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Valid as of version
01.01 (device version)

Operating Instructions
iTEMP TMT31

Temperature transmitter

Endress+Hauser
People for Process Automation

Table of contents

1 About this document

1.1 Document function

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

1.2 Safety Instructions (XA)

When using in hazardous areas, compliance with national regulations is mandatory. Separate Ex-specific documentation is provided for measuring systems that are used in hazardous areas. This documentation is an integral part of these Operating Instructions. The installation specifications, connection data and safety instructions it contains must be strictly observed! Make sure that you use the right Ex-specific documentation for the right device with approval for use in hazardous areas! The number of the specific Ex documentation (XA...) is provided on the nameplate. If the two numbers (on the Ex documentation and the nameplate) are identical, then you may use this Ex-specific documentation.

1.3 Symbols

1.3.1 Safety symbols

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

1.3.2 Symbols for certain types of information

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

Symbol	Meaning
1., 2., 3....	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

1.3.3 Electrical symbols

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

1.3.4 Symbols in graphics

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

1.4 Tool symbols

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

1.5 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. Information on the Safety Instructions (XA) that are relevant for the device is provided on the nameplate.

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 configurable temperature transmitter with a sensor input for resistance thermometers (RTD) or thermocouples (TC). The head transmitter version of the device is intended for mounting in a terminal head (flat face) as per DIN EN 50446. It is also possible to mount the device on a DIN rail using the optional DIN rail clip. The device is also optionally available in a version suitable for DIN rail mounting as per IEC 60715 (TH35).

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

The manufacturer is not liable for damage caused by using the device incorrectly or for purposes for which it was not intended.

The head transmitter must not be operated as a DIN rail substitute in a cabinet by using the DIN rail clip with remote sensors.

2.3 Workplace safety

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

2.4 Operational safety

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

Hazardous area

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

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

NOTICE

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

2.5 Product safety

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

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

2.6 IT security

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

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

3 Incoming acceptance and product identification

3.1 Incoming acceptance

On receipt of the delivery:

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

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

3.2 Product identification

The device can be identified in the following ways:
- 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, 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 Wetzer GmbH + Co. KG
Address of manufacturer:	Obere Wank 1, D-87484 Nesselwang or www.endress.com

3.3 Scope of delivery

The scope of delivery of the device comprises:
- Temperature transmitter
- Mounting material (head transmitter), optional
- Printed version of Brief Operating Instructions in English
- Additional documentation for devices which are suitable for use in the hazardous area (ATEX, CSA) , such as Safety Instructions (XA...)

3.4 Storage and transport

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

When storing and transporting the device, pack it so that it is reliably protected against impact. The original packaging provides the best protection.

Avoid the following environmental influences during storage:
- Direct sunlight
- Proximity to hot objects
- Mechanical vibration
- Aggressive media

Storage temperature
- Head transmitter: −50 to +100 °C (−58 to +212 °F)
- DIN rail transmitter: −50 to +100 °C (−58 to +212 °F)

3.5 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**.

4 Mounting

4.1 Mounting requirements

4.1.1 Dimensions

The device dimensions can be found in the "Technical data" section of the Operating Instructions.

4.1.2 Mounting location

- Head transmitter:
  In the terminal head, flat face, as per DIN EN 50446, direct mounting on insert with cable entry (middle hole 7 mm).
- DIN rail transmitter:
  Designed for mounting on a DIN rail (IEC 60715 TH35).

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 accessory.

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

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

NOTICE

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

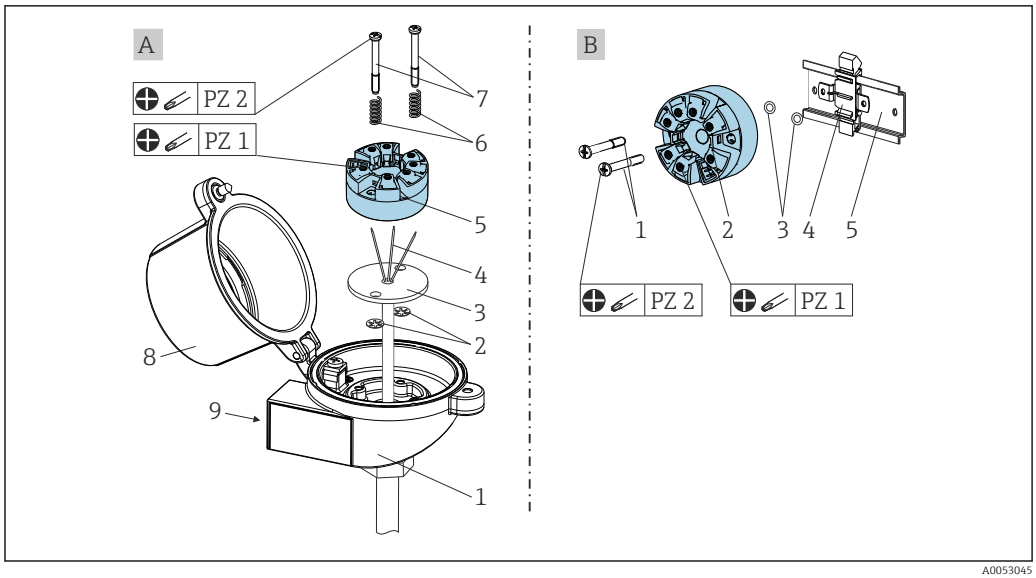
- ▶ If the DIN rail transmitter is mounted on the DIN rail without any adjacent devices, this may result in deviations of up to ±1.3 °C. Greater deviations may arise if the DIN rail device is mounted in series between other DIN rail devices.

4.2 Mounting the device

4.2.1 Mounting the head transmitter

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

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



1 Head transmitter mounting

A Terminal head, flat face, as per DIN EN 50446, direct mounting 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)

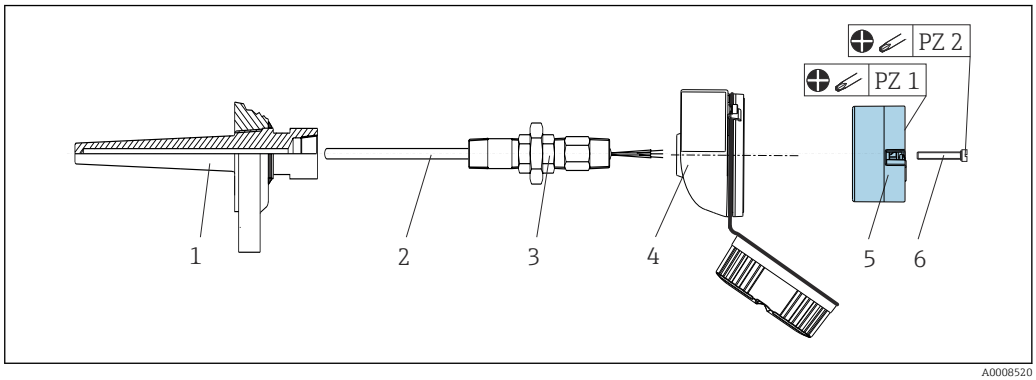
A	Mounting in a terminal head (terminal head flat face as per DIN 43729)
1	Terminal head
2	Snap rings
3	Insert
4	Connection wires
5	Head transmitter
6	Mounting springs
7	Mounting screws
8	Terminal head cover
9	Cable entry

Procedure for mounting in a terminal head, Fig. A:

1. Open the terminal head cover (8) on the terminal head.
2. Guide the connection wires (4) of the insert (3) through the center hole in the head transmitter (5).
3. Fit the mounting springs (6) on the mounting screws (7).
4. Guide the mounting screws (7) through the side boreholes of the head transmitter and the insert (3). Then fix both mounting screws with the snap rings (2).
5. Then tighten the head transmitter (5) along with the insert (3) in the terminal head.
6. After wiring , close the terminal head cover (8) tightly again.

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

Mounting typical of North America



2 *Head transmitter mounting*

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

Thermometer design with thermocouples or RTD sensors and head transmitter:

1. Fit the thermowell (1) on the process pipe or the container wall. Secure the thermowell according to the instructions before the process pressure is applied.
2. Fit the necessary neck tube nipples and adapter (3) on the thermowell.
3. Make sure sealing rings are installed if such rings are needed for harsh environmental conditions or special regulations.
4. Guide the mounting screws (6) through the lateral bores of the head transmitter (5).
5. Position the head transmitter (5) in the terminal head (4) in such a way that the power supply lines (terminals 1 and 2) point to the cable entry.
6. Using a screwdriver, screw down the head transmitter (5) in the terminal head (4).
7. Guide the connection wires of the insert (3) through the lower cable entry of the terminal head (4) and through the middle hole in the head transmitter (5). Wire the connection wires to the transmitter .
8. Screw the terminal head (4), with the integrated and wired head transmitter, onto the ready-mounted nipple and adapter (3).

NOTICE

The terminal head cover must be secured properly to meet the requirements for explosion protection.

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

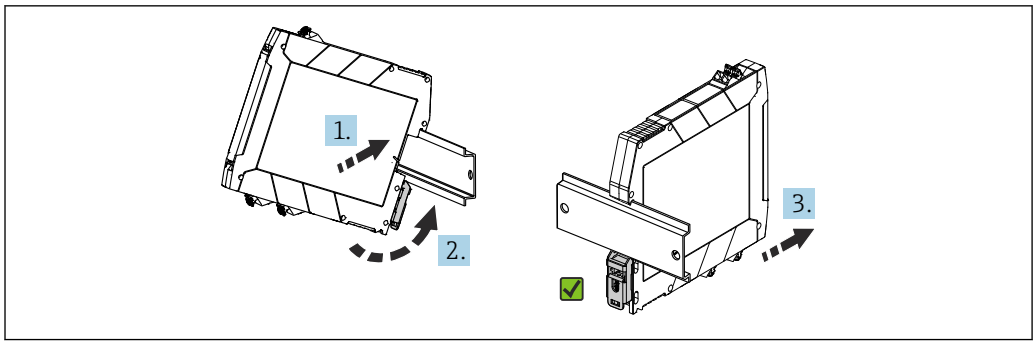
4.2.2 Mounting the DIN rail transmitter

NOTICE

Wrong orientation

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

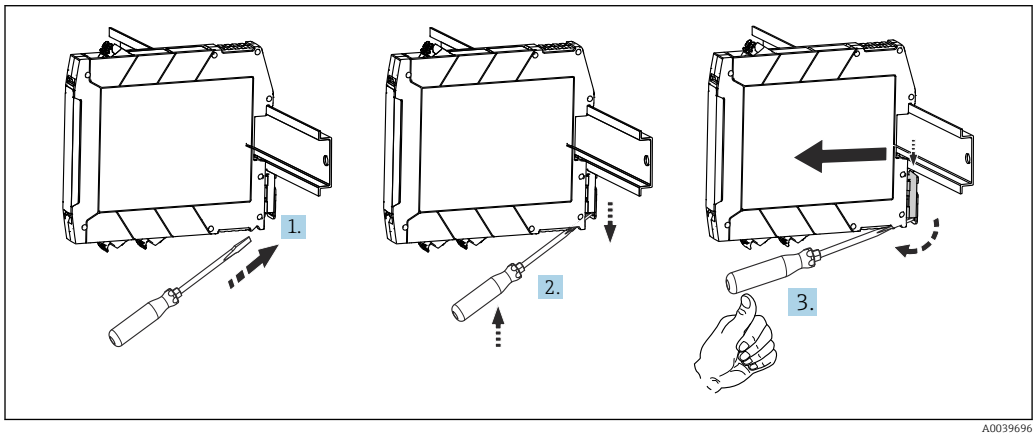
▶ Mount the device vertically and ensure it is correctly oriented.



3 *Mounting the DIN rail transmitter*

1. Position the top DIN rail groove at the top end of the DIN rail.
2. Slide the bottom of the device over the bottom end of the DIN rail until you can hear the lower DIN rail clip click into place on the DIN rail.
3. Pull gently on the device to check if it is correctly mounted on the DIN rail.

If it doesn't move, the DIN rail transmitter is correctly mounted.



4 *Dismantling the DIN rail transmitter*

Dismantling the DIN rail transmitter:

1. Insert a screwdriver into the tab of the DIN rail clip.
2. Use the screwdriver to pull down on the DIN rail clip as shown in the diagram.
3. Hold down the screwdriver to remove the device from the DIN rail.

4.3 Post-mounting check

After installing the device, always perform the following checks:

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

5 Electrical connection

5.1 Connecting requirements

CAUTION

Destruction of parts of the electronics

- Switch off power supply before installing or connecting the device.
- Do not occupy the CDI connection.

For information on the connection data, see the "Technical data" section.

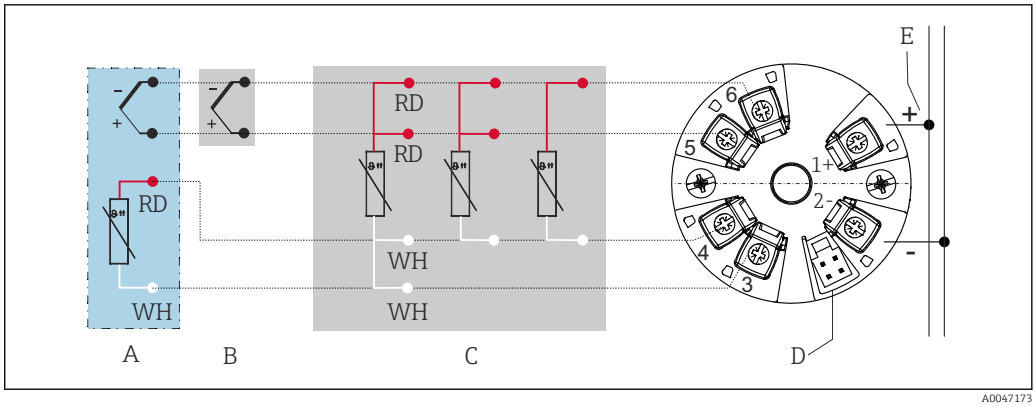
A Phillips head screwdriver is required to wire the head transmitter with screw terminals. Use a flat blade screwdriver for the DIN rail housing version with screw terminals. The push-in terminal version can be wired without any tools.

Proceed as follows to wire a mounted head transmitter:

1. Open the cable gland and the housing cover on the terminal head or the field housing.
2. Feed the cables through the opening in the cable gland.
3. Connect the cables as shown in → 15. If the head transmitter is fitted with push-in terminals, pay particular attention to the information in the "Connecting to push-in terminals" section. → 16
4. Tighten the cable gland again and close the housing cover.

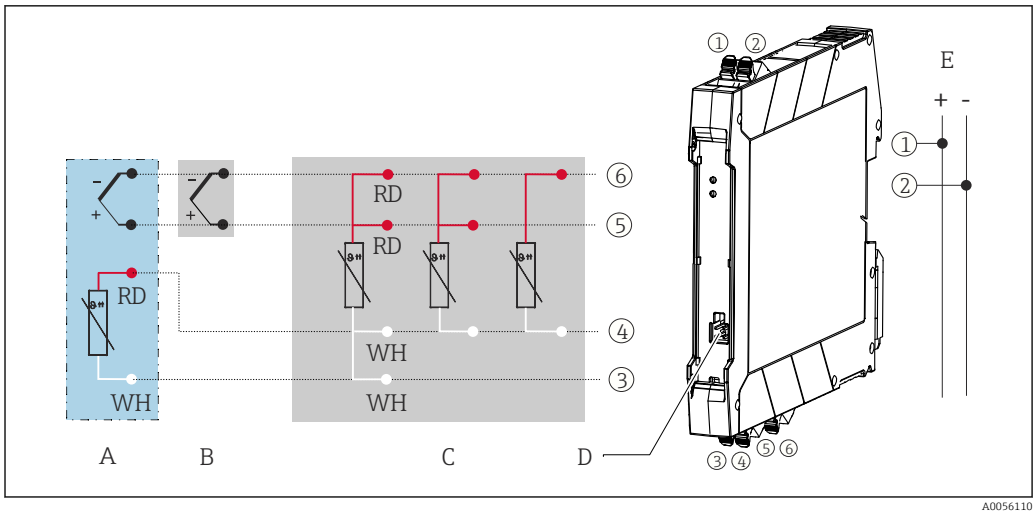
In order to avoid connection errors always follow the instructions in the post-connection check section before commissioning!

5.2 Quick wiring guide



5 *Terminal assignment of head transmitter*

A TC sensor input, external cold junction (CJ) Pt1000
B TC sensor input, internal cold junction (CJ)
C RTD sensor input: 4-, 3- and 2-wire
D CDI interface
E Power supply



6 *Terminal assignment of DIN rail transmitter*

A TC sensor input, external cold junction (CJ) Pt1000
B TC sensor input, internal cold junction (CJ)
C RTD sensor input: 4-, 3- and 2-wire
D CDI interface
E Power supply

For a thermocouple measurement, a 2-wire RTD can be connected to measure the cold junction temperature. This is connected to terminals 3 and 4.

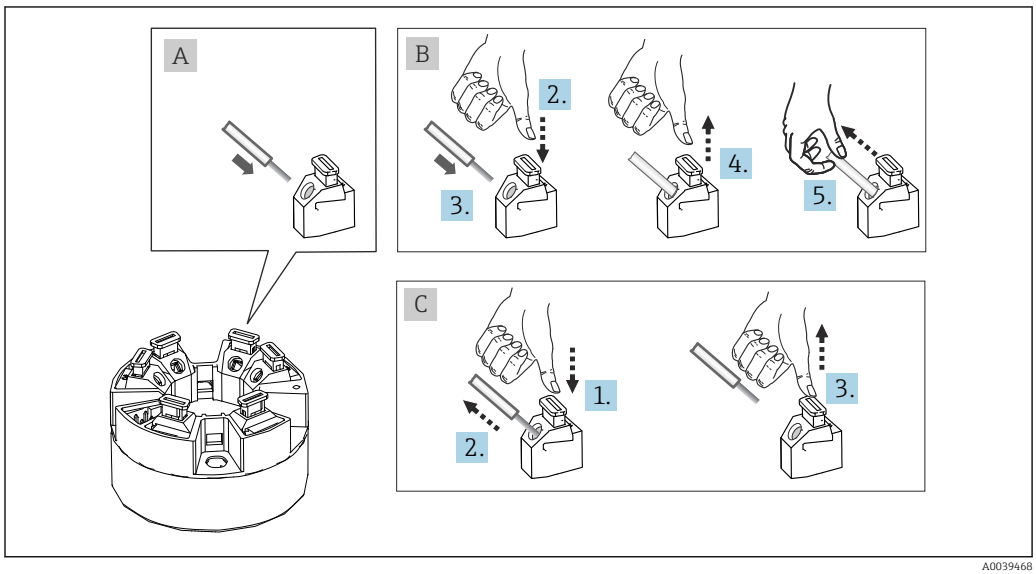
NOTICE

► 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.

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

5.3 Connecting the sensor input

5.3.1 Connecting to push-in terminals



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

Item A, solid wire:

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

Item B, fine-strand wire without ferrule:

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

Item C, releasing the connection:

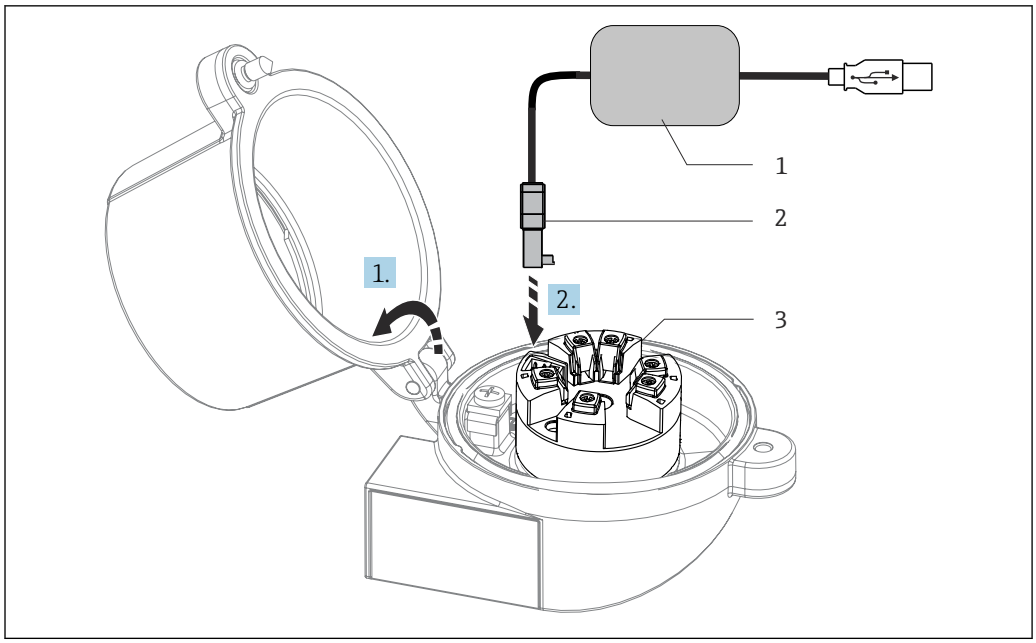
1. Press down on the lever opener.
2. Remove the wire from the terminal.
3. Release lever opener.

5.4 Connecting the transmitter

Cable specification
The instrument cable is not subject to special requirements, such as shielding. The DIN rail version with RTD input is an exception here; shielded cables must be used in this case.

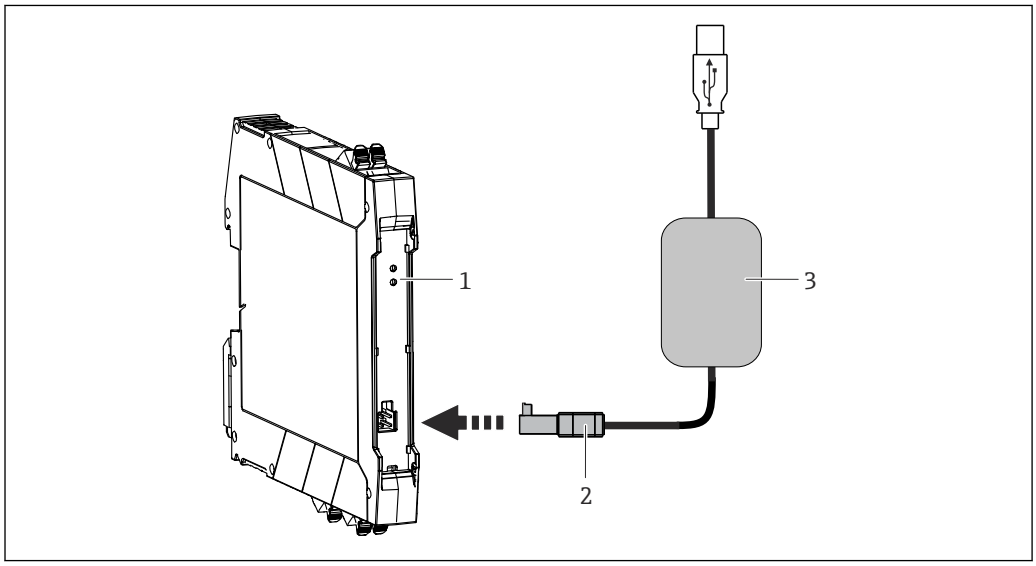
Please also observe the general procedure on → 15.

- The terminals for the power supply (1+ and 2-) are protected against reverse polarity.
- Cable cross-section, see the "Technical data", → 35



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

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



9 *Fitting the CDI connector of the configuration kit for configuration, visualization and maintenance of the DIN rail transmitter via PC and configuration software*

1 *DIN rail transmitter*
2 *CDI connector*
3 *Configuration kit with USB port*

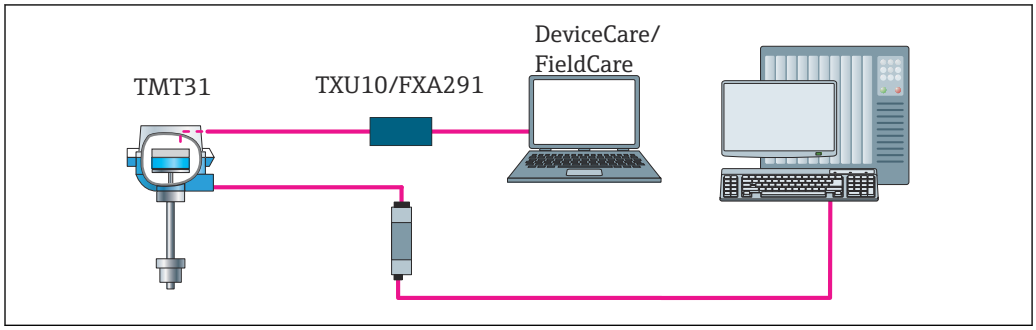
The supply voltage from the communication kit (CDI) is sufficient for configuration - no additional power supply required.

5.5 Post-connection check

Device conditions and specifications	Notes
Are the device or cables free from damage (visual check)?	--
Do the ambient conditions match the device specification (e.g. ambient temperature, measuring range, etc.)?	See 'Technical data'
Electrical connection	**Notes**
Does the supply voltage match the specifications on the nameplate?	U = e.g. 10 to 36 V_{DC}
Do the cables have adequate strain relief?	--
Are the power supply and signal cables correctly connected?	→ 🖹 15
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

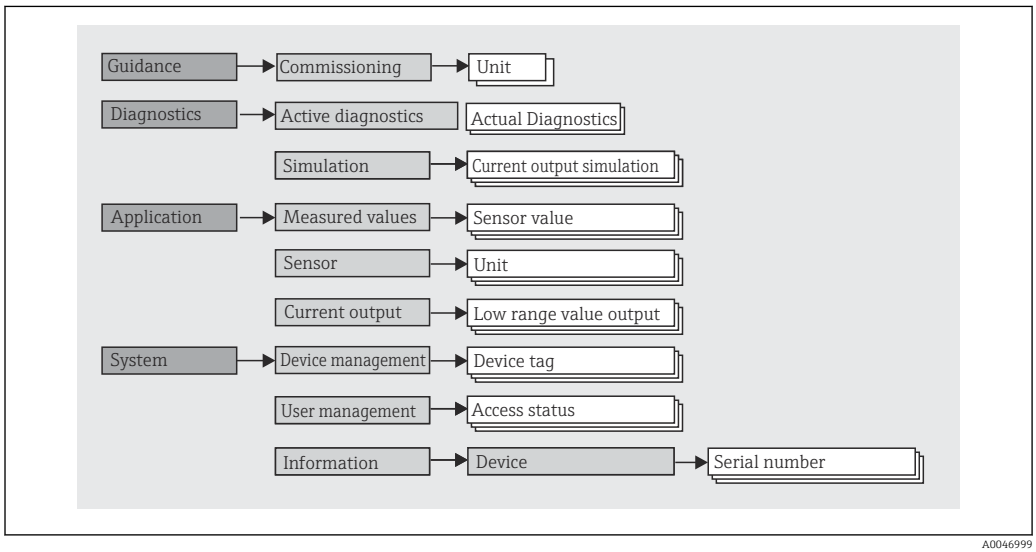
6.1 Overview of operation options



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

6.2 Structure and function of the operating menu

6.2.1 Structure of the operating menu



User roles

Navigation **System → User management**

The role-based access concept consists of two hierarchical levels for the user and presents the various user roles with defined read/write authorizations derived from the NAMUR shell model.

- **Operator**
  The plant operator can only change settings that do not affect the application - and particularly the measuring path - and simple, application-specific functions that are used during operation. The operator is able to read all the parameters, however.
- **Maintenance**
  The **Maintenance** user role refers to configuration situations: commissioning and process adaptations as well as troubleshooting. It allows the user to configure and modify all available parameters. In contrast to the **Operator** user role, in the Maintenance role the user has read and write access to all the parameters.
- **Changing the user role**
  A user role - and therefore existing read and write authorization - is changed by selecting the desired user role (already pre-selected depending on the operating tool) and entering the correct password when subsequently prompted. When a user logs out, system access always returns to the lowest level in the hierarchy. A user logs out by actively selecting the logout function when operating the device.
- **As-delivered state**
  The **Operator** user role is not enabled when the device is delivered from the factory, i.e. the **Maintenance** role is the lowest level in the hierarchy ex-works. This state makes it possible to commission the device and make other process adaptations without having to enter a password. Afterwards, a password can be assigned for the **Maintenance** user role to protect this configuration. If the option *Configuration locked when delivered* was selected during device configuration, the device is set to the **Operator** user role when delivered. It is therefore not possible to change the configuration. The delivery password stored can be reset and reassigned.
- **Password**
  The **Maintenance** user role can assign a password in order to restrict access to device functions. This activates the **Operator** user role, which is now the lowest hierarchy level where the user is not asked to enter a password. The password can only be changed or disabled in the **Maintenance** user role.

Submenus

Menu	Typical tasks	Content/meaning
"Diagnostics"	Troubleshooting: ▪ Diagnosing and eliminating process errors. ▪ Error diagnostics in difficult cases. ▪ Interpretation of device error messages and correcting associated errors.	Contains all parameters for detecting and analyzing errors: ▪ **Active diagnostics** Displays the error message that is currently active ▪ **"Current output simulation" submenu** Used to simulate output values.
"Application"	Commissioning: ▪ Configuration of the measurement. ▪ Configuration of data processing (scaling, linearization, etc.). ▪ Configuration of the analog measured value output. Tasks during operation: Reading measured values.	Contains all the parameters for commissioning: ▪ **"Measured values" submenu** Contains all the current measured values ▪ **"Sensor" submenu** Contains all the parameters for configuring the measurement ▪ **"Output" submenu** Contains all the parameters for configuring the analog current output
"System"	Tasks that require detailed knowledge of the system administration of the device: ▪ Optimum adaptation of the measurement for system integration. ▪ User and access administration, password control ▪ Information for device identification	Contains all higher-level device parameters that are assigned to system, device and user management. ▪ **"Device management" submenu** Contains parameters for general device management ▪ **"User management" submenu** Parameters for access authorization, password assignment, etc. ▪ **"Information" submenu** Contains all the parameters for the unique identification of the device

6.3 Access to the operating menu via the operating tool

The Endress+Hauser FieldCare and DeviceCare operating tools are available to download (https://www.software-products.endress.com) or can be found on the data storage medium, which you can obtain from your local Endress+Hauser Sales Center.

6.3.1 DeviceCare

Function scope

DeviceCare is a free configuration tool for Endress+Hauser devices. It supports devices with the following protocols, provided a suitable device driver (DTM) is installed: HART, PROFIBUS, FOUNDATION Fieldbus, Ethernet/IP, Modbus, CDI, ISS, IPC and PCP. The 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 information in the "System integration" section → 24

Establishing a connection

Example: CDI communication kit TXU10 and FXA291 (USB)

1. Make sure that the DTM library is updated for all the connected devices (e.g. FXA29x, TMTxy).
2. Start DeviceCare and connect the device via the **Automatic** button.
   ↳ The device is detected automatically.

When transmitting the device parameters following offline parameter configuration, the password for **Maintenance** must first be entered in the **System -> User administration** menu, if specified.

6.3.2 FieldCare

Function scope

FDT/DTM-based plant asset management tool from Endress+Hauser. It can configure all intelligent field units in a system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. Access is via the HART® protocol, CDI (= Endress+Hauser Common Data Interface). It also supports devices with the following protocols, provided a suitable device driver (DTM) is installed: PROFIBUS, FOUNDATION Fieldbus.

Typical functions:
- Configuration of transmitter parameters
- Loading and saving of device data (upload/download)
- Documentation of the measuring point
- Visualizing the measured value memory and event logbook

For details, see Operating Instructions BA027S/04/xx and BA059AS/04/xx

Source for device description files

See information → 24

Establishing a connection

Example: CDI communication kit TXU10 or FXA291 (USB)

1. Make sure that the DTM library is updated for all the connected devices (e.g. FXA29x, TMTxy).
2. Start FieldCare and create a project.

3. Right-click **Host PC** Add device...
   ↳ The **Add New Device** window opens.
4. Select the **CDI Communication FXA291** option from the list and press **OK** to confirm.
5. Double-click **CDI Communication FXA291** DTM.
   ↳ Check whether the correct modem is connected to the serial interface connection.
6. Right-click **CDI Communication FXA291** and in the context menu select the **Create network** option.
   ↳ The connection to the device is established.

When transmitting the device parameters following offline parameter configuration, the password for **Maintenance** must first be entered in the **System -> User administration** menu, if specified.

7 System integration

7.1 Overview of device description files

Version data for the device

Firmware version	01.01.zz	▪ On the title page of the manual ▪ On the nameplate ▪ **Firmware version** parameter System → Information → Device

The suitable device driver software (DD/DTM) for the individual operating tools can be acquired from various sources:
- www.endress.com → Downloads → Search field: Software → Software type: Device driver
- www.endress.com → Products: individual product page, e.g. TMTxy → Documents / Manuals / Software: Device Type Manager (DTM).

The Endress+Hauser FieldCare and DeviceCare operating tools are available to download (https://www.software-products.endress.com) or can be found on the data storage medium, which you can obtain from your local Endress+Hauser Sales Center.

8 Commissioning

8.1 Post-installation check

Before commissioning the measuring point, make sure that all final checks have been carried out:
- "Post-mounting check" checklist→ 11
- "Post-connection check" checklist → 15

8.2 Switching on the transmitter

Once you have completed the post-connection checks, switch on the supply voltage. The transmitter performs a number of internal test functions after power-up.

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

8.3 Configuring the measuring instrument

The starting point is in the **Guidance** menu. Parameter settings that require specific access permissions may be disabled (lock symbol). In order to use a device for the designated application, the first step is to commission the device.

Navigation **Guidance → Commissioning**

The following parameters can be configured:

RTD version:
Unit
Sensor type
Type of connection
2-wire compensation
Lower range value output
Upper range value output
Failure mode

TC version:
Unit
Sensor type
Cold junction
Lower range value output
Upper range value output
Failure mode

In the final section, a password can be defined for the "Maintenance" user role. This is strongly recommended to protect the device against unauthorized access. The following steps describe how to configure a password for the "Maintenance" role for the first time.

Navigation **System → User management**

Access status
Log out
Delete password

1. In the "Access status" field, the **Maintenance** role appears with the two entry fields **Logout** and **Delete password**.

2. **Logout** function:
   Enable the **Logout** entry field.
   ↳ The **Operator** role appears in the "Access status" field. The **Enter access code** entry field is displayed.
3. To return to the **Maintenance** role, enter a four-digit access code, which you have already defined, in this entry field.
   ↳ The **Maintenance** role appears in the "Access status" field.
4. **Delete password** function:
   Enable the **Delete password** entry field.
5. In the **Define software write protection code** entry field, enter a user-defined password that meets the specifications in the online help.
   ↳ The startup screen as described in Step 1 appears.

Once the password has been entered successfully, parameter changes, particularly those that are needed for commissioning, process adaptation/optimization and troubleshooting, can only be implemented in the **Maintenance** user role and if the password is entered successfully.

8.4 Protecting settings from unauthorized access

8.4.1 Software locking

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

The parameters are also protected against modification by logging out of the **Maintenance** user role and switching to the **Operator** role. A lock symbol appears.

To disable the write protection, the user must log on with the **Maintenance** user role via the relevant operating tool.

User role concept → 20

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 action.

The device cannot be repaired due to its design. However, it is possible to send the device in for examination. See the information in the "Return" section.

General faults

Fault	Possible cause	Remedial action
Device is not responding.	Supply voltage does not match the voltage specified on the nameplate.	Check the voltage at the transmitter directly using a voltmeter and correct.
	Connecting cables are not in contact with the terminals.	Ensure electrical contact between the cable and the terminal.
	Electronics unit is defective.	Replace the device.
Output current < 3.6 mA	Signal cable is not wired correctly.	Check wiring.
	Electronics unit is defective.	Replace the device.
	'Low Alarm' failure current is set	Set the failure current to 'High Alarm'.

Error messages in the configuration software
→ 🖹 28

Application errors without status messages for RTD sensor connection

Fault	Possible cause	Remedial action
Measured value is incorrect/ inaccurate	Incorrect sensor orientation.	Install the sensor correctly.
	Heat conducted by sensor.	Observe the installed length of the sensor.
	Device programming is incorrect (number of wires).	Change the **Connection type** device function.
	Device programming is incorrect (scaling).	Change scaling.
	Incorrect RTD configured.	Change the **Sensor type** device function.
	Sensor connection.	Check that the sensor is connected correctly.
	The cable resistance of the sensor (2-wire) was not compensated.	Compensate the cable resistance.
	Offset incorrectly set.	Check offset.
Failure current (≤ 3.6 mA or ≥ 21 mA)	Faulty sensor.	Check the sensor.
	RTD connected incorrectly.	Connect the connecting cables correctly (terminal diagram).
	Device programming is incorrect (e.g. number of wires).	Change the **Connection type** device function.
	Incorrect programming.	Incorrect sensor type set in the **Sensor type** device function. Set the correct sensor type.

Application errors without status messages for TC sensor connection

Fault	Possible cause	Remedial action
Measured value is incorrect/ inaccurate	Incorrect sensor orientation.	Install the sensor correctly.
	Heat conducted by sensor.	Observe the installed length of the sensor.
	Device programming is incorrect (scaling).	Change scaling.
	Incorrect thermocouple type (TC) configured.	Change the **Sensor type** device function.
	Incorrect cold junction set.	Set the correct cold junction .
	Interference via the thermocouple wire welded in the thermowell (interference voltage coupling).	Use a sensor where the thermocouple wire is not welded.
	Offset incorrectly set.	Check offset.
Failure current (≤ 3.6 mA or ≥ 21 mA)	Faulty sensor.	Check the sensor.
	Sensor is connected incorrectly.	Connect the connecting cables correctly (terminal diagram).
	Incorrect programming.	Incorrect sensor type set in the **Sensor type** device function. Set the correct sensor type.

9.2 Diagnostic information via communication interface

Status signals

Letter/ symbol [1]	Event category	Meaning
F	Operating error	An operating error has occurred.
C	Service mode	The device is in service mode (e.g. during a simulation).
S	Out of specification	The device is being operated outside its technical specifications (e.g. during startup or cleaning processes).
M	Maintenance required	Maintenance is required.
N -	Not categorized	

1) As per NAMUR NE107

Diagnostic behavior

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

9.3 Active diagnostics

If several diagnostic events are pending at the same time, only the current diagnostic message is displayed. The status signal dictates the priority in which the diagnostic messages are displayed. The following order of priority applies: F, C, S, M.

9.4 Overview of diagnostic events

Each diagnostic event is assigned a specific diagnostic behavior ex works.

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
041	Sensor breakage detected	1. Check electrical connection 2. Replace sensor 3. Check configuration of connection type	F	Alarm
043	Short circuit	1. Check electrical connection 2. Check sensor 3. Replace sensor or cable	F	Alarm
047	Sensor limit reached	1. Check sensor 2. Check process conditions	S	Warning
145	Compensation reference point	1. Check terminal temperature 2. Check external reference point	F	Alarm
Diagnostic of electronic				
201	Electronics faulty	1. Restart device 2. Replace electronics	F	Alarm
Diagnostic of configuration				
402	Initialization active	Initialization in progress, please wait	C	Warning
410	Data transfer failed	1. Check connection 2. Repeat data transfer	F	Alarm
411	Up-/download active	Up-/download in progress, please wait	C	Warning
435	Linearization faulty	Check linearization	F	Alarm
485	Process variable simulation active	Deactivate simulation	C	Warning
491	Output simulation	Deactivate simulation	C	Warning
531	Factory adjustment missing	1. Contact service organization 2. Replace device	F	Alarm
537	Configuration	1. Check device configuration 2. Up- and download new configuration	F	Alarm
537	Configuration	Check current output configuration	F	Alarm
Diagnostic of process				
801	Supply voltage too low	Increase supply voltage	S	Alarm
825	Operating temperature	1. Check ambient temperature 2. Check process temperature	S	Warning
844	Process value out of specification	1. Check process value 2. Check application 3. Check sensor	S	Warning

9.5 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	Version	Firmware version	Changes	Documentation
12/2021	RTD	01.01.zz	Original firmware	BA02157T/09/EN/01.21
03/2025	RTD	01.01.zz	DIN rail transmitter functions added	BA02157T/09/EN/02.24
03/2025	TC	01.01.zz	Original firmware	BA02157T/09/EN/02.24

10 Maintenance and cleaning

No special maintenance work is required for the device.

10.1 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.

11 Repair

11.1 General notes

Due to its design, the device cannot be repaired.

11.2 Spare parts

For spare parts currently available for the product, see online at:
https://www.endress.com/deviceviewer (→ Enter serial number)

Type	Order code
Standard - DIN mounting set (2 screws and springs, 4 lock washers, 1 CDI connector cover)	71044061
US - M4 mounting set (2 screws and 1 CDI connector cover)	71044062

11.3 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.

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, DIN rail clip as per IEC 60715 (TH35) without securing screws
Standard - DIN mounting set (2 screws + springs, 4 lock washers and 1 CDI connector cover)
US - M4 securing screws (2 M4 screws and 1 CDI connector cover)

12.2 Service-specific accessories

Configuration kit TXU10

Configuration kit for PC-programmable transmitter - FDT/DTM-based plant asset management tool, FieldCare/DeviceCare, and interface cable (4-pin connector) for PC with USB port.

For more information, please refer to: www.endress.com

DeviceCare SFE100	Configuration tool for devices via fieldbus protocols and Endress+Hauser service protocols. DeviceCare is the tool developed by Endress+Hauser for the configuration of Endress+Hauser devices. All smart devices in a plant can be configured via a point-to-point or point-to-bus connection. The user-friendly menus enable transparent and intuitive access to the field devices. For details, see Operating Instructions BA00027S

FieldCare SFE500	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. For details, see Operating Instructions BA00027S and BA00065S

12.3 Online tools

Configurator
Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

The Configurator is available 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 **Configuration**.

Applicator
Software for selecting and sizing Endress+Hauser measuring devices:
- Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections.
- Graphic illustration of the calculation results

Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project.

Applicator is available:
https://portal.endress.com/webapp/applicator

12.4 System components

RN series active barrier

Single- or two-channel active barrier for safe separation of 0/4 to 20 mA standard signal circuits with bidirectional HART transmission. In the signal duplicator option, the input signal is transmitted to two galvanically isolated outputs. The device has one active and one passive current input; the outputs can be operated actively or passively.

For more information, please refer to: www.endress.com

Process indicators from the RIA product family

Easily readable process indicators with various functions: loop-powered indicators for displaying 4 to 20 mAvalues, display of up to four HART variables, process indicators with control units, limit value monitoring, sensor power supply, and galvanic isolation.

Universal application thanks to international hazardous area approvals, suitable for panel mounting or field installation..

For more information, please refer to: www.endress.com

13 Technical data

13.1 Input

Measured variable: Temperature (temperature-linear transmission behavior)

Resistance thermometer (RTD) as per standard	Description	α	Measuring range limits	Min. span
IEC 60751:2008	Pt100 (1) Pt1000 (4)	0.003851	−200 to +850 °C (−328 to +1 562 °F) −200 to +500 °C (−328 to +932 °F)	10 K (18 °F)
JIS C1604:1984	Pt100 (5)	0.003916	−200 to +510 °C (−328 to +950 °F)	10 K (18 °F)
GOST 6651-94	Pt100 (9)	0.003910	−200 to +850 °C (−328 to +1 562 °F)	10 K (18 °F)
-	Pt100 (Callendar van Dusen)	-	The measuring range limits are specified by entering the limit values that depend on the coefficients A to C and R0.	10 K (18 °F)
	▪ Type of connection: 2-wire, 3-wire or 4-wire connection, sensor current: ≤ 0.3 mA ▪ With 2-wire circuit, compensation of wire resistance possible (0 to 30 Ω) ▪ With 3-wire and 4-wire connection, sensor wire resistance up to max. 50 Ω per wire			

Thermocouples as per standard	Description	Measuring range limits		Min. span
IEC 60584, Part 1	Type A (W5Re-W20Re) (30) Type B (PtRh30-PtRh6) (31) Type E (NiCr-CuNi) (34) Type J (Fe-CuNi) (35) Type K (NiCr-Ni) (36) Type N (NiCrSi-NiSi) (37) Type R (PtRh13-Pt) (38) Type S (PtRh10-Pt) (39) Type T (Cu-CuNi) (40)	0 to +2 500 °C (+32 to +4 532 °F) +40 to +1 820 °C (+104 to +3 308 °F) −250 to +1 000 °C (−418 to +1 832 °F) −210 to +1 200 °C (−346 to +2 192 °F) −270 to +1 372 °C (−454 to +2 502 °F) −270 to +1 300 °C (−454 to +2 372 °F) −50 to +1 768 °C (−58 to +3 214 °F) −50 to +1 768 °C (−58 to +3 214 °F) −200 to +400 °C (−328 to +752 °F)	Recommended temperature range: 0 to +2 500 °C (+32 to +4 532 °F) +500 to +1 820 °C (+932 to +3 308 °F) −150 to +1 000 °C (−238 to +1 832 °F) −150 to +1 200 °C (−238 to +2 192 °F) −150 to +1 200 °C (−238 to +2 192 °F) −150 to +1 300 °C (−238 to +2 372 °F) +200 to +1 768 °C (+392 to +3 214 °F) +200 to +1 768 °C (+392 to +3 214 °F) −150 to +400 °C (−238 to +752 °F)	50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F) 50 K (90 °F)
IEC 60584, Part 1 ASTM E230-3 ASTM 988-96	Type C (W5Re-W26Re) (32)	0 to +2 315 °C (+32 to +4 199 °F)	0 to +2 000 °C (+32 to +3 632 °F)	50 K (90 °F)
ASTM 988-96	Type D (W3Re-W25Re) (33)	0 to +2 315 °C (+32 to +4 199 °F)	0 to +2 000 °C (+32 to +3 632 °F)	50 K (90 °F)
DIN 43710	Type L (Fe-CuNi) (41)	−200 to +900 °C (−328 to +1 652 °F)	−150 to +900 °C (−238 to +1 652 °F)	50 K (90 °F)
	▪ Internal cold junction (Pt1000) ▪ External preset value: configurable value −40 to +85 °C (−40 to +185 °F) ▪ Maximum sensor wire resistance 10 kΩ (If the sensor wire resistance is greater than 10 kΩ, an error message is output in accordance with NAMUR NE89.)			

13.2 Output

Output signal

Analog output	4 to 20 mA, 20 to 4 mA (can be inverted)
Galvanic isolation (TC)	U = 1.5 kV AC for 1 minute (input/output)

Failure information: **Failure information as per NAMUR NE43:**

Failure information is created if the measuring information is missing or not valid. The error with the highest priority is displayed.

Underranging	Linear decrease from 4.0 to 3.8 mA
Overranging	Linear increase from 20.0 to 20.5 mA
Failure e.g. sensor failure; sensor short-circuit	≤ 3.6 mA ("low") or ≥ 21 mA ("high"), can be selected

Linearization/transmission behavior

Temperature linear

Filter

1st order digital filter: 0 to 120 s

Network frequency filter: 50/60 Hz (cannot be adjusted)

Protocol-specific data

device description files DTM	Information and files available at: www.endress.com

Switch-on delay

≤ 5 s, until the first valid measured value signal is present at the current output. While switch-on delay = I_a ≤ 3.8 mA

13.3 Power supply

Supply voltage

Values for non-hazardous areas, protected against polarity reversal:
10 V ≤ Vcc ≤ 36 V (standard)

Values for hazardous area, see Ex documentation.

Current consumption

3.5 to 22.5 mA

Terminals

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

Terminal design	Cable design	Cable cross-section
Screw terminals	Rigid or flexible	≤ 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 wire end ferrules with/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

Resistance thermometer (RTD)	0.5 s
Thermocouple (TC)	0.5 s
Cold junction (CJ)	2.0 s

Update time

Approx. 500 ms

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

MV = Measured value

LRV = lower range value of the sensor in question

Measurement error for resistance thermometers (RTD)

	Measurement error (±)	
	Increased accuracy in limited measuring range, −50 to +250 °C (−58 to +482 °F)	in the entire measuring range
RTD	+0.1 °C (+0.18 °F) or 0.07 % of measuring span [1]	+0.15 °C (+0.27 °F) or 0.07% of the measuring span [1]

1) * The larger value is valid

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

Measurement error for thermocouples (TC)

Standard	Description	Measuring range	Measurement error (±)	Measurement error (±)
			Measuring span ≤ 500 K	Measuring span > 500 K
IEC 60584-1 ASTM E230-3	Type A (30)	0 to +2 500 °C (+32 to +4 532 °F)	1.63 °C (2.93 °F)	1.75 °C (2.93 °F) or 0.08% of the measuring span [1]
	Type B (31)	+500 to +1 820 °C (+932 to +3 308 °F)	1.55 °C (2.79 °F)	1.58 °C (2.79 °F) or 0.15 % of measuring span [1]
IEC 60584-1 ASTM E230-3 ASTM E988-96	Type C (32)	0 to +2 000 °C (+32 to +3 632 °F)	0.88 °C (1.58 °F)	1.00 °C (1.58 °F) or 0.06 % of measuring span [1]
ASTM E988-96	Type D (33)		0.81 °C (1.46 °F)	0.92 °C (1.46 °F) or 0.06 % of measuring span [1]
IEC 60584-1 ASTM E230-3	Type E (34)	−150 to +1 000 °C (−238 to +1 832 °F)	0.30 °C (0.54 °F)	0.33 °C (0.54 °F) or 0.05 % of measuring span [1]
	Type J (35)	−150 to +1 200 °C (−238 to +2 192 °F)	0.33 °C (0.59 °F)	0.44 °C (0.59 °F) or 0.04 % of measuring span [1]
	Type K (36)		0.41 °C (0.74 °F)	0.50 °C (0.74 °F) or 0.05 % of measuring span [1]
	Type N (37)	−150 to +1 300 °C (−238 to +2 372 °F)	0.54 °C (0.97 °F)	0.60 °C (0.97 °F) or 0.06 % of measuring span [1]
	Type R (38)	+200 to +1 768 °C (−392 to +3 214 °F)	0.91 °C (1.64 °F)	0.99 °C (1.64 °F) or 0.07 % of measuring span [1]
	Type S (39)	+200 to +1 768 °C (+392 to +3 214 °F)	0.97 °C (1.75 °F)	1.06 °C (1.75 °F) or 0.07 % of measuring span [1]
	Type T (40)	−150 to +400 °C (−238 to +752 °F)	0.42 °C (0.76 °F)	0.43 °C (0.76 °F)
DIN 43710	Type L (41)	−150 to +900 °C (−238 to +1 652 °F)	0.36 °C (0.65 °F)	0.41 °C (0.65 °F) or 0.05 % of measuring span [1]

1) The larger value is valid

Operating influences The measurement error data correspond to 2 σ(Gaussian distribution).

Operating influences of ambient temperature and supply voltage on resistance thermometers (RTD)

Description	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change		Supply voltage: Influence (±) per V change	
		0 to +200 °C (+32 to +392 °F)	Entire measuring range	0 to +200 °C (+32 to +392 °F)	Entire measuring range
Pt100 (1)	IEC 60751:2008	0.02 °C (0.04 °F)	0.04 °C (0.07 °F)	0.01 °C (0.014 °F)	0.02 °C (0.04 °F)
Pt1000 (4)		0.01 °C (0.02 °F)	0.02 °C (0.03 °F)	0.01 °C (0.009 °F)	0.01 °C (0.02 °F)
Pt100 (5)	JIS C1604:1984	0.01 °C (0.03 °F)	0.03 °C (0.05 °F)	0.01 °C (0.011 °F)	0.02 °C (0.03 °F)
Pt100 (9)	GOST 6651-94	0.02 °C (0.04 °F)	0.04 °C (0.07 °F)	0.01 °C (0.014 °F)	0.02 °C (0.04 °F)

Operating influences of ambient temperature and supply voltage on thermocouples (TC)

Description	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change		Supply voltage: Influence (±) per V change	
		Measuring span ≤ 500 K	Measuring span > 500 K	Measuring span ≤ 500 K	Measuring span > 500 K
Type A (30)	IEC 60584-1 ASTM E230-3	0.07 °C (0.126 °F)	0.1 °C (0.18 °F)	0.04 °C (0.07 °F)	0.07 °C (0.13 °F)
Type B (31)		0.04 °C (0.072 °F)	0.07 °C (0.126 °F)	0.03 °C (0.05 °F)	0.05 °C (0.09 °F)
Type C (32)	IEC 60584-1 ASTM E230-3 ASTM E988-96				
Type D (33)	ASTM E988-96				
Type E (34)	IEC 60584-1 ASTM E230-3	0.02 °C (0.036 °F)	0.04 °C (0.072 °F)	0.02 °C (0.04 °F)	0.03 °C (0.05 °F)
Type J (35)					
Type K (36)		0.03 °C (0.05 °F)	0.05 °C (0.09 °F)	0.02 °C (0.04 °F)	0.04 °C (0.07 °F)
Type N (37)					
Type R (38)					
Type S (39)					
Type T (40)		0.02 °C (0.04 °F)	0.03 °C (0.05 °F)	0.01 °C (0.02 °F)	0.02 °C (0.04 °F)
Type L (41)	DIN 43710				

Long-term drift, resistance thermometers (RTD)

Long-term drift (±) [1]		
after 1 year	after 3 years	after 5 years
Based on measured value		
0.05 °C (0.09 °F) or 0.03 % of the measuring span	0.06 °C (0.11 °F) or 0.04 % of the measuring span	0.07 °C (0.13 °F) or 0.05 % of the measuring span

1) The larger value is valid

Long-term drift, thermocouples (TC)

Long-term drift (±) [1]			
	after 1 year	after 3 years	after 5 years
Type A	1.25 °C (2.25 °F) or 0.065 % of the measuring span	1.60 °C (2.88 °F) or 0.085 % of the measuring span	1.75 °C (3.15 °F) or 0.100 % of the measuring span
Type B	1.71 °C (3.078 °F)	2.24 °C (4.032 °F)	2.44 °C (4.392 °F)

Long-term drift (±) [1]			
Type C	0.85 °C (1.53 °F) or 0.055 % of the measuring span	1.08 °C (1.944 °F) or 0.070 % of the measuring span	1.20 °C (2.16 °F) or 0.070 % of the measuring span
Type D	0.97 °C (1.746 °F) or 0.070 % of the measuring span	1.27 °C (2.286 °F) or 0.085 % of the measuring span	1.38 °C (2.484 °F) or 0.100 % of the measuring span
Type E	0.35 °C (0.63 °F) or 0.050 % of the measuring span	0.45 °C (0.81 °F) or 0.055 % of the measuring span	0.50 °C (0.9 °F) or 0.060 % of the measuring span
Type J	0.4 °C (0.72 °F) or 0.050 % of the measuring span	0.53 °C (0.954 °F) or 0.055 % of the measuring span	0.57 °C (1.026 °F) or 0.065 % of the measuring span
Type K	0.48 °C (0.864 °F) or 0.045 % of the measuring span	0.55 °C (0.99 °F) or 0.070 % of the measuring span	0.61 °C (1.098 °F) or 0.070 % of the measuring span
Type N	0.62 °C (1.116 °F) or 0.055 % of the measuring span	0.80 °C (1.44 °F) or 0.070 % of the measuring span	0.86 °C (1.548 °F) or 0.080 % of the measuring span
Type R	1.02 °C (1.836 °F) or 0.080 % of the measuring span	1.31 °C (2.358 °F) or 0.115 % of the measuring span	1.48 °C (2.664 °F)
Type S	1.10 °C (1.98 °F)	1.42 °C (2.556 °F)	1.54 °C (2.772 °F)
Type T	0.41 °C (0.738 °F)	0.53 °C (0.954 °F)	0.58 °C (1.044 °F)
Type L	0.34 °C (0.612 °F) or 0.045 % of the measuring span	0.4 °C (0.72 °F) or 0.065 % of the measuring span	0.47 °C (0.846 °F) or 0.060 % of the measuring span

1) The higher value is valid

Calculation of the maximum measurement error for analog value (current output):
√(Measurement error² + Influence of ambient temperature² + Influence of supply voltage²)

Influence of the cold junction

Pt1000 DIN IEC 60751 Cl. B (internal cold junction with thermocouples TC)

A 2-wire Pt1000 resistor must be used for external cold junction measurement. The Pt1000 must be positioned directly at the sensor terminals of the device, as the temperature difference between the Pt1000 and the terminal must be added to the measurement error of the sensor element and sensor input Pt1000.

Sensor adjustment

Sensor-transmitter-matching

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

Callendar van Dusen coefficients (Pt100 resistance thermometer)
The Callendar van Dusen equation is described as:
$R_T = R_0[1+AT+BT^2+C(T-100)T^3]$

The coefficients A, B and C are used to match the sensor (platinum) and transmitter in order to improve the accuracy of the measuring system. The coefficients for a standard sensor are specified in IEC 751. If no standard sensor is available or if greater accuracy is required, the coefficients for each sensor can be determined specifically with the aid of sensor calibration.

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

Current output adjustment	Correction of the 4 and/or 20 mA current output value.

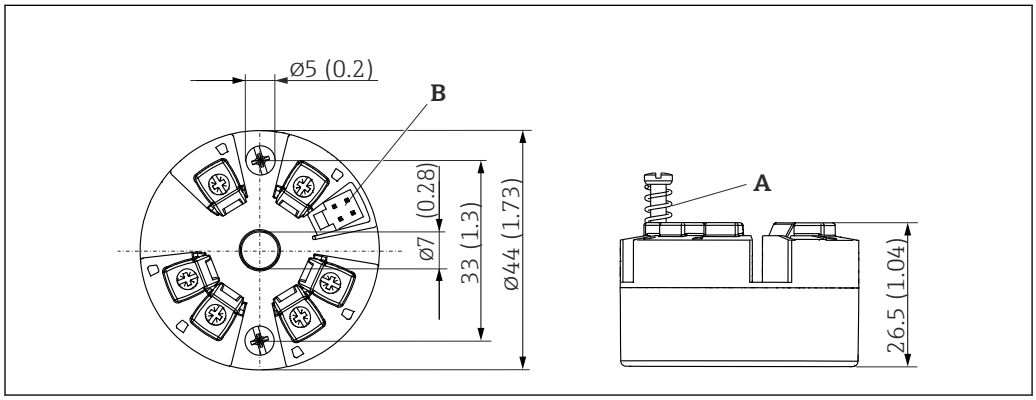
13.5 Environment

Ambient temperature	−40 to +85 °C (−40 to +185 °F),
Storage temperature	−50 to +100 °C (−58 to +212 °F)
Operating altitude	Up to 4,000 m (4,374.5 yards) above sea level.
Humidity	Condensation: ▪ Permitted for head transmitters (95% r.h. according to IEC 60068-2-30) ▪ Not permitted for DIN rail transmitters (95% r.h. IEC 60068-2-78)
Climate class	▪ Head transmitter climate class: C1 (−5 to +45 °C, 5 to 95r.h.) according to IEC 60654-1 ▪ DIN rail transmitter climate class: B2 (−5 to +45 °C, 5 to 95r.h.) according to IEC 60654-1
Degree of protection	▪ Head transmitter with screw terminals: IP 20, head transmitter with push-in terminals: IP 30. When the device is installed, the degree of protection depends on the terminal head or housing used for field mounting. ▪ DIN rail transmitter: IP 20
Shock and vibration resistance	Vibration resistance according to IEC 60068-2-6: ▪ Head transmitter: ▪ 2 to 10 Hz, 10 mm ▪ 10 to 150 Hz at 4 g ▪ DIN rail transmitter: ▪ 2 to 13.2 Hz, 1 mm ▪ 13.2 to 100 Hz at 0.7 g Shock resistance as per KTA 3505 (section 5.8.4 Shock test)
Electromagnetic compatibility (EMC)	**CE conformity** Electromagnetic compatibility in accordance with all the relevant requirements of the IEC/EN 61326 series and NAMUR Recommendation EMC (NE21). For details, refer to the Declaration of Conformity. 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
Overvoltage category	Overvoltage category II
Pollution degree	Pollution degree 2 as per IEC 61010-1

13.6 Mechanical construction

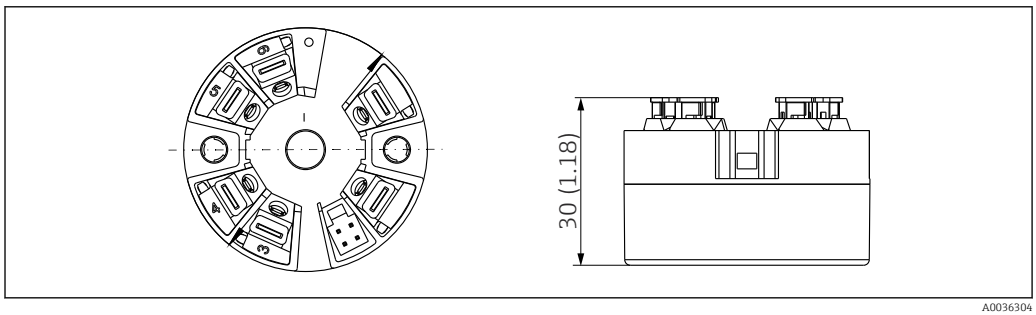
Design, dimensions

Dimensions in mm (in)



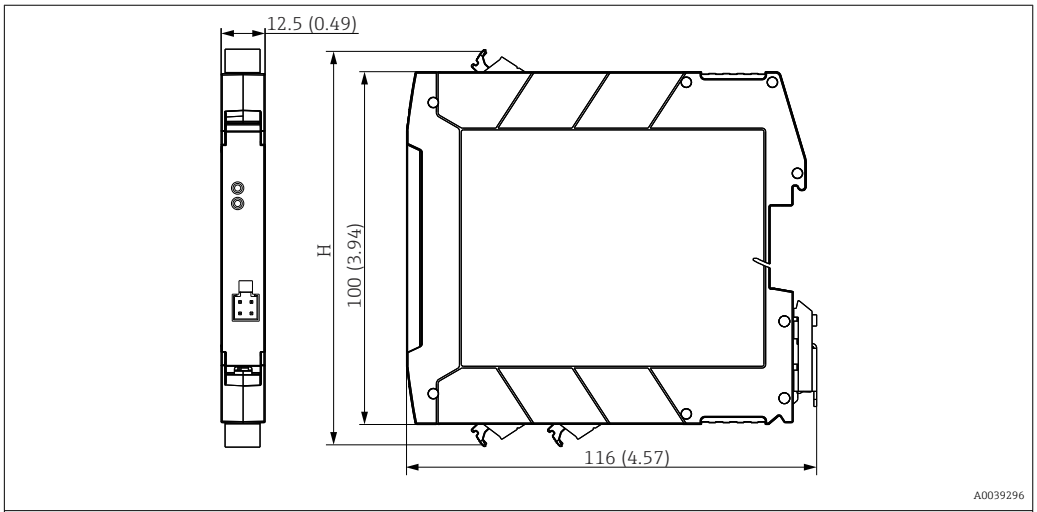
11 Version with screw terminals

A Spring travel L ≥ 5 mm (not for US - M4 securing screws)
B CDI interface for connecting a configuration tool



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

DIN rail transmitter



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

Weight

Head transmitter:

40 to 50 g (1.4 to 1.8 oz)

DIN rail transmitter:

Approx. 100 g (3.53 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

- **RTD input:**
  418 years
- **TC input:**
  350 years

The mean time to failure (MTTF) denotes the theoretically expected time until the device fails during normal operation. The term MTTF is used for systems that cannot be repaired, e.g. temperature transmitters.

13.8 Documentation

- Technical Information 'iTEMP TMT31' with analog output 4 to 20 mA (TI01613T) and associated printed copy of Brief Operating Instructions 'iTEMP TMT31' (KA01540T)
- Description of Device Parameters (GP01182T)
- Supplementary ATEX (XA02682T) and CSA (XA02683T) documentation

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