pt1000 (4)	0.003851	−200 to 850 °C (−328 to 1 562 °F) −200 to 500 °C (−328 to 932 °F)
-	Callendar-Van Dusen	-	The measuring range limits are specified by entering the limit values that depend on the coefficients A to C and R0.
	▪ Type of connection: 2-wire, 3-wire or 4-wire connection, sensor current: ≤ 0.3 mA ▪ With 2-wire circuit, compensation of the wire resistance possible (0 to 30 Ω) ▪ With 3-wire and 4-wire connection, sensor wire resistance up to max. 50 Ω per wire		

13.2 Output

Output signal: C/Q (IO-Link or switch output)

Switch output:
- 1 × PNP, NPN or push-pull switch output, configurable
- Switching capacity Ia ≤ 150 mA
- Voltage drop PNP, NPN ≤ 2 V
- Overload protection: The switching current load is automatically tested. The device switches to a safe state if an overload is detected. The diagnostic message **Overload at the switch output** is issued.
- Switch functions:
  - Hysteresis or window function
  - NC contact or NO contact

Failure information: Failure information is generated if the measuring information is missing or not valid. The device displays the three diagnostic messages with the highest priority.

The fault state of the switch output can be configured: On, off, high-impedance.

Damping

Configurable sensor input damping	0 to 120 s
Factory setting	0 s

Protocol-specific data

IO-Link specification	Version 1.1.3
Device ID	0x93FE01
Manufacturer ID	0x0011 (17)
IO-Link Smart Sensor Profile 4.3.1	Supported: ▪ Identification and diagnosis ▪ Measuring and switching sensor, floating point, 1 channel
SIO	Yes

IO-Link transmission rate	COM2; 38.4 kBaud
Minimum cycle time	10 ms
Process data width	6 bytes
IO-Link data storage	Yes
Block configuration	Yes

Switch-on delay

≤ 5 s, until the first valid measured value signal is present

13.3 Power supply

Supply voltage

U = 18 to 30 V_{DC}, protected against reverse polarity

Current consumption

I ≤ 11 mA

Terminals

Choice of screw-type or push-in terminals:

Terminal design	Cable design	Cable cross-section
Screw terminals	Rigid or flexible	≤ 1.5 mm² (16 AWG)
Push-in terminals [1] (Cable design, stripping length = min. 10 mm (0.39 in)	Rigid or flexible	0.2 to 1.5 mm² (24 to 16 AWG)
	Flexible with ferrules (with or without plastic ferrule)	0.25 to 1.5 mm² (24 to 16 AWG)

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

13.4 Performance characteristics

Response time

Response time:

Resistance thermometer (RTD)	≤ 0.5 s

Reference operating conditions

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

Maximum measurement error

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

	Measurement error (±)
in the entire measuring range	0.15 K

Sensor adjustment

Sensor-Transmitter-Matching

The device enables the following method to improve the temperature measurement accuracy of RTD sensors significantly:

Callendar-Van Dusen equation:
$R_T = R_0[1+AT+BT^2+C(T-100)T^3]$

The coefficients A, B and C are used to match the sensor and transmitter in order to improve the accuracy of the measuring system. The coefficients for a standard sensor are specified in IEC 60751. If no standard sensor is available or if greater accuracy is required, the coefficients for each sensor can be determined specifically with the aid of sensor calibration.

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

1-point adjustment (offset)

Shifts the sensor value

Operating influences

Influence of ambient temperature and supply voltage on operation for resistance thermometers (RTD) in the entire measuring range

Description	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change	Supply voltage: Influence (±) per V change
Pt100 (1)	IEC 60751:2022	0.04 °C (0.07 °F)	0.02 °C (0.04 °F)
Pt1000 (4)		0.02 °C (0.03 °F)	0.01 °C (0.02 °F)

Long-term drift (±)		
after 1 year	after 3 years	after 5 years
Based on measured value		
0.05 °C (0.09 °F)	0.06 °C (0.11 °F)	0.07 °C (0.13 °F)

Calculation of the maximum measurement error:
√(Measurement error² + Influence of ambient temperature² + Influence of supply voltage²)

13.5 Environmental conditions

Ambient temperature: −40 to 85 °C (−40 to 185 °F)

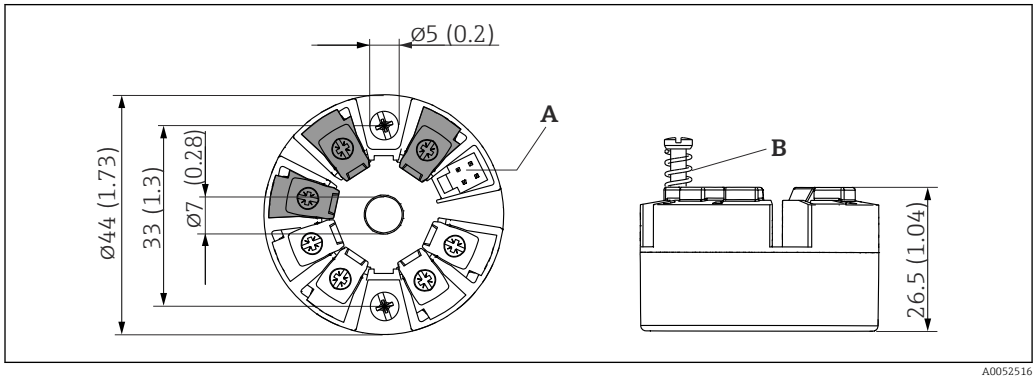
Storage temperature: −50 to 100 °C (−58 to 212 °F)

Operating height: Up to 4 000 m (13 123 ft) above sea level.

Humidity	▪ Condensation: Permitted ▪ Maximum relative humidity: 95 % as per IEC 60068-2-30
Climate class	Climate class C1 as per IEC 60654-1
Degree of protection	Head transmitter with screw-type or push-in terminals: IP 20. In the installed state, it depends on the terminal head used.
Shock and vibration resistance	Vibration resistance according to IEC 60068-2-6: ▪ 5 to 25 Hz, 1.6 mm ▪ 25 to 100 Hz, 4 g Vibration resistance according to IEC 60068-2-27: ▪ 30 g, 18 ms ▪ KTA 3505 (Section 5.8.4)
Electromagnetic compatibility (EMC)	**CE conformity** Electromagnetic compatibility in accordance with all the relevant requirements of the IEC/EN 61326 series and NAMUR Recommendation EMC (NE 21). For details, refer to the Declaration of Conformity. Maximum measurement error <1% of measuring range. Interference immunity as per IEC/EN 61326 series, industrial requirements Interference emission as per IEC/EN 61326 series (CISPR 11), Class B equipment, Group 1 **IO-Link** The requirements of IEC/EN 61131-9 are met in IO-Link mode.
Overvoltage category	Overvoltage category II
Pollution degree	Pollution degree 2

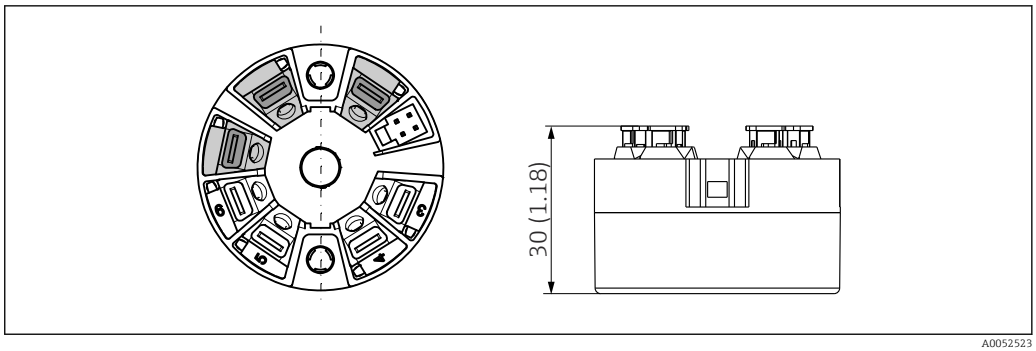
13.6 Mechanical construction

Design, dimensions	Dimensions in mm (in)



9 Version with screw terminals

A Display connection
B Spring travel L ≥ 5 mm (0.2 in) (not for US - M4 securing screws)



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

Weight

40 to 50 g (1.4 to 1.8 oz)

Materials

All the materials used are RoHS-compliant.

- Housing: polycarbonate (PC)
- Terminals:
  - Screw terminals: nickel-plated brass
  - Push-in terminals: tin-plated brass, contact springs 1.4310, 301 (AISI)
- Potting compound: SIL gel

13.7 Certificates and approvals

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

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

MTTF

371 years

The mean time to failure (MTTF) denotes the theoretically expected time until the device fails during normal operation. The term MTTF is used for non-repairable systems.

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