Technical Information
iTHERM ModuLine TST434B

Modular resistance thermometer for outdoor or indoor ambient temperature measurement

Reliable measurement and high accuracy - Best protection of the measuring electronics from extreme ambient conditions. Suitable for wall mounting.

Application areas

- Outdoor or indoor ambient temperature measurement
- Maximum measuring range: −50 to +150 °C (−58 to +302 °F)
- Degree of protection: IP66/68 (NEMA Type 4x encl.)

Head transmitter

All Endress+Hauser transmitters are available with enhanced measurement accuracy and reliability compared to directly wired sensors. They offer easy customizing, with a choice of the following outputs and communication protocols:

- Analog output 4 to 20 mA
- HART®
- PROFIBUS® PA
- FOUNDATION Fieldbus™
- IO-Link
- PROFINET® over Ethernet-APL/SPE

Your benefits

- Robust terminal heads according to DIN EN 50446 or stable plastic housings offer optimal protection from extreme ambient conditions
- Reliable, long term stable and accurate indoor or outdoor ambient temperature measurement
- Simple and fast wall mounting

Endress+Hauser [EH]

People for Process Automation

Function and system design

| Measuring principle | **Resistance thermometer (RTD)** |

Resistance thermometer (RTD)

These resistance thermometers use a Pt100 temperature sensor according to IEC 60751. The temperature sensor is a temperature-sensitive platinum resistor with a resistance of 100 Ω at 0 ℃ (32 ℉) and a temperature coefficient α = 0.003851 ℃⁻¹.

There are generally two different kinds of platinum resistance thermometers:
- **Wire wound (WW):** Here, a double coil of fine, high-purity platinum wire is located in a ceramic support. This is then sealed top and bottom with a ceramic protective layer. Such resistance thermometers not only facilitate very reproducible measurements but also offer good long-term stability of the resistance/temperature characteristic within temperature ranges up to 600 ℃ (1 112 ℉). This type of sensor is relatively large in size and it is comparatively sensitive to vibrations.
- **Thin film platinum resistance thermometers (TF):** A very thin, ultrapure platinum layer, approx. 1 µm thick, is vaporized in a vacuum on a ceramic substrate and then structured photolithographically. The platinum conductor paths formed in this way create the measuring resistance. Additional covering and passivation layers are applied and reliably protect the thin platinum layer from contamination and oxidation, even at high temperatures.

The primary advantages of thin film temperature sensors over wire wound versions are their smaller sizes and better vibration resistance. A relatively low principle-based deviation of the resistance/temperature characteristic from the standard characteristic of IEC 60751 can frequently be observed among TF sensors at high temperatures. As a result, the tight limit values of tolerance category A as per IEC 60751 can only be observed with TF sensors at temperatures up to approx. 300 ℃ (572 ℉).

Thermocouples (TC)

Thermocouples are comparatively simple, robust temperature sensors which use the Seebeck effect for temperature measurement: if two electrical conductors made of different materials are connected at a point, a weak electrical voltage can be measured between the two open conductor ends if the conductors are subjected to a thermal gradient. This voltage is called thermoelectric voltage or electromotive force (emf.). Its magnitude depends on the type of conducting materials and the temperature difference between the "measuring point" (the junction of the two conductors) and the "cold junction" (the open conductor ends). Accordingly, thermocouples primarily only measure differences in temperature. The absolute temperature at the measuring point can be determined from these if the associated temperature at the cold junction is known or is measured separately and compensated for. The material combinations and associated thermoelectric voltage/temperature characteristics of the most common types of thermocouple are standardized in the IEC 60584 and ASTM E230/ANSI MC96.1 standards.

Measuring system
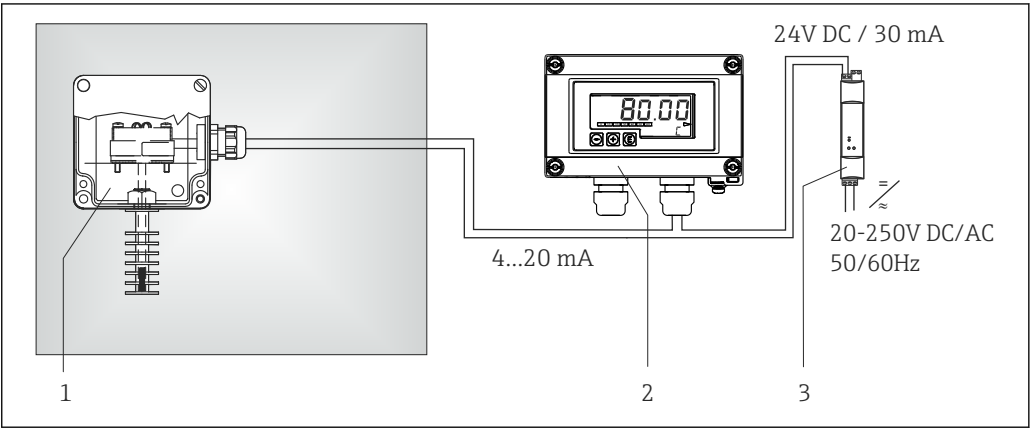
⊞ *1   Application example: indoor ambient temperature monitoring with 4 to 20 mA analog output signal*

1   Wall-mounted thermometer with head transmitter installed.
2   RIA15 process indicator - The process indicator records the analog measuring signal from the head transmitter and shows this on the display. The LC display shows the current measured value in digital form and as a bar graph indicating a limit value violation. The indicator is integrated into the 4 to 20 mA or HART® loop and draws the energy it needs from the loop. Optionally up to 4 HART® process variables of a sensor can be displayed. More information on this can be found in the Technical Information (see "Supplementary Documentation").
3   Active barrier RN221N - The RN221N (24 V DC, 30 mA) active barrier has a galvanically isolated output for supplying voltage to 2-wire transmitters. The universal power supply works with an input supply voltage of 20 to 250 V DC/AC, 50/60 Hz, which means that it can be used in all international power grids. More information on this can be found in the Technical Information (see "Supplementary Documentation").

Input

Measured variable	Temperature (temperature-linear transmission behavior)
Measuring range	Maximum –50 to +150 ℃ (–58 to +302 ℉) according to IEC 60751, depending on the configuration

Output

Output signal

Generally, the measured value can be transmitted in one of two ways:

- Directly-wired sensors - sensor measured values forwarded without a transmitter.
- Via all common protocols by selecting an appropriate Endress+Hauser iTEMP® temperature transmitter. All the transmitters listed below are mounted directly in the terminal head and wired with the sensory mechanism.

Family of temperature transmitters

Thermometers fitted with iTEMP transmitters are an installation-ready complete solution to improve temperature measurement by significantly increasing measurement accuracy and reliability, when compared to direct wired sensors, as well as reducing both wiring and maintenance costs.

4 to 20 mA head transmitters
They offer a high degree of flexibility, thereby supporting universal application with low inventory storage. The iTEMP transmitters can be configured quickly and easily at a PC. Endress+Hauser offers free configuration software which can be downloaded from the Endress+Hauser Website.

HART® head transmitters
The transmitter is a 2-wire device with one or two measuring inputs and one analog output. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using HART® communication. Swift and easy operation, visualization and maintenance using universal configuration software like FieldCare, DeviceCare or FieldCommunicator 375/475. Integrated Bluetooth® interface for the wireless display of measured values and configuration via E+H SmartBlue (app), optional.

PROFIBUS® PA head transmitters

Universally programmable head transmitter with PROFIBUS® PA communication Conversion of various input signals into digital output signals High measurement accuracy over the complete ambient temperature range PROFIBUS PA functions and device-specific parameters are configured via fieldbus communication.

FOUNDATION Fieldbus™ head transmitters

Universally programmable head transmitter with FOUNDATION Fieldbus™ communication Conversion of various input signals into digital output signals High measurement accuracy over the complete ambient temperature range All transmitters are approved for use in all the main process control systems. The integration tests are performed in Endress+Hauser's 'System World'.

Head transmitter with PROFINET® and Ethernet-APL

The temperature transmitter is a 2-wire device with two measuring inputs. The device not only transfers converted signals from resistance thermometers and thermocouples, it also transfers resistance and voltage signals using the PROFINET® protocol. Power is supplied via the 2-wire Ethernet connection according to IEEE 802.3cg 10Base-T1. The transmitter can be installed as an intrinsically safe electrical apparatus in Zone 1 hazardous areas. The device can be used for instrumentation purposes in the terminal head form B (flat face) according to DIN EN 50446.

Head transmitter with IO-Link

The temperature transmitter is an IO-Link device with a measurement input and an IO-Link interface. It offers a configurable, simple and cost-effective solution thanks to digital communication via IO-Link. The device is mounted in a terminal head form B (flat face) as per DIN EN 5044.

Advantages of the iTEMP transmitters:
- Dual or single sensor input (optionally for certain transmitters)
- Attachable display (optionally for certain transmitters)
- Unsurpassed reliability, accuracy and long-term stability in critical processes
- Mathematical functions
- Monitoring of the thermometer drift, sensor backup functionality, sensor diagnostic functions
- Sensor-transmitter-matching for dual-channel transmitters, based on the Callendar van Dusen coefficients (CvD)
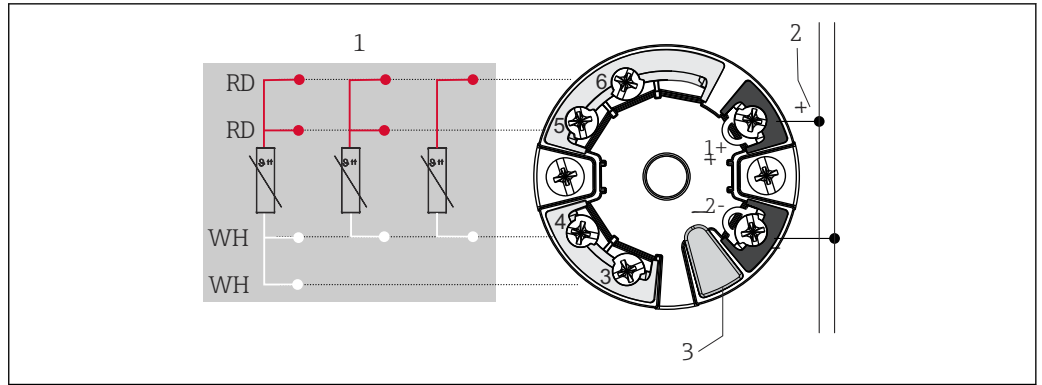
Wiring

| Wiring diagram for RTD | Type of sensor connection |
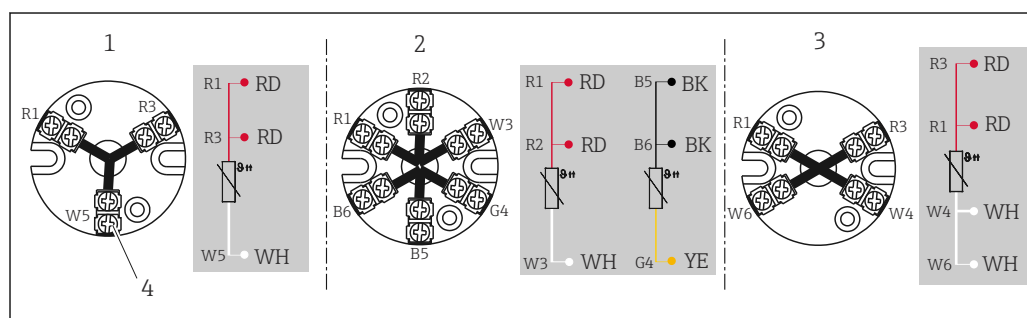
🖾 *2   Terminal block mounted*
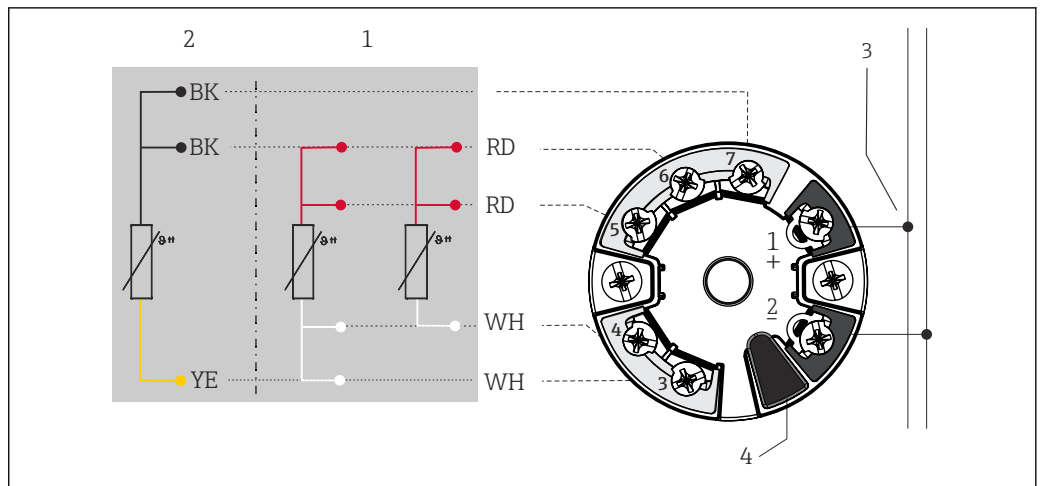
1   3-wire, single
2   2 x 3-wire, single
3   4-wire, single
4   Outside screw

3   *Head mounted transmitter TMT7x or TMT31 (single input)*

1   *Sensor input, RTD and Ω: 4-, 3- and 2-wire*
2   *Power supply or fieldbus connection*
3   *Display connection/CDI interface*

4   *Head-mounted transmitter TMT8x (dual-sensor input)*

1   *Sensor input 1, RTD: 4- and 3-wire*
2   *Sensor input 2, RTD: 3-wire*
3   *Power supply or fieldbus connection*
4   *Display connection*

Fitted with push-in terminals if screw terminals are not explicitly selected or a double sensor is installed.

Cable entries

The cable entries must be selected during configuration of the device. Different terminal heads offer different possibilities with regard to threads and the number of available entries.

Connectors

Endress+Hauser offers a wide variety of connectors for the simple and fast integration of the thermometer into a process control system. The following tables show the PIN assignments of the various plug connector combinations.

ℹ️ We do not recommend connecting thermocouples directly to connectors. The direct connection to the pins of the plug might generate a new 'thermocouple' which influences the accuracy of the measurement. Therefore we do not connect thermocouples directly to connectors. The thermocouples are connected in combination with a transmitter.

Abbreviations

#1	Order: first transmitter/insert	#2	Order: second transmitter/insert
i	Insulated. Wires marked 'i' are not connected and are insulated with heat shrink tubes.	YE	Yellow
GND	Grounded. Wires marked 'GND' are connected to the internal grounding screw in the terminal head.	RD	Red
BN	Brown	WH	White
GNYE	Green-yellow	PK	Pink
BU	Blue	GN	Green
GY	Gray	BK	Black
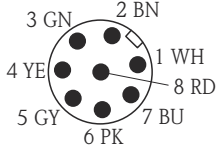
Terminal head with one cable entry

Plug	1x PROFIBUS PA								1x FOUNDATION™ Fieldbus (FF)				1x PROFINET and Ethernet-APL			
Plug thread	M12				7/8"				7/8"				M12			
PIN number	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Electrical connection (terminal head)																
Flying leads and TC	Not connected (not insulated)															
3-wire terminal block (1x Pt100)	RD	RD	WH		RD	RD	WH		RD	RD	WH		RD	RD	WH	
4-wire terminal block (1x Pt100)	RD	RD	WH	WH	RD	RD	WH	WH	RD	RD	WH	WH	RD	RD	WH	WH
6-wire terminal block (2x Pt100)	RD (#1) [1]	RD (#1)	WH (#1)		RD (#1)	RD (#1)	WH (#1)		RD (#1)	RD (#1)	WH (#1)				WH (#1)	
1x TMT 4 to 20 mA or HART®	+	i	-	i	+	i	-	i	+	i	-	i	+	i	-	i
2x TMT 4 to 20 mA or HART® in the terminal head with a high cover	+(#1)	+(#2)	-(#1)	-(#2)	+(#1)	+(#2)	-(#1)	-(#2)	+(#1)	+(#2)	-(#1)	-(#2)	+(#1)	+(#2)	-(#1)	-(#2)
1x TMT PROFIBUS® PA	+	i	-	GND [2]	+	i	-	GND [2]	Cannot be combined							
2x TMT PROFIBUS® PA	+(#1)	i	-(#1)	GND [2]	+	i	-	GND [2]	Cannot be combined							
1x TMT FF	Cannot be combined				Cannot be combined				-	+	GND	i	Cannot be combined			
2x TMT FF	Cannot be combined				Cannot be combined				-(#1)	+(#1)	GND	i	Cannot be combined			
1x TMT PROFINET®	Cannot be combined				Cannot be combined				Cannot be combined				APL signal -	APL signal +	GND	i
2x TMT PROFINET®	Cannot be combined				Cannot be combined				Cannot be combined				APL signal - (#1)	APL signal + (#1)	GND	i
PIN position and color code	1 BN 2 GNYE 3 BU 4 GY A0018929				1 BN 2 GNYE 3 BU 4 GY A0018930				1 BU 2 BN 3 GY 4 GNYE A0018931				1 RD 2 GN A0052119			

1) Second Pt100 is not connected
2) If a head is used without grounding screw, e.g. plastic housing TA30S or TA30P, insulated 'i' instead of grounded GND

Terminal head with a cable entry (continued)

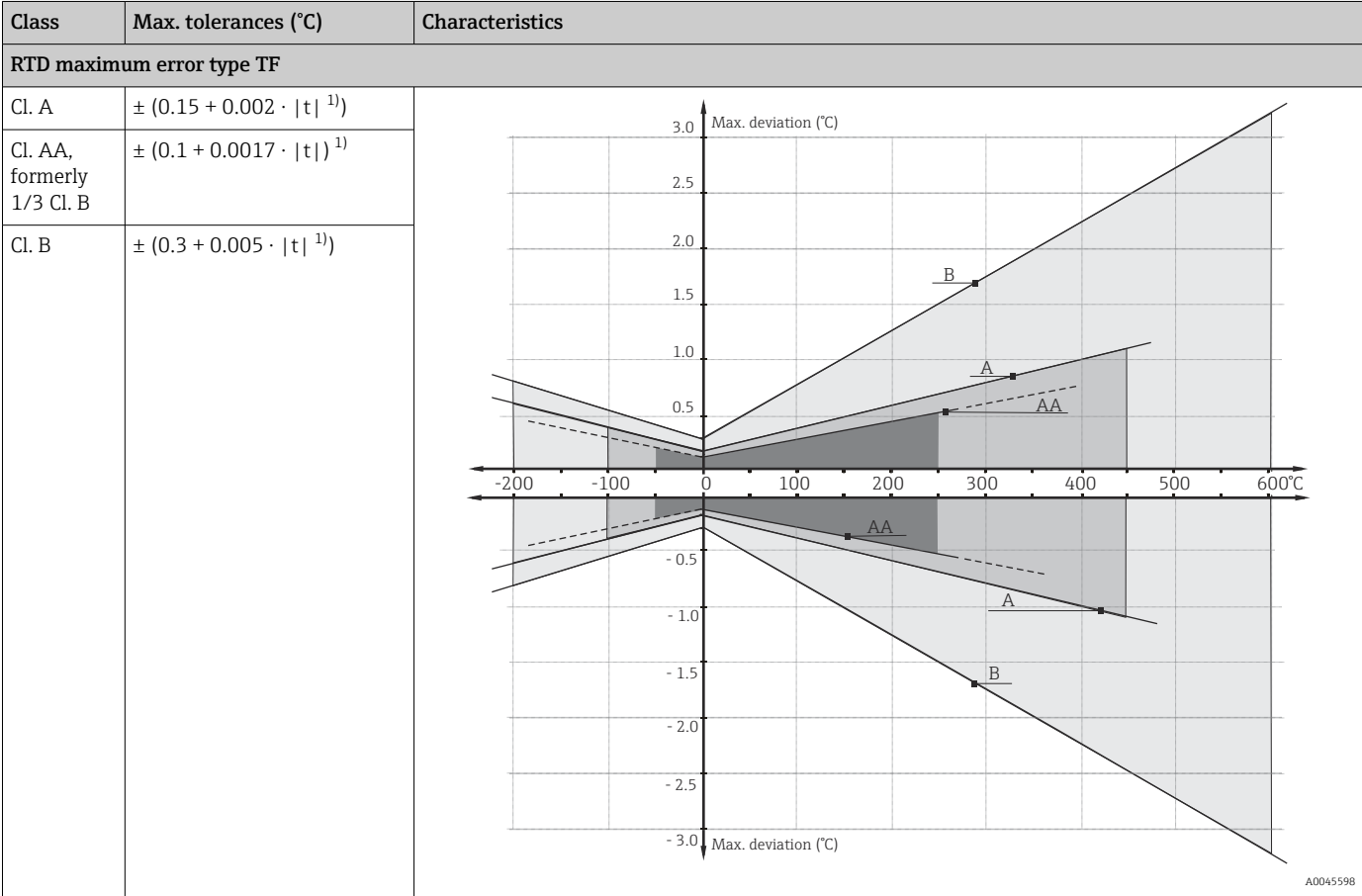| Plug	4-pin/8-pin							
Plug thread	M12							
PIN number	1	2	3	4	5	6	7	8
Electrical connection (terminal head)								
Flying leads and TC	Not connected (not insulated)							
3-wire terminal block (1x Pt100)	RD	RD	WH		i			
4-wire terminal block (1x Pt100)	RD	RD	WH	WH	i			
6-wire terminal block (2x Pt100)			WH		BK	BK	YE	
1x TMT 4 to 20 mA or HART®	+(#1)	i	-(#1)	i	i			
2x TMT 4 to 20 mA or HART® in the terminal head with a high cover	+(#1)	i	-(#1)	i	+(#2)	i	-(#2)	i
1x TMT PROFIBUS® PA	Cannot be combined							
2x TMT PROFIBUS® PA	Cannot be combined							
1x TMT FF	Cannot be combined							
2x TMT FF	Cannot be combined							
1x TMT PROFINET®	Cannot be combined							
2x TMT PROFINET®	Cannot be combined							
PIN position and color code	1 BN 2 GNYE 3 BU 4 GY *5 4-pin plug* A0018929				3 GN 2 BN 1 WH 8 RD 4 YE 5 GY 6 PK 7 BU *6 8-pin plug* A0018927			

Performance characteristics

Reference operating conditions	These data are relevant for determining the measurement accuracy of the temperature transmitters used. More information on this can be found in the Technical Information of the iTEMP® temperature transmitters. → 🕮 13

Accuracy

RTD resistance thermometer as per IEC 60751

Class	Max. tolerances (°C)	Characteristics
RTD maximum error type TF		
Cl. A	$\pm (0.15 + 0.002 \cdot |t|\ ^{1)})$	
Cl. AA, formerly 1/3 Cl. B	$\pm (0.1 + 0.0017 \cdot |t|)\ ^{1)}$	
Cl. B	$\pm (0.3 + 0.005 \cdot |t|\ ^{1)})$	

1) |t| = absolute temperature value in °C

ℹ️ In order to obtain the maximum tolerances in °F, the results in °C must be multiplied by a factor of 1.8.

Insulation resistance	Insulation resistance ≥ 100 MΩ at ambient temperature, measured between the terminals and the outer jacket with a minimum voltage of 100 V_{DC}.
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.

Mounting procedure

Orientation	No restrictions

Installation instructions
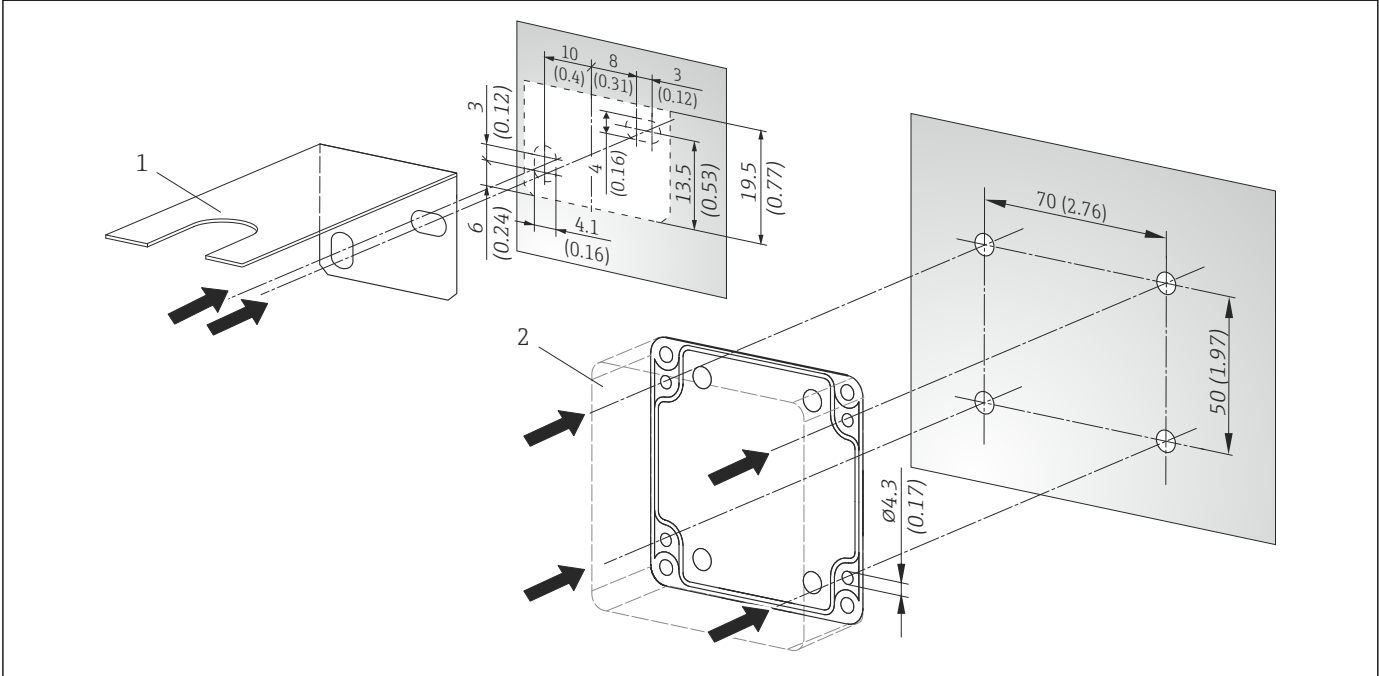
🖼 7   Drilling templates for wall mounting. Dimensions in mm (in)

1   Mounting bracket for mounting with terminal head
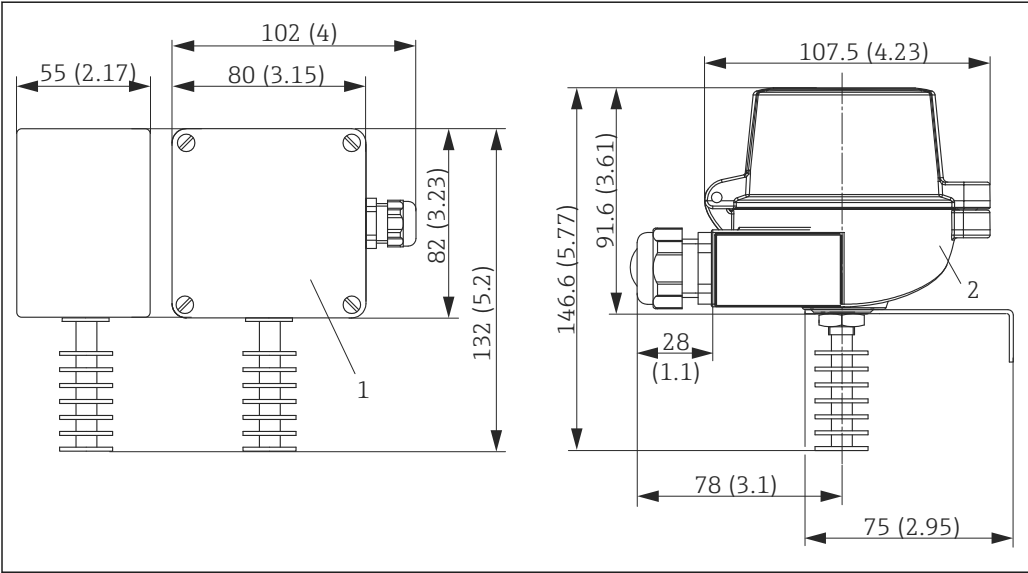*2   Plastic housing*

Environment

Ambient temperature range

Housing	Temperature in °C (°F)
TA30A terminal head without mounted head transmitter	Depends on the use of the cable gland, • W/o: −50 to +150 °C (−58 to +302 °F) • With: −50 to +100 °C (−58 to +212 °F)
TA30 PCB plastic housing without mounted head transmitter	−40 to +100 °C (−40 to +212 °F)
Terminal head with mounted head transmitter	−40 to +85 °C (−40 to +185 °F)

Storage temperature   See "Ambient temperature range"

Degree of protection

Terminal head	Degree of protection: IP66/68 (NEMA Type 4x encl.)
Plastic housing	Degree of protection: IP65

Shock and vibration resistance   4G / 2 to 150 Hz in accordance with IEC 60068-2-6

Process

Process pressure range	Maximum static pressure: 1 bar (14.5 PSI) at an ambient temperature of 20 ℃ (68 ℉).

Mechanical construction

All dimensions in mm (in). Specifications without head transmitter installed.

🖾 8   Dimensions of the thermometer

1   With plastic housing
2   With terminal head

Plastic housing specifications
• Color: gray, RAL 7035 • Cable entry thread: M16

Terminal head specifications
• Color of head: blue, RAL 5012 • Color of cap: gray, RAL 7035 • Ground terminal, internal and external • Cable entry thread: G ½", ½" NPT or M20x1.5"

Weight	200 to 500 g (7.05 to 17.64 oz), depends on the configuration.
Materials	Temperature sensor, housing

Temperature sensor	Anodized aluminum
Housing	Plastic housing made of polycarbonate (PC) or terminal head made of aluminum with polyester powder coating

Spare parts	

Spare part	Material No.
Fixing kit cpl.TMT82/85/84 (European) 2x screws, 2x springs, 2x lock washers, 1x seal, CDI connector	71044061

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**.

MID

Test certificate (only in SIL mode). In compliance with:
- WELMEC 8.8, "Guide on the General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring Instruments."
- OIML R117-1 Edition 2007 (E) "Dynamic measuring systems for liquids other than water"
- EN 12405-1/A2 Edition 2010 "Gas meters - Conversion devices - Part 1: Volume conversion"
- OIML R140-1 Edition 2007 (E) "Measuring systems for gaseous fuel"

Ordering information

Detailed ordering information is available from your nearest sales organization www.addresses.endress.com or in the Product Configurator at www.endress.com:

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

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

Accessories

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

Communication-specific accessories

Configuration kit TXU10	Configuration kit for PC-programmable transmitter with setup software and interface cable for PC with USB port Order code: TXU10-xx
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. 📖 For details, see "Technical Information" TI00404F.
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. 📖 For details, see "Technical Information" TI00405C.
WirelessHART adapter	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. 📖 For details, see Operating Instructions BA061S.
Field Xpert SMT70	Universal, high-performance tablet PC for device configuration The tablet PC enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as a comprehensive, all-in-one solution. With a pre-installed driver library, it is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle. 📖 For details, see Technical Information TI01342S/04.

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: • Calculation of all the necessary data for identifying the optimum measuring device: e.g. pressure loss, accuracy or process connections. • Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: Via the Internet: https://portal.endress.com/webapp/applicator

Accessories	Description
Configurator	Product Configurator - the tool for individual product configuration • Up-to-the-minute configuration data • Depending on the device: direct input of 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 Product Configurator is available on the Endress+Hauser website: www.endress.com-> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.

Accessories	Description
W@M	Life cycle management for your plant W@M offers assistance with a wide range of software applications over the entire process: from planning and procurement to the installation, commissioning and operation of the measuring devices. All the relevant information is available for every measuring device over the entire life cycle, such as the device status, device-specific documentation, spare parts etc. The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records. W@M is available: Via the Internet: www.endress.com/lifecyclemanagement
FieldCare SFE500	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. 📖 For details, see Operating Instructions BA00027S and BA00065S
DeviceCare SFE100	Configuration tool for devices via fieldbus protocols and Endress+Hauser service protocols. DeviceCare is the tool developed by Endress+Hauser for the configuration of Endress+Hauser devices. All smart devices in a plant can be configured via a point-to-point or point-to-bus connection. The user-friendly menus enable transparent and intuitive access to the field devices. 📖 For details, see Operating Instructions BA00027S

System components

Accessories	Description
Process display unit RIA15	Compact process indicator with very low voltage drop for universal use to display 4 to 20 mA/HART® signals. The process indicator does not require an external power supply. It is powered directly from the current loop. 📖 For details, see "Technical Information" TI01043K.
RN221N	Active barrier with power supply for safe separation of 4 to 20 mA standard signal circuits. Offers bidirectional HART transmission. 📖 For details, see "Technical Information" TI00073R and Operating Instructions BA00202R.
RNS221	Supply unit for powering two 2-wire measuring devices solely in the non-Ex area. Bidirectional communication is possible via the HART communication jacks. 📖 For details, see "Technical Information" TI00081R and Brief Operating Instructions KA00110R.

Supplementary documentation

The following types of documentation are available on the product pages and in the Download Area of the Endress+Hauser website (www.endress.com/downloads) (depending on the selected device version):

Document	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.

Document	Purpose and content of the document
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 (XA) are supplied with the device. The Safety Instructions 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.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is an integral part of the device documentation.

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