

Digital temperature transmitter, head-mounted version

For PROFIBUS® PA or FOUNDATION™ Fieldbus

Models OTMT84, OTMT85

WIKA data sheet TE 84.01



for further approvals
see page 7



Applications

- Process industry
- Machine building and plant construction

Special features

- Model OTMT84: PROFIBUS® PA profile 3.02
- Model OTMT85: FOUNDATION™ Fieldbus H1
- Explosion-protected version Ex ia (intrinsically safe/ FISCO) and Ex ec available



Fieldbus temperature transmitter, model OTMT84

Description

The models OTMT84 and OTMT85 temperature transmitters with FOUNDATION™ Fieldbus or PROFIBUS® PA communication feature a universal input for temperature measurements with resistance thermometers, thermocouples, resistance sensors and voltage sources, which are possible with or without customer-specific linearisation. Differential, average or redundancy temperature measurements can be realised.

The temperature transmitters are characterised by their reliability, long-term stability, high accuracy and extended diagnostic options.

For FOUNDATION™ Fieldbus, the OTMT85 is available with LAS functionality (Link Active Scheduler) and PID controller. These functionalities allow for master-independent regulations in the field instrument.

The models OTMT84, OTMT85 temperature transmitters have a polarity-independent bus connection. Due to their small dimensions, the temperature transmitters are suitable for mounting into form B connection heads in accordance with DIN EN 50446.

The temperature transmitters are delivered with a factory configuration or configured according to customer specifications within the given limits.

Specifications

Measuring element					
Sensor type	Max. configurable measuring range	Standard	Digital measuring deviation (\pm) ¹⁾		Non-repeatability (\pm)
			Maximum	Measured value dependent	
Pt100	-200 ... +850 °C	IEC 60751: 2008	$\leq \pm 0.12$ °C	0.06 °C + 0.006 % x (MV-MRS)	≤ 0.05 °C
		JIS C1604: 2013	$\leq \pm 0.09$ °C	0.05 °C + 0.006 % x (MV-MRS)	≤ 0.04 °C
Pt1000	-200 ... +850 °C	IEC 60751:2008	$\leq \pm 0.09$ °C	0.03 °C + 0.013 % x (MV-MRS)	≤ 0.05 °C
Ni100	-60 ... +250 °C	DIN 43760: 1987	$\leq \pm 0.05$ °C	0.05 °C + 0.006 % x (MV-MRS)	≤ 0.03 °C
Resistance sensor	■ 10 ... 400 Ω ■ 10 ... 2,000 Ω	-	■ 32 m Ω ■ 300 m Ω	-	■ 15 m Ω ■ ≤ 200 m Ω
Potentiometer	0 ... 100 %	-	10 %	-	$\leq \pm 0.50$ %
TC type J (Fe-CuNi)	-210 ... +1,200 °C	IEC 60584-1 Cor. 1: 2015	$\leq \pm 0.27$ °C	0.27 °C - 0.005 % x (MV-MRS)	≤ 0.08 °C
TC type K (NiCr-Ni)	-270 ... +1,372 °C	IEC 60584-1 Cor. 1: 2015	$\leq \pm 0.35$ °C	0.35 °C - 0.005 % x (MV-MRS)	≤ 0.11 °C
TC type L (Fe-CuNi)	■ -200 ... +900 °C ■ -200 ... +800 °C	■ DIN 43760: 1987	■ $\leq \pm 0.29$ °C	■ 0.29 °C - 0.009 % x (MV-MRS)	■ ≤ 0.07 °C
		■ GOST R8.8585-2001	■ $\leq \pm 2.2$ °C	■ 2.2 °C - 0.015 % x (MV-MRS)	■ ≤ 0.15 °C
TC type E (NiCr-Cu)	-270 ... +1,000 °C	IEC 60584-1: 2014	$\leq \pm 0.22$ °C	0.22 °C - 0.006 % x (MV-MRS)	≤ 0.07 °C
TC type N (NiCrSi-NiSi)	-270 ... +1,300 °C	IEC 60584-1: 2014	$\leq \pm 0.48$ °C	0.48 °C - 0.014 % x (MV-MRS)	≤ 0.16 °C
TC type T (Cu-CuNi)	-260 ... +400 °C	IEC 60584-1: 2014	$\leq \pm 0.36$ °C	0.36 °C - 0.04 % x (MV-MRS)	≤ 0.11 °C
TC type U (Cu-CuNi)	-200 ... +600 °C	-	$\leq \pm 0.33$ °C	0.33 °C - 0.028 % x (MV-MRS)	≤ 0.10 °C
TC type R (PtRh-Pt)	-50 ... +1,768 °C	IEC 60584-1 Cor. 1: 2015	$\leq \pm 1.12$ °C	1.12 °C - 0.03 % x MV	≤ 0.76 °C
TC type S (PtRh-Pt)	-50 ... +1,768 °C	IEC 60584-1: 2014	$\leq \pm 1.15$ °C	1.15 °C - 0.022 % x MV	≤ 0.74 °C
TC type B (PtRh-Pt)	40 ... 1,820 °C	IEC 60584-1: 2014	$\leq \pm 1.50$ °C	1.5 °C - 0.06 % x (MV-MRS)	≤ 0.67 °C
TC type C (W5Re-W26Re)	0 ... 2,315 °C	IEC 60584-1: 2014	$\leq \pm 0.66$ °C	0.55 °C + 0.0055 % x MV	≤ 0.33 °C
TC type D (W3Re-W25Re)	0 ... 2,315 °C	IEC 60584-1: 2014	$\leq \pm 0.75$ °C	0.75 °C - 0.008 % x MV	≤ 0.41 °C
TC type A (WRe-WRe)	0 ... 2,500 °C	IEC 60584-1: 2014	$\leq \pm 1.33$ °C	0.8 °C + 0.021 % x MV	≤ 0.52 °C
mV sensor	■ -20 ... 100 mV ■ -5 ... +30 mV	-	10 μ V	-	4 μ V

1) Value transmitted via fieldbus

Measuring element					
Sensor type	Long-term stability after 1 year (max.)	Ambient temperature: Effect (\pm) per 1 °C change		Supply voltage: Effect (\pm) per V change	
		Maximum (digital ¹⁾)	Measured value dependent (digital ¹⁾)	Maximum (digital ¹⁾)	Measured value dependent (digital ¹⁾)
Pt100	≤ 0.03 °C + 0.024 % x measuring span	■ ≤ 0.02 °C ■ ≤ 0.01 °C	0.002 % x (MV-MRS), min. 0.005 °C	■ ≤ 0.12 °C ■ ≤ 0.01 °C	0.002 % x (MV-MRS), min. 0.005 °C
Pt1000	≤ 0.034 °C + 0.02 % x measuring span	≤ 0.01 °C	0.002 % x (MV-MRS), min. 0.005 °C	≤ 0.01 °C	0.002 % x (MV-MRS), min. 0.004 °C
Ni100	≤ 0.026 °C + 0.015 % x measuring span	≤ 0.05 °C	-	≤ 0.005 °C	-
Resistance sensor	■ ≤ 10 m Ω + 0.022 % x measuring span ■ ≤ 144 m Ω + 0.009 % x measuring span	■ ≤ 6 m Ω ■ ≤ 30 m Ω	0.0015 % x (MV-MRS), min. 1.5 m Ω 0.015 % x (MV-MRS), min. 15 m Ω	■ ≤ 6 m Ω ■ ≤ 30 m Ω	■ 0.0015 % x (MV-MRS), min. 1.5 m Ω ■ 0.015 % x (MV-MRS), min. 15 m Ω
Potentiometer	-	-	-	-	-
TC type J (Fe-CuNi)	≤ 0.06 °C + 0.019 % x measuring span	≤ 0.02 °C	0.0028 % x (MV-MRS), min. 0.02 °C	≤ 0.02 °C	0.0028 % x (MV-MRS), min. 0.02 °C
TC type K (NiCr-Ni)	≤ 0.09 °C + 0.022 % x (MV + 150 °C)	≤ 0.04 °C	0.003 % x (MV-MRS), min. 0.013 °C	≤ 0.04 °C	0.003 % x (MV-MRS), min. 0.013 °C

Measuring element					
Sensor type	Long-term stability after 1 year (max.)	Ambient temperature: Effect (\pm) per 1 °C change		Supply voltage: Effect (\pm) per V change	
		Maximum (digital ¹⁾)	Measured value dependent (digital ¹⁾)	Maximum (digital ¹⁾)	Measured value dependent (digital ¹⁾)
TC type L (Fe-CuNi)	<ul style="list-style-type: none"> ■ $\leq 0.06 \text{ °C} + 0.017 \% \times$ measuring span ■ $\leq 0.08 \text{ °C} + 0.015 \% \times$ measuring span 	$\leq 0.02 \text{ °C}$	-	$\leq 0.02 \text{ °C}$	-
TC type E (NiCr-Cu)	$\leq 0.06 \text{ °C} + 0.018 \% \times$ measuring span	$\leq 0.03 \text{ °C}$	0.003 % x (MV-MRS), min. 0.016 °C	$\leq 0.03 \text{ °C}$	0.003 % x (MV-MRS), min. 0.016 °C
TC type N (NiCrSi-NiSi)	$\leq 0.13 \text{ °C} + 0.015 \% \times$ (MV + 150 °C)	$\leq 0.04 \text{ °C}$	0.0028 % x (MV-MRS), min. 0.020 °C	$\leq 0.04 \text{ °C}$	0.0028 % x (MV-MRS), min. 0.020 °C
TC type T (Cu-CuNi)	$\leq 0.09 \text{ °C} + 0.011 \% \times$ measuring span	$\leq 0.01 \text{ °C}$	-	$\leq 0.01 \text{ °C}$	-
TC type U (Cu-CuNi)	$\leq 0.09 \text{ °C} + 0.013 \% \times$ measuring span	$\leq 0.01 \text{ °C}$	-	$\leq 0.01 \text{ °C}$	-
TC type R (PtRh-Pt)	$\leq 0.31 \text{ °C} + 0.011 \% \times$ (MV - 50 °C)	$\leq 0.06 \text{ °C}$	0.0035 % x (MV-MRS), min. 0.047 °C	$\leq 0.06 \text{ °C}$	0.0035 % x (MV-MRS), min. 0.047 °C
TC type S (PtRh-Pt)	$\leq 0.31 \text{ °C} + 0.011 \% \times$ measuring span	$\leq 0.05 \text{ °C}$	-	$\leq 0.05 \text{ °C}$	-
TC type B (PtRh-Pt)	$\leq \pm 0.50 \text{ °C}$	$\leq 0.06 \text{ °C}$	-	$\leq 0.06 \text{ °C}$	-
TC type C (W5Re-W26Re)	$\leq 0.15 \text{ °C} + 0.018 \% \times$ measuring span	$\leq 0.09 \text{ °C}$	0.0045 % x (MV-MRS), min. 0.03 °C	$\leq 0.09 \text{ °C}$	0.0045 % x (MV-MRS), min. 0.03 °C
TC type D (W3Re-W25Re)	$\leq 0.21 \text{ °C} + 0.015 \% \times$ measuring span	$\leq 0.08 \text{ °C}$	0.004 % x (MV-MRS), min. 0.035 °C	$\leq 0.08 \text{ °C}$	0.004 % x (MV-MRS), min. 0.035 °C
TC type A (WRe-WRe)	$\leq 0.17 \text{ °C} + 0.021 \% \times$ measuring span	$\leq 0.14 \text{ °C}$	0.0055 % x (MV-MRS), min. 0.03 °C	$\leq 0.14 \text{ °C}$	0.0055 % x (MV-MRS), min. 0.03 °C
mV sensor	$\leq 2 \text{ }\mu\text{V} + 0.022 \% \times$ measuring span	$\leq 3 \text{ }\mu\text{V}$	-	$\leq 3 \text{ }\mu\text{V}$	-

1) Value transmitted via fieldbus

MV = measured value (temperature measured values in °C)

MRS = Start of measuring range of each sensor

Measuring span = configured end of measuring range - configured start of measuring range

Further details on: Measuring element	
Measuring current during measurement	Max. 0.3 mA (Pt100)
Connection methods	
Resistance thermometer (RTD)	1 sensor in 2-/3-/4-wire connection or 2 sensors in 2-/3-wire connection → For further information, see "Designation of connection terminals"
Thermocouples (TC)	1 sensor or 2 sensors → For further information, see "Designation of connection terminals"
Max. lead resistance	
Resistance thermometer (RTD)	50 Ω each wire, 3-/4-wire
Thermocouples (TC)	5 k Ω each wire
Cold junction compensation, configurable	Internal cold junction (Pt100) External cold junction: Value adjustable -40 ... +85 °C [-40 ... +185 °F]

Accuracy specifications			
Typical measuring deviation (per DIN EN 60770, 25 °C ±3 °C, supply voltage 24 V DC)			
Input sensor type	Standard	Measuring range	Typical measuring deviation (±) Digital value ¹⁾
Pt100	IEC 60751:2008	0 ... 200 °C	0.08 °C
Pt1000	IEC 60751:2008	0 ... 200 °C	0.08 °C
TC type K (NiCr-Ni)	IEC 60584-1	0 ... 800 °C	0.31 °C
TC type S (PtRh-Pt)	IEC 60584-1	0 ... 800 °C	0.97 °C
TC type L (Fe-CuNi)	GOST R8.8585-2001	0 ... 800 °C	2.18 °C

The specifications for measurement accuracy correspond to 2 σ (Gaussian normal distribution). The specifications include non-linearity and repeatability.

1) Value transmitted via fieldbus

Example calculation

Pt100 / Measuring range 0 ... 200 °C / Ambient temperature 25 °C / Supply voltage DC 24 V	
Measuring deviation 0.06 °C + 0.006 % x (200 °C - (-200 °C))	0.084 °C

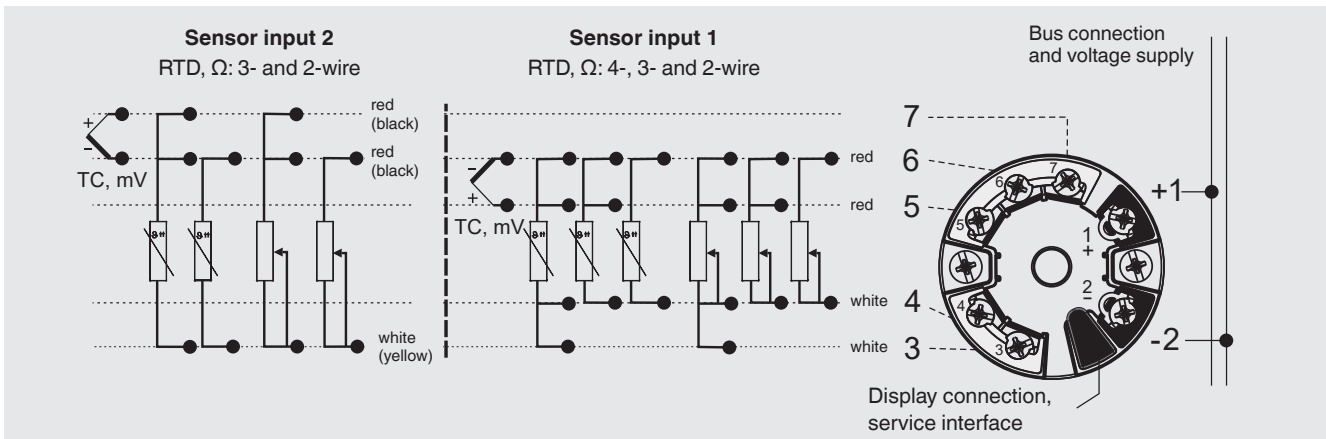
Pt1000 / Measuring range 0 ... 200 °C / Ambient temperature 35 °C / Supply voltage DC 30 V	
Measuring deviation 0.06 °C + 0.006 % x (200 °C - (-200 °C))	0.084 °C
Influence of ambient temperature (35 - 25) x (0.002 % x 200 °C - (-200 °C)) min. 0.005 °C	0.08 °C
Influence of supply voltage (30 - 24) x (0.002 % x 200 °C - (-200 °C)) min. 0.005 °C	0.048 °C
Measuring deviation (typical) $\sqrt{(\text{measuring deviation}^2 + \text{influence of ambient temperature}^2 + \text{influence of supply voltage}^2)}$	0.126 °C

Output signal	
Analogue output	<ul style="list-style-type: none"> ■ FOUNDATION™ Fieldbus ■ PROFIBUS® PA
Version of analogue output	
FOUNDATION™ Fieldbus	H1, IEC 61158-2
PROFIBUS® PA	EN 50170 vol. 2 / profile 3.02
Residual current FDE (Fault Disconnection Electronic)	0 mA
Data transfer rate (supported baud rate)	31.25 kBit/s
Signal coding	Manchester
Functionality	Basic or LAS
Function blocks	
FOUNDATION™ Fieldbus	2 x 3 analogue input (AI) 1 x standard PID controller 1 x input selector (ISEL)
PROFIBUS® PA	4x analogue input (AI)
Execution time, PID controller	< 200 ms
Response time (programmable)	1 ... 60 s
Updating time	< 400 ms
Execution time, analogue input block	< 50 ms
Factory configuration	
Sensor	Pt100
Connection method	3-wire connection
Measuring range ("Limit Handling")	0 ... 100 °C
Communication	
Communication protocol	Model OTMT84 PROFIBUS® PA profile 3.02
	Model OTMT85 FOUNDATION™ Fieldbus H1
Configuration software	Endress+Hauser FieldCare (DTM) SIMATIC PDM (EDD)
	→ Free download from www.de.endress.com
Configuration	
User linearisation	Store customer-specific sensor characteristics in the transmitter using software (other sensor types can be used in this way) Number of data points: min. 2 / max. 30
Monitoring functions	
Test current for sensor monitoring ³⁾	Nom. 20 µA during test cycle, otherwise 0 µA
Sensor break monitoring	Always active
Sensor short-circuit monitoring	Active (only for resistance thermometers)
Self-monitoring	Active permanently, e.g. RAM/ROM test, logical program operating checks and validity check
Measuring range monitoring	Monitoring of the set measuring range for upper/lower deviations Standard: Deactivated

Output signal		
Monitoring functionality when 2 sensors have been connected (dual sensor)	Redundancy	In the case of a sensor error (sensor break, lead resistance too high or outside the measuring range of the sensor) of one of the two sensors, the process value will be only based on the error-free sensor. Once the error is rectified, the process value will again be based on the two sensors, or on sensor 1.
	Ageing control (sensor drift monitoring)	An error signalling on the output is activated if the value of the temperature difference between sensor 1 and sensor 2 is higher than a set value, which can be selected by the user. This monitoring only generates a signal if two valid sensor values can be determined and the temperature difference is higher than the selected limit value. (Cannot be selected for the "Difference" sensor functionality, since the output signal already indicates the difference value).
Voltage supply		
Supply voltage U_B	DC 9 ... 32 V Not dependant on polarity (max. 35 V)	

Electrical connection	
Connection type	Screw terminals
Wire cross-section	$\leq 2.5 \text{ mm}^2$ (14 AWG)
Cable design	Rigid or flexible
Max. lead resistance	
Resistance thermometer (RTD)	50 Ω each wire, 3-/4-wire
Thermocouples (TC)	5 k Ω each wire
Insulation voltage (input to analogue output)	AC 2 kV, (50 Hz / 60 Hz); 1 s

Designation of connection terminals



The following connection combinations are possible when assigning the sensor inputs

Sensor input 2	Sensor input 1			
	RTD or resistance sensor, 2-wire	RTD or resistance sensor, 3-wire	RTD or resistance sensor, 4-wire	Thermocouple (TC), voltage source
RTD or resistance sensor, 2-wire	x	x	-	x
RTD or resistance sensor, 3-wire	x	x	-	x
RTD or resistance sensor, 4-wire	-	-	-	-
Thermocouple (TC), voltage source	x	x	x	x

Materials	
Non-wetted parts	Case: Polycarbonate (PC) Screw terminals: Nickel-plated brass, gold-plated contact Potting: WEVO PU 403 FP/FL

Operating conditions	
Ambient temperature	-40 ... +85 °C
Storage temperature	-40 ... +100 °C
Max. relative humidity per IEC 60068-2-30	95 %
Condensation per IEC 60068-2-33	Condensation allowed
Climate class per IEC 654-1: 1993	Cx (-40 ... +85 °C, 5 ... 95 % r. h.)
Shock and vibration resistance per DIN EN 60068-2-6	10 ... 2,000 Hz at 5 g
Ingress protection of the complete instrument (per IEC/EN 60529)	IP00 (with screw terminals)
Service life	Max. service life of 20 years (in line with ISO 13849-1)


Approvals

Logo	Description	Country
	EU declaration of conformity EMC directive EN 61326 emission (group 1, class B) and immunity (industrial application), and also NAMUR NE21 RoHS directive	European Union

Optional approvals

Logo	Description	Country
	EU declaration of conformity ATEX directive Hazardous areas	European Union
	IECEX Hazardous areas	International

Manufacturer's information and certificates

Logo	Description
-	China RoHS directive
	NAMUR <ul style="list-style-type: none"> ■ EMC per NAMUR NE21 ■ Signalling per NAMUR NE43 ■ Sensor break monitoring per NAMUR NE89

Certificates (option)

Certificates	
Certificates	<ul style="list-style-type: none"> ■ 2.2 test report ■ 3.1 inspection certificate
Calibration	DAkkS calibration certificate

Approvals and certificates, see website

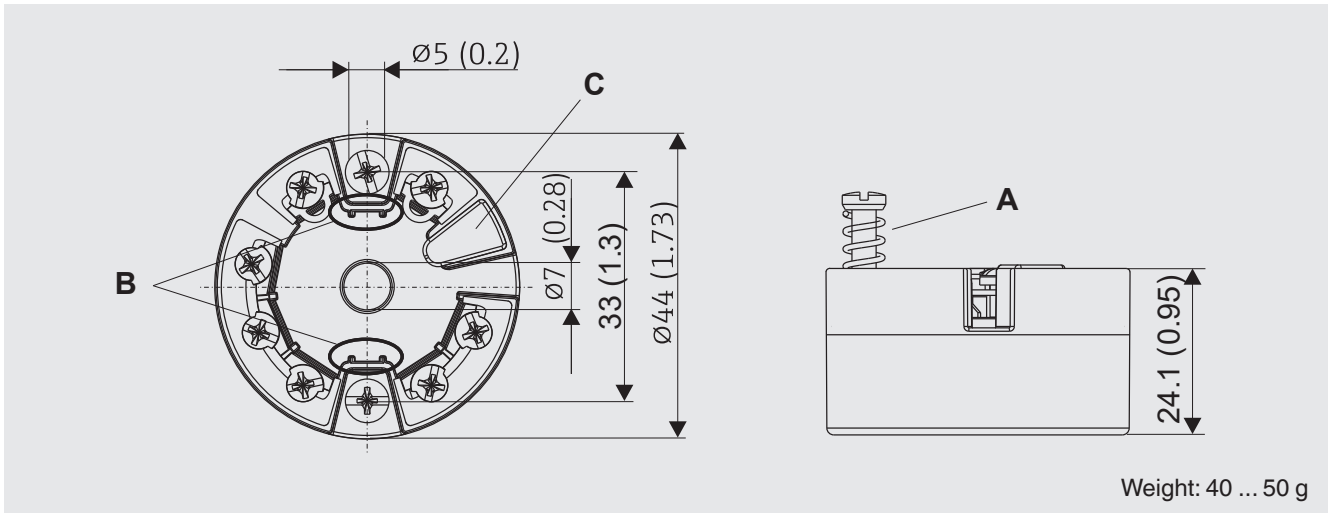
Safety-relevant characteristic values (explosion-protected version)

ATEX approval, IEC

Safety-related characteristic values (Ex)		
Ex marking	PTB 07 ATEX 2056 X BVS 08.0001X (IECEx certificate)	
	Zones 0, 1	II 1G Ex ia IIC T6 ... T4 Ga
Connection values / Intrinsically safe supply and signal circuit (4 ... 20 mA current loop)		
Terminals	+ / -	
Supply voltage U_B	DC 9 ... 32 V, not dependant on polarity	
Maximum voltage U_i	DC 24 V (or DC 17.5 V)	
Maximum current I_i	250 mA (or 380 mA)	
Maximum power P_i	$\leq 1,400$ mW	
Effective internal capacitance C_i	5 nF	
Effective internal inductance L_i	2.75 μ H	
Sensor circuit connection values		
Terminals	3 - 7	
Maximum voltage U_0	DC 7.2 V	
Maximum current I_0	25.9 mA	
Maximum power P_0	46.7 mW	
Effective internal capacitance C_i	5 nF	
Effective internal inductance L_i	Negligibly small	
Maximum external capacitance C_0	Gas, category 1 and 2, group IIC	0.97 μ F
	Gas, category 1 and 2, group IIB	4.6 μ F
	Gas, category 1 and 2, group IIA	6 μ F
Maximum external inductance L_0	Gas, category 1 and 2, group IIC	20 mH
	Gas, category 1 and 2, group IIB	50 mH
	Gas, category 1 and 2, group IIA	100 mH
Characteristic curve	Linear	

Application	Ambient temperature range	Temperature class
Group II Gas, category 1	-20 ... +60 °C	T4
	-20 ... +50 °C	T5
	-20 ... +40 °C	T6
Group II Gas, category 2	-40 ... +85 °C	T4
	-40 ... +70 °C	T5
	-40 ... +55 °C	T6

Dimensions in mm [in]





Version with screw terminals

A = Spring travel $L \geq 5$ mm

B = Mounting elements for attachable measured value display

C = Interface to electrical connection of measured value display

Accessories

Model		Description	Order number
	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

Ordering information

Model / Explosion protection / Configuration / Options

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