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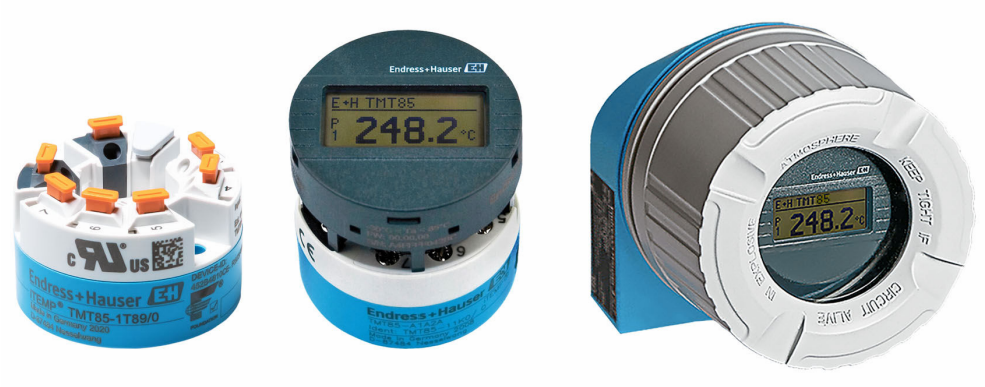
Valid as of version
01.02 (device version)

Operating Instructions
iTEMP TMT85

Two-channel temperature transmitter with FOUNDATION Fieldbus™ protocol



Endress+Hauser
People for Process Automation

Table of contents

1 About this document

1.1 Document function

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

1.2 Safety instructions (XA)

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

1.3 Symbols

1.3.1 Safety symbols

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

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

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

NOTICE
This symbol contains information on procedures and other facts which do not result in personal injury.

1.3.2 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.
	Potential equalization connection (PE: protective earth) Ground terminals that must be connected to ground prior to establishing any other connections. The ground terminals are located on the interior and exterior of the device: ▪ Interior ground terminal: potential equalization is connected to the supply network. ▪ Exterior ground terminal: device is connected to the plant grounding system.

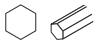
1.3.3 Symbols for certain types of information

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
EX	Hazardous area	EX	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 TI00134R/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 KA00252R/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 Internet site: www.endress.com → Download

1.6 Registered trademarks

FOUNDATION Fieldbus™
Registered trademark of the Fieldbus Foundation, Austin, Texas, USA

2 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.
- Personnel must be authorized by the plant owner/operator.
- Be familiar with federal/national regulations.
- Before starting work: personnel must read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Personnel must follow instructions and comply with general policies.

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

2.2 Intended use

The device is a universal and user-configurable temperature transmitter with either one or two sensor inputs for a resistance thermometer (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-intended use.

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

2.3 Workplace safety

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

2.4 Operational safety

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

Hazardous area

To eliminate a danger for persons or for the facility when the device is used in the hazardous area (e.g. explosion protection or safety 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 as per EN 61010-1, the EMC requirements as per the IEC/EN 61326 series and the NAMUR recommendations NE 21.

2.5 Product safety

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

2.6 IT security

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

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

3 Incoming acceptance and product identification

3.1 Incoming acceptance

1. Unpack the temperature transmitter carefully. Is the packaging or content free from damage?
   ↳ Damaged components must 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.

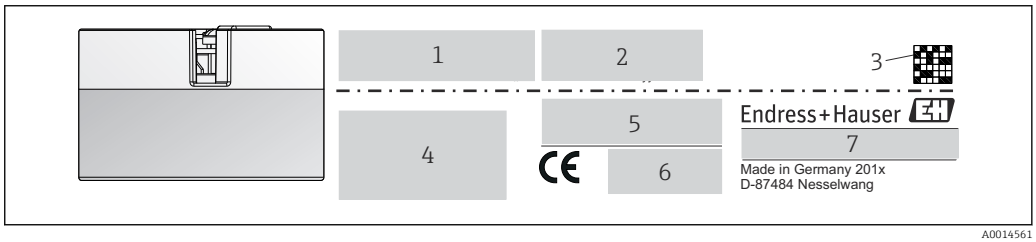
3.2 Product identification

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
- Printed copy of the Brief Operating Instructions in English
- Additional documentation for devices which are suitable for use in the hazardous area (ATEX, FM, CSA)

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 FOUNDATION Fieldbus™ certification

The temperature transmitter successfully passed all tests and is certified and registered by the Fieldbus Foundation. The measuring system meets all the requirements of the following specifications:

- Certified in accordance with FOUNDATION Fieldbus™ specification
- FOUNDATION Fieldbus™ H1
- Interoperability Test Kit (ITK), (device certification number available on request): The device can also be operated with certified devices of other manufacturers
- Physical Layer Conformance Test of the Fieldbus FOUNDATION™

An overview of other approvals and certifications is provided in the "Technical data" section → 49.

3.5 Storage and transport

Dimensions and operating conditions: → 60

- Storage temperature –40 to +100 °C (–40 to +212 °F)
- Humidity: (device-specific): max. rel. humidity: 95 % as per IEC 60068-2-30

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

Avoid the following environmental influences during storage:
- Direct sunlight
- Vibration
- Aggressive media

4 Installation

4.1 Mounting requirements

4.1.1 Dimensions

The dimensions of the device are provided in the "Technical data" section → 📄 49.

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 "Accessories" section → 📄 46)

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

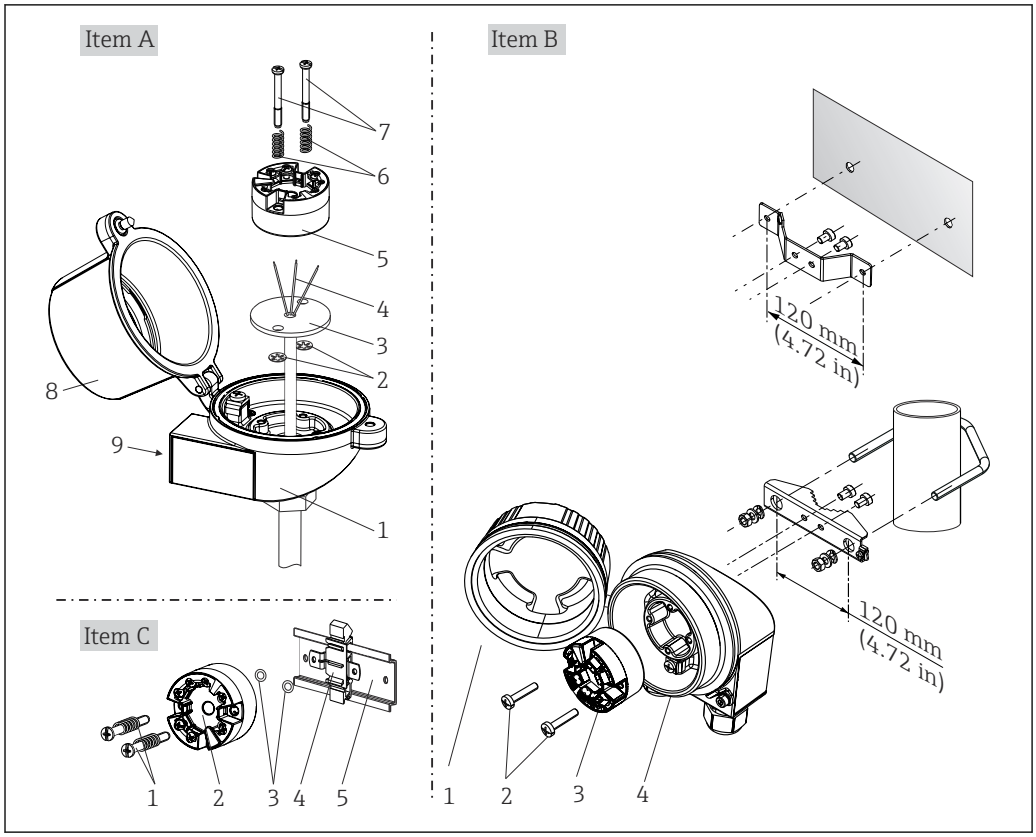
Information about the conditions (such as the ambient temperature, degree of protection, climate class, etc.) that must be present at the installation point so that the device can be mounted correctly is provided in the "Technical data" section → 📄 46.

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

4.2 Mounting the measuring device

A Phillips head screwdriver is required to mount the device:
- 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 Head transmitter mounting



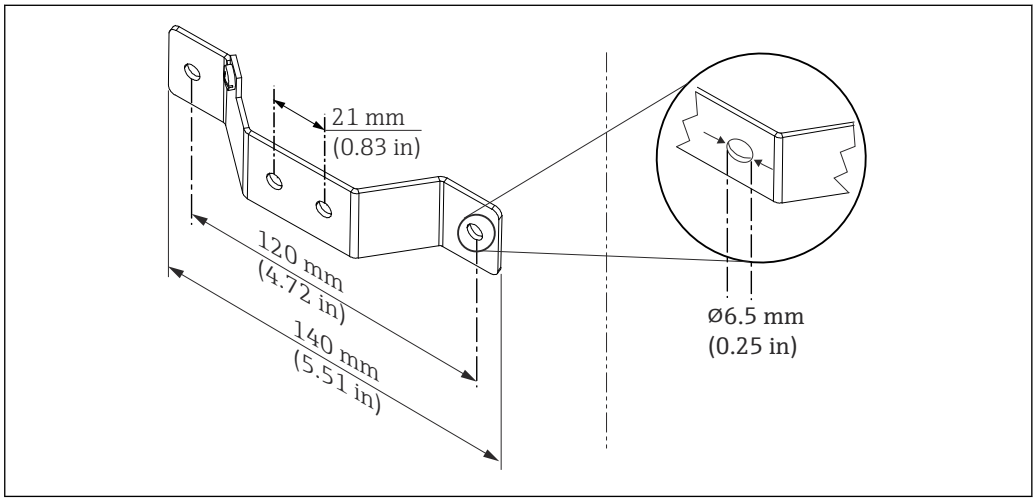
2 *Head transmitter mounting (three versions)*

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. When the wiring is complete, close the terminal head cover (8) tightly again.

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:

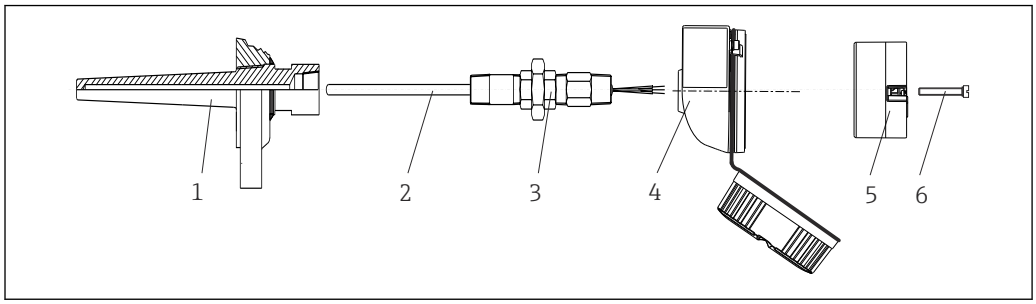
1. Open the cover (1) of the field housing (4).
2. Guide the mounting screws (2) through the lateral bores in the head transmitter (3).
3. Screw the head transmitter to the field housing.
4. When the wiring is complete, close the field housing cover (1) again.

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:

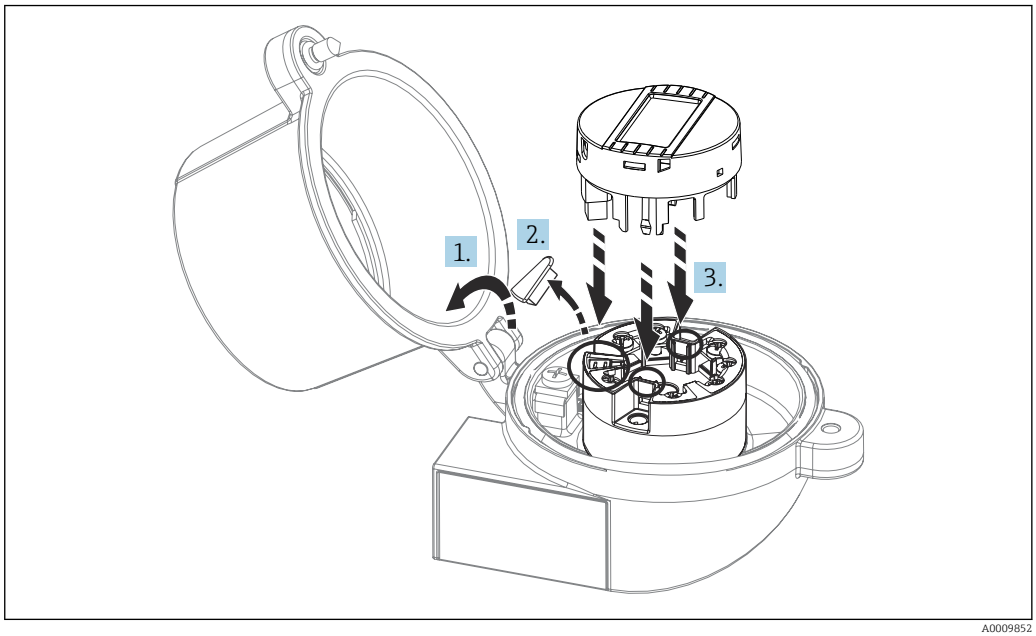
1. Fit the thermowell (1) on the process pipe or the container wall. Secure the thermowell according to the instructions before the process pressure is applied.
2. Fit the necessary neck tube nipples and adapter (3) on the thermowell.
3. Make sure sealing rings are installed if such rings are needed 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). Connect the connection wires to the transmitter.
8. Screw the terminal head (4), with the integrated and wired head transmitter, onto the ready-mounted nipple and adapter (3).

NOTICE

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

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

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-mounting check

After installing the device, run the following final checks:

Device health 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 "Technical data' section" → 49

5 Electrical connection

⚠ CAUTION

- Switch off the power supply before installing or connecting the device. Failure to observe this may result in the 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. An incorrect connection can destroy the electronics.
- Connect the potential matching line to the outer ground terminal before applying the power supply.

5.1 Connecting requirements

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

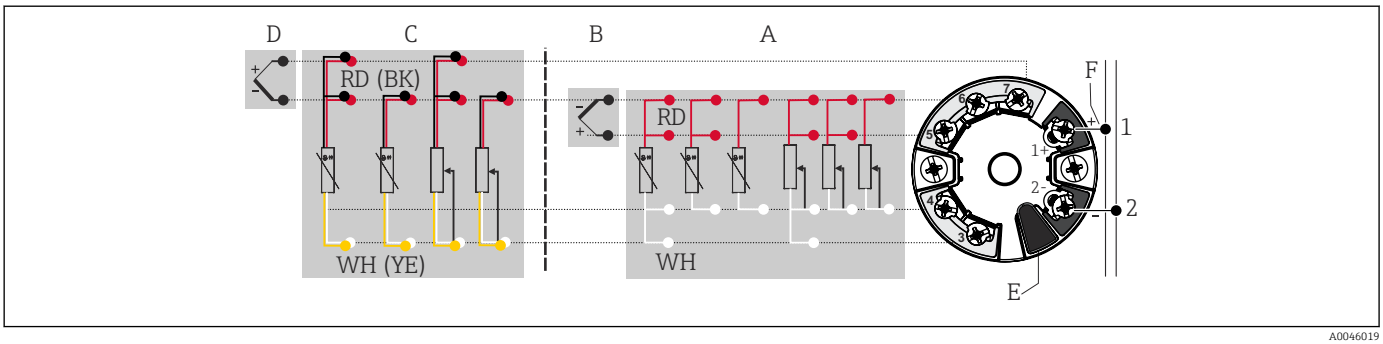
Proceed as follows to wire a mounted head transmitter:

1. Open the cable gland and the housing cover on the terminal head or the field housing.
2. Feed the cables through the opening in the cable gland.
3. Connect the cables as shown in . If the head transmitter is fitted with push-in terminals, pay particular attention to the information in the "Connecting to push-in 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 *Assignment of terminal connections for head transmitter*

A Sensor input 1, RTD and Ω, 4-, 3- and 2-wire
B Sensor input 1, TC and mV
C Sensor input 2, RTD and Ω, 3- and 2-wire
D Sensor input 2, TC and mV
E Display connection, service interface
F Bus terminator and power supply

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 .

NOTICE

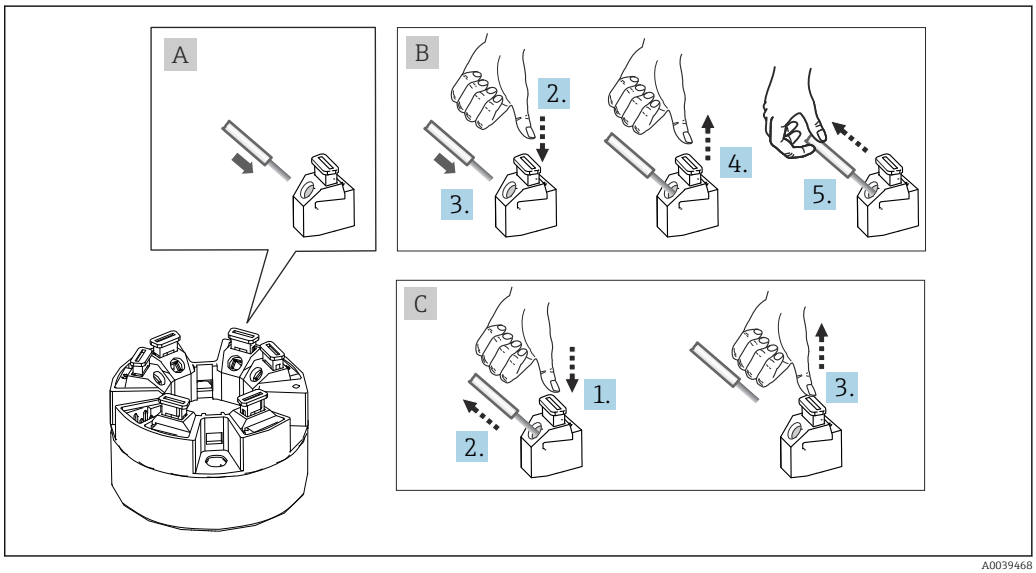
When connecting 2 sensors ensure that there is no galvanic connection between the sensors (e.g. caused by sensor elements that are not isolated from the thermowell). The resulting equalizing currents distort the measurements considerably.

- 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 push-in terminals



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

Fig. 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.

Fig. 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.

Fig. 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 FOUNDATION Fieldbus ™ cable specification

Cable type

Twin-core cables are recommended for connecting the measuring device to the FOUNDATION Fieldbus™ H1. Following IEC 61158-2 (MBP), four different cable types (A, B, C, D) can be used with the FOUNDATION 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 cross-section	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 accordance with IEC 61158-2 (MBP), a maximum of 32 field devices can be connected per fieldbus segment. However, this number is restricted under certain conditions (explosion protection, bus power option, field device current consumption). A maximum of four field devices can be connected to a spur.

Shielding and grounding

The specifications of the Fieldbus Foundation provided in the "Wiring and Installation" document must be observed during installation.

Bus termination

The start and end of each fieldbus segment must always be terminated by 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 wiring can be found on the website (www.fieldbus.org) of the Fieldbus Foundation or in the Operating Instructions "FOUNDATION Fieldbus™ Overview", available at: → www.endress.de → Download).

5.2.3 Fieldbus connection

Devices can be connected to the fieldbus in two ways:

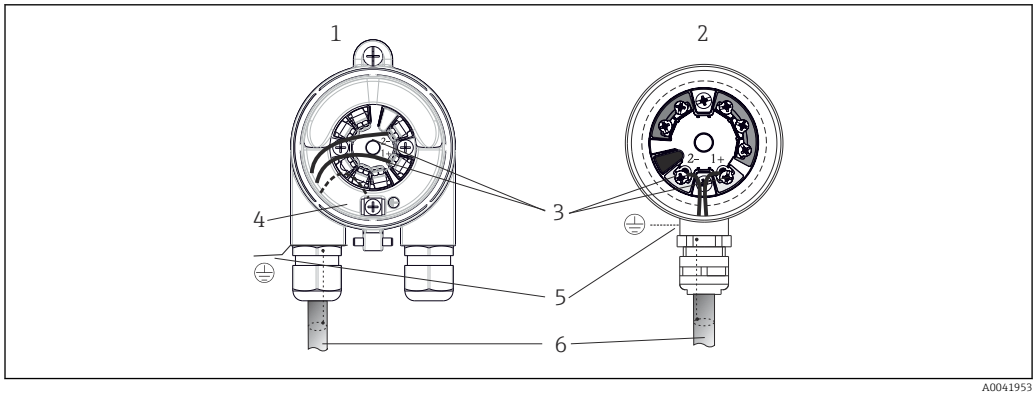
- Using a conventional cable gland → 20
- Using the fieldbus connector (optional, available as an accessory) → 20

Risk of damage

- Switch off the power supply before installing or connecting the head transmitter. Failure to observe this may result in the 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 without additional potential equalization, mains-frequency equalizing currents may occur and cause damage to the cable or shielding. In such cases, the shielding of the fieldbus cable should 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 even just one measuring device at a later date, the bus communication will have to be interrupted.

Cable glands or entries

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

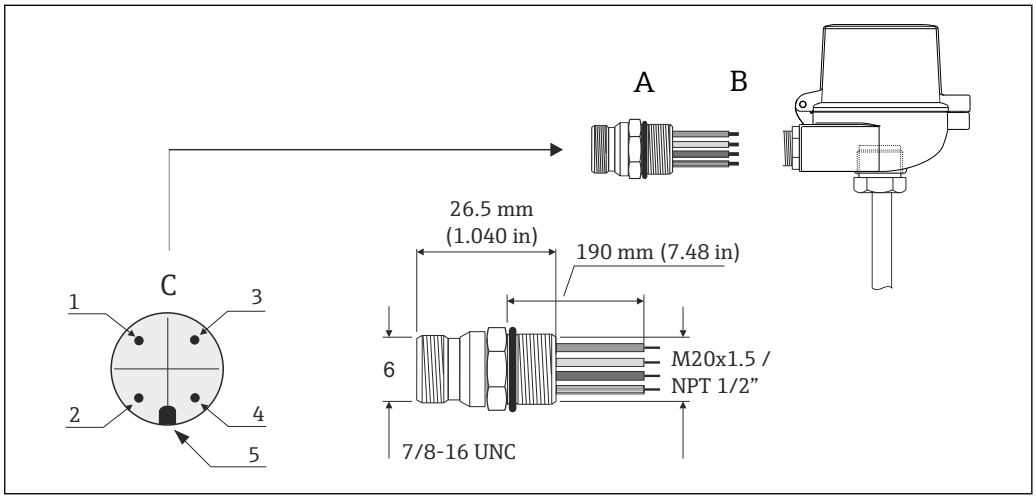
Fieldbus connector

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 (see → 46).

The connection technology of FOUNDATION Fieldbus™ allows measuring 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.



9 Connectors for connection to the FOUNDATION Fieldbus™

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

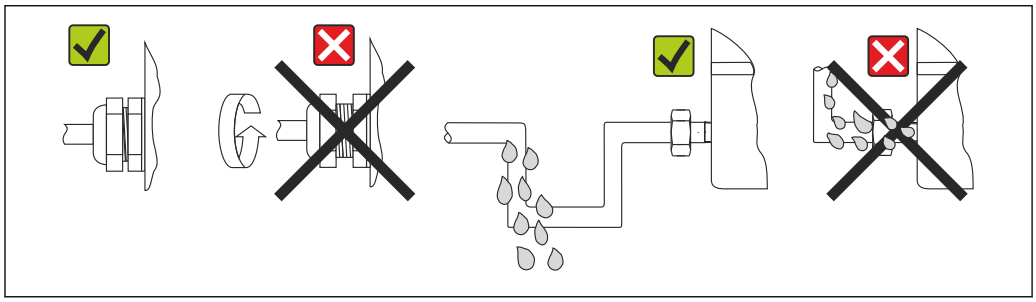
Connector technical data:

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 plating	CuZn, gold-plated
Housing material	1.4401 (316)
Flammability	V - 2 according to UL - 94
Ambient temperature range	−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

Compliance with the following points is mandatory following installation in the field or servicing in order to ensure that IP67 protection is maintained:

- The transmitter must be mounted in a terminal head with the appropriate degree of protection.
- The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- The connecting cables used must have the specified external diameter (e.g. M20x1.5, cable diameter 8 to 12 mm).
- Firmly tighten the cable gland. → 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 undamaged (visual check)?	--
Electrical connection	**Notes**
Does the supply voltage match the specifications on the nameplate?	9 to 32 V_{DC}
Do the cables used meet the required specifications?	Fieldbus cable, → 18 Sensor cable, → 17
Do the mounted cables have adequate strain relief?	--
Are the power supply and signal cables connected correctly?	→ 16
Are all the screw terminals firmly tightened and have the push-in terminal connections been checked?	→ 17
Are all the 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?	--

Device condition and specifications	Notes
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

There are different ways in which the operator can configure and commission the device:

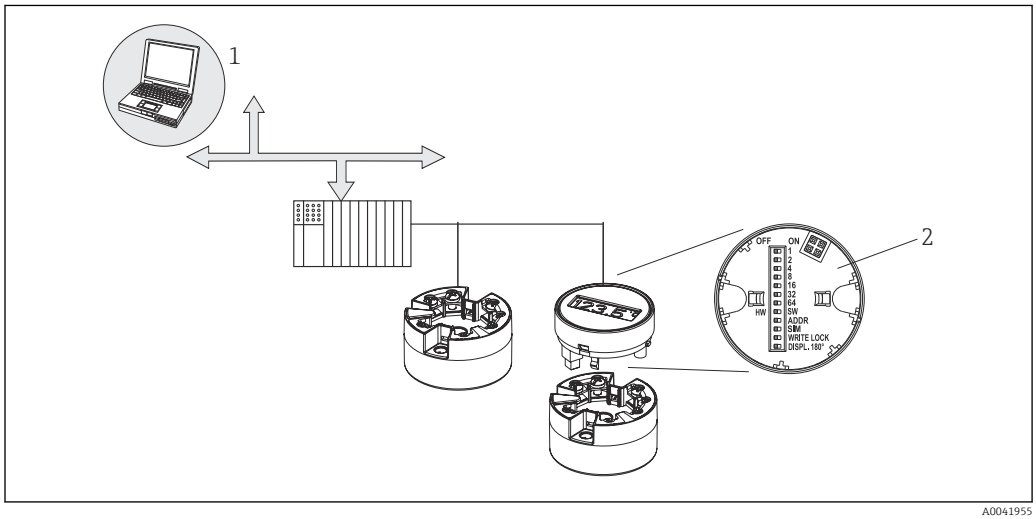
1. Configuration programs

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

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

You can make the following hardware settings for the FOUNDATION Fieldbus™ interface using DIP switches on the rear of the optional display:

- Enable/disable the simulation mode in the Analog Input function block
- Switch the hardware write protection on/off
- rotate the display 180 °



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11 Operation options for the head transmitter

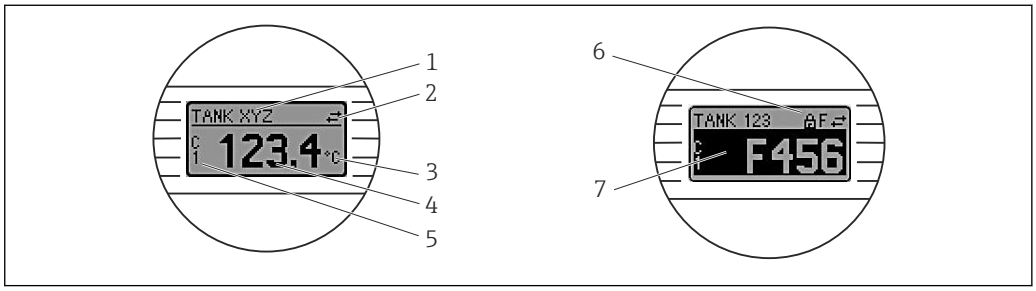
1 Configuration/operating programs for operating via the FOUNDATION Fieldbus™ (fieldbus functions, device parameters)
2 DIP switches for hardware settings on the rear of the optional display (write protection, simulation mode)

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	Meaning
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 RJ	e.g. S1 for a measured value from sensor 1.
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 "Diagnostics and troubleshooting" section→ 37. Detailed information on the error messages can be found in the Operating Instructions.
	C	**"Service mode"** The device is in the service mode (e.g. during a simulation).
	S	**"Out of specification"** The device is being operated outside its technical specifications (e.g. during warm-up or cleaning).
	M	**"Maintenance required"** Maintenance is required. The measured value is still valid. The display alternates between the measured value and the status message.

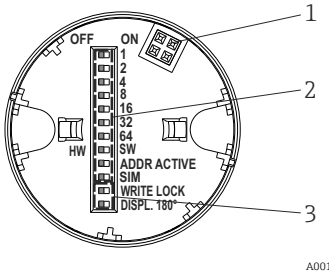
6.2.2 Local operation

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. → 46

NOTICE

- ESD - Electrostatic discharge. Protect the terminals from electrostatic discharge. Non-compliance 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, ADDR and SIM = simulation mode) **no function** for this head transmitter
3:	DIP switch (WRITE LOCK = write protection; DISPL. 180° = switch, turn the display monitor 180°)

Procedure for setting the DIP switch:

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

Turning the display

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

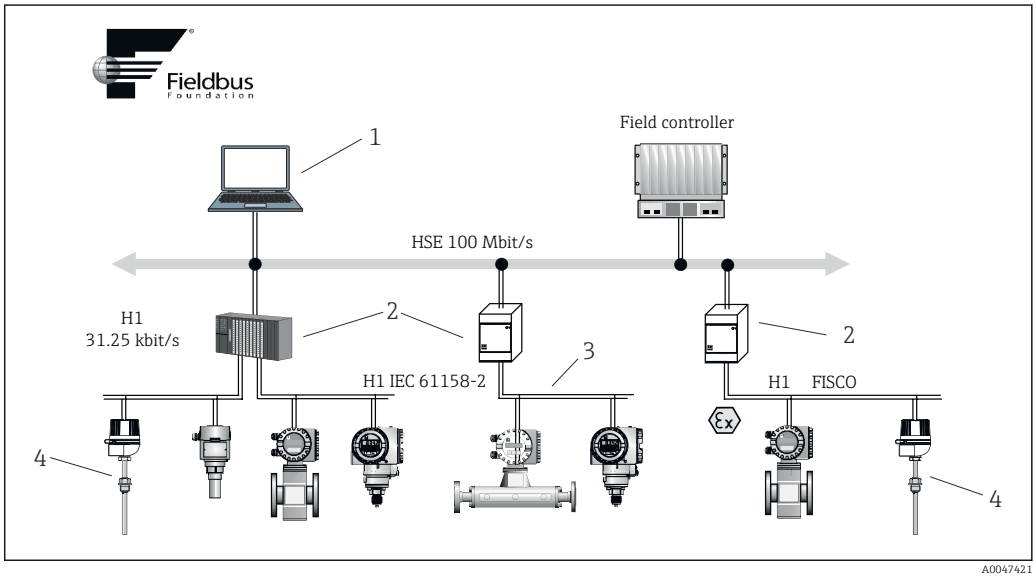
7 System integration

7.1 FOUNDATION Fieldbus™ technology

The FOUNDATION Fieldbus™ (FF) is a purely digital, serial communication system that connects fieldbus devices (sensors, actuators), automation and process control systems with each other. As a local communications network (LAN) for field devices, the FF was primarily designed for the requirements of process engineering. The FF is therefore the basic network in the overall hierarchy of a communication system. For configuration information, please refer to Operating Instructions BA 013S/ 04/en “FOUNDATION Fieldbus Overview: Installation and Commissioning Guidelines”.

7.1.1 System architecture

The graphic below shows an example of a FOUNDATION Fieldbus™ network with the associated components.



14 *System integration via FOUNDATION Fieldbus™*

1 *Visualization and monitoring e.g. P View, FieldCare and diagnostic software*
2 *Linking device*
3 *32 devices per segment*
4 *Measuring point with installed transmitter*

The following system connection options are possible:

- A linking device can be used to connect to higher-level fieldbus protocols (e.g. to the High Speed Ethernet - HSE).
- A H1 connecting card is required for direct connection to a process control system.
- System inputs are directly available for H1 (HSE).

The system architecture of the FOUNDATION Fieldbus™ can be divided into two subnetworks:

H1 bus system:

In the field, fieldbus devices are connected only via the slower H1 bus system that is specified following IEC 61158-2. The H1 bus system enables simultaneous power supply to the field devices and data transfer on the two-wire cable.

The following points describe some important characteristics of the H1 bus system:

- All fieldbus devices are powered via the H1 bus. Like the fieldbus devices, the power supply unit is connected in parallel to the bus line. Devices requiring external power must use a separate power supply.
- The line structure is one of the most common network structures. Star, tree or mixed network structures are also possible using connecting components (junction boxes).
- The bus connection to the individual fieldbus devices is achieved by means of a T-connector or via a spur. This has the advantage that individual fieldbus devices can be connected or disconnected without interrupting the bus or the bus communication.
- The number of connected fieldbus devices depends on various factors, such as use in hazardous areas, the length of the spur, cable types, current consumption of the field devices, etc. (→ 16).
- When fieldbus devices are used in a hazardous area, the H1 bus must be equipped with an intrinsically safe barrier before the transition to the hazardous area.
- A bus terminator is required at each end of the bus segment.

High Speed Ethernet (HSE):

The superior bus system is realized via the High Speed Ethernet (HSE) with a transmission rate of max. 100 MBit/s. This serves as the 'backbone' (basic network) between various local sub-networks and/or where there is a large number of network users.

7.1.2 Link Active Scheduler (LAS)

The FOUNDATION Fieldbus™ works according to the 'producer-consumer' relationship. This offers many advantages.

Data can be directly exchanged between field devices, e.g. a sensor and an actuating valve. Each bus user “publishes” its data on the bus and all the bus users configured accordingly obtain these data. The publication of these data is controlled by a “bus administrator”, known as the “Link Active Scheduler”, which centrally controls the time sequence of the bus communication process. The LAS organizes all the bus activities and sends corresponding commands to the individual field devices.

Other tasks of the LAS include:

- Recognizing and reporting newly connected devices.
- Logging out devices that are no longer communicating with the fieldbus.
- Maintaining the “Live List”. This list contains a record of all the fieldbus users and is checked regularly by the LAS. If devices are logged on or logged off, the "Live List" is updated and sent immediately to all the devices.
- Requesting process data from the field devices according to a fixed schedule.
- Allocating send rights (tokens) to devices between unscheduled data transfer.

The LAS can run redundantly, i.e. it exists both in the process control system and in the field device. If one LAS fails, the other LAS can accurately take over communication. Thanks to the precise timing of bus communication via the LAS, the FF can run exact processes at regular, equidistant intervals.

Fieldbus devices, such as this head transmitter, which can take over the LAS function if the primary master fails, are called “Link Masters”. This contrasts with simple "Basic Devices", which can only receive signals and send them to the central control system. The LAS functionality is deactivated in this head transmitter when the unit is delivered.

7.1.3 Data transfer

A distinction is made between two types of data transfer:

- **Scheduled data transfer (cyclic):** All time-critical data, i.e. continuous measurement or actuating signals, are transmitted and processed according to a fixed schedule.
- **Unscheduled data transfer (acyclic):** Device parameters and diagnostic information that are not time-critical for the process are only transmitted over the fieldbus when required. Data transmission only takes place in the intervals between cyclic (scheduled) communication.

7.1.4 Device ID, addressing

Each fieldbus device in the FF network is identified by a unique device ID (DEVICE_ID).

The fieldbus host system (LAS) automatically gives the network address to the field device. The network address is the address that the fieldbus currently uses.

The FOUNDATION Fieldbus™ uses addresses between 0 and 255:

- Groups/DLL: 0 to 15
- Devices in operation: 20 to 35
- Reserve devices: 232 to 247
- Offline/substitute devices: 248 to 251

The field device tag name (PD_TAG) is assigned to the device during commissioning (→ 🖹 32). The tag name remains stored in the device even in the event of a supply voltage failure.

7.1.5 Function blocks

The FOUNDATION Fieldbus™ uses predefined function blocks to describe the functions of a device and to specify uniform data access. The function blocks implemented in each fieldbus device provide information on the tasks that a device can perform in the overall automation strategy.

In the case of sensors, these are typically the following blocks:

- 'Analog Input' or
- 'Discrete Input' (digital input)

Actuating valves normally have the following function blocks:

- 'Analog Output' or
- 'Discrete Output' (digital output)

The following blocks are available for control tasks:

- PD controller or
- PID controller

For more information, please refer to Section 13.

7.1.6 Fieldbus-based process control

With FOUNDATION Fieldbus™, field devices can perform simple process control functions themselves and thereby reduce the workload on the superior process control system. Here, the Link Active Scheduler (LAS) coordinates data exchange between the sensor and controller and ensures that two field devices cannot access the bus simultaneously. For this purpose, configuration software, e.g. NI-FBUS Configurator from National Instruments, is used to connect the various function blocks to the desired control strategy (generally graphically), (→ 🖹 32).

7.1.7 Device description

For commissioning, diagnostics and parameter configuration, it is important to ensure that process control systems or superior configuration systems can access all measuring device data and have a uniform operating structure.

The device-specific information required for this is stored as so-called device description data in special files (the 'Device Description'- DD). This makes it possible to interpret the device data and display the data via the configuration program. The DD is therefore a kind of “device driver”.

On the other hand, a CFF file (CFF = Common File Format) is required for network configuration in the OFF-line mode.

These files can be acquired as follows:

- Free via the Internet: www.endress.com
- Via the Fieldbus FOUNDATION Organization: www.fieldbus.org

7.2 Configuration of the measuring device and FF functions

The FF communication system will only function properly if correctly configured. You can obtain special configuration and operating programs from various manufacturers for the configuration.

These can be used for configuring both the FF functions and all of the device-specific parameters. The predefined function blocks allow uniform access to all the network and fieldbus device data.

The step-by-step procedure for commissioning the FF functions for the first time is described in detail in the Commissioning section, as is the configuration of device-specific parameters (→ 🖹 32).

System files

You require the following files for commissioning and configuring the network:

- Commissioning → Device description (DD: *.sym, *.ffo, *.sy5, *.ff5)
- Network configuration → CFF file (Common File Format)

8 Commissioning

8.1 Installation check

Before commissioning the measuring point make sure that all final checks have been carried out:
- "Post-installation check" checklist, → 15
- "Post-connection check" checklist, → 16

Compliance with the function-specific data of the FOUNDATION Fieldbus interface according to IEC 61158-2 (MBP) is mandatory.

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 device

Once the final checks have been successfully completed, 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
3	Device name and the firmware, hardware version and device revision of the head transmitter
4	Sensor configuration
5	Current measured value or
	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 → 37.

The device works after approx. 8 seconds, and the attached display after approx. 16 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 Device configuration

Please note the following:

- The files required for commissioning and network configuration can be obtained as described on → 27.
- In the case of the FOUNDATION Fieldbus™, the device is identified in the host or configuration system by means of the device ID (DEVICE_ID). The DEVICE_ID is a combination of the manufacturer ID, device type and device serial number. It is unique and can never be assigned twice. The structure of the DEVICE_ID can be broken down as follows:
  DEVICE_ID = 452B4810CE-XXXXXXXXXXX
  452B48 = Endress+Hauser
  10CE = TMT85
  XXXXXXXXXXX = Device serial number (11-digit)
- For a quick and reliable head transmitter configuration, a wide range of configuration wizards are available to guide the user through the configuration of the most important parameters of the Transducer Blocks. For this, refer to the operating manual of the operating and configuration software used.

The following wizards are available:

Configuration wizards		
Name	Block	Description
Quick Setup	Sensor Transducer	Configuration of the sensor input with the data relevant to the sensor.
Quick Setup	Display Transducer	Menu-guided configuration of the display unit.
Set to OOS mode	Resource, Sensor Transducer, Display Transducer, AdvDiagnostic Transducer, AI, PID and ISEL	Sets the individual block to the "Out Of Service" mode
Set to auto mode	Resource, Sensor Transducer, Display Transducer, AdvDiagnostic Transducer, AI, PID and ISEL	Sets the individual block to the "Auto" mode
Restart	Resource	Restarts the device with different options as to which particular parameters should be reset to the factory settings.
Sensor drift monitoring configuration	AdvDiagnostic Transducer	Settings for drift or differential monitoring with 2 connected sensors.
Calc. wizard for 2-wire compensation value	Sensor Transducer	Calculation of the conductor resistance for 2-wire compensation.
Set all TRD to OOS mode	All Transducer Blocks	Sets all Transducer Blocks simultaneously to the "Out Of Service" mode
Set all TRD to auto mode	All Transducer Blocks	Sets all Transducer Blocks simultaneously to the "Auto" mode
Show recommended action	Resource	Displays the recommended action for the diagnostic event currently pending.
Calibration wizards		
User sensor trim configuration	Sensor Transducer	Menu guidance for linear scaling (offset + slope) for adapting the measuring point to the process (→ 🖹 65).
Factory trim settings	Sensor Transducer	Resets scaling to the "factory standard trim" (→ 🖹 65).
RTD-Platin configuration (Call.-Van Dusen)	Sensor Transducer	Entry of Callendar-Van-Dusen coefficients.
RTD-Copper configuration	Sensor Transducer	Entry of coefficients for nickel polynomial.
RTD-Nickel configuration	Sensor Transducer	Entry of coefficients for copper polynomial.

8.3.1 Initial commissioning

The following description takes you step-by-step through the device commissioning process and all the necessary configurations for the FOUNDATION Fieldbus™:

1. Open the configuration program.
2. Load the device description files or the CFF file into the host system or the configuration program. Make sure you are using the right system files (see Section 5.4).
3. Make a note of the DEVICE_ID on the device nameplate to identify the device in the control system (see → 🖹 9).
4. Switch on the measuring device → 🖹 31.

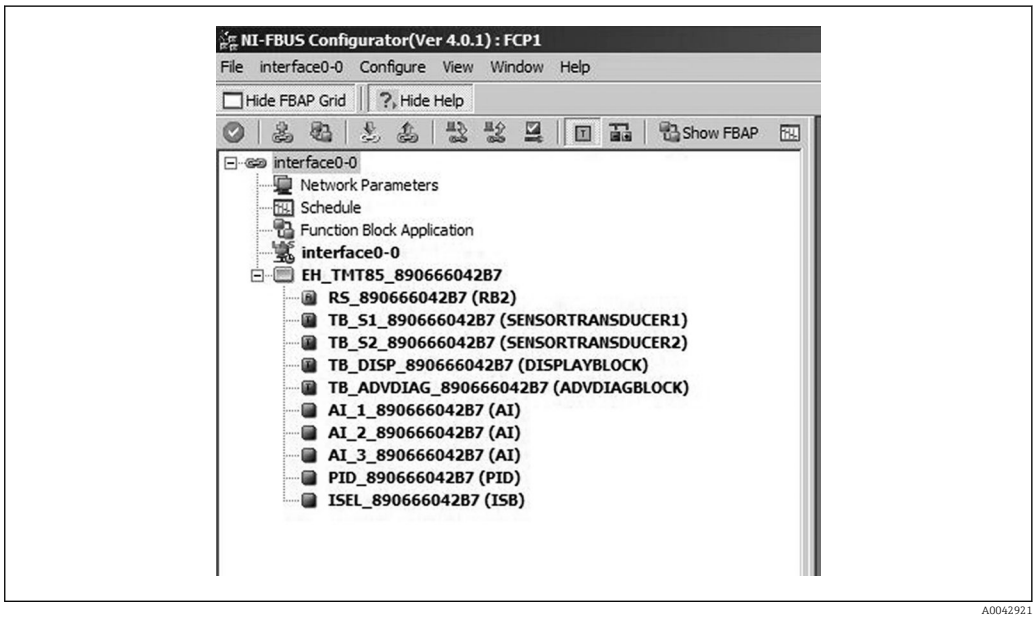
The first time you establish a connection, the device responds as follows in the configuration program:

- EH_TMT85_xxxxxxxxxxx (tag name PD-TAG)
- 452B4810CE-xxxxxxxxxxx (DEVICE_ID)
- Block structure:

Display text (xxx... = serial number)	Base index	Description
RS_xxxxxxxxxxx	400	Resource Block
TB_S1_xxxxxxxxxxx	500	Transducer Block temperature sensor 1
TB_S2_xxxxxxxxxxx	600	Transducer Block temperature sensor 2
TB_DISP_xxxxxxxxxxx	700	Transducer Block “Display” (local display)
TB_ADVDIAG_xxxxxxxxxxx	800	Transducer Block “Advanced Diagnostic”
AI_1_xxxxxxxxxxx	900	Analog Input function block 1
AI_2_xxxxxxxxxxx	1000	Analog Input function block 2
AI_3_xxxxxxxxxxx	1100	Analog Input function block 3
PID_xxxxxxxxxxx	1200	PID function block
ISEL_xxxxxxxxxxx	1300	Input Selector function block

The device is delivered from the factory with the bus address "247" and is therefore in the 232 to 247 address range which is reserved for changing the address of field devices. A lower bus address should be assigned to the device for commissioning.

5. Using the DEVICE_ID noted, identify the field device and assign the desired tag name (PD_TAG) to the fieldbus device in question. Factory setting: EH_TMT85_xxxxxxxxxxx (xxx... = serial number).



15 *Screen displayed in the "NI-FBUS Configurator" configuration program (National Instruments) once the connection is established*

Device designation in the Configurator (EH_TMT85_xxxxxxxxxxx = tag name PD_TAG) and block structure

Configuring the “Resource Block” (base index 400)

6. Open the Resource Block.

7. When the device is delivered, the hardware write protection is disabled so the write parameters can be accessed via the FOUNDATION Fieldbus™. Check this status via the WRITE_LOCK parameter: – write protection enabled = LOCKED – write protection disabled = NOT LOCKED. Disable the write protection if necessary, → 26.
8. Enter the desired block name (optional). Factory setting: RS_xxxxxxxxxxx
9. Set the operating mode in the MODE_BLK parameter group (TARGET parameter) to AUTO.

Configuring the "Transducer Blocks"

The individual Transducer Blocks comprise various parameter groups arranged by device-specific functions:

Temperature sensor 1	→ Transducer Block “TB_S1_xxxxxxxxxxx” (base index: 500)
Temperature sensor 2	→ Transducer Block “TB_S2_xxxxxxxxxxx” (base index: 600)
Local display functions	→ Transducer Block “TB_DISP_xxxxxxxxxxx” (base index: 700)
Advanced diagnostics	→ Transducer Block “TB_ADVDIAG_xxxxxxxxxx” (base index: 800)

10. Enter the desired name for the block (optional). For factory settings, see the table above. Set the operating mode in the MODE_BLK parameter group (TARGET parameter) to AUTO.

Configuring the "Analog Input function blocks"

The device has 2 x three Analog Input function blocks which can be assigned to the different process variables as desired. The following section describes an example for the Analog Input function block 1 (base index 900).

11. Enter the required name for the Analog Input function block (optional). Factory setting: AI_1_xxxxxxxxxxx
12. Open Analog Input function block 1.
13. Set the operating mode in the MODE_BLK parameter group (TARGET parameter) to OOS, i.e. the block is out of service.
14. Use the parameter to select the process variable which should be used as the input value for the function block algorithm (scaling and limit value monitoring functions). The following settings are possible: CHANNEL → Uninitialized, Primary Value 1, Primary Value 2, Sensor Value 1, Sensor Value 2, Device temperature
15. In the XD_SCALE parameter group, select the desired unit and the block input range for the process variable concerned.

Incorrect configuration

Please ensure that the selected engineering unit suits the measured variable of the selected process variable. Otherwise, the BLOCK_ERROR parameter will display the "Block Configuration Error" error message and the operating mode of the block cannot be set to AUTO.

16. In the L_TYPE parameter, select the type of linearization for the input variable (direct, indirect, indirect sq. root), see Section 13.

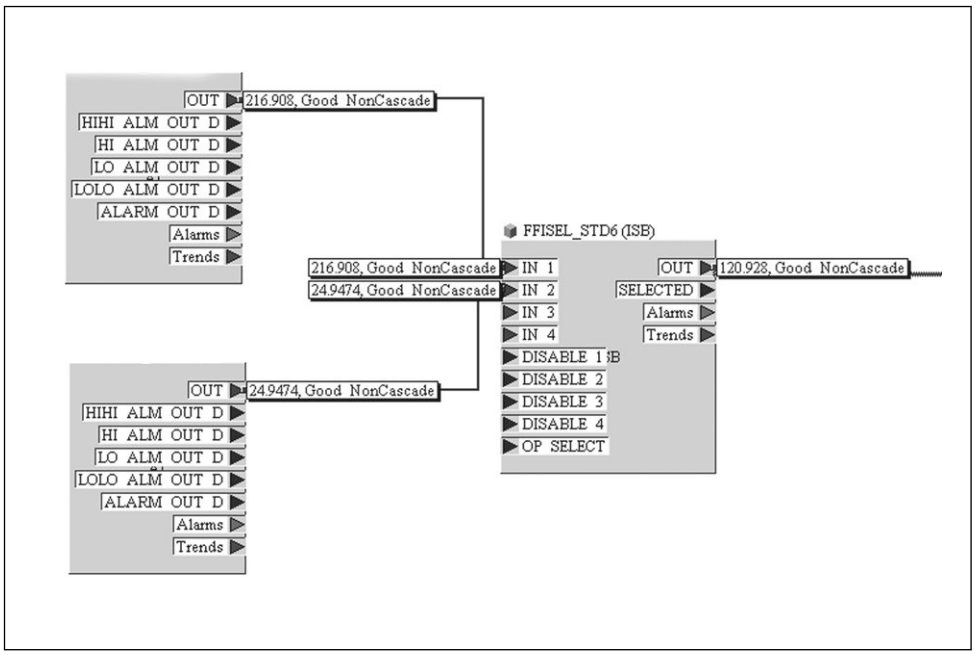
Please note that if the "Direct" linearization type is selected, the settings in the OUT_SCALE parameter group are not taken into account. The engineering units selected in the XD_SCALE parameter group are decisive.

17. Define the limit values for alarms and warnings using the following parameters: – HI_HI_LIM → limit value for the high alarm – HI_LIM → limit value for the high warning – LO_LIM → limit value for the low warning – LO_LO_LIM → limit value for the low alarm The limit values entered must be within the value range defined in the OUT_SCALE parameter group.
18. In addition to the actual limit values, the behavior in the event of limit value overshoot must be specified by "alarm priorities" (HI_HI_PRI, HI_PRI, LO_PR, LO_LO_PRI parameters), see Section 11. Reporting to the fieldbus host system only occurs if the alarm priority is greater than 2. In addition to the settings for the alarm priorities, digital outputs can be defined for limit value monitoring. These outputs (HIHI_ALM_OUT_D, HI_ALM_OUT_D, LOLO_ALM_OUT_D, LO_ALM_OUT_D parameters) then switch from 0 to 1 when the specific limit value is exceeded. The general alarm output (ALM_OUT_D parameter) in which different alarms can be grouped must be configured appropriately via the ALM_OUT_D_MODE parameter. The behavior of the output in the event of an error must be configured in the parameter Fail Safe Type (FSAFE_TYPE) and if FSAFE_TYPE = "Fail Safe Value" is selected, the value to be output must be defined in the parameter Fail Safe Value (FSAFE_VALUE).

Alarm limit value:	HIHI_ALM_OUT_D	HI_ALM_OUT_D	LOLO_ALM_OUT_D	LO_ALM_OUT_D
PV ≥ HI_HI_LIM	1	x	x	x
PV < HI_HI_LIM	0	x	x	x
PV ≥ HI_LIM	x	1	x	x
PV < HI_LIM	x	0	x	x
PV > LO_LIM	x	x	0	x
PV ≤ LO_LIM	x	x	1	x
PV > LO_LO_LIM	x	x	x	0
PV ≤ LO_LO_LIM	x	x	x	1

System configuration / connecting function blocks:

19.



A final "overall system configuration" is mandatory so that the operating mode of the Analog Input function block can be set to AUTO and the field device is integrated into the system application. For this purpose, configuration software, e.g. NI-FBUS Configurator from National Instruments, is used to connect the function blocks to the desired control strategy (generally graphically) and then the time for processing the individual process control functions is specified.

20. Once you have specified the active LAS (), download all the data and parameters to the field device.

21. Set the operating mode in the MODE_BLK parameter group (TARGET parameter) to AUTO.

↳ This is only possible if the following two conditions are met:
- The function blocks are correctly connected to one another.
- The Resource Block is in the AUTO operating mode.

9 Diagnostics and troubleshooting

9.1 Troubleshooting

Always start troubleshooting with the checklists below if faults occur after startup or during operation. The checklists take you directly (via various queries) to the cause of the problem and the appropriate remedial 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. → 46

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 retainers and the connection of the display module are correctly seated on the head transmitter, Section 4.2. → 15 3. If available, 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
→ 39

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,
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 cable length and number of spurs
Basic current	Is there a basic current of min. 11 mA?
Terminating resistors	Has the FOUNDATION Fieldbus H1 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 FF configuration system	
→ 39	

Problems when configuring function blocks	
Transducer Blocks: The operating mode cannot be set to AUTO.	Check whether the operating mode of the Resource Block is set to AUTO → MODE_BLK parameter group / TARGET parameter. **Incorrect parameterization** Please ensure that the unit selected suits the process variable chosen in the SENSOR_TYPE parameter. Otherwise the BLOCK_ERROR parameter displays the "Block Configuration Error" error message. In this state, the operating mode cannot be set to AUTO.
Analog Input function block: The operating mode cannot be set to AUTO.	There can be several reasons for this. Check the following points one after another: 1. Check whether the operating mode of the Analog Input function block is set to AUTO: MODE_BLK parameter group / TARGET parameter. If not and the mode cannot be changed to AUTO, first check the following points. 2. Make sure that the CHANNEL parameter (select process variable) has already been configured in the Analog Input function block (→ 32). The option CHANNEL = 0 (uninitialized) is not valid. 3. Make sure that the XD_SCALE parameter group (input range, unit) has already been configured in the Analog Input function block. 4. Make sure that the L_TYPE parameter (linearization type) has already been configured in the Analog Input function block, (→ 32). 5. Check whether the operating mode of the Resource Block is set to AUTO. MODE_BLK parameter group / TARGET parameter. 6. Make sure that the function blocks are correctly connected together and that this system configuration has been sent to the fieldbus users, → 32.
Analog Input function block: Although the operating mode is set to AUTO, the status of the AI output value OUT is "BAD" or "UNCERTAIN".	Check whether an error is pending in the Transducer Block "Advanced Diagnostic": Transducer Block "Adv. Diagnostic", "Actual Status Category" and "Actual Status Number" parameters, → 39.
▪ Parameters cannot be changed or ▪ No write access to parameters.	1 Parameters that only show values or settings cannot be changed! 2. Hardware write protection is enabled → Disable write protection, → 26. **Write protection** You can check whether hardware write protection is enabled or disabled via the WRITE_LOCK parameter in the Resource Block: LOCKED = write protection enabled UNLOCKED = write protection disabled. 3. The block operating mode is set to the wrong mode. Certain parameters can only be modified in the OOS (out of service) or MAN (manual) mode → Set the operating mode of the block to the required mode → MODE_BLK parameter group. 4. The value entered is outside the specified input range for the parameter in question: → Enter a suitable value → Increase the input range if necessary.
Transducer Blocks: The manufacturer-specific parameters are not visible..	The device description file (Device Description, DD) has not yet been loaded to the host system or the configuration program? → Download the file to the configuration system. For information on where to obtain the DD, Make sure you are using the system files for integrating field devices into the host system.
Analog Input function block: The output value OUT is not updated despite having a valid "GOOD" status.	Simulation is active → Deactivate simulation by means of the SIMULATE parameter group.
▼	
Other errors (application errors without messages)	
Some other error has occurred.	Possible causes and remedial action, → 44.

9.2 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 function group
M	Maintenance required ('Maintenance')	WARNING
C	Device is in the service mode (check) ('Service mode')	
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 and the primary measured value indicated by the relevant letter plus the defined error number.

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 instances, the sensor that generates the status is output, 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

9.2.1 Category F diagnostics messages

Category	No.	Status messages ▪ ACTUAL_STATUS_NUMBER in the 'Advanced Diagnostics' Transducer Block ▪ Local display	Error messages in the Sensor Transducer Block in question	Sensor Transducer Block measured value status (default)	Cause of error / remedy	Output variables affected
F-	041	Device status message (FF): Sensor open circuit F-041 Local display: F041	BLOCK_ERR = Other | Input Failure Transducer_Error = Mechanical failure	QUALITY = BAD SUBSTATUS = Sensor failure	Cause of error: 1. Electr. interruption of sensor or sensor wiring. 2. Incorrect setting for type of connection in the SENSOR_CONNECTION 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-	043	Device status message (FF): Sensor short circuit F-043 Local display: F043	BLOCK_ERR = Other Input Failure Transducer_Error = Mechanical failure	QUALITY = BAD SUBSTATUS = Sensor failure	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-	221	Device status message (FF): Reference measurement F-221 Local display: F221	BLOCK_ERR = Other Transducer_Error = General error	QUALITY = BAD SUBSTATUS = Device failure	Cause of error: Internal reference junction defective. Remedy: Device defective, replace	SV1, SV2, PV1, PV2, DT
F-	261	Device status message (FF): Electronic failure F-261 Local display: F261	BLOCK_ERR = Other Transducer_Error = Electronic failure	QUALITY = BAD SUBSTATUS = Device failure	Cause of error: Electronics error. Remedy: Device defective, replace	SV1, SV2, PV1, PV2, DT
F-	283	Device status message (FF): Memory error F-283 Local display: F283	BLOCK_ERR = Other Transducer_Error = Data integrity error	QUALITY = BAD SUBSTATUS = Device failure	Cause of error: Error in memory. Remedy: Device defective, replace	SV1, SV2, PV1, PV2, DT
F-	431	Device status message (FF): No calibration F-431 Local display: F431	BLOCK_ERR = Other Transducer_Error = Calibration error	QUALITY = BAD SUBSTATUS = Device failure	Cause of error: Error in calibration parameters. Remedy: Device defective, replace	SV1, SV2, PV1, PV2, DT

Category	No.	Status messages ▪ ACTUAL_STATUS_NUMBER in the 'Advanced Diagnostics' Transducer Block ▪ Local display	Error messages in the Sensor Transducer Block in question	Sensor Transducer Block measured value status (default)	Cause of error / remedy	Output variables affected
F-	437	Device status message (FF): Configuration incorrect F-437 Local display: F437	BLOCK_ERR = Other | Block configuration error	QUALITY = BAD	Cause of error: Incorrect configuration in Transducer Blocks "Sensor 1 and 2". The reason for the configuration error is displayed in the "BLOCK_ERR_DESC1" parameter. Remedy: Check the configuration of the sensor types used, the units and the settings of PV1 and/or PV2.	SV1, SV2, PV1, PV2, DT
			Transducer_Error = Configuration error	SUBSTATUS = Device failure		

9.2.2 Category M diagnostics messages

Category	No.	Status messages ▪ ACTUAL_STATUS_NUMBER in the 'Advanced Diagnostics' Transducer Block ▪ Local display	Error messages in the Sensor Transducer Block in question	Sensor Transducer Block measured value status (default)	Cause of error / remedy	Output variables affected
M-	042	Device status message (FF): Corrosion M-042 Local display: M042 ↔ Measured value	BLOCK_ERR = Other	QUALITY = UNCERTAIN (configurable)	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
			Transducer_Error = No error	SUBSTATUS = Sensor conversion not accurate		
M-	101	Device status message (FF): Sensor value too low M-101 Local display: M101 ↔ Measured value	BLOCK_ERR = Other	QUALITY = UNCERTAIN	Cause of error: Physical measuring range undershot. Remedy: Select suitable sensor type.	SV1, SV2, also PV1, PV2 depending on the configuration
			Transducer_Error = No error	SUBSTATUS = Sensor conversion not accurate		
M-	102	Device status message (FF): Sensor value too high M-102 Local display: M102 ↔ Measured value	BLOCK_ERR = Other	QUALITY = UNCERTAIN	Cause of error: Physical measuring range overshot. Remedy: Select suitable sensor type.	SV1, SV2, also PV1, PV2 depending on the configuration
			Transducer_Error = No error	SUBSTATUS = Sensor conversion not accurate		

Category	No.	Status messages ▪ ACTUAL_STATUS_NUMBER in the 'Advanced Diagnostics' Transducer Block ▪ Local display	Error messages in the Sensor Transducer Block in question	Sensor Transducer Block measured value status (default)	Cause of error / remedy	Output variables affected
M-	103	Device status message (FF): Sensor drift/ difference M-103 Local display: M103 ↔ Measured value	BLOCK_ERR = Other	QUALITY = UNCERTAIN (configurable)	Cause of error: Sensor drift has been detected (in accordance with the settings in the Advanced Diagnostics Block). Remedy: Check the sensor, depending on the application.	PV1, PV2 SV1, SV2
			Transducer_Error = No error	SUBSTATUS = Non specific		
M-	104	Device status message (FF): Backup active M-104 Local display: M104 ↔ Measured value	BLOCK_ERR = Other	QUALITY = GOOD / BAD	Cause of error: Backup function activated and an error was detected at a sensor. Remedy: Resolve sensor error.	SV1, SV2, also PV1, PV2 depending on the configuration
			Transducer_Error = No error	SUBSTATUS = Non specific		

9.2.3 Category S diagnostics messages

Category	No.	Status messages ▪ ACTUAL_STATUS_NUMBER in the 'Advanced Diagnostics' Transducer Block ▪ Local display	Error messages in the Sensor Transducer Block in question	Sensor Transducer Block measured value status (default)	Cause of error / remedy	Output variables affected
S-	502	Device status message (FF): Special linearization S-501 Local display: S501 ↔ Measured value	BLOCK_ERR = Other | Block Configuration Error	QUALITY = BAD	Cause of error: Linearization error. Remedy: Select valid type of linearization (sensor type).	SV1, SV2, PV1, PV2, DT
			Transducer_Error = Configuration error	SUBSTATUS = Configuration error		
S-	901	Device status message (FF): Ambient temperature too low S-901 Local display: S901 ↔ Measured value	BLOCK_ERR = Other	QUALITY = UNCERTAIN (configurable)	Cause of error: Reference temperature < −40 °C (−40 °F) Remedy: Observe ambient temperature in accordance with specification.	SV1, SV2, PV1, PV2, DT
			Transducer_Error = No error	SUBSTATUS = Non specific		

Category	No.	Status messages ▪ ACTUAL_STATUS_NUMBER in the 'Advanced Diagnostics' Transducer Block ▪ Local display	Error messages in the Sensor Transducer Block in question	Sensor Transducer Block measured value status (default)	Cause of error / remedy	Output variables affected
S-	902	Device status message (FF): Ambient temperature too high S-902 Local display: S902 ↔ Measured value	BLOCK_ERR = Other	QUALITY = UNCERTAIN (configurable)	Cause of error: Reference temperature < +85 °C (+185 °F) Remedy: Observe ambient temperature in accordance with specification.	SV1, SV2, PV1, PV2, DT
			Transducer_Error = No error	SUBSTATUS = Non specific		

9.2.4 Category C diagnostics messages

Category	No.	Status messages ▪ ACTUAL_STATUS_NUMBER in the 'Advanced Diagnostics' Transducer Block ▪ Local display	Error messages in the Sensor Transducer Block in question	Sensor Transducer Block measured value status (default)	Cause of error / remedy	Output variables affected
C-	402	Device status message (FF): Device initialization C-402 Local display: C402 ↔ Measured value	BLOCK_ERR = Power up	QUALITY = UNCERTAIN	Cause of error: Device starting/ initializing. Remedy: Message is only displayed during power-up.	SV1, SV2, PV1, PV2, DT
			Transducer_Error = Data integrity error	SUBSTATUS = Non specific		
C-	482	Device status message (FF): Simulation active C-482 Local display: C482 ↔ Measured value	BLOCK_ERR = Other	QUALITY = UNCERTAIN	Cause of error: Simulation is active. Remedy: -	
			Transducer_Error = No error	SUBSTATUS = Substitute		
C-	501	Device status message (FF): Device reset C-501 Local display: C501 ↔ Measured value	BLOCK_ERR = Other	QUALITY = UNCERTAIN / GOOD	Cause of error: Device reset is performed. Remedy: Message is only displayed during a reset.	SV1, SV2, PV1, PV2, DT
			Transducer_Error = No error	SUBSTATUS = Non specific / update event		

9.2.5 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 (Diagnostic event 041 sensor break (default category: F) is output when the alarm limit is reached)
- On (Diagnostic event 042 sensor corrosion (default category: M) is output before the alarm limit is reached. This allows preventive maintenance/troubleshooting to be performed. An alarm message is displayed after the alarm limit is reached)

Corrosion detection is configured via the field diagnostic parameters in the Resource Block. Depending on the configuration of diagnostic event 042 - "sensor corrosion", you configure which category is output in the event of corrosion.

If corrosion detection is disabled, an F-041 error is output only 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	---	---	ALARM (F-041)
On	---	F-/C-/S-/M-042, depending on the configuration	ALARM (F-042)

TC	< ≈ 10 kΩ	10 kΩ ≈ < x ≈ 15 kΩ	> ≈ 15 kΩ
Off	---	---	ALARM (F-041)
On	---	F-/C-/S-/M-042, depending on the configuration	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.

9.3 Application errors without messages

9.3.1 Application errors for RTD connection

For sensor types, see → 49 .

Symptoms	Cause	Action/remedy
Measured value is incorrect/ inaccurate	Incorrect sensor orientation	Install the sensor correctly
	Heat conducted by sensor	Observe the installed length of the sensor
	Device programming is incorrect (number of wires)	Change the **SENSOR_CONNECTION** device function
	Device programming is incorrect (scaling)	Change scaling
	Incorrect RTD configured	Change the **SENSOR_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

Symptoms	Cause	Action/remedy
	Sensor, sensing element defective	Check the sensor, sensing element
	RTD connection incorrect	Connect the connecting cables correctly (see the "Electrical connection" section)
	Programming	Incorrect sensor type set in the **SENSOR_TYPE** device function. Set the correct sensor type
	Device defective	Replace device

9.3.2 Application errors for TC connection

For sensor types, see → 49.

Symptoms	Cause	Action/remedy
Measured value is incorrect/ inaccurate	Incorrect sensor orientation	Install the sensor correctly
	Heat conducted by sensor	Observe the installed length of the sensor
	Device programming is incorrect (scaling)	Change scaling
	Incorrect thermocouple type (TC) configured	Change the **SENSOR_TYPE** device function
	Incorrect reference junction set	See Section 13
	Offset incorrectly set	Check offset
	Interference via the thermocouple wire welded in the thermowell (interference voltage coupling)	Use a sensor where the thermocouple wire is not welded
	Sensor connected incorrectly	Connect the connecting cables correctly (see the "Electrical connection" section)
	Sensor, sensing element defective	Check the sensor, sensing element
	Programming	Incorrect sensor type set in the **SENSOR_TYPE** device function; set the correct thermocouple (TC)
	Device defective	Replace device

9.4 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
10/07	01.00.zz	Original firmware	BA251R/09/en/10.07
10/07	01.01.zz		BA00251R/09/en/13.12
03/13	02.00.zz	Device revision 2	BA00251R/09/en/14.13

10 Maintenance

No special maintenance work is required for the device.

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

11 Repair

11.1 General information

Due to its design, the device cannot be repaired.

11.2 Spare parts

Spare parts currently available for your product can be found online at: http://www.products.endress.com/spareparts_consumables, temperature transmitter: TMT85. 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

11.3 Return

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

1. Refer to the web page for information:
   http://www.endress.com/support/return-material
   ↳ Select the region.
2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

11.4 Disposal

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

12 Accessories

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:
- Printed copy of the Brief Operating Instructions
- ATEX supplementary documentation: ATEX Safety instructions (XA), **C**ontrol **D**rawings (CD)
- Mounting material for head transmitter
- Mounting material for field housing (wall or pipe mounting) as option

12.1 Device-specific accessories

Accessories	
TID10 display unit for Endress+Hauser head transmitter iTEMP TMT8x [1], attachable	
TID10 service cable for the remote operation of the display for service purposes; length 40 cm	
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 (FF):	▪ NPT ½" → 7/8" ▪ M20 → 7/8"
Stainless steel wall mounting bracket Stainless steel pipe mounting bracket	

1) Without TMT80

12.2 Communication-specific accessories

Accessories	Description
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
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

12.3 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

13 Technical data

13.1 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	Description	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
	▪ Connection type: 2-wire, 3-wire or 4-wire connection, sensor current: ≤ 0.3 mA ▪ with 2-wire circuit, compensation of the wire resistance is 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	Description	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) +150 to +1 768 °C (+302 to +3 214 °F) +150 to +1 768 °C (+302 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	Description	Measuring range limits
	▪ 2-wire connection ▪ 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

Type of input

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

		Sensor input 1			
		RTD or resistance transmitter, 2-wire	**RTD or resistance transmitter, 3-wire**	**RTD or resistance transmitter, 4-wire**	**Thermocouple (TC), voltage transmitter**
Sensor input 2	**RTD or resistance transmitter, 2-wire**	☑	☑	-	☑
	RTD or resistance transmitter, 3-wire	☑	☑	-	☑
	RTD or resistance transmitter, 4-wire	-	-	-	-
	Thermocouple (TC), voltage transmitter	☑	☑	☑	☑

13.2 Output

Output signal

- FOUNDATION Fieldbus™ H1, IEC 61158-2
- 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
- LAS (Link Active Scheduler), LM (Link Master) function is supported: Therefore, the head transmitter can assume the function of a Link Active Scheduler (LAS) if the current Link Master (LM) is no longer available. The device is supplied as a BASIC device. To use the device as an LAS, this must be defined in the control system and activated by downloading the configuration to the device.
- According to IEC 60079-27, FISCO/FNICO

Failure information

Status message in accordance with FOUNDATION Fieldbus™ 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

FOUNDATION Fieldbus™ basic data

Basic data

Device type	10CE (hex)
Device revision	02
Node address	Default: 247
ITK version	6.0.1
ITK Certification Driver No.	IT085900
Link Master capability (LAS)	Yes
Choice of Link Master / Basic Device	Yes; factory setting: Basic Device
Number of VCRs	44
Number of link objects in VFD	50

Virtual communication references (VCRs)

Permanent entries	1
Fully configurable entries	43

Link settings

Slot time	8
Min. inter PDU delay	10
Max. response delay slot time	24

Blocks

Block description	Block Index [1]	Execution time (macro-cycle ≤ 500 ms)	Block category
Resource Block	400	-	Extended
Transducer Block Sensor 1	500	-	Manufacturer-specific
Transducer Block Sensor 2	600	-	Manufacturer-specific
Transducer Block Display	700	-	Manufacturer-specific
Transducer Block Adv. Diag.	800	-	Manufacturer-specific
Function Block AI1	900	30 ms	Extended
Function Block AI2	1000	30 ms	Extended
Function Block AI3	1100	30 ms	Extended
Function Block AI4	(1200)	30 ms (not instantiated)	Extended
Function Block AI5	(1300)	30 ms (not instantiated)	Extended
Function Block AI6	(1400	30 ms (not instantiated)	Extended
Function Block PID	1200 (1500)	25 ms	Standard
Function Block ISEL	1300 (1600)	20 ms	Standard

1) The values in brackets are valid if all the AI blocks (AI1-AI6) are instantiated.

Brief description of the blocks

Resource Block

The Resource Block contains all the data that clearly identify and characterize the device. It is like an electronic version of the device nameplate. In addition to parameters required to

operate the device on the fieldbus, the Resource Block makes information available such as the order code, device ID, hardware version, firmware version, etc.

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.

Display Transducer

The parameters of the "Display" Transducer Block enable the configuration of the optional display.

Advanced Diagnostic

All the parameters for self-monitoring and diagnostics are grouped in this Transducer Block.

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).

PID

This function block contains input channel processing, proportional integral-differential control (PID) and analog output channel processing. The following can be implemented: Basic controls, feedforward control, cascade control and cascade control with limiting.

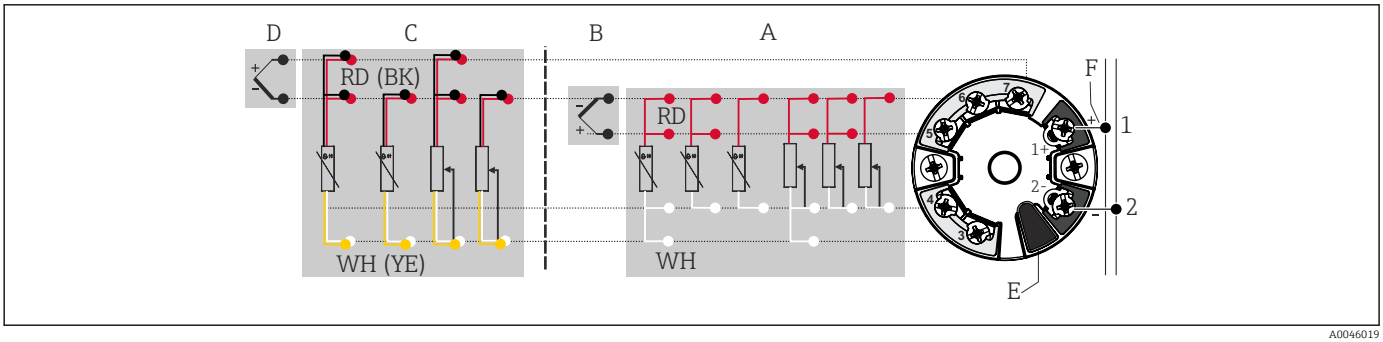
Input Selector (ISEL)

The Input Selector Block enables the selection of up to four inputs and generates an output based on the configured action.

13.3 Power supply

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

Electrical connection



16 *Assignment of terminal connections for head transmitter*

A Sensor input 1, RTD and Ω, 2-, 3- and 4-wire
B Sensor input 1, TC and mV
C Sensor input 2, RTD and Ω, 2- and 3-wire
D Sensor input 2, TC and mV
E Display connection, service interface
F Bus terminator and power supply

Terminals

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

Terminal design	Cable design	Cable cross-section
Screw terminals (with tabs on the fieldbus terminals for easy connection of a handheld terminal, e.g. FieldXpert, FC475, Trex)	Rigid or flexible	≤ 2.5 mm² (14 AWG)
Push-in terminals (cable design, stripping length = min. 10 mm (0.39 in)	Rigid or flexible	0.2 to 1.5 mm² (24 to 16 AWG)
	Flexible with wire end ferrules with/without plastic ferrule	0.25 to 1.5 mm² (24 to 16 AWG)

Ferrules must be used with push-in terminals and when using flexible cables with a cable cross-section of ≤ 0.3 mm². Otherwise, the use of ferrules when connecting flexible cables to push-in terminals is not recommended.

13.4 Performance characteristics

Response time

1s per channel

Reference 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 corresponds to ±2σ (Gaussian distribution). The data include non-linearities and repeatability.

Typical

Standard	Description	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)
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)		0.84 °C (1.51 °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	Description	Measuring range	Measured error (±)	Non-repeatability: ±
			Digital [1]	
			Based on measured value [2]	

Standard	Description	Measuring range	Measured error (±)	Non-repeatability: ±
IEC 60751:2008	Pt100 (1)	−200 to +850 °C (−328 to +1562 °F)	0.06 °C (0.11 °F) + 0.006% * (MV - LRV)	≤ 0.05 °C (0.09 °F)
	Pt200 (2)		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)	0.05 °C (0.09 °F) + 0.015% * (MV - LRV)	≤ 0.08 °C (0.14 °F)
	Pt1000 (4)	−200 to +250 °C (−328 to +482 °F)	0.03 °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 +1200 °F)	0.05 °C (0.09 °F) + 0.006% * (MV - LRV)	≤ 0.04 °C (0.07 °F)
GOST 6651-94	Pt50 (8)	−200 to +1100 °C (−328 to +2012 °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 +1562 °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) - 0.006% * (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 +1562 °F)	0.09 °C (0.16 °F) + 0.006% * (MV - LRV)	≤ 0.05 °C (0.09 °F)
	Cu100 (11)		0.05 °C (0.09 °F) + 0.003% * (MV - LRV)	≤ 0.04 °C (0.07 °F)
Resistance transmitter	Resistance Ω	10 to 400 Ω	max. 32 mΩ	15mΩ
		10 to 2000 Ω	max. 300 mΩ	≤ 200mΩ

1) Measured value transmitted via FIELDBUS®.
2) Deviations from maximum measured error possible due to rounding.

Measured error for thermocouples (TC) and voltage transmitters

Standard	Description	Measuring range	Measured error (±)	Non-repeatability: ±
			Digital [1]	
			Based on measured value [2]	
IEC 60584-1	Type A (30)	0 to +2500 °C (+32 to +4532 °F)	0.8 °C (1.44 °F) + 0.021% * MV	≤ 0.52 °C (0.94 °F)
	Type B (31)	+500 to +1820 °C (+932 to +3308 °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 +2000 °C (+32 to +3632 °F)	0.55 °C (1 °F) + 0.0055% * MV	≤ 0.33 °C (0.59 °F)
ASTM E988-96	Type D (33)		0.75 °C (1.44 °F) - 0.008% * MV	≤ 0.41 °C (0.74 °F)
IEC 60584-1	Type E (34)	−150 to +1000 °C (−238 to +2192 °F)	0.22 °C (0.40 °F) - 0.006% * (MV - LRV)	≤ 0.07 °C (0.13 °F)
	Type J (35)	−150 to +1200 °C (−238 to +2192 °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) - 0.005% * (MV - LRV)	≤ 0.11 °C (0.20 °F)
	Type N (37)	−150 to +1300 °C (−238 to +2372 °F)	0.48 °C (0.86 °F) - 0.014% * (MV - LRV)	≤ 0.16 °C (0.29 °F)
	Type R (38)	+150 to +1768 °C (+302 to +3214 °F)	0.9 °C (1.62 °F) - 0.015% * MV	≤ 0.76 °C (1.37 °F)
	Type S (39)		0.95 °C (1.71 °F) - 0.013% * MV	≤ 0.74 °C (1.33 °F)

Standard	Description	Measuring range	Measured error (±)	Non-repeatability: ±
	Type T (40)	−150 to +400 °C (−238 to +752 °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) - 0.009% * (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) - 0.028% * (MV - LRV)	≤ 0.10 °C (0.18 °F)
GOST R8.585-2001	Type L (43)	−200 to +800 °C (−328 to +1 472 °F)	2.2 °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 fieldbus.
2) Deviations from maximum measured error possible due to rounding.

MV = measured value

LRV = lower range value of the sensor in question

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

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)), at least 0.005 °C	0.08 °C (0.144 °F)
Influence of supply voltage = (30 - 24) x (0.002% x 200 °C - (-200 °C)), at least 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 mentioned above significantly improves the temperature measurement accuracy of the entire system. This is because the transmitter uses the specific data pertaining to the connected sensor to calculate the measured temperature, instead of using the standardized sensor curve data.

Operating influences

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

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

Description	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change	Supply voltage: Influence (±) per V change
		Digital [1]	Digital [1]
		Based on measured value	Based on measured value
Pt100 (1)	IEC 60751:2008	0.002% * (MV -LRV), at least 0.005 °C (0.009 °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)		0.002% * (MV -LRV), at least 0.009 °C (0.016 °F)	0.002% * (MV -LRV), at least 0.009 °C (0.016 °F)
Pt1000 (4)		0.002% * (MV -LRV), at least 0.004 °C (0.007 °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	0.002% * (MV -LRV), at least 0.01 °C (0.018 °F)	0.002% * (MV -LRV), at least 0.01 °C (0.018 °F)
Pt100 (9)		0.002% * (MV -LRV), at least 0.005 °C (0.009 °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		≤ 0.005 °C (0.009 °F)	≤ 0.005 °C (0.009 °F)
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)			

Description	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change	Supply voltage: Influence (±) per V change
10 to 400 Ω		0.0015% * (MV -LRV), at least 1.5 mΩ	0.0015% * (MV -LRV), at least 1.5 mΩ
10 to 2 000 Ω		0.0015% * (MV -LRV), at least 15 mΩ	0.0015% * (MV -LRV), at least 15 mΩ

1) Measured value transmitted via fieldbus.

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

Description	Standard	Ambient temperature: Influence (±) per 1 °C (1.8 °F) change	Supply voltage: Influence (±) per V change
		Digital [1]	Digital
		Based on measured value	Based on measured value
Type A (30)	IEC 60584-1	0.0055% * MV, at least 0.03 °C (0.005 °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	0.0045% * MV, at least 0.03 °C (0.005 °F)	0.0045% * MV, at least 0.03 °C (0.005 °F)
Type D (33)	ASTM E988-96	0.004% * MV, at least 0.035 °C (0.063 °F)	0.004% * MV, at least 0.035 °C (0.063 °F)
Type E (34)	IEC 60584-1	0.003% * (MV -LRV), at least 0.016 °C (0.029 °F)	0.003% * (MV -LRV), at least 0.016 °C (0.029 °F)
Type J (35)		0.0028% * (MV -LRV), at least 0.02 °C (0.036 °F)	0.0028% * (MV -LRV), at least 0.02 °C (0.036 °F)
Type K (36)		0.003% * (MV -LRV), at least 0.013 °C (0.023 °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)		0.0035% * MV, at least 0.047 °C (0.085 °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)
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 fieldbus.

MV = measured value

LRV = lower range value of the sensor in question

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

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

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

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

Description	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% * span	≤ 0.27 °C (0.486 °F) + 0.03% * span	≤ 0.38 °C (0.683 °F) + 0.035% * 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% * span	≤ 0.24 °C (0.43 °F) + 0.026% * span	≤ 0.34 °C (0.61 °F) + 0.027% * span
Type D (33)	ASTM E988-96	≤ 0.21 °C (0.38 °F) + 0.015% * span	≤ 0.34 °C (0.61 °F) + 0.02% * span	≤ 0.47 °C (0.85 °F) + 0.02% * span
Type E (34)	IEC 60584-1	≤ 0.06 °C (0.11 °F) + 0.018% * span	≤ 0.09 °C (0.162 °F) + 0.025% * span	≤ 0.13 °C (0.234 °F) + 0.026% * span
Type J (35)	IEC 60584-1	≤ 0.06 °C (0.11 °F) + 0.019% * span	≤ 0.1 °C (0.18 °F) + 0.025% * span	≤ 0.14 °C (0.252 °F) + 0.027% * 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% * span	≤ 0.19 °C (0.342 °F) + 0.024% * span

Description	Standard	Long-term drift (±)		
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% * span	≤ 0.28 °C (0.5 °F) + 0.02% * 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% * span	≤ 0.69 °C (1.241 °F) + 0.011% * span
Type S (39)	IEC 60584-1	≤ 0.31 °C (0.558 °F) + 0.011% * span	≤ 0.5 °C (0.9 °F) + 0.013% * span	≤ 0.7 °C (1.259 °F) + 0.011% * span
Type T (40)		≤ 0.09 °C (0.162 °F) + 0.011% * span	≤ 0.15 °C (0.27 °F) + 0.013% * span	≤ 0.2 °C (0.36 °F) + 0.012% * span
Type L (41)		≤ 0.06 °C (0.108 °F) + 0.017% * span	≤ 0.1 °C (0.18 °F) + 0.022% * span	≤ 0.14 °C (0.252 °F) + 0.022% * span
Type U (42)		≤ 0.09 °C (0.162 °F) + 0.013% * span	≤ 0.14 °C (0.252 °F) + 0.017% * span	≤ 0.2 °C (0.360 °F) + 0.015% * span
Type L (43)	GOST R8.585-2001	≤ 0.08 °C (0.144 °F) + 0.015% * span	≤ 0.12 °C (0.216 °F) + 0.02% * span	≤ 0.17 °C (0.306 °F) + 0.02% * span
Voltage transmitter (mV)				
−20 to 100 mV	-	≤ 2 µV + 0.022% * span	≤ 3.5 µV + 0.03% * span	≤ 4.7 µV + 0.033% * span

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

13.5 Environment

Ambient temperature range: −40 to +85 °C (−40 to +185 °F), for hazardous areas see Ex documentation → 63

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

Operating altitude: Up to 4000 m (4374.5 yards) above mean sea level as per IEC 61010-1, CAN/CSA C22.2 No. 61010-1

Relative 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 push-in terminals: IP 30. When the device is installed, the degree of protection 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 conformity**

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

Maximum 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

Measuring category II as per IEC 61010-1. The measuring category is provided for measuring on power circuits that are directly connected electrically with the low-voltage network.

Pollution degree

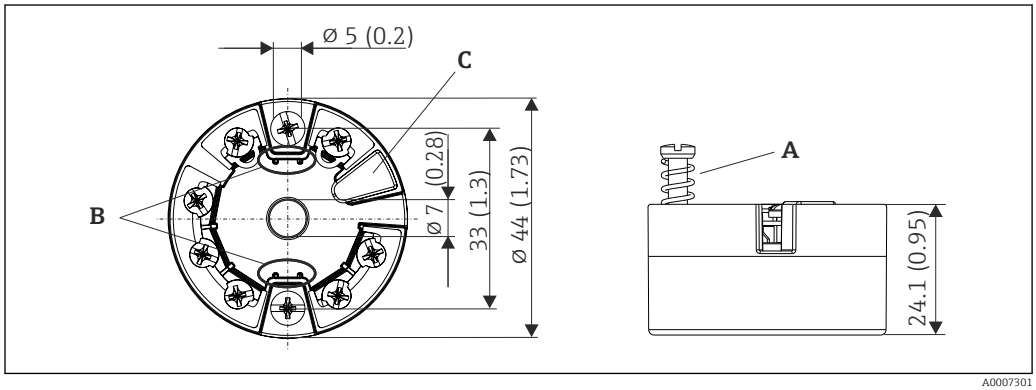
Pollution degree 2 as per IEC 61010-1.

13.6 Mechanical construction

Design, dimensions

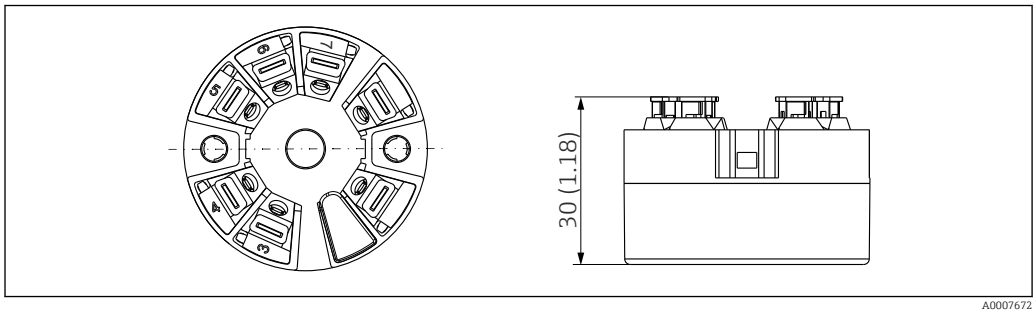
Dimensions in mm (in)

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

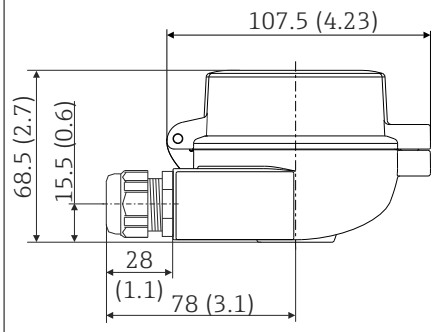


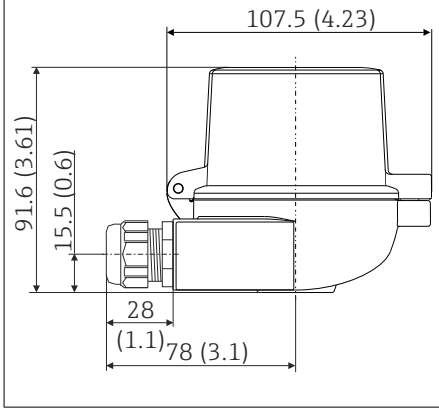
18 *Version with push-in terminals. Dimensions are identical to the version with screw terminals, apart from housing height.*

Field housing

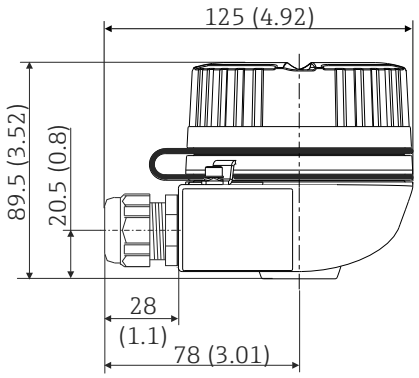
All field housings have an internal geometry in accordance with DIN EN 50446, form B (flat face). Cable glands in the diagrams: M20x1.5

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)

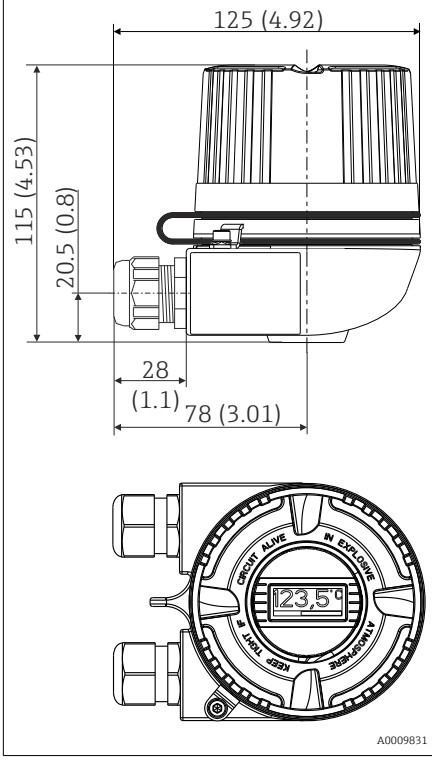
TA30A	Specification
	▪ Two cable entries ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry glands: 1/2" NPT and M20x1.5 ▪ Head color: blue, RAL 5012 ▪ Cap color: gray, RAL 7035 ▪ Weight: 330 g (11.64 oz)

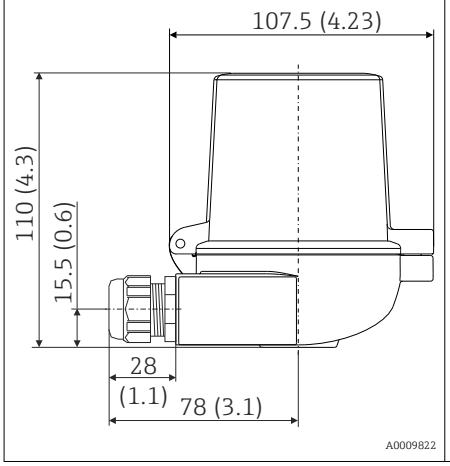
TA30A with display window in cover	Specification
	▪ Two cable entries ▪ Material: aluminum, polyester powder coated Seals: silicone ▪ Cable entry glands: 1/2" NPT and M20x1.5 ▪ Head color: blue, RAL 5012 ▪ Cap color: gray, RAL 7035 ▪ Weight: 420 g (14.81 oz)

TA30H	Specification

	▪ Flameproof (XP) version, explosion-protected, captive screw cap, with two cable entries
	▪ Protection class: NEMA Type 4x Encl.
	▪ 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:
	  ▪ Aluminium 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.
	▪ 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:
	  ▪ Aluminium approx. 860 g (30.33 oz)
	  ▪ Stainless steel approx. 2 900 g (102.3 oz)

TA30D	Specification
	▪ 2 cable entries ▪ 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. ▪ Head color: blue, RAL 5012 ▪ Cap color: 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), complies with UL94 HB (fire resistance properties)
- Terminals:
  - Screw terminals: nickel-plated brass and gold-plated or tin-plated contacts
  - Push-in 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

13.7 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

UL approval

More information under UL Product iq™, search for keyword "E225237")

CSA GP	CSA General Purpose
FOUNDATION Fieldbus™ certification	The temperature transmitter is certified and registered by the Fieldbus FOUNDATION. The device meets all the requirements of the following specifications: ▪ Certified in accordance with FOUNDATION Fieldbus™ specification ▪ FOUNDATION Fieldbus™ H1 ▪ Interoperability Test Kit (ITK), revision status 6.0.1 (device certification number available on request): The device can also be operated with certified devices of other manufacturers ▪ Physical Layer Conformance Test of the Fieldbus FOUNDATION™ (FF-830 FS 2.0)

13.8 Supplementary documentation

- Operating Instructions 'iTEMP TMT85' (BA00251R)
- Brief Operating Instructions 'iTEMP TMT85' (KA00252R)
- Operating Instructions "Guideline FOUNDATION Fieldbus Function Blocks" (BA00062S)
- Supplementary ATEX documentation:
  ATEX II 1G Ex ia IIC: XA00069R
  ATEX II 3G Ex nA II: XA01006T
  ATEX II 3D Ex tc IIIC: XA01006T
  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)

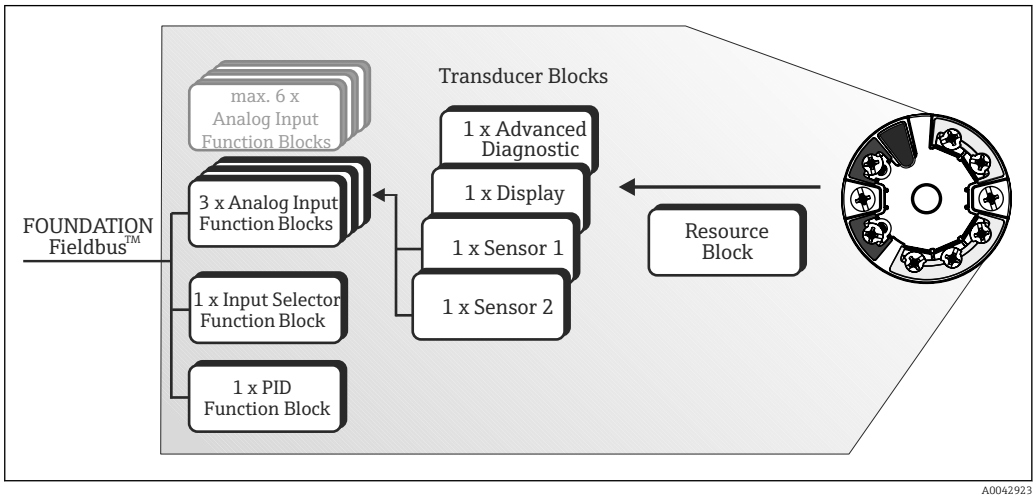
14 Operation via FOUNDATION Fieldbus™

14.1 Block model

With FOUNDATION Fieldbus™, all the device parameters are categorized according to their functional properties and task and are generally assigned to three different blocks. A block can be regarded as a container that contains parameters and the functionalities associated with these parameters. A FOUNDATION Fieldbus™ device has the following block types:

- A Resource Block (device block):
  The Resource Block contains all the device-specific features of the device.
- One or more Transducer Blocks:
  The Transducer Blocks contain the measuring- and device-specific parameters of the device.
- One or more function blocks:
  The function blocks contain the automation functions of the device. A distinction is made between different function blocks, e.g. Analog Input function block, Analog Output function block, etc. Each of these function blocks is used to execute different application functions.

Different automation tasks can be implemented depending on how the individual function blocks are arranged and connected. In addition to these blocks, a field device may have other blocks, e.g. several Analog Input function blocks if more than one process variable is available from the field device.



19 *TMT85 block model*

14.2 Resource Block (device block)

The Resource Block contains all the data that clearly identify and characterize the field device. It is like an electronic version of the field device nameplate. In addition to parameters required to operate the device on the fieldbus, the Resource Block makes information available such as the order code, device ID, hardware version, firmware version, etc.

Another task of the Resource Block is to manage general parameters and functions that have an influence on the execution of the remaining function blocks in the field device. The Resource Block is therefore a central unit that also checks the device status and in doing so influences and controls the operability of the other function blocks and therefore of the device. The Resource Block does not have any block input and block output data and therefore cannot be linked to other blocks.

The primary functions and parameters of the Resource Block are listed below.

14.2.1 Selecting the operating mode

The operating mode is set via the MODE_BLK parameter group. The Resource Block supports the following operating modes:

- AUTO (automatic mode)
- OOS (out of service)
- MAN (manual mode)

The 'Out Of Service' (OOS) mode is also shown via the BLOCK_ERR parameter. In the OOS operating mode, you can access all the write parameters without restriction if write protection is not enabled.

14.2.2 Block status

The current operating status of the Resource Block is shown in the RS_STATE parameter.

The Resource Block can adopt the following states:

- STANDBY
  The Resource Block is in the OOS operating mode. It is not possible to execute the remaining function blocks.
- ONLINE LINKING
  The configured connections between the function blocks are not yet established.
- ONLINE
  Normal operating mode, the Resource Block is in the AUTO (automatic) operating mode. The configured connections between the function blocks have been established.

14.2.3 Write protection and simulation

Device parameter write protection and simulation in the Analog Input function block can be disabled or enabled by means of DIP switches on the optional display.

The WRITE_LOCK parameter shows the status of the hardware write protection. The following statuses are possible:

- LOCKED
  = Device data cannot be changed via the FOUNDATION Fieldbus interface.
- NOT LOCKED
  = Device data can be changed via the FOUNDATION Fieldbus interface.

The BLOCK_ERR parameter indicates whether simulation is active in the Analog Input function block.

Simulation active
= DIP switch for simulation mode is active.

14.2.4 Alarm detection and processing

Process alarms provide information about certain block states and block events. The status of the process alarms is communicated to the fieldbus host system via the BLOCK_ALM parameter. The ACK_OPTION parameter specifies whether an alarm must be acknowledged via the fieldbus host system. The following process alarms are generated by the Resource Block:

Block process alarms

The following block process alarms of the Resource Block are shown via the BLOCK_ALM parameter:

- OUT OF SERVICE
- SIMULATE ACTIVE

Write protect process alarm

If write protection is disabled, the alarm priority specified in the WRITE_PRI parameter is checked prior to communicating the change of status to the fieldbus host system. The

alarm priority specifies the action taken when the write protection alarm WRITE_ALM is active.

If the option of a process alarm has not been activated in the ACK_OPTION parameter, this process alarm only has to be acknowledged in the BLOCK_ALM parameter.

14.2.5 Resource Block FF parameters

The following table shows all the specified FOUNDATION Fieldbus™ parameters of the Resource Block.

Resource Block			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
38	Acknowledge Option (ACK_OPTION)	AUTO - OOS	This parameter is used to specify whether a process alarm must be acknowledged by the fieldbus host system when the alarm is detected. If the option is activated, the process alarm is acknowledged automatically. **Factory setting:** The option is not activated for any alarm. The alarms must be acknowledged.
37	Alarm Summary (ALARM_SUM)	AUTO - OOS	Displays the current status of the process alarms in the Resource Block. The process alarms can also be disabled in this parameter group.
4	Alert Key (ALERT_KEY)	AUTO - OOS	Use this function to enter the identification number of the plant unit. This information can be used by the fieldbus host system to sort alarms and events. **User input:** 1 to 255 **Factory setting:** 0
36	Block Alarm (BLOCK_ALM)	AUTO - OOS	Displays the current block condition with information on pending configuration, hardware or system errors, including information on the date and time when the error occurred. The block alarm is triggered by the following block errors: ▪ SIMULATE ACTIVE ▪ OUT OF SERVICE If the alarm option is not activated in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.
6	Block Error (BLOCK_ERR)	Read only	Displays the active block errors. **Display:** SIMULATE ACTIVE Simulation in the Analog Input function block is possible via the SIMULATE parameter (see also the settings for HW write protection in → 🖹 26). OUT OF SERVICE The block is in the “Out of Service” mode.
75	Block Error Description 1 (BLOCK_ERR_DESC_1)	Read only	Displays additional information to troubleshoot a block error: ▪ Simulation permitted: Simulation is permitted with the activated simulation switch ▪ Failsafe active: Failsafe mechanism in an AI block is active
42	Capability Level (CAPABILITY_) LEVEL	Read only	Indicates the capability level which the device supports.
30	Clear Fault State (CLR_FSTATE)	AUTO - OOS	The fault state of the Analog Output and Discrete Output function blocks can be manually disabled via this parameter.
43	Compatibility Revision (COMPATIBILITY_REV)	Read only	Indicates the previous device revision with which the device is compatible.

Resource Block			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
33	Confirm Time (CONFIRM_TIME)	AUTO - OOS	Specify the confirmation time for the event report. If the device does not receive confirmation within this time, the event report is sent to the fieldbus host system again. **Factory setting:** 640000 1/32 ms
20	Cycle Selection (CYCLE_SEL)	AUTO - OOS	Displays the block execution method used by the fieldbus host system. The block execution method is selected by the fieldbus host system.
19	Cycle Type (CYCLE_TYPE)	Read only	Displays the block execution methods supported by the device. **Display:** SCHEDULED Scheduled block execution method BLOCK EXECUTION Sequential block execution method MANUF SPECIFIC Manufacturer-specific
9	DD Resource (DD_RESOURCE)	Read only	Displays the source for the device description in the device. **Display:** (blank spaces)
13	DD Revision (DD_REV)	Read only	Displays the revision number of the ITK-tested device description.
12	Device Revision (DEV_REV)	Read only	Displays the revision number of the device.
45	Device Tag (DEVICE_TAG)	Read only	Tag name/device TAG.
11	Device Type (DEV_TYPE)	Read only	Displays the device ID number in hexadecimal format. **Display:** 0x10CE (hex) for TMT85
44	Electronic Name Plate Version (ENP_VERSION)	Read only	Version of the ENP (electronic name plate).
28	Fault State (FAULT_STATE)	Read only	Current status display of the fault state of the Analog Output and Discrete Output function blocks.
54	Check Active (FD_CHECK_ACTIVE)	Read only	Indicates whether a diagnostic event of the defined category is currently pending.
66	Check Alarm (FD_CHECK_ALM)	AUTO - OOS	Alarms that are actively transmitted by the device to the fieldbus.
58	Check Map (FD_CHECK_MAP)	AUTO - OOS	Enable or disable diagnostic events or diagnostic groups for the relevant category.
62	Check Mask (FD_CHECK_MASK)	AUTO - OOS	Disables the transmission of device messages to the fieldbus.
70	Check Priority (FD_CHECK_PRI)	AUTO - OOS	Indicates the alarm priority of the alarm transmitted to the fieldbus.
51	Fail Active (FD_FAIL_ACTIVE)	Read only	Indicates whether a diagnostic event of the defined category is currently pending.
63	Fail Diagnostic Alarm (FD_FAIL_ALM)	AUTO - OOS	Alarms that are actively transmitted by the device to the fieldbus.
55	Fail Map (FD_FAIL_MAP)	AUTO - OOS	Enable or disable diagnostic events or diagnostic groups for the relevant category.
59	Fail Mask (FD_FAIL_MASK)	AUTO - OOS	Disables the transmission of device messages to the fieldbus.
67	Fail Priority (FD_FAIL_PRI)	AUTO - OOS	Indicates the alarm priority of the alarm transmitted to the fieldbus.
53	Maintenance Active (FD_MAINT_ACTIVE)	Read only	Indicates whether a diagnostic event of the defined category is currently pending.
65	Maintenance Alarm (FD_MAINT_ALM)	AUTO - OOS	Alarms that are actively transmitted by the device to the fieldbus.
57	Maintenance Map (FD_MAINT_MAP)	AUTO - OOS	Enable or disable diagnostic events or diagnostic groups for the relevant category.

Resource Block			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
61	Maintenance Mask (FD_MAINT_MASK)	AUTO - OOS	Disables the transmission of device messages to the fieldbus.
69	Maintenance Priority (FD_MAINT_PRI)	AUTO - OOS	Indicates the alarm priority of the alarm transmitted to the fieldbus.
52	Offspec Active (FD_OFFSPEC_ACTIVE)	Read only	Indicates whether a diagnostic event of the defined category is currently pending.
64	Offspec Alarm (FD_OFFSPEC_ALM)	AUTO - OOS	Alarms that are actively transmitted by the device to the fieldbus.
56	Offspec Map (FD_OFFSPEC_ MAP)	AUTO - OOS	Enable or disable diagnostic events or diagnostic groups for the relevant category.
60	Offspec Mask (FD_OFFSPEC_ MASK)	AUTO - OOS	Disables the transmission of device messages to the fieldbus.
68	Offspec Priority (FD_OFFSPEC_PRI)	AUTO - OOS	Indicates the alarm priority of the alarm transmitted to the fieldbus.
72	Recommended Action (FD_RECOMMEN_ACT)	Read only	Displays the cause of the highest-priority diagnostic event in plain text along with remedial action.
71	Field Diagnostic Simulate (FD_SIMULATE)	AUTO - OOS	Makes it possible to simulate the field diagnostic parameters when the simulation switch is enabled.
50	Field device diagnostic version (FD_VER)	Read only	The main version of the FF field diagnostic specification which was used for development purposes for this device.
17	Features (FEATURES)	Read only	Displays the additional functions supported by the device. **Display:** Reports | Faultstate | Hard W Lock | Change Bypass in Auto | MVC Report Distribution supported Multi-bit Alarm (Bit-Alarm) Support
18	Feature Selection (FEATURES_SEL)	AUTO - OOS	Use this function to select the additional functions supported by the device.
75	FF communication software version (FF_COMM_VERSION)	Read only	Displays the version of the FF communication software (stack).
49	Firmware Version (FIRMWARE_ VERSION)	Read only	Displays the device software version.
25	Free Time (FREE_TIME)	Read only	Displays the free system time available (as a percentage) for the execution of additional function blocks. This parameter always displays the value 0 because the function blocks of the device are preconfigured.
24	Free Space (FREE_SPACE)	Read only	Displays the free space available (as a percentage) for the execution of additional function blocks. This parameter always displays the value 0 because the function blocks of the device are preconfigured.
14	Grant Deny (GRANT_DENY)	AUTO - OOS	Grant or deny a fieldbus host system access authorization to the field device.
15	Hard Types (HARD_TYPES)	Read only	Displays the input signal type for the Analog Input function block.
73	Hardware Version (HARDWARE_ VERSION)	Read only	Displays the device hardware version.
41	ITK Version (ITK_VER)	Read only	Displays the version number of the supported ITK test.
32	Limit Notify (LIM_NOTIFY)	AUTO - OOS	Use this parameter to specify the number of event reports that can simultaneously exist as unconfirmed reports. **Options:** 0 to 4 **Factory setting:** 4

Resource Block			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
10	Manufacturer ID (MANUFAC_ID)	Read only	Displays the manufacturer's ID number. **Display:** 0x452B48 (hex) = Endress+Hauser
31	Max Notify (MAX_NOTIFY)	Read only	Displays the maximum number of event reports supported by the device that can simultaneously exist as unconfirmed reports. **Display:** 4
22	Memory Size (MEMORY_SIZE)	Read only	Displays the available configuration memory in kilobytes. This parameter is not supported.
21	Minimum Cycle Time (MIN_CYCLE_T)	Read only	Displays the min. execution time.
5	Block Mode (MODE_BLK)	AUTO - OOS	Displays the actual and target operating mode of the Resource Block, the permitted modes which the Resource Block supports and the normal operating mode. **Display:** AUTO - OOS The Resource Block supports the following operating modes: ▪ AUTO (automatic mode) The execution of the remaining blocks (ISEL, AI and PID function block) is permitted in this operating mode. ▪ OOS, (Out of Service) The block is in the “Out of Service” mode. The execution of the remaining blocks (ISEL, AI and PID function block) is stopped in this operating mode. These blocks cannot be set to the AUTO mode. The current operating status of the Resource Block is also shown via the RS_STATE parameter.
50	Resource Directory (RES_DIRECTORY)	Read only	Displays the Resource Directory for the electronic name plate (ENP).
23	Nonvolatile Cycle Time (NV_CYCLE_T)	Read only	Displays the time interval in which the dynamic device parameters are stored in the nonvolatile memory. The time interval displayed refers to the storage of the following dynamic device parameters: ▪ OUT ▪ PV ▪ FIELD_VAL ▪ SP These values are stored in the nonvolatile memory every 11 minutes. Display: 21120000 (1/32 ms).
49	Order Code / Identification (ORDER_CODE)	Read only	Displays the order code for the device.
47	Extended order code (ORDER_CODE_EXT)	Read only	Displays the extended order code of the device.
48	Extended order code part2 (ORDER_CODE_ EXT_PART2)	Read only	Displays the second part of the extended order code. This is always empty in the case of this device, which is why this parameter does not appear in some host systems.

Resource Block			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
16	Restart (RESTART)	AUTO - OOS	The device can be reset in a variety of ways via this parameter. **Options:** ▪ Restart UNINITIALIZED ▪ RUN ▪ Restart RESOURCE (restart the Resource Block) ▪ Restart with DEFAULTS (restart with the defined default values according to FFSpec. (only FF bus parameters)) ▪ Restart PROCESSOR (restart the processor) ▪ Restart Factory (resets all the device parameters to the default values) ▪ Restart Order Configuration (resets all the device parameters to the order configuration) ▪ Restart Default Blocks (resets the blocks to the order configuration, e.g. pre-instantiatied blocks)
7	Resource State (RS_STATE)	Read only	Displays the current operating status of the Resource Block. **Display:** STANDBY The Resource Block is in the OOS operating mode. The remaining blocks cannot be executed. ONLINE LINKING The configured connections between the function blocks are not yet established. ONLINE Normal operating mode, the Resource Block is in the AUTO operating mode. The configured connections between the function blocks have been established.
46	Serial Number (SERIAL_NUMBER)	Read only	Displays the device serial number.
29	Set Fault State (SET_FSTATE)	AUTO - OOS	The fault state can be activated manually via this parameter.
26	Shed Remote Cascade (SHED_RCAS)	AUTO - OOS	Specify the monitoring time for checking the connection between the fieldbus host system and a function block in the RCAS operating mode. Once the monitoring time elapses, the function block switches from the RCAS operating mode to the operating mode selected in the SHED_OPT parameter. **Factory setting:** 640000 1/32 ms
27	Shed Remote Out (SHED_ROUT)	AUTO - OOS	Specify the monitoring time for checking the connection between the fieldbus host system and the PID function block in the ROUT operating mode. Once the monitoring time elapses, the PID function block switches from the ROUT operating mode to the operating mode selected in the SHED_OPT parameter. A detailed description of the PID function block is provided in the FOUNDATION Fieldbus™ Function Block Manual on the CD-ROM provided (BA00062S/04). **Factory setting:** 640000 1/32 ms
3	Strategy (STRATEGY)	AUTO - OOS	Parameter for grouping the blocks, thereby enabling faster evaluation. Grouping is performed by entering the same numerical value in the STRATEGY parameter of each individual block. **Factory setting:** 0 These data are neither checked nor processed by the Resource Block.
1	Static Revision (ST_REV)	Read only	Displays the revision status of the static data. The revision status is incremented each time the static data change.
2	Tag Description (TAG_DESC)	AUTO - OOS	Use this function to enter a user-specific text for the clear identification and assignment of the block.
8	Test Read Write (TEST_RW)	AUTO - OOS	This parameter is required only for interoperability tests and has no significance in normal operation.

Resource Block			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
35	Update Event (UPDATE_EVT)	Read only	Indicates whether static block data have been modified, including the date and time.
40	Write Alarm (WRITE_ALM)	AUTO - OOS	Displays the status of the write protection alarm. The alarm is triggered when the write protection is disabled.
34	Write Lock (WRITE_LOCK)	Read only	Displays the current write protection setting (setting only via DIP switch on the display). **Display:** LOCKED Not possible to write to the device. NOT LOCKED Device data can be modified. UNINITIALIZED
39	Write Priority (WRITE_PRI)	AUTO - OOS	Specify the behavior in the event of a write protection alarm ("WRITE_ALM" parameter). User entry: 0 = The write protection alarm is not evaluated. 1 = The fieldbus host system is not notified in the event of a write protection alarm. 2 = Reserved for block alarms. 3-7 = The write protection alarm is output with the appropriate priority (3 = low priority, 7 = high priority) to the fieldbus host system as a user notice. 8-15 = The write protection alarm is output with the appropriate priority (8 = low priority, 15 = high priority) to the fieldbus host system as a critical alarm. **Factory setting:** 0

14.3 Transducer Blocks

The Transducer Blocks of the TMT85 contain all the measurement- and device-specific parameters. All the settings directly associated with the application (temperature measurement) are made here. They form the interface between sensor-specific measured value processing and the Analog Input function blocks required for automation.

A Transducer Block allows the user to influence the input and output variables of a function block. The parameters of a Transducer Block include information on the sensor configuration, physical units, calibration, damping, error messages, etc. as well as the device-specific parameters. The device-specific parameters and functions of the TMT85 are split into several Transducer Blocks, each covering different task areas (→ 65).

Transducer Block "Sensor 1" / base index 500 or Transducer Block "Sensor 2" / base index 600:

This block contains all the parameters and functions associated with the measurement of input variables (e.g. temperature).

Transducer Block "Display" / base index 700:

The parameters of this block enable the configuration of the display.

Transducer Block "Advanced Diagnostic" / base index 800:

This block comprises parameters for self-monitoring and diagnostics.

14.3.1 Block output variables

The following table shows which output variables (process variables) the Transducer Blocks make available. The "Display" and "Advanced Diagnostic" Transducer Blocks do not have any output variables. The CHANNEL parameter in the Analog Input function block is

used to specify which process variable is read in and processed in the downstream Analog Input function block.

Block	Process variable	Channel parameter (AI Block)	Channel
Transducer Block "Sensor 1"	Primary Value	Primary Value 1	1
	Sensor Value	Sensor Value 1	3
	Device temperature value	Device temperature	5
Transducer Block "Sensor 2"	Primary Value	Primary Value 2	2
	Sensor Value	Sensor Value 2	4
	Device temperature value	Device temperature	6

14.3.2 Selecting the operating mode

The operating mode is set via the MODE_BLK parameter group (→ 74).

The Transducer Block supports the following operating modes:

- AUTO (automatic mode)
- OOS (out of service)
- MAN (manual mode)

The OOS block status is also shown via the BLOCK_ERR parameter (→ 74).

14.3.3 Alarm detection and processing

The Transducer Block does not generate any process alarms. The status of the process variables is evaluated in the downstream Analog Input function blocks. If the Analog Input function block receives an input value that cannot be evaluated from the Transducer Block, a process alarm is generated. This process alarm is displayed in the BLOCK_ERR parameter of the Analog Input function block (BLOCK_ERR = Input Failure).

The BLOCK_ERR parameter of the Transducer Block (→ → 74) displays the device error that produced the input value that could not be evaluated and thus triggered the process alarm in the Analog Input function block.

14.3.4 Accessing the device-specific parameters

To access the manufacturer-specific parameters, the hardware write protection must be disabled, see → 26.

14.3.5 Selecting the units

The system units selected in the Transducer Blocks do not have any effect on the desired units which should be transmitted via the FOUNDATION Fieldbus interface. This setting is made separately via the corresponding AI Block in the XD_SCALE parameter group. The unit selected in the Transducer Blocks is only used for the onsite display and for displaying the measured values within the Transducer Block in the relevant configuration program. A detailed description of the Analog Input (AI) function block is provided in the FOUNDATION Fieldbus™ Function Block Manual on the CD-ROM provided (BA00062S/04).

14.3.6 FF parameters of the Transducer Blocks

The following table provides a description of all the specified FOUNDATION Fieldbus parameters of the Transducer Blocks. The device-specific parameters are described from → 79.

Transducer Block (FF parameters)

Parameter	Write access with operating mode (MODE_BLK)	Description
Static Revision (STAT_REV)	Read only	Displays the revision status of the static data. The revision status parameter is incremented each time the static data change. When a factory reset is performed, this parameter is reset to 0 in all the blocks.
Tag Description (TAG_DESC)	AUTO - OOS	Use this function to enter a user-specific text (max. 32 characters) for the clear identification and assignment of the block. **Factory setting:** (_____) no text
Strategy (STRATEGY)	AUTO - OOS	Parameter for grouping the blocks, thereby enabling faster evaluation. Grouping is performed by entering the same numerical value in the STRATEGY parameter of each individual block. **Factory setting:** 0 These data are neither checked nor processed by the Transducer Blocks.
Alert key (ALERT_KEY)	AUTO - OOS	Use this function to enter the identification number of the plant unit. This information can be used by the fieldbus host system to sort alarms and events. **User input:** 1 to 255 **Factory setting:** 0
Block Mode (MODE_BLK)	AUTO - OOS	Displays the actual and target operating mode of the corresponding Transducer Block, the permitted modes which the Resource Block supports and the normal operating mode. **Display:** AUTO OOS MAN The Transducer Block supports the following operating modes: ▪ AUTO (automatic mode): The block is executed. ▪ OOS (Out of Service): The block is in the “Out of Service” mode. The process variable is updated but the process variable status changes to BAD. ▪ MAN (manual mode): The block is in the "Manual mode". The process variable is updated. This state indicates that the Resource Block is "Out of Service".

Parameter	Write access with operating mode (MODE_BLK)	Description
Block Error (BLOCK_ERR)	Read only	Displays the active block errors. **Display:** OUT OF SERVICE The block is in the “Out of Service” mode. The following block errors are only displayed in the Sensor Transducer Blocks: ▪ OTHER Additional information is available in the Advanced Diagnostic Transducer. ▪ BLOCK CONFIGURATION ERROR The block has been configured incorrectly. The reason for the configuration error is displayed in the BLOCK_ERR_DESC1 parameter ▪ SENSOR FAILURE Error at one or both sensor inputs. An exact error description as well as information on rectifying faults is provided in → 🖹 39.
Update Event (UPDATE_EVT)	AUTO - OOS	Indicates whether static block data have been modified, including the date and time.
Block Alarm (BLOCK_ALM)	AUTO - OOS	Displays the current block condition with information on pending configuration, hardware or system errors, including information on the date and time when the error occurred. ▪ In addition, the active block alarm can be acknowledged in this parameter group. ▪ The device does not use this parameter to display a process alarm since this is generated in the BLOCK_ALM parameter of the Analog Input function block.
Transducer Type (TRANSDUCER_ TYPE)	Read only	Displays the Transducer Block type. **Display:** ▪ Sensor Transducer Blocks: Custom Sensor Transducer ▪ Display Transducer Block: Custom Display Transducer ▪ Advanced Diagnostic Block: Custom Adv. Diag. Transducer
Transducer Type Version (TRANSDUCER_ TYPE_VER)	Read only	Displays the version of the Transducer Block type.
Collection Directory (COLLECTION_ DIR)	Read only	Displays the Collection Directory, always 0.
Transducer Error (XD_ERROR)	Read only	Displays the active device error. **Possible display:** ▪ No Error (normal state) ▪ Electronics Failure ▪ Data Integrity Error ▪ Mechanical Failure ▪ Configuration Error ▪ Calibration Error ▪ General Error ▪ The summarized device status/condition and more precise information on the pending error(s) are available via the manufacturer-specific error display. This can be read via the “Advanced Diagnostic” Transducer Block in the “ACTUAL_STATUS_CATEGORY” and "ACTUAL_STATUS_NUMBER" parameters. ▪ An exact error description as well as information on rectifying errors is provided in → 🖹 39.

14.3.7 Transducer Blocks "Sensor 1 and 2"

The "Sensor 1 and 2" Transducer Blocks evaluate the signals of both sensors from a metrological perspective and display them as a physical variable (value, measured value status and unit). Two physical measured values and an additional primary value, which is mathematically calculated from the sensor values (the PRIMARY_VALUE), are available in each Sensor Transducer Block:

- The sensor value (SENSOR_VALUE) and its unit (SENSOR_RANGE -> UNITS_INDEX)
- The value of the internal temperature measurement of the device (DEVTEMP_VALUE) and its unit (DEVTEMP_UNIT)
- The primary value (PRIMARY_VALUE -> VALUE) and its unit (PRIMARY_VALUE_UNIT)

The internal temperature measurement of the reference junction is in both Transducer Blocks but both values are identical. A third value in the Block, the PRIMARY_VALUE, is calculated mathematically from the sensor values.

The rule for forming the PRIMARY_VALUE can be selected in the PRIMARY_VALUE_TYPE parameter. The sensor value can be mapped unchanged in the PRIMARY_VALUE but it is also possible to calculate the differential value or mean value for both sensor values. Furthermore, various additional functions for connecting the two sensors are also available. These can help increase process safety, like the backup function or sensor drift detection.

- Backup function:
  If a sensor fails, the system automatically switches to the remaining sensor and a diagnostic message is generated in the device. The backup function ensures that the process is not interrupted by the failure of an individual sensor and that maximum safety and availability is achieved.
- Sensor drift detection:
  If 2 sensors are connected and the measured values differ by a specified value, a diagnostic message is generated in the device. The drift detection function can be used to verify the correctness of the measured values and for mutual monitoring of the connected sensors. Sensor drift detection is configured in the "Advanced Diagnostic" Transducer Block, → 🖹 83.

The electronics can be configured for various sensors and measured variables via the SENSOR_TYPE parameter.

If resistance thermometers or resistance transmitters are connected, the type of connection can be selected via the SENSOR_CONNECTION parameter. If the "2-wire" connection type is used, the TWO_WIRE_COMPENSATION parameter is available. The resistance value of the sensor connection cables is stored in this parameter.

The resistance value can be calculated as follows:

- Total cable length: 100 m
- Conductor cross-section: 0.5 mm^2
- Conductor material: copper
- Resistivity of Cu: 0.0178 Ω * mm^2/m

$R = 0.0178\ \Omega * mm^2/m * (2 * 100\ m)/0.5\ mm^2 = 7.12\ \Omega$

Resulting measured error = 7.12 Ω / 0.385 Ω/K = 18.5 K

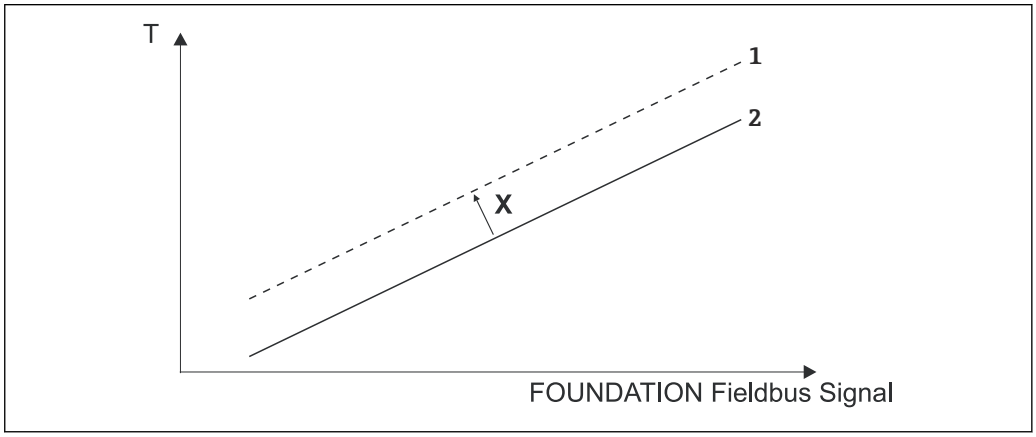
The Transducer Blocks for sensor 1 and 2 have a wizard (configuration assistant) for calculating the resistance of sensor cables with different material properties, cross-sections and lengths.

When measuring temperature with thermocouples, the type of reference junction compensation is specified in the RJ_TYPE parameter. The internal terminal temperature measurement of the device (INTERNAL) or a fixed value (EXTERNAL) can be specified for the compensation. This value must be entered in the RJ_EXTERNAL_VALUE parameter.

The units displayed are selected with the PRIMARY_VALUE_UNIT and SENSOR_ RANGE → UNITS_INDEX parameters. It must be ensured that the selected units physically suit the measured variables.

The Sensor 1 and 2 Transducer Blocks each provide the "Quick Setup" wizard for the quick and safe configuration of the measurement settings.

A sensor error adjustment can be performed with the sensor offset function. Here, the difference between the reference temperature (target value) and the measured temperature (actual value) is determined and entered in the SENSOR_OFFSET parameter. This results in a parallel shift of the standard sensor characteristic and an adjustment between the target value and actual value.



20 Sensor offset

X Offset
1 Sensor characteristic with offset setting
2 Standard sensor characteristic

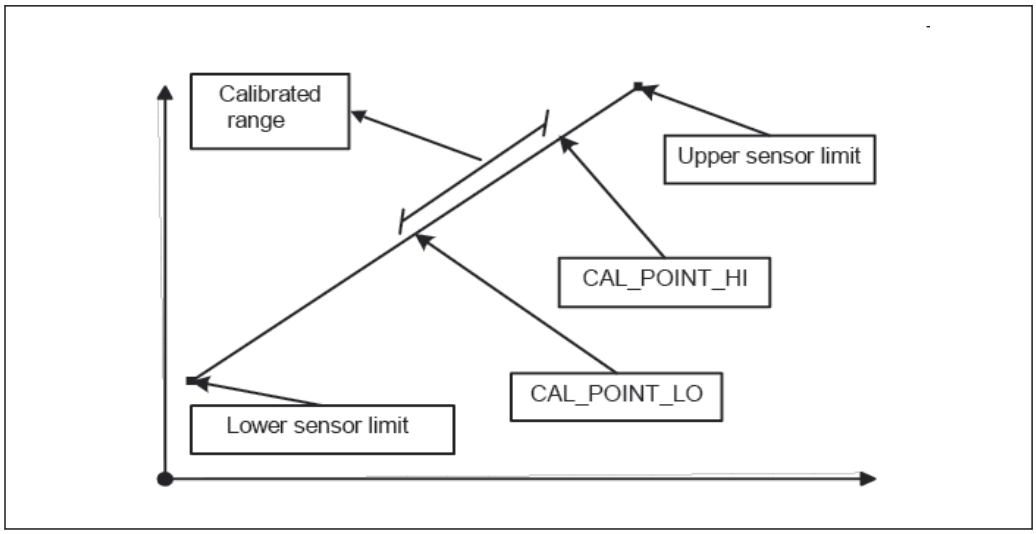
The Sensor 1 and 2 Transducer Blocks also allow users to linearize any sensor type by entering polynomial coefficients. The design provides for three types of linearization:

Linear scaling of temperature-linear curve:

The complete measuring point (device + sensor) can be adapted to the desired process using linear scaling (offset and slope). It is necessary to run through the following procedure for this purpose:

1. Switch the setting for the SENSOR_CAL_METHOD parameter to "user trim standard calibration". Then apply the lowest process value to be expected (e.g. -10 °C) to the sensor of the device. This value is then entered in the CAL_POINT_LO parameter. Make sure that the status for SENSOR_VALUE is "Good".
2. Now apply the highest process value to be expected (e.g. 120 °C) to the sensor, again ensure the status is "Good" and enter the value in the CAL_POINT_HI parameter. The device now shows precisely the specified process value at the two calibrated points. The curve follows a straight line between the points.
3. The SENSOR_CAL_LOC, SENSOR_CAL_DATE and SENSOR_CAL_WHO parameters are available to track the sensor calibration. The place, date and time of calibration can be entered here along with the name of the person responsible for the calibration.
4. To undo sensor input calibration, set the SENSOR_CAL_METHOD parameter to "factory trim standard calibration".

Menu guidance via the "User Sensor Trim" wizard is available for linear scaling. The "Factory Trim Settings" wizard can be used to reset the scaling.



21 *Linear scaling of temperature-linear curve*

Linearization of platinum resistance thermometers using Callendar Van Dusen coefficients:

The coefficients R0, A, B, C can be specified in the CVD_COEFF_R0, CVD_COEFF_A, CVD_COEFF__B, CVD_COEFF_C parameters. To activate this linearization, select the "RTD Callendar Van Dusen" setting in the SENSOR_TYPE parameter. In addition, the upper and lower calculation limits must be entered in the CVD_COEFF_MIN and CVD_COEFF_MAX parameters.

The Callendar Van Dusen coefficients can also be entered via the "Callendar Van Dusen" wizard.

Linearization of copper/nickel resistance thermometers (RTD):

The coefficients R0, A, B, C can be specified in the POLY_COEFF_R0, POLY_COEFF_A, POLY_COEFF_B, POLY_COEFF_C parameters. To activate this linearization, select the "RTD nickel polynomial" or "RTD copper polynomial" setting in the SENSOR_TYPE parameter, depending on the sensor element used. In addition, the upper and lower calculation limits must be entered in the POLY_COEFF_MIN and POLY_COEFF_ MAX parameters.

The coefficients for the nickel and copper polynomials can be entered with the aid of a wizard in the Sensor 1 and 2 Transducer Blocks.

Each of the values can be passed onto an AI function block or shown on the display. The AI Block and the Display Block provide additional ways for displaying and scaling measured values.

Block configuration error:

The device may display the diagnostic event "437-configuration" due to an incorrect setting. This means that the current configuration of the transmitter is not valid. The BLOCK_ERR_DESC1 parameter in the Transducer Blocks displays the reason for this configuration error.

Display	Description
Sensor 1 is 4 wire RTD and sensor 2 is RTD	If sensor 1 is configured as a 4 wire RTD, an RTD cannot be selected at sensor 2.
Sensor type 1 and sensor unit 1 do not match	The sensor type at channel 1 and the selected sensor unit do not match.
Sensor type 2 and sensor unit 2 do not match	The sensor type at channel 2 and the selected sensor unit do not match.

Display	Description
PV type calculation mode and "No Sensor" chosen	The PV is an interconnection of the two sensor inputs, but "No Sensor" is selected as the sensor type.
PV type calculation mode, sensor 1 unit Ohm and sensor 2 unit not Ohm	The PV is an interconnection of the two sensor inputs; sensor unit 1 is Ohm but sensor unit 2 is not.
PV type calculation mode, sensor 2 unit Ohm and sensor 1 unit not Ohm	The PV is an interconnection of the two sensor inputs; sensor unit 2 is Ohm but sensor unit 1 is not.
PV type calculation mode, sensor 1 unit mV and sensor 2 unit not mV	The PV is an interconnection of the two sensor inputs; sensor unit 1 is mV but sensor unit 2 is not.
PV type calculation mode, sensor 2 unit mV and sensor 1 unit not mV	The PV is an interconnection of the two sensor inputs; sensor unit 2 is mV but sensor unit 1 is not.
Sensor 1 unit and PV unit do not match	The sensor 1 unit and the PV unit are not compatible.
Sensor 2 unit and PV unit do not match	The sensor 2 unit and the PV unit are not compatible.
Drift and "No Sensor" chosen	The sensor drift function has been activated but "No Sensor" has been selected as the sensor type.
Drift chosen and units do not match	The sensor drift function has been activated but the units of the two sensors are not compatible.

The following table shows all the device-specific parameters of the Sensor Transducer Blocks:

Transducer Block "Sensor 1 and 2" (device-specific parameters)

Parameter	Write access with operating mode (MODE_BLK)	Description
Primary value (PRIMARY_ VALUE)	Dynamic / read only	Result of link PRIMARY_VALUE_TYPE: ▪ VALUE ▪ STATUS The PRIMARY_VALUE value can be made available to an AI Block for further processing. The PRIMARY_VALUE_UNIT is the assigned unit.
Primary value unit (PRIMARY_ VALUE_UNIT)	OOS	Setting for the unit of the PRIMARY_VALUE The measurement range and unit are configured with an existing link in the Analog Input function block using the XD_SCALE parameter group. A detailed description of the Analog Input (AI) function block is provided in the FOUNDATION Fieldbus™ Function Block Manual on the CD-ROM provided (BA00062S/04).

Parameter	Write access with operating mode (MODE_BLK)	Description
Primary value type (PRIMARY_VALUE_TYPE)	OOS	Displays the calculation process for the PRIMARY_VALUE. **Display:** Sensor Transducer 1: ▪ PV = SV_1: Sensor value 1 ▪ PV = SV_1-SV_2: Difference ▪ PV = 0.5 x (SV_1+SV_2): Average ▪ PV = 0.5 x (SV_1+SV_2) Redundancy: Average or Sensor Value 1 or Sensor Value 2 in the event of a sensor error in the other sensor. ▪ PV = SV_1 (OR SV_2): Backup function: If sensor 1 fails, the value of sensor 2 automatically becomes the Primary Value. ▪ PV = SV_1 (OR SV_2 if SV_1>T): PV changes from SV_1 to SV_2 if SV_1 > value T (THRESHOLD_ VALUE parameter) Sensor Transducer 2: ▪ PV = SV_2: Sensor value 2 ▪ PV = SV_2-SV_1: Difference ▪ PV = 0.5 x (SV_2+SV_1): Average ▪ PV = 0.5 x (SV_2+SV_1) Redundancy: Average or Sensor Value 1 or Sensor Value 2 in the event of a sensor error in the other sensor. ▪ PV = SV_2 (OR SV_1): Backup function: If sensor 2 fails, the value of sensor 1 automatically becomes the Primary Value. ▪ PV = SV_2 (OR SV 1 if SV_2>T): PV changes from SV_2 to SV_1 if SV_2 > value T (THRESHOLD_VALUE parameter)
Threshold value (THRESHOLD_ VALUE)	OOS	Value for switching in the threshold PV mode. Entry in the range from−270 to 2 450 °C (−454 to 4 442 °F) -270°C to 2450°C (-454°F to 4442°F)
Primary value max. indicator (PV_MAX_INDICATOR)	AUTO - OOS	Max. indicator for PV is stored in the non-volatile memory in intervals of 10 minutes. Can be reset.
Primary value min. indicator (PV_MIN_INDICATOR)	AUTO - OOS	Min. indicator for PV, is stored in the non-volatile memory in intervals of 10 minutes. Can be reset.
Sensor value (SENSOR_ VALUE)	Dynamic / read only	Sensor Transducer 1: ▪ VALUE = Value of the sensor connected to the S1 terminal group ▪ STATUS = Status of this value Sensor Transducer 2: ▪ VALUE = Value of the sensor connected to the S2 terminal group ▪ STATUS = Status of this value
Sensor type (SENSOR_ TYPE)	OOS	Setting for the sensor type. Sensor Transducer 1: Settings for sensor input 1 Sensor Transducer 2: Settings for sensor input 2 Please observe the wiring diagram in when connecting the individual sensors. In the case of 2-channel operation, the possible connection options in must also be observed.
Sensor connection (SENSOR_ CONNECTION)	OOS	Sensor connection type: Sensor Transducer 1: ▪ 2-wire ▪ 3-wire ▪ 4-wire Sensor Transducer 2: ▪ 2-wire ▪ 3-wire

Parameter	Write access with operating mode (MODE_BLK)	Description
Sensor range (SENSOR_ RANGE)	Read only (EU_100, EU_0) OOS (UNITS_INDEX, DECIMAL)	Physical measuring range of the sensor: EU_100 (upper sensor range limit) EU_0 (lower sensor range limit) UNITS_INDEX (unit of the SENSOR_VALUE) DECIMAL (number of decimal places for the SENSOR_VALUE. This does not affect the measured value display.)
Sensor offset (SENSOR_ OFFSET)	OOS	Offset of the SENSOR_VALUE The following values are permitted: ▪ -10 to +10 for Celsius, Kelvin, mV and Ohm ▪ -18 to +18 for Fahrenheit, Rankine
2-wire compensation (TWO_WIRE_ COMPENSATION)	OOS	Two-wire compensation The following values are permitted: 0 to 30 Ω
Sensor serial number (SENSOR_SN)	AUTO - OOS	Sensor serial number
Sensor max. indicator (SENSOR_MAX_ INDICATOR)	AUTO - OOS	Max. indicator of the SENSOR_VALUE Is stored in the non-volatile memory in intervals of 10 minutes. Can be reset.
Sensor min. indicator SENSOR_MIN_ INDICATOR	AUTO - OOS	Min. indicator of the SENSOR_VALUE Is stored in the non-volatile memory in intervals of 10 minutes. Can be reset.
Mains filter (MAINS_FILTER)	OOS	Mains filter for the A/D converter
Calibration highest point (CAL_POINT_HI)	OOS	Upper point for linear characteristic calibration (this affects offset and slope). To be able to write this parameter, "SENSOR_CAL_METHOD" must be set to "User trim standard calibration".
Calibration lowest point (CAL_POINT_LO)	OOS	Lower point for linear characteristic calibration (this affects offset and slope). To be able to write this parameter, "SENSOR_CAL_METHOD" must be set to "User trim standard calibration".
Calibration minimum span (CAL_MIN_SPAN)	OOS	Span of the measurement range, depending on the configured sensor type.
Calibration unit (CAL_UNIT)	Read only	Unit for sensor calibration.
Sensor calibration method (SENSOR_CAL_ METHOD)	OOS	Factory trim standard calibration: Sensor linearization with the factory calibration values User trim standard calibration: Sensor linearization with the values CAL_POINT_HI and CAL_POINT_LO The original linearization can be restored by resetting this parameter to "Factory trim standard calibration". The Transducer Block makes a wizard available (User Sensor Trim) for linear characteristic calibration.
Sensor calibration location (SENSOR_CAL_ LOC)	AUTO - OOS	Name of the location where the sensor calibration was performed.
Sensor calibration date (SENSOR_CAL_ DATE)	AUTO - OOS	Date and time of the calibration.
Sensor calibration who (SENSOR_CAL_ WHO)	AUTO - OOS	Name of the person responsible for the calibration.

Parameter	Write access with operating mode (MODE_BLK)	Description
Callendar Van Dusen A (CVD_COEFF_A)	OOS	Sensor linearization according to the Callendar Van Dusen method. The CVD_COEFF_XX parameters are used to calculate the sensor characteristic curve if "RTD-Callendar Van Dusen" is set in the SENSOR_TYPE parameter. Both Transducer Blocks make a wizard available for configuring the parameters according to the "Callendar Van Dusen method".
Callendar Van Dusen B (CVD_COEFF_B)	OOS	
Callendar Van Dusen C (CVD_COEFF_C)	OOS	
Callendar Van Dusen R0 (CVD_COEFF_R0)	OOS	
Callendar Van Dusen Measuring Range Maximum (CVD_COEFF_MAX)	OOS	Upper calculation limit for Callendar Van Dusen linearization.
Callendar Van Dusen Measuring Range Minimum (CVD_COEFF_MIN)	OOS	Lower calculation limit for Callendar Van Dusen linearization.
Polynom Coeff. A (POLY_COEFF_A)	OOS	Sensor linearization of copper/nickel resistance thermometers (RTD). The POLY_COEFF_XX parameters are used to calculate the sensor characteristic curve if "RTD - polynomial nickel" or "RTD - polynomial copper" is set in the SENSOR_TYPE parameter. Both Transducer Blocks make a wizard available (Sensor Polynomial) for configuring the parameters according to the "Polynomial method".
Polynom Coeff. B (POLY_COEFF_B)	OOS	
Polynom Coeff. C (POLY_COEFF_C)	OOS	
Polynom Coeff. R0 (POLY_COEFF_R0)	OOS	
Polynom (Nickel/ Copper) Measuring Range Maximum (POLY_COEFF_ MAX)	OOS	Upper calculation limit for the RTD polynomial (nickel/ copper) linearization.
Polynom (Nickel/ Copper) Measuring Range Minimum (POLY_COEFF_ MIN)	OOS	Lower calculation limit for the RTD polynomial (nickel/ copper) linearization.
Device temperature (DEVTEMP_ VALUE)	Dynamic / read only	Internal device temperature measurement: ▪ VALUE ▪ STATUS
Reference junction type (RJ_TYPE)	OOS	Configuration of reference junction measurement for temperature compensation: ▪ NO_REFERENCE: No temperature compensation is used. ▪ INTERNAL: The internal reference junction temperature is used for temperature compensation. ▪ EXTERNAL: RJ_EXTERNAL_VALUE is used for temperature compensation.
Device temperature value unit (DEVTEMP_UNIT)	Read only	Unit of the internal device temperature. This always corresponds to the unit set in SENSOR_RANGE → UNITS_INDEX.
Reference junction external value (RJ_EXTERNAL_VALUE)	OOS	Value for temperature compensation (see the RJ_TYPE parameter).
Device temperature max. indicator (DEVTEMP_ MAX_INDICATOR)	AUTO - OOS	Max. indicator for the internal device temperature, is stored in the non-volatile memory in intervals of 10 minutes.
Device temperature min. indicator (DEVTEMP_ MIN_INDICATOR)	AUTO - OOS	Min. indicator for the internal device temperature, is stored in the non-volatile memory in intervals of 10 minutes.

14.3.8 Transducer Block "Advanced Diagnostic"

The "Advanced Diagnostic" Transducer Block is used to configure and display all the diagnostic functions of the transmitter.

Functions such as

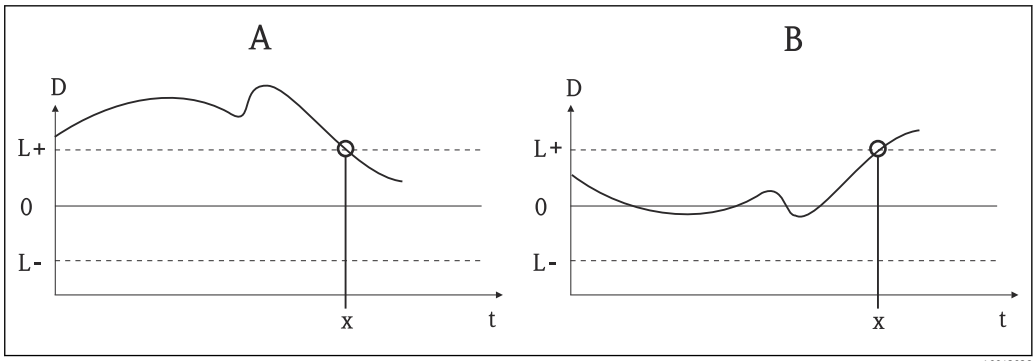
- Corrosion detection
- Drift detection
- Ambient temperature monitoring

are displayed here.

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 (see also → 📄 43).

Drift detection can be configured with the SENSOR_DRIFT_MONITORING parameter. Drift detection can be enabled or disabled. If drift detection is enabled and a drift occurs, an error or maintenance request is generated. A distinction is made between 2 specific modes (SENSOR_ DRIFT_MODE). In the 'Overshooting' mode, a status message is generated if the limit value (SENSOR_DRIFT_ALERT_VALUE) for the drift is overshot, or if the limit value is undershot in the 'Undershooting' mode.



22 Drift detection

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

In addition, the entire status information of the device and the maximum/minimum indicators for the two sensor values and the internal temperature are also available.

Transducer Block "ADVANCED DIAGNOSTIC" (device-specific parameters)

Parameter	Write access with operating mode (MODE_BLK)	Description
Corrosion detection (CORROSION_ DETECTION)	OOS	▪ OFF: Corrosion detection off ▪ ON: Corrosion detection on Only possible for RTD 4-wire connection and thermocouples (TC).
Sensor Drift monitoring (SENSOR_ DRIFT_MONITORING)	OOS	Drift between SV1 and SV2 is displayed according to the field diagnostic configuration of diagnostic event "103 - Drift": ▪ OFF: Sensor drift monitoring off (diagnostic event 103 has been deactivated) ▪ ON: Sensor drift monitoring on (when a drift occurs, diagnostic event 103 is displayed with the category configured for the event)
Sensor Drift mode (SENSOR_ DRIFT_MO DE)	OOS	Select whether a status is generated if the value set in the SENSOR_DRIFT_LIMIT parameter is undershot (Undershooting) or overshot (Overshooting). If "Overshooting" is selected, the corresponding diagnostic event is generated if the limit value is overshot (SENSOR_DRIFT_LIMIT). In the case of "Undershooting", the diagnostic event is output if the limit value is undershot.
Sensor Drift alert value (SENSOR_ DRIFT_ALERT_VALUE)	OOS	Limit value of the permitted drift from 1 to 999.99.
System Alarm delay (SYSTEM_ ALARM_DELAY)	OOS	Alarm hysteresis: Value specifying the time a diagnostic event (F, C, S, M) and measured value status (Bad or Uncertain) is delayed until the status is output. Can be set between 0 and 10 seconds. This setting does not affect the display.
Actual Status Category / Previous Status Category (ACTUAL_ STATUS_ CATE GORY / PREVIOUS_ STATUS_ CATEGORY)	Read only / AUTO - OOS	Current/last status category ▪ Good: No errors detected ▪ F: Failure: Error detected ▪ C: Function check: Device is in the service mode ▪ S: Out of Spec.: Device is being operated outside the specifications ▪ M: Maintenance required ▪ Not categorized: No Namur category has been selected for the current diagnostic event.

Parameter	Write access with operating mode (MODE_BLK)	Description
Actual Status Number / Previous Status Number (ACTUAL_ STATUS_ NUMBER / PREVIOUS_ STATUS_ NUMBER)	Read only / AUTO - OOS	Current/previous status number: 000 NO_ERROR: No error is present 041 SENSOR_BREAK: Sensor break 043 SENSOR_SHORTCUT: Sensor short-circuit 042 SENSOR_CORROSION: Corrosion of terminals or sensor cables 101 SENSOR_UNDERUSAGE: Sensor measured value is below the linearization range 102 SENSOR_OVERUSAGE: Sensor measured value is above the linearization range 104 BACKUP_ACTIVATED: Backup function activated due to sensor failure 103 DEVIATION: Sensor drift detected 501 DEVICE_PRESET: Reset routine in progress 482 SIMULATION: Device is in the simulation mode 402 STARTUP: Device is in the startup/initialization phase 502 LINEARIZATION: Linearization incorrectly selected or configured 901 AMBIENT_TEMPERATUR_LOW: Ambient temperature too low; DEVTEMP_VALUE < −40 °C (−40 °F) 902 AMBIENT_TEMPERATURE_HIGH: Ambient temperature too high; DEVTEMP_VALUE > 85 °C (185 °F) 261 ELECTRONICBOARD: Electronics module/hardware faulty 431 NO_CALIBRATION: Calibration values lost/modified 283 MEMORY_ERROR: Contents of memory inconsistent 221 RJ_ERROR: Error in reference junction measurement/ internal temperature measurement
Actual Status Channel / Previous Status Channel (PREVIOUS/ ACTUAL_ STATUS_ CHANNEL)	Read only / AUTO - OOS	ACTUAL_STATUS_CHANNEL displays the channel that currently has the error with the highest value. PREVIOUS_STATUS_CHANNEL indicates the channel where an error last occurred.
Actual Status Description / Previous Status Description (PREVIOUS/ ACTUAL_ STATUS_DESC)	Read only / AUTO - OOS	Displays the descriptions of the current and previous error status. The descriptions can be taken from the description for the Actual Status Number/ Previous Status Number parameter.
Actual Status Count (ACTUAL_ STATUS_ COUNT)	Read only	The number of status messages currently active in the device.
Primary Value 1 Max. Indicator PV1_MAX_ INDICATOR	AUTO - OOS	Indicator for the maximum value to occur for PV1, can be reset by writing any value in this parameter.
Primary Value 1 Min. Indicator PV1_MIN_ INDICATOR	AUTO - OOS	Indicator for the minimum value to occur for PV1, can be reset by writing any value in this parameter.
Primary Value 2 Max. Indicator PV2_MAX_ INDICATOR	AUTO - OOS	Indicator for the maximum value to occur for PV2, can be reset by writing any value in this parameter.
Primary Value 2 Min. Indicator PV2_MIN_ INDICATOR	AUTO - OOS	Indicator for the minimum value to occur for PV2, can be reset by writing any value in this parameter.
Sensor 1 Max. Indicator SV1_MAX_ INDICATOR	AUTO - OOS	Indicator for the maximum value to occur at sensor 1, can be reset by writing any value in this parameter.
Sensor 1 Min. Indicator SV1_MIN_ INDICATOR	AUTO - OOS	Indicator for the minimum value to occur at sensor 1, can be reset by writing any value in this parameter.
Sensor 2 Max. Indicator SV2_MAX_ INDICATOR	AUTO - OOS	Indicator for the maximum value to occur at sensor 2, can be reset by writing any value in this parameter.

Parameter	Write access with operating mode (MODE_BLK)	Description
Sensor 2 Min. Indicator SV2_MIN_ INDICATOR	AUTO - OOS	Indicator for the minimum value to occur at sensor 2, can be reset by writing any value in this parameter.
Device Temperature Max. Indicator DEVTEMP_ MAX_ INDICATOR	AUTO - OOS	Indicator for the maximum value to occur at the internal reference temperature measuring point, can be reset by writing any value in this parameter.
Device Temperature Min. Indicator DEVTEMP_MIN_ INDICATOR	AUTO - OOS	Indicator for the minimum value to occur at the internal reference temperature measuring point, can be reset by writing any value in this parameter.
CONFIG_ AREA_1...CONFIG_ AREA_15	OOS	The configurable area of FOUNDATION Fieldbus field diagnostics. One of the four diagnostic events: ▪ 42 - Corrosion ▪ 103 - Drift ▪ 901 - Ambient temperature too low ▪ 902 - Ambient temperature too high can be separated from the factory-configured diagnostic group and categorized individually here. By setting the event to one of the Field Diagnostic Bits 1-15, the category for this bit can be configured in the Resource Block to one of the categories F, C, S, M (→ 🖹 92).
STATUS_SELECT_ 42	OOS	The measured value status (BAD, UNCERTAIN, GOOD) can be configured for the individual diagnostic event
STATUS_SELECT_ 103	OOS	
STATUS_SELECT_ 901	OOS	
STATUS_SELECT_ 902	OOS	
DIAGNOSIS_ SIMULATION_ ENABLE	OOS	Enable/disable simulation of a diagnostic event.
DIAGNOSIS_ SIMULATION_ NUMBER	AUTO - OOS	Use this function to select the diagnostic event to be simulated.

14.3.9 Transducer Block "Display"

The settings in the "Display" Transducer Block make it possible to display measured values from the two Transducer Blocks "Sensor 1 + 2" on the optional display. The selection is made via the DISPLAY_SOURCE_X1 parameter. The number of decimal places displayed can be configured independently for every channel using the DISP_VALUE_X_FORMAT parameter. Symbols are available for the units °C, K, F, %, mV, R and Ω. These units are displayed automatically when the measured value is selected.

The "Display" Transducer Block can show up to 3 values alternately on the display. The display automatically switches between the values after a configurable time interval (between 6 and 60 seconds), which can be set in the ALTERNATING_TIME parameter.

Transducer Block "DISPLAY" (device-specific parameters)

Parameter	Write access with operating mode (MODE_BLK)	Description
Alternating time ALTERNATING_TIME	AUTO - OOS	Entry (in s) specifying how long a value should be shown on the display. Setting from 6 to 60 s.
Display value x DISP_VALUE_X1)	Read only	Selected measured value: ▪ Status ▪ Value

Parameter	Write access with operating mode (MODE_BLK)	Description
Display source x DISP_SOURCE_X	AUTO - OOS	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 ▪ Device temperature 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, 'SENSOR_TYPE' parameter), primary value 2 is displayed.
Display value description x DISP_VALUE_X_DESC	AUTO - OOS	Description of value displayed. Maximum 12 letters. The value is not shown on the display.
Decimal places x DISP_VALUE_ X_FORMAT	AUTO - OOS	Use this function to select the number of decimal places displayed. Choose between 0 and 4. The option 4 'AUTO' means that the maximum possible number of decimal places will always appear on the display. Possible settings: ▪ Auto ▪ xxxxx ▪ xxxx.x ▪ xxx.xx ▪ xx.xxx

Example of parameterization:

The following measured values should be shown on the display:

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

Value 2:	
Measured value to be displayed:	DEVTEMP_VALUE
Measured value unit:	° C
Decimal places:	1

Value 3:	
Measured value to be displayed:	Sensor Value (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.

The following settings should therefore be made in the "Display" Transducer Block:

Parameter	Value
DISP_SOURCE_1	'Primary Value 1'
DISP_VALUE_1_DESC	TEMP PIPE 11
DISPLAY_VALUE_1_FORMAT	'xxx.xx'
DISP_SOURCE_2	'DEVTEMP_VALUE'
DISP_VALUE_2_DESC	INTERN TEMP
DISPLAY_VALUE_2_FORMAT	'xxxx.x'
DISP_SOURCE_3	'Sensor value 2'
DISP_SOURCE_3	PIPE 11 BACK
DISPLAY_VALUE_3_FORMAT	'xxx.xx'
ALTERNATING_TIME	12

14.4 Analog Input function block

In the Analog Input function block (AI function block), the process variables from the Transducer Blocks are prepared for subsequent automation functions (e.g. linearization, scaling and limit value processing). The automation function is defined by interconnecting the outputs. A detailed description of the Analog Input (AI) function block is provided in the FOUNDATION Fieldbus™ Function Block Manual on the CD-ROM provided (BA00062S/04).

14.5 PID function block (PID controller)

A PID function block contains input channel processing, proportional-integral-differential control (PID) and analog output channel processing. The configuration of the PID function block depends on the automation task. The following can be implemented: Basic controls, feedforward control, cascade control and cascade control with limiting. The options available for measured value processing within the PID function block include: signal scaling, signal limitation, operating mode control, feedforward control, limitation control, alarm detection, signal status forwarding. A detailed description of the PID function block is provided in the FOUNDATION Fieldbus™ Function Block Manual on the CD-ROM provided (BA00062S/04).

14.6 Input Selector function block

The Input Selector Block enables the selection of up to four inputs and generates an output based on the configured action. A detailed description of the Input Selector function block is provided in the FOUNDATION Fieldbus™ Function Block Manual on the CD-ROM provided (BA00062S/04).

14.7 Configuring event behavior according to FOUNDATION Fieldbus™ Field Diagnostics

The device supports FOUNDATION Fieldbus Field Diagnostics configuration. Among other things this means that:

- The diagnostic category as per NAMUR Recommendation NE107 is transmitted over the fieldbus in a format that is independent of the manufacturer:
  - F: Failure
  - C: Function check
  - S: Out of specification
  - M: Maintenance required
- The diagnostic category of the predefined event groups can be adapted by the user according to the requirements of the individual application.
- Certain events can be separated from their group and be treated individually:
  - 042: Sensor corrosion
  - 103: Drift
  - 901: Ambient temperature too low
  - 902: Ambient temperature too high
- Additional information and troubleshooting measures are transmitted over the fieldbus with the event message.

It is important to ensure that the Multi-bit Alarm Support option is activated in the FEATURE_SEL parameter from the Resource Block.

14.7.1 Event groups

The diagnostic events are divided into 16 default groups according to the source and the importance (weighting) of the event. A default event category is assigned to each group at the factory. Here, one bit of the assignment parameters belongs to every event group. Default assignments of diagnostic messages to the individual groups are defined in the following table.

Event weighting	Default event category	Event source	Bit	Events in this group
Highest weighting	Failure (F)	Sensor	31	▪ F041: Sensor break ▪ F043: Sensor short-circuit
		Electronics	30	▪ F221: Reference measurement ▪ F261: Device electronics ▪ F283: Memory error
		Configuration	29	▪ F431: Reference values ▪ F437: Configuration error
		Process	28	Not used with this device

Event weighting	Default event category	Event source	Bit	Events in this group
High weighting	Function check (C)	Sensor	27	Not used with this device
		Electronics	26	Not used with this device
		Configuration	25	▪ C402: Device initialization ▪ C482: Simulation active ▪ C501: Device reset
		Process	24	Not used with this device

Event weighting	Default event category	Event source	Bit	Events in this group
Low weighting	Out of specification (S)	Sensor	23	Not used with this device
		Electronics	22	Not used with this device
		Configuration	21	S502: Special linearization
		Process	20	▪ S901: Ambient temperature too low [1)] ▪ S902: Ambient temperature too high [1)]

1) This event can be removed from the group and treated separately; see the "Configurable area" section.

Event weighting	Default event category	Event source	Bit	Events in this group
Lowest weighting	Maintenance required (M)	Sensor	19	▪ M042: Sensor corrosion [1)] ▪ M101: Sensor value too low ▪ M102: Sensor value too high ▪ M103: Sensor drift/difference [1)] ▪ M104: Backup active
		Electronics	18	Not used with this device
		Configuration	17	Not used with this device
		Process	16	Not used with this device

1) This event can be removed from the group and treated separately; see the "Configurable area" section.

14.7.2 Assignment parameters

Event categories are assigned to the event groups via four assignment parameters. These are located in the RESOURCE Block (RB2):

- FD_FAIL_MAP: For the "Failure (F)" event category
- FD_CHECK_MAP: For the Function Check (C) event category
- FD_OFFSPEC_MAP: For the Out of Specification (S) event category
- FD_MAINT_MAP: For the "Maintenance required (M)" event category

Each of these parameters consists of 32 bits with the following meaning:

- Bit 0: Reserved by the Fieldbus Foundation
- Bits 1-15:
  Configurable area; certain diagnostic events can be assigned independently of the event group they belong to. They are then removed from the event group and their behavior can be configured individually. The following parameters can be assigned to the configurable area of this device:
  - 042:
    Sensor corrosion
  - 103:
    Drift
  - 901:
    Ambient temperature too low
  - 902:
    Ambient temperature too high
- Bits 16-31: standard range; these bits are permanently assigned to the event groups. If the bit is set to 1, this event group is assigned to the individual event category.

The following table indicates the default setting of the assignment parameters. In the default setting, there is a clear assignment between the event weighting and the event category (i.e. the assignment parameter).

Default setting of assignment parameters

	Standard area																Configurable area
Event weighting	Highest weighting				High weighting				Low weighting				Lowest weighting				
Event source1) [1)]	S	E	C	P	S	E	C	P	S	E	C	P	S	E	C	P	
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15...1
FD_FAIL_MAP	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
FD_CHECK_MAP	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0
FD_OFFSPEC_MAP	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0
FD_MAINT_MAP	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0

1) S: Sensor; E: Electronics; C: Configuration; P: Process

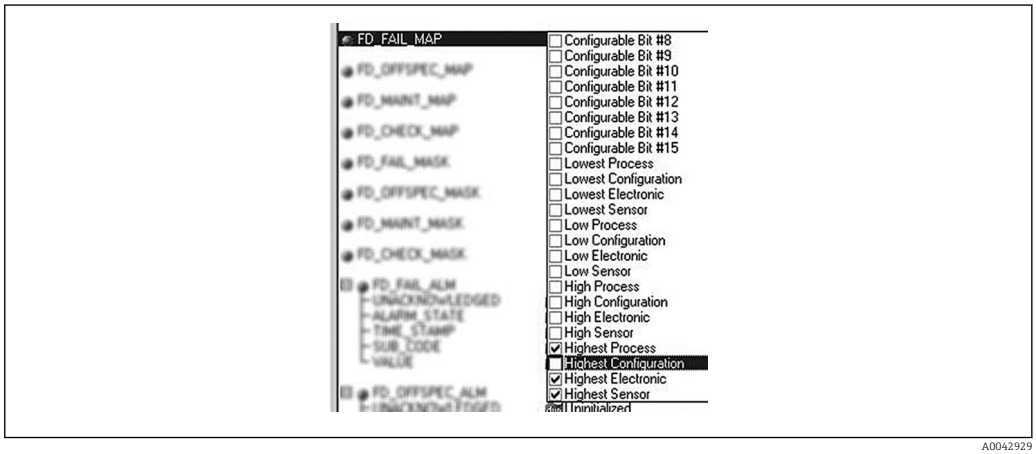
Proceed as follows to change the diagnostic behavior of an event group:

1. Open the assignment parameter in which the group is currently assigned.
2. Change the event group bit from 1 to 0. In the configuration systems, this is done by deselecting the corresponding check box.
3. Open the assignment parameter to which the group should be assigned.
4. Change the event group bit from 0 to 1. In the configuration systems, this is done by ticking the corresponding check box.

Example

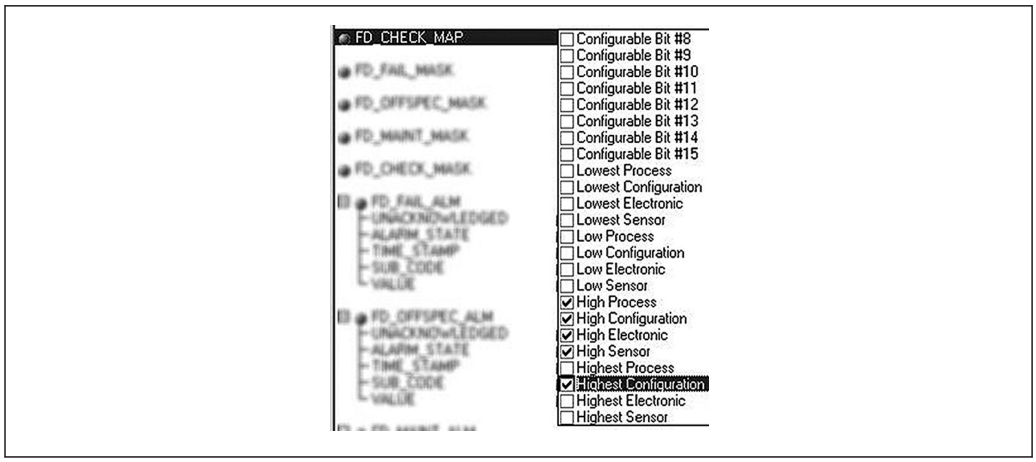
The Highest Weighting/Configuration Error group contains the events 431: Calibration values and 437: Configuration error. These should be categorized as Function check (C) and no longer as Failure (F).

In the Resource Block, search for the "Highest Configuration" group in the FD_FAIL_MAP parameter and deselect the corresponding check box.



A0042929

Then search for the "Highest Configuration" group in the FD_CHECK_MAP parameter and tick the corresponding check box.



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It is important to ensure that the corresponding bit is set in at least one of the assignment parameters for each event group. Otherwise no category will be transmitted with the event over the bus, and the control system will therefore generally ignore the presence of the event.

The detection of diagnostic events is parameterized with the MAP parameters (F, C, S, M) but the transmission of messages over the bus is not. The latter is done with the MASK parameters. The Resource Block must be in the Auto mode for the status information to be transmitted over the bus.

14.7.3 Configurable area

The event category can be individually defined for the following events - irrespective of the event group they are assigned to in the default setting:

- 042: Sensor corrosion
- 103: Drift
- 901: Ambient temperature too low
- 902: Ambient temperature too high

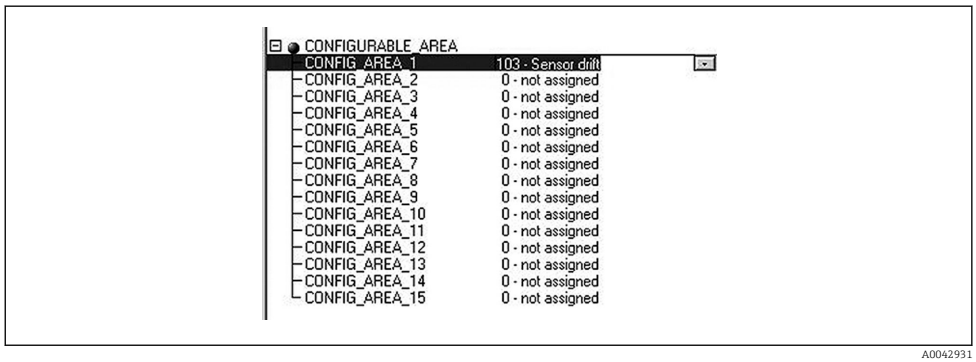
To change the event category, the event first has to be assigned to one of the bits 1 to 15. The ConfigArea_1 to ConfigArea_15 parameters in the ADVANCED DIAGNOSTIC (ADVDIAG) Block are used for this. Then the corresponding bit can be set from 0 to 1 in the desired assignment parameter.

Example

The diagnostic event 103 "Drift" should no longer be categorized as Maintenance required (M) and should be categorized as Out of Specification (S) instead. Furthermore the status of the measurement value should display BAD in this case.

1. Navigate to the Advanced Diagnostic Transducer Block and the CONFIGURABLE_AREA parameter.
   ↳ In the default setting, all bits in the Configurable Area Bits column have the value "not assigned".

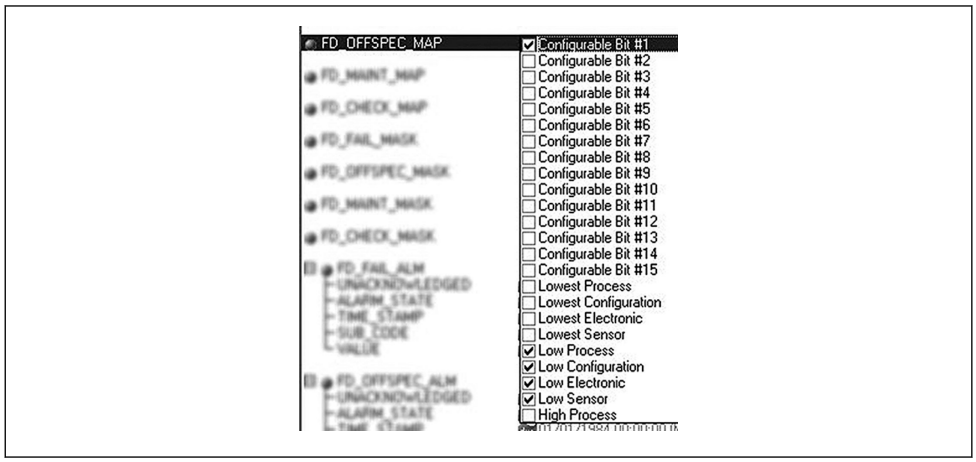
2.



A0042931

Select one of these bits (here for example: Configurable Area Bit 1) and select the Drift option from the corresponding selection list. Press Enter to confirm the option selected.

3.



A0042932

Now go to the Resource Block and activate the corresponding bit (here: Configurable Area Bit 1) in the FD_OFFSPEC_MAP parameter.

4. The measurement value status can now also be set for this event. With the STATUS_SELECT_103 parameter, the measured value status BAD is selected for this purpose via the selection menu.

14.7.4 Reasons for a diagnostic event and corrective action

In the FD_RECOMMEN_ACT parameter in the Resource Block, a description is displayed for the diagnostic event with the highest priority that is currently active. This description has the following structure:

Diagnostic number:Diagnostic text with channel (ch x):troubleshooting recommendations separated by hyphens, e.g. for the diagnostic event sensor break: 41:Sensor break ch01:Check electrical connection - Replace sensor - Check configuration of the connection type

The value transmitted via the bus has the following structure: XXYYY

XX = Channel number

YYY = Diagnostic number

For the "Sensor break" example above, this value is 01041

14.8 Transmission of event messages over the bus

The process control system used must support the transmission of event messages.

14.8.1 Event priority

Event messages are only transmitted over the bus if their priority is between 2 and 15. Priority 1-events are displayed but are not transmitted over the bus. Priority 0-events are ignored. In the factory setting, the priority of all events is 0. The priority can be individually changed for the four assignment parameters. The 4 PRI (F, C, S, M) parameters from the Resource Block are used for this purpose.

14.8.2 Suppressing certain events

It is possible to suppress certain events during transmission over the bus using a mask. While these events are displayed they are not transmitted over the bus. This mask can be found in the MASK parameters (F, C, S, M). The mask is a negative selection mask, i.e. if a field is selected the associated events are not transmitted over the bus.

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