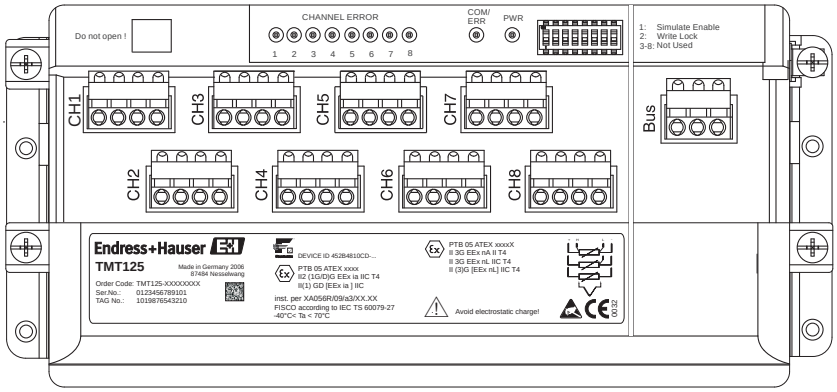
Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Operating Instructions

iTEMP® TMT125

Temperature transmitter with 8 input channels and FOUNDATION Fieldbus™ protocol



BA00240R/09/en/01.11
Device software
01.02
71033906

Endress+Hauser

People for Process Automation

Brief Overview

For quick and easy commissioning:

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Device-specific parameters are configured and automation functions for FOUNDATION Fieldbus™ are specified using configuration programs of various manufacturers.	
↓	
Customer-specific configuration/ Description of device functions	→ 44
Complex measurement tasks require the configuration of additional functions which you can individually select, set and adapt to your process conditions using the relevant device parameters.	

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1 Safety instructions

1.1 Designated use

- The 8 channel device transfers signals from resistance temperature measuring sensors (RTD's), thermocouples (TC's), resistance and millivolt signals via FOUNDATION Fieldbus™. Each channel could be configured independently.
- The device can be used for FOUNDATION Fieldbus™ H1 bus that use the physical layout in accordance with IEC 61158-2/ISA-S50.02-1992.
- The manufacturer cannot be held responsible for damage caused by misuse of the unit. The device can, however, be a source of danger if used incorrectly or for anything other than the designated use.

1.2 Installation, commissioning and operation

Note the following points:

- The device may only be installed, connected, commissioned and maintained by properly qualified and authorized staff (e.g. electrical technicians) in strict compliance with these Operating Instructions, applicable standards, legal regulations and certificates (depending on the application).
- The specialist staff must have read and understood these Operating Instructions and must follow the instructions they contain.
- The device may only be modified and repaired if such work is specifically permitted in the Operating Instructions.
- Damaged devices which could constitute a source a danger must not be put into operation and must be clearly indicated as defective.
- Invariably, local regulations governing the opening and repair of electrical devices apply.

1.3 Operational safety

- The measuring device complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326 and NAMUR Recommendations NE 21, NE 43 and NE 53. The device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. Applicable regulations and European standards have been taken into consideration.
- Please pay particular attention to the technical data on the nameplate! The nameplate is located on the upper side of the device.

Hazardous areas

When using in hazardous areas, the national safety requirements must be met. Separate Ex documentation is contained in these Operating Instructions for measurement systems that are to mounted in hazardous areas. Strict compliance with the installation instructions, ratings and safety instructions as listed in this supplementary documentation is mandatory.

- The device may be installed in category 2G (Zone 1) or category 3G (Zone 2) of a hazardous area.
- For category 2G (Zone 1) applications the type of protection is "Intrinsic Safety". The associated field devices could operate in a category 1G (Zone 0) or category 1D (Zone 20) location.
- For category 3G (Zone 2) applications the type of protection is EEx n A. The device could be connected to Non IS H1 segment. Independent of the type of protection of the H1 bus the inputs remain intrinsically safe.

Warning!
Devices that are operated in general electrical systems must not thereafter be operated in electrical systems that are connected in hazardous areas.

Repairs
Repairs that are not described in the Operating Instructions may only be carried out directly at the manufacturer's site or by the Service team.

Electromagnetic compatibility
The measuring system complies with the general safety requirements in accordance with IEC 61010 and the EMC requirements of IEC 61326 and NAMUR Recommendation NE 21.

Caution!
Power must be supplied to the device from a 9 to 32 VDC power supply in accordance with NEC Class 02 (low voltage/current) with short-circuit power limitation to 8 A/150 VA.

1.4 Notes on safety conventions and icons

Always refer to the safety instructions in these Operating Instructions labeled with the following symbols:

Warning!
This symbol draws attention to activities or procedures that can lead to injuries to persons, safety risks or the destruction of the unit if not carried out properly.

Caution!
This symbol draws attention to activities or procedures that can lead to defective operation or to destruction of the unit if not carried out properly.

Note!
This symbol draws attention to activities or procedures that have an indirect effect on operation, or can trigger an unforeseen unit reaction if not carried out properly.

ESD – Electrostatic discharge
Protect the terminals against electrostatic discharge. Failure to comply with this instruction can result in the destruction of parts of the electronics.

2 Identification

2.1 Device designation

2.1.1 Nameplate

Compare the nameplate on the DIN rail or field housing device with the following graphic:

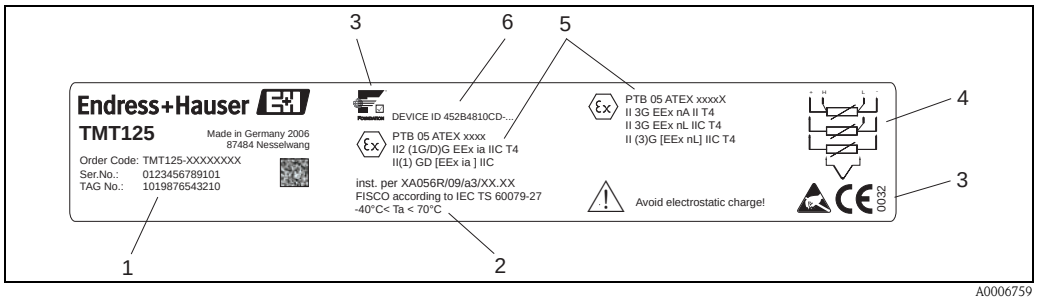

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Fig. 1: Nameplate of the temperature transmitter (DIN rail device as example)

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Fig. 2: Nameplate on the field housing (example)

1 Order code, serial number and TAG of device
2 Ambient temperature
3 Approvals with symbols
4 Sensor wiring diagram
5 Hazardous area approvals
6 Device ID number

2.2 Scope of delivery

The scope of delivery comprises:
- Temperature transmitter (as DIN rail adapter or attached in an aluminum field housing)
- Operating Instructions on CD-ROM
- Multi-language hard copy of Brief Operating Instructions
- Delivery note
- Safety Instructions for use in hazardous areas (Ex approval), on CD-ROM as well

2.3 Certificates and approvals

CE mark, declaration of conformity
The temperature transmitter is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations in accordance with EN 61010-1 “Safety requirements for electrical equipment for measurement, control and laboratory use” and with the EMC requirements of IEC/EN 61326.

The device described in these Operating Instructions is therefore in conformity with the statutory requirements of the EU Directives. The manufacturer confirms a positive completion of all tests by fitting the unit with a CE mark.

Device certification FOUNDATION Fieldbus™
The temperature transmitter has successfully passed all the test procedures implemented and has been certified and registered by the FOUNDATION Fieldbus™. The measuring device thus meets all the requirements of the following specifications:

- Certified to fieldbus specification, revision status 4.61
- Device certification number: IT035400
- The measuring device meets all the specifications of FOUNDATION Fieldbus-H1 (www.fieldbus.org).
- The measuring device may also be operated with certified devices from other manufacturers (interoperability).

An overview of other approvals and certificates can be found in chapter 'Technical Data', → 38.

3 Mounting

3.1 Incoming acceptance, transport, storage

3.1.1 Incoming acceptance

After receiving the goods, check the following points:
- Is the packaging or the contents damaged?
- Is the delivery complete? Compare the goods delivered with what you ordered.

3.1.2 Transport and storage

Observe the following points:
- The unit must be packed in shockproof packaging for storage (and transport). The original packaging offers the best protection for this.
- The permitted storage temperature is -40 to +85 °C (-40 to 185 °F)

3.2 Mounting conditions

3.2.1 Dimensions

The dimensions of the device can be found in chapter 'Technical Data', → 42.

3.2.2 Mounting point

Information on mounting conditions, such as ambient temperature, protection classification, climatic class etc., can be found in chapter 'Technical Data', → 41.

3.3 Mounting instructions

Mounting must only be performed by specialist who are trained specifically for this purpose. Recognized rules of the technology and setup requirements must be maintained during mounting and dismounting. Especially for tasks on electrical systems, special safety requirements must be observed.

3.3.1 Mounting of the attached field housing transmitter

The field housing reaches the degree of protection IP 67. 2 screws with a diameter of 6 mm should be used for mounting. The mounting material should be selected according to the nature of the subsurface (the wall). When selecting mounting material, care must be taken that it will ensure a secure fastening.

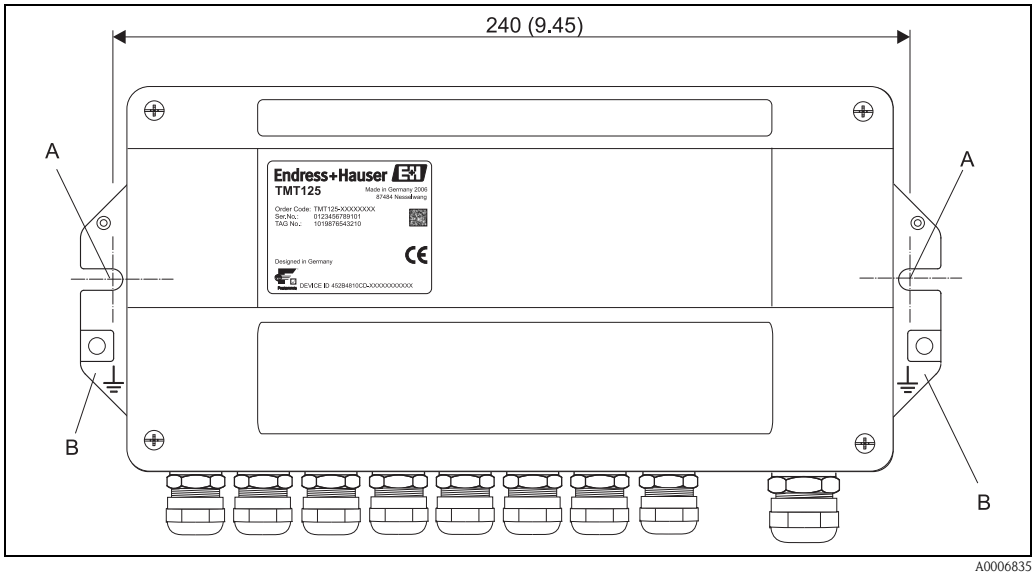

Fig. 3: Field housing mounting

A Mounting holes for fixing with screws M6
B Earthing point

3.3.2 Mounting of the DIN rail transmitter

The DIN rail transmitter is designed for mounting on a 35 mm DIN rail in accordance with IEC 60715 and must be protected against electrostatic discharge.
The Device must be mounted inside a housing that corresponds to at least degree of protection:

- IP 20 in accordance with IEC 60529 or higher for category 2G (Zone 1) application. The housing must be suitable for this application.
- IP 54 in accordance with IEC 60529 or higher for category 3G (Zone 2) application. The housing must be suitable for this application.

Caution!
Plastic housing must be designed in accordance with IEC 60079-0 or need to be protected against electrostatic discharge.

Now snap the device onto the DIN rail by firstly hanging the device on the DIN rail and then pressing it down gently until it engages (→ 4, item 1 and 2).

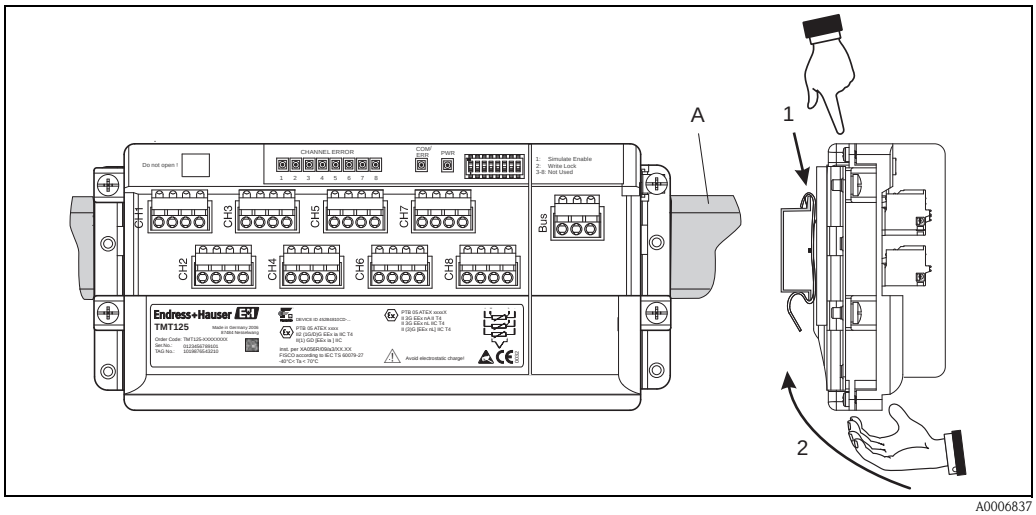

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Fig. 4: DIN rail transmitter mounting

A: 35 mm DIN rail according to IEC 60715

3.4 Post-mounting check

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

Device condition and specifications	Notes
Has the device been mounted in accordance with specifications?	–
Is the device free of damage?	–
Is IP protection ensured?	–
Are the mounting screws (field housing) tightened securely?	–

4 Wiring

Caution!
Switch off power supply before installing or connecting the device. Failure to observe this may result in destruction of parts of the electronics.

Note!
When installing intrinsically safe fieldbus segments, EN 60079-14/IEC 60079-14 must be observed. For the Federal Republic of Germany, the "National Foreword“ of DIN EN 60079-14/VDE 0165 Part 1 must also be observed.

4.1 Quick wiring guide

Terminal assignment

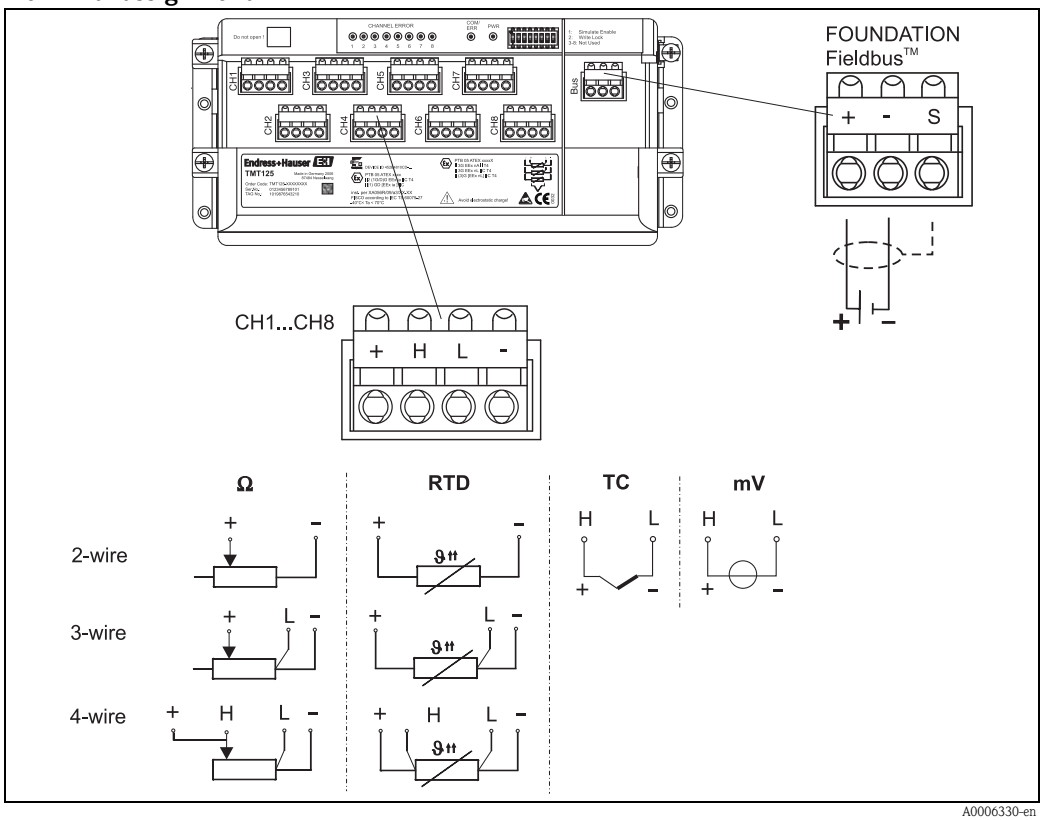

Fig. 5: Terminal assignment of the temperature transmitter

ESD – Electrostatic discharge
Protect the terminals from electrostatic discharge. Failure to observe this may result in destruction of parts of the electronics.

The following identifying values must be observed when connecting fieldbus transmission lines:

- The insulating length of the wire is 9 mm (0.35 in).
- Wire cross-section 0.2 mm² to 2.5 mm² or AWG 24 to 14.
- If a cable, consisting of fine wire is in use, the ends of the leads must be protected (e. g. with core cable ends).
- Tightening torque of the screw terminals (if present) 0.4... 0.5 Nm.
- If a Thermocouple is connected to the terminals H and L of the transmitter, it is not allowed to connect something to the terminals + and –.
- A fieldbus transmission line with an insulation voltage between the bus line and shield of at least 500 V must be used for intrinsically safe fieldbus segments.

Note!
The service interface (→ 9) is for parameterization only. It fulfills the type of protection EEx ia IIC/IIB resp. EEx ib IIC/IIB with the following values:

U_O = 7.2 V	Characteristic curve: linear
I_O = 29.1 mA	Only for connection of intrinsically safe circuits
P_O = 52.38 mW	U_i = 5 V
L_i = 0 C_i = 0	

Note!
Tasks for parameterization via the service interface must only be performed by E+H service only!

4.2 Connecting the device

4.2.1 Cable glands or entries

- If the device has not been grounded as a result of the housing being installed, we recommend grounding it via one of the ground screws. Observe the grounding concept of the plant! Between the stripped fieldbus cable and the ground terminal, the cable shielding should be kept as short as possible.
- Risk of damaging the fieldbus cable!
  – If the shielding of the fieldbus cable is grounded at more than one point in systems without additional potential matching, power supply frequency equalizing currents can occur that damage the cable or the shielding. In such cases the shielding of the fieldbus cable is to be grounded on only one side, i.e. it must not be connected to the ground terminal of the housing. The shield that is not connected should be insulated!
  – We recommend that the fieldbus not be looped using conventional cable glands. If you later replace even just one measuring device, the bus communication will have to be interrupted.

Note!
- The terminals for the fieldbus connection have an integral polarity protection.
  – Cable cross-section: max. 2.5 mm^2
- A shielded cable must be used for the connection.

Tightening torques of the screwed connection of cable glands (field housing):
The tightening torques of cap nuts depend on what type of cable is used and must therefore be determined by the user. The cap nuts must be securely tightened. Tightening the cap nuts too tight can have a negative effect on the protection method. The following specification should be taken as rough guides:

Type	Cap nut	Lower part
Temperature transmitter attached in field housing	4.17 Nm	6.25 Nm

Only permanently laid cables and lines must be inserted into the cable glands. The permissible cable diameters can be found in chap. 'Technical Data, → 40. The operator must provide an appropriate strain-relief clamp (for example with a suitable cable clamp). The mounting notes on → 9 must be observed. Cable glands that are not in use must be closed off with a corresponding stop plug or replaced by an appropriate screw plug. The required degree of protection (IP 67) must be observed.

Note!
The ambient temperature range can be restricted by the stop plug. For examples of stop plugs and screw plugs, please refer to the respective data sheets.

Note!
For metal housings in hazardous areas, a suitable potential equalization in accordance with IEC 60 079 is required. A grounding screw is provided on the housing for this purpose (→ 3, item B). The connection must be designed to prevent self locking and must be protected against corrosion. Protection against corrosion can also be achieved by using tinned cable plates, for example.

Note!
Before closing the cover, a visual inspection must be performed to ensure that there are no visible signs of damage on the cover seal. In the event of damage, the seal must be replaced by an original seal. The screws on the cover should be tightened to a torque of 2.5 Nm.

Handling the cable gland

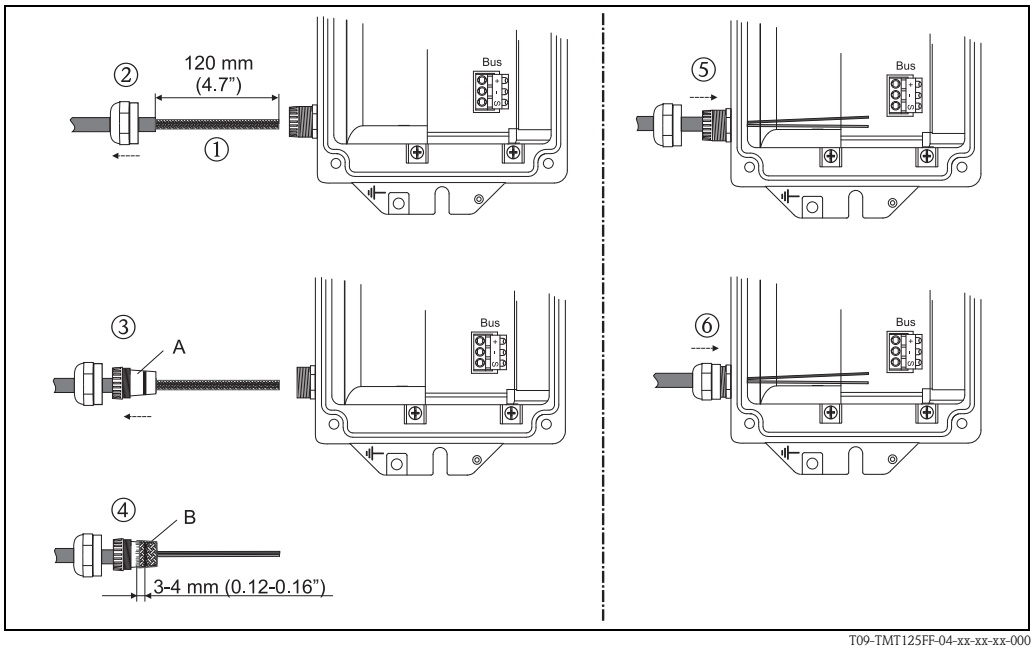

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Fig. 6: Handling the cable gland

Pos. A: Inside plastic part
Pos. B: O-ring

1. Insulate the covering of the cable up to about 120 mm (4.7 in).
2. Loosen the cap nuts from the field housing and push it onto the cable.
3. Remove the inside plastic part as well and push it onto the cable. Move the inside plastic part far enough over the cable that the covering is completely surrounded. The covering must not stand out over the end of the inside plastic part.
4. Pull the shield over the inside plastic part and shorten it to the correct length. The shield should protrude about 3 to 4 mm (0.12 to 0.16 in) beyond the O-ring.
5. Insert the cable with the inside plastic part into the lower part of the cable gland.
6. Then tighten the cap nut. The tightening torques of cap nuts depend on what type of cable is used and must therefore be determined by the user. As rough guide you may use 4.17 Nm for the cap nut and 6.25 Nm for the lower part.

4.2.2 Fieldbus connector

The connection technology of FOUNDATION Fieldbus™ allows measuring devices to be connected to the fieldbus via uniform mechanical connections such as T-boxes, distribution modules, etc. This connection technology using prefabricated distribution modules and plug-in connectors offers substantial advantages over conventional wiring:
Field devices can be removed, replaced or added at any time during normal operation. Communication is not interrupted.
Installation and maintenance are significantly easier.
Existing cable infrastructures can be used and expanded instantly, e.g. when constructing new star distributors using 4-channel or 8-channel distribution modules.
The device can therefore be supplied with the option of a fieldbus connector. The fieldbus connector is supplied pre-assembled and wired ex works. Fieldbus connectors for retrofitting can be ordered from Endress+Hauser as an accessory (→ 30).

Supply line/T-box shielding

Use cable glands with good EMC properties, if possible with all-round contact of the cable shielding (Iris spring). This requires small differences in potential, poss. potential matching.
The fieldbus cable shielding must be intact.
The shielding connection must always be kept as short as possible.
Ideally, cable glands with Iris springs should be used for the shielding connection. The shielding is connected to the T-box housing by means of the Iris spring located inside the gland. The shielding braid is located beneath the Iris spring. When the armored thread is tightened, the Iris spring is pressed against the shielding, thereby creating a conductive connection between the shielding and the metal housing.
A connection box or a plug-in connection is to be seen as part of the shielding (Faraday shield). This applies, in particular, to remote boxes if these are connected to a FOUNDATION Fieldbus™ measuring device by means of a pluggable cable. In such instances, a metallic connector must be used where the cable shielding is positioned at the plug housing (e.g. prefabricated cables).

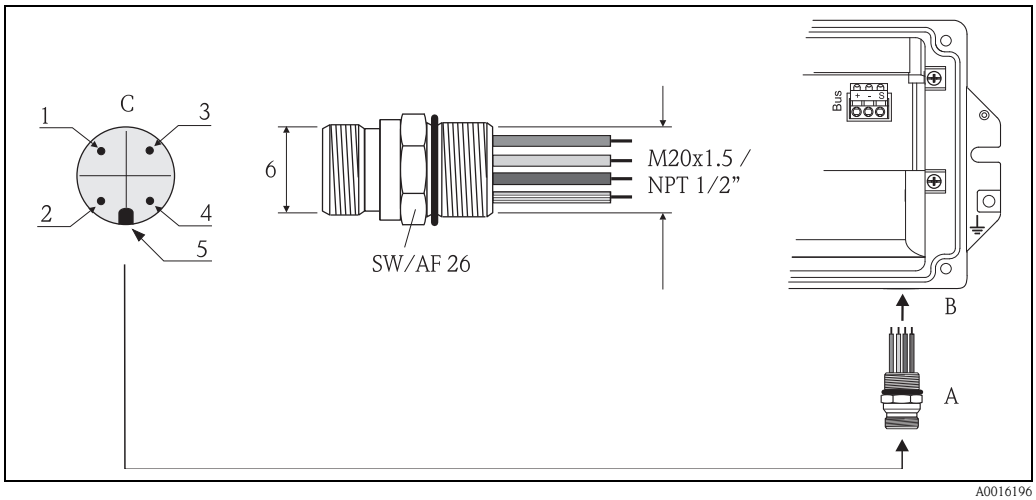

Fig. 7: Connectors for connecting to the FOUNDATION Fieldbus™

A Fieldbus connector (pin assignment/color codes):
– 1 Blue wire: FF– (terminal 2)
– 2 Brown wire: FF+ (terminal 1)
– 3 Grey wire: Shielding
– 4 Green/yellow wire: Ground
– 5 Positioning tappet
– 6 7/8" UNC thread
B Field housing
C Connector at the housing (male)

Connector technical data:

Wire cross-section	4 x 0.8 mm²
Connection thread	M20 x 1.5 / NPT ½"
Degree of protection	IP 67 as per DIN 40 050 IEC 529
Contact surface	CuZn, gold-plated
Housing material	1.4401 (316)
Flammability	V - 2 as per UL - 94
Ambient temperature	–40 to +105 °C (–40 to +221 °F)
Current carrying capacity	9 A
Rated voltage	Max. 600 V
Contact resistance	≤ 5 mΩ
Insulation resistance	≥ 10^9 Ω

If the transmitter was ordered attached in the field housing with fieldbus connector (order code - housing: position 3) it is supplied with the fieldbus connector pre-assembled and wired ex works. Shielding and ground (pin 3 and 4) are connected to the terminal S of the intrinsically safe fieldbus segment (→ 5).

4.3 Fieldbus cable specifications

Cable type

Twin-core cables are required for connecting the 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 size	0.8 mm² (AWG 18)	0.32 mm² (AWG 22)
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)	1900 m	1200 m
* 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). Note the following points:
The maximum permissible overall cable length depends on the cable type used.
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):

Number of spurs	1 to 12	13 to 14	15 to 18	19 to 24	25 to 32
Max. length per spur	120 m	90 m	60 m	30 m	1 m

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
Optimum electromagnetic compatibility of the fieldbus system can only be guaranteed if the system components and, in particular, the lines are shielded and the shield forms as complete a cover as possible. A shield coverage of 90% is ideal.
To ensure an optimum shield effect, connect the shield as often as possible to the reference ground. Where applicable, national installation regulations and guidelines must be observed!
Where there are large differences in potential between the individual grounding points, only one point of the shielding is connected directly with the reference ground. In systems without potential equalization, therefore, cable shielding of fieldbus systems should only be grounded on one side, for example at the fieldbus supply unit or at safety barriers.

Caution!
If the shielding of the cable is grounded at more than one point in systems without potential matching, power supply frequency equalizing currents can occur that damage the bus cable or shielding or have a serious effect on signal transmission.

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

- 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 pointers on wiring can be found on www.fieldbus.org, the website of the FOUNDATION Fieldbus™.

4.4 Potential equalization

Shielding and grounding of the Transmitter

Caution!
If the shield of the fieldbus transmission line is grounded for reasons related to EMC, Section 12.2.2.3 of IEC 60079-14 and Sections 6.2 and 6.3 of the FOUNDATION Fieldbus™ Application Guide 31.35 bit/s Intrinsically Safe Systems must always be observed.

The terminal S of the intrinsically safe fieldbus segment is:
▪ in case of using the field housing version connected internally to the housing. The housing should be connected to the potential equalization. ⚠ Warning! The housing of the field housing version must be connected to the potential equalization in case of Category 2G (Zone 1) applications.
▪ in case of using the DIN rail version connected internally to the DIN rail. The DIN rail should be connected to the cabinet and the cabinet should be connected to the potential equalization.

Depending on this the shield is automatically connected to the potential equalization.

Please also refer to Operating Instructions BA00062S/04/en "Guideline FOUNDATION Fieldbus™ Function Blocks" for configuration information.

4.5 Degree of protection

The device conforms to the requirements to IP 67 ingress protection for the field housing version. In order to fulfill an IP 67 degree of protection after installation or service, the following points must be taken into consideration:
The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
All housing screws and screw caps must be firmly tightened.
The cables used for connection must be of the correct specified outside diameter (e.g. M20 x 1.5, cable diameter from 8 to 12 mm; 0.315 to 0.47 in).
Firmly tighten the cable gland (→ 8 and → 12).
The cables must loop down before they enter the cable glands ("water trap", → 8). This means that any moisture that may form cannot enter the gland. Install the device so that the cable glands are not facing upwards.
Cable glands not used are to be blanked off using stop plugs.
Do not remove the grommet from the cable gland.

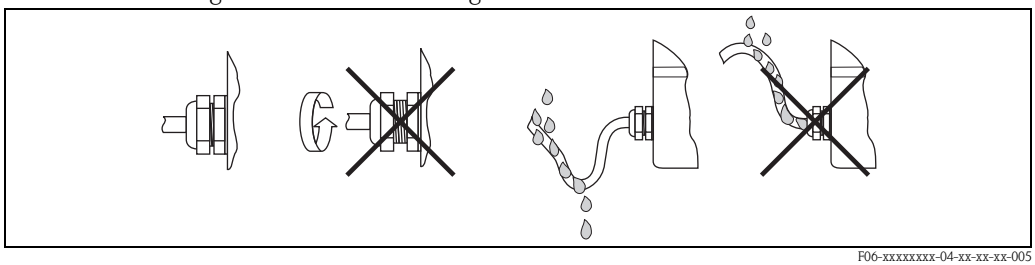

Fig. 8: Connection hints to retain IP 67 protection

4.6 Post-connection check

After the electrical installation of the device, always perform the following final checks:

Device condition and specifications	Notes
Are the device or the cables damaged (visual check)?	-
Electrical connection	Notes
Does the supply voltage match the device specification?	9 to 32 V DC
Do the cables used comply with the specifications?	→ 15 → 40
Do the cables have adequate strain relief?	-
Are the power supply and fieldbus cables correctly connected?	See the wiring diagram → 11
Are all terminals firmly tightened?	-
Are all the cable glands installed, tightened and sealed? Cable run with "water trap"?	→ 12 → 17
Are all the housing covers installed and tightened?	-
Electrical connection of FOUNDATION Fieldbus™	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?	→ 15
Has the max. length of the fieldbus cable been observed in accordance with the FOUNDATION Fieldbus™ specifications?	→ 15 → 17
Has the max. length of the spurs been observed in accordance with the FOUNDATION Fieldbus™ specifications?	
Is the fieldbus cable fully shielded and correctly grounded?	

5 Operation

5.1 Quick operation guide

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

1. Configuration programs, → 🖹 22
The configuration of FF functions and device-specific parameters is primarily done via the fieldbus interface. You can obtain special configuration and operating programs from various manufacturers for these purposes.

2. Miniature switches (DIP switches) for diverse hardware settings, → 🖹 23
You can make diverse hardware settings for the FOUNDATION Fieldbus™ interface using miniature switches (DIP switches) on the transmitter. There are eight DIP switches. Only DIP switch 1 (Simulation) and DIP switch 2 (hardware write protection) are in use.

The DIP-switches for configuration can be activated even during operation.

5.2 Display and Operating elements

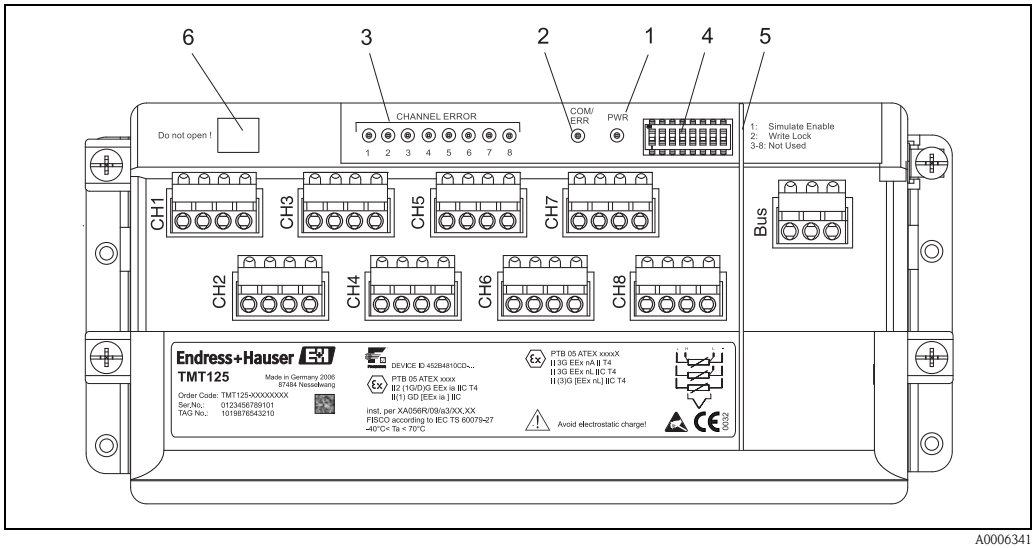

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Fig. 9: Display and operating elements of the transmitter

Item No.	Function	Description
1	Green lit LED	signalizes 'Power on'
2	Red lit or flashing LED	signalizes communication status: hardware or communication error
3	Red flashing LEDs	signalizes connected sensor status: sensor errors (over- / underrange, wiring error, leadbreakage)
4	DIP switches	switches for hardware settings (only switch 1 and 2 are in use): Simulation ON/OFF; Hardware write protection ON/OFF
5	Segregation plate	required for installation in hazardous area category 3 (see separate Safety Instruction for use in hazardous areas)
6	Service interface	for E+H service only

5.3 FOUNDATION Fieldbus™ technology

The FOUNDATION Fieldbus™ (FF) is a purely digital, serial communication system that connects fieldbus devices (sensors, actors), 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 technology. The FF thus forms the basic network throughout the hierarchy of a communication system.

Please refer to Operating Instructions BA00062S/04/en “Guideline FOUNDATION Fieldbus™ Function Blocks” for configuration information.

5.3.1 System architecture

The following figure shows an example of a FOUNDATION Fieldbus™ network with the associated components. It also shows the possibilities of device installation in hazardous areas.

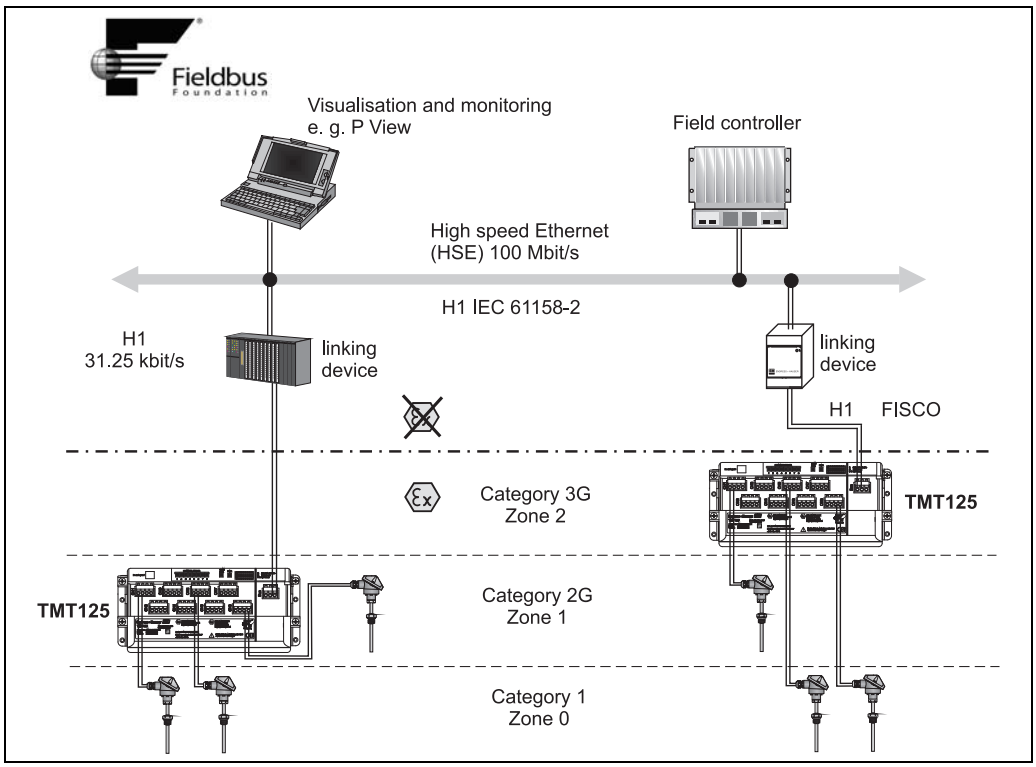

Fig. 10: FOUNDATION Fieldbus™ system architecture including associated components

HSE = High Speed Ethernet, H1 = FOUNDATION Fieldbus-H1
The following system connection options are possible:
- *A linking device can be used to connect to higher ranking fieldbus protocols (e.g. to the High Speed Ethernet - HSE) (Control Net)*
- *A H1 card is required for direct connection to a process control system.*
- *System inputs are available directly for H1 and H2 (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 allows simultaneous feed to the field devices and data transfer on the two-wire line.

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 is connected in parallel to the bus line. Devices requiring external power must use a separate power supply.
- One of the most common network structures is the line structure. 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, length of spur, cable types, current consumption of field devices etc. (→ 15).
- If using fieldbus devices 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 H2 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.

5.3.2 Data transfer

We distinguish between two types of data transfer:
- **Scheduled data transfer (cyclic):** all time-critical process data (i.e. continuous measurement or actuating signals) are transferred and processed in accordance with a fixed schedule.
- **Unscheduled data transfer (acyclic):** device parameters that are not time-critical for the process and diagnosis information are only transferred to the fieldbus when needed. This data transfer is always carried out in the intervals between timed communication.

5.3.3 Device ID, addressing

Within the FF network, each fieldbus device is identified by a unique device ID (DEVICE_ID). The fieldbus host system (LAS) automatically gives the network address for this 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 given to the device in question during commissioning (→ 24). It remains stored in the device even during a supply voltage failure.

5.3.4 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 which a device can accept in the whole of the automation strategy.

In the case of sensors these are typically the following blocks:
- 'Analog Input'

Actuating valves normally have the function blocks:
- 'Analog Output'

Note!
More information on this can be found on → 44 onwards.

5.3.5 Fieldbus based process control

With the FOUNDATION Fieldbus™ field devices can carry out simple process control functions themselves, thereby relieving pressure on the superior process control system. Here the Link Active Scheduler (LAS) coordinates data exchange between the sensor and controller and makes sure that two field devices cannot access the bus at the same time. To do this, configuration software such as the NI-FBUS Configurator from National Instruments is used to connect the various function blocks to the desired control strategy – generally graphically.

5.3.6 Device description

For commissioning, diagnosis, configuration etc. make sure that process control systems or superior configuration systems can access all device data and that the operating structure is uniform.
The device-specific information required for this is stored as so-called device description data in special files (the 'Device Description'- DD). This enables the device data to be interpreted and shown via the configuration program. The DD is thus a kind of 'device driver'.
On the other hand, a CFF file (CFF = Common File Format) is required for the network configuration in the OFF-line mode.

These files can be acquired as follows:
– Free of charge via the Internet: www.endress.com
– Via the FOUNDATION Fieldbus™ organization: www.fieldbus.org (also free of charge)

5.4 Configuration of the temperature transmitter 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.

Process control systems	Asset management systems
Endress+Hauser Controlcare	■ National Configurator ■ AMS ■ FC375 (handheld) ■ FC475 (handheld) ■ Fieldcare
Emerson DeltaV	
Yokogawa Centum CS3000/VP	
ABB: ■ AC800 XA ■ AC800 M ■ Freelance	
Honeywell PKS Experion	
Foxboro Invensys I/A Series	

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.

System files
■ You require the following files for commissioning and configuring the network:
  – Commissioning → DD (Device Description: *.sym, *.ffo files)
  – Network configuration → *.cff file (Common File Format)

These files can be acquired as follows:
– Free of charge via the Internet: www.endress.com
– Via the FOUNDATION Fieldbus™ organization: www.fieldbus.org

5.5 Hardware settings (DIP switches)

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

Note!
The simulation mode via the hardware setting has priority over the software setting.

You can make the following hardware settings for the FOUNDATION Fieldbus™ interface using miniature switches (DIP switches) on the transmitter (∅ fig. 9). There are eight DIP switches. Only DIP switch 1 and 2 are in use.

Switch 1: Simulation ON/OFF
With activated simulation, the sensor input transferred from the transducer block to the function block can be set by the control system independent from the hardware input of an input channel. For safety reasons, is strongly recommended to set the switch to OFF for normal operation.

Switch 2: Hardware write protection ON/OFF
Parameterization of the device via the bus is no longer possible when write protection is activated (setting ON).

6 Commissioning

6.1 Function check

Before commissioning the measurement point make sure that all final checks have been carried out:
- Checklist “Post-mounting check” → 10
- Checklist “Post-connection check” → 18

Note!
- The FOUNDATION Fieldbus™ interface's technical data must be maintained in accordance with IEC 61158-2 (MBP).
- The bus voltage of 9 to 32 V and the current consumption of 23 mA at the measuring device can be checked using a normal multimeter.

6.2 Configuration

Identification, Device ID, PD Tag
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 DEVICE_ID of the device is composed as follows:

DEVICE_ID = 452B4810CD-XXXXXXXXXXX
452B48 = Endress+Hauser
10CD = TMT125
XXXXXXXXXXX = device serial number (11-digit)

The serial number is also provided on the name plate:
- on the upper right side
- on the upper side of the field housing cover.

The PD Tag contains as default a cleartext identification for the device and the serial number, "EH_TMT125_ xxxxxxxxxxx".

6.2.1 Getting Started

Step 1:
Integration of DD and capability file on the configuration tool of the host system
To parameterize the temperature transmitter in the online mode the associated device description (DD) must be imported in the engineering tool used. For offline parameterization a capability file is available. Unless the manufacturer of the control system has made integration, you will find the necessary files on the Internet at www.endress.com or www.fieldbus.org (→ 22). Please consult the control system's manual for instructions on how to import the files.

Step 2:
Physical connection to the fieldbus, address assignment
Connect the fieldbus to appropriate terminals on the device (→ 5). If a power supply is connected, the device boots up and the LEDs show a kind of „progress bar“. In the following the green power LED is on, the sensor error LEDs are off. The communication LED (→ 9, Pos. 2) is flashing red until communication with a link master is established.
Upon delivery, the device is configured to address 245. Most control systems automatically change the address after startup, so no user action is required. Please refer to the control system's manual.

Step 3:
Commissioning
First, the transducer blocks need to be configured. This can be accomplished in two ways:
- Executing the DD methods of the sensor block or concentrator block. The user is guided through the setup process or
- by hand via the parameters described in the following sections.

Second, the AI/MAI blocks are configured according to the application's needs.

Third, a schedule for the complete application is built and downloaded to all involved devices. For a more detailed temperature transmitter configuration description, please refer to the following sections.

6.2.2 Sensor Block configuration

Note!
The concentrator and sensor block contains DD methods for convenient and fast sensor configuration.

Measurement data flow
The following figure shows the internal data flow in the sensor block and illustrates the block parameters' influence on measurement. These parameters are explained in detail in the following sections.

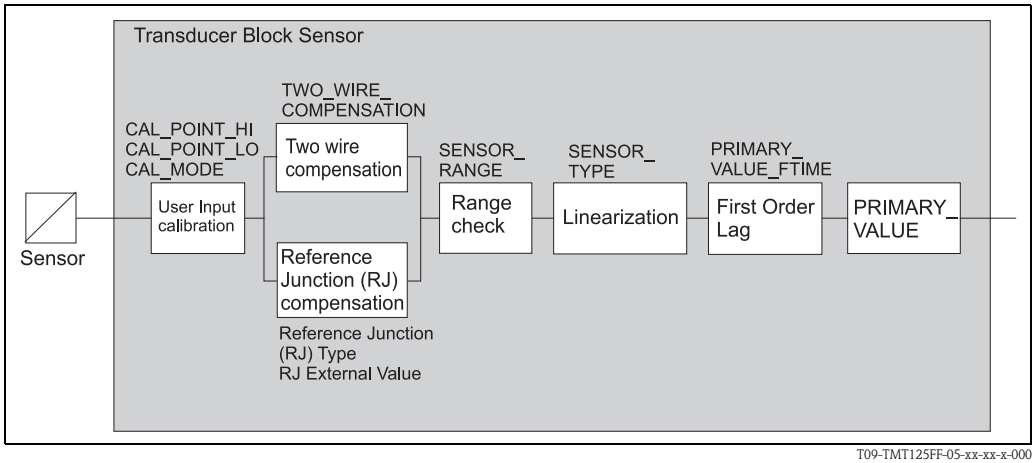

Fig. 11: Measurement data flow

Sensor Type
The type of the sensor attached to the corresponding connector can be configured via the „Sensor Type“ parameter. The device supports Thermocouples, RTD's and bare voltage or resistance measurement. A list of supported sensors can be found in chapter 'Technical Data', → 38.

Sensor Wiring and Wire Resistance
For resistive sensors, a wiring method can be chosen by the „Sensor Connection“ parameter. A maximum value of 50 Ω is allowed for the resistance of one sensor wire. If 2-wire connection is chosen, it is possible to supply a constant wire resistance value that is subtracted from the measured resistance via the „2-wire compensation“ parameter. For all other sensor connection methods, the parameter is ignored. Allowed value range is 0 to 100 Ω.

For voltage based sensors, the „Sensor Connection“ parameter is ignored (and thus will not produce a configuration error if it is set to another value than 2-wire).

Measurement Unit
It is possible to select between several units for „Primary Value.Value“ via the „Sensor Range.Units Index“ parameter. If an invalid unit is chosen for the sensor (e.g. „mV“ for a resistance based sensor), the „Configuration error“ bit is set in the „BLOCK_ERR“ parameter.

Filtering
The „Primary Value.Value“ can be filtered by a first order lag. The filter time is selectable between 0 s and 255 s via the „Primary Value Filtertime“ parameter. A value of 0 s disables filtering.

Sensor Diagnosis
It is possible to enable sensor monitoring for each sensor via the "Sensor Diagnostics" parameter. If the sensor diagnosis indicates an sensor error, this will be reported in the "BLOCK_ERR", "Sensor status" and "Transducer error" parameter. The "Primary Value.Status" will be set to BAD.
The default adjustment is sensor diagnosis enabled. Endress+Hauser recommends to use the sensor diagnosis for normal operation.

Reference Junction (RJ) compensation
Thermocouple temperature sensors require reference junction (RJ) compensation for accurate measurement. The device supports two methods of RJ compensation:
- **Internal:** The RJ temperature measured by a built-in temperature sensors is used for compensation. This is the recommended method.
- **Constant:** The user can define a constant RJ temperature that is used for compensation.

The two methods can be selected via the "RJ Type" parameter. If it is set to "Constant", the device uses the value in "RJ External Value" for compensation, the unit is the same as for the "Primary Value.Value" parameter, which is specified by the "Sensor Range.Units Index" parameter. If the unit is changed, the "RJ External Value" is automatically converted to the new unit.

User Calibration
It is possible to perform a user calibration of the device. User calibrated measurement can be enabled by writing "Calibration on" to the "Calibration Mode" parameter.

A user calibration is done by executing the following steps:

Note!
Set the operating mode to OOS (out-of-service). In OOS mode, measurement is disabled and the sensor can be calibrated. In AUTO mode, measurement is enabled, all functional parameters except "Sensor Diagnostics" are write protected.

1. Select sensor type, wiring and sensor diagnosis. It may be necessary to turn off sensor diagnosis if the device is connected to a calibration source that interferes with the sensor monitoring.
2. Write "Execute user calibration" to "Calibration Mode" parameter.
3. The unit used for calibration can be read from "Calibration Units" parameter.
4. Wait until "Calibration state" reads "Wait first calibration point".
5. Connect first resistor / apply first calibration voltage. Please note that the limits that can be read from "Calibration highest/lowest Point Limit" have to be taken into account.
6. Write the first calibration value to "Calibration Highest/Lowest Point" depending on the applied physical value.
7. Wait until "Calibration state" reads "Wait HI/LO Calibration Point" depending on whether high or low point was calibrated first.
8. Connect second resistor / apply second calibration voltage. Please note that the limits that can be read from "Calibration highest/lowest Point Limit" and "Calibration Minimum Span" have to be taken into account.
9. Write the second calibration value to "Calibration Highest/Lowest Point" depending on the point that was calibrated first. Note that it is not possible to write two times to the same parameter during the same calibration procedure to prevent errors.
10. "Calibration state" now reads "OK".
11. Enable user calibrated measurement by writing "Calibration On" to "User calibration" parameter.

If "Calibration state" reads "Failure" during calibration, the following errors may have happened:
- Sensor diagnosis is enabled and a sensor error was detected
- A higher value was written to "Calibration Lowest Point" than to "Calibration Highest Point".
- Calibration span was too small (see parameter "Calibration Minimum Span" during calibration)
- Values higher / lower than specified in "Calibration highest/lowest Point Limit" were applied

✎ Note!
Endress+Hauser recommends to use not user calibration feature, the device is delivered with a suitable factory calibration.

Non-functional Parameters
The device offers several non-functional parameters (parameters that do not affect the device's operation in any kind) to store additional information. These parameters are:
- "Primary Value Type"
- "Sensor Serial No."
- "Sensor Calibration Method"
- "Sensor Calibration Location"
- "Sensor Calibration Date"
- "Sensor Calibration Who"
- "Calibration Location"
- "Calibration Date"
- "Calibration Who"
- "Sensor Range.Decimal"

Block Mode
Sensor block support two modes: OOS (out-of-service) and AUTO. In OOS mode, measurement is disabled and the sensor can be configured and/or calibrated. In AUTO mode, measurement is enabled, all functional parameters except "Sensor Diagnostics" are write protected.

6.2.3 Concentrator Block Configuration

The concentrator block provides a summary view for the most important sensor configuration parameters of each sensor block. These parameters are simply mapped to their corresponding counterparts in the sensor blocks. The write protection of the parameters depends on the sensor block's actual block mode.

Body Temperature
The device's body temperature can be read from the "Body Temperature" parameter. It is possible to configure the temperature unit via the "Body Temperature Unit" parameter.

✎ Note!
Please note that it is possible to map body temperature to an AI block (→ 📄 44).

EMC Filter
Measurement values are filtered internally with a 50 Hz or 60 Hz filter to suppress EMC disturbance by that frequency. The filter can be configured via the "ASIC Rejection" parameter.

✎ Note!
Endress+Hauser recommends to configure the filter in accordance to the countries' power supply system frequency.

Block Mode
The block mode supports two modes of operation: OOS (out-of-service) and AUTO.
In OOS mode, the body temperature status is always BAD and the body temperature unit can be configured.
In AUTO mode, body temperature status is GOOD.

✎ Note!
The concentrator block mode does not affect write protection of the sensor parameters since they solely depend on the sensor block's target block mode.

6.2.4 AI and MAI Block Configuration

The AI and MAI blocks are standard FOUNDATION Fieldbus™ block types. Please refer to the FOUNDATION Fieldbus™ standard for configuration information. The channel map can be found on → 44.

6.3 Operation

6.3.1 Primary Value Status

The primary value of the sensor blocks can have the following status:
- Good (NC)-Non specific
- Good (NC)-Active Block Alarm
- Good (NC)-Unacknowledged Block Alarm
- Bad-Sensor Failure:
  The sensor value exceeds the values defined by Primary Value. A sensor range or sensor error (wiring error, lead breakage) is detected for the sensor inputs. The substatus "Hi-limited" or "Low-limited" define in which direction the sensor's range has been exceeded. The substatus "Not limited" indicates a sensor error.
- Bad-Device Error:
  The internal diagnosis of the device detected a hardware fault.
- Bad-OOS:
  The actual mode of the block is OOS

6.3.2 Body Temperature Status

The body temperature status in the Concentrator block is BAD if the block is in OOS mode. In AUTO mode, the value is always GOOD as long as there is no self-diagnosis error detected.

6.3.3 Device Self-diagnosis

The temperature transmitter continuously monitors its internal hardware and body temperature. If an error occurs, the status of all Primary Values switches over to BAD and the "Device needs maintenance now" bit in the "BLOCK_ERR" error parameter of the resource block is set which will generate an alarm.

6.3.4 Alarms

If an error occurs, the corresponding transducer block issues a block alarm ("BLOCK_ALM"). It is a summary alarm for all alarms of this block and is asserted as long as the fault is still valid. To get information about the reason for the block alarm, read the following parameters and refer to Section 9 for remedy:

- "BLOCK_ERR"
- "Transducer error"

If the control system supports alarms, the "Alarm occur" and "Alarm clear" conditions are conveyed through the bus to the system.
Since this mechanism is not supported by all control systems, the temperature transmitter supports another method for error detection: All errors are shown in the "BLOCK_ERR" parameter of the transducer block. Usually, this parameter is cyclically read by the control system. For a list of errors reported by "BLOCK_ERR", please refer to Section 9.

Note!
If the control system does not support Alarms, the Option "Reports" in the "FEATURES_SEL" parameter of the resource block should be deactivated.

7 Maintenance

In general, no specific maintenance is required for this device.

8 Accessories

Following accessories, which can be ordered separately from Endress+Hauser, are available for the temperature transmitter. The Endress+Hauser service organisation can provide detailed information on the order code of your choice.

If ordering accessories, please specify the serial number of the unit!

Order number		**Type**
71005804		Fieldbus connector (FOUNDATION Fieldbus^{TM}), for M20 → 7/8"
TMT125A-	AA AB	Field housing 8xM16 + 1x M20 gland Field housing 8xM16 + 1x plug 7/8" FOUNDATION Fieldbus^{TM}

9 Troubleshooting

9.1 Troubleshooting instructions

✎ Note!
In the event of a serious fault, a measuring device might have to be replaced. In this case follow the instructions in Section 9.5.

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

LED indications on site (→ 9)

The temperature transmitter provides 8 sensor input specific red LEDs to indicate the status of the related sensor input channels. The status of the bus power is provided by a green LED, the communication status by a red LED. The LEDs are located on the upper side of the device.

LED	State	Cause	Remedy
Green LED (Pos. 1)	OFF	No power supply	■ Check power supply ■ Check fieldbus cable wiring
	ON (permanently)	Power available	-
Red LED - communication status (Pos. 2)	OFF	Communication active	-
	ON (permanently)	Hardware error	Replace device
	ON (flashing)	No communication, communication error	■ Check LAS ■ Check wiring (→ 11)
8 red LEDs - status channel 1 to 8 (Pos. 3)	OFF	No sensor errors detected	-
	ON (flashing)	Sensor error (over- / underrange, wiring error, leadbreakage)	Check sensor wiring. (→ 11) For more information refer to diagnostic messages in the corresponding sensor transducer block (see Section 11.3.2)

↓

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 data lines
Fieldbus connector (optional)	Check pin assignment / wiring, → 14
Fieldbus voltage	Check that a min. bus voltage of 9 V DC is present at the +/- terminals. Permissible range: 9 to 32 V DC
Network structure	Check permissible fieldbus length and number of spurs, → 15
Basic current	Is there a basic current of 23 mA?
Terminating resistors	Has the FOUNDATION Fieldbus™ network 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 communication.
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. permissible feed current of the bus power supply unit.

↓

Error messages in the FF process control systems

Please refer to Section 9.2

9.2 System error messages

9.2.1 Resource Block

Problem		Remedy	
Parameter	**Message**	**Cause**	**Procedure**
BLOCK_ERR	Lost Static Data	The parameterization data stored in the device were faulty and replaced by default settings	Repeat parameterization. If this error occurs repeatedly, send the device to Endress+Hauser for repair
	Device needs Maintenance now	Hardware error	Send device to Endress+Hauser for repair
	Simulation active	Simulation allowed by setting the DIP-switch 1	Check whether simulation shall be allowed
	OOS	The target mode of the block is OOS	Set block to "Auto" mode
RS_STATE	Online	No error	-
	Stand-by	The target mode of the block is OOS	Set block into "Auto" mode

9.2.2 Transducer Block 'Sensor'

Sensor block errors

Problem		Remedy	
Parameter	**Message**	**Cause**	**Procedure**
BLOCK_ERR	Block Configuration Error	■ "Sensor Type" is set to "Undefined" ■ "Sensor Range.Unit" is set to a value not supported by sensor (e.g. "mV" for a resistance based sensor) ■ User calibration is turned on at "Calibration Mode", but "Calibration State" shows no valid user calibration exists	Correct parameterization
	Input failure	Several	see next table 'Common Sensor Block Problems' below
	OOS	The target mode of the block is OOS	Set block to "Auto" mode
Transducer Error (XD_ERROR)	Configuration Error	See above at "BLOCK_ERR"	See above at "BLOCK_ERR"
	I/O failure	The sensor value exceeds the HI or LO sensor limits	See next table 'Common Sensor Block Problems' below
	Lead Breakage / Sensor connection error	Sensor wiring fault	See next table 'Common Sensor Block Problems' below
Sensor Status	Sensor connection error	See "Transducer Error"	See "Transducer Error"
	Overrange	Sensor high measurement limit exceeded	See next table 'Common Sensor Block Problems' below
	Underrange	Sensor low measurement limit exceeded	See next table 'Common Sensor Block Problems' below

Common sensor block problems

Problem	Remedy	
	Cause	**Procedure**
Block does not leave OOS mode	A configuration error is reported	Clear configuration error cause. See above
	Resource block is in OOS mode	Set Resource block to AUTO mode
Sensor failure	Sensor error (overrange, underrange, leadbreakage)	■ Check wiring ■ Use sensor with a greater input range
	Wrong sensor type selected	Configure correct sensor type
	RTD3 / RTD4 wires mixed up	Check wiring, → 12
Wrong measurement values	Thermocouple polarity reversed	Check thermocouple polarity
Unable to write to parameters	Write protection is enabled	Set write protection DIP switch to OFF, → 23
	Block is in AUTO mode	Set "MODE_BLK.Target" to "OOS"

9.2.3 Transducer Block 'Concentrator block'

Concentrator Block Errors

Problem		Remedy	
Parameter	**Message**	**Cause**	**Procedure**
BLOCK_ERR	Body temperature out of range	Devices' body temperature is too high / too low	■ Choose another mounting location ■ Adjust mounting locations' ambient temperature
	OOS	The target mode of the block is OOS	Set block to "Auto" mode
Transducer error (XD_ERROR)	Body temperature out of range	See "BLOCK_ERR"	See "BLOCK_ERR"

Common Concentrator Problems

Problem	Remedy	
	Cause	**Procedure**
Block does not leave OOS mode	Resource block is in OOS mode	Set Resource block to AUTO mode
Unable to write to parameters	Write protection is enabled	Set write protection DIP switch to OFF (→ 23)
	Corresponding sensor block is in AUTO mode	Set sensor block to OOS mode
	Block is in AUTO mode	Set "MODE_BLK.Target" to "OOS"

9.2.4 AI Function Blocks

AI Function Block Errors

Problem		Remedy	
Parameter	**Message**	**Cause**	**Procedure**
BLOCK_ERR	Block Configuration Error	The channel parameter contains an invalid value.	Set valid value (see Section 6.2)
		The function block does not have a schedule downloaded.	Include block into application and download schedule to device.
		"L_TYPE" parameter is set to an incorrect value.	Set "L_TYPE" to correct value.
	Input failure	Transducer block reports BAD "Primary Value.Status"	Check transducer block diagnostics (→ 32)
	Simulate active	Simulation for block is activated	Check simulation activation
	Out-of-service	Actual block mode is OOS	Choose suitable target mode. Check block configuration

Common AI Block Problems

Problem	Remedy	
	Cause	**Procedure**
Function block does not leave OOS mode	A "BLOCK_ERR" is reported	Clear block error cause
	The function block does not have a schedule downloaded	Include block into application and download schedule to device
	Resource block is in OOS mode	Set Resource block to AUTO mode
OUT does not show transducer block value	Simulation activated	Disable simulation
Simulation does not activate	Simulation DIP switch set to OFF	Set simulation DIP switch to ON → 23
Unable to write to parameters	Write protection is enabled	Set write protection DIP switch to OFF → 23
	Block is in AUTO mode	Set "MODE_BLK.Target" to "OOS"

9.2.5 MAI Function Block

MAI Function Block Errors

Problem		Remedy	
Parameter	**Message**	**Cause**	**Procedure**
BLOCK_ERR	Block Configuration Error	The channel parameter contains an invalid value.	Set valid value,→ 44
		The function block does not have a schedule downloaded.	Include block into application and download to device.

Common MAI problems

Problem	Remedy	
	Cause	**Procedure**
Function block does not leave OOS mode	A "BLOCK_ERR" is reported	Clear block error cause. See above
	Resource block is in OOS mode	Set Resource block to AUTO mode
	The function block does not have a schedule downloaded	Include block into application and download schedule to device

Problem	Remedy	
Unable to write to parameters	Write protection is enabled	Set write protection DIP switch to OFF, → 23.
	Block is in AUTO mode	Set "MODE_BLK.Target" to "OOS"

9.2.6 Diagnostic Summary

The table shows a summary of the diagnostic features the temperature transmitter will provide and the way they are reported.

Diagnostic Alarm	Description	Alarm indication
Communication Failure	H1 segment communication is not established	COM/ERR LED (→ 8, Pos. 2)
EEPROM Failure	The device configuration data base is corrupted	Resource Block Alarm, Resource Block BLOCK_ERR
Program Storage Failure	The devices firmware is corrupted	COM/ERR LED (→ 8, Pos. 2)
Memory Failure	The memory inside the device is defective	COM/ERR LED (→ 8, Pos. 2)
Body Temperature too high/low	The body temperature of the device exceeds it's specification	Resource Block Alarm, Concentrator BLOCK_ERR
Resource Block is in Out of Service Mode	The actual mode of the RB is OOS	Resource Block Alarm, Resource Block BLOCK_ERR
Block is in Out of Service Mode	The actual mode of the block is OOS. This is the same for all function and transducer blocks	Block Alarm, BLOCK_ERR
Block Configuration Error	One or more parameters of the block contain invalid or conflicting values. This is the same for all function and transducer blocks.	Block Alarm, BLOCK_ERR
Sensor error (wiring, lead break)	A cable of the sensor is broken, incorrect sensor wiring.	Block Alarm, BLOCK_ERR of all Transducer Blocks
Sensor Over / Under Range	Measured sensor value exceeds its high or low range limit.	Block Alarm, BLOCK_ERR of all Transducer Blocks
Simulation active	The Simulation is enabled for a function block.	Block Alarm, BLOCK_ERR of all Function Blocks
Device HW Failure (ADC, RJ measurement etc.)	The device detected an internal HW failure at the measurement unit.	Block Alarm, BLOCK_ERR of Resource Block, status of affected values, LED

9.3 Application errors without messages

9.3.1 Application errors for RTD connection

Pt100/Pt500/Pt1000/Ni100

Problem	Cause	Procedure
Measured value is incorrect/ inaccurate	Incorrect sensor orientation	Install the sensor correctly
	Heat conducted by sensor	Observe the face-to-face length of the sensor
	Device programming is incorrect (number of wires)	Change the SENSOR_CONNECTION device function
	Device programming is incorrect (scaling)	Change scaling
	Incorrect RTD configured	Change SENSOR_TYPE device function
	Sensor connection (two-wire)	Check the sensor connection
	The cable resistance of the sensor (two-wire) was not compensated	Compensate the cable resistance
	Offset incorrectly set	Check offset
	Sensor defective	Check sensor
	RTD connection incorrect	Connect the connecting cables correctly (terminal diagram)
	Programming	Incorrect sensor type set in the SENSOR_TYPE device function; change to the correct sensor type
	Device defective	Send device to Endress+Hauser for repair

9.3.2 Application errors for TC connection

Problem	Cause	Procedure
Measured value is incorrect/ inaccurate	Incorrect sensor orientation	Install the sensor correctly
	Heat conducted by sensor	Observe the face-to-face length of the sensor
	Device programming is incorrect (scaling)	Change scaling
	Incorrect thermocouple type (TC) configured	Change SENSOR_TYPE device function
	Incorrect comparison measurement point set	Check reference junction (RJ) compensation
	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 incorrectly connected	Connect the sensor as per the terminal diagram (polarity)
	Sensor defective	Check sensor
	Programming	Incorrect sensor type set in the SENSOR_TYPE device function; set the correct thermocouple
	Device defective	Replace device

9.4 Spare parts

There are no spare parts provided for the temperature transmitter.

9.5 Returns

The device should be well packed, preferably in the original packaging when storing for further use or returning it for repair. Repairs must only be done by the service organization.
When returning the device for repair, please add a desription of both the fault and the application with the device.

9.6 Disposal

The device contains electronic components and when being disposed of should be placed in the electronic waste. Please take note of any local waste disposal legislation when disposing of the device.
The transmitter does not contain any batteries that must be disposed of separately from the transmitter.

9.7 Software history and overview of compatibility

Release
The release number on the title page in the Operating Instructions indicates the device release history: XX.YY.ZZ (example 01.02.01).

XX Change in the main version.
No longer compatible. Changes to device and Operating Instructions.

YY Change in functionality and operation.
Compatible. Changes to Operating Instructions.

ZZ Debugging and internal modifications.
No changes to Operating Instructions.

Date	Firmware version	Changes to software	Operating Instructions
07/2006	01.02.ZZ	Original Firmware Compatibility to the PLC and Asset Management Systems, → 🖹 22.	71033906/BA240R/09/en/09.06
			71033906/BA00240R/09/en/01.11

10 Technical data

10.1 Input

Measured variable	Temperature (temperature linear transmission behavior), resistance and voltage.
Measuring range	The transmitter records different measuring ranges depending on the sensor connection and input signals.

Type of input **Resistance thermometer (RTD)**

Type	Standard	Measuring range limits	Maximum measured error (accuracy)	Temperature drift
Pt50	IEC 60751 (ITS90) (α = 0.00385)	-200 to 850 °C (-328 to 1562 °F)	± 0.77 °C (± 1.39 °F)	± 0.0010 °C/K
Pt100		-200 to 850 °C (-328 to 1562 °F)	± 0.33 °C (± 0.59 °F)	± 0.0010 °C/K
Pt100	JIS C 1604-1989 (α = 0.003916)	-200 to 630 °C (-328 to 1166 °F)	± 0.33 °C (± 0.59 °F)	± 0.0010 °C/K
Pt200	IEC 60751 (ITS90) (α = 0.00385)	-200 to 850 °C (-328 to 1562 °F)	± 0.33 °C (± 0.59 °F)	± 0.0010 °C/K
Pt500		-200 to 850 °C (-328 to 1562 °F)	± 0.31 °C (± 0.56 °F)	± 0.0010 °C/K
Pt1000		-200 to 850 °C (-328 to 1562 °F)	± 0.31 °C (± 0.56 °F)	± 0.0010 °C/K
Ni100	DIN 43760-1987 (α = 0.006180)	-60 to 250 °C (-76 to 482 °F)	± 0.18 °C (± 0.32 °F)	± 0.0010 °C/K
Ni120	Minco Standard	-80 to 320 °C (-112 to 608 °F)	± 0.18 °C (± 0.32 °F)	± 0.0010 °C/K
Ni200	DIN 43706-1987 (α = 0.006180)	-60 to 250 °C (-76 to 482 °F)	± 0.18 °C (± 0.32 °F)	± 0.0010 °C/K
Cu10	SAMA RC21-4-1966 (α = 0.003923)	-70 to 150 °C (-94 to 302 °F)	± 2.99 °C (± 5.38 °F)	± 0.0010 °C/K
With 2-wire circuit, compensation of wire resistance possible (0 to 100 Ω) With 3-wire and 4-wire connection, sensor wire resistance to max. 50 Ω per wire				

Thermocouples (TC)[1)]

Type	Standard	Measuring range limits	Maximum measured error (accuracy)	Temperature drift	
				Range	Deviation
B	IEC 60584-1	300 to 600 °C (572 to 1112 °F) 600 to 1200 °C (1112 to 2192 °F) 1200 to 1800 °C (2192 to 3272 °F)	± 3.32 °C (± 5.98 °F) ± 1.77 °C (± 3.19 °F) ± 1.08 °C (± 1.94 °F)	300 to 600 °C (572 to 1112 °F) 600 to 1200 °C (1112 to 2192 °F) 1200 to 1800 °C (2192 to 3272 °F)	± 0.0060 °C/K ± 0.0131 °C/K ± 0.0242 °C/K
E		-200 to -50 °C (-328 to -58 °F) -50 to 1000 °C (-58 to 1832 °F)	± 0.42 °C (± 0.76 °F) ± 0.31 °C (± 0.56 °F)	-200 to -50 °C (-328 to -58 °F) -50 to 200 °C (-58 to 392 °F) 200 to 1000 °C (392 to 1832 °F)	± 0.0070 °C/K ± 0.0036 °C/K ± 0.0203 °C/K
J		-200 to 0 °C (-328 to 32 °F) 0 to 1000 °C (32 to 1832 °F)	± 0.48 °C (± 0.86 °F) ± 0.31 °C (± 0.56 °F)	-200 to 0 °C (-328 to 32 °F) 0 to 200 °C (32 to 392 °F) 200 to 1000 °C (392 to 1832 °F)	± 0.0072 °C/K ± 0.0039 °C/K ± 0.0243 °C/K
K		-200 to 0 °C (-328 to 32 °F) 0 to 1372 °C (32 to 2501 °F)	± 0.68 °C (± 1.22 °F) ± 0.43 °C (± 0.77 °F)	-200 to 0 °C (-328 to 32 °F) 0 to 500 °C (32 to 932 °F) 500 to 1372 °C (932 to 2501 °F)	± 0.0077 °C/K ± 0.0097 °C/K ± 0.0323 °C/K
N		-200 to -100 °C (-328 to -148 °F) -100 to 500 °C (-148 to 932 °F) 500 to 1300 °C (932 to 2372 °F)	± 1.03 °C (± 1.85 °F) ± 0.54 °C (± 0.97 °F) ± 0.39 °C (± 0.70 °F)	-200 to -100 °C (-328 to -148 °F) -100 to 500 °C (-148 to 932 °F) 500 to 1300 °C (932 to 2372 °F)	± 0.0080 °C/K ± 0.0088 °C/K ± 0.0264 °C/K

1) Grounding of all thermocouples possible

Type	Standard	Measuring range limits	Maximum measured error (accuracy)	Temperature drift	
				Range	Deviation
R		0 to 350 °C (32 to 662 °F) 350 to 1768 °C (662 °F to 3214 °F)	± 1.93 °C (± 3.47 °F) ± 1.16 °C (± 2.09 °F)	0 to 350 °C (32 to 662 °F) 350 to 800 °C (662 to 1472 °F) 800 to 1768 °C (1472 to 3214 °F)	± 0.0057 °C/K ± 0.0129 °C/K ± 0.0338 °C/K
S		0 to 550 °C (32 to 1022 °F) 550 to 1768 °C (1022 to 3214 °F)	± 1.92 °C (± 3.46 °F) ± 1.15 °C (± 2.07 °F)	0 to 550 °C (32 to 1022 °F) 550 to 800 °C (1022 to 1472 °F) 800 to 1768 °C (1472 to 3214 °F)	± 0.0094 °C/K ± 0.0135 °C/K ± 0.0355 °C/K
T		-200 to -50 °C (-328 to -58 °F) -50 to 400 °C (-58 to 752 °F)	± 0.66 °C (± 1.19 °F) ± 0.35 °C (± 0.63 °F)	-200 to -50 °C (-328 to -58 °F) -50 to 200 °C (-58 to 392 °F) 200 to 400 °C (392 to 752 °F)	± 0.0071 °C/K ± 0.0035 °C/K ± 0.0067 °C/K
W5Re W24Re	ASTM E988-96	0 to 800 °C (32 to 1472 °F) 800 to 2000 °C (1472 to 3632 °F)	± 0.80 °C (± 1.45 °F) ± 1.05 °C (± 1.89 °F)	0 to 800 °C (32 to 1472 °F) 800 to 2000 °C (1472 to 3632 °F)	± 0.0151 °C/K ± 0.0552 °C/K
Reference junction internal Accuracy of reference junction ± 0.5 °C (± 0.9 °F)					

Resistance transmitter Ω

Measuring range limits	Maximum measured error (accuracy)	Temperature drift
0 to 650 Ω	± 115 mΩ	± 6 mΩ/K
0 to 1300 Ω	± 230 mΩ	± 6 mΩ/K
0 to 2600 Ω	± 460 mΩ	± 13 mΩ/K
0 to 5200 Ω	± 920 mΩ	± 26 mΩ/K

Voltage transmitter (mV)

Measuring range limits	Maximum measured error (accuracy)	Temperature drift
-100 to 150 mV	± 20 µV	± 2 µV/K

10.2 Output

Output signal	FOUNDATION Fieldbus™ H1, IEC 61158-2, galvanically isolated Physical Layer profile: ■ Profile type 511 (FISCO) ■ Profile type 111 (Entity) ITK version 4.61
Linearization/transmission behavior	Temperature linear, resistance linear, voltage linear
Galvanic isolation	Û = 375 V AC (fieldbus/inputs)
Filter	50 or 60 Hz
Min. current consumption	≤ 23 mA
Switch-on delay	approx. 20 s

Function blocks

- Resource block (RS):
  1 x RS
- Function blocks (execution time max. 40 ms, macro cycle ≤ 500 ms):
  8 x Analog Input block (AI)
  1 x Multiple Analog Input block (MAI)
- Transducer blocks (TB):
  8 x sensor TB
  1 x concentrator TB

FDE
(Fault Disconnect Equipment)

6.7 mA

10.3 Power supply

Electrical connection

Wiring diagram, → 11

Supply voltage

U = 9 to 32 V DC, reverse polarity protection

Cable entries
(field housing)

	Sensor connection		FOUNDATION Fieldbus™ connection	
Cable connections, material	Cable gland	Cable diameter mm (in) / across flats	Cable gland	Cable diameter mm (in) / across flats
Terminals and cable guide, nickeled brass	M16 x 1.5	5 to 10 (0.19 to 0.39 in) / 20	M20 x 1.5	7 to 12 (0.28 to 0.47 in) / 24

10.4 Performance characteristics

Response time

< 1 s per channel

Reference operating conditions

+25 °C ± 5 K (+77 °F ± 9 °F)

Maximum measured error

Accuracy for the various types of input, → 38.

Influence of ambient temperature (temperature drift)

Temperature drift for the various types of input, → 38.

Influence of reference junction

± 0.5 °C (± 0.9 °F)

Linearization

- RTD input 0.03 °C (0.054 °F)
- TC input 0.1 °C (0.18 °F)

Internal update time

For all sensor types ≤ 1 s

Potential separation

600 V_{SS} (input/input)

10.5 Installation conditions

Installation instructions

Installation/mounting location
Wall or cabinet mounting on DIN rail as per IEC 60715. A mounted device in aluminum field housing for field instrumentation is optionally available (for dimensions, → 42).

10.6 Environment conditions

Ambient temperature

Type of connection	Temperature range	
	Hazardous area	Non-hazardous area
Field housing; cable guide, nickeled brass	-40 to +70 °C (-40 to +158 °F)	-40 to +85 °C (-40 to +185 °F)
Without field housing		

Storage temperature

-40 to +85 °C (-40 to +185 °F)

Relative humidity

≤ 95 % not condensing, valid for the DIN rail version

Climate class

Tested as per IEC 60068-2-30, meets the requirements regarding class C1-C3 in accordance with IEC 60721-4-3

Degree of protection

Mounting on a DIN rail	IP 20
Mounting in aluminum field housing	IP 67

Shock resistance

Impact resistance as per IEC 60068-2-27

Mounting on a DIN rail	15g, 11 ms
Mounting in aluminum field housing	15g, 11 ms

Vibration resistance

As per IEC 60068-2-6

Mounting on a DIN rail	5g, 10 to 150 Hz
Mounting in aluminum field housing	10g, 10 to 150 Hz

Electromagnetic compatibility (EMC)

This recommendation is a consistent and practical way of determining whether the devices used in laboratories and in process control systems are resistant to impact, thus increasing their functional safety.

ESD (electrostatic discharge)	IEC 61000-4-2	6 kV cont., 8 kV air	
Electromagnetic fields	IEC 61000-4-3	0.08 to 4 GHz	10 V/m
Burst (fast transients)	IEC 61000-4-4	1 kV	
Surge	IEC 61000-4-5	1 kV asym.	
Conducted RF	IEC 61000-4-6	0.01 to 80 MHz	10 V

10.7 Mechanical construction

Design, dimensions

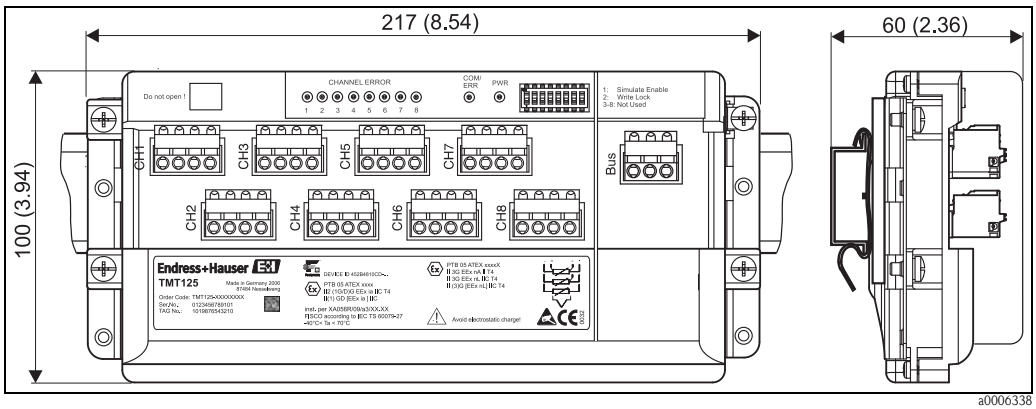

Fig. 12: Housing for DIN rail as per IEC 60715; specifications in mm (in)

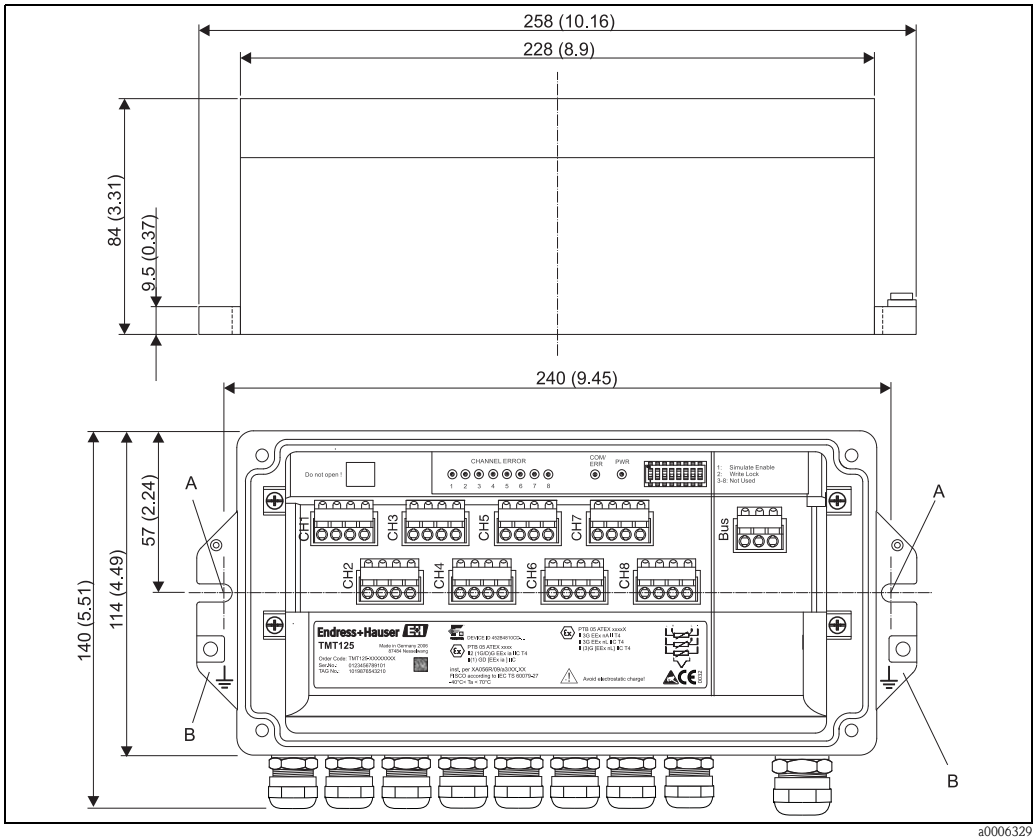

Fig. 13: Dimensions of field housing; specifications in mm (in)

Item A: Securing with M6 bolt
Item B: Grounding, shielding point

Weight

- DIN rail version: 360 g (12.7 oz)
- Installed in field housing: 1.8 kg (3.97 lb)

Material

- DIN rail housing: polycarbonate (PC)
- Field housing: AlSi12 (Cu), EN573 (Si 1.2% – proportion), anodized
- Nameplate: polyester (PE)

Terminals	■ Plug-in terminals, sensor and fieldbus cables up to max. 2.5 mm^2 (14 AWG) ■ Specifications for cable glands and diameters, → 🖹 40.

10.8 Certificates and approvals

CE-Mark	The device meets the legal requirements of the EC directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.
Hazardous area approvals	For further details on the available Ex versions (ATEX, CSA, FM, etc.), please contact your nearest Endress+Hauser sales organisation. All relevant data for hazardous areas can be found in separate Ex documentation. If required, please request copies from us or your Endress+Hauser sales organisation.
Other standards and guidelines	■ IEC 60529: Degree of protection provided by housing (IP-code) ■ IEC 61158-2: Fieldbus for use in industrial control systems ■ IEC 60068-2-27 and IEC 60068-2-6: Shock and vibration tests ■ IEC 61326: Electromagnetic compatibility (EMC requirements) ■ NAMUR Standards working group for measurement and control technology in the chemical industry (www.namur.de)
Certification FOUNDATION Fieldbus™	The temperature transmitter has successfully passed all test procedures and is certified and registered by the Fieldbus Foundation. The device thus meets all the requirements of the specifications following: ■ Certified according to FOUNDATION Fieldbus™ specification ■ The device meets all the specifications of the FOUNDATION Fieldbus™ H1 ■ Interoperability Test Kit (ITK), revision status 4.61 (device certification no. available on request): the device can also be operated with certified devices of other manufacturers ■ Physical layer conformance test of the FOUNDATION Fieldbus™

10.9 Documentation

■ Brief Operating Instructions iTEMP® TMT125 (KA241R/09)
■ Ex supplementary documentation: ATEX II 2(1G/D)G; II (1)GD; II 3G: XA056R/09/a3

11 Operation via FOUNDATION Fieldbus™

11.1 Introduction

The temperature transmitter contains a resource block (like any FOUNDATION Fieldbus™ device), 9 transducer blocks (8 sensor and one concentrator block) and 9 standard FOUNDATION Fieldbus™ function blocks (8 AI and one MAI block).
The **sensor transducer blocks** provide connection to the sensor hardware and the possibility to configure the eight temperature sensors that can be connected to the device.
The **concentrator transducer block** provides convenient access to the most important configuration options of all sensors as well as Device Description (DD) methods for easy configuration of the device. This will increase the productivity at configuration time. Additionally, it provides the device's body temperature and EMC filter settings. It will also allow viewing the values and diagnostics information of all channels at the same time.
The **Analog Input (AI) blocks** are conform to the FOUNDATION Fieldbus™ specification and can be used to build a FOUNDATION Fieldbus™ application and provides temperature/voltage/ resistance value depending on the configuration.
The **Multiple Analog Input (MAI)** block conforms to the FOUNDATION Fieldbus™ specification and provides all eight sensor values in one block. Limits handling and alarms are not implemented in this block. Also, the block consumes only one execution time so the FOUNDATION Fieldbus™ schedule time can be reduced. This block is convenient if e.g. the device is used for monitoring purposes because it is very easy to project and doesn't require configuration. Additionally, there is only one block to configure instead of 8 blocks.

Block Interaction and Channel Mapping
Transducer blocks provide a measurement value to AI and MAI blocks. The connection between the blocks is configured via the „Channel“ parameter of the AI block which chooses the sensor block to get the process data from.

Number	Selected sensor	Usable by
1	Sensor 1	AI
2	Sensor 2	AI
3	Sensor 3	AI
4	Sensor 4	AI
5	Sensor 5	AI
6	Sensor 6	AI
7	Sensor 7	AI
8	Sensor 8	A
9	Sensor 1 to 8	MAI
10	Body temperature	AI

In addition to the measurement value, status information is conveyed to the AI and MAI block which can be used to determine the measurement value's quality. For more information see Section 6.3.1.

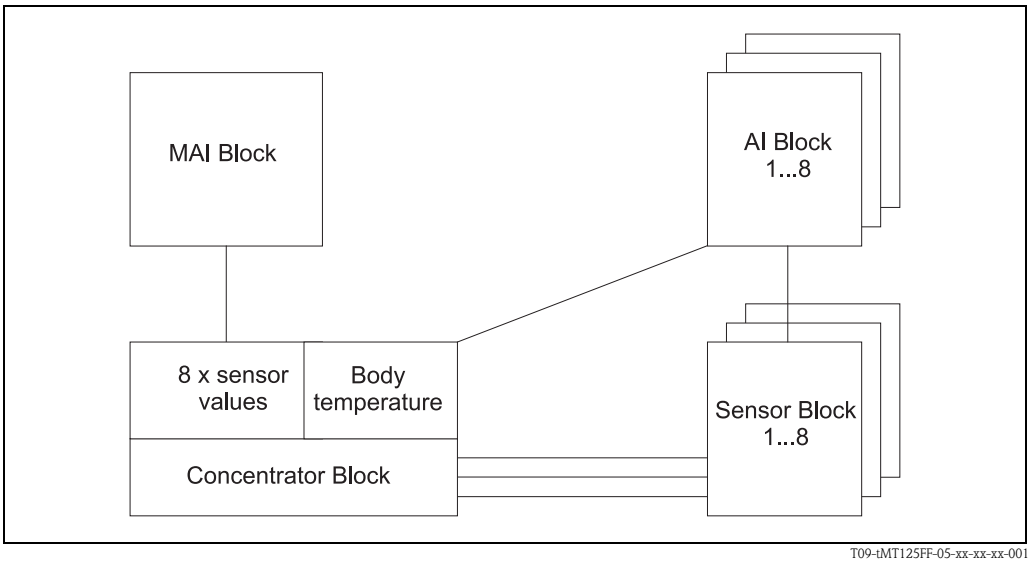

Fig. 14: Block interaction

11.2 Resource Block

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**
1	**ST_REV**	**Read only**	The revision level of the static data associated with the resource block. ✎ Note! The revision status is incremented on each modification of static data.
2	**TAG_DESC**	**AUTO - OOS**	Entry of a user specific text for unique identification and assignment of the block.
3	**STRATEGY**	**AUTO - OOS**	Parameter for grouping and thus faster evaluation of blocks. Grouping is carried out by entering the same numerical value in the STRATEGY parameter of each individual block. **Factory default: 0** ✎ Note! This data is neither checked nor processed by the Resource Block.
4	**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 for sorting alarms and events. User input: 1 to 255 **Factory default: 0**

Resource Block			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
5	**MODE_BLK**	**AUTO - OOS**	Displays the current (Actual) and desired (Target) operating mode of the Resource Block, the permitted modes (Permitted) supported by the Resource Block and the normal operating mode (Normal). Display: AUTO - OOS ✎ Note! The Resource Block supports the following operating modes: ■ AUTO (automatic operation) In this mode the execution of the remaining blocks (AI and MAI function block) is permitted. ■ OOS (out of service): The block is in the "out of service" mode. In this mode execution of the remaining blocks (AI and MAI function block) is blocked. These blocks cannot be set to AUTO mode. ✎ Note! The current operating status of the Resource Block is also shown via the RS_STATE parameter.
6	**BLOCK_ERR**	**Read only**	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string so that multiple errors may be shown. Supported values: ■ Simulate Active: Hardware switch is set to simulation possible ■ Lost Static Data: The database used for storing the NV parameters within the device is corrupt ■ Device Needs Maintenance Now: The hardware of the device failed in some way (e.g. body temperature too high) ■ Out Of Service: The Resource Block is in Mode OOS
7	**RS_STATE**	**Read only**	Displays the current operating status of the Resource Blocks. Display: STANDBY — The Resource Block is in the OOS operating mode. It is not possible to execute the remaining blocks. ONLINE LINKING — The configured connections between the function blocks have not yet been made. ONLINE — Normal operating status, the Resource Block is in the AUTO operating mode. The configured connections between the function blocks are established.
8	**TEST_RW**	**AUTO - OOS**	✎ Note! This parameter is required only for interoperability tests and has no meaning in normal operation.
9	**DD_RESOURCE**	**Read only**	Displays the refference source for the device description in the device.
10	**MANUFAC_ID**	**Read only**	Displays the manufacturer's ID number. Display: 0 x 452B48 = Endress+Hauser
11	**DEV_TYPE**	**Read only**	Displays the device type in decimal numeric format. Display: 0 x 10CD hex for TMT125 FF

Resource Block			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
12	**DEV_REV**	**Read only**	Displays the revision number of the device.
13	**DD_REV**	**Read only**	Displays the revision number of the device description.
14	**GRANT_DENY**	**AUTO - OOS**	Enables or restricts the access authorization of a fieldbus host system to the field device.
15	**HARD_TYPES**	**Read only**	Displays the input signal type for the Analog Input function block.
16	**RESTART**	**AUTO - OOS**	This parameter is used to reset the device in various ways. Options: ■ Restart UNINITIALIZED ■ RUN ■ Restart RESOURCE ■ Restart with DEFAULTS ■ Restart PROCESSOR
17	**FEATURES**	**Read only**	Displays the additional options supported by the device. Display: REPORTS FAULTSTATE SOFT W LOCK
18	**FEATURES_SEL**	**AUTO - OOS**	For selecting the additional functions supported by the device.
19	**CYCLE_TYPE**	**Read only**	Displays the block execution method supported by the device. Display: SCHEDULED timed block execution method BLOCK EXECUTION sequential block execution method MANUF SPECIFIC manufacturer specified
20	**CYCLE_SEL**	**AUTO - OOS**	Displays the block execution method used by the fieldbus host system. ✎ Note! The block execution method is selected by the fieldbus host system.
21	**MIN_CYCLE_T**	**Read only**	Displays the minimum execution time.
22	**MEMORY_SIZE**	**Read only**	Displays the available configuration memory in kilobytes.
23	**NV_CYCLE_T**	**Read only**	Displays the time interval for which the dynamic device parameters are stored in the nonvolatile memory. The time interval displayed relates to storage of the following dynamic device parameters: ■ OUT ■ PV ■ FIELD_VAL ✎ Note! Since the device does not store the dynamic device parameters in the nonvolatile memory, this parameter always displays the value 0.

Resource Block			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
24	**FREE_SPACE**	**Read only**	Displays the free system memory (in percent) available for execution of further function blocks. ✎ Note! Since the function blocks of the device are preconfigured, this parameter always displays the value 0. The device does not support this function.
25	**FREE_TIME**	**Read only**	Displays the free system time (in percent) available for execution of further function blocks. ✎ Note! Since the function blocks of the device are preconfigured, this parameter always displays the value 0. The device does not support this function.
26	**SHED_RCAS**	**AUTO - OOS**	Specifies the monitoring time for checking the connection between the fieldbus host system and a function block in the RCAS operating mode. When the monitoring time elapses, the function block changes from the RCAS operating mode to the operating mode selected in the SHED_OPT parameter. **Factory default: 640000 $^{1}/_{32}$ ms**
27	**SHED_ROUT**	**AUTO - OOS**	Specifies the monitoring time for checking the connection between the fieldbus host system and the function block in the ROUT operating mode. When the monitoring time elapses, the function block changes from the ROUT operating mode to the operating mode selected in the SHED_OPT parameter. **Factory default: 640000 $^{1}/_{32}$ ms**
28	**FAULT_STATE**	**Read only**	Current status display of the security behavior of output function blocks. The device does not support this function.
29	**SET_FSTATE**	**AUTO - OOS**	This parameter can be used to manually enable the security behavior of the device. The device does not support this function.
30	**CLR_FSTATE**	**AUTO - OOS**	This parameter can be used to manually disable the security behavior of the output function blocks. The device does not support this function.
31	**MAX_NOTIFY**	**Read only**	Displays the maximum number of event reports supported by the device that can exist unconfirmed at the same time. This number cannot be changed. The device supports a maximum 42.
32	**LIM_NOTIFY**	**AUTO - OOS**	This parameter is used to specify the number of event reports that can exist unconfirmed at the same time. The device supports a maximum 42.
33	**CONFIRM_ TIME**	**AUTO - OOS**	Specifies the confirmation time for the event report. If the device does not receive confirmation within this time then the event report is sent to the fieldbus host system again. **Factory default: 640000 $^{1}/_{32}$ ms**

Resource Block			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
34	**WRITE_LOCK**	**Read only**	Able and disable write protection Display: LOCKED Device data cannot be modified NOT LOCKED Device data can be modified UNINITIALIZED
35	**UPDATE_EVT**	**Read only**	Indicates whether static block data have been altered, including date and time.
36	**BLOCK_ALM**	**AUTO - OOS**	The current block status appears on the display with information on pending configuration, hardware or system errors, including information on the alarm period (date, time) when the error occurred. The block alarm is triggered in the event of the following block errors: ■ SIMULATE ACTIVE ■ OUT OF SERVICE ✎ Note! If the option of the alarm has **not** been enabled in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.
37	**ALARM_SUM**	**AUTO - OOS**	Displays the current status of the process alarms in the Resource Block. ✎ Note! In addition the process alarms can also be disabled in this parameter group.
38	**ACK_OPTION**	**AUTO - OOS**	This parameter is used to specify whether a process alarm must be acknowledged at the time of alarm recognition by the fieldbus host system. If this option is enabled, the process alarm is acknowledged automatically. **Factory default: 0**
39	**WRITE_PRI**	**AUTO - OOS**	Specifies the behavior of a write protected alarm ("WRITE_ALM" parameter). User input: 0 = The write protection alarm is not evaluated. 1 = No report to the fieldbus host system 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 default: 0**
40	**WRITE_ALM**	**AUTO - OOS**	Displays the status of the write protected alarm. ✎ Note! The alarm is triggered if the write protection is disabled.
41	**ITK_VER**	**Read only**	Major revision number of the Interoperability Test Case used to register the device with the Fieldbus FOUNDATION Fieldbus™.
42	**SERIAL_NUMBER**	**Read only**	Serial number of the electronics. Is used to create the Device ID.
43	**VERSIONINFO SWREV**	**Read only**	Software version of the device.

Resource Block			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
44	**VERSIONINFO HWREV**	**Read only**	Hardware version of the device.
45	**VERSIONINFO DEVREL**	**Read only**	Device release of the device.
46	**DEVICE_CAL_ DATE**	**Read only**	Date of calibration.
47	**ORDER_CODE**	**Read only**	Order code of the device.

11.3 Transducer blocks

11.3.1 Transducer Block FF parameters

The following table lists all the specified FOUNDATION Fieldbus™ parameters of the Transducer Blocks. The device-specific parameters are described as of → 52.

Transducer Block (FF parameters)			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
1	**Static revision (ST_REV)**	**Read only**	The revision status of the static data appears on the display. ✎ Note! The revision status parameter is incremented on each modification of static data. When a factory reset is done this parameter will be reset to 0 in all blocks.
2	**Tag description (TAG_DESC)**	**AUTO - OOS**	Use this function to enter a user-specific text of max. 32 characters for unique identification and assignment of the block. **Factory default:** (_____) no text
3	**Strategy (STRATEGY)**	**AUTO - OOS**	Parameter for grouping and thus faster evaluation of blocks. Grouping is carried out by entering the same numerical value in the STRATEGY parameter of each individual block. **Factory default: 0** ✎ Note! These data are neither checked nor processed by the Transducer Blocks.
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 for sorting alarms and events. **User input:** 1 to 255 **Factory default: 0**

Transducer Block (FF parameters)			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
5	**Block Mode (MODE_BLK)**	**AUTO - OOS**	Displays the current (Actual) and desired (Target) operating mode of the corresponding Transducer Block, the permitted modes (Permitted) supported by the Resource Block and the normal operating mode (Normal). **Display:** AUTO OOS ✎ Note! 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 status of the process variable changes to BAD
6	**Block Error (BLOCK_ERR)**	**Read only**	The active block errors appear on the display. **Display:** ■ Out-of-service: The block is in the "out of service" operating mode The following block error is only shown in the Transducer Block ’Concentrator block’: ■ 129: Body temperature too high or too low The following block errors are only shown in the Transducer Block ’Sensor’: ■ Input Failure: "Primary Value Status" is BAD, but not BAD/OOS ■ Block Configuration Error: Target block mode is different than OOS and one of the following conditions is true: – Sensor type is set to undefined – "Sensor Range.Unit" is set to a value not supported by sensor (e.g. "mV" for a resistance based sensor) – User calibration is turned on at "Calibration Mode", but Calibration State shows no valid user calibration exists An exact error description as well as information on rectifying faults can be found on → 31.
7	**Update Event (UPDATE_EVT)**	**AUTO - OOS**	Indicates whether static block data have been altered, including date and time.
8	**Block Alarm (BLOCK_ALM)**	**AUTO - OOS**	The current block status appears on the display with information on pending configuration, hardware or system errors, including information on the alarm period (date, time) when the error occurred. ✎ Note! ■ 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.
9	**Transducer Error (XD_ERROR)**	**Read only**	Displays the actual transducer block error with the highest priority. Supported values for the Transducer Block ’Sensor’: ■ Configuration Error: A block configuration error exists. See "BLOCK_ERR" for details ■ I/O Failure: The sensor value exceeds the HI or LO sensor Limits ■ Sensor Connection Error: Sensor cabling error detected Supported values for the Transducer Block ’Concentrator block’: ■ 129: Body temperature too high or too low

11.3.2 Transducer Block 'Sensor'

The properties column lists parameter properties:
- S: Static (a write access to this parameter increments ST_REV)
- W: Parameter is writeable
- OOS: Parameter is writeable in OOS mode only
- SP: Special (See description column)
- NF: non-functional parameter (does not change block behaviour).

Since all parameters can be read, this is not explicitly stated.

Transducer Block (Sensor)			
Parameter Index	**Parameter**	**Properties**	**Description**
10	**Primary Value Type**	**S, W, NF**	Defines the type of the Primary Value. The following values are valid: ■ Process temperature ■ Non-process temperature ■ mV ■ Ohm
11	**Primary Value**		The value and status of the sensor input (Section 6.3.1).
12	**Primary Value Filtertime**	**S, OOS**	Time constant in seconds of a first order lag filter applied to "Primary Value". Valid values are 0 to 255 s. A value of 0 disables filtering.
13	**Sensor Type**	**S, OOS**	Type of the attached sensor. For a list of supported sensors, → 📄 38. If "Sensor Type" is written some other parameters will be set automatically for convenience: ■ If voltage mode is selected, "Sensor Range.Units Index" is set to mV ■ If resistance input is selected the "Sensor Range.Units Index" is set to Ohm ■ If a TC or RTD sensor is selected and the "Sensor Range.Units Index" is mV or Ohm it is set to °C
14	**Sensor Range**	**S, OOS, (EU_100, EU_0, UNITS_INDEX, DECIMAL)**	Defines the absolute maximum ends of the sensor range, the units of those limits and the number of digits to the right of the decimal point to be used to display these values. Supported units: mV, Ohm, °C, °F, K, °R
15	**Sensor Connection**	**S, OOS**	Number of wires used to connect the sensor. This parameter is only honored if a resistance-based sensor is configured. Supported values: ■ Two wires ■ Three wires ■ Four wires
16	**Sensor Diagnostics**	**S, W**	Enables sensor diagnosis.
17	**Sensor Status**		Shows failures of the attached sensor, it is a bit string so multiple errors can be shown. Supported values: ■ Sensor connection error ■ Over range: The measured value is too high for current sensor ■ Under range: The measured value is too low for current sensor ✎ Note! Failure status: 0 = OK/inactive; 1 = error/active
18	**Sensor Serial No.**	**S, W, NF**	The serial number of the attached sensor.
19	**Sensor Calibration Method**	**S, W, NF**	Last calibration method used for the attached sensor: ■ Factory trim standard calibration ■ User trim standard calibration ■ Factory trim special calibration ■ User trim special calibration ■ Other

Transducer Block (Sensor)			
Parameter Index	**Parameter**	**Properties**	**Description**
20	**Sensor Calibration Location**	**S, W, NF**	Shows location of the last calibration for the attached sensor.
21	**Sensor Calibration Data**	**S, W, NF**	Shows date of the last calibration for the attached sensor.
22	**Sensor Calibration Who**	**S, W, NF**	Shows name of person responsible for the last calibration for the attached sensor.
23	**Two Wire Compensation**	**S, OOS**	Specifies an offset subtracted from the measured resistance if a 2-wire RTD or Ohm sensor is attached. The value is specified as a positive floating point number. The following values are permitted: **0 to 100 Ω**
24	**Reference Junction (RJ) Type**	**S, OOS**	Selects the method used to do a Reference junction (RJ) compensation: ■ Internal: use the internally measured value ■ Constant: use the value of parameter "RJ External Value"
25	**RJ External Value**	**S, OOS**	Value used for RJ compensation if "RJ Type" is set to Constant. Uses the Unit of "Sensor Range.Units Index". The value is converted automatically if "Sensor Range.Units Index" is changed.
26	**Calibration Highest Point**	**S, SP**	Upper value for calibration of the input. Writeable only during calibration.
27	**Calibration Lowest Point**	**S, SP**	Lower value for calibration of the input. Writeable only during calibration.
28	**Calibration Highest Point Limit**		Highest value allowed to calibrate the input.
29	**Calibration Lowest Point Limit**		Lowest value allowed to calibrate the input.
30	**Calibration Minimum Span**		Minimum needed difference between "Calibration Highest Point" and "Calibration Lowest Point".
31	**Calibration Units**		Unit used to calibrate the input. It is set automatically if a calibration starts. Valid values: mV and Ohm
32	**Calibration Mode**	**S, OOS**	Stipulates the validity of user calibration and turns the calibration mode on for the input ■ User calibration off ■ User calibration on: A calibration error ("Calibration State" reads "Failure") will be reported as a block configuration error so the block will not switch to AUTO mode. ■ Execute user calibration
33	**Calibration State**		Shows the state of the user calibration for the input. Supported values: ■ Not initialized: No user calibration was carry out yet. It's not possible to turn on the user calibration ■ Executing: A user calibration is being started ■ OK: A valid user calibration was executed ■ Failure: A failure happened during the last user calibration. The values are invalid. It's not possible to turn on the user-calibrated measurement. The block will report a configuration error if "Calibration Mode" is set to "User calibration on". ■ Wait first: Device is waiting for write on "Calibration Highest Point" or "Calibration Lowest Point" as first calibration point ■ Wait second HI: Device is waiting for write on " Calibration Highest Point " as second calibration point ■ Wait second LO: Device is waiting for write on " Calibration Lowest Point " as second calibration point ■ Sampling HI: Device is measuring HI calibration value ■ Sampling LO: Device is measuring LO calibration value
34	**Calibration Location**	**S, W, NF**	Shows location of the last calibration for the input.

Transducer Block (Sensor)			
Parameter Index	**Parameter**	**Properties**	**Description**
35	**Calibration Date**	**S, W, NF**	Shows date of the last calibration for the input.
36	**Calibration Who**	**S, W, NF**	Shows name of person responsible for the last calibration for the input.

11.3.3 Transducer Block 'Concentrator block'

The properties column lists parameter properties:
- S: Static (a write access to this parameter increments ST_REV)
- W: Parameter is writeable
- OOS: Parameter is writeable in OOS mode only
- SP: Special (See description column)
  NF: non-functional parameter (does not change block behaviour).

Since all parameters can be read, this is not explicitly stated.

Transducer Block (Concentrator block)			
Parameter Index	**Parameter**	**Properties**	**Description**
10	**Block Mode Channel 1**	**S, W**	Mode block of sensor input 1.
11	**Primary Value**		The value and status of sensor input 1.
12	**Primary Value Filtertime Channel 1**	**S, SP**	The damping value for sensor input 1. Parameter is writeable if corresponding sensor block is in OOS mode.
13	**Sensor Unit Channel 1**	**S, SP**	The unit used for sensor input 1. Parameter is writeable if corresponding sensor block is in OOS mode.
14	**Sensor Type Channel 1**	**S, SP**	The type of sensor input 1. Parameter is writeable if corresponding sensor block is in OOS mode.
15	**Sensor Connection Channel 1**	**S, SP**	The connection type of sensor input 1. Parameter is writeable if corresponding sensor block is in OOS mode.
16	**Sensor Diagnostics Channel 1**	**S, W**	Allows to enable/disable the sensor diagnosis for sensor 1.
18 - 73	The sensor specific values above are repeated for the sensor inputs 2 - 8: ■ 18 - 24 channel 2 ■ 25 - 31 channel 3 ■ 32 - 38 channel 3 ■ 39 - 45 channel 4 ■ 46 - 52 channel 5 ■ 53 - 59 channel 6 ■ 60 - 66 channel 7 ■ 67 - 73 channel 8		
74	**Body Temperature**		Value and status of the body temperature.
75	**Body temperature Unit**	**S, OOS**	The unit used to display body temperature. Valid units: °C, °F, °R, K
76	**ASIC Rejection**	**S, W**	Used to set the mains filter depending on the frequency of mains of the installation. Valid values are 50Hz and 60Hz.

Transducer Block (Concentrator block)			
Parameter Index	**Parameter**	**Properties**	**Description**
77	**Status Summary**	**S, W, NF**	Overview of the sensor status of all sensors. The parameter is a bit string, so multiple errors can be displayed. Supported values: "Bad sensor 1" to "Bad sensor 8"

11.4 Analog Input function block (AI)

Analog Input function block (AI)			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
1	**ST_REV**	**Read only**	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
2	**TAG_DESC**	**AUTO - OOS**	Entry of a user-specific text of max. 32 characters for unique identification and assignment of the block.
3	**STRATEGY**	**AUTO - OOS**	Parameter for grouping and thus faster evaluation of blocks. Grouping is carried out by entering the same numerical value in the STRATEGY parameter of each individual block. ✎ Note! This data is neither checked nor processed by the Analog Input function block.
4	**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 for sorting alarms and events. User input: 1 to 255 **Factory default: 0**
5	**MODE_BLK**	**MAN - AUTO - OOS**	Displays the current (Actual) and desired (Target) operating mode of the Analog Input function block, the permitted modes (Permitted) supported by the Resource Block and the normal operating mode (Normal). Display: AUTO - MAN - OOS ✎ Note! The Analog Input function block supports the following operating modes: ■ AUTO (automatic mode): The block is executed. ■ MAN (manual intervention by the operator): The output value OUT can be specified. ■ OOS (out of service): The block is in the "out of service" mode. With the output value OUT the last valid value is output. The status of the output value OUT switches to BAD.
6	**BLOCK_ERR**	**Read only**	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	**PV**	**Read only**	Displays the process variable used for the block execution, including the status of the process variable. ✎ Note! The unit used is copied from the OUT_SCALE parameter group.
8	**OUT**	**MAN - OOS**	Displays the output value with alarm evaluation and the status of the Analog Input function block. User input: Range and unit of OUT_SCALE

Analog Input function block (AI)			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
9	**SIMULATE**	**AUTO - MAN - OOS**	Simulation of the input value and input status. Since this value runs through the entire algorithm, the behavior of the Analog Input function block can be checked. The BLOCK_ERROR parameter of the Resource Block shows whether simulation is possible.
10	**XD_SCALE**	**MAN - OOS**	In this parameter group the measurement range of the sensor is scaled and the unit of the process variable is determined. User input: Measurement range of the sensor ■ Defining the measurement range in this parameter group does not represent a restriction. If the value is outside the measurement range, it is transferred nonetheless. ■ The unit selected in this parameter group is also valid for the Transducer Block. If the unit is changed in XD_SCALE parameter, this unit will also be adapted automatically in the connected unit at the Transducer function block. An exception is the connection with the internal temperature, whose unit won't be adapted automatically at the Transducer function block. ■ Entry of the measurement range via the XD_SCALE parameter does not restrict the output.
11	**OUT_SCALE**	**MAN - OOS**	Definition of the output range (lower and upper limit), the physical unit and the number of decimal places for the output value (OUT). Defining the measurement range in this parameter group does not restrict the output value OUT. If the output value OUT is outside the measurement range, this value is transferred.
12	**GRANT_DENY**	**AUTO - OOS**	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by device.
13	**IO_OPTS**	**OOS**	Activates the options for processing the input and output values of the function block (I/O options). The following options are available when the appropriate bit is set to true. ■ 0: Invert ■ 1: SP-PV Track in Man ■ 2: Reserved ■ 3: SP-PV Track in LO ■ 4: SP Track retained target ■ 5: Increase or close ■ 6: Fault State to value ■ 7: Use Fault State value on restart ■ 8: Target to Man if Fault State activated ■ 9: Use PV for BKCAL_OUT ■ 10: Low cutoff
14	**STATUS_OPTS**	**OOS**	Allows selecting options for status handling and processing. The following options are supported in the AI block: ■ Propagate fault forward ■ Uncertain if limited ■ Bad if limited ■ Uncertain if manual mode
15	**CHANNEL**	**OOS**	The CHANNEL value is the number of the physical input (transducer output) that is used as input for the function block. Supported values: ■ 1-8: physical input from Channel 1 to Channel 8 ■ 10: physical input from Concentrator block which is the internal device temperature

Analog Input function block (AI)			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
16	**L_TYPE**	**MAN**	For selecting the type of linearization for the input value. Options: Uninitialized Direct: With this setting the measured value from the Transducer Block (input value) avoids the linearization function and is looped unchanged with the same unit by the Analog Input function block. This setting must be selected when the input value already has got the designated phyical units. **PV = input value** Indirect (linear conversion): With this setting the measured value from the Transducer Block (input value) is rescaled linearly via the input scaling XD_SCALE to the desired output range OUT_SCALE. **PV = (FIELD_VAL / 100) x (OUT_SCALE 100% - OUT_SCALE 0%) - OUT_SCALE 0%** Indirect Square Root: With this setting the measured value from the Transducer Block (input value) is rescaled via the XD_SCALE parameter group and recalculated using a square root function. Further rescaling follows to the desired output range via the OUT_SCALE parameter group. **PV =(√(FIELD_VAL / 100)) x (OUT_SCALE 100% - OUT_SCALE 0%) - OUT_SCALE 0%**
17	**LOW_CUT**	**AUTO - MAN - OOS**	If the converted measured value is below this limit value then PV is shown as zero. User input: Range and unit of OUT_SCALE
18	**PV_FTIME**	**AUTO - MAN - OOS**	Entry of the filter time constant (in seconds) of the digital filter of the 1st order. This time is required in order for 63% of a change in the FIELD_VAL parameter to have an effect on the value of PV.
19	**FIELD_VAL**	**Dynamic/ read only**	Displays the process variable with the associated status from the Transducer Block. The value relates to a percentage of the input range XD_SCALE and when simulation is active is replaced by the simulation value. FIELD_VAL = 100 x (process variable - XD_SCALE_0%) (XD_SCALE_100% - XD_SCALE_0%)
20	**UPDATE_EVT**	**Read only**	This alert is generated by any change to the static data.
21	**BLOCK_ALM**	**AUTO - MAN - OOS**	The current block status appears on the display with information on pending configuration, hardware or system errors, including information on the alarm period (date, time) when the error occurred. The block alarm is triggered in the event of the following block errors: ■ SIMULATE ACTIVE ■ INPUT FAILURE ■ OUT OF SERVICE ■ OUTPUT FAILURE ■ READBACK FAILURE ■ BLOCK CONFIG ERROR ✎ Note! If the option of the alarm has not been enabled in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.

Analog Input function block (AI)			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
22	**ALARM_SUM**	**AUTO - MAN - OOS**	The current status of the process alarms appears on the display (0 = OK/inactive; 1 = error/active) Display: 1 DISC_ALM Write protection 2 HI_HI_ALM Violation of the upper limit value alarm 3 HI_ALM Violation of the upper limit value warning 4 LO_LO_ALM Violation of the lower limit value alarm 5 LO_ALM Violation of the lower limit value warning 6 DV_HI_ALM Violation of the limit value alarm for the upper control deviation 7 DV_LO_ALM Violation of the limit value alarm for the lower control deviation 8 BLOCK ALM Block alarm
23	**ACK_OPTION**	**AUTO - MAN - OOS**	This parameter is used to specify whether a process alarm must be acknowledged at the time of alarm recognition by the fieldbus host system. If this option is enabled, the process alarm is acknowledged automatically. Options: 1 DISC ALM Write protection no longer exists, thus data access 2 HI_HI_ALM Upper limit value alarm 3 HI_ALM Upper limit value/warning 4 LO_LO_ALM Lower limit value alarm 5 LO_ALM Lower limit value/warning 6 DV_HI_ALM Limit alarm for upper differential control (SP-PV) 7 DV_LO_ALM Limit alarm for lower differential control (SP-PV) 8 BLOCK ALM Block alarm Factory setting: The option is not enabled for any alarm, the alarms must be acknowledged
24	**ALARM_HYS**	**AUTO - MAN - OOS**	For entry of the hysteresis value for the upper and lower warning or alarm limit values. The alarm conditions remain active as long as the measured value is within the hysteresis.
25	**HI_HI_PRI**	**AUTO - MAN - OOS**	Specifies the action taken when the upper alarm limit value (HI_HI_LIM) is exceeded. User input: 0 = The violation of the upper alarm limit is not evaluated. 1 = No notification if the upper alarm limit is infringed. 2 = Reserved for block alarms. 3-7 = The violation of the upper alarm limit is output as a user notice with the appropriate priority (3 = low priority, 7 = high priority). 8-15 = The violation of the upper alarm limit is output as a critical alarm with the appropriate priority (8 = low priority, 15 = high priority).

Analog Input function block (AI)			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
26	**HI_HI_LIM**	**AUTO - MAN - OOS**	Entry of the alarm limit value for the upper alarm (HI_HI_ALM). If the output value OUT exceeds this limit value then the HI_HI_ALM alarm status parameter is output. User input: Range and unit of OUT_SCALE
27	**HI_PRI**	**AUTO - MAN - OOS**	Specifies the action taken when the upper early warning alarm limit value (HI_LIM) is exceeded. User input: 0 = The violation of the upper early warning limit is not evaluated. 1 = No notification if the upper warning limit is infringed. 2 = Reserved for block alarms. 3-7 = The violation of the upper warning limit is output as a user notice with the appropriate priority (3 = low priority, 7 = high priority). 8-15 = The violation of the upper warning limit is output as a critical alarm with the appropriate priority (8 = low priority, 15 = high priority).
28	**HI_LIM**	**AUTO - MAN - OOS**	Entry of the alarm limit value for the upper warning (HI_ALM). If the output value OUT exceeds this limit value, then the HI_ALM alarm status parameter is output. User input: Range and unit of OUT_SCALE
29	**LO_PRI**	**AUTO - MAN - OOS**	Specifies the action taken when the lower pre alarm limit value (LO_LIM) is exceeded. User input: 0 = The violation of the lower warning limit is not evaluated. 1 = No notification to master if the lower warning limit is infringed. 2 = Reserved for block alarms. 3-7 = The violation of the lower warning limit is output as a user notice with the appropriate priority (3 = low priority, 7 = high priority). 8-15 = The violation of the lower warning limit is output as a critical alarm with the appropriate priority (8 = low priority, 15 = high priority).
30	**LO_LIM**	**AUTO - MAN - OOS**	Entry of the alarm limit value for the lower warning (LO_ALM). If the output value OUT is below this limit value then the LO_ALM alarm status parameter is output. User input: Range and unit of OUT_SCALE
31	**LO_LO_PRI**	**AUTO - MAN - OOS**	Specifies the action taken when the lower alarm limit value (LO_LO_LIM) is not reached. User input: 0 = The violation of the lower alarm limit is not evaluated. 1 = No notification to master if the lower alarm limit is infringed. 2 = Reserved for block alarms. 3-7 = The violation of the lower alar limit is output as a user notice with the appropriate priority (3 = low priority, 7 = high priority). 8-15 = The violation of the lower alarm limit is output as a critical alarm with the appropriate priority (8 = low priority, 15 = high priority).

Analog Input function block (AI)			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
32	**LO_LO_LIM**	**AUTO - MAN - OOS**	Entry of the alarm limit value for the lower alarm (LO_LO_ALM). If the output value OUT is below this limit value then the LO_LO_ALM alarm status parameter is output. User input: Range and unit of OUT_SCALE
33	**HI_HI_ALM**	**Read only**	Alarm status display for the upper alarm limit value (HI_HI_LIM), including details of the time of the alarm (date, time) and the value that triggered the alarm. ✎ Note! ■ In addition the active alarm can be acknowledged in this parameter group. ■ If the option of the alarm has not been enabled in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.
34	**HI_ALM**	**Read only**	Alarm status display for the upper warning limit value (HI_LIM), including details of the time of the alarm (date, time) and the value that triggered the alarm. ✎ Note! ■ In addition the active alarm can be acknowledged in this parameter group. ■ If the option of the alarm has not been enabled in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.
35	**LO_ALM**	**Read only**	Alarm status display for the lower warning limit value (LO_LIM), including details of the time of the alarm (date, time) and the value that triggered the alarm. ✎ Note! ■ In addition the active alarm can be acknowledged in this parameter group. ■ If the option of the alarm has not been enabled in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.
36	**LO_LO_ALM**	**Read only**	Alarm status display for the lower alarm limit value (LO_LO_LIM), including details of the time of the alarm (date, time) and the value that triggered the alarm. ✎ Note! ■ In addition the active alarm can be acknowledged in this parameter group. ■ If the option of the alarm has not been enabled in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.

11.5 Multiple Analog Input function block (MAI)

Multiple Analog Input function block (MAI)			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
1	**ST_REV**	**Read only**	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
2	**TAG_DESC**	**AUTO - OOS**	Entry of a user-specific text of max. 32 characters for unique identification and assignment of the block.
3	**STRATEGY**	**AUTO - OOS**	Parameter for grouping and thus faster evaluation of blocks. Grouping is carried out by entering the same numerical value in the STRATEGY parameter of each individual block. **Factory default: 0** ✎ Note! This data is neither checked nor processed by the Multiple Analog Input function block.
4	**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 for sorting alarms and events. User input: 1 to 255 **Factory default: 0**
5	**MODE_BLK**	**MAN - AUTO - OOS**	Displays the current (Actual) and desired (Target) operating mode of the Multiple Analog Input function block, the permitted modes (Permitted) supported by the Resource Block and the normal operating mode (Normal). Display: AUTO - MAN - OOS ✎ Note! The Multiple Analog Input function block supports the following operating modes: ■ AUTO (automatic mode): The block is executed. ■ MAN (manual intervention by the operator): The output value OUT can be specified. ■ OOS (out of service): The block is in the “out of service” mode. With the output value OUT the last valid value is output. The status of the output value OUT switches to BAD.
6	**BLOCK_ERR**	**Read only**	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	**CHANNEL**	**OOS**	Allows for custom channel setting. Valid values: ■ 0: Uninitialized ■ 9: Physical channels 1 to 8 will be set to the corresponding sensors
8 - 15	**OUT (1-8)**	**MAN - OOS**	Displays the output value with alarm evaluation and the status of the Multiple Analog Input function block. User input: Range and unit of OUT_SCALE
16	**UPDATE_EVT**	**Read only**	This alert is generated by any change to the static data.

Multiple Analog Input function block (MAI)			
Parameter Index	**Parameter**	**Write access with operating mode (MODE_BLK)**	**Description**
17	**BLOCK_ALM**	**AUTO - MAN - OOS**	The current block status appears on the display with information on pending configuration, hardware or system errors, including information on the alarm period (date, time) when the error occurred. The block alarm is triggered in the event of the following block errors: ■ SIMULATE ACTIVE ■ INPUT FAILURE ■ OUT OF SERVICE ■ OUTPUT FAILURE ■ READBACK FAILURE ■ BLOCK CONFIG ERROR ✎ Note! If the option of the alarm has not been enabled in the ACK_OPTION parameter, the alarm can only be acknowledged via this parameter.

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