Digital temperature transmitter
For thermocouples, head- and rail-mounted version
Models T16.H, T16.R

For approvals, see page 8

Configurator

Standard article

Applications

- Process industry
- Machine building and plant construction

Special features

- For the connection of all standard thermocouples
- High accuracy
- Parameterisation with the WIKAsoft-TT configuration software and electrical connection via quick connector magWIK
- Connection terminals also accessible from the outside
- EMC stability in compliance with the latest standard (EN 61326-2-3:2013)

Fig. left: head-mounted version, model T16.H
Fig. right: rail-mounted version, model T16.R

Description

These temperature transmitters are designed for universal use in plant and machine building, and also in the process industry. They offer high accuracy and excellent protection against electromagnetic influences (EMI). Via the WIKAsoft-TT configuration software and the model PU-548 programming unit, the model T16 temperature transmitters can be parameterised very easily, quickly and with a clear overview.

Besides the selection of the sensor type and the measuring range, the software enables the error signalling operation, damping, several measuring location descriptions and process adjustment to be stored. Furthermore, the WIKAsoft-TT software offers a line recording functionality where the temperature profile for the thermocouple connected to the T16 can be displayed.

The model T16 transmitter features diverse monitoring functions, such as sensor break monitoring and measuring range monitoring. Moreover, these transmitters have comprehensive cyclic self-monitoring functionality.

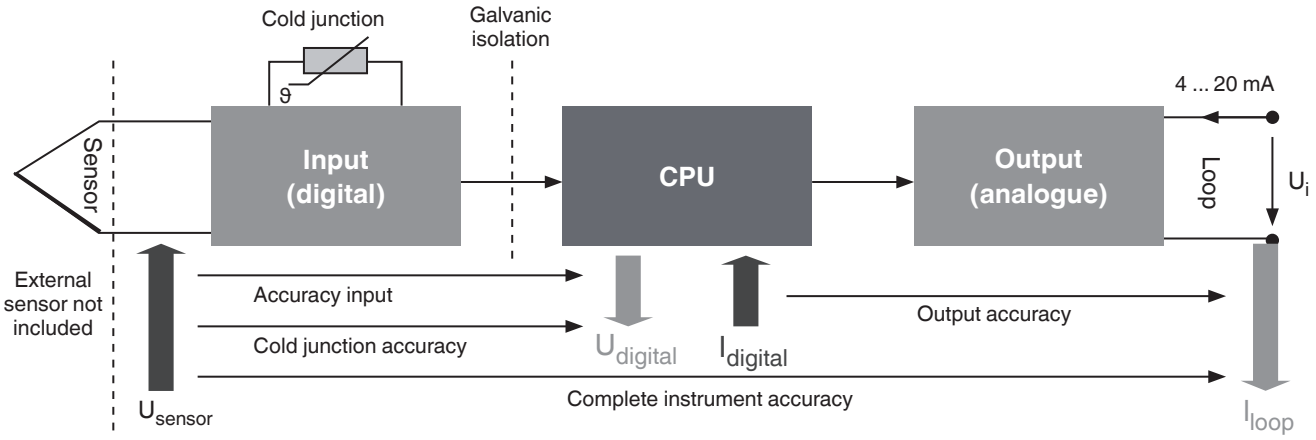
Data sheets showing similar products and accessories:
Temperature transmitter, model T15; see data sheet TE 15.01
Programming unit model PU-548; see data sheet AC 80.18

Specifications

Basic information		
Case	**T16.H head-mounted version**	**T16.R rail-mounted version**
Material	PBT plastic, glass-fibre reinforced	Plastic
Weight	Approx. 50 g (approx. 1.76 oz)	Approx. 0.2 kg (approx. 7.1 oz)
Connection terminals, captive screws, wire cross-section		
Solid wire	0.14 ... 2.5 mm² (24 ... 14 AWG)	0.14 ... 2.5 mm² (24 ... 14 AWG)
Stranded wire with end splice	0.14 ... 1.5 mm² (24 ... 16 AWG)	0.14 ... 2.5 mm² (24 ... 14 AWG)
Screwdriver	Cross head ('Pozidrive' tip), size 2 (ISO 8764)	Slotted, 3 x 0.5 mm (ISO 2380)
Tightening torque	0.5 Nm	0.5 Nm

Measuring element			
Sensor type	**Max. configurable measuring range**	**Standard**	**Min. measuring span (MS)**
Thermocouple			
J	-210 ... +1,200 °C [-346 ... +2,192 °F]	IEC 60584-1	50 K
K	-270 ... +1,300 °C [-454 ... +2,372 °F]	IEC 60584-1	50 K
B	0 ... 1,820 °C [32 ... 3,308 °F]	IEC 60584-1	200 K
N	-270 ... +1,300 °C [-454 ... +2,372 °F]	IEC 60584-1	50 K
R	-50 ... +1,768 °C [-58 ... +3,214.4 °F]	IEC 60584-1	150 K
S	-50 ... +1,768 °C [-58 ... +3,214.4 °F]	IEC 60584-1	150 K
T	-270 ... +400 °C [-454 ... +752 °F]	IEC 60584-1	50 K
E	-270 ... +1,000 °C [-454 ... +1,832 °F]	IEC 60584-1	50 K
C	0 ... 2,315 °C [32 ... 4,199 °F]	IEC 60584-1	150 K
A	0 ... 2,500 °C [32 ... 4,532 °F]	IEC 60584-1	150 K
L (DIN 43710)	-200 ... +900 °C [-328 ... +1,652 °F]	DIN 43710	50 K
L (GOST R 8.585 - 2001)	-200 ... +800 °C -328 ... +1,472 °F]	-	50 K

Accuracy specifications

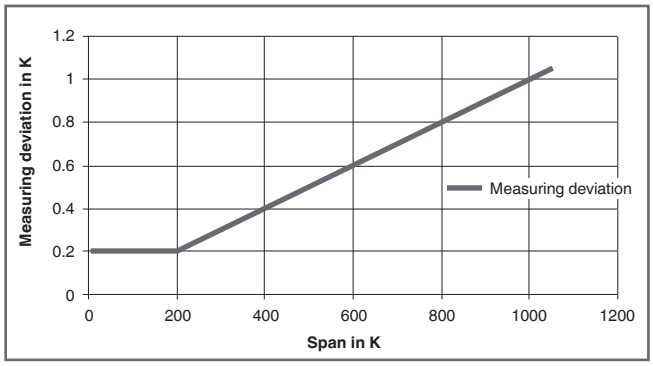


The product-specific accuracy specifications refer to the complete instrument.
($Error_{overall} = Error_{input} + Error_{cold\ junction} + Error_{output}$)
To determine the total error, all possible types of error must be considered. These are summarised in the following table.

Accuracy specifications				
Input and output in accordance with IEC 62828				
Input sensor type	**Mean temperature coefficient (TC) every 10 K ambient temperature deviation from T_{ref}**	**Measuring deviation at reference conditions [1] in accordance with DIN EN 60770, NE 145 [2]**	**Influence of auxiliary power every 1 V voltage change from U_{i_ref}**	**Long-term drift in line with IEC 61298-2 per year**
Thermocouples				
Type J (Fe-CuNi)	±1.7 K	≤ 0 °C: 0.45 K + 0.3 % |MV| ≥ 0 °C: 0.45 K + 0.045 % MV	±0.005 % of ML	40 µV / 0.1 % MV (greater value applies)
Type K (NiCr-Ni)		≤ 0 °C: 0.6 K + 0.3 % |MV| ≥ 0 °C: 0.6 K + 0.06 % MV		
Type L (DIN / Fe-CuNi)		≤ 0 °C: 0.45 K + 0.15 % |MV| ≥ 0 °C: 0.45 K + 0.045 % MV		
Type L (GOST / Fe-CuNi)		≤ 0 °C: 0.45 K + 0.15 % |MV| ≥ 0 °C: 0.45 K + 0.045 % MV		
Type E (NiCr-Cu)		≤ 0 °C: 0.45 K + 0.3 % |MV| ≥ 0 °C: 0.45 K + 0.045 % MV		
Type N (NiCrSi-NiSi)		≤ 0 °C: 0.75 K + 0.3 % |MV| ≥ 0 °C: 0.75 K + 0.045 % MV		
Type T (Cu-CuNi)		≤ 0 °C: 0.6 K + 0.3 % |MV| ≥ 0 °C: 0.6 K + 0.015 % MV		
Type R (PtRh-Pt)		≤ 400 °C: 2.2 K + 0.18 % |MV| ≥ 400 °C: 2.2 K + 0.015 % MV		
Type S (PtRh-Pt)		≤ 400 °C: 2.2 K + 0.18 % |MV| ≥ 400 °C: 2.2 K + 0.015 % MV		
Type B (PtRh-Pt)		≤ 1,000 °C: 2.5 K + 0.3 % |MV - 1,000| ≥ 1,000 °C: 2.5 K		
Type C (W5Re-W26Re)		≤ 1,000 °C: 2.2 K + 0 % |MV| ≥ 1,000 °C: 2.2 K + 0.175 % MV - 1,000		
Type A (W5Re-W20Re)		≤ 1,000 °C: 2.4 K + 0 % |MV| ≥ 1,000 °C: 2.4 K + 0.175 % MV - 1,000		
Cold junction (only with TC)	±0.1 K (±1.8 °F)	≤ ±1.5 K (≤ ±2.7 °F)		≤ 0.4 K (≤ 0.72 °F)
Output	0.06 % of ML	0.045 % of ML		0.1 % of ML

1) Reference conditions: temperature: 23 °C [73 °F] ±3 K, relative humidity: 50 ... 70 %, ambient pressure: 86 ... 106 kPa, auxiliary power U_{i_ref}: 24 V
2) In the event of interference caused by high-frequency electromagnetic fields in a frequency range from 80 to 400 MHz, an increased measuring deviation of up to 0.8 % is to be expected. During transient interferences (e.g. burst, surge, ESD) take into account an increased measuring deviation of up to 1.5 %.

Measuring deviation via span



Example calculation for transmitter accuracy

Type K thermocouple / Measuring range 0 ... 400 °C → Span 400 K [720 °F] / Ambient temperature 25 °C [77 °F] / Measured value 300 °C [572 °F]	
Input 300 °C > 0 °C → 0.6 K + 0.06 % x MV 0.6 K + (0.06 % x 300 °C)	±0.78 K (±1.4 °F)
Output 0.045 % x 300 K	±0.135 K (±0.243 °F)
Cold junction 1.5 K	±1.5 K (±2.7 °F)
Measuring deviation (typical) $\sqrt{\text{input}^2 + \text{output}^2 + \text{cold junction}^2}$	±1.7 K (±3.06 °F)
Measuring deviation (maximum) Input + TC_{input} + output + cold junction	±2.42 K (±4.36 °F)

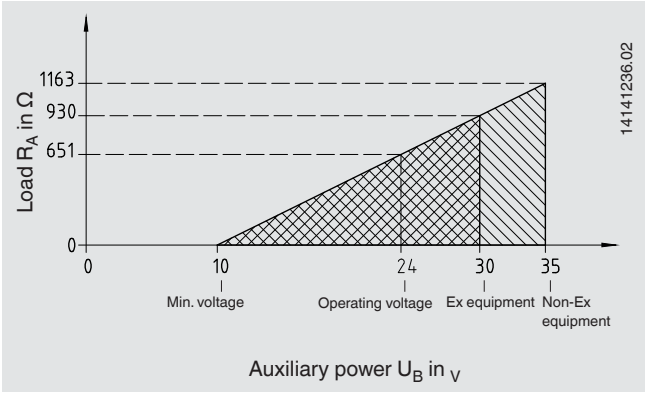
Type K thermocouple / Measuring range 0 ... 600 °C → Span 600 K [1,080 °F] / Ambient temperature 45 °C [113 °F] / Measured value 550 °C [1,022 °F]	
Input 550 °C > 0 °C → 0.6 K + 0.06 % x MV 0.6 K + (0.06 % x 550 °C)	±0.93 K (±1.67 °F)
Temperature coefficient input 45 °C - 26 °C = 9 K → 2 x 10 K	±0.4 K (±0.72 °F)
Output 0.045 % x 600 K	±0.27 K (±0.49 °F)
Temperature coefficient output 45 °C - 26 °C = 19 K → 2 x 10 K 0.06 % x 600 K x 2	±0.72 K (±1.3 °F)
Cold junction 1.5 K	±1.5 K (±2.7 °F)
Cold junction temperature coefficient 45 °C - 26 °C = 19 K → 2 x 10 K	±4.0 K (±7.2 °F)
Measuring deviation (typical) $\sqrt{\text{input}^2 + TC_{input}^2 + \text{output}^2 + TC_{output}^2 + \text{cold junction}^2 + TC_{cold\ junction}^2}$	**±4.5 K (±8.1 °F)**
Measuring deviation (maximum) Input + TC_{input} + output + cold junction	**±7.8 K (±14.04 °F)**

Output signal		
Analogue output	Linear to temperature per IEC 60584 / DIN 43710	
Output limits per NAMUR NE43	Lower limit	Upper limit
	3.8 mA	20.5 mA
Current value for signalling per NAMUR NE43	Downscale	Upscale
	< 3.6 mA (3.5 mA)	> 20.5 mA (21.5 mA)
Voltage supply		
Auxiliary power U_B	DC 10 … 35 V	
Load R_A	$R_A \leq (U_B - 10\ V) / 0.0215\ A$ with R_A in Ω and U_B in V	
Ex-relevant connection values	See “Safety-relevant characteristics (explosion-protected version)”	
Factory configuration		
Sensor	Type K	
Measuring range	0 ... 600 °C [32 ... 1,112 °F]	
Error signalling	Downscale	
Damping	Off	
Monitoring functions		
Sensor break monitoring	Configurable via software Default: downscale	
Measuring range monitoring	Monitoring of the set measuring range for upper/lower deviations configurable Standard: deactivated	
Drag pointer (internal temperature of the electronics)	Stores the maximum ambient temperature (no reset possible)	
Time response		
Step response time	< 0.9 s (typical < 0.7 s)	
Switch-on time	Max. 4 s	
Damping	Configurable between 1 s and 60 s	
Warm-up time	After a max. 45 minutes the accuracy specifications are met (due to the internal cold junction)	
Measuring rate	Measured value update approx. 8/s	

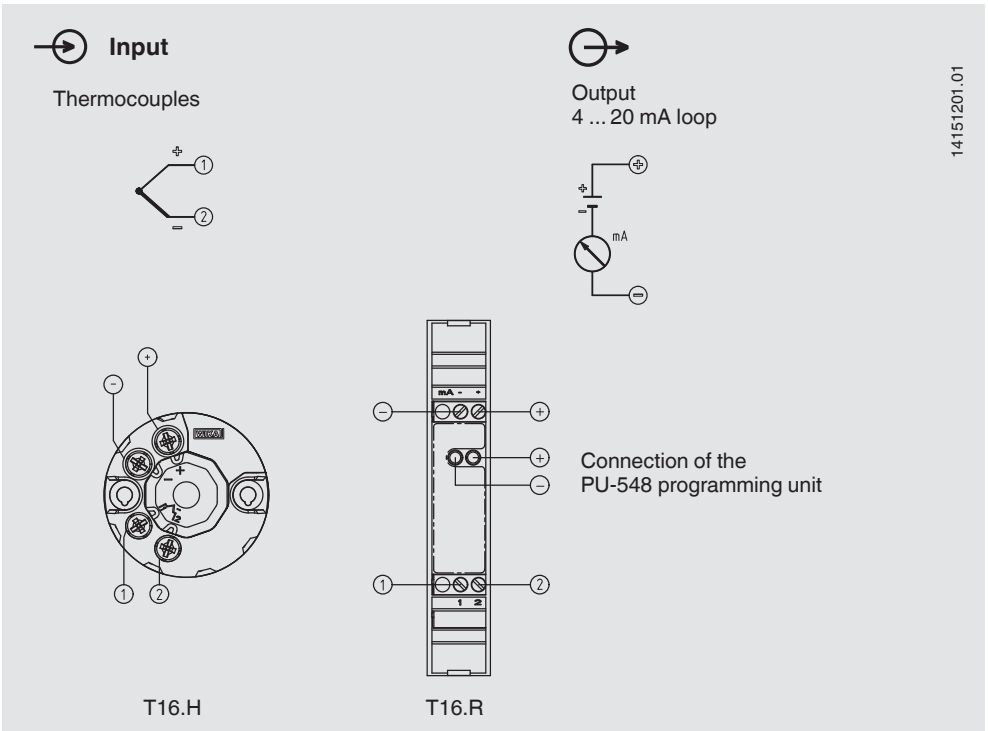
Electrical connection		
Connection type	Cable	
Wire cross-section		
T16.H head-mounted version	Solid wire	0.14 ... 2.5 mm² (24 ... 14 AWG)
	Stranded wire with end splice	0.14 ... 1.5 mm² (24 ... 16 AWG)
T16.R rail-mounted version	Solid wire	0.14 ... 2.5 mm² (24 ... 14 AWG)
	Stranded wire with end splice	0.14 ... 2.5 mm² (24 ... 14 AWG)
Insulation resistance R_{is}	AC 1,500 V	

Load diagram

The permissible load depends on the loop supply voltage.



Assignment of connection terminals



Operating conditions	
Ambient temperature range	{-50} -40 ... +85 {+105} °C [{-58} -40 ... +185 {+221} °F]
Storage temperature range	-40 ... +85 °C [-40 ... +185 °F]
Humidity	
Model T16.H per IEC 60068-2-38:2009	Test max. temperature variation 65 °C (149 °F) / -10 °C (14 °F), 93 % ±3 % relative humidity (non-condensing)
Model T16.R per IEC 60068-2-30:2005	Test max. temperature 55 °C (131 °F), 95 % relative humidity (condensation permissible in vertical mounting position)
Climate class per IEC 654-1:1993	Cx (-40 ... +85 °C / -40 ... +185 °F, 5 ... 95 % r. h.)
Salz mist per IEC 68-2-52:1996, IEC 60068-2-52:1996	Severity grade 1
Vibration resistance per IEC 60068-2-6:2008	Test Fc: 10 ... 2,000 Hz; 10 g, amplitude 0.75 mm (0.03 in)
Shock resistance per IEC 68-2-27:2009	
Model T16.H	100 g / 6 ms
Model T16.R	30 g / 11 ms
Free fall per IEC 60721-3-2:1997, DIN EN 60721-3-2:1998	Height of fall 1.5 m [4.9 ft]
Ingress protection of the complete instrument	
Head-mounted version	IP00 (electronics completely potted)
Rail-mounted version	IP20
Electromagnetic compatibility (EMC) [1] per DIN EN 55011:2010, DIN EN 61326, NAMUR NE21:2012, GL 2012 VI Part 7	Emission (group 1, class B) and immunity (industrial environment) [HF field, HF cable, ESD, Burst, Surge]

{} Items in curved brackets are options for an additional price, not for ATEX versions of the head-mounted version and not for T16.R rail-mounted version

1) In the event of interference caused by high-frequency electromagnetic fields in a frequency range from 80 to 400 MHz, an increased measuring deviation of up to 0.8 % is to be expected. During transient interferences (e.g. burst, surge, ESD) take into account an increased measuring deviation of up to 1.5 %.

Approvals

Logo	Description	Region
CE	**EU declaration of conformity**	European Union
	EMC Directive EN 61326 emission (group 1, class B) and immunity (industrial environments)	
	RoHS directive	

Optional approvals

Logo	Description	Region
Ex	**EU declaration of conformity**	European Union
	ATEX directive Hazardous areas - Ex i Zone 0 gas — II 1G Ex ia IIC T6...T4 Ga Zone 2 gas — II 3G Ex ic IIC T6...T4 Gc X Zone 20 dust — II 1D Ex ia IIIC T135 °C Da - Ex e Zone 2 gas — II 3G Ex ec IIC T6...T4 Gc X	
IEC IECEx	**IECEx** Hazardous areas - Ex i Zone 0 gas — Ex ia IIC T6...T4 Ga Zone 2 gas — Ex ic IIC T6...T4 Gc X Zone 20 dust — Ex ia IIIC T135 °C Da - Ex e Zone 2 gas — Ex ec IIC T6...T4 Gc X	International
FM APPROVED	**FM** Hazardous areas Class I, division 1 or 2, groups A/B/C/D, T6...T4 Class I, zone 0 or 1, AEx ia IIC T6...T4	USA
CSA	**CSA**	Canada
	Safety (e.g. electr. safety, overpressure, ...)	
	Hazardous areas Class I, division 1 or 2, groups A/B/C/D, T6...T4 Class II, division 1 or 2, groups E/F/G, T6...T4 / T135 °C, class III Class I, zone 0 or 1, Ex ia [ia Ga] IIC T6...T4 Ga Class I, zone 20 or 21, Ex ia [ia Da] IIIC T135 °C Da	
EAC Ex	**EAC**	Eurasian Economic Community
	EMC Directive	
	Hazardous areas - Ex i Zone 0 gas — 0 Ex ia IIC T4/T5/T6 Zone 1 gas — 1 Ex ib IIC T4/T5/T6 Zone 2 gas — 2 Ex ic IIC T4/T5/T6 Zone 20 dust — DIP A20 Ta 135 °C Zone 21 dust — DIP A21 Ta 135 °C - Ex e Zone 2 gas — 2 Ex ec IIC T4/T5/T6	
	Ex Ukraine	Ukraine
	Mining	
	Hazardous areas - Ex i Zone 0 gas — II 1G Ex ia IIC T6...T4 Ga Zone 20 dust — II 1D Ex ia IIIC T135 °C Da	
-	**PESO** Hazardous areas - Ex i Zone 0 gas — Ex ia IIC T6...T4 Ga Zone 2 gas — Ex ic IIC T6...T4 Gc X Zone 20 dust — Ex ia IIIC T135 °C Da - Ex e Zone 2 gas — Ex ec IIC T6...T4 Gc X	India

Logo	Description	Region
	PAC Kazakhstan Metrology, measurement technology	Kazakhstan
	PAC Uzbekistan Metrology, measurement technology	Uzbekistan

Certificates

Description	
Certificates	■ 2.2 test report per EN 10204 (e.g. state-of-the-art manufacturing, material proof, indication accuracy) ■ 3.1 inspection certificate per EN 10204 (e.g. material proof for wetted metal parts, indication accuracy, calibration certificate)

→ For approvals and certificates, see website

Safety-related characteristic values (Ex)

■ Models T16.x-AI, T16.x-AC

Intrinsically safe connection values for the current loop (4 ... 20 mA)
Protection level Ex ia IIC/IIB/IIA, Ex ia IIIC or Ex ic IIC/IIB/IIA

Safety-related characteristic values (Ex)	Models T16.x-AI, T16.x-AC	Model T16.x-AI
	Gas hazardous application	Dust hazardous application
Connection values		
Terminals	+ / -	+ / -
Max. voltage U_i	DC 30 V	DC 30 V
Max. current I_i	130 mA	130 mA
Max. power P_i	800 mW	750/650/550 mW
Effective internal capacitance C_i	7.8 nF	7.8 nF
Effective internal inductance L_i	20 µH	20 µH
Connection values of sensor circuit		
Terminals	1 - 2	1 - 4
Max. voltage U_0	DC 6.6 V	DC 6.6 V
Max. current I_0	4 mA	4 mA
Max. power P_0	10 mW	10 mW
Characteristic curve	Linear	

Due to distance requirements of the applied standards, the IS power and signal circuit as well as the IS sensor circuit shall be considered as being galvanically connected to each other.

Application	Ambient temperature range	Temperature class	Power Pi
Group II	-40 °C [-40 °F] ≤ T_a ≤ +85 °C [+185 °F]	T4	800 mW
	-40 °C [-40 °F] ≤ T_a ≤ +70 °C [+158 °F]	T5	800 mW
	-40 °C [-40 °F] ≤ T_a ≤ +55 °C [+131 °F]	T6	800 mW
Group IIIC	-40 °C [-40 °F] ≤ T_a ≤ +40 °C [+104 °F]	N/A	750 mW
	-40 °C [-40 °F] ≤ T_a ≤ +75 °C [+167 °F]	N/A	650 mW
	-40 °C [-40 °F] ≤ T_a ≤ +85 °C [+185 °F]	N/A	550 mW

N/A = not applicable

Legend

U_o: Maximum voltage of any conductor against the other three conductors
I_o: Maximum output current for the least favourable connection of the internal current limiting resistors
P_o: U_o x I_o divided by 4 (linear characteristic)

■ Model T16.x-AE

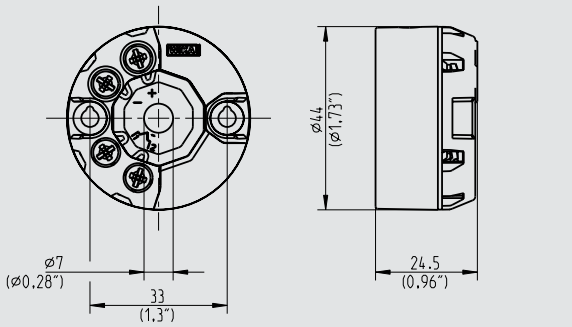
Power and signal circuit (4 ... 20 mA loop)

Safety-related characteristic values (Ex)	Model T16.x-AE
	Gas hazardous application
Connection values	
Protection level	Ex ec
Terminals	+ / -
Max. voltage U_i	DC 35 V
Max. current I_i	21.5 mA
Connection values of sensor circuit	
Protection level	Ex ec IIC/IIB/IIA
Terminals	1 - 2
Max. power P_0	■ 2.575 V x 0.1 mA → 0.256 mW ■ DC 2.575 V ■ 0.1 mA

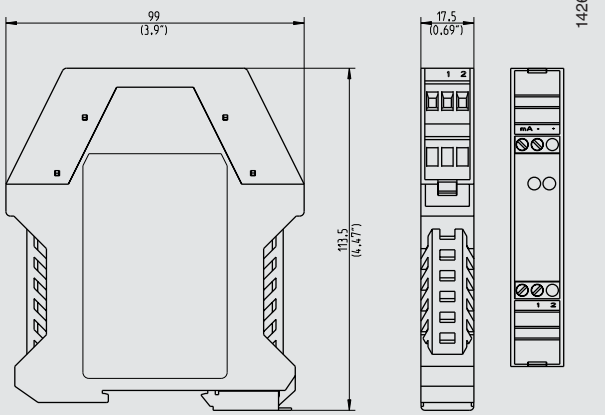
Application	Ambient temperature range	Temperature class
Group II	-40 °C [-40 °F] ≤ T_a ≤ +85 °C [+185 °F]	T4
	-40 °C [-40 °F] ≤ T_a ≤ +70 °C [+158 °F]	T5
	-40 °C [-40 °F] ≤ T_a ≤ +55 °C [+131 °F]	T6

Dimensions in mm [in]

Head-mounted version, model T16.H



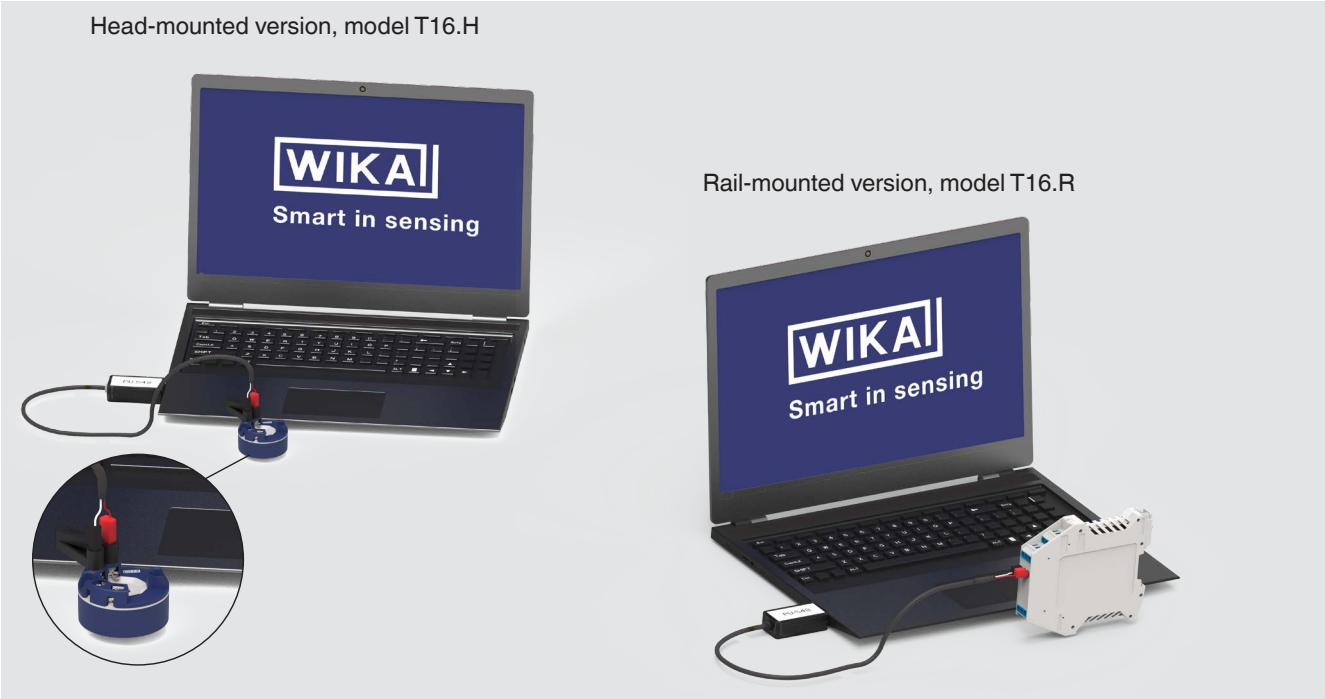
Rail-mounted version, model T16.R



The dimensions of the head-mounted transmitter match the form B DIN connection heads with extended mounting space, e.g. WIKA model BSZ.
The transmitters in rail mounting cases are suitable for all standard rails in accordance with IEC 60715.

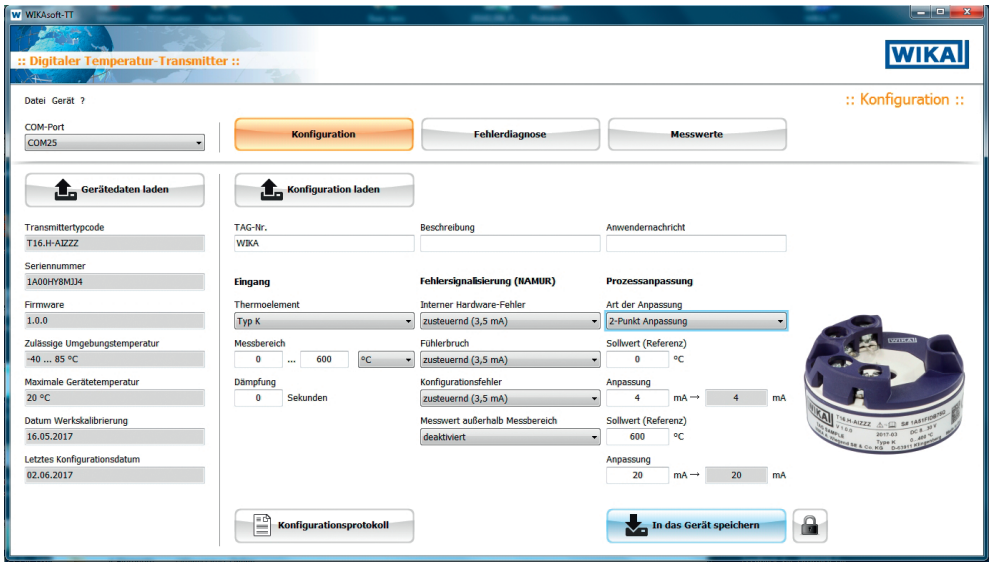
Configuration

Connecting the PU-548 programming unit



For direct communication via the USB interface of a PC/notebook, a model PU-548 programming unit is needed (see “Accessories”).

Configuration software WIKAsoft-TT



Accessories and spare parts

Model		Description	Order number
	**Programming unit model PU-548**	Programming unit for USB interface for use with the WIKAsoft-TT configuration software Easy to use LED status display Compact design No further voltage supply needed, neither for the programming unit nor for the transmitter Incl. 1 model magWIK magnetic quick connector	14231581
	**Adapter**	Suitable for TS 35 per DIN EN 60715 (DIN EN 50022) or TS 32 per DIN EN 50035 Material: plastic / stainless steel Dimensions: 60 x 20 x 41.6 mm	3593789
	**Adapter**	Suitable for TS 35 per DIN EN 60715 (DIN EN 50022) Material: steel, tin-plated Dimensions: 49 x 8 x 14 mm	3619851
	**Magnetic quick connector, model magWIK**	Replacement for crocodile clips and HART® terminals Fast, safe and secure electrical connection For all configuration and calibration processes	14026893

Ordering information

Model / Explosion protection / Additional approvals / Permissible ambient temperature / Configuration / Certificates / Options

Standard article

Configurator

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