

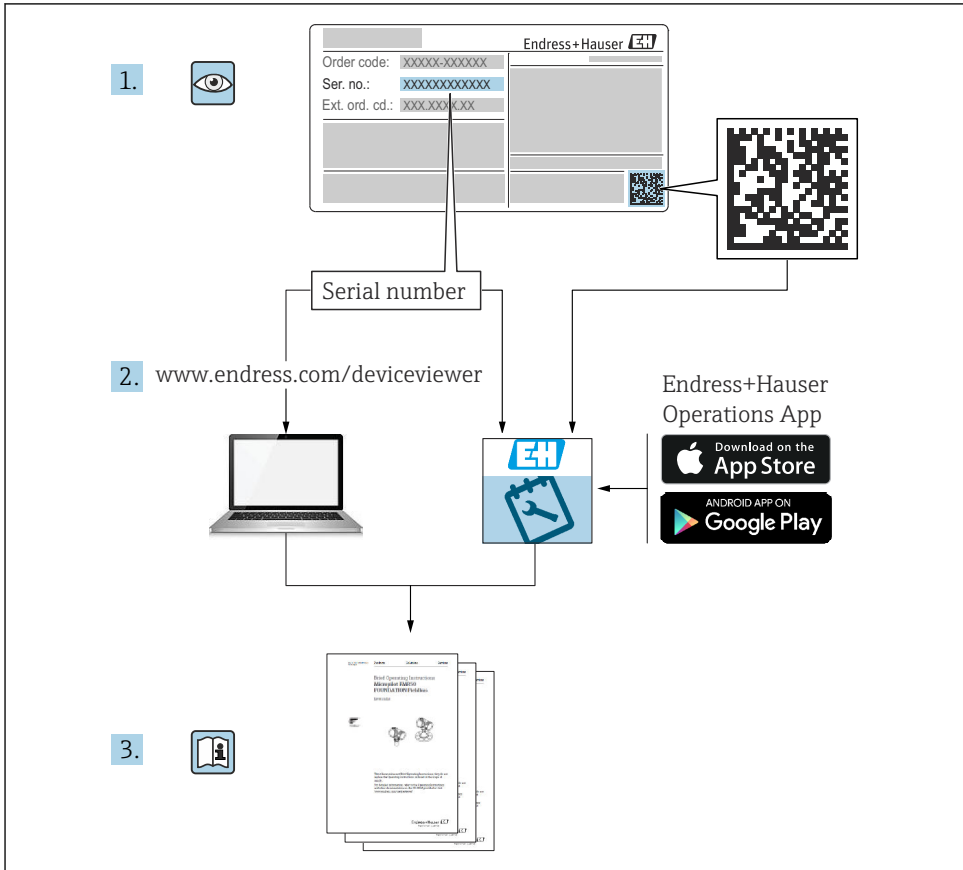
Operating Instructions

iTHERM ModuLine

thermometer

Universal, modular RTD/TC thermometers for a wide range of industrial applications





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1 About this document

These instructions are only valid for the following thermometers in the Endress+Hauser iTHERM ModuLine product family:

Direct installation without a thermowell	Installation with thermowell
TM101	TM121
TM111	TM131
TM112	TM151
	TM152
	TST90

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 Symbols for certain types of information

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

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

1.2.3 Symbols in graphics

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

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 device version:

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 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.
Safety instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions.  The nameplate indicates which Safety Instructions (XA) apply to the device.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent 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 Designated use

The thermometers described here are suitable for temperature measurement in industrial and hygienic applications. Depending on the version, the thermometers can be installed either in the process in direct contact with the medium, or in a thermowell. The thermowell designs can be configured. However, the process parameters (temperature, pressure, density and flow velocity) must be taken into account. It is the responsibility of the operator to select the thermometer and thermowell, in particular the material used, to ensure safe operation of the temperature measuring point.

Incorrect use

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

With regard to process media and media used for cleaning, Endress+Hauser will be happy to assist in clarifying the corrosion-resistant properties of wetted materials but gives no guarantee or warranty as to the suitability of the materials.

2.3 Workplace safety

⚠ CAUTION

Extreme temperatures (hot and cold) occur at the thermometer and in the terminal head. There is a risk of burning and damage to property.

- ▶ Wear appropriate protective equipment.

⚠ CAUTION

There is an increased risk of electric shock if working on and with the device with wet hands.

- ▶ Wear appropriate protective equipment.

2.4 Operational safety

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 ensuring that the device is in good working order.

Hazardous area

To avoid danger to individuals or the facility when the device is used in the approval-related area (e.g. explosion protection or safety instrumented systems):

- ▶ Based on the technical data on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area. The nameplate can be found on the side of the device.
- ▶ Observe the specifications in the separate supplementary documentation included as an integral part of these instructions.

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.

Temperature

NOTICE

During operation, heat conduction or heat radiation may cause the temperature in the terminal head to rise.

- ▶ Prevent transmitter or housing from exceeding the operating temperature by using appropriate heat insulation or a suitably long extension neck.

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.

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 measuring device:

- The device label
- Order code with breakdown of the device features on the delivery note
- Enter the serial number on the device label in *W@M Device Viewer* (www.endress.com/deviceviewer): all the information about the measuring device is displayed.
- Enter the serial number on the device label into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the measuring device with the *Endress+Hauser Operations App*: all the information about the measuring 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, e.g. 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 Wetzlar GmbH + Co. KG
Address of manufacturer:	Obere Wank 1, D-87484 Nesselwang or www.endress.com

3.3 Storage and transport

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

Avoid the following environmental influences during storage:

- Direct sunlight
- Proximity to hot objects
- Mechanical vibration
- Aggressive media

Maximum relative humidity: < 95%

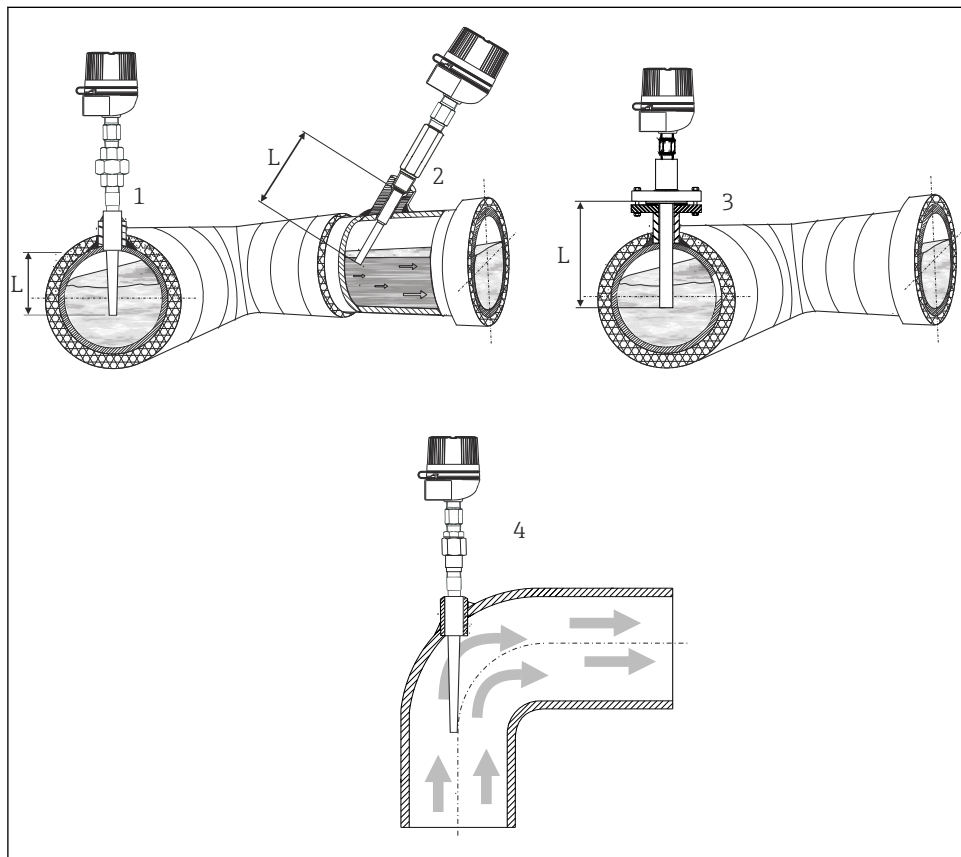


Pack the device for storage and transportation in such a way that it is reliably protected against impact and external influences. The original packaging provides the best protection.

4 Installation

4.1 Installation requirements

Depending on the process connection selected, thermometers can be installed in three positions in pipes or storage tanks. There are no restrictions with regard to orientation. 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 in the process connection.



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1 Installation examples

- 1 General orientation. In pipes with a small cross-section, the sensor tip should reach or extend slightly past the center axis of the pipe (= L).
- 2 Angled orientation
- 3 Straight orientation
- 4 Orientation in pipe elbow

The immersion length of the thermometer can influence the measurement accuracy. If the immersion length is too small, then measurement errors are caused by heat conduction via the process connection and the container wall. Therefore, if installing in a pipe, the immersion length should ideally correspond to half of the pipe diameter. Another possibility is to install the thermometer at an angle (see 2 and 4). When determining the immersion length, all the parameters of the thermometer and of the process medium to be measured must be taken into account (e.g. flow velocity, process pressure).

- Installation options: Pipes, tanks or other plant components
- Recommended minimum immersion depth: 80 to 100 mm (3.15 to 3.94 in)
The immersion length should be at least eight times the thermowell diameter. Example: Thermowell diameter 12 mm (0.47 in) x 8 = 96 mm (3.8 in).
- ATEX certification: Observe the installation instructions in the Ex documentation!



When using the device in a potentially explosive atmosphere, the relevant national standards and regulations as well as the safety instructions or installation regulations must be observed.



Other types of installation are possible. The manufacturer will advise on the correct design of the measuring point.

4.2 Installing the thermometer



Pay attention to whether the thermometer may be installed directly in the process or whether a thermowell must be used.

See Technical Information for the relevant thermometer.

To install, proceed as follows:

- The permitted loading capacity of the process connections can be found in the relevant standards.
- The process connection and compression fitting must comply with the maximum specified process pressure.
- Make sure that the device is installed and secured before applying the process pressure.
- Adjust the loading capacity of the thermowell in accordance with the process conditions. It may be necessary to calculate the static and dynamic loading capacity.



It is possible to check the mechanical loading capacity as a function of the installation and process conditions online using the Sizing Thermowell calculation tool in the Endress+Hauser 'Applicator' online tool: www.endress.com/onlinetools

Cylindrical threads

Seals must be used for cylindrical threads. In the case of combined thermometer and thermowell assemblies, these seals are already installed (if ordered). It is the responsibility of the system operator to verify the suitability of this seal with regard to the operating conditions, and to replace it with a suitable seal. The seals must be replaced following disassembly. All threads must be firmly tightened; use appropriate tightening torques.

Tapered threads

The operator must verify if additional sealing by means of PTFE tape, hemp or an additional welded seam, for example, is necessary in the case of NPT threads or other tapered threads.

Flange

When using flange connections, the flange of the thermowell must match the counter-flange on the process side. The seals used must be suitable for the process and for the flange geometries. Use the appropriate tightening torques for the installation.

Weld-in thermowells

Thermowells for welding in can be welded directly into the pipe or vessel wall, or secured using a welding socket. The specifications on the relevant material data sheets and the applicable guidelines and standards regarding welding procedures, heat treatment, welding fillers, etc. must be observed.

CAUTION

Incorrectly designed, faulty or leaking welding seams may lead to uncontrolled discharge of the process medium.

- ▶ Welding activities must be performed by qualified technical personnel only.
- ▶ When designing the welded seam, the requirements arising from the process conditions must be taken into account.

Installation instructions for electrical thermometers with ceramic thermowell

NOTICE

Ceramic thermowell materials are usually only partially resistant to rapid changes in temperature. A temperature shock may lead to stress cracks in the thermowell.

- ▶ Higher process temperatures require a lower insertion speed. Thermocouples with ceramic thermowells must be pre-heated prior to installation in the hot process, and immersed slowly.
- ▶ Ceramic thermowells must be protected against mechanical loads.
- ▶ When installed horizontally, mechanical shocks or bending stress caused by the weight of the thermowell itself must be avoided.
- ▶ Depending on the material, diameter, length and design, additional support must be provided when installed horizontally.



Problems with bending stress apply to metallic thermowells too. Vertical installation is preferable.



Replace the measuring insert in accordance with EA01014T only.

Installation instructions for thermometers for installation in existing thermowells on site

Pay attention to the following points when installing thermometers in existing thermowells:

NOTICE

Incorrect installation may lead to inaccurate measurement.

- ▶ The measuring insert should be spring-loaded to ensure reliable contact between the insert and the tip of the thermowell (use iTHERM ModuLine TM131 instead of iTHERM ModuLine TM111).
- ▶ The length of the measuring insert must match the length of the thermowell. Consider the required spring loading.

In order to simplify delivery and to avoid transport damage, measuring inserts of thermometers without a thermowell are delivered coiled from a certain length. At best, the measuring inserts are inserted from the coil into the thermowell without straightening them.

However, if it is necessary, proceed as follows when straightening the insert:

- Disconnect the connection leads before straightening.
- Ensure that the connection leads in the terminal head are not damaged, especially when using rotating devices.
- Straighten the measuring insert.

The measuring insert is straightened. It can be inserted into the thermowell.

4.3 Post-installation check

☐	Is the device undamaged (visual inspection)?
☐	Is the device correctly secured?
☐	Does the device correspond to the specifications at the measuring point, e.g. Ambient temperature, measuring range?

5 Electrical connection

NOTICE

Risk of short-circuit – may cause the device to malfunction.

- Check for damage to cables, wires and connection points.

Terminal assignment

⚠ WARNING

Risk of injury from the uncontrolled activation of processes!

- Switch off the supply voltage before connecting the device.
- Make sure that downstream processes are not started unintentionally.

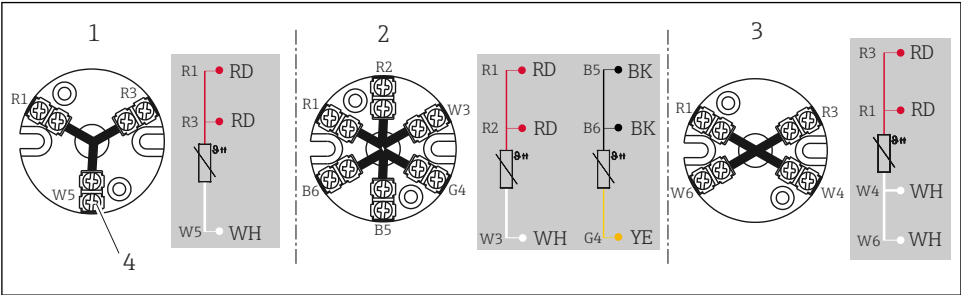
⚠ WARNING

An incorrect connection compromises the electrical safety!

- When using the device in a potentially explosive atmosphere, the installation must comply with the corresponding national standards and regulations as well as the safety instructions.
- All data relating to explosion protection is contained in the separate Ex documentation. The Ex documentation is supplied as standard with all Ex-systems.

 Pay attention to the respective Technical Information when connecting the transmitter electrically!

5.1 **Wiring diagram for RTD**



2 *Mounted ceramic terminal block*

- 1 3-wire
- 2 2x3-wire
- 3 4-wire
- 4 Outside screw

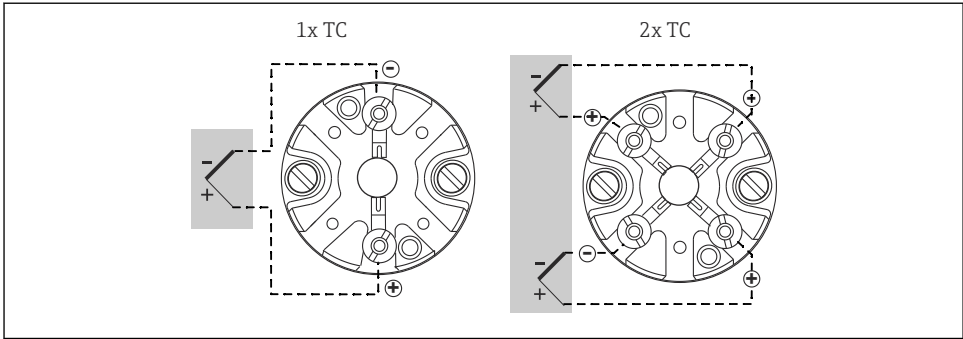
5.2 **Wiring diagram for TC**

Thermocouple wire colors

As per IEC 60584	As per ASTM E230
■ Type J: black (+), white (-) ■ Type K: green (+), white (-) ■ Type N: pink (+), white (-)	■ Type J: white (+), red (-) ■ Type K: yellow (+), red (-) ■ Type N: orange (+), white (-)

Thermocouple wire colors

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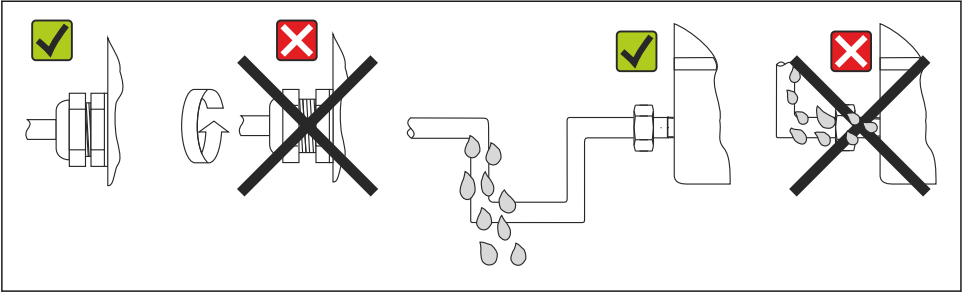
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■ 3 Installed ceramic terminal block for thermocouples.

5.3 Ensuring the degree of protection

The device meets all of the requirements in accordance with the degree of protection indicated on the nameplate. To ensure that the degree of protection of the housing is maintained following installation in the field or after servicing, compliance with the following points is mandatory:

- The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- All housing screws and screw caps must be firmly tightened.
- The connecting cables used must have the specified external diameter (e.g. M20x1.5, cable diameter 5 to 9 mm (0.2 to 0.35 in)).
- Firmly tighten the cable gland, and use it only in the specified clamping area (the cable diameter must be appropriate to the cable gland).
- The cables must loop down before they enter the cable gland ("water trap"). This means that any moisture that may form cannot enter the gland. The device must be installed so that the cable glands are not facing upwards.
- Do not twist the cables, and use only round cables.
- Replace unused cable glands with a dummy plug (included in the scope of delivery).
- Do not remove the grommet from the cable gland.
- Repeated opening/closing of the device is possible but has a negative impact on the degree of protection.



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 4 Connection tips to retain IP67 protection

5.4 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?	
Do the cables have adequate strain relief?	
Are the power supply and signal cables connected correctly?	--
Are all the screw terminals firmly tightened and have the push-in terminal connections been checked?	--
Are all the cable entries installed, tightened and leak-tight?	--

6 Operation options

 See the technical documentation for the specific transmitter.

7 Commissioning

7.1 Switching on the device

After the electrical connection, switch on the supply voltage. During the switch-on procedure, the transmitter runs through internal test functions. Depending on the type of transmitter selected, the device operates after 5 to 33 s. Normal measuring mode commences as soon as the switch-on procedure is completed.

7.2 Configuring the device



See the technical documentation for the specific transmitter.

8 Maintenance

No special maintenance work is required for the device.

8.1 Cleaning

WARNING

Risk of explosion! Static charge in the potentially explosive atmosphere.

- ▶ Do not clean with a dry cloth in potentially explosive atmospheres.

8.1.1 Cleaning of surfaces not in contact with the medium

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



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

8.1.2 Cleaning of surfaces in contact with the medium

Note the following for cleaning and sterilization in place (CIP/SIP):

- Use only cleaning agents to which the materials in contact with the medium are sufficiently resistant.
- Observe the permitted maximum medium temperature.

8.2 Endress+Hauser services

Service	Description
Calibration	RTD measuring inserts may drift depending on the application. Regular recalibration to verify accuracy is recommended. The calibration can be performed by Endress+Hauser or by qualified specialist staff using calibration devices on site.

9 Repair

9.1 General notes

To repair the device, individual components, e.g. terminal head, detachable neck tube, thermowell, transmitter, can be replaced by trained specialist personnel of the system operator.

9.2 Spare parts

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

9.3 Return

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

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

9.4 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.

10 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**.

11 Technical data

11.1 Input

11.1.1 Measured variable

Temperature (temperature-linear transmission behavior)

11.1.2 Measuring range

Depends on the type of sensor used

Sensor type	Measuring range
Pt100 thin film (TF), basic	-50 to +200 °C (-58 to +392 °F)
Pt100 thin film (TF), iTHERM QuickSens	-50 to +200 °C (-58 to +392 °F)
Pt100 thin film (TF), standard	-50 to +400 °C (-58 to +752 °F)
Pt100 thin film (TF), iTHERM StrongSens, vibration-resistant > 60 g	-50 to +500 °C (-58 to +932 °F)
Pt100 wire wound (WW), extended measuring range	-200 to +600 °C (-328 to +1 112 °F)
Thermocouple TC, type J	-40 to +750 °C (-40 to +1 382 °F)
Thermocouple TC, type K	-40 to +1 100 °C (-40 to +2 012 °F)
Thermocouple TC, type N	

11.2 Output

11.2.1 Output signal

The measured values can be transmitted in two ways:

- Via directly-wired sensors: sensor measured values are forwarded without an iTEMP transmitter.
- By selecting the appropriate iTEMP transmitter via all common protocols.

 All iTEMP transmitters are mounted directly in the terminal head and wired with the sensory mechanism.

11.3 Power supply

11.3.1 Supply voltage

$U = \max. 9 \text{ to } 42 \text{ V}_{\text{DC}}$, depending on the iTEMP temperature transmitter used.

11.3.2 Current consumption

$I \leq 23 \text{ mA}$, depending on the iTEMP temperature transmitter used.

11.3.3 Terminals

iTEMP head transmitters fitted with push-in terminals unless screw terminals are explicitly selected, DualSeal is selected or a double sensor is installed.

Terminal design	Cable design	Cable cross-section
Screw terminals	Rigid or flexible	$\leq 1.5 \text{ mm}^2$ (16 AWG)
Push-in terminals (cable version, stripping length = min. 10 mm (0.39 in))	Rigid or flexible	0.2 to 1.5 mm^2 (24 to 16 AWG)
	Flexible with wire end ferrules with/without plastic ferrule	0.25 to 1.5 mm^2 (24 to 16 AWG)



Ferrules must be used with push-in terminals and when using flexible cables with a cable cross-section of $\leq 0.3 \text{ mm}^2$. Otherwise, the use of ferrules when connecting flexible cables to push-in terminals is not recommended.

11.3.4 Overvoltage protection

To protect against overvoltages in the supply and signal/communication lines for the thermometer electronics, the manufacturer offers surge arresters from the HAW product family.



For further information, see the technical information for the respective surge arrester.

An integrated surge arrester can be selected as an option for the field transmitters. The module protects the electronics from damage from overvoltage. Overvoltage occurring in signal cables (e.g. 4 to 20 mA, communication lines (fieldbus systems) and power supply is diverted to ground. The functionality of the transmitter is not affected as no problematic voltage drop occurs.

Connection data:

Maximum continuous voltage (rated voltage)	$U_C = 36 \text{ V}_{\text{DC}}$
Nominal current	$I = 0.5 \text{ A}$ at $T_{\text{amb.}} = 80^\circ\text{C}$ (176°F)
Surge current resistance - Lightning surge current D1 (10/350 μs) - Nominal discharge current C1/C2 (8/20 μs)	$I_{\text{imp}} = 1 \text{ kA}$ (per wire) $I_n = 5 \text{ kA}$ (per wire) $I_n = 10 \text{ kA}$ (total)
Series resistance per wire	1.8Ω , tolerance $\pm 5 \%$

11.4 Performance characteristics

11.4.1 Reference operating conditions

This data is relevant for determining the measurement accuracy of the iTEMP transmitters used. See technical documentation of the specific iTEMP transmitter.

11.4.2 Maximum measurement error

RTD resistance thermometer as per IEC 60751:

Permissible deviation limits of thermoelectric voltages from the standard characteristic for thermocouples in accordance with IEC 60584 or ASTM E230/ANSI MC96.1.

11.4.3 Influence of ambient temperature

Depending on the iTEMP temperature transmitter used. For details, see the respective Technical Information.

11.4.4 Self-heating

RTD elements are passive resistances that are measured using an external current. This measurement current causes a self-heating effect in the RTD element itself, which in turn creates an additional measurement error. In addition to the measurement current, the size of the measurement error is also affected by the temperature conductivity and flow velocity of the process. This self-heating error is negligible when an Endress+Hauser iTEMP temperature transmitter (very small measurement current) is connected.

11.4.5 Response time

Depending on the iTEMP temperature transmitter used. For details, see the respective Technical Information.

11.4.6 Insulation resistance

- RTD:

Insulation resistance between the terminals and the extension neck, as per IEC 60751 > 100 M Ω at +25 °C, measured with a minimum testing voltage of 100 V_{DC}.

- TC:

Insulation resistance as per IEC 61515 between terminals and sheath material for a test voltage of 500 V_{DC}:

- > 1 G Ω at +20 °C
- > 5 M Ω at +500 °C

11.5 Environment

11.5.1 Ambient temperature range

Terminal head	Temperature in °C (°F)
Without mounted iTEMP head transmitter	Depends on the terminal head used and the cable gland or fieldbus connector  See the technical information for the respective iTHERM thermometer, "Terminal heads" section
With mounted iTEMP head transmitter	-40 to 85 °C (-40 to 185 °F)
With mounted iTEMP head transmitter and display	-30 to +85 °C (-22 to +185 °F)

Tube neck	Temperature in °C (°F)
Quick-fastening iTHERM QuickNeck	-50 to +140 °C (-58 to +284 °F)

11.5.2 Storage temperature

-40 to +80 °C (-40 to +176 °F)

11.5.3 Relative humidity

Depending on the transmitter used. When using iTEMP head transmitters:

- Condensation permitted in accordance with IEC 60 068-2-33
- Max. relative humidity: 95% in accordance with IEC 60068-2-30

11.5.4 Operating height

Up to 4 000 m (13 123 ft) above sea level in accordance with IEC 61010-1

11.5.5 Climate class

Depending on the installed iTEMP transmitter

- Head transmitter: In accordance with EN 60654-1, Class C1
- Field transmitter: In accordance with IEC 60654-1, Class Dx

11.5.6 Degree of protection

Max. IP 66 (NEMA Type 4x encl.)	Depending on the design (terminal head, connector, etc.)
Partly IP 68	Tested in 1.83 m (6 ft) over 24 h

11.5.7 Shock and vibration resistance

The Endress+Hauser inserts exceed the requirements of IEC 60751 with regard to shock and vibration resistance of 3g in a range of 10 to 500 Hz. The vibration resistance of the measuring point depends on sensor type and design:

Sensor type ¹⁾	Vibration resistance for the sensor tip
Pt100 (WW)	≤ 30 m/s² (≤ 3g)
Pt100 (TF) Basic	
Pt100 (TF) Standard	≤ 40 m/s² (≤ 4g)
Pt100 (TF) iTHERM StrongSens	600 m/s² (60g)
Pt100 (TF) iTHERM QuickSens, version: ø6 mm (0.24 in)	600 m/s² (60g)
Pt100 (TF) iTHERM QuickSens, version: ø3 mm (0.12 in)	≤ 30 m/s² (≤ 3g)
Thermocouple TC, type J, K, N	≤ 30 m/s² (≤ 3g)

1) Options depend on product and configuration

11.5.8 Electromagnetic compatibility (EMC)

Electromagnetic compatibility in accordance with all the relevant requirements of the IEC/EN 61326 series and NAMUR Recommendation EMC (NE21). For details refer to the EU Declaration of Conformity.

Maximum measurement error < 1% of the measuring range.

Interference immunity as per IEC/EN 61326 series, industrial requirements

Interference emission as per IEC/EN 61326 series, Class B equipment

11.5.9 Pollution degree

Pollution level 2

11.6 Process

11.6.1 Process temperature range

Depending on the sensor type and the material used,

- Max. -200 to +1 100 °C (-328 to +2 012 °F)
- For TM121: -200 to +650 °C (-328 to +1 202 °F)
- Fast-response thermowell max. -200 to +400 °C (-328 to +752 °F)

11.6.2 Process pressure range

The maximum possible process pressure depends on various influencing factors, such as the design, process connection and process temperature.

Process connection	Standard	Max. process pressure
Weld-in version/ socket weld	-	≤ 500 bar (7 252 psi)
Flange	EN1092-1 or ISO 7005-1	Depending on the flange pressure rating PNxx: 20, 40, 50 or 100 bar at 20 °C (68 °F)
	ASME B16.5	Depending on the flange pressure rating 150, 300, 600, 900/1500 or 2500 psi at 20 °C (68 °F)
	JIS B 2220	Depending on the flange pressure rating 10K
Thread	ISO 965-1 / ASME B1.13M ISO 228-1	■ 140 bar (2 031 psi) at +40 °C (+140 °F) ■ 85 bar (1 233 psi) at +400 °C (+752 °F)
Thread for direct installation	ANSI B1.20.1 DIN EN 10226-1 / JIS B 0203	■ Max. 75 bar (1 088 psi) to +200 °C (+392 °F) for standard thin film and iTHERM QuickSens Pt100 sensors. ■ Max. 50 bar (725 psi) to +400 °C (+752 °F) for all other sensor types.



The highest flow velocity tolerated by the thermometer diminishes with increasing immersion length exposed to the flowing process medium. In addition, it is dependent on the diameter of both the thermometer tip and thermowell, on the type of measuring medium, the process temperature and the process pressure.

It is possible to check the mechanical loading capacity as a function of the installation and process conditions online using the Sizing Thermowell calculation tool in the Endress+Hauser Applicator software: <https://portal.endress.com/webapp/applicator>

11.7 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**.



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Mail: Sales@ainstru.com