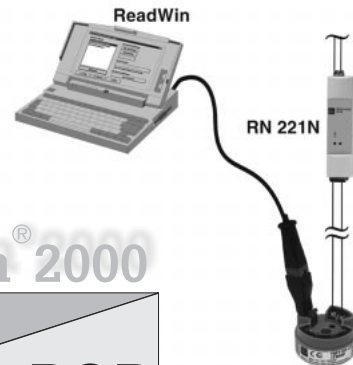


BA 100R/09/c5/08.01
No.: 510 01887

iTEMP[®] PCP TMT 181

Betriebsanleitung
Operating instructions
Mise en service
Manuale operativo
Manual de Utilizaciòn



ReadWin[®] 2000
iTEMP[®]
PCP



Endress + Hauser
The Power of Know How



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1 Safety notes

Safe and secure operation of the head transmitter can only be guaranteed if the operating instructions and all safety notes contained are read, understood and followed.

1.1 Correct use

- The unit is a universal, presettable temperature transmitter for resistance thermometer (RTD), thermocouple (TC) as well as resistance and voltage sensors. The unit is constructed for mounting in a connection head (form B) and a field housing.
- The user cannot be held responsible for damage caused by misuse of the unit.
- Separate Ex documentation, is contained in this operating manual, for measurement systems that are to be mounted in hazardous areas. The installation conditions as well as the connection values indicated in these instructions must be completely followed!

1.2 Installation, commissioning and operation

The unit is constructed using the most up-to-date production equipment and complies to the safety requirements of the EU guidelines. However, if it is installed incorrectly or is misused then certain application dangers can occur. Installation, wiring and maintenance of the unit must only be done by trained skilled personnel who are authorised to do so by the plant operator. These skilled staff must have read and understood these instructions and must also follow them to the letter. The plant operator must make sure that the measurement system has been correctly wired to the connection schematics.

1.3 Operational safety

Hazardous areas

When installing the unit in a hazardous area the national safety requirements must be met. Make sure that all personnel are trained in these areas. The measurement and safety values must be followed in all these installations.

Technical advancement

The manufacturer reserves the right to change the technical data without notification if this advances the technical development. Details regarding the validity and further expansions to these instructions can be obtained from your nearest sales office.

1.4 Returns

When returning the unit for repair please add a description of both the fault and the application.

On transport damage please contact both the supplier and shipping agent.

1.5 Safety pictograms and symbols

Safe and reliable operation of this unit can only be guaranteed if the safety hints and warnings in these operating instructions are followed. The safety hints in these instructions are highlighted using the following symbols.

Hint:

This symbol indicates activities and actions that, if not followed correctly, could have an indirect influence on the unit operation or could lead to an unforeseen unit reaction.

Attention:

This symbol indicates activities and actions that, if not followed correctly, could lead to faulty unit operation or even damage to the unit.

Correct use

Installation, commissioning and operation

Operational safety

Returns

Safety pictograms and symbols





Hazardous area, certified equipment:

If this character can be seen on the unit then it may be operated in hazardous areas.



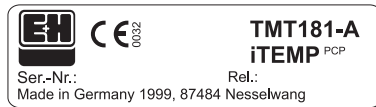
Non-hazardous areas:

This symbol identifies the non-hazardous areas in these instructions. Units that operate in the non-hazardous areas but that are connected to the hazardous areas must also be certified.

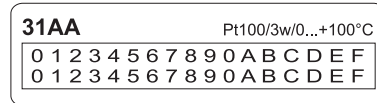
2 Identification

2.1 Unit identification

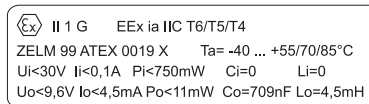
Unit identification



Head transmitter legend plate



Order code (example)



Identification for hazardous area use (only on Ex certified units)

CE-marks, conformity description

The unit has been manufactured using up-to-date production equipment and has left our works in perfect and safe condition. It complies with the safety requirements to EN 61 010.

The unit described in these instructions therefore fulfils the legal requirements set by the EU guide lines. The manufacturer confirms a positive completion of all tests by fitting the unit with a CE mark.

2.2 Delivery contents

The delivery contents of a temperature head transmitter are as follows:

- Head transmitter
- Installation screws and springs
- Operating instructions
- ATEX-operating instructions for use in hazardous areas

Hint!

Please take note of the head transmitter accessories in chapter 9.



3 Function and system construction

Function

3.1 Function

Electronic monitoring and transformation of various input signals into an analogue output signal in industrial temperature measurement. The head transmitter is mounted in a connection head form B or separated from the sensor in field housing. Setting up of the head transmitter is done using a PC and setting up software. The configuration kit is required for setting up the head transmitter.

Measurement system

3.2 Measurement system

Transforming the following input signals:

- Resistance thermometers (RTD) and resistance sensors (in 2-,3- or 4-wire connection systems)
- Thermocouples (TC) and
- voltage sensors into a scalable analogue output signal (4...20 mA or 20...4 mA).

Fault monitoring of:

- Measurement range override or undercut
- Sensor breakage and short circuit ^[1]

The head transmitter is set up using a PC and the PC setting up programme together with the configuration kit. The kit can be obtained as a unit accessory.

Application in hazardous areas is certified to ATEX II 1 G
EEx ia IIC T4/T5/T6.

4 Installation

Installation conditions

4.1 Installation conditions

- When installing and operating the unit please take note of the allowable ambient temperature (see chapter 11: Technical data).
- When operating in hazardous areas please take note and operate within the limits set in the certification (see chapter 11: Technical data).

Dimensions

The head transmitter dimensions can be found in Chapter 11: Technical data.

Installation point

- Sensor connection head to DIN 43 729 Form B
- Field housing

Installation angle

There are no limits as to the angle on installation.

Installation

4.2 Installation

For installation proceed as follows:

Installing in a sensor connection head to DIN 43 729 Form B (Fig. 4.1)

- Feed the sensor inset cables (Pos. 5) through the central hole in the head transmitter (Pos. 4).
- Place the installation springs (Pos. 3) onto the screws (Pos. 2).
- Feed the installation screws (Pos. 2) through the holes in the head transmitter and the holes in the sensor inset (Pos. 5). Fix both screws using the circlips (Pos. 6).
- Position the head transmitter in the connection head in such a way so that the current output terminals (terminal 1 and 2) are towards the cable entry gland (Pos. 7).
- Fix the head transmitter (Pos. 4) and sensor inset (Pos. 5) into the connection head.

[1] not for thermocouples (TC)

Installation in a field housing (Fig. 4.2)

- Feed the installation screws (Pos. 2) with installation springs (Pos. 3) through the holes in the head transmitter (Pos. 4). Fix these using the circlips (Pos. 5).
- Screw the head transmitter into the field housing using a screw driver.



Attention:

In order to avoid damaging the head transmitter do not over tighten the installation screws.

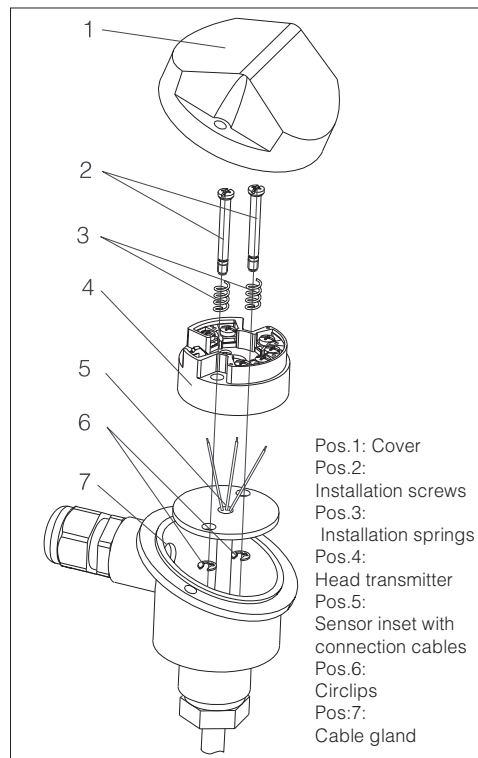


Fig. 4.1: Installation of head transmitter into a Form B sensor connection head.

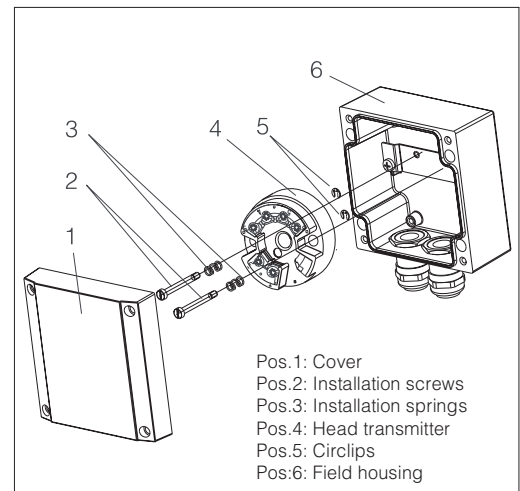


Fig. 4.2: Installation of head transmitter into a field housing

5 Wiring

5.1 Overview Terminal layout

Wiring overview

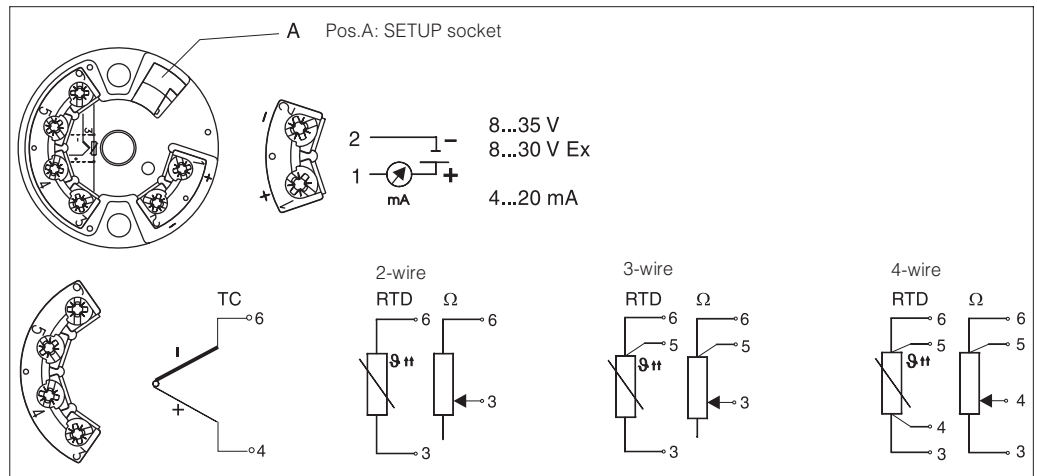


Fig. 5.1: Head transmitter wiring

Measurement unit connection



5.2 Measurement unit connection

Attention:

Switch off power supply before opening the housing cover. Do not install or connect the unit to mains power. If this is not followed parts of the electronic circuit will be damaged.

- **Sensors:**
Connect the sensor cables to the respective head transmitter terminals (Terminals 3 to 6) by following the wiring diagram (see fig. 5.1).
- **Output signal and power supply:**
Open the PG cable gland on the head transmitter or field housing. Feed the cable through the opening in the PG cable gland and then connect the cable cores to terminals 1 and 2 according to the wiring diagram (see fig. 5.1).
- **PC configuration (SETUP socket):**
Open the flap on the SETUP socket (Fig. 5.1, Pos. A) and connect the SETUP connection cable.



Hint:

The screws on the terminals must be screwed up tightly. Head transmitter configuration during measurement operation is possible. There is no need to disconnect cables!



Potential leveling

Hint:

Please take note of the following when installing the head transmitter remotely in a field housing. The screen on the output (output signal 4...20 mA) must have the same potential as the screen at the sensor connections!

For an effective screening the cable screen must be widely connected to the field housing. This can be achieved by connecting the cable screen to the special EMC-PG13.5 cable gland.

Open the field housing PG cable gland and connect the screen of the output and sensor connection according to Fig. 5.2.

When using earthed thermocouples screening of the output cable (4 ... 20 mA cable) is recommended. In plants with strong EMC problems screening of all cables with a low ohm connection to the transmitter housing is recommended.

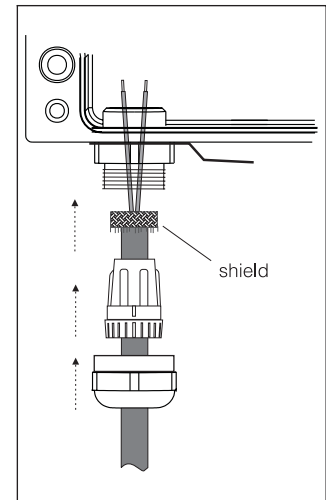


Fig. 5.2: Screening on remote installation

6 Operation

6.1 Short form instructions (SETUP)

Operation

Presetable parameters	
Standard settings (Quick-SETUP)	<ul style="list-style-type: none"> - Sensor type (see Chap. 11 Techn. data) - Connection mode ^[1] - Units (°C/°F) - Measurement range start (see Chap. 11 Techn. data) - Measurement range end (see Chap. 11 Techn. data)
Expanded settings	<ul style="list-style-type: none"> - Cold junction compensation (internal/external) ^[2] - Compensation resistance (0...20 Ω) ^[3] - Fault condition reaction (see Chap. 11 Techn. data) - Output (analogue standard/inverse) - Damping (0...60 s) - Offset (-9.9 to +9.9 K) - Measurement point identification/TAG
Service functions	<ul style="list-style-type: none"> - Simulation (on/off)

6.2 Communication

Communication

The head transmitter must be set up using a PC and configuration set. The following points must be taken into account if trouble free setting up is to be achieved:

- Configuration software installation
- Connect the head transmitter to the PC using the connection cable from the configuration set

Configuration software installation

System conditions	<ul style="list-style-type: none"> - IBM PC or compatible computer (min. Pentium 166 MHz) - Windows 95/98/ME/NT4.0/2000 - 64 MB RAM - min. 30 MB free memory on hard drive - CD-ROM drive - Screen resolution 800 x 600 Pixel - free serial interface
Recommended minimum configuration	<ul style="list-style-type: none"> - Pentium 400 MHz - 128 MB main RAM - 120 MB free hard drive memory - Screen resolution 1024 x 768 Pixel
Installation start	<p>Start Windows</p> <ol style="list-style-type: none"> 1. Place installations-CD in the respective drive 2. Start "Setup.exe" and follow the installation instructions 3. If required the help/operating manual can be printed out once the software has been successfully installed.

Connecting the head transmitter to the PC using the configuration kit connection cable

1. Connect the SETUP connector of the interface cable to the SETUP socket in the head transmitter (see chapter 5.2 Connecting measurement unit).
2. Connect the RS232C connector to a free serial interface socket on the PC. In order to achieve optimum connection tighten the RS232C connector screws to the PC.



Hint:

Configuration of the head transmitter can be done either under power e.g. using a 9 Volt battery or in an installed condition during measurement operation.

[1] 2-, 3-, or 4-wire connection

[2] on TC-connection

[3] on 2-wire connection

7 Commissioning

Installation check

7.1 Installation check

Monitor all connections making sure they are tight. In order to guarantee fault free operation the terminal screws must be tight onto the connection cables. The unit is now ready for operation.

Commissioning

7.2 Commissioning

Once the power supply has been connected the head transmitter is operational.

Setting up using the PC configuration software

The head transmitter left the factory with a default parameter configuration. If no customer specific configuration was mentioned on the order then the default parameter configuration is constructed as follows:

Sensor	Pt100 (RTD)
Connection mode	3-wire
Measurement range and units	0...+100°C



Hint:

If a change has been made to the measurement point then the head transmitter can be re-configured. In order to re-configure the parameters follow these instructions:

- Install the configuration software and make connection to the PC (see Chap. 6, Operation).
- For detailed operating instructions for the PC configuration software please read the online documentation contained in the PC configuration software.

Interactive setting up of the temperature transmitter

Customer specific linearisation and sensor matching is done using the **SMC32.exe** (Sensor Matching Calibration) configuration software. The **SMC32.exe** programme calculates the linearisation coefficients X0 to X4, that need to be entered into the PC configuration software.

Function check

7.3 Function check

Measuring the analogue 4-20 mA output signal or following failure signals:

Measurement range undercut	linear fall to 3.8 mA
Measurement range excess	linear rise to 20.5 mA
Sensor break; sensor short circuit	≤ 3.6 mA or ≥ 21.0 mA selectable

8 Maintenance

Maintenance

The head transmitter is maintenance free.

9 Accessories

Accessories

Configuration set for PC SETUP settings of the head transmitter:

SETUP programme and PC serial interface cable (TTL/RS 232C).

Order No.:

TMT181A-VK



Hint:

Please contact your supplier when ordering!

10 Fault finding

Fault finding

10.1 Spare parts

Head transmitter installation set
(4 screws, 6 springs, 10 circlips)

Order No.:

510 01112

10.2 Repair concept and disposal

Due to its construction the head transmitter cannot be repaired.

Disposal:

When disposing of the head transmitter please take note of the local disposal regulations.

10.3 Fault finding and repairs

Trouble shooting in general

Fault	Cause	Action/cure
No communication	2 wire connection incorrect	Re-connect correctly (see connection diagram)
	No power supply to the 2 wire connection	Check the current loop
	Power supply too low (<8 V)	Check power supply
	Interface cable defective	Check the interface cable
	PC-interface defective	Check the interface of your PC
	Head transmitter defective	Replace head transmitter

Trouble shooting on RTDs (Pt100/Pt500/Pt1000/Ni100)

Fault	Cause	Action/cure
Current (≤ 3.6 mA or ≥ 21 mA)	Sensor defective	Check sensor
	Incorrect RTD connection	Connect the cables correctly (see connection diagram)
	Incorrect 2 wire connection	Connect the cables correctly (see connection diagram) (Polarity)
	No power supply on the 2 wire connection	Check current loop; the supply should be >8 V
	Incorrect transmitter programming (number of wires)	Change parameter 'connection mode' (see chap. Operation)
	Programming	Thermocouple set up (see chap. Operation). Change to RTD
	Head transmitter defective	Replace head transmitter
Incorrect or inaccurate measured value	Sensor is incorrectly installed	Reinstall sensor correctly
	Heat dissipation via sensor	Monitor sensor installation positioning
	Incorrect transmitter programming (number of wires)	Change parameter 'connection mode'
	Incorrect transmitter programming (Scale)	Change scale
	Wrong RTD set up	Change parameter 'sensor type'
	Sensor connection (2 wire)	Monitor sensor connection
	Sensor cable resistance not compensated (2 wire)	Compensate cable resistance
	Offset incorrectly set up	Monitor offset

Trouble shooting for thermocouple connection (TC)

Fault	Cause	Action/cure
Current (≤ 3.6 mA or ≥ 21 mA)	Incorrect sensor connection	Connect the sensor correctly (see connection diagram) (Polarity)
	Sensor defective	Check sensor
	Incorrectly set up	Sensor type 'RTD' is set up. Set up the correct thermocouple
	Incorrect 2 wire connection (current loop)	Connect the cables correctly (see connection diagram)
	No power supply on the 2 wire connection	Check current loop; the supply should be >8 V
	Head transmitter defective	Replace head transmitter
Incorrect or inaccurate measured value	Sensor is incorrectly installed	Reinstall sensor correctly
	Heat dissipation via sensor	Monitor sensor installation positioning
	Incorrect transmitter programming (scale)	Change scale
	Wrong thermocouple set up	Change parameter 'sensor type'
	Incorrect comparison set up	See chap. 'Operation' and 'Technical data'
	Offset incorrectly set up	Check offset
	Fault due to the thermo wire welded to the well (interference voltages incurred)	Please use a sensor in which the thermo wire is not welded

11 Technical Data

Function and system construction

Measurement principle	Electronic measurement and conversion of input signals in industrial temperature measurement.
Measurement system	The temperature head transmitter is a two wire transmitter with an analogue output. It has measurement input for resistance thermometers (RTD) in 2-, 3- or 4-wire connection, thermocouples and voltage transmitters. Setting up of the unit is done using the PC configuration kit.

Input

Resistance thermometer (RTD)

Type	Measurement ranges	min. range
Pt100	-200 to 850 °C	-328 to 1562 °F
Pt500	-200 to 250 °C	-328 to 482 °F
Pt1000	-200 to 250 °C	-328 to 482 °F
according to IEC 751		10 K (18 °F)
Ni100	-60 to 180 °C	-76 to 356 °F
Ni500	-60 to 150 °C	-76 to 302 °F
Ni1000	-60 to 150 °C	-76 to 302 °F
according to DIN 43760		10 K (18 °F)
Connection type	2-, 3- or 4-wire connection cable resistance compensation possible in the 2 wire system (0...20 Ω)	
Sensor cable resistance	max. 11 Ω per cable	
Sensor current	≤ 0.6 mA	

Resistance transmitter (Ω)

Type	Measurement range	min. range
Resistance (Ω)	10... 400 Ω 10...2000 Ω	10 Ω 100 Ω

Thermocouples (TC)

Type	Measurement range	min. range
B (PtRh30-PtRh6)	0 to +1820 °C	32 to 3308 °F
C (W5Re-W26Re) ^[3]	0 to +2320 °C	32 to 4208 °F
D (W3Re-W25Re) ^[3]	0 to +2495 °C	32 to 4523 °F
E (NiCr-CuNi)	-200 to +915 °C	-328 to 1679 °F
J (Fe-CuNi)	-200 to +1200 °C	-328 to 2192 °F
K (NiCr-Ni)	-200 to +1372 °C	-328 to 2501 °F
L (Fe-CuNi) ^[2]	-200 to + 900 °C	-328 to 1652 °F
N (NiCrSi-NiSi)	-270 to +1300 °C	-454 to 2372 °F
R (PtRh13-Pt)	0 to +1768 °C	32 to 3214 °F
S (PtRh10-Pt)	0 to +1768 °C	32 to 3214 °F
T (Cu-CuNi)	-200 to + 400 °C	-328 to 752 °F
U (Cu-CuNi) ^[2]	-200 to + 600 °C	-328 to 1112 °F
MoRe5-MoRe41 ^[1]	0 to +2000 °C	32 to 3632 °F
accord. to IEC 584 Part 1		500 K (900 °F)
Cold junction	internal (Pt100) or external (0...80 °C)	
Cold junction accuracy	± 1 K	
Sensor current	350 nA	

Voltage transmitters (mV)

Type	Measurement range	min. range
Millivolt transmitter (mV)	-10...100 mV	5 mV

[1] no reference
 [2] according to DIN 43710
 [3] according to ASTM E 988

Output

Output (analogue)

Output signal	4...20 mA, 20...4 mA
Transmission as	temperature linear, resistance linear, voltage linear
Max. load	$(V_{\text{power supply}} - 8 \text{ V}) / 0.022 \text{ A}$
Digital filter 1 st degree	0...8 s
Input current required	$\leq 3.5 \text{ mA}$
Current limit	$\leq 23 \text{ mA}$
Switch on delay	4 s (during power up $I_a = 3.8 \text{ mA}$)
Reply time	1 s

Failure signal (fault monitoring)

Measurement range undercut	Linear drop to 3.8 mA
Exceeding measurement range	Linear rise to 20.5 mA
Sensor breakage; Sensor short circuit [1]	$\leq 3.6 \text{ mA}$ or $\geq 21.0 \text{ mA}$ can be set up

Electrical connection

Power supply	$U_b = 8...35 \text{ V DC}$, polarity protected
Galvanic isolation (In/out)	$\hat{U} = 3.75 \text{ kV AC}$
Allowable ripple	$U_{ss} \leq 5 \text{ V}$ at $U_b \geq 13 \text{ V}$, $f_{\text{max.}} = 1 \text{ kHz}$

Accuracy

Reference conditions	Calibration temperature $23 \text{ °C} \pm 5 \text{ K}$
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Resistance thermometer (RTD)

Type	Measurement accuracy ^[2]
Pt100, Ni100	0.2 K or 0.08%
Pt500, Ni500	0.5 K or 0.20%
Pt1000, Ni1000	0.3 K or 0.12%

Resistance transmitter (Ω)

Type	Measurement accuracy ^[2]	Measurement range
Resistance (Ω)	$\pm 0.1 \Omega$ or 0.08%	10...400 Ω
	$\pm 1.5 \Omega$ or 0.12%	10...2000 Ω

Thermocouple (TC)

Type	Measurement accuracy ^[2]
K, J, T, E, L, U	typ. 0.5 K or 0.08%
N, C, D	typ. 1.0 K or 0.08%
S, B, R MoRe5-MoRe41	typ. 2.0 K or 0.08%
Influence of the internal reference junction	Pt100 DIN IEC 751 Cl. B

Voltage transmitter (mV)

Type	Measurement accuracy ^[2]	Measurement range
Millivolt transmitter (mV)	$\pm 20 \mu\text{V}$ or 0.08%	-10...100 mV

[1] Not for thermocouple

[2] % is related to the adjusted measurement range (the value to be applied is the greater)

Influence of power supply	$\leq \pm 0.01\%/V$ deviation from 24 V ^[1]
Load influence	$\leq \pm 0.02\%/100 \Omega$ ^[1]

Temperature drift	Resistive thermometer (RTD): $T_d = \pm (15 \text{ ppm/K} * \text{max. meas. range} + 50 \text{ ppm/K} * \text{preset meas. range}) * \Delta\theta$ Resistive thermometer (Pt100): $T_d = \pm (15 \text{ ppm/K} * \text{range end value} + 200) + 50 \text{ ppm/K} * \text{preset meas. range} * \Delta\theta$ Thermocouple (TC): $T_d = \pm (50 \text{ ppm/K} * \text{max. meas. range} + 50 \text{ ppm/K} * \text{preset meas. range}) * \Delta\theta$ $\Delta\theta$ = Deviation of the ambient temperature according to reference junction
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Long term stability	$\leq 0.1 \text{ K/Year}$ ^[2] or $\leq 0.05\%/Year$ ^{[2][3]}
---------------------	--

Application conditions

Installation conditions

Installation angle	No limit
Installation area	Connection head accord. to DIN 43 729 Form B; field housing

Ambient conditions

Ambient temperature	-40...+85 °C (for Ex-areas see Ex-certification)
Storage temperature	-40...+100 °C
Climatic class	To EN 60 654-1, Class C
Moisture condensation	Allowable
Ingress protection	IP 00 / IP 66 installed
Vibration protection	4g / 2...150 Hz according to IEC 60 068-2-6
EMC immunity	Interference immunity and interference emission according to EN 61 326-1 and NAMUR NE21

Dimensions

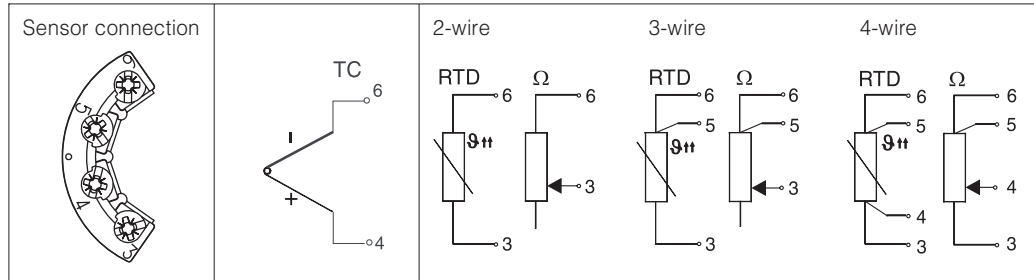
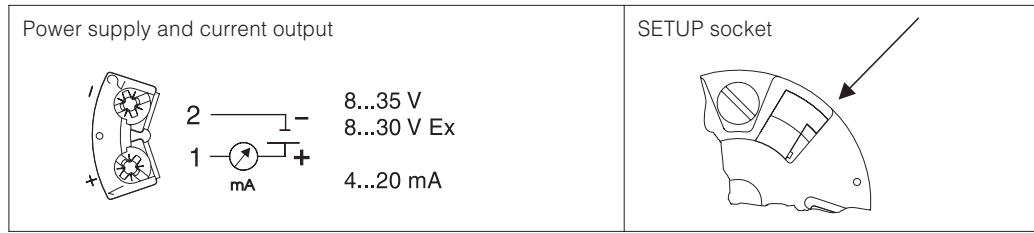
Dimensions	<p style="text-align: right;">Dimensions in mm</p>
Weight	approx. 40 g
Materials	Housing: PC Potting: PUR
Terminals	Cable up to max. 1.75 mm ² (secure screws)

[1] All data is related to a measurement end value (FSD) of 20 mA

[2] Under reference conditions

[3] % is related to the adjusted measurement range (the value to be applied is the greater)

Terminal connections



Display and operating level

Remote operation

Configuration set	PC configuration kit
Configuration	Using PC programme
Interface	PC interface connection cable TTL -/ RS 232 with plug
Configurable parameters	Sensor type and connection type, engineering units (°C/°F), measurement range, internal/external cold junction compensation, cable resistance compensation on 2 wire connection, fault conditioning, output signal (4...20/20...4 mA), digital filter (damping), offset, measurement point identification (8 characters), output simulation

Certification

CE mark	The measurement system fulfills the requirements demanded by the EU regulations. The manufacturer acknowledges successful unit testing by adding the CE mark.
Ex certification	For further details on the available Ex versions (ATEX, FM, CSA, etc.) contact your respective sales organisation. All relevant data for hazardous areas can be found in separate Ex documentation. If required, please request copies from your sales organisation.

12 Appendix

Short form instructions (SETUP)

Presetable parameters	
Standard settings (Quick-SETUP)	<ul style="list-style-type: none"> - Sensor type (see Chap. 11 Techn. data) - Connection mode ^[1] - Units (°C/°F) - Measurement range start (see Chap. 11 Techn. Data) - Measurement range end (see Chap. 11 Techn. Data)
Expanded settings	<ul style="list-style-type: none"> - Cold junction compensation (internal/external) ^[2] - Compensation resistance (0...20 Ω) ^[3] - Fault condition reaction (see Chap. 11 Techn. Data) - Output (analogue standard/inverse) - Damping (0...60 s) - Offset (-9.9 to +9.9 K) - Measurement point identification/TAG
Service functions	<ul style="list-style-type: none"> - Simulation (on/off)

[1] 2-, 3-, or 4-wire connection
 [2] on TC-connection
 [3] on 2-wire connection