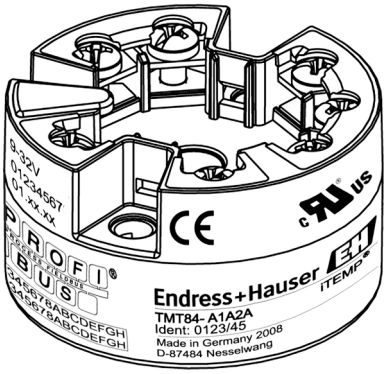
BA00257R/09/EN/05.20
71498846
2020-03-31

Valid as of version
01.02 (device version)

Operating Instructions
iTEMP TMT84

Dual-input temperature transmitter with PROFIBUS® PA protocol



Endress+Hauser
People for Process Automation

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1 About this document

1.1 Document function

These Operating Instructions contain all the information 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.

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 Electrical symbols

Symbol	Meaning
⎓	Direct current
~	Alternating current
⎓ ~	Direct current and alternating current

Symbol	Meaning
	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	**Protective Earth (PE)** A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device: ▪ Inner ground terminal: Connects the protectiv earth to the mains supply. ▪ Outer ground terminal: Connects the device to the plant grounding system.

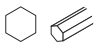
1.3.3 Symbols for certain types of information

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

1.3.4 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

Document	Purpose and content of the document
Technical Information TI00138T/09/en	**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 KA00258R/09/en	**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.

The document types listed are available:
In the Download Area of the Endress+Hauser website: www.endress.com → Download

1.6 Registered trademarks

PROFIBUS®
Registered trademark of the PROFIBUS Nutzerorganisation e.V. (Profibus User Organization), Karlsruhe, Germany

2 Basic safety instructions

2.1 Requirements for 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 beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- Follow instructions and comply with conditions

The operating personnel must fulfill the following requirements:
- Operating personnel are instructed and authorized according to the requirements of the task by the facility's owner-operator
- Follow the instructions in this manual

2.2 Designated use

The device is a universal and configurable temperature transmitter with either one or two sensor inputs for resistance thermometers (RTD), thermocouples (TC), resistance and voltage transmitters. The head transmitter version of the device is intended for mounting in a terminal head (flat face) as per DIN EN 50446. It is also possible to mount the device on a DIN rail using the optional DIN rail clip.

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

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

2.3 Operational safety

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

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 equipment):
- 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 of EN 61010-1, the EMC requirements of the IEC/EN 61326 series and NAMUR recommendation NE 21.

NOTICE
- The device may only be powered by a power unit with an energy-limited circuit in accordance with UL/EN/IEC 61010-1, Section 9.4 and the requirements of Table 18.

2.4 Product safety

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

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

2.5 IT security

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

IT security measures, which provide additional protection for the device 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

1. Unpack the temperature transmitter carefully. Is the packaging or content free from damage?
   ↳ Damaged components may not be installed as the manufacturer can otherwise not guarantee compliance with the original safety requirements or the material resistance, and can therefore not be held responsible for any resulting damage.
2. Is the delivery complete or is anything missing? Check the scope of delivery against your order.
3. Does the nameplate match the ordering information on the delivery note?
4. Are the technical documentation and all other necessary documents provided? If applicable: are the Safety Instructions (e.g. XA) for hazardous areas provided?

If one of these conditions is not satisfied, contact your Endress+Hauser Sales Center.

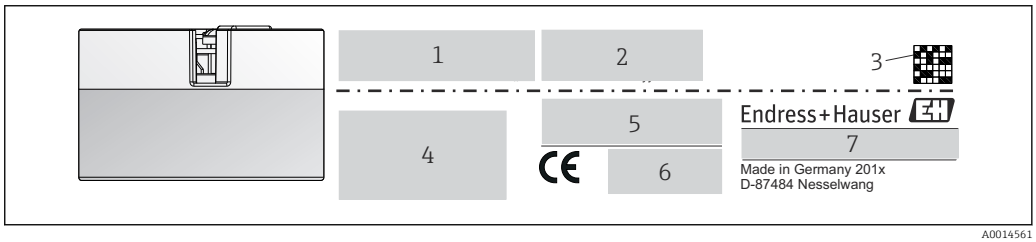
3.2 Product identification

The following options are available for identification of the device:
- Nameplate specifications
- Extended order code with breakdown of the device features on the delivery note
- Enter the serial number from the nameplate in the *W@M Device Viewer* (www.endress.com/deviceviewer): All data relating to the device and an overview of the Technical Documentation supplied with the device are displayed.
- Enter the serial number on 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

The right device?

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



1 Nameplate of the head transmitter (example, Ex version)

1 Power supply, current consumption and radio approval (Bluetooth)
2 Serial number, device revision, firmware version and hardware version
3 Data Matrix 2D code
4 2 lines for the TAG name and extended order code
5 Approval in hazardous area with number of the relevant Ex documentation (XA...)
6 Approvals with symbols
7 Order code and manufacturer ID

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
Address of manufacturing plant:	See nameplate

3.3 Scope of delivery

The scope of delivery of the device comprises:
- Temperature transmitter
- Mounting material, optional
- Hard copy of multi-language Brief Operating Instructions
- Additional documentation for devices which are suitable for use in the hazardous area (ATEX, FM, CSA), such as Safety Instructions (XA...), Control or Installation Drawings (ZD...)

3.4 Certificates and approvals

The device complies with the requirements of the standards EN 61 010-1 "Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use" and with the EMC requirements as per the IEC/EN 61326 series.

3.4.1 CE/EAC mark, Declaration of Conformity

The device meets the legal requirements of the EU/EEU guidelines. The manufacturer confirms that the device is compliant with the relevant guidelines by applying the CE/EAC mark.

3.4.2 PROFIBUS® PA protocol certification

The temperature transmitter is certified and registered by the PNO (PROFIBUS® User Organization). The device meets the requirements of the following specifications:

- Certified according to PROFIBUS® PA Profile 3.02
- The device can also be operated with certified devices of other manufacturers (interoperability)

An overview of other approvals and certifications is provided in the "Technical data" section → 53.

3.5 Storage and transport

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

Dimensions and operating conditions: → 63

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

Storage temperature
−40 to +100 °C (−40 to +212 °F)

4 Installation

4.1 Installation conditions

4.1.1 Dimensions

The dimensions of the device are provided in the "Technical data" section → 53.

4.1.2 Mounting location

- In the terminal head, flat face, as per DIN EN 50446, direct mounting on insert with cable entry (middle hole 7 mm)
- In the field housing, separated from the process (see the "Accessories" section → 39)

It is also possible to mount the head transmitter on a DIN rail as per IEC 60715 using the DIN rail clip accessory (see the "Accessories" section → 39).

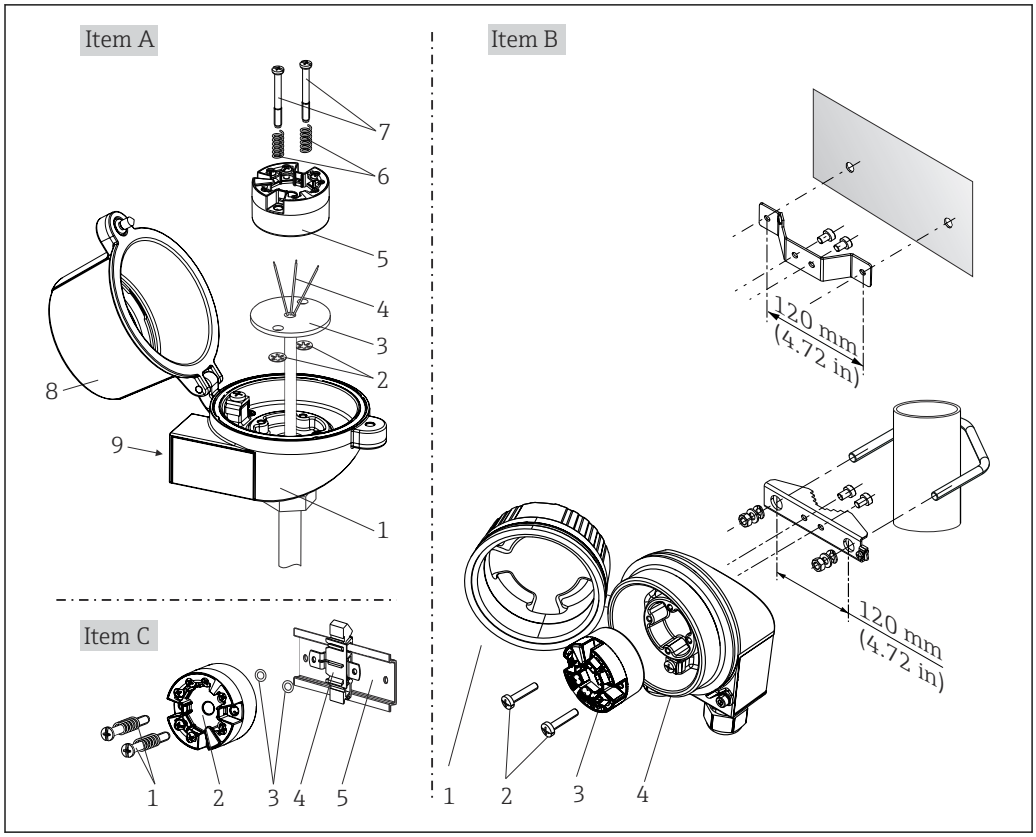
Information about the conditions that must be present at the installation point (such as the ambient temperature, degree of protection, climate class etc.) so that the device can be mounted correctly is provided in the "Technical data" section → 53.

When using in hazardous areas, the limit values of the certificates and approvals must be observed (see Ex Safety Instructions).

4.2 Installation

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

4.2.1 Mounting the head transmitter



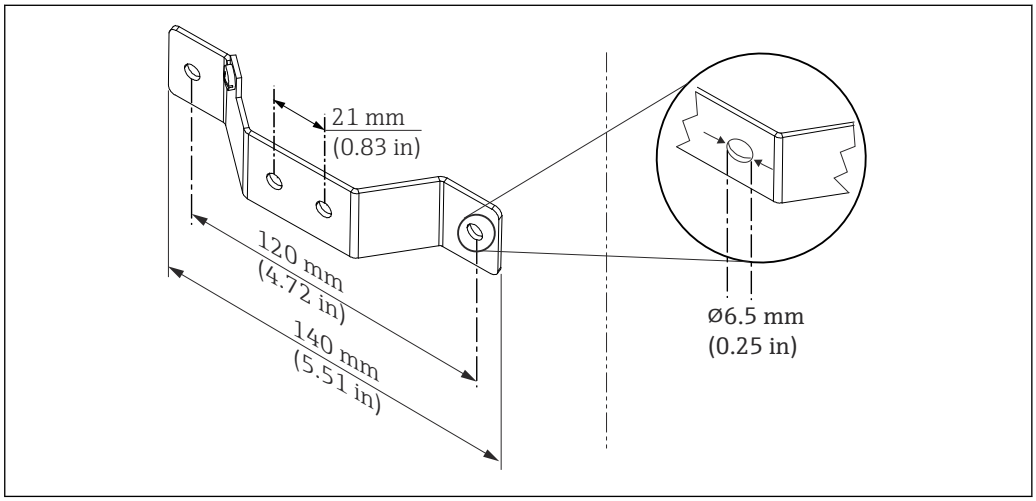
2 *Head transmitter mounting (three versions)*

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

Procedure for mounting in a terminal head, Item A:

1. Open the terminal head cover (8) on the terminal head.
2. Guide the connection wires (4) of the insert (3) through the center hole in the head transmitter (5).
3. Fit the mounting springs (6) on the mounting screws (7).
4. Guide the mounting screws (7) through the side boreholes of the head transmitter and the insert (3). Then 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.→ 16

Item B	Mounting in a field housing
1	Field housing cover
2	Mounting screws with springs
3	Head transmitter
4	Field housing



3 Dimensions of angle bracket for wall mount (complete wall mounting set available as accessory)

Procedure for mounting in a field housing, Item B:

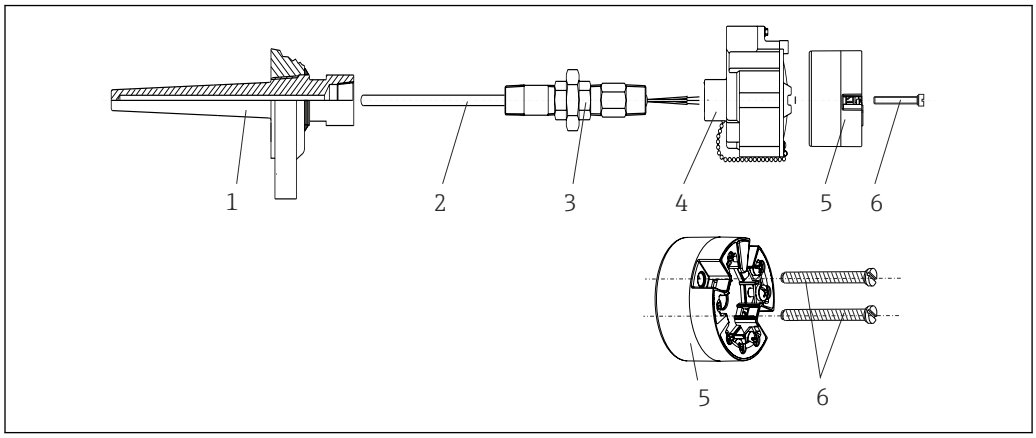
1. Open the cover (1) of the field housing (4).
2. Guide the mounting screws (2) through the lateral bores in the head transmitter (3).
3. Screw the head transmitter to the field housing.
4. After wiring, close the field housing cover (1) again. → 16

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

Procedure for mounting on a DIN rail, Item C:

1. Press the DIN rail clip (4) onto the DIN rail (5) until it engages with a click.
2. Fit the mounting springs on the mounting screws (1) and guide the screws through the side boreholes of the head transmitter (2). Then fix both mounting screws with the snap rings (3).
3. Screw the head transmitter (2) onto the DIN rail clip (4).

Mounting typical of North America



4 *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:

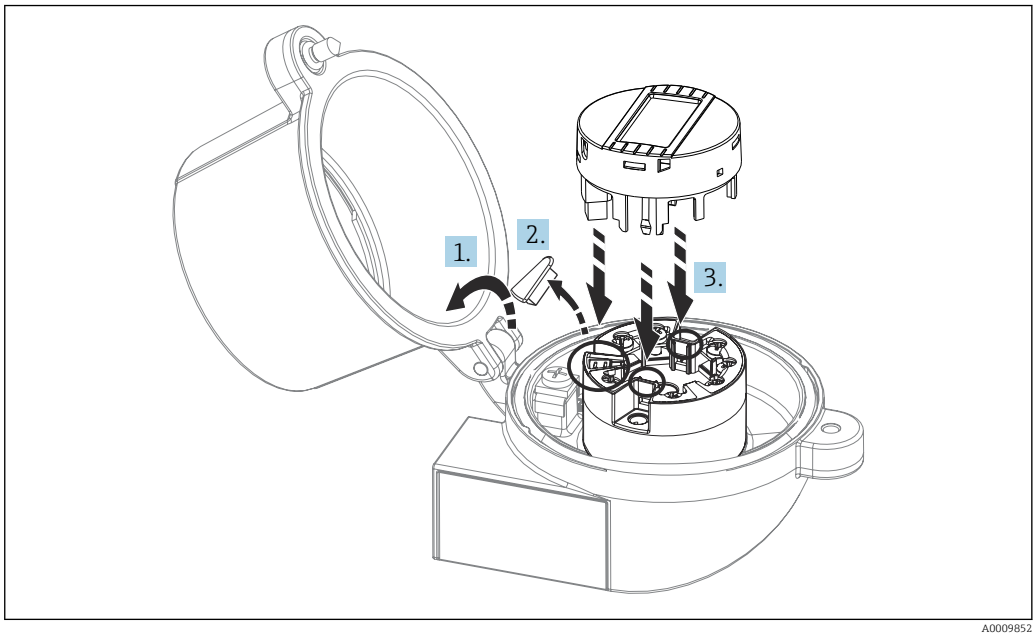
1. Fit the thermowell (1) on the process pipe or the container wall. Secure the thermowell according to the instructions before the process pressure is applied.
2. Fit the necessary neck tube nipples and adapter (3) on the thermowell.
3. Make sure sealing rings are installed if such rings are needed 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 bus cable (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 up to the transmitter . → 16
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.

Mounting the display on the head transmitter



5 *Mounting the display*

1. Loosen the screw on the terminal head cover. Flip back the terminal head cover.
2. Remove the cover of the display connection area.
3. Fit the display module onto the mounted and wired head transmitter. The fastening pins must click securely into place on the head transmitter. After mounting, securely tighten the terminal head cover.

The display can be used only with the appropriate terminal heads - cover with viewing window (e.g. TA30 from Endress+Hauser).

4.3 Post-installation check

After installing the device, always run the following final checks:

Device condition and specifications	Notes
Is the device undamaged (visual inspection)?	-
Do the ambient conditions match the device specification (e.g. ambient temperature, measuring range, etc.)?	See the "Technical data" section→ 53

5 Electrical connection

⚠ CAUTION

- Switch off power supply before installing or connecting the device. Failure to observe this may result in destruction of parts of the electronics.
- When connecting Ex-certified devices, please take special note of the instructions and connection schematics in the Ex-specific supplement to these Operating Instructions. Please contact Endress+Hauser's representative if you have any questions.
- Do not occupy the display connection. Connecting other devices can destroy the electronics.
- Connect the potential matching line to the outer ground terminal before applying the power supply.

5.1 Connection conditions

A Phillips head screwdriver is required to wire the head transmitter with screw terminals. The spring terminal version can be wired without any tools.

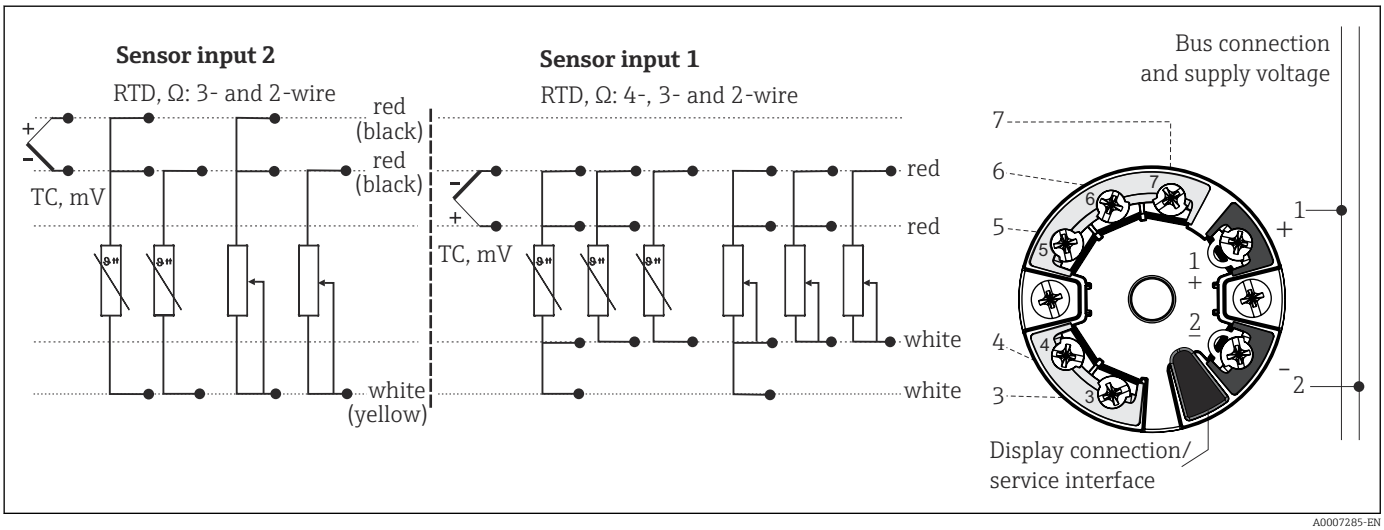
Proceed as follows to wire a mounted head transmitter:

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 → 6, 16. If the head transmitter is fitted with spring terminals, pay particular attention to the information in the "Connecting to spring terminals" section". → 17
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 Connecting the measuring device

Terminal assignment



6 *Terminal assignment of head transmitter*

NOTICE

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

5.2.1 Connecting the sensor cables

Terminal assignment of the sensor connections → 6, 16.

NOTICE

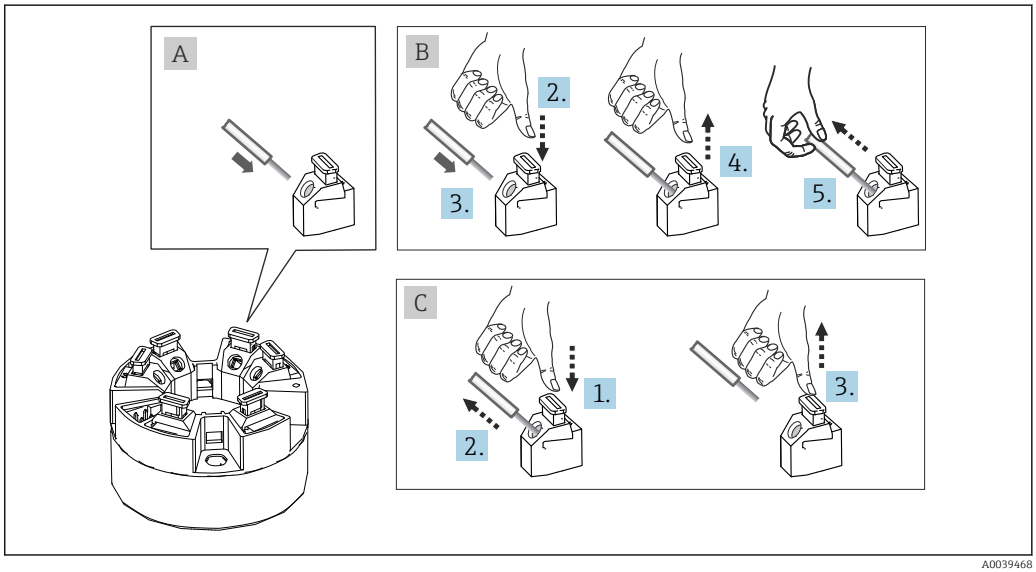
When connecting 2 sensors ensure that there is no galvanic connection between the sensors (e.g. caused by sensor elements that are not isolated from the thermowell). The resulting equalizing currents interfere with the measurements considerably, resulting in false readings.

- The sensors must remain galvanically isolated from one another by connecting each sensor separately to a transmitter. The transmitter provides sufficient galvanic isolation (> 2 kV AC) between the input and output.

The following connection combinations are possible when both sensor inputs are assigned:

		Sensor input 1			
		RTD or resistance transmitter, two-wire	RTD or resistance transmitter, three-wire	RTD or resistance transmitter, four-wire	Thermocouple (TC), voltage transmitter
Sensor input 2	RTD or resistance transmitter, two-wire	✔	✔	-	✔
	RTD or resistance transmitter, three-wire	✔	✔	-	✔
	RTD or resistance transmitter, four-wire	-	-	-	-
	Thermocouple (TC), voltage transmitter	✔	✔	✔	✔

Connecting to spring terminals



7 *Spring 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.

5.2.2 PROFIBUS® PA cable specification

Cable type

Twin-core cables are recommended for connecting the measuring device to the fieldbus. Following IEC 61158-2 (MBP), four different cable types (A, B, C, D) can be used with the fieldbus, only two of which (cable types A and B) are shielded.

- Cable types A or B are particularly preferable for new installations. Only these types have cable shielding that guarantees adequate protection from electromagnetic interference and thus the most reliable data transfer. In the case of cable type B, several fieldbuses (same degree of protection) may be operated in one cable. No other circuits are permissible in the same cable.
- Practical experience has shown that cable types C and D should not be used due to the lack of shielding, since the freedom from interference generally does not meet the requirements described in the standard.

The electrical data of the fieldbus cable have not been specified but determine important characteristics of the design of the fieldbus, such as distances bridged, number of users, electromagnetic compatibility, etc.

	Type A	Type B
Cable structure	Twisted pair, shielded	One or more twisted pairs, fully shielded
Wire size	0.8 mm^2 (18 in^2)	0.32 mm^2 (22 in^2)
Loop-resistance (direct current)	44 Ω/km	112 Ω/km
Characteristic impedance at 31.25 kHz	100 Ω ±20 %	100 Ω ±30 %
Attenuation constant at 39 kHz	3 dB/km	5 dB/km
Capacitive asymmetry	2 nF/km	2 nF/km
Envelope delay distortion (7.9 to 39 kHz)	1.7 mS/km	*)
Shield coverage	90 %	*)
Max. cable length (incl. spurs > 1 m (3 ft)	1 900 m (6 233 ft)	1 200 m (3 937 ft)
*) Not specified		

Suitable fieldbus cables (type A) from various manufacturers for non-hazardous areas are listed below:

- Siemens: 6XV1 830-5BH10
- Belden: 3076F
- Kerpen: CeL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL

Maximum overall cable length

The maximum network expansion depends on the type of protection and the cable specifications. The overall cable length combines the length of the main cable and the length of all spurs (>1 m/3.28 ft). Please note the following:

- The maximum permissible overall cable length depends on the cable type used.
  - Type A: 1900 m (6200 ft)
  - Type B: 1200 m (4000 ft)
- If repeaters are used, the maximum permissible cable length is doubled. A maximum of three repeaters are permitted between user and master.

Maximum spur length

The line between the distribution box and field device is described as a spur. In the case of non-Ex applications, the max. length of a spur depends on the number of spurs (> 1 m (3.28 ft)):

Number of spurs	1 to 12	13 to 14	15 to 18	19 to 24	25 to 32
Max. length per spur	120 m (393 ft)	90 m (295 ft)	60 m (196 ft)	30 m (98 ft)	1 m (3.28 ft)

Number of field devices

In systems that meet FISCO with Ex ia types of protection, the line length is limited to max. 1000 m (3280 ft). A maximum of 32 users per segment in non-Ex areas or a maximum of 10 users in an Ex-area (Ex ia IIC) is possible. The actual number of users must be determined during the planning stage.

Shielding and grounding

The specifications of the PROFIBUS User Organization for device installation must be observed during installation.

Bus termination

The start and end of each fieldbus segment must always be terminated with a bus terminator. With various junction boxes (non-Ex), the bus termination can be activated via a switch. If this is not the case, a separate bus terminator must be installed. Please also note the following:

- In the case of a branched bus segment, the device furthest from the segment coupler represents the end of the bus.
- If the fieldbus is extended with a repeater, then the extension must also be terminated at both ends.

Further information

General information and further details about the wiring can be found in the Operating Instructions "Guidelines for planning and commissioning, PROFIBUS ® DP/PA, field communication". Available at: → www.endress.com/download → Advanced → "Documentation code" BA00034S.

5.2.3 Fieldbus connection

Devices can be connected to the fieldbus in two ways:

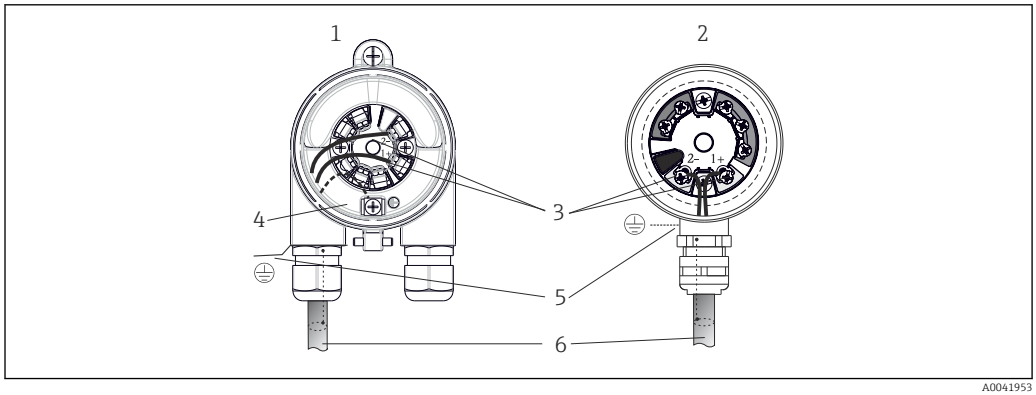
- Using a conventional cable gland → 20
- Using the fieldbus connector (optional, available as an accessory) → 20

Risk of damage

- Switch off the power supply before installing or connecting the head transmitter. Failure to observe this may result in destruction of parts of the electronics.
- Grounding via one of the grounding screws (terminal head, field housing) is recommended.
- If the shielding of the fieldbus cable is grounded at more than one point in systems that do not have additional potential equalization, mains frequency equalizing currents can occur that damage the cable or the shielding. In such cases the shielding of the fieldbus cable must be grounded on one side only, i.e. it must not be connected to the ground terminal of the housing (terminal head, field housing). The shield that is not connected should be insulated!
- We recommend that the fieldbus not be looped using conventional cable glands. If you replace just one measuring device later on, bus communication will have to be interrupted.

Cable gland or entry

Please also observe the general procedure on → 16.



8 *Connecting the signal cables and power supply*

1 *Head transmitter installed in field housing*
2 *Head transmitter installed in terminal head*
3 *Terminals for fieldbus communication and power supply*
4 *Internal ground connection*
5 *External ground connection*
6 *Shielded fieldbus cable*

- The terminals for the fieldbus connection (1+ and 2-) are not polarity sensitive.
- Conductor cross-section:
  - Max. 2.5 mm² for screw terminals
  - Max. 1.5 mm² for spring terminals. Min. stripping length of cable 10 mm (0.39 in).
- A shielded cable must be used for the connection.

Fieldbus connector

As an option, a fieldbus connector can be screwed into the terminal head or field housing instead of a cable gland. Fieldbus connectors can be ordered as accessories from Endress +Hauser (→ 39).

The connection technology of PROFIBUS® PA allows devices to be connected to the fieldbus via uniform mechanical connections such as T-boxes, junction boxes, etc.

This connection technology using prefabricated distribution modules and plug-in connectors offers substantial advantages over conventional wiring:

- Field devices can be removed, replaced or added at any time during normal operation. Communication is not interrupted.
- Installation and maintenance are significantly easier.
- Existing cable infrastructures can be used and expanded instantly, e.g. when constructing new star distributors using 4-channel or 8-channel distribution modules.

The device can therefore be supplied with the option of a ready-mounted fieldbus connector. Fieldbus connectors for retrofitting can be ordered from Endress+Hauser as a spare part. → 39.

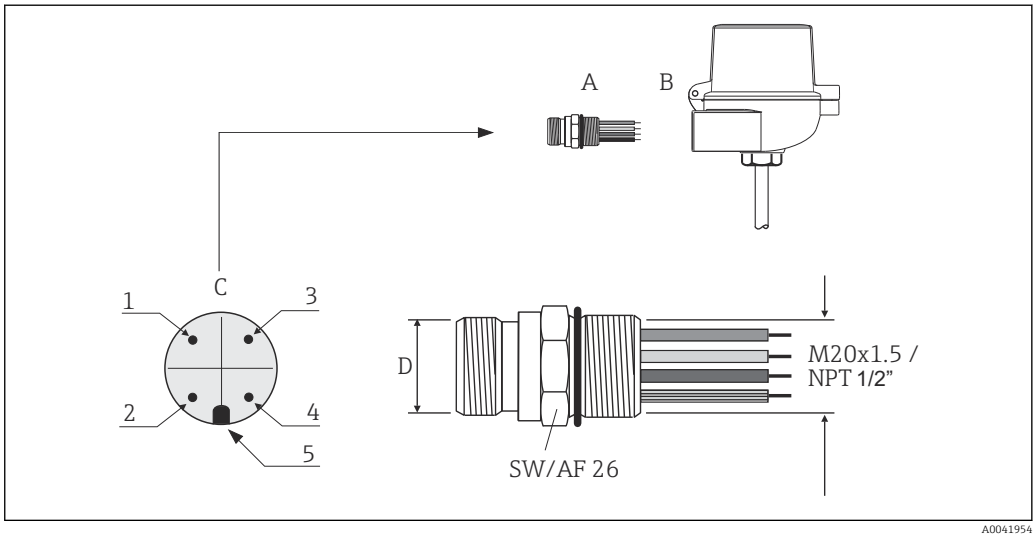
Supply line/T-box shielding

Always use cable glands with good EMC properties, where possible with wraparound cable shielding (Iris spring). This requires minimum differences in potential, and possibly potential equalization.

- The shielding of the PA cable may not be interrupted.
- The shielding connection must always be kept as short as possible.

Ideally, cable glands with Iris springs should be used to connect the shielding. The shielding is connected to the T-box housing by means of the Iris spring located inside the gland. The shielding braid is located under the Iris spring. When the armored thread is tightened, the Iris spring is pressed against the shielding, thereby creating a conductive connection between the shielding and the metal housing.

A terminal box or a plug-in connection must be considered part of the shielding (Faraday shield). This is particularly true for separate boxes if they are connected to a PROFIBUS® PA device with a plug-in cable. In this case, a metal connector must be used whereby the cable shielding is connected to the connector housing (e.g. preterminated cables).



9 Connectors for connection to the PROFIBUS® PA fieldbus

		Pin assignment / color codes			
		D	**7/8" connector:**	**D**	**M12 connector:**
A	Fieldbus connector	1	Brown wire: PA+ (terminal 1)	1	Gray wire: shield
B	Terminal head	2	Green-yellow wire: ground	2	Brown wire: PA+ (terminal 1)
C	Connector on housing (male)	3	Blue wire: PA- (terminal 2)	3	Blue wire: PA- (terminal 2)
		4	Gray wire: shield	4	Green-yellow wire: ground
		5	Positioning key	5	Positioning key

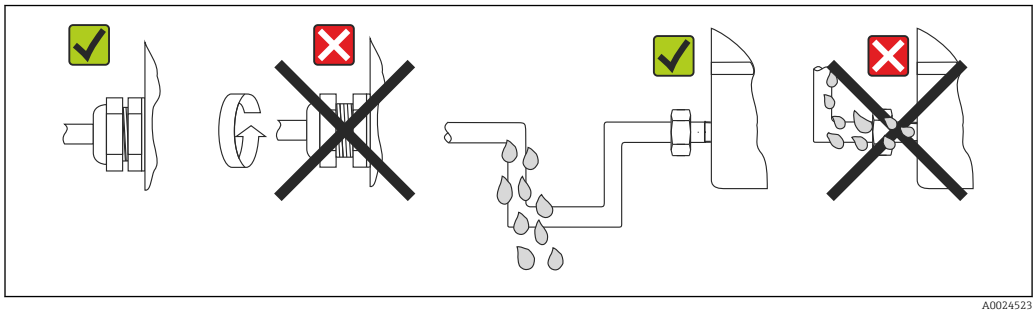
Connector technical data:

Wire cross-section	4 x 0.8 mm
Connection thread	M20 x 1.5 / NPT ½"
Degree of protection	IP 67 according to DIN 40 050 IEC 529
Contact surface	CuZn, gold-plated
Housing material	1.4401 (316)
Flammability	V - 2 according to UL - 94
Ambient temperature	−40 to +105 °C (−40 to +221 °F)
Current carrying capacity	9 A
Rated voltage	Max. 600 V
Contact resistance	≤ 5 mΩ
Insulation resistance	≥ 10 mΩ

5.3 Ensuring the degree of protection

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

- The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- The cables used for connection must be of the specified outside diameter (e.g. M20x1.5, cable diameter 8 to 12 mm).
- Firmly tighten the cable gland. → 10, 22
- The cables must loop down before they enter the cable glands ("water trap"). This means that any moisture that may form cannot enter the gland. Install the device in such a way that the cable glands are not facing upwards. → 10, 22
- Replace unused cable glands with dummy plugs.
- Do not remove the grommet from the cable gland.



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10 *Connection tips to retain IP67 protection*

5.4 Post-connection check

Device condition and specifications	**Notes**
Are the device or cables free from damage (visual check)?	--
Electrical connection	**Notes**
Does the supply voltage match the information on the nameplate?	9 to 32 V_{DC}
Do the cables used meet the required specifications?	Fieldbus cable, → 18 Sensor cable, → 17

Device condition and specifications	Notes
Do the cables have adequate strain relief?	--
Are the power supply and signal cables connected correctly?	→ 16
Are all the screw terminals well tightened and have the connections of the spring terminals been checked?	→ 17
Are all cable entries mounted, tightened and leak-tight? Cable run with "water trap"?	--
Are all housing covers installed and firmly tightened?	--
Electrical connection of the fieldbus system	**Notes**
Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected with each other correctly?	--
Has each fieldbus segment been terminated at both ends with a bus terminator?	--
Has the max. length of the fieldbus cable been observed in accordance with the fieldbus specifications?	→ 18
Has the max. length of the spurs been observed in accordance with the fieldbus specifications?	
Is the fieldbus cable fully shielded and correctly grounded?	

6 Operation options

6.1 Overview of operation options

Operators have a number of options for configuring and commissioning the device:

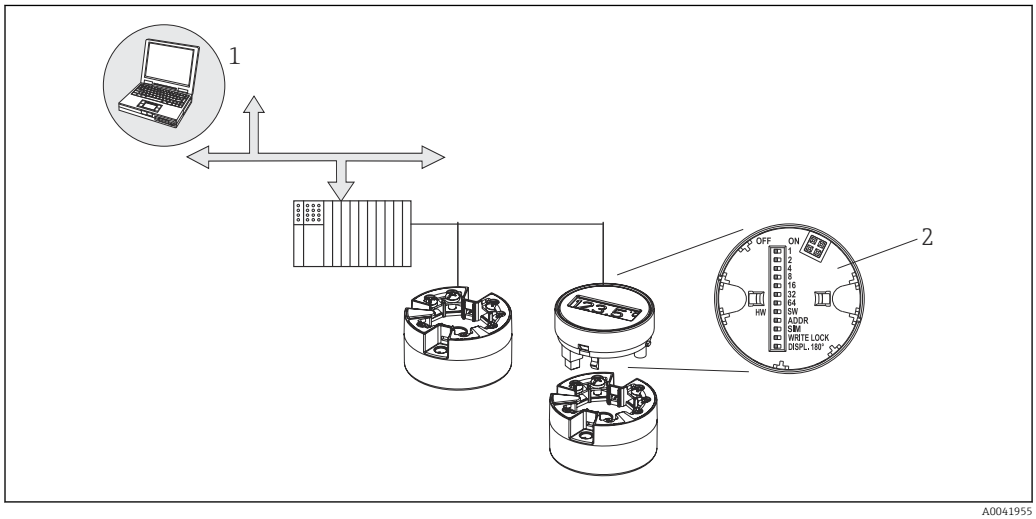
1. Configuration programs → 28

Profile parameters and device-specific parameters are configured exclusively via the fieldbus interface. Special configuration and operating programs are available from various manufacturers for this purpose.

2. Miniature switches (DIP switches) for diverse hardware settings, optional → 25

The following hardware settings for the PROFIBUS® PA interface can be made using DIP switches on the rear of the optional display:

- Entry of the device bus address
- Switching the hardware write protection on/off
- Switching (rotating) the display by 180 °



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11 Operation options for the head transmitter

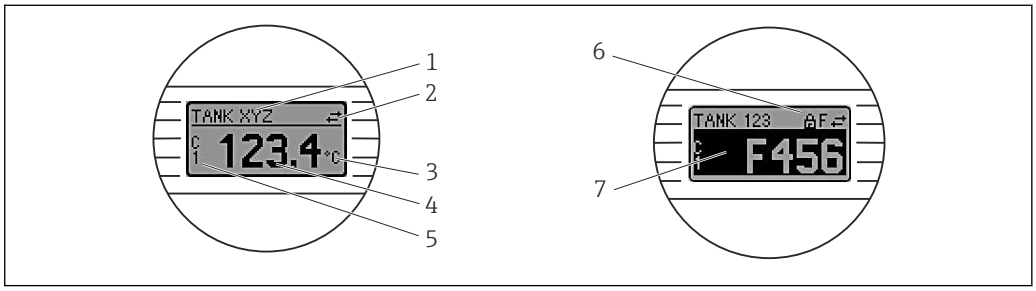
1 Configuration/operating programs for operation via PROFIBUS® PA (fieldbus functions, device parameters)
2 DIP switches for hardware settings on the rear of the optional display (write protection, device address, switch display)

For the head transmitter, display and operating elements are available locally only if the head transmitter was ordered with a display unit!

6.2 Measured value display and operating elements

6.2.1 Display elements

Head transmitter



12 *Optional LC display for head transmitter*

Item no.	Function	Description
1	Displays the TAG	TAG, 32 characters long.
2	'Communication' symbol	The communication symbol appears when read and write-accessing via the fieldbus protocol.
3	Unit display	Unit display for the measured value displayed.
4	Measured value display	Displays the current measured value.
5	Value/channel display C1 or C2, P1, S1 or P2, S2, RJ	e.g. C1 for a measured value from channel 1. (S = Secondary value, P = Primary value; C = Channel, RJ = Reference junction)
6	'Configuration locked' symbol	The 'configuration locked' symbol appears when configuration is locked via the hardware.
7	Status signals	
	Symbols	Meaning
	F	**Error message "Failure detected"** An operating error has occurred. The measured value is no longer valid. The display alternates between the error message and "- - - -" (no valid measured value present), see the "Diagnostics and troubleshooting" section → 42 Detailed information on the error messages can be found in the Operating Instructions.
	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 warm-up or cleaning processes).
	M	**"Maintenance required"** Maintenance is required. The measured value is still valid. The display alternates between the measured value and the status message.

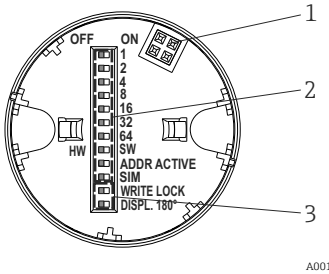
6.2.2 Local operation

You can make various hardware settings using miniature switches (DIP switches) on the rear of the optional display.

The user has the option of ordering the display with the head transmitter, or as an accessory for subsequent mounting. → 39

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.



13 Hardware settings via DIP switches

1:	Connection to head transmitter
2:	DIP switches (1 - 64, SW/HW and ADDR) for configuring the device address
3:	DIP switch (SIM = simulation mode (has no function); WRITE LOCK = write protection; DISPL. 180° = switch (turn) the display screen 180°)

Procedure for setting the DIP switch:

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

Switching write protection on/off

Write protection is switched on and off via a DIP switch on the rear of the optional attachable display. When write protection is active, parameters cannot be modified. A lock symbol on the display indicates that write protection is on. Write protection prevents any write access to the parameters. Write protection remains active even when the display is removed. To deactivate write protection, the display must be attached to the transmitter with the DIP switch switched off (WRITE LOCK = OFF). The transmitter adopts the setting during operation and does not need to be restarted.

Hardware locking for the TMT84 is disabled (HW_WRITE_PROTECTION = 0) as soon as the display is removed. When the displayed is attached, the value set at the DIP switch is updated in the device.

Turning the display

The display can be rotated 180° via the DIP switch. The setting of the DIP switch is saved and displayed in the Display Transducer Block via a read-only parameter (DISP_ORIENTATION). The setting is retained when the display is removed.

Configuring the device address

Preparing the display:

1. Set the ADDR ACTIVE DIP switch to ON.
2. Set the SW-HW DIP switch to HW.
3. Set the address as required.

Connecting the display:

1. Connect the display.
2. Wait until the display has completely started and displays the measured temperature.

3. Disconnect the TMT84 from the PA bus (power off).
4. Remove the display module from the TMT84 and set the ADDR ACTIVE DIP switch to OFF.
5. Connect the TMT84 to the PA bus again (power on).
   ↳ The configured address is permanently saved in the TMT84.
6. Optionally, check the address in the PLC or attach a display with the ADDR ACTIVE DIP switch set to OFF (the configured PA address is displayed when the display is started).

Please note the following:

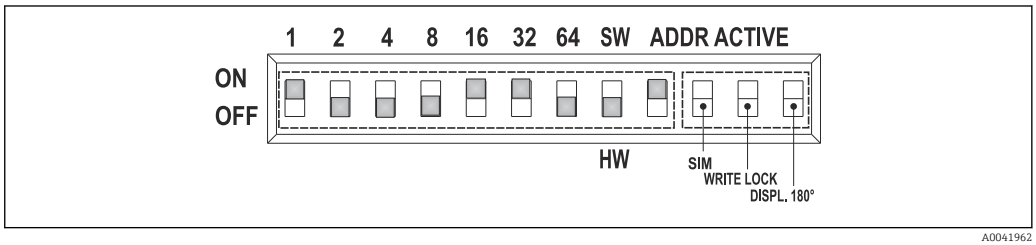
- The address must always be configured for a PROFIBUS® PA device. Valid device addresses are in the range between 0 and 125. In a PROFIBUS® PA network, each address can only be assigned once. If an address is not configured correctly, the device is not recognized by the master. The address 126 is used for initial commissioning and service purposes.
- All devices are delivered ex works with the address 126 and software addressing.

The hardware address is set via DIP switches 1 (1) - 7 (64). The "SW-HW" DIP switch must be set to "HW" and the "ADDR ACTIVE" DIP switch to "ON" to use the configured hardware address.

The transmitter must be restarted so that the TMT84 will adopt and save the DIP switch settings.

Software address means that the saved bus address can be changed via a DDLM_SLAVE_ADD message. In contrast, if a display with a valid address is fitted, this means that the address configured on the display is used and a DDLM_SLAVE_ADD message is ignored.

Therefore, if the display is removed or a display is fitted with the "SW/HW" DIP switch set to SW ("ADDR ACTIVE" DIP switch set to ON), this means that the currently saved bus address can be changed once more via a DDLM_SLAVE_ADD message. The currently saved bus address is used until it is changed via a DDLM_SLAVE_ADD message. When this happens, the bus address is changed directly on receipt of the message and does not require the device to be restarted.



14 *Configuring the device address using the example of bus address 49*

DIP switch set to ON: 32 + 16 + 1 = 49. Furthermore, SW/HW DIP switch set to "HW" and ADDR ACTIVE to "ON".

- **Attaching the display during measuring operation**
  The DIP switches for the bus address are checked during operation and a configured, valid bus address (DIP switches: SW/HW set to HW; ADDR ACTIVE set to ON; bus address < 126) is saved and adopted the next time the device is restarted.
  Attaching the display does not affect the bus address provided that the "ADDR ACTIVE" DIP switch is set to OFF. If the switch is set to ON and if a valid bus address is configured (DIP switch: SW/HW to HW; ADDR ACTIVE to ON; bus address < 126), the address is adopted the next time the device is started. If the device does not start within 30 minutes of changing the bus address, this change is rejected and the device retains the last saved address.
  If the "ADDR ACTIVE" DIP switch is set to ON and the SW/HW DIP switch is set to SW, this does not affect the bus address.
- **Removing the display during operation**
  If the display is removed during operation, the TMT84 uses the address saved in the device and operation continues without restriction.
- **Resetting the bus address to the default value 126**

1. Attach a display with a valid HW address (DIP switch: SW/HW to HW; ADDR ACTIVE to ON; bus address < 126).
2. Wait until the company logo appears on the display.
3. Remove the display and set the SW/HW DIP switch to SW.
4. Attach the display again and wait until the company logo appears.
   ↳ Once the device is restarted, bus address 126 is used.

6.3 "FieldCare" operating program

FieldCare is Endress+Hauser's FDT-based plant asset management tool and enables the configuration and diagnosis of smart field devices. Using status information, FieldCare serves as a simple but effective tool for monitoring devices. Access to the iTEMP TMT84 occurs exclusively via Profibus communication.

Additional information:

- Regarding the menu structure, see the "Operating structure" section → 📄 68
- Regarding the display of diagnostics information according to NAMUR NE107. → 📄 43

Detailed information on PROFIBUS® PA device parameterization and operation concept can be found in the BA00034S/04 Operating Instructions "Guidelines for Planning and Commissioning PROFIBUS® DP/PA - Field Communication".

6.4 "SIMATIC PDM" operating program (Siemens)

SIMATIC PDM is a standardized, non-proprietary tool for the operation, configuration, maintenance and diagnosis of intelligent field devices. For more information, visit www.de.endress.com

6.5 Current device description files

The following table indicates the suitable device description file for the individual operating tools and specifies where these files can be obtained.

PROFIBUS PA protocol (IEC 61158-2, MBP):

Valid for firmware/ software:	1.00.zz	1.01.zz	See the DEVICE SOFTWARE parameter
PROFIBUS® PA device data Profile version:	3.01	3.02	See the PROFILE VERSION parameter
TMT84 device ID: Profile ID:	1551_{hex} Depending on the Profile GSD file used: 0x9703, 0x9702, 0x9701 or 0x9700		See the DEVICE ID parameter
GSD information			
TMT84 GSD:	Extended		Compatibility matrix:
Profile GSD:	PA139700.gsd PA139701.gsd PA139702.gsd PA139703.gsd		| EH3x1551.gsd | EH021551.gsd 1.00.zz | OK | STOP [1)] 1.01.zz | OK | OK
Bitmaps	EH1551_D.bmp EH1551_N.bmp EH1551_S.bmp		
Operating program/ device driver:	**Sources for obtaining device descriptions/program updates, free on the Internet:**		
GSD	▪ www.endress.com (→ Download → Software → Device Drivers) ▪ www.profibus.com		
FieldCare / DTM	www.endress.com (→ Download → Software → Device Drivers)		
SIMATIC PDM	▪ www.endress.com (→ Download → Software → Device Drivers) ▪ www.fielddevices.com		

1) Can be used if the entry "C1_Read_Write_supp = 1" in the GSD file is set to "C1_Read_Write_supp = 0".

7 System integration

The device is ready for system integration after commissioning using the class 2 master. In order to integrate the field devices into the bus system, the PROFIBUS® PA system needs a description of the device parameters, such as output data, input data, data format, data volume and supported transmission rate.

These data are stored in a device master file (GSD file), which is made available to the PROFIBUS® PA master during commissioning of the communication system.

In addition device bitmaps, which appear as icons in the network structure, can also be integrated. With the Profile 3.02 device master file (GSD) it is possible to exchange field devices made by different manufacturers without having to reconfigure. Generally, two different GSD versions are possible using the Profile 3.02 (factory setting: manufacturer-specific GSD):

- **Manufacturer-specific GSD:**
  This GSD ensures the complete and unrestricted functionality of the field device. Device-specific process parameters and functions are therefore available.
- **Profile GSD:**
  Varies with regard to the number of Analog Input blocks (AI). If a system is configured with the Profile GSD, devices of different manufacturers can be exchanged. However, it is essential to ensure that the order of the cyclic process values is correct.

1. Manufacturer-specific GSD, EH021551.gsd or EH3x1551.gsd (→ Section 6.5 "Current device description files" → 🖹 28) Ident number = 1551 (hex) Ident number selector = 1
2. Profile GSD, PA139703.gsd (4 Analog Inputs) Ident number = 9703 (hex) Ident number selector = 0
3. Profile GSD, PA139700.gsd (1 Analog Input) Ident number = 9700 (hex) Ident number selector = 129
4. Profile GSD, PA139701.gsd (2 Analog Inputs) Ident number = 9701 (hex) Ident number selector = 130
5. Profile GSD, PA139702.gsd (3 Analog Inputs) Ident number = 9702 (hex) Ident number selector = 131
6. Manufacturer-specific GSD, Eh3x1523.gsd (TMT184 compatibility mode) Ident number = 1523 (hex) Ident number selector = 128

Before configuring, it is essential to decide which GSD should be used to operate the system. The setting can be changed with a Class 2 master. The TMT84 head transmitter supports the following GSD files (see the table under → Section 6.5 "Current device description files" → 🖹 28).

Every device is assigned an identification number (ID) by the PROFIBUS User Organization (PNO). The name of the GSD file is derived from this number. For Endress+Hauser, this ID number begins with the manufacturer ID 15xx. For better classification and clarity, Endress+Hauser GSD names are as follows:

EH0215xx	EH = Endress+Hauser 02 = GSD revision 15xx = ID No.

The GSD files for all Endress+Hauser devices can be requested as follows:

- Internet (Endress+Hauser) → http://www.endress.com (download → software)
- Internet (PNO) → http://www.profibus.com (GSD library)
- On a CD-ROM from Endress+Hauser. Please contact an Endress+Hauser sales office.

7.1 Extended formats

There are some GSD files whose modules are transferred using an extended identification (e.g. 0x42, 0x84, 0x08, 0x05). These GSD files are located in the "Extended" folder.

7.2 Content of the download file

- All Endress+Hauser GSD files
- Endress+Hauser bitmap files
- Useful information on the devices

7.3 Working with the GSD files

The GSD files must be integrated into the automation system. Depending on the firmware/ software used, the GSD files can be either copied to the specific program directory or imported into the database using an import function in the configuration software.

Example:

The subdirectory is ...\ siemens \ step7 \ s7data \ gsd for the Siemens STEP 7 configuration software from Siemens PLC S7-300 / 400.

The GSD files also include bitmap files. These bitmap files are required to illustrate the measuring points. The bitmap files must be loaded into the directory ...\ siemens \ step7 \ s7data \ nsbmp.

For other configuration software programs, please ask the PLC vendor for the name of the correct directory.

7.4 Compatibility with previous TMT184 model

If the device is replaced, the iTEMP TMT84 head transmitter guarantees the compatibility of the cyclic data with the previous iTEMP TMT184 model with Profile Version 3.0 (ID No. 1523). It is possible to replace an iTEMP TMT184 with an iTEMP TMT84 without the need to reconfigure the PROFIBUS® DP/PA network in the automation system even though the devices have different names and ident numbers.

Automatic identification

Once the head transmitter is replaced, the device switches automatically from the standard operating mode to the compatibility mode if the **PROFIBUS Ident Number Selector** parameter is set to 127 (default factory setting). The compatibility mode can also be activated by setting the **PROFIBUS Ident Number Selector** parameter to 128 (Manuf. specific Ident Number 1523 - TMT184). This value is transmitted and evaluated by the master when cyclic communication is being established. This number determines whether the iTEMP TMT84 is configured for the standard mode or the compatibility mode.

Manual changeover from operation as an iTEMP TMT84 or iTEMP TMT184 is supported.

Information on diagnostics in the compatibility mode

- If the iTEMP TMT84 is acyclically configured via an operating program (Class 2 master), access is directly via the block structure or the parameters of the device.
- If parameters have been changed in the device to be replaced (iTEMP TMT184, parameter setting no longer corresponds to the original factory default setting), these parameters must be changed accordingly in the new replacement iTEMP TMT84 using an operating program (Class 2 master).
- As the iTEMP TMT84 behaves the same as an iTEMP TMT184 in compatibility mode with regard to diagnostics and status handling, only the PA-Profile 3.0 is supported with regard to the diagnostic bits and status codes during operation in this mode.

Replacing the devices

Procedure:

Remove the iTEMP TMT184
▼
Configure the device address (→ 🖹 26) The same device address that was set in the iTEMP TMT184 must be used.
▼
Connect the iTEMP TMT84
▼
Adjust the following settings if necessary (if the factory setting was changed): Configuration of the application-specific parameters Setting of the units for the process variables

7.5 Cyclic data exchange

In PROFIBUS® PA the analog values are cyclically transmitted to the automation system in data blocks of 5 bytes. The measured value is represented in the first 4 bytes in the form of floating point numbers in accordance with the IEEE 754 standard (see IEEE floating point number). The 5th byte contains status information relating to the measured value. This information is implemented according to the Profile 3.02 [1]) specification. The status is shown as a symbol on the device display, if available. An exact description of the data types is provided in Section 11 "Operation using PROFIBUS® PA".

7.5.1 IEEE floating point number

Conversion of a hexadecimal value to an IEEE floating point number for measured value acquisition. The measured values are displayed as follows in the IEEE-754 number format and transmitted to the Class 1 master:

Byte n			**Byte n+1**		**Byte n+2**	**Byte n+3**
Bit 7	Bit 6	Bit 0	Bit 7	Bit 6 Bit 0	Bit 7 Bit 0	Bit 7 Bit 0
Sign	2^7 2^6 2^5 2^4 2^3 2^2 2^1		2^0	2^{-1} 2^{-2} 2^{-3} 2^{-4} 2^{-5} 2^{-6} 2^{-7}	2^{-8} 2^{-9} 2^{-10} 2^{-11} 2^{-12} 2^{-13} 2^{-14} 2^{-15}	2^{-16}...2^{-23}
	Exponent			**Mantissa**	**Mantissa**	**Mantissa**

Sign = 0: positive number

Sign = 1: negative number

$Number = -1^{sign} \cdot (1 + M) \cdot 2^{E-127}$

E = exponent; M = mantissa

1) According to Profile 3.01: Profile GSD files used or IDENT_NUMBER_SELECTOR set to {0, 129, 130 or 131} or TMT84 GSD file used or IDENT_NUMBER_SELECTOR set to 1 and "CondensedStatus" parameter to OFF. According to Profile 3.02: TMT84 GSD file used or IDENT_NUMBER_SELECTOR set to 1 and "CondensedStatus" parameter to ON. If the IDENT_NUMBER_SELECTOR = 127, the GSD file used for cyclic data exchange determines whether diagnosis is performed according to Profile 3.01 or Profile 3.02.

Example: 40 F0 00 00 h	= 0100 0000 1111 0000 0000 0000 0000 0000 b
Value	$= -1^{0} \cdot 2^{129-127} \cdot (1 + 2^{-1} + 2^{-2} + 2^{-3})$
	$= 1 \cdot 2^{2} \cdot (1 + 0.5 + 0.25 + 0.125)$
	$= 1 \cdot 4 \cdot 1.875 = 7.5$

7.5.2 Block model

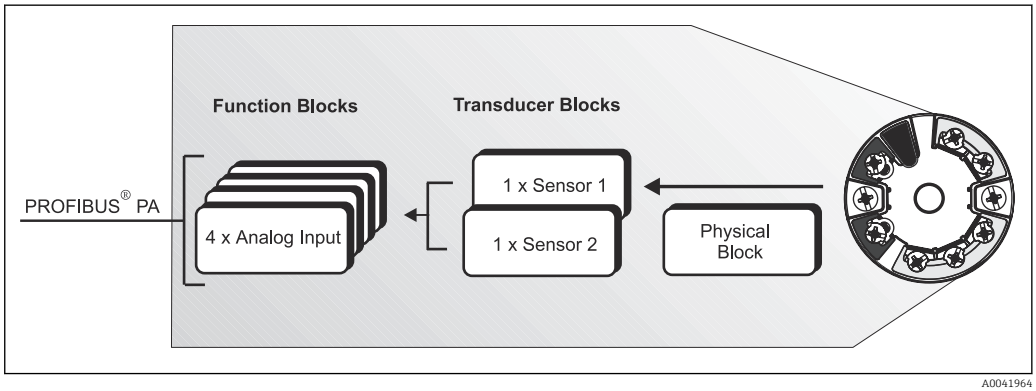
The head transmitter supports a maximum of 5 slots for cyclic data exchange. A maximum of 4 values can be selected and transmitted. Elements of cyclic communication:

Slot	Data block	Access
1	Analog Input 1	Read
2	Analog Input 2	Read
3	Analog Input 3	Read
4	Analog Input 4	Read
5	Display Value	Write

General description of the blocks:

Block name	Short description	Slot
Physical Block	General device data	0
Transducer Block 1	Sensor settings, channel 1	1
Transducer Block 2	Sensor settings, channel 2	2
Analog Input Block 1	Output of a measured value	1
Analog Input Block 2	Output of a measured value	2
Analog Input Block 3	Output of a measured value	3
Analog Input Block 4	Output of a measured value	4

The block model displayed (→ 15, 33) shows the input and output data the head transmitter makes available for cyclic data transfer.



15 *Head transmitter block model, Profile 3.02*

7.5.3 Display value

The display value contains 4 bytes with the measured value and 1 byte with the status.

7.5.4 Input data

Input data are the process temperature and internal reference temperature.

7.5.5 Data transfer from the head transmitter to the automation system

The order of the input and output bytes is fixed. If addressing is performed automatically via the configuration program, the numerical values of the input and output bytes can differ from the values in the following table.

Input byte	Process parameters	Access type	Comment/data format	Default value unit
0, 1, 2, 3	*Temperature [1]	Read	32-bit floating point number (IEEE-754) Representation → 32	°C
4	*Status temperature [1]		Status code	-
Possible settings: ▪ PV value of the transducer ▪ Measured value of the sensor at the sensor input ▪ Measured value of the internal reference measuring point		→ 37 → Select in the CHANNEL parameter → Primary Value TB1 → Select in the CHANNEL parameter → Secondary Value TB1 → Select in the CHANNEL parameter → Internal Temperature		

1) Depends on the option selected in the CHANNEL parameter of the Analog Input function block → 37

The system units in the table correspond to the preset scalings that are transferred during cyclic data exchange. In the case of customized settings, however, the units can differ from the default value.

7.5.6 Output data

The display value makes it possible to transmit a measured value calculated in the automation system directly to the head transmitter. This measured value is purely a display value and is displayed, for example, by the PROFIBUS® PA Display RID16. The display value contains 4 bytes with the measured value and 1 byte with the status.

Input byte	Process parameters	Access type	Comment/data format
0, 1, 2, 3	Display value	Write	32-bit floating point number (IEEE-754) representation → 32
4	Status display value	Write	-

Only activate the data blocks that are processed in the automation system. This improves the data throughput rate of a PROFIBUS® PA network. A flashing, double arrow symbol appears on the optional display to indicate that the device is communicating with the automation system.

7.5.7 System units

The measured values are transmitted to the automation system via cyclic data exchange in the system units as described in the "Group Setup" section (UNIT N parameter).

7.5.8 Configuration example

Generally, a PROFIBUS® DP/PA system is configured as follows:

1. The field devices to be configured (iTEMP TMT84) are integrated in the configuration program of the automation system via the PROFIBUS® DP network using the GSD file. Any measured variables that are required can be configured offline with the configuration software.
2. The user program of the automation system should now be programmed. The input and output data are controlled in the user program and the location of the measured variables is specified so that they can be processed further.
3. An additional measured value conversion component may need to be used for an automation system that does not support the IEEE-754 floating point number format.
4. Depending on the data processing method in the automation system (little-endian or big-endian format) it may be necessary to change the byte order (byte swapping).
5. Once the configuration has been completed, it is transferred to the automation system as a binary file.
6. The system can now be started. The automation system establishes a connection to the configured devices. The process-related device parameters can now be configured using a Class 2 master, e.g. with the help of FieldCare.

7.6 Acyclic data exchange

Acyclic data exchange is used to transfer parameters during commissioning, maintenance or to display additional measured variables that are not contained in cyclic data communication. Parameters for identification, control or adjustment can therefore be changed in the various blocks (Physical Block, Transducer Block, Function Block) while the device is engaged in cyclic data exchange with a PLC.

The device supports the following basic types of acyclic data transfer:

MS2AC communication with 2 available SAPs.

There are two types of acyclic communication:

7.6.1 Acyclic communication with a Class 2 master (MS2AC)

MS2AC refers to acyclic communication between a field device and a Class 2 master (e.g. Fieldcare, PDM, etc.). Here, the master opens a communication channel via a service access point (SAP) to access the device.

All parameters to be exchanged with a device via PROFIBUS® must be communicated to a Class 2 master. This assignment is done either in a device description (DD), a DTM (device type manager) or within a software component in the master via slot and index addressing for each individual parameter.

The slot and index, length specifications (bytes) and the data record are transferred in addition to the field device address when parameters are written using a Class 2 master. The slave acknowledges this write request on completion. The blocks can be accessed with a Class 2 master. The parameters that can be used in the Endress+Hauser operating program (FieldCare) are listed in the tables in Section 13.

Please note the following for MS2AC communication:

- As explained above, a Class 2 master accesses a device via special SAPs. Therefore, the number of Class 2 masters that can communicate simultaneously with a device is limited to the number of SAPs made available for this communication.
- The use of a Class 2 master increases the cycle time of the bus system. This must be taken into account when programming the controller or the control system used.

7.6.2 Acyclic communication with a Class 1 master (MS1AC)

In the case of MS1AC, a cyclic master, which is already reading the cyclic data from the device or writing the data to the device, opens the communication channel via the SAP 0x33 (special service access point for MS1AC). It can then acyclically read or write (if supported) a parameter like a Class 2 master via the slot and the index.

Please note the following for MS1AC communication:

- Currently, there are not many PROFIBUS masters on the market that support this kind of communication.
- Not all PROFIBUS devices support MS1AC.
- In the user program, it is important to note that constant writing of parameters (e.g. with every program cycle) can significantly reduce the operating life of a device. Parameters written acyclically are saved as persistent data to the memory modules (e.g. EEPROM, Flash, etc.). These memory modules are only designed for a limited number of writes. During standard operation without MS1AC (during configuration), the number of write operations will not come close to reaching this limit. Incorrect programming can cause the maximum limit to be reached quickly, however, thereby significantly shortening the life of a device.

The device supports MS2AC communication with 2 available SAPs. MS1AC communication is supported by the device. The memory module is designed for 106 writes.

8 Commissioning

8.1 Installation check

Before commissioning the measuring point make sure that all final checks have been carried out:
- Checklist “Post-installation check”, → 15
- Checklist “Post-connection check”, → 22

The functional data of the PROFIBUS®PA interface as per IEC 61158-2 (MBP) must be observed.

A standard multimeter can be used to check the bus voltage of 9 to 32 V and the current consumption of approx. 11 mA at the measuring device.

8.2 Switching on the transmitter

Once you have successfully completed the final checks, it is time to switch on the supply voltage. The transmitter performs a number of internal test functions after power-up. During this process, the following sequence of messages appears on the display:

Step	User interface
1	Display name and the firmware (FW) and hardware (HW) version
2	Firm logo
3a	Device name and the FW and HW of the head transmitter
3b	The device address, the IDENT_NUMBER_SELECTOR mode and the current IDENT_NUMBER are displayed
3c	The sensor configuration is displayed
4a	Current measured value or
5b	Current status message If the switch-on procedure is not successful, the relevant diagnostic event, depending on the cause, is displayed. A detailed list of diagnostic events and the corresponding troubleshooting instructions can be found in the "Diagnostics and troubleshooting" section .

The device operates as normal after approx. 8 seconds, and the attached display after approx. 12 seconds! Normal measuring mode commences as soon as the switch-on procedure is completed. Measured values and status values appear on the display.

8.3 Commissioning the PROFIBUS® PA interface

A detailed description of all the functions required for commissioning is provided in Section 13 "Operation using PROFIBUS® PA".

8.3.1 Commissioning PROFIBUS® PA

Procedure:

Check the hardware write protection
▼
Configuration of bus address
▼
Enter the tag name

▼

Configuration of the measuring inputs (for a detailed description, see Section 13)

▼

Configuration of the Analog Input parameters (for a detailed description, see Section 13)

1. Check the hardware write protection.
   ↳ The **WRITE PROTECTION** parameter indicates whether write-access to the device is possible via PROFIBUS® (acyclic data transmission, e.g. via the "FieldCare" operating program):
   SETUP → ADVANCED SETUP → WRITE PROTECTION
   One of the following options is displayed:
   – OFF (factory setting) = Write access is possible via PROFIBUS®
   – ON = Write access is not possible via PROFIBUS®
2. Disable the write protection if necessary, → 🖹 26
3. Enter the tag name (optional)
   ↳ DIAGNOSTICS → SYSTEM INFORMATION → TAG
4. Set the bus address
   ↳ Hardware addressing via DIP switches, → 🖹 26
5. Configuration of the Transducer Blocks
   ↳ The individual Transducer Blocks comprise various configuration options, such as unit, sensor type, etc.
   The parameter groups are grouped together in the blocks as follows:
   – Temperature sensor 1 → Transducer Block 1 (slot 1)
   – Temperature sensor 2 → Transducer Block 2 (slot 2)
6. Configuration of the Analog Input function blocks 1-4
   ↳ The device has four analog input function blocks (AI module). They are used to transmit different measured variables to the PROFIBUS® master (class 1) cyclically. The procedure for assigning a measured variable to the Analog Input function block is explained below, taking the example of the Analog Input function block 1 (AI module, slot 1).
   Using the CHANNEL function, you can specify the measured variables that should be transferred cyclically to the PROFIBUS® master (class 1) (e.g. Primary Value Transducer 1):
   ▸ Call up the CHANNEL function.
   ▸ Select the "PV Transducer 1" option
   The following settings are possible:
   CHANNEL →
   – Primary Value Transducer 1
   – Secondary Value 1 Transducer 1
   – Reference Junction Temperature
   – Primary Value Transducer 2
   – Secondary Value 1 Transducer 2

8.4 Enabling parameter configuration

If the device is locked and the parameter settings cannot be changed, it must first be enabled via the hardware or software lock. The device is write-protected if the keyhole symbol appears in the header of the measured value display.

To unlock the device:
- Either switch the write protection switch on the rear of the display to the “OFF” position (hardware write protection), → 25 or
- Disable the software write protection via the operating tool. See the description for the “Define device write protection” parameter in the Operating Instructions.

When hardware write protection is active (write protection switch on the rear of the display is set to "ON"), write protection cannot be disabled via the operating tool. Hardware write protection must always be disabled before software write protection can be enabled or disabled.

9 Maintenance

No special maintenance work is required for the device.

Cleaning
A clean, dry cloth can be used to clean the device.

10 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.

Accessories included in the scope of delivery:
- Multilingual Brief Operating Instructions as hard copy
- ATEX supplementary documentation: ATEX Safety Instructions (XA), **C**ontrol **D**rawings (CD)
- Mounting material for head transmitter
- Optional mounting material for field housing (wall or pipe mounting)

10.1 Device-specific accessories

Accessories		
TID10 display unit for Endress+Hauser head transmitter iTEMP TMT8x [1], attachable		
Field housing TA30x for Endress+Hauser head transmitter		
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 display connector cover)		
US - M4 securing screws (2 M4 screws and 1 display connector cover)		
Fieldbus connector (PROFIBUS® PA):	Threaded connection ▪ M20x1.5 ▪ NPT ½" ▪ M20x1.5	Cable connection thread ▪ M12 ▪ M12 ▪ 7/8"
Stainless steel wall mounting bracket Stainless steel pipe mounting bracket		

1) Without TMT80

10.2 Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART® communication with FieldCare via the USB interface. For details, see Technical Information TI404F/00
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 TI405C/07
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. For details, see Operating Instructions BA061S/04
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

10.3 Service-specific accessories

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

Accessories	Description
Configurator	Product Configurator - the tool for individual product configuration ▪ Up-to-the-minute configuration data ▪ Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language ▪ Automatic verification of exclusion criteria ▪ Automatic creation of the order code and its breakdown in PDF or Excel output format ▪ Ability to order directly in the Endress+Hauser Online Shop The Configurator is available on the Endress+Hauser website at: www.endress.com -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.

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

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

11 Diagnostics and troubleshooting

11.1 Troubleshooting

Always start troubleshooting with the checklists below if faults occur after start up or during operation. This takes you directly (via various queries) to the cause of the problem and the appropriate remedial measures.

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

Check the display (optional, attachable LC display)	
Display is blank	1. Check the supply voltage at the head transmitter → terminals + and - 2. Check whether the holders and the connection of the display module are correctly seated on the head transmitter, Section 4.2. → 15 3. If possible, test the display module with other suitable E+H head transmitters 4. Display module defective → Replace module 5. Head transmitter defective → Replace transmitter

Onsite error messages on the display
→ 45

Faulty connection to the fieldbus host system	
No connection can be made between the fieldbus host system and the device. Check the following points:	
Fieldbus connection	Check the data cable
Fieldbus connector (optional)	Check the pin assignment/wiring, → 20
Fieldbus voltage	Check whether a min. bus voltage of 9 V_{DC} is present at the +/- terminals. Permitted range: 9 to 32 V_{DC}
Network structure	Check permissible fieldbus length and number of spurs → 18
Basic current	Is there a basic current of min. 11 mA?
Terminating resistors	Has the PROFIBUS® PA segment been terminated correctly? Each bus segment must always be terminated with a bus terminator at both ends (start and finish). Otherwise there may be interference in data transmission.
Current consumption, permissible feed current	Check the current consumption of the bus segment: The current consumption of the bus segment in question (= total of basic currents of all bus users) must not exceed the max. permitted feed current of the bus power supply unit.
Error messages in the PROFIBUS® PA configuration system	
→ 45	

Other errors (application errors without messages)	
Some other error has occurred.	Possible causes and remedial measures, see Section 11.4 → 50

11.2 Displaying the device status on PROFIBUS® PA

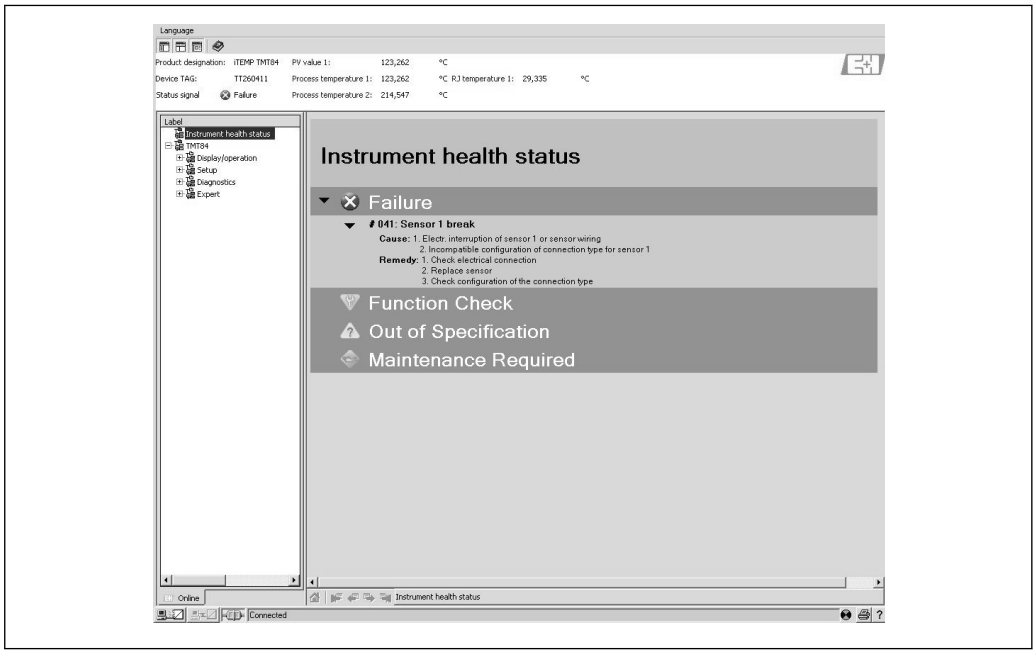
11.2.1 Display in the operating program (acyclic data transfer)

The device status can be queried via an operating program, see Section 13.2.3: EXPERT → DIAGNOSTICS → STATUS).

11.2.2 Display in the FieldCare diagnostic module (acyclic data transfer)

The general device status as per NAMUR NE107 can be quickly determined using the start screen of an online connection to the device. All diagnostic messages for the measuring point have been classified into four categories (Failure, Function Check, Out of Specification, Maintenance Required), thereby providing the user with information on the cause and possible corrective measures. If there is no diagnostic message, the status signal "ok" appears.

The graphic shows a failure caused by a line break at sensor 1:

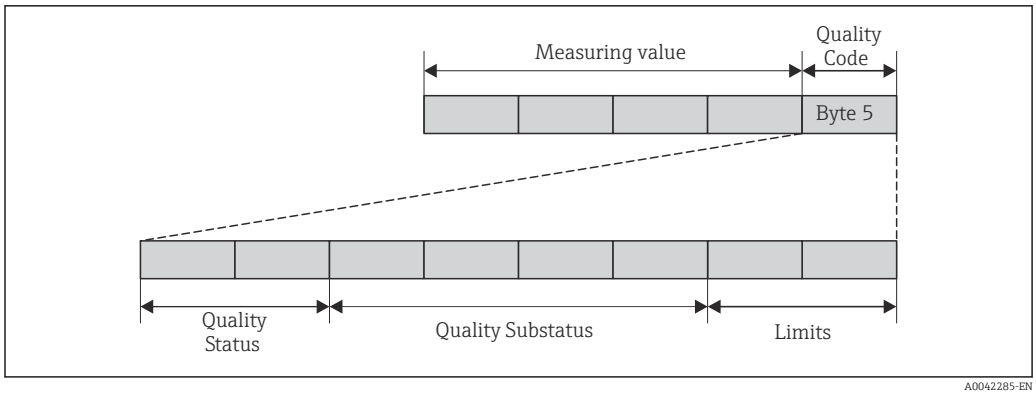


A0042284

11.2.3 Display in the PROFIBUS® master system (cyclic data transfer)

If the AI module is configured for cyclic data transfer, the device status is coded according to PROFIBUS Profile Specification 3.02 [2)] and transferred, together with the measured value, via the quality byte (byte 5) to the PROFIBUS master (Class 1). The quality byte is divided into the segments quality status, quality substatus and limits (limit values).

2) According to Profile 3.01: Profile GSD files used or IDENT_NUMBER_SELECTOR set to {0, 129, 130 or 131} or TMT84 GSD file used or IDENT_NUMBER_SELECTOR set to 1 and "CondensedStatus" parameter to OFF. According to Profile 3.02: TMT84 GSD file used or IDENT_NUMBER_SELECTOR set to 1 and "CondensedStatus" parameter set to ON. If the IDENT_NUMBER_SELECTOR = 127, the GSD file used for cyclic data exchange determines whether diagnosis is performed according to Profile 3.01 or Profile 3.02.



The content of the quality byte of an Analog Input function block depends on its configured failsafe mode. Depending on the failsafe mode configured in the FAILSAFE MODE function, the following status information is transferred to the PROFIBUS master (Class 1) via the quality byte:

FAILSAFE MODE as per Profile 3.01

Quality code (hex)	Quality status	Quality substatus	Limits
0x48 0x49 0x4A	UNCERTAIN	Substitute set	OK Low High

If FAILSAFE MODE → LAST GOOD VALUE is selected (default value)

Valid output value before error				No valid output value before error			
Quality code (hex)	Quality status	Quality substatus	Limits	Quality code (hex)	Quality status	Quality substatus	Limits
0x44 0x45 0x46	UNCERTAIN	Last usable value	OK Low High	0x4C 0x4D 0x4E	UNCERTAIN	Initial value	OK Low High

If FAILSAFE MODE → WRONG VALUE is selected: status messages (→ 45).

The FAILSAFE MODE function can be configured via an operating program (e.g. FieldCare) in the respective Analog Input function block 1-4.

FAILSAFE MODE as per Profile 3.02

Input	Result		
State before Fail Safe Mechanism (FB-Input)	FSAFE_TYPE 0 (failsafe value)	FSAFE_TYPE 1 (last usable value)	FSAFE_TYPE 2 (wrong calculated value)
BAD - non specific (not generated by the device)	-	-	-
BAD - passivated	BAD - passivated	BAD - passivated	BAD - passivated
BAD - maintenance alarm	UNCERTAIN - substitute set	UNCERTAIN - substitute set	BAD - maintenance alarm
BAD - process related	UNCERTAIN - process related	UNCERTAIN - process related	BAD - process related
BAD - function check	UNCERTAIN - substitute set	UNCERTAIN - substitute set	BAD - function check

11.3 Status messages

The device displays warnings or alarms as status messages. If errors occur during commissioning or measuring operation, these errors are displayed immediately. Errors are displayed in the configuration program via the parameter in the Physical Block or on the attached display. A distinction is made here between the following 4 status categories:

Status category	Description	Error category
F	Fault detected ('Failure')	ALARM
M	Maintenance required	WARNING
C	Device is in the service mode (check)	
S	Specifications not observed ('Out of specification')	

WARNING error category:

With "M", "C" and "S" status messages, the device tries to continue measuring (uncertain measurement!). If a display unit is attached, the display alternates between the status indicated by the relevant letter plus the defined error number and the primary measured value.

ALARM error category:

The device does not continue measuring with the "F" status message. If a display unit is attached, the display alternates between the status message and "- - - -" (no valid measured value available). Depending on the setting of the Fail Safe Type parameter (FSAFE_TYPE), the last valid measured value, the incorrect measured value or the value configured under Fail Safe Value (FSAFE_VALUE) is transmitted via the fieldbus with the status "BAD" or "UNCERTAIN" for the measured value. The fault state is displayed in the form of the letter "F" plus a defined number.

In both cases, the sensor that generates the status is displayed, e.g. "C1", "C2". If the name of a sensor is not displayed, the status message does not refer to a sensor but refers to the device itself.

Abbreviations for output variables:

- SV1 = Secondary value 1 = Sensor value 1 in Temperature Transducer Block 1 = Sensor value 2 in Temperature Transducer Block 2
- SV2 = Secondary value 2 = Sensor value 2 in Temperature Transducer Block 1 = Sensor value 1 in Temperature Transducer Block 2
- PV1 = Primary value 1
- PV2 = Primary value 2
- RJ1 = Reference junction 1
- RJ2 = Reference junction 2

11.3.1 Category F diagnostics code messages

Category	No.	Status messages ▪ In the Physical Block ▪ Diagnostic code ▪ Advanced diagnostics ▪ Local display	Sensor Transducer Block measured value status 1 = status (Profile 3.01/3.02) 2 = quality 3 = substatus (Profile 3.01/3.02) 4 = limits	Cause of error / remedy	Output variables affected
F-	041	Device status message (PA): Open circuit F-041 Local display: F041	1 = 0x10 [1)]/0x24 [1)] 2 = BAD 3 = Sensor Failure / Maintenance alarm, more diagnosis available 4 = OK	Cause of error: 1. Electr. interruption of sensor or sensor wiring. 2. Incorrect configuration for connection type in the CONNECTION TYPE parameter. Remedy: Re 1.) Reestablish electr. connection or replace sensor. Re 2.) Configure correct type of connection.	SV1, SV2, also PV1, PV2 depending on the configuration
F-	042	Device status message (PA): Sensor corrosion F-042 Local display: F042	1 = 0x10x24 [1)] 2 = BAD 3 = Sensor Failure / Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Corrosion detected on the sensor terminals. Remedy: Check wiring and replace if necessary.	SV1, SV2, also PV1, PV2 depending on the configuration
F-	043	Device status message (PA): Sensor short circuit F-043 Local display: F043	1 = 0x10x24 [1)] 2 = BAD 3 = Sensor Failure / Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Short circuit detected at the sensor terminals. Remedy: Check the sensor and sensor wiring.	SV1, SV2, also PV1, PV2 depending on the configuration
F-	103	Device status message (PA): Sensor drift F-103 local display: F103	1 = 0x10x24 [1)] 2 = BAD 3 = Sensor Failure / Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Sensor drift has been detected (according to the settings in the Transducer Blocks). Remedy: Check the sensor, depending on the application.	PV1, PV2 SV1, SV2
F-	221	Device status message (PA): Reference temperature measurement F-221 local display: F221	1 = 0x0C/0x24 [1)] 2 = BAD 3 = Sensor Failure / Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Internal reference junction defective. Remedy: Device defective, replace	SV1, SV2, PV1, PV2, RJ1, RJ2
F-	261	Device status message (PA): Electronic failure F-261 Local display: F261	1 = 0x0C/0x24 [1)] 2 = BAD 3 = Sensor Failure / Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Electronics error. Remedy: Device defective, replace	SV1, SV2, PV1, PV2, RJ1, RJ2
F-	283	Device status message (PA): Memory error F-283 Local display: F283	1 = 0x0C/0x24 [1)] 2 = BAD 3 = Sensor Failure / Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Error in memory. Remedy: Device defective, replace	SV1, SV2, PV1, PV2, RJ1, RJ2
F-	431	Device status message (PA): Calibration incorrect F-431 Local display: F431	1 = 0x0C/0x24 [1)] 2 = BAD 3 = Sensor Failure / Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Error in calibration parameters. Remedy: Device defective, replace	SV1, SV2, PV1, PV2, RJ1, RJ2

Category	No.	Status messages ▪ In the Physical Block ▪ Diagnostic code ▪ Advanced diagnostics ▪ Local display	Sensor Transducer Block measured value status 1 = status (Profile 3.01/3.02) 2 = quality 3 = substatus (Profile 3.01/3.02) 4 = limits	Cause of error / remedy	Output variables affected
F-	437	Device status message (PA): Configuration incorrect F-437 Local display: F437	1 = 0x0C/0x24 [1] 2 = BAD 3 = Sensor Failure / Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Incorrect configuration in Transducer Blocks "Sensor 1 and 2". Remedy: Check the configuration of the sensor types used, the units and the settings of PV1 and/or PV2.	SV1, SV2, PV1, PV2, RJ1, RJ2
F-	502	Device status message (PA): Linearization error F-502 Local display: F502	1 = 0x0C/0x24 [1] 2 = BAD 3 = Sensor Failure / Maintenance alarm, more diagnosis available 4 = OK	Cause of error: Linearization error. Remedy: Select valid type of linearization (sensor type).	SV1, SV2, PV1, PV2, RJ1, RJ2

1) → 49

11.3.2 Category M diagnostics code messages

Category	No.	Status messages ▪ In the Physical Block ▪ Diagnostic code ▪ Advanced diagnostics ▪ Local display	Sensor Transducer Block measured value status 1 = status (Profile 3.01/3.02) 2 = quality 3 = substatus (Profile 3.01/3.02) 4 = limits	Cause of error / remedy	Output variables affected
M-	042	Device status message (PA): Corrosion M-042 Local display: M042	1 = 0x50 [1]/0xA4 [1] 2 = UNCERTAIN/GOOD 3 = Sensor conversion not accurate / Maintenance required/ demanded 4 = OK	Cause of error: Corrosion detected on the sensor terminals. Remedy: Check wiring and replace if necessary.	SV1, SV2, also PV1, PV2 depending on the configuration
M-	103	Device status message (PA): Drift M-103 Local display: M103	1 = 0x10 [1]/0xA4 [1] 2 = UNCERTAIN / GOOD 3 = Non-specific / Maintenance required / demanded 4 = OK	Cause of error: Sensor drift has been detected (according to the settings in the Transducer Blocks). Remedy: Check the sensor, depending on the application.	PV1, PV2 SV1, SV2
M-	262	Device status message (PA): Display communication error M-262 Local display: M262	Does not affect the measured value status	Cause of error: No communication possible with the display. Remedy: ▪ Check whether the holders and the connection of the display module are correctly seated on the head transmitter ▪ If possible, test the display module with other suitable E+H head transmitters ▪ Display module defective → Replace module	SV1, SV2, PV1, PV2, RJ1, RJ2

1) See note → 49

11.3.3 Category S diagnostics code messages

Category	No.	Status messages ▪ In the Physical Block ▪ Diagnostic code ▪ Advanced diagnostics ▪ Local display	Sensor Transducer Block measured value status 1 = status (Profile 3.01/3.02) 2 = quality 3 = substatus (Profile 3.01/3.02) 4 = limits	Cause of error / remedy	Output variables affected
S-	101	Device status message (PA): Sensor measuring range undershot S-101 Local display: S101	1 = 0x50 [1)]/0x78 [1)] 2 = UNCERTAIN 3 = Sensor conversion not accurate / Process related, no maintenance 4 = OK	Cause of error: Physical measuring range undershot. Remedy: Select suitable sensor type.	SV1, SV2, also PV1, PV2 depending on the configuration
S-	102	Device status message (PA): Sensor measuring range overshot S-102 Local display: S102	1 = 0x50 [1)]/0x78 [1)] 2 = UNCERTAIN 3 = Sensor conversion not accurate / Process related, no maintenance 4 = OK	Cause of error: Physical measuring range overshot. Remedy: Select suitable sensor type.	SV1, SV2, also PV1, PV2 depending on the configuration
S-	901	Device status message (PA): Ambient temperature too low S-901 Local display: S901	1 = 0x40 [1)]/0x78 [1)] 2 = UNCERTAIN 3 = Non specific / Process related, no maintenance 4 = OK	Cause of error: Reference temperature < −40 °C (−40 °F): parameter **Ambient temperature alarm = On.** Remedy: Observe ambient temperature in accordance with specification.	SV1, SV2, PV1, PV2, RJ1, RJ2
S-	902	Device status message (PA): Ambient temperature too high S-902 Local display: S902	1 = 0x40 [1)]/0x78 [1)] 2 = UNCERTAIN 3 = Non specific / Process related, no maintenance 4 = OK	Cause of error: Reference temperature < +85 °C (+185 °F): parameter **Ambient temperature alarm = On.** Remedy: Observe ambient temperature in accordance with specification.	SV1, SV2, PV1, PV2, RJ1, RJ2

1) See note → 🖹 49

11.3.4 Category C diagnostics code messages

Category	No.	Status messages ▪ In the Physical Block ▪ Diagnostic code ▪ Advanced diagnostics ▪ Local display	Sensor Transducer Block measured value status 1 = status (Profile 3.01/3.02) 2 = quality 3 = substatus (Profile 3.01/3.02) 4 = limits	Cause of error / remedy	Output variables affected
C-	402	Device status message (PA): Startup initialization C-402 Local display: C402 ↔ Measured value	1 = 0x4C [1]/0x3C [1] 2 = UNCERTAIN / BAD 3 = Init value / function check / local override 4 = OK	Cause of error: Device starting/initializing. Remedy: Message is only displayed during power-up.	SV1, SV2, PV1, PV2, RJ1, RJ2
C-	482	Device status message (PA): Simulation active C-482 Local display: C482 ↔ Measured value	1 = 0x70 [1]/0x73(0x74) 2 = UNCERTAIN / BAD 3 =Init value / simulated value, start (end) 4 = OK	Cause of error: Simulation is active. Remedy: -	
C-	501	Device status message (PA): Device reset C-501 Local display: C501 ↔ Measured value	1 = 0x4C [1]/0x7F 2 = UNCERTAIN 3 = Init value / - - 4 = OK	Cause of error: Device reset is performed. Remedy: Message is only displayed during a reset.	SV1, SV2, PV1, PV2, RJ1, RJ2

1) See note → 49

The specified status can increase by the value 1 (low limit), 2 (high limit) or 3 (constant) due to a limit violation. The status value can increase as a result of a limit violation of the error directly displayed, or can be transferred from a low-priority error when more than one status occurs simultaneously.

Example:

	Quality (BAD)		Quality substatus				Limits		
Fault (F)	0	0	1	0	0	1	x	x	= 0x24 0x27

11.3.5 Corrosion monitoring

Sensor connection cable corrosion can lead to false measured value readings. Therefore the unit offers the possibility of detecting corrosion before a measured value is affected.

Corrosion monitoring is only possible for RTDs with a 4-wire connection and thermocouples.

2 different levels can be selected in the CORROSION_DETECTION parameter (see Section 11) depending on the application requirements:

- Off (No corrosion monitoring)
- On (Warning is displayed before the alarm value is reached - see table below. This allows preventative maintenance/troubleshooting to be performed. An alarm message is displayed after the alarm limit is reached)

The following table describes how the device behaves when the resistance in a sensor connection cable changes, depending on whether on or off is selected for the parameter.

RTD	< ≈ 2 kΩ	2 kΩ ≈ < x ≈ 3 kΩ	> ≈ 3 kΩ
Off	---	No alarm	No alarm
On	---	WARNING (M-042)	ALARM (F-042)

TC	< ≈ 10 kΩ	10 kΩ ≈ < x ≈ 15 kΩ	> ≈ 15 kΩ
Off	---	No alarm	No alarm
On	---	WARNING (M-042)	ALARM (F-042)

The sensor resistance can affect the resistance data in the table. If all the sensor connection cable resistances are increased at the same time, the values given in the table are halved.

The corrosion detection system presumes that this is a slow process with a continuous increase in the resistance.

11.4 Application errors without messages

11.4.1 Application errors for RTD connection

Sensor types, see → 54.

Symptoms	Cause	Action/remedy
Measured value is incorrect/ inaccurate	Incorrect sensor orientation	Install the sensor correctly
	Heat conducted by sensor	Observe the face-to-face 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 **Characterization Type** device function
	Sensor connection (2-wire), incorrect connection configuration compared to actual connection	Check the sensor connection/ configuration of the transmitter
	The cable resistance of the sensor (2-wire) was not compensated	Compensate the cable resistance
	Offset incorrectly set	Check offset
	Sensor, sensing element defective	Check the sensor, sensing element
	RTD connection incorrect	Connect the connecting cables correctly (see the "Electrical connection" section → 16)
	Programming	Incorrect sensor type set in the **Characterization Type** device function; set the correct sensor type
	Device defective	Replace device

11.4.2 Application errors for TC connection

Sensor types, see → 54.

Symptoms	Cause	Action/remedy
Measured value is incorrect/ inaccurate	Incorrect sensor orientation	Install the sensor correctly
	Heat conducted by sensor	Observe the face-to-face length of the sensor

Symptoms	Cause	Action/remedy
	Device programming is incorrect (scaling)	Change scaling
	Incorrect thermocouple type (TC) configured	Change the **Characterization Type** device function
	Incorrect reference junction set	See Section 13
	Offset incorrectly set	Check offset
	Interference via the thermocouple wire welded in the thermowell (interference voltage)	Use a sensor where the thermocouple wire is not welded
	Sensor connected incorrectly	Connect the connecting cables correctly (see the "Electrical connection" section → 16)
	Sensor, sensing element defective	Check the sensor, sensing element
	Programming	Incorrect sensor type set in the **Characterization Type** device function; set the correct thermocouple (TC)
	Device defective	Replace device

11.5 Spare parts

Spare parts currently available for your product can be found online at: http://www.products.endress.com/spareparts_consumables, temperature transmitter: TMT84. Always quote the serial number of the device when ordering spare parts!

Type	Order number
Adapter for DIN rail mounting, DIN rail clip according to IEC 60715	51000856
Standard - DIN securing set (2 screws and springs, 4 shaft lock-down rings, 1 plug for the display interface)	71044061
US - M4 securing set (2 screws and 1 plug for the display interface)	71044062

11.6 Return

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

1. For more information, please refer to our website: https://www.endress.com/en/instrumentation-services/instrumentation-repair
2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

11.7 Disposal

The device contains electronic components and must, therefore, be disposed of as electronic waste in the event of disposal. Please pay particular attention to the local regulations governing waste disposal in your country.

11.8 Software history and overview of compatibility

Revision history

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

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

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

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

Date	Firmware version	Modifications	Documentation
07/08	01.00.zz	Original firmware	BA257R/09/en/07.08 71076270
06/11	01.01.zz	Update to PROFIBUS Profile 3.02	BA00257R/09/en/01.11 71137263
06/11	01.01.zz	-	BA00257R/09/en/02.11 71137263
06/11	01.01.zz	-	BA00257R/09/en/03.12 71192570
03/17	01.01.zz	No firmware specific changes	BA00257R/09/en/04.17 71357863

12 Technical data

12.1 Input

Measured variable	Temperature (temperature-linear transmission behavior), resistance and voltage.
Measuring range	Two independent sensors can be connected. The measuring inputs are not galvanically isolated from each other.

Resistance thermometer (RTD) as per standard	Designation	α	Measuring range limits
IEC 60751:2008	Pt100 (1) Pt200 (2) Pt500 (3) Pt1000 (4)	0.003851	−200 to +850 °C (−328 to +1 562 °F) −200 to +850 °C (−328 to +1 562 °F) −200 to +250 °C (−328 to +482 °F) −200 to +250 °C (−328 to +482 °F)
JIS C1604:1984	Pt100 (5)	0.003916	−200 to +649 °C (−328 to +1 200 °F)
DIN 43760 IPTS-68	Ni100 (6) Ni1000	0.006180	−60 to +250 °C (−76 to +482 °F) −60 to +150 °C (−76 to +302 °F)
Edison Copper Winding No. 15	Cu10	0.004274	−100 to +260 °C (−148 to +500 °F)
Edison Curve	Ni120	0.006720	−70 to +270 °C (−94 to +518 °F)
GOST 6651-94	Pt50 (8) Pt100 (9)	0.003910	−200 to +1 100 °C (−328 to +2 012 °F) −200 to +850 °C (−328 to +1 562 °F)
OIML R84: 2003 GOST 6651-2009	Cu50 (10) Cu100 (11)	0.004280	−200 to +200 °C (−328 to +392 °F)
-	Pt100 (Callendar van Dusen) Nickel polynomial Copper polynomial	-	10 to 400 Ω, 10 to 2 000 Ω 10 to 400 Ω, 10 to 2 000 Ω 10 to 400 Ω, 10 to 2 000 Ω
	▪ 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		
Resistance transmitter	Resistance Ω		10 to 400 Ω 10 to 2 000 Ω

Thermocouples as per standard	Designation	Measuring range limits	
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) −270 to +1 000 °C (−454 to +1 832 °F) −210 to +1 200 °C (−346 to +2 192 °F) −270 to +1 372 °C (−454 to +2 501 °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) −260 to +400 °C (−436 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) +50 to +1 768 °C (+122 to +3 214 °F) +50 to +1 768 °C (+122 to +3 214 °F) −150 to +400 °C (−238 to +752 °F)
IEC 60584, Part 1; ASTM E988-96	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)
ASTM E988-96	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)
DIN 43710	Type L (Fe-CuNi) (41) Type U (Cu-CuNi) (42)	−200 to +900 °C (−328 to +1 652 °F) −200 to +600 °C (−328 to +1 112 °F)	−150 to +900 °C (−238 to +1 652 °F) −150 to +600 °C (−238 to +1 112 °F)
GOST R8.585-2001	Type L (NiCr-CuNi) (43)	−200 to +800 °C (−328 to +1 472 °F)	−200 to +800 °C (+328 to +1 472 °F)

Thermocouples as per standard	Designation	Measuring range limits
	▪ Internal reference junction (Pt100) ▪ 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.)	
Voltage transmitter (mV)	Millivolt transmitter (mV)	−20 to 100 mV −5 to 30 mV

Type of input

The following connection combinations are possible when both sensor inputs are assigned:

		Sensor input 1			
		RTD or resistance transmitter, two-wire	**RTD or resistance transmitter, three-wire**	**RTD or resistance transmitter, four-wire**	**Thermocouple (TC), voltage transmitter**
Sensor input 2	**RTD or resistance transmitter, two-wire**	☑	☑	-	☑
	RTD or resistance transmitter, three-wire	☑	☑	-	☑
	RTD or resistance transmitter, four-wire	-	-	-	-
	Thermocouple (TC), voltage transmitter	☑	☑	☑	☑

Input signal

Input data: The head transmitter is able to receive a cyclic value and its status sent by a PROFIBUS® master. This value can be read acyclically.

12.2 Output

Output signal

- PROFIBUS® PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
  Amendment 2 “Condensed status and diagnostic messages”
  Amendment 3 “Identification and Maintenance Functions”
- Failure current FDE (Fault Disconnection Electronic) = 0 mA
- Data transmission rate, supported baudrate: 31.25 kBit/s
- Signal encoding = Manchester II
- Output data:
  Available values via AI blocks: temperature (PV), temp sensor 1 + 2, terminal temperature
- In a control system, the transmitter always operates as a slave and, depending on the application, enables data exchange with one or more masters.
- According to IEC 60079-27, FISCO/FNICO

Failure information

Status messages and alarms in accordance with PROFIBUS® PA Profile 3.01/3.02 specification

Linearization/transmission behavior

Temperature-linear, resistance-linear, voltage-linear

Mains filter

50/60 Hz

Galvanic isolation	U = 2 kV AC (input/output)
Current consumption	≤ 11 mA
Switch-on delay	8 s

PROFIBUS® PA basic data

Manufacturer-specific ID no.:	Profile 3.0 ID No.:	Manufacturer-specific GSD
1551 (hex)	9700 (hex) 9701 (hex) 9702 (hex) 9703 (hex)	EH021551.gsd (Profile 3.01 EH3x1551.gsd)
Profile 3.0 GSD	Device or bus address	Bitmaps
Pa139700.gsd Pa139701.gsd Pa139702.gsd Pa139703.gsd	126 (default)	EH_1551_d.bmp EH_1551_n.bmp EH_1551_s.bmp

If the TMT84 is operating in compatibility mode, the device reports the manufacturer-specific ID No.: 1523 (hex) - TMT184 during cyclic data transfer.

Brief description of the blocks

Physical Block

The Physical Block contains all the data that clearly identify and distinguish the device. It is like an electronic version of the device nameplate. In addition to parameters that are needed to operate the device on the fieldbus, the Physical Block makes information available, such as the order code, device ID, hardware revision, software revision, device release, etc. The Physical Block can also be used to configure the display.

Transducer Block "Sensor 1" and "Sensor 2"

The Transducer Blocks of the head transmitter contain all the measurement-specific and device-specific parameters which are relevant for the measurement of the input variables.

Analog Input (AI)

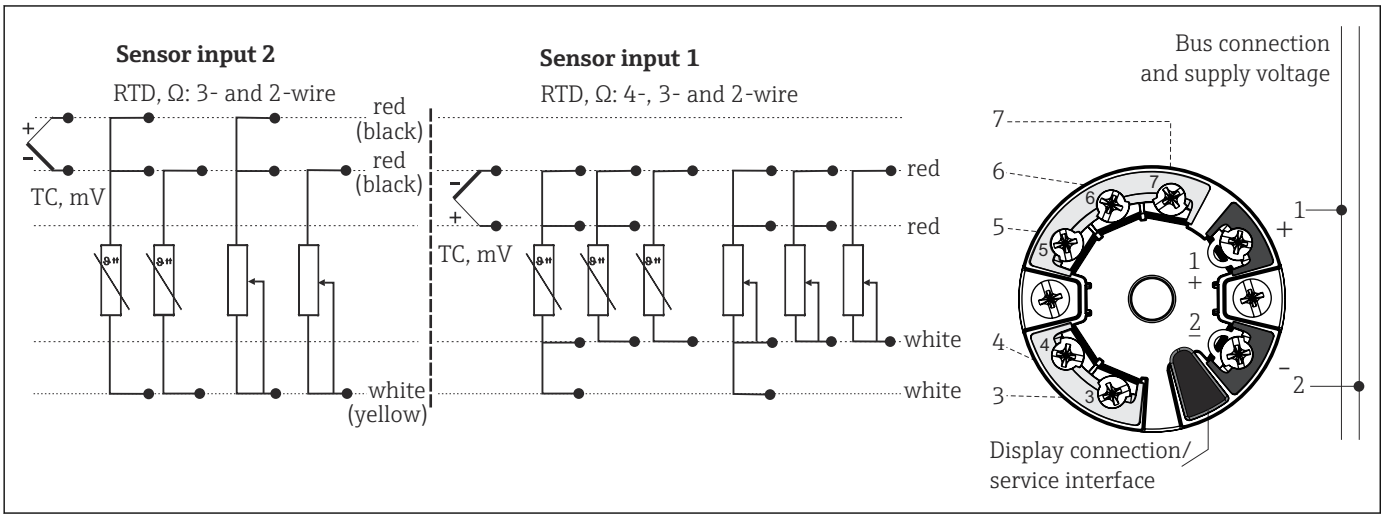
In the AI function block, the process variables from the Transducer Blocks are prepared for subsequent automation functions in the control system (e.g. scaling, limit value processing).

12.3 Power supply

Supply voltage

U = 9 to 32 V DC, independent of polarity (max. voltage U_b = 35 V)

Electrical connection



16 *Assignment of terminal connections for head transmitter*

Terminals

Choice of screw or spring terminals for sensor and supply cables:

Terminal version	Cable version	Cable cross-section
Screw terminals(with tabs on the fieldbus terminals for easy connection of a handheld terminal,)	Rigid or flexible	≤ 2.5 mm² (14 AWG)
Spring terminals (cable version, 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)

12.4 Performance characteristics

Response time

1 s per channel

Reference operating conditions

- Calibration temperature: +25 °C ±5 K (77 °F ±9 °F)
- Supply voltage: 24 V DC
- 4-wire circuit for resistance adjustment

Resolution

Resolution of A/D converter = 18 bit

Maximum measured error

In accordance with DIN EN 60770 and the reference conditions specified above. The measured error data correspond to ±2 σ (Gaussian distribution). The data include non-linearities and repeatability.

Typical

Standard	Designation	Measuring range	Typical measured error (±)
Resistance thermometer (RTD) as per standard			Digital value [1]
IEC 60751:2008	Pt100 (1)	0 to +200 °C (32 to +392 °F)	0.08 °C (0.14 °F)

Standard	Designation	Measuring range	Typical measured error (±)
IEC 60751:2008	Pt1000 (4)		0.08 K (0.14 °F)
GOST 6651-94	Pt100 (9)		0.07 °C (0.13 °F)
Thermocouples (TC) as per standard			Digital value [1]
IEC 60584, Part 1	Type K (NiCr-Ni) (36)	0 to +800 °C (32 to +1 472 °F)	0.31 °C (0.56 °F)
IEC 60584, Part 1	Type S (PtRh10-Pt) (39)		0.97 °C (1.75 °F)
GOST R8.585-2001	Type L (NiCr-CuNi) (43)		2.18 °C (3.92 °F)

1) Measured value transmitted via FIELDBUS®.

Measured error for resistance thermometers (RTD) and resistance transmitters

Standard	Designation	Measuring range	Measured error (±)		Non-repeatability (±)
			Digital [1]		
			Maximum [2]	Based on measured value [3]	
IEC 60751:2008	Pt100 (1)	−200 to +850 °C (−328 to +1 562 °F)	≤ 0.12 °C (0.21 °F)	0.06 °C (0.11 °F) + 0.006% * (MV - LRV)	≤ 0.05 °C (0.09 °F)
	Pt200 (2)		≤ 0.30 °C (0.54 °F)	0.11 °C (0.2 °F) + 0.018% * (MV - LRV)	≤ 0.13 °C (0.23 °F)
	Pt500 (3)	−200 to +250 °C (−328 to +482 °F)	≤ 0.16 °C (0.29 °F)	0.05 °C (0.09 °F) + 0.015% * (MV - LRV)	≤ 0.08 °C (0.14 °F)
	Pt1000 (4)	−200 to +250 °C (−328 to +482 °F)	≤ 0.09 °C (0.16 °F)	0.03 °C (0.05 °F) + 0.013% * (MV - LRV)	≤ 0.05 °C (0.09 °F)
JIS C1604:1984	Pt100 (5)	−200 to +649 °C (−328 to +1 200 °F)		0.05 °C (0.09 °F) + 0.006% * (MV - LRV)	≤ 0.04 °C (0.07 °F)
GOST 6651-94	Pt50 (8)	−200 to +1 100 °C (−328 to +2 012 °F)	≤ 0.20 °C (0.36 °F)	0.10 °C (0.18 °F) + 0.008% * (MV - LRV)	≤ 0.11 °C (0.2 °F)
	Pt100 (9)	−200 to +850 °C (−328 to +1 562 °F)	≤ 0.11 °C (0.2 °F)	0.05 °C (0.09 °F) + 0.006% * (MV - LRV)	≤ 0.05 °C (0.09 °F)
DIN 43760 IPTS-68	Ni100 (6)	−60 to +250 °C (−76 to +482 °F)	≤ 0.05 °C (0.09 °F)	0.05 °C (0.09 °F) - 0.006% * (MV - LRV)	≤ 0.03 °C (0.05 °F)
	Ni1000	−60 to +150 °C (−76 to +302 °F)			
OIML R84: 2003 / GOST 6651-2009	Cu50 (10)	−200 to +200 °C (−328 to +1 562 °F)	≤ 0.11 °C (0.2 °F)	0.09 °C (0.16 °F) + 0.006% * (MV - LRV)	≤ 0.05 °C (0.09 °F)
	Cu100 (11)		≤ 0.06 °C (0.11 °F)	0.05 °C (0.09 °F) + 0.003% * (MV - LRV)	≤ 0.04 °C (0.07 °F)
Resistance transmitter	Resistance Ω	10 to 400 Ω	32 mΩ	-	15mΩ
		10 to 2 000 Ω	300 mΩ	-	≤ 200mΩ

1) Measured value transmitted via FIELDBUS®.
2) Maximum measured error for the specified measuring range.
3) Deviations from maximum measured error possible due to rounding.

Measured error for thermocouples (TC) and voltage transmitters

Standard	Designation	Measuring range	Measured error (±)		Non-repeatability (±)
			Digital [1]		
			Maximum [2]	Based on measured value [3]	

Standard	Designation	Measuring range	Measured error (±)		Non-repeatability (±)
IEC 60584-1	Type A (30)	0 to +2 500 °C (+32 to +4 532 °F)	≤ 1.33 °C (2.39 °F)	0.8 °C (1.44 °F) + 0.021% * MV	≤ 0.52 °C (0.94 °F)
	Type B (31)	+500 to +1 820 °C (+932 to +3 308 °F)	≤ 1.5 °C (2.7 °F)	1.5 °C (2.7 °F) - 0.06% * (MV - LRV)	≤ 0.67 °C (1.21 °F)
IEC 60584-1 / ASTM E988-96	Type C (32)	0 to +2 000 °C (+32 to +3 632 °F)	≤ 0.66 °C (1.19 °F)	0.55 °C (1 °F) + 0.0055% * MV	≤ 0.33 °C (0.59 °F)
ASTM E988-96	Type D (33)		≤ 0.75 °C (1.35 °F)	0.75 °C (1.44 °F) - 0.008% * MV	≤ 0.41 °C (0.74 °F)
IEC 60584-1	Type E (34)	−150 to +1 000 °C (−238 to +2 192 °F)	≤ 0.22 °C (0.4 °F)	0.22 °C (0.40 °F) - 0.006% * (MV - LRV)	≤ 0.07 °C (0.13 °F)
	Type J (35)	−150 to +1 200 °C (−238 to +2 192 °F)	≤ 0.27 °C (0.49 °F)	0.27 °C (0.49 °F) - 0.005% * (MV - LRV)	≤ 0.08 °C (0.14 °F)
	Type K (36)		≤ 0.35 °C (0.63 °F)	0.35 °C (0.63 °F) - 0.005% * (MV - LRV)	≤ 0.11 °C (0.20 °F)
	Type N (37)	−150 to +1 300 °C (−238 to +2 372 °F)	≤ 0.48 °C (0.86 °F)	0.48 °C (0.86 °F) - 0.014% * (MV - LRV)	≤ 0.16 °C (0.29 °F)
	Type R (38)	+50 to +1 768 °C (+122 to +3 214 °F)	≤ 1.12 °C (2.00 °F)	1.12 °C (2.00 °F) - 0.03% * MV	≤ 0.76 °C (1.37 °F)
	Type S (39)		≤ 1.15 °C (2.07 °F)	1.15 °C (2.07 °F) - 0.022% * MV	≤ 0.74 °C (1.33 °F)
	Type T (40)	−150 to +400 °C (−238 to +752 °F)	≤ 0.36 °C (0.47 °F)	0.36 °C (0.47 °F) - 0.04% * (MV - LRV)	≤ 0.11 °C (0.20 °F)
DIN 43710	Type L (41)	−150 to +900 °C (−238 to +1 652 °F)	≤ 0.29 °C (0.52 °F)	0.29 °C (0.52 °F) - 0.009% * (MV - LRV)	≤ 0.07 °C (0.13 °F)
	Type U (42)	−150 to +600 °C (−238 to +1 112 °F)	≤ 0.33 °C (0.6 °F)	0.33 °C (0.6 °F) - 0.028% * (MV - LRV)	≤ 0.10 °C (0.18 °F)
GOST R8.585-2001	Type L (43)	−200 to +800 °C (−328 to +1 472 °F)	≤ 2.20 °C (4.00 °F)	2.2 °C (4.00 °F) - 0.015% * (MV - LRV)	≤ 0.15 °C (0.27 °F)
Voltage transmitter (mV)		−20 to +100 mV	10 µV	-	4 µV

1) Measured value transmitted via the fieldbus.
2) Maximum measured error for the specified measuring range.
3) Deviations from maximum measured error possible due to rounding.

MV = Measured value

LRV = Lower range value of relevant sensor

Total measured error of transmitter at current output = $\sqrt{(\text{Measured error digital}^2 + \text{Measured error D/A}^2)}$

Sample calculation with Pt100, measuring range 0 to +200 °C (+32 to +392 °F), ambient temperature +25 °C (+77 °F), supply voltage 24 V:

Measured error = 0.06 °C + 0.006% x (200 °C - (-200 °C)):	0.084 °C (0.151 °F)

Sample calculation with Pt100, measuring range 0 to +200 °C (+32 to +392 °F), ambient temperature +35 °C (+95 °F), supply voltage 30 V:

Measured error = 0.06 °C + 0.006% x (200 °C - (-200 °C)):	0.084 °C (0.151 °F)
Influence of ambient temperature = (35 - 25) x (0.002% x 200 °C - (-200 °C)), min. 0.005 °C	0.08 °C (0.144 °F)
Influence of supply voltage = (30 - 24) x (0.002% x 200 °C - (-200 °C)), min. 0.005 °C	0.048 °C (0.086 °F)
Measured error: √(Measured error² + Influence of ambient temperature² + Influence of supply voltage²)	**0.126 °C (0.227 °F)**

Sensor adjustment

Sensor-transmitter-matching

RTD sensors are one of the most linear temperature measuring elements. Nevertheless, the output must be linearized. To significantly improve temperature measurement accuracy, the device allows the use of two methods:

- 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.

- Linearization for copper/nickel resistance thermometers (RTD)
  The polynomial equation for copper/nickel is as follows:
  $R_T = R_0(1+AT+BT^2)$

  The coefficients A and B are used for the linearization of nickel or copper resistance thermometers (RTD). The exact values of the coefficients derive from the calibration data and are specific to each sensor. The sensor-specific coefficients are then sent to the transmitter.

Sensor-transmitter-matching using one of the methods explained 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.

Operating influences

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

Influence of ambient temperature and supply voltage on operation for resistance thermometers (RTD) and resistance transmitters

Designation	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change		Supply voltage: Influence (±) per V change	
		Digital [1]		Digital [1]	
		Maximum	Based on measured value	Maximum	Based on measured value
Pt100 (1)	IEC 60751:2008	≤ 0.02 °C (0.036 °F)	0.002% * (MV -LRV), at least 0.005 °C (0.009 °F)	≤ 0.12 °C (0.021 °F)	0.002% * (MV -LRV), at least 0.005 °C (0.009 °F)
Pt200 (2)		≤ 0.026 °C (0.047 °F)	-	≤ 0.026 °C (0.047 °F)	-
Pt500 (3)		≤ 0.014 °C (0.025 °F)	0.002% * (MV -LRV), at least 0.009 °C (0.016 °F)	≤ 0.014 °C (0.025 °F)	0.002% * (MV -LRV), at least 0.009 °C (0.016 °F)

Designation	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change		Supply voltage: Influence (±) per V change	
Pt1000 (4)		≤ 0.01 °C (0.018 °F)	0.002% * (MV -LRV), at least 0.004 °C (0.007 °F)	≤ 0.01 °C (0.018 °F)	0.002% * (MV -LRV), at least 0.004 °C (0.007 °F)
Pt100 (5)	JIS C1604:1984		0.002% * (MV -LRV), at least 0.005 °C (0.009 °F)		0.002% * (MV -LRV), at least 0.005 °C (0.009 °F)
Pt50 (8)	GOST 6651-94	≤ 0.03 °C (0.054 °F)	0.002% * (MV -LRV), at least 0.01 °C (0.018 °F)	≤ 0.03 °C (0.054 °F)	0.002% * (MV -LRV), at least 0.01 °C (0.018 °F)
Pt100 (9)		≤ 0.02 °C (0.036 °F)	0.002% * (MV -LRV), at least 0.005 °C (0.009 °F)	≤ 0.02 °C (0.036 °F)	0.002% * (MV -LRV), at least 0.005 °C (0.009 °F)
Ni100 (6)	DIN 43760 IPTS-68	≤ 0.005 °C (0.009 °F)	-	≤ 0.005 °C (0.009 °F)	-
Ni1000			-		-
Cu50 (10)	OIML R84: 2003 / GOST 6651-2009	≤ 0.008 °C (0.014 °F)	-	≤ 0.008 °C (0.014 °F)	-
Cu100 (11)			0.002% * (MV -LRV), at least 0.004 °C (0.007 °F)		0.002% * (MV -LRV), at least 0.004 °C (0.007 °F)
Resistance transmitter (Ω)					
10 to 400 Ω		≤ 6 mΩ	0.0015% * (MV -LRV), at least 1.5 mΩ	≤ 6 mΩ	0.0015% * (MV -LRV), at least 1.5 mΩ
10 to 2 000 Ω		≤ 30 mΩ	0.0015% * (MV -LRV), at least 15 mΩ	≤ 30 mΩ	0.0015% * (MV -LRV), at least 15 mΩ

1) Measured value transmitted via the fieldbus.

Influence of ambient temperature and supply voltage on operation for thermocouples (TC) and voltage transmitters

Designation	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change		Supply voltage: Influence (±) per V change	
		Digital [1]		Digital	
		Maximum	Based on measured value	Maximum	Based on measured value
Type A (30)	IEC 60584-1	≤ 0.14 °C (0.25 °F)	0.0055% * MV, at least 0.03 °C (0.005 °F)	≤ 0.14 °C (0.25 °F)	0.0055% * MV, at least 0.03 °C (0.005 °F)
Type B (31)		≤ 0.06 °C (0.11 °F)	-	≤ 0.06 °C (0.11 °F)	-
Type C (32)	IEC 60584-1 / ASTM E988-96	≤ 0.09 °C (0.16 °F)	0.0045% * MV, at least 0.03 °C (0.005 °F)	≤ 0.09 °C (0.16 °F)	0.0045% * MV, at least 0.03 °C (0.005 °F)
Type D (33)	ASTM E988-96	≤ 0.08 °C (0.14 °F)	0.004% * MV, at least 0.035 °C (0.063 °F)	≤ 0.08 °C (0.14 °F)	0.004% * MV, at least 0.035 °C (0.063 °F)
Type E (34)	IEC 60584-1	≤ 0.03 °C (0.05 °F)	0.003% * (MV - LRV), at least 0.016 °C (0.029 °F)	≤ 0.03 °C (0.05 °F)	0.003% * (MV - LRV), at least 0.016 °C (0.029 °F)
Type J (35)		≤ 0.02 °C (0.04 °F)	0.0028% * (MV - LRV), at least 0.02 °C (0.036 °F)	≤ 0.02 °C (0.04 °F)	0.0028% * (MV - LRV), at least 0.02 °C (0.036 °F)
Type K (36)		≤ 0.04 °C (0.07 °F)	0.003% * (MV - LRV), at least 0.013 °C (0.023 °F)	≤ 0.04 °C (0.07 °F)	0.003% * (MV - LRV), at least 0.013 °C (0.023 °F)
Type N (37)			0.0028% * (MV - LRV), at least 0.020 °C (0.036 °F)		0.0028% * (MV - LRV), at least 0.020 °C (0.036 °F)
Type R (38)		≤ 0.06 °C (0.11 °F)	0.0035% * MV, at least 0.047 °C (0.085 °F)	≤ 0.06 °C (0.11 °F)	0.0035% * MV, at least 0.047 °C (0.085 °F)
Type S (39)		≤ 0.05 °C (0.09 °F)	-	≤ 0.05 °C (0.09 °F)	-
Type T (40)		≤ 0.01 °C (0.02 °F)	-	≤ 0.01 °C (0.02 °F)	-

Designation	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change		Supply voltage: Influence (±) per V change	
Type L (41)	DIN 43710	≤ 0.02 °C (0.04 °F)	-	≤ 0.02 °C (0.04 °F)	-
Type U (42)		≤ 0.01 °C (0.02 °F)	-	≤ 0.01 °C (0.02 °F)	-
Type L (43)	GOST R8.585-2001	≤ 0.02 °C (0.04 °F)	-	≤ 0.02 °C (0.04 °F)	-
Voltage transmitter (mV)					
–20 to 100 mV	-	≤ 3 µV	-	≤ 3 µV	-

1) Measured value transmitted via the fieldbus.

MV = Measured value

LRV = Lower range value of relevant sensor

Total measured error of transmitter at current output = √(Measured error digital² + Measured error D/A²)

Long-term drift, resistance thermometers (RTD) and resistance transmitters

Designation	Standard	Long-term drift (±)		
		after 1 year	after 3 years	after 5 years
		Maximum		
Pt100 (1)	IEC 60751:2008	≤ 0.03 °C (0.05 °F) + 0.024% * measuring span	≤ 0.042 °C (0.076 °F) + 0.035% * measuring span	≤ 0.051 °C (0.092 °F) + 0.037% * measuring span
Pt200 (2)		≤ 0.17 °C (0.31 °F) + 0.016% * measuring span	≤ 0.28 °C (0.5 °F) + 0.022% * measuring span	≤ 0.343 °C (0.617 °F) + 0.025% * measuring span
Pt500 (3)		≤ 0.067 °C (0.121 °F) + 0.018% * measuring span	≤ 0.111 °C (0.2 °F) + 0.025% * measuring span	≤ 0.137 °C (0.246 °F) + 0.028% * measuring span
Pt1000 (4)		≤ 0.034 °C (0.06 °F) + 0.02% * measuring span	≤ 0.056 °C (0.1 °F) + 0.029% * measuring span	≤ 0.069 °C (0.124 °F) + 0.032% * measuring span
Pt100 (5)	JIS C1604:1984	≤ 0.03 °C (0.054 °F) + 0.022% * measuring span	≤ 0.042 °C (0.076 °F) + 0.032% * measuring span	≤ 0.051 °C (0.092 °F) + 0.034% * measuring span
Pt50 (8)	GOST 6651-94	≤ 0.055 °C (0.01 °F) + 0.023% * measuring span	≤ 0.089 °C (0.16 °F) + 0.032% * measuring span	≤ 0.1 °C (0.18 °F) + 0.035% * measuring span
Pt100 (9)	GOST 6651-94	≤ 0.03 °C (0.054 °F) + 0.024% * measuring span	≤ 0.042 °C (0.076 °F) + 0.034% * measuring span	≤ 0.051 °C (0.092 °F) + 0.037% * measuring span
Ni100 (6)	DIN 43760 IPTS-68	≤ 0.025 °C (0.045 °F) + 0.016% * measuring span	≤ 0.042 °C (0.076 °F) + 0.02% * measuring span	≤ 0.047 °C (0.085 °F) + 0.021% * measuring span
Ni1000	DIN 43760 IPTS-68	≤ 0.02 °C (0.036 °F) + 0.018% * measuring span	≤ 0.032 °C (0.058 °F) + 0.024% * measuring span	≤ 0.036 °C (0.065 °F) + 0.025% * measuring span
Cu50 (10)	OIML R84:2003 / GOST 6651-2009	≤ 0.053 °C (0.095 °F) + 0.013% * measuring span	≤ 0.084 °C (0.151 °F) + 0.016% * measuring span	≤ 0.094 °C (0.169 °F) + 0.016% * measuring span
Cu100 (11)		≤ 0.027 °C (0.049 °F) + 0.019% * measuring span	≤ 0.042 °C (0.076 °F) + 0.026% * measuring span	≤ 0.047 °C (0.085 °F) + 0.027% * measuring span
Resistance transmitter				
10 to 400 Ω	-	≤ 10 mΩ + 0.022% * measuring span	≤ 14 mΩ + 0.031% * measuring span	≤ 16 mΩ + 0.033% * measuring span
10 to 2 000 Ω	-	≤ 144 mΩ + 0.019% * measuring span	≤ 238 mΩ + 0.026% * measuring span	≤ 294 mΩ + 0.028% * measuring span

Long-term drift, thermocouples (TC) and voltage transmitters

Designation	Standard	Long-term drift (±)		
		after 1 year	after 3 years	after 5 years
		Maximum		
Type A (30)	IEC 60584-1	≤ 0.17 °C (0.306 °F) + 0.021% * measuring span	≤ 0.27 °C (0.486 °F) + 0.03% * measuring span	≤ 0.38 °C (0.683 °F) + 0.035% * measuring span
Type B (31)		≤ 0.5 °C (0.9 °F)	≤ 0.75 °C (1.35 °F)	≤ 1.0 °C (1.8 °F)
Type C (32)	IEC 60584-1 / ASTM E988-96	≤ 0.15 °C (0.27 °F) + 0.018% * measuring span	≤ 0.24 °C (0.43 °F) + 0.026% * measuring span	≤ 0.34 °C (0.61 °F) + 0.027% * measuring span
Type D (33)	ASTM E988-96	≤ 0.21 °C (0.38 °F) + 0.015% * measuring span	≤ 0.34 °C (0.61 °F) + 0.02% * measuring span	≤ 0.47 °C (0.85 °F) + 0.02% * measuring span
Type E (34)	IEC 60584-1	≤ 0.06 °C (0.11 °F) + 0.018% * measuring span	≤ 0.09 °C (0.162 °F) + 0.025% * measuring span	≤ 0.13 °C (0.234 °F) + 0.026% * measuring span
Type J (35)	IEC 60584-1	≤ 0.06 °C (0.11 °F) + 0.019% * measuring span	≤ 0.1 °C (0.18 °F) + 0.025% * measuring span	≤ 0.14 °C (0.252 °F) + 0.027% * measuring span
Type K (36)		≤ 0.09 °C (0.162 °F) + 0.017% * (MV + 150 °C (270 °F))	≤ 0.14 °C (0.252 °F) + 0.023% * measuring span	≤ 0.19 °C (0.342 °F) + 0.024% * measuring span
Type N (37)	IEC 60584-1	≤ 0.13 °C (0.234 °F) + 0.015% * (MV + 150 °C (270 °F))	≤ 0.2 °C (0.36 °F) + 0.02% * measuring span	≤ 0.28 °C (0.5 °F) + 0.02% * measuring span
Type R (38)		≤ 0.31 °C (0.558 °F) + 0.011% * (MV - 50 °C (90 °F))	≤ 0.5 °C (0.9 °F) + 0.013% * measuring span	≤ 0.69 °C (1.241 °F) + 0.011% * measuring span
Type S (39)	IEC 60584-1	≤ 0.31 °C (0.558 °F) + 0.011% * measuring span	≤ 0.5 °C (0.9 °F) + 0.013% * measuring span	≤ 0.7 °C (1.259 °F) + 0.011% * measuring span
Type T (40)		≤ 0.09 °C (0.162 °F) + 0.011% * measuring span	≤ 0.15 °C (0.27 °F) + 0.013% * measuring span	≤ 0.2 °C (0.36 °F) + 0.012% * measuring span
Type L (41)		≤ 0.06 °C (0.108 °F) + 0.017% * measuring span	≤ 0.1 °C (0.18 °F) + 0.022% * measuring span	≤ 0.14 °C (0.252 °F) + 0.022% * measuring span
Type U (42)		≤ 0.09 °C (0.162 °F) + 0.013% * measuring span	≤ 0.14 °C (0.252 °F) + 0.017% * measuring span	≤ 0.2 °C (0.360 °F) + 0.015% * measuring span
Type L (43)	GOST R8.585-2001	≤ 0.08 °C (0.144 °F) + 0.015% * measuring span	≤ 0.12 °C (0.216 °F) + 0.02% * measuring span	≤ 0.17 °C (0.306 °F) + 0.02% * measuring span
Voltage transmitter (mV)				
−20 to 100 mV	-	≤ 2 µV + 0.022% * measuring span	≤ 3.5 µV + 0.03% * measuring span	≤ 4.7 µV + 0.033% * measuring span

Influence of reference junction: Pt100 DIN IEC 60751 Cl. B (internal reference junction with thermocouples TC)

12.5 Environment

Ambient temperature range: −40 to +85 °C (−40 to +185 °F), for hazardous areas see Ex documentation

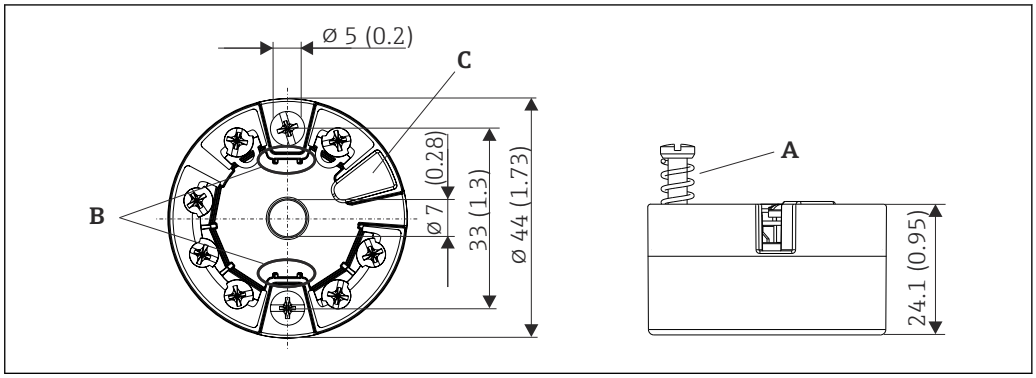
Storage temperature: −40 to +100 °C (−40 to +212 °F)

Altitude: Up to 4000 m (4374.5 yards) above sea level

Humidity	▪ Condensation permitted as per IEC 60 068-2-33 ▪ Max. rel. humidity: 95% as per IEC 60068-2-30
Climate class	C as per EN 60654-1
Degree of protection	▪ Head transmitter with screw terminals: IP 00, with spring terminals: IP 30. In installed state, depends on the terminal head or field housing used. ▪ When installing in field housing TA30A, TA30D or TA30H: IP 66/67 (NEMA Type 4x encl.)
Shock and vibration resistance	Vibration resistance as per IEC 60068-2-6 10 to 2 000 Hz at 5g (increased vibration stress)
Electromagnetic compatibility (EMC)	**CE compliance** 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 measured error <1% of measuring range. Interference immunity as per IEC/EN 61326 series, industrial requirements Interference emission as per IEC/EN 61326 series, Class B equipment
Overvoltage category	Measurement category II
Pollution level	Pollution level 2

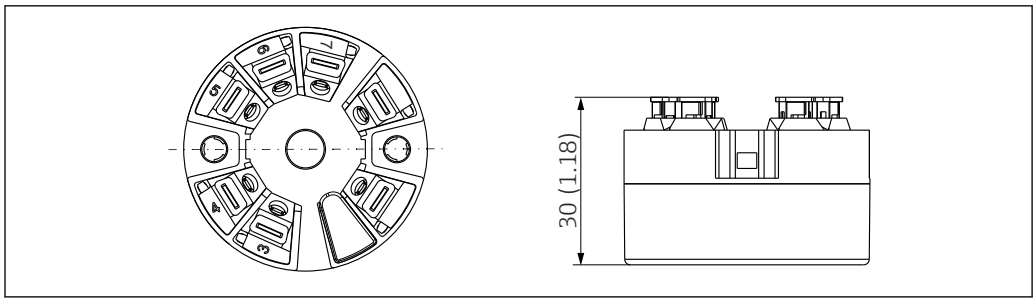
12.6 Mechanical construction

Design, dimensions	Dimensions in mm (in) *Head transmitter*



17 Version with screw terminals

A Spring travel L ≥ 5 mm (not for US - M4 securing screws)
B Mounting elements for attachable measured value display TID10
C Service interface for connecting measured value display or configuration tool

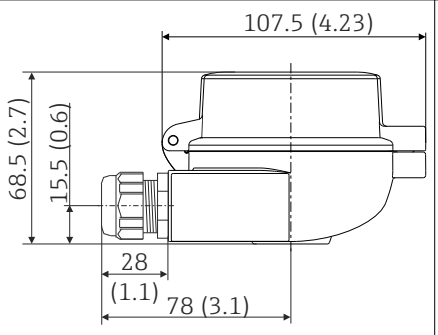


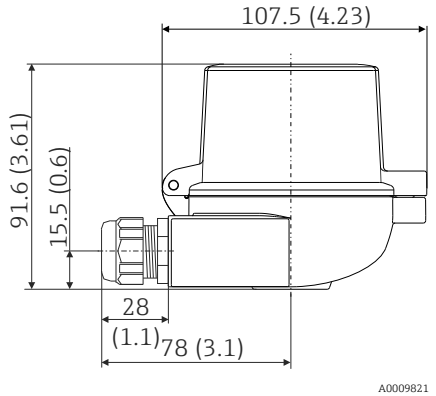
18 *Version with spring terminals. Dimensions are identical to the version with screw terminals, apart from housing height.*

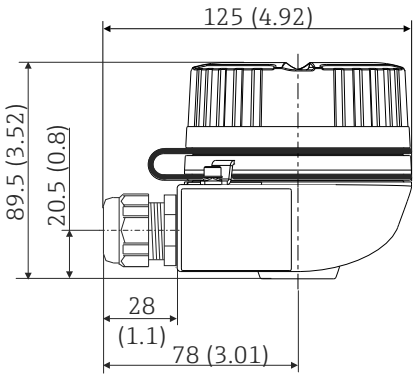
Field housing

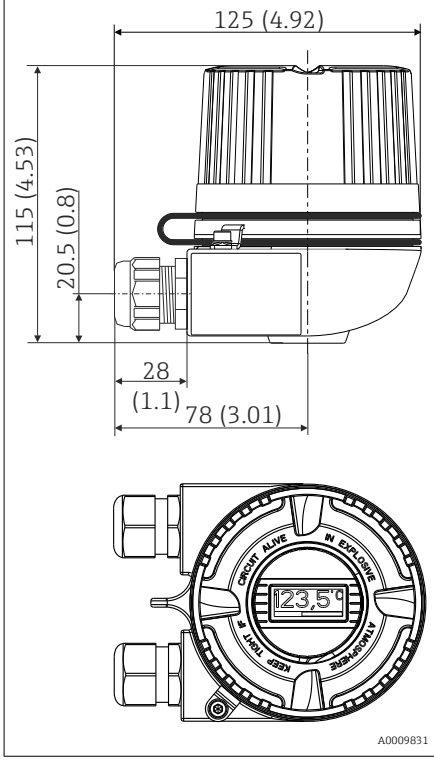
All field housings have an internal geometry in accordance with DIN EN 50446, form B (flat face). Cable glands in the diagrams: M20x1.5

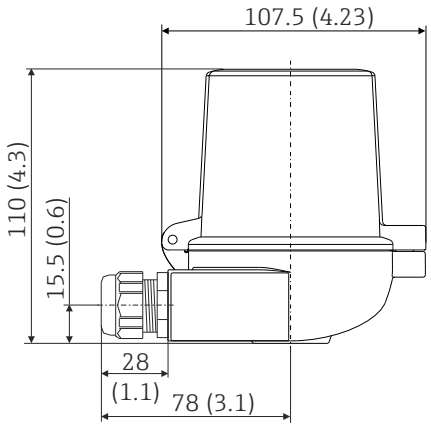
Maximum ambient temperatures for cable glands	
Type	**Temperature range**
Polyamide cable gland ½" NPT, M20x1.5 (non-Ex)	−40 to +100 °C (−40 to 212 °F)
Polyamide cable gland M20x1.5 (for dust ignition-proof area)	−20 to +95 °C (−4 to 203 °F)
Brass cable gland ½" NPT, M20x1.5 (for dust ignition-proof area)	−20 to +130 °C (−4 to +266 °F)
Fieldbus connector (M12x1 PA, 7/8" FF)	−40 to +105 °C (−40 to +221 °F)

TA30A	Specification
	▪ Two cable entries ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry glands: 1/2" NPT and M20x1.5 ▪ Color of head: blue, RAL 5012 ▪ Color of cap: gray, RAL 7035 ▪ Weight: 330 g (11.64 oz)

TA30A with display window in cover	Specification
	▪ Two cable entries ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry glands: 1/2" NPT and M20x1.5 ▪ Color of head: blue, RAL 5012 ▪ Color of cap: gray, RAL 7035 ▪ Weight: 420 g (14.81 oz)

TA30H	Specification
	▪ Flameproof (XP) version, explosion-protected, captive screw cap, with two cable entries ▪ Protection class: NEMA Type 4x Encl. ▪ Temperature: −50 to +150 °C (−58 to +302 °F) for rubber seal without cable gland (observe max. permitted temperature of cable gland!) ▪ Material: ▪ Aluminum with polyester powder coating ▪ Stainless steel 316L without coating ▪ Cable entry glands: ½" NPT, M20x1.5 ▪ Color of aluminum head: blue, RAL 5012 ▪ Color of aluminum cap: gray, RAL 7035 ▪ Weight: ▪ Aluminum approx. 640 g (22.6 oz) ▪ Stainless steel approx. 2 400 g (84.7 oz)

TA30H with display window in cover	Specification
	▪ Flameproof (XP) version, explosion-protected, captive screw cap, with two cable entries ▪ Protection class: NEMA Type 4x Encl. ▪ Temperature: −50 to +150 °C (−58 to +302 °F) for rubber seal without cable gland (observe max. permitted temperature of cable gland!) ▪ Material: ▪ Aluminum with polyester powder coating ▪ Stainless steel 316L without coating ▪ Cable entry glands: ½" NPT, M20x1.5 ▪ Color of aluminum head: blue, RAL 5012 ▪ Color of aluminum cap: gray, RAL 7035 ▪ Weight: ▪ Aluminum approx. 860 g (30.33 oz) ▪ Stainless steel approx. 2 900 g (102.3 oz)

TA30D	Specification
	▪ 2 cable entries ▪ Temperature: −50 to +150 °C (−58 to +302 °F) without cable gland ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry glands: 1/2" NPT and M20x1.5 ▪ Two head transmitters can be mounted. In the standard configuration one transmitter is mounted in the terminal head cover and an additional terminal block is installed directly on the insert. ▪ Color of head: blue, RAL 5012 ▪ Color of cap: gray, RAL 7035 ▪ Weight: 390 g (13.75 oz)

Weight

- Head transmitter: approx. 40 to 50 g (1.4 to 1.8 oz)
- Field housing: see specifications

Materials

All the materials used are RoHS-compliant.

- Housing: polycarbonate (PC), corresponds to UL94 HB (fire resistance properties)
- Terminals:
  - Screw terminals: nickel-plated brass and gold-plated contacts
  - Spring terminals: tin-plated brass, contact springs 1.4310, 301 (AISI)
- Potting: PU, corresponds to UL94 V0 WEVO PU 403 FP / FL (fire resistance properties)

Field housing: see specifications

12.7 Certificates and approvals

CE mark

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EC directives. The manufacturer confirms successful testing of the product by affixing to it the CE-mark.

Ex approval

Information about currently available Ex versions (ATEX, FM, CSA, etc.) can be supplied by your E+H Sales Center on request. All explosion protection data are given in separate documentation which is available upon request.

Other standards and guidelines

- IEC 60529:
  Degrees of protection provided by enclosures (IP code)
- IEC 61158-2:
  Fieldbus standard
- IEC 61326-1:2007:
  Electromagnetic compatibility (EMC requirements)
- IEC 60068-2-27 and IEC 60068-2-6:
  Shock and vibration resistance
- NAMUR
  User association of automation technology in process industries
- IEC 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use

UL approval	More information under UL Product iq™, search for keyword "E225237")
CSA GP	CSA General Purpose
PROFIBUS® PA certification	The temperature transmitter is certified and registered by the PNO (PROFIBUS® User Organization). The device meets the requirements of the following specifications: ▪ Certified in accordance with PROFIBUS® PA Profile 3.02 ▪ The device can also be operated with certified devices of other manufacturers (interoperability)

12.8 Supplementary documentation

- Operating Instructions 'iTEMP TMT84' (BA00257R) and hard copy of associated Brief Operating Instructions 'iTEMP TMT84' (KA00258R)
- Supplementary ATEX documentation:
  ATEX II 1G Ex ia IIC: XA00069R
  ATEX II 2(1)G Ex ia IIC: XA01012T
  ATEX II 2G Ex d IIC and ATEX II 2D Ex tb IIIC: XA01007T
- Operating Instructions for "Display TID10" (BA00262R)
- Guidelines for planning and commissioning "PROFIBUS® DP/PA" (BA00034S)

13 Operation using PROFIBUS® PA

The operation is geared towards the user role of the operator in question and groups the operating parameters into appropriate operating menus.

Two setup modes are available in this user-oriented operating system: The "Standard" setup and the "Expert" setup.

All the basic settings that are needed to operate the device can be made in the Standard setup mode.

The "Expert" setup is reserved for experienced users or service staff. All the configuration options of the "Standard" setup are available in the "Expert" setup mode. In addition, additional parameters make it possible to make special device settings in this mode. Besides these two menu items, the Display/Operation menus are available for configuring the optional display and the Diagnostics menu is available for system and diagnostics information.

The device parameters are explained in the following section using the user-oriented operating system. All the device parameters that are not listed in this operating structure can only be modified with the aid of appropriate tools and the information in the slot index lists (→ chap. 14.4 → 🖹 98).

13.1 Operating structure

→ **Display/operation** → 🖹 69			

→ **Setup** → 🖹 70	→ Advanced setup → 🖹 74	→ Sensor 1
		→ Sensor 2
		→ Security settings

→ **Diagnostics** → 🖹 76	→ System information → 🖹 77	
	→ Measured value → 🖹 77	→ Min./ max. values
	→ Device test/reset → 🖹 78	

→ **Expert** → 🖹 79	→ System → 🖹 80	→ Display	
	→ Sensory mechanism → 🖹 81	→ Sensor 1	→ Special linearization 1
		→ Sensor 2	→ Special linearization 2
	→ Communication→ 🖹 86	→ Analog Input 1	
		→ Analog Input 2	
		→ Analog Input 3	
		→ Analog Input 4	
	→ Diagnostics → 🖹 96	→ System information	
		→ Measured value	→ Min./ max. values
		→ Device test/reset	

13.2 Standard setup

The following parameter groups are available in the standard setup. These parameters are used for basic device configuration. The head transmitter can be put into operation with this limited parameter set.

13.2.1 Group Display/Operation

The settings for displaying the measured value on the optional TID10 plug-in display are made in the Display/Operation menu. The following parameters can be found in the **Display/Operation** group and under Expert → System → Display.

These settings do not have any effect on the output values of the transmitter. They are only used to configure how information is shown on the display.

Display/operation

Menu item	Parameter name	Parameter access	Description
Expert → System → Display	Alternating time	Read/write	Entry (in s) as to how long a value should be shown on the display. Setting from 4 to 60 s. **Factory setting:** 6 s
	Display source n	Read/write	Use this function to select the value to be displayed. Possible settings: ▪ Off ▪ Primary Value 1 ▪ Sensor Value 1 ▪ Primary Value 2 ▪ Sensor Value 2 ▪ RJ Value **Factory setting:** Primary Value 1 If all 3 display channels are switched off ('Off' option), the value for primary value 1 automatically appears on the display. If this value is not available (e.g. 'No Sensor' option selected in the Sensor Transducer Block 1, parameter 'Characterization Type 1'), primary value 2 is displayed.
	Display value description n	Read/write	Description of the display value displayed. **Factory setting:** "P1 " Maximum 16 letters. The value is not shown on the display.
	Display format n	Read/write	Use this function to select the number of decimal places displayed. Configuration option from 0 to 4. The option 4 means 'AUTO'. The maximum number of decimal places possible always appears on the display. Possible settings: ▪ 0 - xxxxx ▪ 1 - xxxx.x ▪ 2 - xxx.xx ▪ 3 - xx.xxx ▪ 4 - Auto **Factory setting:** 1 - xxxx.x

n = Number of display channels (1 to 4)

Configuration example:

The following measured values should be shown on the display:

Value 1

Measured value to be displayed:	Primary Value 1 of Sensor Transducer 1 (PV1)
Measured value unit:	° C
Decimal places:	2

Value 2

Measured value to be displayed:	RJ Value
Measured value unit:	°C
Decimal places:	1

Value 3

Measured value to be displayed:	Sensor Value 2 (measured value) of Sensor Transducer 2 (SV2)
Measured value unit:	°C
Decimal places:	2

Every measured value should be visible on the display for 12 seconds. For this purpose, the following settings should be made in the **Display/Operation** operating menu

Parameter	Value
Alternating time	12
Display source 1	'Primary Value 1'
Display value description 1	TEMP PIPE 11
Display format 1	'xxx.xx'
Display source 2	'RJ Value'
Display value description 2	INTERN TEMP
Display format 2	'xxxx.x'
Display source 3	'Sensor value 2'
Display value description 3	PIPE 11 BACK
Display format 3	'xxx.xx'

13.2.2 Group Setup

Information on the device mode, such as the target mode, and parameters for the basic configuration of the measuring inputs, such as the sensor type. All the settings that are needed to operate the device can be made in the Standard setup mode. The individual parameters are summarized in the Setup menu:

Standard setup	Basic settings for the measuring inputs that are needed to commission the device.
Advanced setup	Configuration of special diagnostics functions such as drift or corrosion detection.

→ **Setup**	→ Advanced setup → 📄 74	→ Sensor 1
		→ Sensor 2
		→ Security settings

Selecting the operating mode

The operating mode is set by means of the **Physical Block - target mode** parameter group (→ 📄 71). The Physical Block supports the following operating modes:

- AUTO - (automatic mode)
- Out of Service (OOS)

OOS can only be configured if the Condensed Status and Diagnostics (as per Profile 3.01 Am2) are activated. Otherwise, only AUTO is supported.

Procedure for configuring a measuring input:

1. Start
▼
2. Select sensor type (linearization type) e.g. Pt100
▼
3. Select unit (°C)
▼
4. Select type of connection e.g. 3-wire
▼
5. Configure the type of measurement e.g. PV=SV1
▼
6. Enter the offset (optional)
▼
7. Select the reference measuring point and enter the value in the event of external reference measurement (only for TC measurement)
▼
8. If a second measuring channel is used, repeat steps 2 to 5
▼
9. End

Setup

Menu item	Parameter name	Parameter access	Description
	Block Mode		**General information on Block Mode:** Block Mode contains three elements: ▪ the block's current operating mode (Actual Mode) ▪ the modes supported by the block (Permitted Mode): Analog Input (AI): AUTO, MAN, OOS Physical Block: AUTO, OOS Transducer Block: AUTO ▪ normal operating mode (Normal Mode) Only the current Block Mode is displayed in the menu. Generally, you can select from several operating modes in a function block, while other block types only operate in the AUTO operating mode for example.
	Physical Block - Actual Mode	Read	Displays the current operating mode of the Physical Block.
	Physical Block - Target Mode	Read/write	Use this function to select the required operating mode. Only automatic operation can be selected in the Physical Block. The Physical Block can also be set to OOS if diagnostics is enabled as per Profile 3.01 Am2 (Physical Block parameter "COND_STATUS_DIAG" = 1). **Options:** ▪ 0x08 - AUTO ▪ 0x80 - Out of Service (OOS) **Factory setting:** AUTO

Menu item	Parameter name	Parameter access	Description
	Characterization Type n [1)]	Read/write	Configuration of the sensor type. ▪ Characterization Type 1: sensor input settings ▪ Characterization Type 2: sensor input 2 settings **Factory setting:** Channel 1: Pt100 IEC751 Channel 2: No sensor Please observe the terminal assignment in Section 5.2 → 16 when connecting the individual sensors. In the case of 2-channel operation, the possible connection options in Section 5.2.1 → 17 also have to be observed.
	Input Range and Mode n	Read/write	Configuration of the input measurement range. ▪ 0: mV, range 1: −5 to 30 mV; range: −5 to 30 mV; min. span: 1 mV ▪ 1: mV, range 2: −20 to 100 mV; min. span: 1 mV ▪ 128: Ω, range 1: 10 to 400 Ω; min. span: 10 Ω ▪ 129: Ω, range 2: 10 to 2 000 Ω; min. span: 10 Ω **Factory setting:** 128: Ω, range 1: 10 to 400 Ω; min. span: 10 Ω
	Unit n	Read/write	Configuration of temperature unit for PV value n ▪ 1000 - K ▪ 1001 - °C ▪ 1002 - °F ▪ 1003 - Rk ▪ 1281 - Ohm ▪ 1243 - mV ▪ 1342 - % **Factory setting:** °C
	Connection type n	Read/write	Sensor connection mode: Sensor Transducer 1 (Connection mode 1): ▪ 0 - 2 wires ▪ 1 - 3 wires ▪ 2 - 4 wires **Factory setting:** 3 wires Sensor Transducer 2 (Connection mode 2): ▪ 0 - 2 wires ▪ 1 - 3 wires **Factory setting:** 3 wires

Menu item	Parameter name	Parameter access	Description
	Measuring type n	Read/write	Displays the calculation process for Primary Value 1. **Options:** Sensor Transducer 1 (Measuring mode 1): ▪ PV = SV1: Secondary value 1 ▪ PV = SV1-SV2: Difference ▪ PV = 0.5 x (SV1+SV2): Average ▪ PV = 0.5 x (SV1+SV2) redundancy: Average or Secondary Value 1 or Secondary Value 2 in the event of a sensor error in the other sensor. ▪ PV = SV1 (OR SV2): Backup function: If sensor 1 fails, the value of sensor 2 automatically becomes the Primary Value. ▪ PV = SV1 (OR SV2 if SV1>T): PV changes from SV1 to SV2 if SV1 > value T (Parameter: **Threshold value n**) ▪ PV =ABS(SV1-SV2) if PV> drift value: PV is the drift value between sensor 1 and sensor 2. If PV exceeds the configured drift value (Sensor drift detection limit value), a drift alarm is output. ▪ PV =ABS(SV1-SV2) if PV< drift value: PV is the drift value between sensor 1 and sensor 2. If PV undershoots the configured drift value (Sensor drift detection limit value), a drift alarm is output. **Factory setting:** PV = SV1 Sensor Transducer 2 (Measuring mode 2): ▪ PV = SV2: Secondary value 2 ▪ PV = SV2-SV1: Difference ▪ PV = 0.5 x (SV2+SV1): Average ▪ PV = 0.5 x (SV2+SV1) redundancy: Average or Secondary Value 1 or Secondary Value 2 in the event of a sensor error in the other sensor. ▪ PV = SV2 (OR SV1): Backup function: If sensor 2 fails, the value of sensor 1 automatically becomes the Primary Value. ▪ PV = SV2 (OR SV 1 if SV2>T): PV changes from SV2 to SV1 if SV2 > value T (Parameter: **Threshold value n**) ▪ PV =ABS(SV1-SV2) if PV> drift value: PV is the drift value between sensor 1 and sensor 2. If PV exceeds the configured drift value (Sensor drift detection limit value), a drift alarm is output. ▪ PV =ABS(SV1-SV2) if PV< drift value: PV is the drift value between sensor 1 and sensor 2. If PV undershoots the configured drift value (Sensor drift detection limit value), a drift alarm is output. **Factory setting:** PV = SV1 = Sensor 2
	2-wire compensation n	Read/write	Two-wire compensation for RTDs. The following values are permitted: 0 to 30 Ω **Factory setting:** 0
	Offset n	Read/write	Offset for Primary Value 1 The following values are permitted: ▪ -10 to +10 for Celsius, Kelvin, mV and Ohm ▪ -18 to +18 for Fahrenheit, Rankine **Factory setting:** 0.0
	Threshold value n	Read/write	Value for switching in PV mode for sensor switching. Entry in the range of −270 to 2 200 °C (−454 to 3 992 °F). **Factory setting:** 0

Menu item	Parameter name	Parameter access	Description
	Reference Junction Type n	Read/write	Configuration of reference junction measurement for temperature compensation in thermocouples: ▪ 0 - no reference: no temperature compensation is used. ▪ 1 - internally measured reference junction: internal reference junction temperature is used for temperature compensation. ▪ 2 - external fixed value: "Ext. Reference Junction Temperature" is used for temperature compensation. **Factory setting:** 1 - internally measured reference junction
	Ext. Reference Junction Temperature n	Read/write	Value for temperature compensation (see the **Reference Junction Type n** parameter). **Factory setting:** 0.0

1) Number of the Transducer Block (1-2) or the sensor input (1 or 2)

Submenu Setup - Advanced setup

Corrosion monitoring

Sensor connection cable corrosion can lead to false measured value readings. Therefore the unit offers the possibility of recognizing any corrosion before a measured value is affected. Corrosion monitoring is only possible for RTDs with a 4-wire connection and thermocouples.

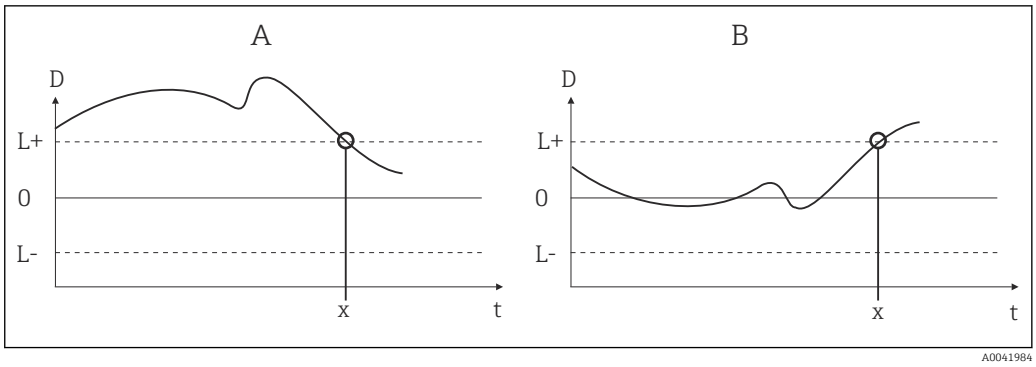
Sensor drift detection

If two sensors are connected and the measured values differ by a specified value, an error or a maintenance prompt (sensor drift detection) is sent to the distributed control system. The drift detection function can be used to verify the correctness of the measured values and for mutual monitoring of the connected sensors.

The drift detection can be activated with the **Type of measurement** parameter. A distinction is made between two separate modes. For the measuring mode **PV =(|SV1-SV2|) if PV < sensor drift detection limit value**, a status message is output if the limit value is undershot or, in the case of **PV =(|SV1-SV2|) if PV> sensor drift detection limit value**, if the limit value is overshot.

Procedure for configuring drift detection for sensor 1:

1. Start
▼
2. Select Type of measurement **PV =ABS(SV1-SV|) if PV < sensor drift detection limit value** or **PV =ABS(SV1-SV2) if PV > sensor drift detection limit value**
▼
3. Set sensor drift detection limit value 1 to the desired value.
▼
4. Where necessary, set the sensor drift detection to **Warning** or **Failure**.
▼
5. End



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A 'Undershooting' mode
B 'Overshooting' mode
D Drift
L+, L- Upper (+) or lower (-) limit value
t Time
x Error (failure) or need for maintenance (warning), depending on the setting

Write protection

Hardware write protection for the device parameters is enabled and disabled by means of a DIP switch on the rear of the optional display.

The **Hardware write protection** parameter (→ 75) shows the status of the hardware write protection. The following statuses are possible:

1 → Hardware write protection enabled, device data cannot be overwritten

0 → Hardware write protection disabled, device data can be overwritten

No software write protection is available to prevent all parameters being written acyclically. n: Number of the Transducer Block (1-2) or the sensor input (1 or 2)

Setup

Menu item	Parameter name	Parameter access	Description
Advanced setup	HW write protection	Read	Displays the status of hardware write protection. **Display:** ▪ 0 - Off → write protection disabled, parameters can be changed. ▪ 1 - On → write protection enabled, parameters **cannot** be changed. **Factory setting:** 0
	Ambient alarm	Read/write	Status message in the event of the operating temperature of the transmitter being undershot or overshot, < −40 °C (−40 °F) or > +85 °C (185 °F): ▪ 0 - Maintenance: Int. temperature overshoot/ undershoot results in warning. ▪ 1 - Failure: Int. temperature overshoot/undershoot results in alarm. **Factory setting:** 0 - Maintenance

Menu item	Parameter name	Parameter access	Description
	Sensor drift monitoring	Read/write	Deviation between SV1 and SV2 is identified as an error (Failure) or as need for maintenance (Warning): ▪ 1- FAILURE: (sensor deviation > Sensor drift detection limit value n) → Failure. Sensor drift is displayed as error ▪ 0 - Warning: (sensor deviation > Sensor drift detection limit value n) → Warning. Sensor drift is displayed as warning **Factory setting:** 0 - Warning
	Sensor drift detection limit value n	Read/write	Configuration of the max. permitted measured value deviation between sensor 1 and sensor 2. This value is relevant if **"PV =ABS(SV1- SV2) if PV < drift value"** was selected for the measuring mode. Permitted deviation from 0.1 to 999. **Factory setting:** 999
	Corrosion detection n	Read/write	▪ 0 - OFF: Corrosion detection off ▪ 1 - ON: Corrosion detection on **Factory setting:** 0 - OFF Only possible for RTD 4-wire connection and thermocouples (TC).

13.2.3 Group Diagnostics

All the information that describes the device, the device status and the process conditions can be found in this group. The individual parameters are summarized in the Diagnostics menu (→ 🖹 76):

→ Diagnostics	→System information → 🖹 77	
	→ Measured value → 🖹 77	→ Min./ max. values
	→ Device test/reset → 🖹 78	

System information	Standard Setup/Expert	Basic settings that are needed to operate the device.
Measured values → Min/max values	Standard Setup/Expert	Settings for the measuring input of channel 1 and channel 2.
Device test/reset	Standard Setup/Expert	Settings for special diagnostics functions such as drift or corrosion detection.

Diagnostics menu

Diagnostics

Menu item	Parameter name	Parameter access	Description
Expert → Diagnostics	Current diagnostics	Read	Displays the diagnostics code. The diagnostics code consists of the "Current status" and "Current error code". **Example:** F041 (Failure + sensor failure)
	Current diagnostics description	Read	Displays the status information as description text, see Section 11.3 → 🖹 45

Menu item	Parameter name	Parameter access	Description
	Status channel	Read	Displays where in the device the highest priority error occurs. ▪ 0: Device ▪ 1: Sensor 1 ▪ 2: Sensor 2
	Status count	Read	The number of status messages currently pending in the device.
	Device bus address	Read	Displays the device bus address. **Factory setting:** 126

Submenu Diagnostics - System information

Diagnostics

Menu item	Parameter name	Parameter access	Description
Submenu System information	Software Revision	Read	Revision status of device firmware.
	Device serial Num	Read [1]	Displays the serial number of the device.
	Order code	Read [1]	Displays the device order code.
	Order identifier	Read [1]	Displays the order identification numbers as description for the device delivery status
	Device TAG	Read/write	Use this function to enter a user-specific text (max. 32 characters) for the unique identification and assignment of the block. **Factory setting:** "– – – – – – – –" no text
	ENP version	Read	Displays the ENP (electronic name plate) version
	Profile	Read	0x4002 - PROFIBUS PA, Compact Class B
	Profile Revision	Read	Displays the profile version implemented in the device.
	Manufacturer	Read	Displays the manufacturer ID number. **Display:** 0x11(hex);17 (decimal): Endress+Hauser
	Product designation	Read	Displays the manufacturer-specific device designation. **Display:** iTEMP TMT84
	PROFIBUS Ident Number	Read	Displays the Profibus User Organization identification number of the device. ▪ 0x1523 → TMT184 ▪ 0x1551 → TMT84 ▪ 0x9700 → Profile Ident Number 1x AI Block ▪ 0x9701 → Profile Ident Number 2x AI Block ▪ 0x9702 → Profile Ident Number 3x AI Block ▪ 0x9703 → Profile Ident Number 4x AI Block, factory setting: 0x1551 **Factory setting:** 0x1551

1) These parameters may be changed if the parameter "Service locking" in the expert menu is set correspondingly.

Submenu Diagnostics - Measured values

This menu is only visible in the online mode.

n: Number of the Transducer Block (1-2) or the sensor input (1 or 2)

Diagnostics

Menu item	Parameter name	Parameter access	Description
Submenu "Measured values"	PV value n	Read	Displays the primary output value of the Transducer Block. The PV value n can be made available to an AI Block for further processing.
	Process temperature n	Read	Displays the measured value of sensor n
	Reference Junction Temperature	Read	Internal reference temperature measurement

Submenu Diagnostics - Measured values - Min./max. value

This menu is only visible in the online mode.

In this menu, you can view the minimum/maximum indicators of the PV values, the two measuring inputs and the internal reference measurement. In addition, the PV values saved can be reset.

n: Number of the Transducer Block (1-2) or the sensor input (1 or 2)

Diagnostics

Menu item	Parameter name	Parameter access	Description
Submenu "Measured values - Min/max value"	Primary Value n Min.	Read/write	Min. indicator for PV is stored in the nonvolatile memory in intervals of 10 minutes. Can be reset.
	Primary Value n Max.	Read/write	Max. indicator for PV is stored in the nonvolatile memory in intervals of 10 minutes. Can be reset.
	Sensor Value n Min.	Read	Displays the minimum sensor value. Is stored in the nonvolatile memory in intervals of 10 minutes. Can be reset.
	Sensor Value n Max.	Read	Displays the maximum sensor value. Is stored in the nonvolatile memory in intervals of 10 minutes. Can be reset.
	RJ min. value	Read	Indicator for the minimum value to occur at the internal reference temperature measuring point.
	RJ max. value	Read	Indicator for the maximum value to occur at the internal reference temperature measuring point.

Submenu Diagnostics - Device test/reset

This menu is only visible in the online mode.

By means of a reset, the device can be set to a defined state depending on the reset code.

Diagnostics

Menu item	Parameter name	Parameter access	Description
Submenu Device test/reset	Reset	Read/write	Resets or restarts the device. **User input:** 0 → No function/no action 1 → Standard configuration/reset all bus-specific parameters to factory settings with the exception of the configured station address. The device displays the next cold start for 10 seconds in the corresponding bit of the DIAGNOSTICS parameter group. 2506 → Warm start/execution of a warm start. The device displays the next warm start for 10 seconds in the corresponding bit of the DIAGNOSTICS parameter group. 2712 → Resets address to '126' / resets the station address to the usual PROFIBUS default address 126. 32769 → Configuration ordered / resets to delivery status. **Factory setting:** 0 If you select 1, the units are reset according to the factory setting, not the delivery status. After resetting, check the units and configure the unit you require. Then run the **Set Unit To Bus** parameter (→ 🖹 87).

13.3 Setup Expert

The parameter groups for the Expert setup contain all the parameters of the Standard setup and other parameters that are solely reserved for experts.

→ Expert	→ System → 🖹 80 Settings and description of the measuring point	→ Display → 🖹 69	
	→ Sensory mechanism → 🖹 81 Settings of the two measuring inputs	→ Sensor 1	→ Special linearization 1
		→ Sensor 2	→ Special linearization 2
	→ Communication → 🖹 86 Settings of the Profibus address and setup of the 4 Analog Input Blocks	→ Analog Input 1	
		→ Analog Input 2	
		→ Analog Input 3	
		→ Analog Input 4	
	→ Diagnostics → 🖹 96 Displays device information and status for service and maintenance purposes.	→ System information → 🖹 77	
		→ Measured value	→ Min./ max. values
		→ Device test/reset → 🖹 78	

13.3.1 Group System

All the parameters that describe the measuring point in greater detail can be viewed and configured in the "System" group.

System

Menu item	Parameter name	Parameter access	Description
	Target Mode	Read/write	Use this function to select the required operating mode.Only automatic operation can be selected in the Physical Block. The Physical Block can also be set to OOS if diagnostics is enabled as per Profile 3.02 (Physical Block parameter "COND_STATUS_DIAG" = 1). **Options:** ▪ 0x08 - AUTO ▪ 0x80 - Out of Service **Factory setting:** AUTO
	Block Mode	**General information on Block Mode:** Block Mode contains three elements: ▪ the block's current operating mode (Actual Mode) ▪ the modes supported by the block (Permitted Mode): Analog Input (AI): AUTO, MAN, OOS Physical Block: AUTO, OOS Transducer Block: AUTO ▪ normal operating mode (Normal Mode) Only the current Block Mode is displayed in the menu. Generally, you can select from several operating modes in a function block, while other block types only operate in the AUTO operating mode for example.	
	Actual Mode	Read	Displays the current operating mode. **Display:** AUTO
	PROFIBUS Ident Number Selector	Read/write	Use this function to select the configuration behavior. Every PROFIBUS device must check an identification number assigned by the PROFIBUS User Organization during the configuration phase. As well as these device-specific identification numbers, there are also PROFILE identification numbers that must be accepted during the configuration phase for the purpose of compatibility with products from other manufacturers. In this case, it is possible that the device restricts the functionality relating to the cyclical data to a profile-defined level. **Options:** ▪ 0 → Profile-specific Ident Number 9703 (1xAI) ▪ 1 → Manuf.-specific Ident Number 1551 (TMT84) ▪ 127 → Automatic (0x9700, 0x9701, 0x9702, 0x9703, 0x1551, 0x1523) ▪ 128 → Manuf.-specific Ident Number 1523 (TMT184) ▪ 129 → Profile-specific Ident Number 9700 (1xAI) ▪ 130 → Profile-specific Ident Number 9701 (2xAI) ▪ 131 → Profile-specific Ident Number 9702 (3xAI) **Factory setting:** 127
	Descriptor	Read/write	Use this function to enter a description for the application for which the device is used. **Factory setting:** No description (32 x space characters)
	Message	Read/write	Use this function to enter a message about the application for which the device is used. **Factory setting:** No message (32 x space characters)

Menu item	Parameter name	Parameter access	Description
	Installation Date	Read/write	Use this function to enter the device installation date. **Factory setting:** No date (16 x space characters)
	TAG location	Read/write	I&M Parameter TAG_LOCATION
	Signature	Read/write	I&M Parameter SIGNATURE
Only visible in online mode	HW write protection	Read	Displays the status of the hardware write protection. **Display:** ▪ 0 → write protection disabled, parameters can be changed. ▪ 1 → write protection enabled, parameters cannot be changed. **Factory setting:** 0 Write protection is enabled/disabled using a DIP switch (see Section 6.2.2). → 26
	System alarm delay		Alarm hysteresis: Value as to the time a device status (Failure or Maintenance) and measured value status (Bad or Uncertain) is delayed until the status is output. Can be configured between 0 and 10 seconds. **Factory setting:** 2s This setting does not affect the display.
	Mains filter	Read/write	Mains filter for the A/D converter. **Options:** ▪ 0 to 50 Hz ▪ 1 to 60 Hz **Factory setting:** 0 to 50 Hz
	Ambient alarm	Read/write	Status message in the event of the operating temperature of the transmitter being undershot or overshot, < −40 °C (−40 °F) or > +85 °C (185 °F): ▪ 0 - Maintenance: Int. temperature overshoot/ undershoot results in warning. ▪ 1 - Failure: Int. temperature overshoot/undershoot results in alarm. **Factory setting:** 0 - Maintenance

13.3.2 Group Sensory mechanism

Procedure for configuring a sensor input → 70

n: Number of the Transducer Block (1-2) or the sensor input (1 or 2)

Sensory mechanism

Menu item	Parameter name	Parameter access	Description
Submenu "Sensor 1" and "Sensor 2"	Characterization Type n	Read/write	Configuration of the sensor type. Characterization Type 1: settings for sensor input 1 Characterization Type 2: settings for sensor input 2 **Factory setting:** Channel 1: Pt100 IEC751 Channel 2: No sensor Please observe the terminal assignment in Section 5.2 when connecting the individual sensors. In the case of 2-channel operation, the possible connection options in Section 5.2.1 also have to be observed.
	Input Range and Mode n	Read/write	Configuration of the input measurement range. ▪ 0: mV, range 1: −5 to 30 mV; range: −5 to 30 mV; min. span: 1 mV ▪ 1: mV, range 2: −20 to 100 mV; min. span: 1 mV ▪ 128: Ω, range 1: 10 to 400 Ω; min. span: 10 Ω ▪ 129: Ω, range 2: 10 to 2 000 Ω; min. span: 10 Ω **Factory setting:** 128: Ω, range 1: 10 to 400 Ω; min. span: 10 Ω
	Unit n	Read/write	Configuration of the temperature unit for PV value n ▪ 1000 - K ▪ 1001 - °C ▪ 1002 - °F ▪ 1003 - Rk ▪ 1281 - Ohm ▪ 1243 - mV ▪ 1342 - % **Factory setting:** °C
	Connection type n	Read/write	Sensor connection mode: Sensor Transducer 1 (Connection mode 1): ▪ 0 - 2 wires ▪ 1 - 3 wires ▪ 2 - 4 wires **Factory setting:** 3 wires Sensor Transducer 2 (Connection mode 2): ▪ 0 - 2 wires ▪ 1 - 3 wires **Factory setting:** 3 wires

Menu item	Parameter name	Parameter access	Description
	Measure type n	Read/write	Displays the calculation process for Primary Value 1. See also → 📄 70 SV1 = Secondary Value 1 = sensor value 1 in temperature Transducer Block 1 = sensor value 2 in temperature Transducer Block 2 SV2 = Secondary Value 2 = sensor value 2 in temperature Transducer Block 1 = sensor value 1 in temperature Transducer Block 2 **Options:** Sensor Transducer 1 (Measuring mode 1): ▪ PV = SV1: Secondary value 1 ▪ PV = SV1-SV2: Difference ▪ PV = 0.5 x (SV1+SV2): Average ▪ PV = 0.5 x (SV1+SV2) redundancy: Average or Secondary Value 1 or Secondary Value 2 in the event of a sensor error in the other sensor. ▪ PV = SV1 (OR SV2): Backup function: If sensor 1 fails, the value of sensor 2 automatically becomes the Primary Value. ▪ PV = SV1 (OR SV2 if SV1>T): PV changes from SV1 to SV2 if SV1 > value T (Parameter: **Threshold value n**) ▪ PV = (|SV1-SV2|) if PV> drift value: PV is the drift value between sensor 1 and sensor 2. If PV exceeds the configured drift value (Sensor drift detection limit value), a drift alarm is output. ▪ PV =(|SV1-SV2|) if PV< drift value: PV is the drift value between sensor 1 and sensor 2. If PV undershoots the configured drift value (Sensor drift detection limit value), a drift alarm is output. **Factory setting:** PV = SV1 Sensor Transducer 2 (Measuring mode 2): ▪ PV = SV2: Secondary value 2 ▪ PV = SV2-SV1: Difference ▪ PV = 0.5 x (SV2+SV1): Average ▪ PV = 0.5 x (SV2+SV1) redundancy: Average or Secondary Value 1 or Secondary Value 2 in the event of a sensor error in the other sensor. ▪ PV = SV2 (OR SV1): Backup function: If sensor 2 fails, the value of sensor 1 automatically becomes the Primary Value. ▪ PV = SV2 (OR SV 1 if SV2>T): PV changes from SV2 to SV1 if SV2 > value T (Parameter: **Threshold value n**) ▪ PV = (|SV1-SV2|) if PV> drift value: PV is the drift value between sensor 1 and sensor 2. If PV exceeds the configured drift value (Sensor drift detection limit value), a drift alarm is output. ▪ PV = (|SV1-SV2|) if PV< drift value: PV is the drift value between sensor 1 and sensor 2. If PV undershoots the configured drift value (Sensor drift detection limit value), a drift alarm is output. **Factory setting:** PV = SV1 = Sensor 2
	2-wire compensation n	Read/write	Two-wire compensation for RTDs. The following values are permitted: 0 to 30 Ω
	Offset n	Read/write	Offset for Primary Value 1 The following values are permitted: ▪ -10 to +10 for Celsius, Kelvin, mV and Ohm ▪ -18 to +18 for Fahrenheit, Rankine **Factory setting:** 0.0

Menu item	Parameter name	Parameter access	Description
(Only visible in online mode)	Lower sensor range n	Read	Displays the lower, physical sensor range.
(Only visible in online mode)	Upper sensor range n	Read	Displays the upper, physical sensor range.
	Threshold value n	Read/write	Value for switching in PV mode for sensor switching. Entry in the range of −270 to 2 200 °C (−454 to 3 992 °F).
	Reference Junction Type n	Read/write	Configuration of reference junction measurement for temperature compensation in thermocouples: ▪ 0 - no reference: no temperature compensation is used. ▪ 1 - internally measured reference junction: internal reference junction temperature is used for temperature compensation. ▪ 2 - external fixed value: "Ext. Reference Junction Temperature" is used for temperature compensation. **Factory setting:** 1 - internally measured reference junction
	Ext. Reference Junction Temperature n	Read/write	Value for temperature compensation (see parameter: **Reference Junction**). **Factory setting:** 0.0
	Sensor drift monitoring	Read/write	Deviation between SV1 and SV2 is identified as an error (Failure) or as need for maintenance (Warning): ▪ 1 - FAILURE: (sensor deviation > Sensor drift detection limit value n) → Failure. Sensor drift is displayed as error ▪ 0 - Warning: (sensor deviation > Sensor drift detection limit value n) → Warning. Sensor drift is displayed as warning **Factory setting:** 0 - Warning
	Sensor drift detection limit value n	Read/write	Configuration of the max. permitted measured value deviation between sensor 1 and sensor 2. This value is relevant if **"PV =ABS(SV1- SV2) if PV < drift value"** was selected for the measuring mode. Permitted deviation from 0.1 to 999. **Factory setting:** 999
	Corrosion detection n	Read/write	▪ 0 - OFF: Corrosion detection off ▪ 1 - ON: Corrosion detection on **Factory setting:** 0 - OFF Only possible for RTD 4-wire connection and thermocouples (TC).

Submenu "Special linearization 1" or "Special linearization 2"

Procedure for configuring a special linearization using Callendar-Van Dusen coefficients from a calibration certificate:

1. Start
▼
2. Configure the type of measurement e.g. PV=SV1
▼
3. Select unit (°C)
▼

4. Select the sensor type (linearization type) "RTD platinum (Callendar-Van Dusen)"
▼
5. Select type of connection e.g. 4-wire
▼
6. Enter the four coefficients A, B, C and R0
▼
7. If special linearization is also used for a second sensor, repeat steps 2 to 6
▼
8. End

Sensory mechanism

Menu item	Parameter name	Parameter access	Description
Submenu "Special linearization n"	Call.-v. Dusen lower range	Read/write	Lower calculation limit for Callendar-Van Dusen linearization. **Factory setting:** 0.0
	Call.-v. Dusen upper range	Read/write	Upper calculation limit for Callendar-Van Dusen linearization. **Factory setting:** 100.0
	Call.-v. Dusen coeff. R0	Read/write	The values for the R0 value must be in the range of 40 to 1 050 Ω. **Factory setting:** 100
	Call.-v. Dusen coeff. A	Read/write	Sensor linearization based on the Callendar-Van Dusen method. The Call.-v. Dusen coeff. X parameters are used for calculating the response curve if "RTD- Callendar-Van Dusen" is set in the Characterization Type 1 parameter. **Factory setting Call.-v. Dusen coeff. A:** 3.9083E-03 **Factory setting Call.-v. Dusen coeff. B:** -5.775E-07 **Factory setting Call.-v. Dusen coeff. C:** 0
	Call.-v. Dusen coeff. B	Read/write	
	Call.-v. Dusen coeff. C	Read/write	
(Only visible in online mode)	Sensor trim	Read/write	▪ Factory trim standard calibration: Sensor linearization with the factory calibration values ▪ User trim standard calibration: Sensor linearization with the values "Calibration Highest Point" and "Calibration Lowest Point" The original linearization can be established by resetting this parameter to "Factory Trim Standard Calibration".
	Sensor trimming lower value	Read/write	Lower point for linear characteristic calibration (this affects offset and slope). To write to this parameter, "Sensor trim" must be set to "User trim standard calibration".
	Sensor trimming upper value	Read/write	Upper point for linear characteristic calibration (this affects offset and slope). To write to this parameter, "Sensor calibration method" must be set to "User trim standard calibration".
	Sensor trim min. span	Read	Span of the measurement range, depending on the sensor type set

Menu item	Parameter name	Parameter access	Description
	Poly. Meas. range min.	Read/write	Lower calculation limit for the RTD polynomial (nickel/copper) linearization. **Factory setting:** For Characterization Type = copper: 0 For Characterization Type = nickel: -60
	Poly. Meas. range max.	Read/write	Upper calculation limit for the RTD polynomial (nickel/copper) linearization. **Factory setting:** For Characterization Type = copper: 200 For Characterization Type = nickel: 100
	Poly. coeff. R0	Read/write	The values for the R0 value must be in the range of 40 to 1 050 Ω. **Factory setting:** For Characterization Type = copper: 100 For Characterization Type = nickel: 100
	Poly. coeff. A	Read/write	Sensor linearization of copper/nickel resistance thermometers (RTD). The POLY_COEFF_XX parameters are used for calculating the response curve if "RTD - polynomial nickel" or "RTD - polynomial copper" is set in the **Characterization Type n** parameter. **Factory setting:** **Poly. coeff. A** Copper = 0.00428 Nickel = 5.4963E-03 **Poly. coeff. B** Copper = 6.2032E-07 Nickel = 6.7556E-06 **Poly. coeff. C** Copper = 8.5154E-10 Nickel = 0
	Poly. coeff. B	Read/write	
	Poly. coeff. C	Read/write	
	Sensor serial number	Read/write	Serial number of the connected sensor.

13.3.3 Group Communication

Changing the unit

The system unit for the temperature can be changed in the Sensor 1 or Sensor 2 menu for the channel in question.

Changing the unit does not initially have any effect on the measured value transmitted to the automation system. This ensures that there are no sudden changes in the measured values that could have an effect on the subsequent control routine.

Communication

Menu item	Parameter name	Parameter access	Description
	Bus address	Read	Displays the device bus address. **Factory setting:** 126
(Only visible in online mode)	Set Unit To Bus	Read/write	Transfers configured system units to the automation system. During the transfer, the scaling of the OUT SCALE value in the Analog Input Block is automatically overwritten with the configured PV SCALE and the unit from the Transducer Block is copied to the "Out Scale - Unit" (output unit). **Options:** ▪ 0 - OFF ▪ 1 - ON **Factory setting:** 0 - OFF Activating this parameter can result in an erratic change of the output value "Out value" and thus affect subsequent control loops.

Submenus "Analog Input 1" to "Analog Input 4"

The standard parameters for the "Security settings" menu can be found in the submenu Setup → Advanced setup → 74. The expert parameters are listed in the following table.

Status of the Output value

The status of the **Output value** parameter group tells the downstream function blocks the status of the Analog Input function block and the validity of the **Output value**.

Status of the OUT output value:	Meaning of the output value:
GOOD NON CASCADE	→ OUT is valid and can be used for further processing.
UNCERTAIN	→ OUT can only be used for further processing to a limited extent.
BAD	→ OUT is not valid.
The BAD status value occurs when the Analog Input function block is switched to OOS (out-of-service) or in the event of serious errors (see status code and system/process error messages, → 45).	

Simulation of input/output

Various parameters of the Analog Input 1-4 menus allow simulation of the input and output of the function block:

- **Simulating the input of the Analog Input function block:**
  The input value (measured value and status) can be specified by means of the "AI Simulation / AI Simulation value / AI Simulation status" parameters. Since the simulation value runs through the entire function block, all the parameter settings of the block can be checked.
- **Simulating the output of the Analog Input function block:**
  Set the operating mode to MAN with the **Current mode** parameter (→ 70) and directly specify the desired output value in the **Output value** parameter (→ 89).

Failsafe mode

If an input or simulation value has the status BAD, the Analog Input function block uses the failsafe mode defined in the "Failsafe mode" parameter. The "Failsafe mode" parameter (→ 🖹 89) offers the following options:

Options in the FAILSAFE TYPE parameter (failsafe mode):	Failsafe mode:
FSAFE VALUE	The value specified in the "Failsafe value" parameter is used for further processing.
LAST GOOD VALUE	The last good value is used for further processing.
WRONG VALUE	The current value is used for further processing, despite the BAD status.
The factory setting is WRONG VALUE.	

Failsafe mode is also activated if the Analog Input function block is set to the "OUT OF SERVICE" operating mode.

Limit values

You can set two warning limits and two alarm limits for monitoring your process. The status of the measured value and the parameters of the limit value alarms are indicative of the measured value's relative situation. You also have the option of defining an alarm hysteresis in order to avoid frequent changes of the limit value flags and frequent switching between enabled and disabled alarm settings (see → 🖹 89).

The limit values are based on the OUT output value. If the output value OUT exceeds or undershoots the defined limit values, an alarm is sent to the automation system via the limit value process alarms.

Process alarms provide information on certain block states and events. The following process alarms can be defined and generated in the Analog Input function block:

HI HI LIM	→ 🖹 89		LO LO LIM	→ 🖹 89
HI LIM	→ 🖹 89		LO LIM	→ 🖹 89

Limit value process alarms

If a limit value is violated, the specified priority of the limit value alarm is checked before the limit value violation is communicated to the fieldbus host system.

Rescaling the input value

In the Analog Input function block the input value or input range can be scaled in accordance with the automation requirements.

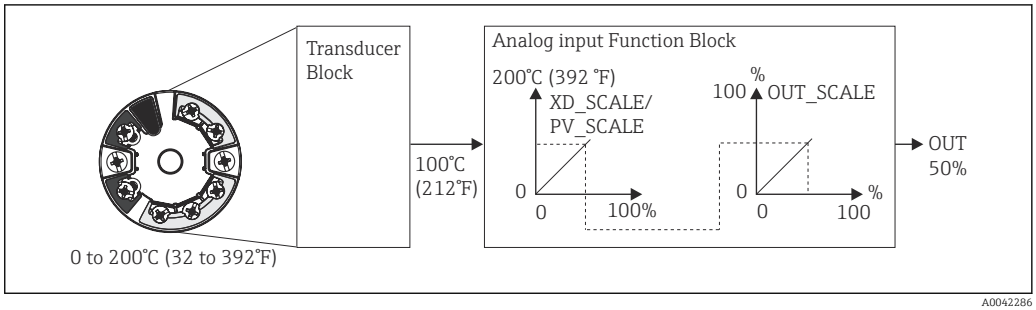
Example:

- The system unit in the Transducer Block is °C.
- The measurement range of the sensor is -200 to 850°C.
- The process-relevant measurement range is 0 to 200°C.
- The output range to the process control system should be 0 to 100%.

The measured value from the Transducer Block (input value) is rescaled linearly via the input scaling PV SCALE to the desired output range OUT SCALE:

Parameter group PV SCALE (→ 🖹 86)		Parameter group OUT SCALE (→ 🖹 86)	
PV SCALE MIN	→ 0	OUT SCALE MIN	→ 0
PV SCALE MAX	→ 200	OUT SCALE MAX	→ 100
		OUT UNIT	→ %

The result is that with an input value of, for example, 100°C (212 °F), a value of 50% is output via the OUT parameter.



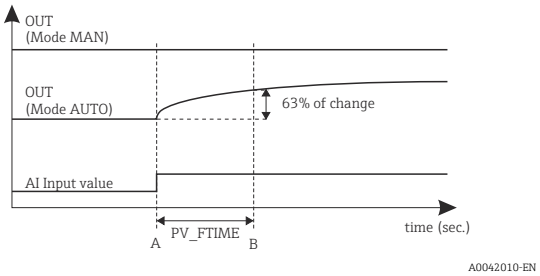
20 *Scaling procedure in the Analog Input function block*

Communication

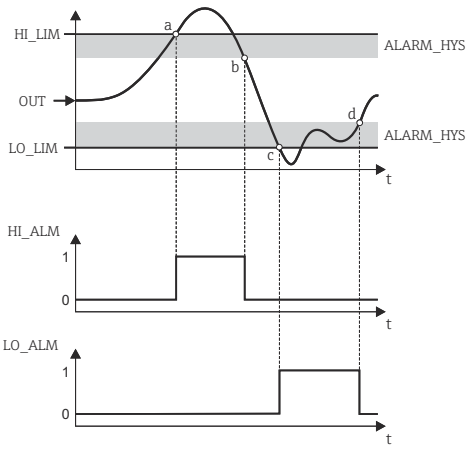
Menu item	Parameter name	Parameter access	Description
Analog Input	Static Revision No.	Read	A block operates static parameters (Static attribute) that are not changed by the process. Static parameters, whose values change during optimization or configuration, cause the ST REV parameter to increment by 1. This supports parameter version management. If several parameters change within a very short time, e.g. due to loading of parameters from FieldCare, PDM, etc. in the device, the static revision counter can show a higher value. This counter can never be reset and is not reset to a default value after a device reset. If the counter overflows, (16 bit), it starts again at 1.
	TAG	Read/write	Use this function to enter a user-specific text (max. 32 characters) for the unique identification and assignment of the block. **User input:** Text with 32 characters maximum, options: A-Z, 0-9, +,–, punctuation marks **Factory setting:** "– – – – – – – –" no text
	Target Mode	Read/write	Use this function to select the required operating mode. **Options:** 0x08 AUTO 0x10 MAN 0x80 OOS **Factory setting:** 0x08 AUTO
	BLOCK MODE	**General information on the BLOCK MODE parameter group:** This parameter group contains three elements: ▪ the block's current operating mode (Actual Mode) ▪ the modes supported by the block (Permitted Mode) ▪ normal operating mode (Normal Mode) A distinction is made between "Automatic operation" (AUTO), manual intervention by the user (MAN) and the "Out of service" (O/S) mode. Generally, you can select from several operating modes in a function block, while other block types only operate in the AUTO operating mode for example.	
	Actual Mode	Read	Displays the current operating mode. **Options:** 0x08 AUTO 0x10 MAN 0x80 OOS **Factory setting:** 0x08 AUTO

Menu item	Parameter name	Parameter access	Description
	AI n channel	Read/write	Assignment between the logical hardware channel of the Transducer Block and the input of the Analog Input function block. The Transducer Block of the TMT84 makes five different measured values available to the input channel of the Analog Input function block. **Options:** ▪ 0x0108 (264) → Primary Value Transducer 1 ▪ 0x010A (266) → Secondary Value 1 Transducer 1 ▪ 0x015D (349) → Reference Junction Temperature ▪ 0x0208 (520) → Primary Value Transducer 2 ▪ 0x020A (522) → Secondary Value 1 Transducer 2 **Factory setting:** AI1 Primary Value Transducer 1 → 1 AI2 Secondary Value Transducer 1 → 2 AI3 Primary Value Transducer 2 → 2 AI4 Secondary Value Transducer 2 → 3
	Alarm Sum	**General information on the "Alarm Sum" parameter group:** The Active Block Alarm is supported, which indicates a change to a parameter with static parameters (Static attribute) for 10 sec. and displays that a warning or alarm limit was violated in the Analog Input function block. **Display values:** 0x0000 No alarm 0x0200 Upper alarm limit value 0x0400 Upper warning limit value 0x0800 Lower alarm limit value 0x1000 Lower warning limit value 0x8000 Parameter set changed	
(Only visible in online mode)	Current State Alarm Sum	Read	Displays the device's current alarms.
	Unacknowledged State Alarm Sum	Read	Displays the device's unacknowledged alarms.
	Unreported State Alarm Sum	Read	
	Disabled State Alarm Sum	Read	Displays the device's acknowledged alarms.
	Out unit text	Read/write	Use this function to enter ASCII text if the required unit is not available in the OUT UNIT (output unit) parameter.
(Only visible in online mode)	Output value	Read	Displays the (output) value OUT of the process variable selected in the CHANNEL parameter

Menu item	Parameter name	Parameter access	Description
(Only visible in online mode)	Quality	Read	Displays the quality (measured value status) for the "Output value". 0x80 - Good 0x84 - Good: Parameters changed 0x88 - Good: Warning limit 0x8C - Good: Alarm limit 0x90 - Good: Unacknowledged block alarm (Pr. 3.0/ 3.01 only) 0x94 - Good: Unacknowledged warning (Pr. 3.0/3.01 only) 0x98 - Good: Unacknowledged alarm (Pr. 3.0/3.01 only) 0xA0 - Good: Go to failsafe mode 0xA4 - Good: Maintenance required 0xA8 - Good: Request for maintenance (Pr. 3.02) 0xBC - Good: Function check/local overrride (3.02) 0x40 - Uncertain (Pr. 3.0/3.01 only) 0x44 - Uncertain: Last usable value (Pr. 3.0/3.01 only) 0x48 - Uncertain: Substitute value (0x4B in Pr. 3.02) 0x4C - Uncertain: Initial value (0x4F in Pr. 3.02) 0x50 - Uncertain: Value incorrect (Pr. 3.0/3.01 only) 0x54 - Uncertain: Outside value range (Pr. 3.0/3.01 only) 0x58 - Uncertain: Abnormal (Pr. 3.0/3.01 only) 0x5C - Uncertain: Configuration error (Pr. 3.0/ 3.01 only) 0x60 - Uncertain: Simulation value (Pr. 3.0/3.01 only) 0x64 - Uncertain: Simulated value, start 0x68 - Uncertain: Request for maintenance (Pr. 3.02) 0x73 - Uncertain: Simulated value, start (Pr. 3.02) 0x74 - Uncertain: Simulated value, end (Pr. 3.02) 0x78 - Uncertain: Process fault/no maintenance required (Pr. 3.02) 0x00 - Bad (Pr. 3.0/3.01 only) 0x04 - Bad: Configuration error (Pr. 3.0/ 3.01 only) 0x08 - Bad: No connection (Pr. 3.0/3.01 only) 0x0C - Bad: Device error (Pr. 3.0/3.01 only) 0x10 - Bad: Sensor error (Pr. 3.0/3.01 only) 0x14 - Bad: Last usable value (no comm., Pr. 3.0/3.01 only) 0x18 - Bad: No usable value (no comm., (Pr. 3.0/3.01 only) 0x1C - Bad: Out of service (Pr. 3.0/3.01 only) 0x23 - Bad: Passive (Pr. 3.02) 0x24 - Bad: Maintenance alarm (Pr. 3.02) 0x2B - Bad: Process fault/no maintenance required (Pr. 3.02) 0x3C - Bad: Function check/local override (Pr. 3.02)
	Status	Read	Displays the limit (measured value status) for the "Output value" 0x00 - OK 0x01 - Limit underflow 0x02 - Limit overflow 0x03 - Value constant

Menu item	Parameter name	Parameter access	Description
	Filter Time Const.	Read/write	Use this function to enter the filter time constant (in seconds) of the digital filter of the 1st order. This time is required in order for 63% of a change in the Analog Input (input value) to have an effect on OUT (output value). The diagram shows the time-dependent signal characteristics of the Analog Input function block:  A → The Analog Input changes. B → OUT reacted 63% to the change of the Analog Input. **Factory setting:** 0 s
	PV SCALE	In the PV SCALE parameter group, the process variable is standardized to one value by means of the "Lower Value" and "Upper Value" parameters using the unit of the connected Transducer Block. For an example on rescaling the input value, see → 🖹 86	
	PV SCALE - lower value	Read/write	This parameter is used to enter the lower value for input scaling. **Factory setting:** 0
	PV SCALE - upper value	Read/write	This parameter is used to enter the upper value for input scaling. **Factory setting:** 100
	OUT SCALE	In the OUT SCALE parameter group, the measurement range (lower and upper limit) and the physical unit for the output value (Out value) are defined. The following parameters are available in this parameter group: ▪ Out Scale - lower value ▪ Out Scale - upper value ▪ Unit ▪ Decimal point Defining the measurement range in this parameter group does not represent a restriction of the output value "Out value". If the output value "Out value" is outside the measurement range, it is transferred nonetheless.	
	Out Scale - upper value	Read/write	Use this function to enter the upper value for output scaling. **Factory setting:** 100
	Out Scale - lower value	Read/write	Use this function to enter the lower value for output scaling. **Factory setting:** 0
	Unit	Read/write	Use this function to select the output unit. **Factory setting:** Analog Input function block = 0x07CD (1997)= none OUT UNIT (output unit) does not affect measured value scaling.

Menu item	Parameter name	Parameter access	Description
	Decimal Point	Read/write	Specifies the number of places after the decimal point for the output value "Out value". This parameter is not supported by the device.
	Upper limit alarm	Read/write	Use this function to enter the alarm limit value for the upper warning (HI ALM). If the output value OUT exceeds this limit value, the HI ALM alarm status parameter is output. **User input:** Unit from OUT SCALE **Factory setting:** Max value
	Upper limit warning	Read/write	Use this function to enter the alarm limit value for the upper alarm (HI HI ALM). If the output value OUT exceeds this limit value, the HI HI ALM alarm status parameter is output. **User input:** Unit from OUT SCALE **Factory setting:** Max value
	Lower limit warning	Read/write	Use this function to enter the alarm limit value for the lower warning (LO ALM). If the output value OUT is below this limit value, the LO ALM alarm status parameter is output. **User input:** Unit from OUT SCALE **Factory setting:** Min value
	Lower limit alarm	Read/write	Use this function to enter the alarm limit value for the lower alarm (LO LO ALM). If the output value OUT is below this limit value, the LO LO ALM alarm status parameter is output. **User input:** Unit from OUT SCALE **Factory setting:** Min value

Menu item	Parameter name	Parameter access	Description
	Limit Hysteresis	Read/write	Use this function to enter the hysteresis value for the upper and lower warning or alarm limit values. The alarm conditions remain active as long as the measured value is within the hysteresis. The hysteresis value affects the following warning and alarm limit values of the Analog Input function block: HI HI ALM → Upper limit alarm HI ALM → Upper limit warning LO LO ALM → Lower limit alarm LO ALM → Lower limit warning **User input:** 0 to 50% **Factory setting:** 0.5% of the measurement range ▪ The hysteresis value refers to a percentage of the range specified in the OUT SCALE parameter group in the Analog Input function block. ▪ If the limit values are entered in FieldCare, ensure that absolute values can be displayed and entered. **Example:** ▪ The diagram on the top shows the defined limit values for the warnings LO LIM and HI LIM with their respective hystereses (gray background) and the signal characteristics of the output value OUT. ▪ The two bottom diagrams show the behavior of the relevant alarms HI ALM and LO ALM on the changing signal characteristics (0 = no alarm, 1 = alarm is output).  A0042011 *a* *Output value OUT exceeds limit value HI LIM, HI ALM is enabled.* *b* *Output value OUT undershoots the hysteresis value of HI LIM, HI ALM is disabled.* *c* *Output value OUT undershoots the limit value LO LIM, LO ALM is enabled.* *d* *Output value OUT exceeds the hysteresis value of LO LIM, LO ALM is disabled.*

Menu item	Parameter name	Parameter access	Description
	Fail Safe Mode	Read/write	Use this function to select the failsafe mode in the event of a device error or bad measured value. ACTUAL MODE (current operating mode of the block) remains in AUTO MODE (automatic operation). The status information only applies to diagnostics as per Profile 3.0/3.01. For Profile 3.02, see Section 11.2.2 → 43. **Options:** ▪ FSAFE VALUE (The substitute value is adopted in the output value) When this option is selected, the value entered in the "Fail Safe Default Value" parameter is displayed in OUT (output value). The status changes to UNCERTAIN - SUBSTITUTE VALUE. ▪ LAST GOOD VALUE (The last valid output value saved is adopted in the output value) The output value valid before the failure is used. The status is set to UNCERTAIN – LAST USABLE VALUE. If there was no valid value previously, the initial value is provided with the status UNCERTAIN – INITIAL VALUE (for values not saved during a device reset). The initial value of the TMT84 Profibus PA is "0". ▪ WRONG VALUE (Incorrect measured value at the output value) The value is still used for calculation despite the bad status. **Factory setting:** WRONG VALUE
	Fail Safe Default Value	Read/write	This parameter is used to enter a default value to be displayed when there is an error in OUT (output value). **Factory setting:** 0
	AI(n) simulation quality	Read/write	Simulation of Analog Input function block quality. For list of options, see → 86 **Factory setting:** Bad
	AI(n) simulation status	Read/write	Simulation of Analog Input function block status. 0x00 - OK 0x01 - Limit underflow 0x02 - Limit overflow 0x03 - Value constant
	AI(n) simulation value	Read/write	Simulation of the input value. Since this value runs through the entire algorithm, the behavior of the Analog Input function block can be checked. **Factory setting:** 0.0
	AI(n) simulation enable	Read/write	Enable/disable simulation. **Options:** Disabled Enabled **Factory setting:** Disabled

13.3.4 Group Diagnostics

All the information that describes the device, the device status and the process conditions can be found in this group. The individual parameters are summarized in the Diagnostics menu in this section:

Diagnostics

Menu item	Parameter name	Parameter access	Description
	Current diagnostics	Read	Displays the diagnostics code. The diagnostics code consists of the "Current status" and the "Current error code". **Example:** F041 (Failure + sensor failure)
	Current diagnostics description	Read	Displays the status information as description text, → 🖹 45
	Status channel	Read	Displays where in the device the highest priority error occurs. ▪ 0: Device ▪ 1: Sensor 1 ▪ 2: Sensor 2
	Status count	Read	The number of status messages currently pending in the device.
	Diagnostics	Read	Diagnostics information of the device encoded in bits. **Current status number:** ▪ 0 - Status OK ▪ 0x01000000 -Hardware failure electronics. ▪ 0x02000000 - Hardware failure mechanics. ▪ 0x08000000 - Electronics temperature too high. ▪ 0x10000000 - Memory checksum error. ▪ 0x20000000 - Failure in measurement. ▪ 0x80000000 - Self calibration failed. ▪ 0x00040000 - Configuration not valid. ▪ 0x00080000 - New start-up (warm startup) carried out. ▪ 0x00100000 - Restart (cold startup) carried out. ▪ 0x00200000 - Maintenance required. ▪ 0x00800000 - Ident Number Violation. ▪ 0x00000100 - Failure of the device ▪ 0x00000200 - Maintenance demanded ▪ 0x00000400 - Function check or simulation mode ▪ 0x00000800 - Out of Specification ▪ 0x00000080 - More information available.
	Last diagnostics	Read	Displays the last diagnostics code. The diagnostics code consists of the "Last status" and "Last error code". Example: F041 (Failure + sensor failure)
	Last status channel	Read	Displays where in the device the last highest priority error occurred. 0: Device 1: Sensor 1 2: Sensor 2
	Clear last diagnostics	Read/write	The last diagnostics information can be deleted. 0: Show last error 1: Clear last error **Factory setting:** 0
	Extended diagnostics	Read	Manufacturer-specific diagnostics information encoded in bits. Several messages are possible. See the "Status diagnostics bits" at the end of this manual.
	Extended diagnostics mask	Read	Displays the bit mask that outputs the manufacturer-specific diagnostic messages

Menu item	Parameter name	Parameter access	Description
(Only visible in online mode)	Enabled features	Read	FEATURE.Enabled: X=0 → Condensed status and diagnostics supported/ diagnostics as per Profile 3.01/3.0. X=1 → Diagnostics as per Profile 3.02/extended status/ diagnostics are supported. **Factory setting:** X=1
	Supported features	Read	FEATURE.Enabled: X=0 → Condensed status and diagnostics supported/ diagnostics as per Profile 3.01/3.0. X=1 → Diagnostics as per Profile 3.02/extended status/ diagnostics are supported. **Factory setting:** X=1
	Setting condensed status diagnostics	Read/write	Displays whether "Condensed Status & Diagnostic Messages" is used. 0 = Status and diagnostics as described in Profile 3.01 1 = Support for condensed status and diagnostics 2-255 = Reserved for the Profibus User Organization (PNO) **Factory setting:** 1
(Only visible in online mode)	Service locking	Read/write	Configuration for enabling the ENP service parameters.

Submenu "System information"

In addition to the system information described from → 77 onwards, the following parameter is also available in the Expert setup.

Diagnostics

Menu item	Parameter name	Parameter access	Description
Submenu "System information"	UpDown Feature Supported	Read	0x00: Upload Supported 0x01: Parallel Upload Supported 0x02: Download Supported 0x03: Two Buffer Device **Factory setting:** Upload Supported

Submenu "Measured values"

This menu is only visible in the online mode.

All the measured values with their related status information are displayed in the "Measured values" Expert menu. Furthermore, the unscaled, unlinearized measured value of the sensor input in question can be read out by means of the "Raw value" parameter. For example, in the case of a Pt100 the actual Ohm value that can be used to calibrate and calculate Callendar-Van Dusen coefficients is displayed.

n: Number of the Transducer Block (1-2) or the sensor input (1 or 2)

Diagnostics

Menu item	Parameter name	Parameter access	Description
Submenu "Measured values"	PV value n	Read	Displays the primary output value of the Transducer Block. The PV value n can be made available to an AI Block for further processing. The quality of the measured value is displayed by the "Quality" and "Status" parameters.
	PV value n - Quality	Read	Displays the quality (measured value status) for the PV value. For list of options, see → 86
	PV value n - Status	Read	Displays the limit (measured value status) for the PV value. 0x00 - OK 0x01 - Limit underflow 0x02 - Limit overflow 0x03 - Value constant
	Process temperature n	Read	Displays the measured value of sensor n
	Process temperature n - Quality	Read	Displays the quality (measured value status) of the process temperature for sensor n. For value, see "PV value n - Quality"
	Process temperature n - Status	Read	Displays the limit (measured value status) of the process temperature for sensor n. For value, see "PV value n - Status"
	RJ temperature n	Read	Displays the internal reference temperature
	RJ temperature - Quality	Read	Displays the quality (measured value status) of the internal reference temperature. For value, see "PV value n - Quality"
	RJ temperature - Status	Read	Displays the status (measured value status) of the internal reference temperature. For value, see "PV value n - Status"
	Sensor raw value n	Read	Displays the non-linearized mV/Ohm of the relevant sensor.

13.4 Slot/Index lists

13.4.1 General explanatory remarks

Abbreviations used in the Slot/Index lists:

Endress+Hauser matrix → The number of the page in which you will find the explanation of the parameter. Object Type:
- Record → Contains data structures (DS)
- Simple → Contains only single data types (e.g. float, integer, etc.)

Parameters:
- M → Mandatory parameter
- O → Optional parameter

Data Types:
- DS → Data structure, contains data types such as Unsigned8, OctetString, etc.
- Float → IEEE 754 format
- Integer → 8 (range of values -128 to 127), 16 (-327678 to 327678), 32 (-2^{31} to 2^{31})

- Octet String → Binary coded
- Unsigned → 8 (range of values 0 to 255), 16 (0 to 65535), 32 (0 to 4294967295)
- Visible String → ISO 646, ISO 2375

Storage Class:
- C → Calibration data
- Cst → Constant parameter
- D → Dynamic parameter
- N → Non-volatile parameter. Changing a parameter in this class does not affect the ST_REV parameter of the block in question
- S → Static parameter. Changing a parameter in this class increases the ST_REV parameter of the block in question
- V → Storage class V means that the altered parameter value is not saved in the device

13.4.2 Device management slot 1

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter	Default value
Device Management Slot 1									
Directory Header/ Composite Directory Entries	0	X		Record	Unsigned 16	12	Cst	M	
Composite Directory Entry/ Composite Directory Entries	1	X		Record	Unsigned 16	28	Cst	M	
Not used	2 - 15	-	-	-	-	-	-	-	

13.4.3 Physical Block slot 0

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
Physical Block Slot 0								
Not used	0 - 15	X	-	-	-	-	-	-
BLOCK_OBJECT	16	X	-	Record	DS-32	20	Cst	M
ST_REV	17	X	-	Simple	Unsigned16	2	N	M
TAG_DESC	18	X	X	Simple	Octet String	32	S	M
STRATEGY	19	X	X	Simple	Unsigned 16	2	S	M
ALERT_KEY	20	X	X	Simple	Unsigned 8	1	S	M
TARGET_MODE	21	X	X	Simple	Unsigned 8	1	S	M
MODE_BLK	22	X	-	Record	DS-37	3	D	M
ALARM_SUM	23	X	-	Record	DS-42	8	D	M
SOFTWARE_REVISION	24	X	-	Simple	Visible String	16	Cst	M
HARDWARE_REVISION	25	X	-	Simple	Visible String	16	Cst	M
DEVICE MAN_ID	26	X	-	Simple	Unsigned 16	2	Cst	M
DEVICE_ID	27	X	-	Simple	Visible String	16	Cst	M
DEVICE SER NUM	28	X	-	Simple	Visible String	16	Cst	M
DIAGNOSIS	29	X	-	Simple	Octet String	4	D	M
DIAGNOSIS_EXTENSION	30	X	-	Simple	Octet String	6	D	O

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
DIAGNOSIS_MASK	31	X	-	Simple	Octet String	4	Cst	M
DIAGNOSIS_MASK_EXTENSION	32	X	-	Simple	Octet String	6	Cst	O
DEVICE CERTIFICATION	33	X	-	Simple	Visible String	32	Cst	O
Not used	34	-	-	-	-	-	-	-
FACTORY_RESET	35	X	X	Simple	Unsigned 16	2	S	O
DESCRIPTOR	36	X	X	Simple	Octet String	32	S	O
DEVICE MESSAGE	37	X	X	Simple	Octet String	32	S	O
DEVICE INSTAL DATE	38	X	X	Simple	Octet String	16	S	O
Not used	39	-	-	-	-	-	-	-
IDENT_NUMBER_SELECTION	40	X	X	Simple	Unsigned 8	1	S	O
HW_WRITE_PROTECTION	41	X	-	Simple	Unsigned 8	1	D	O
FEATURE	42	X	-	Record	DS-68	8	N	M
COND_STATUS_DIAGNOSIS	43	X	X		Unsigned 8	1	S	M
Not used	44-53	-	-	-	-	-	-	-
ACTUAL_ERROR_CODE	54	X	-	Simple	Unsigned 16	2	D	M
LAST_ERROR_CODE	55	X	-	Simple	Unsigned 16	2	D/S	M
UPDOWN_FEAT_SUPP	56	X	-	Simple	Octet String	1	Const	M
Not used	57-58	-	-	-	-	-	-	-
DEVICE_BUS_ADDRESS	59	X	-	Simple	Unsigned 8	1	D	M
Not used	60	-	-	-	-	-	-	-
SET UNIT TO BUS	61	X	X	Simple	Unsigned 8	1	V	M
DISPLAY_VALUE	62	X	-	Record	LocalDispVal	6	D	O
Not used	63	-	-	-	-	-	-	-
PROFILE_REVISION	64	X	-	Simple	Octet String	32	Cst(D)	M
CLEAR_LAST_ERROR	65	X	X	Simple	Unsigned 8	1	V	M
IDENT_NUMBER	66	X	-	Simple	Unsigned 16	2	D	M
CHECK_CONFIGURATION	67	X	-	Simple	Unsigned 8	1	D	O
Not used	68	-	-	-	-	-	-	-

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
ORDER_CODE	69	X	-	Simple	Visible String	32	C	M
TAG_LOCATION	70	X	X	Simple	Visible String	22	C	O
SIGNATURE	71	X	X	Simple	Octet String	54	C	O
ENP_VERSION	72	X	-	Simple	Visible String	16	Cst	M
DEVICE_DIAGNOSIS	73	X	-	Simple	Octet String	10	D	M
EXTENDED_ORDER_CODE	74	X	-	Simple	Visible String	60	C	M
SERVICE_LOCKING	75	X	X	Simple	Unsigned 16	2	D	M
Not used	76 - 94	-	-	-	-	-	-	-
STATUS	95	X	-	Simple	Octet String	16	D	O
DIAGNOSTICS_CODE	96	X	-	Simple	Octet String	4	D	O
STATUS_CHANNEL	97	X	-	Simple	Unsigned 8	1	D	O
STATUS_COUNT	98	X	-	Simple	Unsigned 8	1	D	O
LAST_STATUS	99	X	-	Simple	Octet String	16	D/S	O
LAST_DIAGNOSTICS_CODE	100	X	-	Simple	Octet String	4	D/S	O
LAST_STATUS_CHANNEL	101	X	-	Simple	Unsigned 8	1	D/S	O
Not used	102 - 103	-	-	-	-	-	-	-
VERSIONINFO SWREV	104	X	-	Simple	Octet String	16	N	O
VERSIONINFO HWREV	105	X	-	Simple	Octet String	16	N	O
VERSIONINFO DEVREV	106	X	-	Simple	Octet String	16	N	O
ELECTRONICAL_SERIAL_NUMBER	107	X	-	Simple	Visible String	16	Cst	M
Not used	108 - 112	-	-	-	-	-	-	-
DEV_BUS_ADDR_CONFIG	113	X	X	Simple	Unsigned 8	1	N	O
CAL_IDENTNUMBER	114	X	-	Simple	Unsigned 16	2	C	O
Not used	115 - 118	-	-	-	-	-	-	-
SENSOR_DRIFT_MONITORING	118	X	X	Simple	Unsigned 8	1	S	MS
SYSTEM_ALARM_DELAY	119	X	X	Simple	Unsigned 8	1	S	O
MAINS_FILTER	120	X	X	Simple	Unsigned 8	1	S	O
AMBIENT_ALARM	121	X	X	Simple	Unsigned 8	1	S	O
Not used	122 - 125	-	-	-	-	-	-	-

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
DISP_ALTERNATING_TIME	126	X	X	Simple	Unsigned 8	1	S	O
DISP_SOURCE_1	127	X	X	Simple	Unsigned 16	2	S	O
DISP_VALUE_1_DESC	128	X	X	Simple	Octet String	16	S	O
DIS_VALUE_1_FORMAT	129	X	X	Simple	Unsigned 8	1	S	O
DISP_SOURCE_2	130	X	X	Simple	Unsigned 16	2	S	O
DISP_VALUE_2_DESC	131	X	X	Simple	Octet String	16	S	O
DISP_VALUE_2_FORMAT	132	X	X	Simple	Unsigned 8	1	S	O
DISP_SOURCE_3	133	X	X	Simple	Unsigned 16	2	S	O
DISP_VALUE_3_DESC	134	X	X	Simple	Octet String	16	S	O
DISP_VALUE_3_FORMAT	135	X	X	Simple	Unsigned 8	1	S	O
Not used	136 - 139	-	-	-	-	-	-	-
VIEW_PHYSICAL_BLOCK	140	X	X	Simple	Unsigned16, DS-37, DS- 42, OctetString[4]	17	D	M

13.4.4 Transducer Block slot 1

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
BLOCK_OBJECT	70	X	-	Record	DS-32	20	C	M
ST_REV	71	X	-	Simple	Unsigned16	2	S	M
TAG_DESC	72	X	X	Simple	Octet String	32	S	M
STRATEGY	73	X	X	Simple	Unsigned 16	2	S	M
ALERT_KEY	74	X	X	Simple	Unsigned 8	1	S	M
TARGET_MODE	75	X	X	Simple	Unsigned 8	1	S	M
MODE_BLK	76	X	-	Record	DS-37	3	D	M
ALARM_SUM	77	X	-	Record	DS-42	8	D	M
PRIMARY_VALUE	78	X	-	Record	101	5	D	M
PRIMARY_VALUE_UNIT	79	X	X	Simple	Unsigned 16	2	S	M
SECONDARY_VALUE_1	80	X	-	Record	101	5	D	M
SECONDARY_VALUE_2	81	X	-	Record	101	5	D	M
SENSOR_MEAS_TYPE	82	X	X	Simple	Unsigned 8	1	S	M

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
INPUT_RANGE	83	X	X	Simple	Unsigned 8	1	S	M
LIN_TAPE	84	X	X	Simple	Unsigned 8	1	S	M
Not used	85 - 88	-	-	-	-	-	-	-
BIAS_1	89	X	X	Simple	Float	4	S	M
Not used	90	-	-	-	-	-	-	-
UPPER_SENSOR_LIMIT	91	X		Simple	Float	4	N	M
LOWER_SENSOR_LIMIT	92	X		Simple	Float	4	N	M
Not used	93	-	-	-	-	-	-	-
INPUT_FAULT_GEN	94	X	-	Simple	Unsigned 8	1	D	M
INPUT_FAULT_1	95	X	-	Simple	Unsigned 8	1	D	M
Not used	96 - 98	-	-	-	-	-	-	-
MAX_SENSOR_VALUE_1	99	X	X	Simple	Float	4	N	O
MIN_SENSOR_VALUE_1	100	X	X	Simple	Float	4	N	O
Not used	101 - 102	-	-	-	-	-	-	-
RJ_TEMP	103	X	-	Simple	Float	4	D	O
RJ_TYPE	104	X	X	Simple	Unsigned 8	1	S	M
EXTERNAL_RJ_VALUE	105	X	X	Simple	Float	4	S	O
SENSOR_CONNECTION	106	X	X	Simple	Unsigned 8	1	S	M
COMP_WIRE1	107	X	-	Simple	Float	4	S	M
Not used	108 - 131	-	-	-	-	-	-	-
MAX_PV	132	X	X	Simple	Float	4	N	M
MIN_PV	133	X	X	Simple	Float	4	N	M
CVD_COEFF_A	134	X	X	Simple	Float	4	S	M
CVD_COEFF_B	135	X	X	Simple	Float	4	S	M
CVD_COEFF_C	136	X	X	Simple	Float	4	S	M
CVD_COEFF_R0	137	X	X	Simple	Float	4	S	M
CVD_MAX	138	X	X	Simple	Float	4	S	M
CVD_MIN	139	X	X	Simple	Float	4	S	M
Not used	140 - 144	-	-	-	-	-	-	-
CAL_POINT_HI	145	X	X	Simple	Float	4	S	M
CAL_POINT_LO	146	X	X	Simple	Float	4	S	M
CAL_POINT_SPAN	147	X	-	Simple	Float	4	S	M

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
CAL_POINT_TEMP_LO	148	X	X	Simple	Float	4	S	M
CAL_POINT_TEMP_HI	149	X	X	Simple	Float	4	S	M
CAL_METHOD	150	X	X	Simple	Unsigned 8	2	S	M
SENSOR_SERIAL_NUMBER	151	X	X	Simple	Octet String	32	S	M
POLY_COEFF_A	152	X	X	Simple	Float	4	S	M
POLY_COEFF_B	153	X	X	Simple	Float	4	S	M
POLY_COEFF_C	154	X	X	Simple	Float	4	S	M
POLY_COEFF_R0	155	X	X	Simple	Float	4	S	M
POLY_MEAS_RANGE_MAX	156	X	-	Simple	Float	4	S	M
POLY_MEAS_RANGE_MIN	157	X	-	Simple	Float	4	S	M
Not used	158 - 161	-	-	-	-	-	-	-
CORROSION_DETECTION	162	X	X	Simple	Unsigned 8	2	S	M
CORROSION_CYCLES	163	X	-	Simple	Unsigned 8	2	S	M
SENSOR_DRIFT_ALERT_VALUE	164	X	X	Simple	Float	4	S	M
Not used	165 - 168	-	-	-	-	-	-	-
RJ_MAX_SENSOR_VALUE	169	X	-	Simple	Float	4	N	M
RJ_MIN_SENSOR_VALUE	170	X	-	Simple	Float	4	N	M
Not used	171	-	-	-	-	-	-	-
TEMPERATURE_THRESHOLD	172	X	X	Simple	Float	4	S	M
RJ_OUT	173	X	-	Record	101	5	D	M
SENSOR_RAW_VALUE	174	X	-	Simple	Float	4	D	M
Not used	175 - 219	-	-	-	-	-	-	-
VIEW_TRANSDUCER_BLOCK	220	X	-	Simple	Unsigned16, DS-37, DS- 42, 101, Unsigned8, Unsigned8	20	D	M

13.4.5 Transducer Block slot 2

Transducer Block slot 2 contains the same parameters as Transducer Block slot 1. The settings in slot 2 affect sensor input 2.

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
All parameters → 🖹 102	70 - 220	-	-	-	-	-	-	-

13.4.6 Analog Input Block (AI 1) slot 1

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
Not used	2 - 15	X	-	-	-	-	-	-
BLOCK_OBJECT	16	X	-	Record	DS-32	20	C	M
ST_REV	17	X	-	Simple	Unsigned 16	2	N	M
TAG_DESC	18	X	X	Simple	Octet String	32	S	M
STRATEGY	19	X	X	Simple	Unsigned 16	2	S	M
ALERT_KEY	20	X	X	Simple	Unsigned 8	1	S	M
TARGET_MODE	21	X	X	Simple	Unsigned 8	1	S	M
MODE_BLK	22	X	-	Record	DS-37	3	D	M
ALARM_SUM	23	X	-	Record	DS-42	8	D	M
BATCH	24	X	X	Record	DS-67	10	S	M
Not used	25	X	-	-	-	-	-	-
OUT	26	X	-	Record	101	5	D	M
PV_SCALE	27	X	X	Array	Float	8	S	M
OUT_SCALE	28	X	X	Record	DS-36	11	S	M
LIN_TYPE	29	X	X	Simple	Unsigned 8	1	S	M
CHANNEL	30	X	X	Simple	Unsigned 16	2	S	M
Not used	31	X	-	-	-	-	-	-
PV_FTIME	32	X	X	Simple	Float	4	S	M
FSAFE_TYPE	33	X	X	Simple	Unsigned 8	1	S	O
FSAFE_VALUE	34	X	X	Simple	Float	4	S	O
ALARM_HYS	35	X	X	Simple	Float	4	S	M
Not used	36	X	-	-	-	-	-	-
HI_HI_LIM	37	X	X	Simple	Float	4	S	M
Not used	38	X	-	-	-	-	-	-
HI_LIM	39	X	X	Simple	Float	4	S	M
Not used	40	X	-	-	-	-	-	-
LO_LIM	41	X	X	Simple	Float	4	S	M
Not used	42	X	-	-	-	-	-	-
LO_LO_LIM	43	X	X	Simple	Float	4	S	M
Not used	44 - 45	-	-	-	-	-	-	-
HI_HI_ALM	46	X	-	Record	DS-39	16	D	O

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
HI_ALM	47	X	-	Record	DS-39	16	D	O
LO_ALM	48	X	-	Record	DS-39	16	D	O
LO_LO_ALM	49	X	-	Record	DS-39	16	D	O
SIMULATE	50	X	X	Record	DS-50	6	S	O
OUT UNIT TEXT	51	X	X	Simple	Octet String	16	S	O
Not used	52 - 64	-	-	-	-	-	-	-
VIEW_AI	65	X	-	Record	Unsigned16, DS- 37, DS-42, 101	18	D	M
Not used	66 - 69	-	-	-	-	-	-	-

13.4.7 Analog Input Block (AI 2) slot 2

Analog Input Block slot 2 contains the same parameters as Analog Input Block slot 1.

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
All parameters → 🖹 105	0 - 65	-	-	-	-	-	-	-
Not used	66 - 69	-	-	-	-	-	-	-

13.4.8 Analog Input Block (AI 3) slot 3

Analog Input Block slot 3 contains the same parameters as Analog Input Block slot 1.

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
All parameters → 🖹 105	0 - 65	-	-	-	-	-	-	-
Not used	66 - 225	-	-	-	-	-	-	-

13.4.9 Analog Input Block (AI 4) slot 4

Analog Input Block slot 4 contains the same parameters as Analog Input Block slot 1.

Parameter name	Index	Read	Write	Object Type	Data Type	Byte Size	Storage Class	Parameter
All parameters → 🖹 105	0 - 65	-	-	-	-	-	-	-
Not used	66 - 225	-	-	-	-	-	-	-

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