



OPTITEMP TT 33 C/R Technical Datasheet

Universal transmitter with NFC™ technology

- NFC™ - Configuration of the transmitter via a portable device such as a smartphone
- High accuracy and long-term stability
- Universal input
- Efficient PC configuration without external power



The documentation is only complete when used in combination with the relevant documentation for the sensor.

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1.1 Smart 2-wire universal temperature transmitter with NFC™ technology

The OPTITEMP TT 33 is a universal, isolated 2-wire transmitter for temperature, resistance or voltage measurements in an industrial environment.

The OPTITEMP TT 33 series consists of two different versions. TT 33 C is primarily intended to be mounted in a DIN-B housing whereas TT 33 R is the rail-mount version.

NFC™ features enables wireless communication and configuration between transmitter and a portable device such a smartphone. Typical characteristics are the high accuracy, stability and reliability combined with a robust housing.



Figure 1-1: Device versions

- ① In-head transmitter
- ② Rail-mount transmitter

Highlights

High measurement accuracy

- Long-term stability: drift over 5 years is the maximum of $\pm 0.1^{\circ}\text{C}$ or $\pm 0.1\%$ of span
- High precision: $\pm 0.08^{\circ}\text{C}$ / $\pm 0.18^{\circ}\text{F}$ or 0.08% of span (Pt100, 3-wire or 4-wire connection)
- Low temperature drift $\pm 0.01^{\circ}\text{C}$ per $^{\circ}\text{C}$ or $\pm 0.01\%$ of span per $^{\circ}\text{C}$

High reliability

- Robust design: 10 g (only valid for in-head version) vibrations, 95% RH (non-condensing) and robust terminals

High safety

- NAMUR compliant to NE 21, NE 43 and NE 107
- ATEX, IECEx (intrinsically safe)

High user efficiency

- NFC™ - Wireless communication enables easy configuration with a portable device such as a smartphone
- Ability to communicate via Bluetooth® requires the Bluetooth® configuration kit TT-CON BT
- Callendar – Van Dusen linearisation
- Run-time counter
- Min. and max. power supply memory
- Min. and max. ambient temperature memory
- Password protection

Industries

Typical industrial applications are in:

- Chemicals
- Oil & Gas
- Power
- Iron, Steel & Metal
- Pulp & Paper
- Food & Beverage
- Pharmaceuticals

1.2 Options and variants

TT 33 C: in-head transmitter



The TT 33 C is a smart, universal 2-wire in-head transmitter for temperature, resistance or voltage measurements in an industrial environment.

The TT 33 C is optionally available in an intrinsically safe version for use in zone 0, 1 and 2.

All versions are intended for installation in a "B connection head" or larger according to DIN EN 50446.

TT 33 R: rail-mount transmitter



The TT 33 R is a smart, universal 2-wire rail-mount transmitter for temperature, resistance or voltage measurements in an industrial environment.

The TT 33 R is optionally available in an intrinsically safe version for use in zone 0, 1 and 2.

All versions are intended for installation on a rail according to EN 60715 / DIN 50022.

1.3 Measuring principles

The kind of the measuring principle depends on the measuring insert that you combine with the transmitter. In matters of the thermometer type the manufacturer offers two different measuring inserts, either with a resistance thermometer or with a thermocouple. This transmitter supports both types.

1.3.1 Resistance temperature sensor

The measuring insert with a temperature-sensitive sensor made from a platinum (Pt) RTD, whose value at 0°C / +32°F is 100 Ω. That is where the name "Pt100" comes from.

It is generally valid that the electric resistance of metals increases according to a mathematical function as the temperature rises. This effect is taken advantage of by resistance temperature sensors to measure temperature. The "Pt100" temperature sensors features a measuring resistance with defined characteristics, standardised in IEC 60751. The same is true for the tolerances. The average temperature coefficient of a Pt100 is $3.85 \times 10^{-3} \text{ K}^{-1}$ in the range from 0...+100°C / +32...+212°F.

During operation, a constant current $I (\leq 1 \text{ mA})$ flows through the Pt100 RTD, which brings about a voltage drop U . The resistance R is calculated using Ohm's Law ($R=U/I$). As the voltage drop U at 0°C / +32°F is 100 mV, the resulting resistance of the Pt100 temperature assembly is 100 Ω (100 mV / 1 mA = 100 Ω).

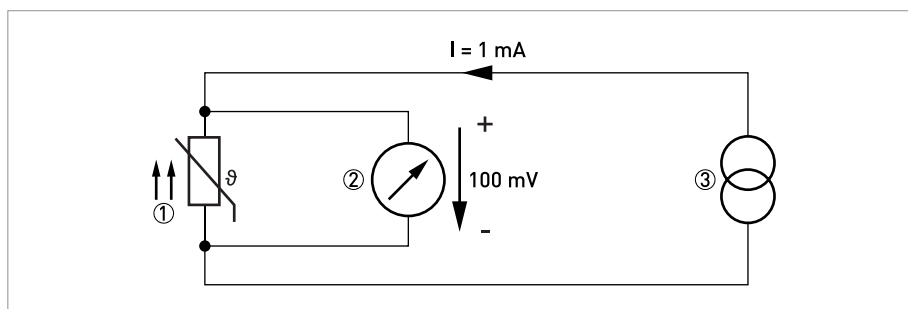


Figure 1-2: Pt100 resistance temperature sensor at 0°C / +32°F, schematic

- ① Pt100 RTD
- ② Voltage meter
- ③ Current source

1.3.2 Thermocouples

The thermocouple features two electric conductors made from different metals, connected at one end. Each free end is connected to a compensation cable which is then connected to a millivolt meter. This circuitry forms a "thermal circuit". The point at which the two electric conductors connect is called the measuring point and the point at which the compensation cables connect to the conductors of the millivolt meter is called the cold junction.

If the measuring point of this thermal circuit is heated up, a small electrical voltage (thermal voltage) can be measured. If, however, the measuring point and the cold junction are at the same temperature, no thermoelectric voltage is generated. The degree of thermoelectric voltage, also known as electromotive force (EMF), depends on the thermocouple material and the extent of the temperature difference between the measuring point and the cold junction. It can be measured using the millivolt meter with no auxiliary power.

Simply put, the thermocouple behaves like a battery, the voltage of which also increases as the temperature rises.

The characteristic curves and tolerances of commercially available thermocouples are standardised in IEC 60584.

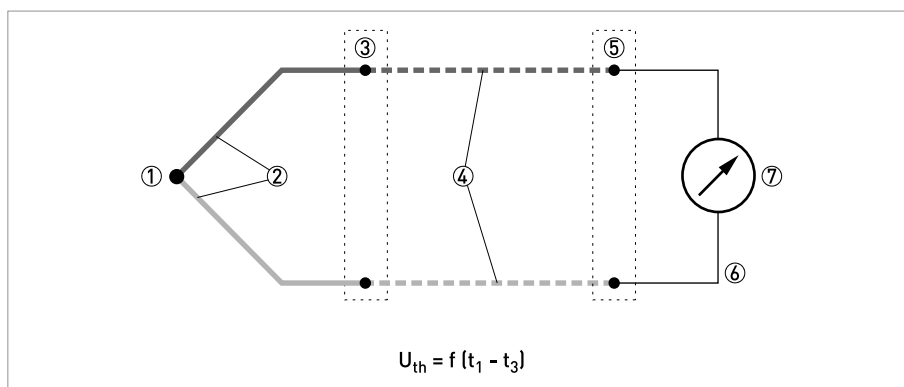


Figure 1-3: Thermocouple measuring circuit, schematic

- ① Measuring point t_1 (hot junction)
- ② Thermocouple
- ③ Transition junction t_2
- ④ Compensation cable / extension cable
- ⑤ Reference junction t_3 (cold junction)
- ⑥ Copper conductor
- ⑦ Voltage meter U_{th}

2.1 Technical data

- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).

Measuring system

Application range	Temperature measurements of solids, liquids and gases in industrial environment.
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Design

Versions	
TT 33 C	In-head transmitters which are intended for installation in a DIN B-head or larger according to DIN EN 50446. This transmitter is optionally available in an intrinsically safe version (zone 0, 1 and 2) for installation in potentially explosive atmospheres.
TT 33 R	Rail-mount transmitters which are intended for installation on a DIN-rail according to DIN 50022 / EN 60715, 35 mm / 1.38". The transmitter is optionally available in an intrinsically safe version (zone 0, 1 and 2) for installation in potentially explosive atmospheres.
Features	
NFC™	NFC™ enables wireless communication and configuration between transmitter and a portable device such a smartphone. NFC™ applies only to versions of TT 33 manufactured from 07/2020.
Sensor matching	A matching to a calibrated temperature sensor can easily be performed by entering the sensor deviation in the low and high ends of the measuring ranges.
Customized linearisation	For resistance and mV inputs, either a 50-point customized linearisation table or via Callendar-Van Dusen (applies only to RTD, $\alpha = 0.00385$) constants can provide a correct process value.
PC programmable	Measuring ranges are set from PC.
	Full accuracy is provided without any need for calibration.
	Configuration without external power.
Runtime counter	Hour counter for elapsed operational time.
Simulated output	Fixed current output during a maximum time of 15 minutes.

Measuring accuracy

Accuracy & stability	Typical accuracy is max. of $\pm 0.08^\circ\text{C}$ or $\pm 0.08\%$ of span. (Pt100, 3-wire or 4-wire connection)
Ambient temperature influence	RTD and thermocouple: for detailed information refer to <i>RTD and T/C accuracy table</i> on page 16.
	Resistance: $\pm 0.01\% < 4000 \Omega$ (2000 Ω at 2-wire) $< \pm 0.02\%$ of span per $^\circ\text{C}$
	Voltage: $\pm 0.01\%$ of span per $^\circ\text{C}$
Supply voltage influence	$< \pm 0.005\%$ of span per V
Long-term drift	Max. of $\pm 0.02^\circ\text{C}$ or $\pm 0.02\%$ of span per year

Operating conditions

Temperature	
In-head transmitter	Operating and storage temperature: Standard version: -40...+85°C / -40...+185°F
	IS version: for detailed information refer to <i>Temperature data for areas with potentially explosive atmospheres</i> on page 13.
Rail-mount transmitter	Operating and storage temperature: Standard version: -40...+85°C / -40...+185°F
	IS version: for detailed information refer to <i>Temperature data for areas with potentially explosive atmospheres</i> on page 13.
Humidity	0...95% RH (non-condensing)
Protection category	
In-head transmitter	Housing: IP65
	Terminals: IP00
Rail-mount transmitter	Housing: IP20
	Terminals: IP20

Installation conditions

Mounting	In-head transmitter: DIN B-head or larger, DIN-rail (with adapter)
	Rail-mount transmitter: DIN-rail according to DIN 50022 / EN 60715, 35 mm / 1.38"
	For detailed information refer to <i>Installation</i> on page 18.
Weight	In-head transmitter: 35 g / 0.08 lb
	Rail-mount transmitter: 64 g / 0.14 lb
Dimensions	For detailed information refer to <i>Dimensions</i> on page 12.

Materials

Housing	PC/ABS + PA
Flammability according to UL	In-head transmitter: V0
	Rail-mount transmitter: V0/HB

Electrical connections

Power supply	Standard version: 8.0...36 VDC
	IS version: 8.0...30 VDC
Isolation	Galvanically isolated (in-out), 1500 VAC, 1 minute
Connection	Single/stranded wires: max. 1.5 mm ² / AWG 16
Reverse Polarity Protection	Yes

Inputs / Outputs

Input - RTD	
Pt100 (IEC 60751, $\alpha = 0.00385$)	-200...+850°C / -328...+1562°F
Pt100 (JIS C1604-1981, $\alpha = 0.003916$)	
PtX ($10 \leq X \leq 1000$) (IEC 60751, $\alpha = 0.00385$)	The upper range depends on the X value, max. input temperature corresponding to 4000 Ω .
Ni100 (DIN 43760)	-60...+250°C / -76...+482°F
Ni120 (Edison No. 7)	

Ni1000 (DIN 43760)	-50...+180°C / -58...+356°F
Cu10 (Edison Copper Windings No. 15)	-50...+200°C / -58...+392°F
Sensor current	≤300 µA
Maximum sensor wire resistance	3-wire and 4-wire connection: 50 Ω/wire 2-wire connection: compensation for 0 to 100 Ω loop resistance
Adjustment	Minimum span 10°C / 18°F Sensor error compensation ±10% of span for span <50°C / 90°F, otherwise ±5°C / ±9°F
Input - resistance / potentiometer	
Range (resistance)	0...10000 Ω
Range (potentiometer)	100...10000 Ω
Zero adjustment	Within range
Max offset adjustment	50% of selected max. value
Minimum span	10 Ω
Sensor current	≤300 µA
Customised linearisation	Up to 50 points
Maximum sensor wire resistance	In-head transmitter: 50 Ω/wire Rail-mount transmitter: 50 Ω/wire
Input - thermocouples	
T/C type B - Pt30Rh-Pt6Rh (IEC 60584)	400...+1800°C / +752...+3272°F
T/C type C - W5Re-W26Re (ASTM E 988)	0...+2315°C / 32...+4199°F
T/C type D - W3Re-W25Re (ASTM E 988)	0...+2315°C / 32...+4199°F
T/C type E - NiCr-CuNi (IEC 60584)	-270...+1000°C / -454...+1832°F
T/C type J - Fe-CuNi (IEC 60584)	-210...+1200°C / -346...+2192°F
T/C type K - NiCr-NiAl (IEC 60584)	-270...+1300°C / -454...+2372°F
T/C type N - NiCrSi-NiSi (IEC 60584)	-270...+1300°C / -454...+2372°F
T/C type R - Pt13Rh-Pt (IEC 60584)	-50...+1750°C / -58...+3182°F
T/C type S - Pt10Rh-Pt (IEC 60584)	-50...+1750°C / -58...+3182°F
T/C type T - Cu-CuNi (IEC 60584)	-270...+400°C / -454...+752°F
Input impedance	>10 MΩ
Maximum wire loop resistance	In-head transmitter (including T/C sensor): 5 kΩ Field transmitter (including T/C sensor): 10 kΩ
Cold Junction Compensation (CJC)	Internal, external (Pt100) or fixed
Input - voltage	
Range	-10...+1000 mV
Zero adjustment	Within range
Minimum span	2 mV
Customised linearisation	Up to 50 points
Input impedance	>10 MΩ
Maximum wire loop resistance	In-head transmitter: 5 kΩ Field transmitter / Switch room transmitter: 10 kΩ
Output	
Output signal	4...20 mA, 20...4 mA; temperature, resistance or voltage linear, customised linearisation possible.
Permissible load	(Supply voltage - 8.0) / 0.022

NAMUR compliance	Output limits and failure currents according to NAMUR NE 43
Adjustable filtering level	0.17...90 s, (default 1.4 s) (3-wire RTD)
Monitoring	Sensor break and short circuit monitoring, selectable, upscale ≥ 21.0 mA or downscale ≤ 3.6 mA action, individually configurable.
Configuration	
ConSoft	The PC configuration software, ConSoft, is a versatile and user-friendly tool for transmitter configuration.
	ConSoft is compatible with Windows XP/Vista/7/8/8.1/10
	ConSoft is part of the complete configuration kit, which also contains a USB interface and necessary cables. Full functionality of the transmitter is achieved with ConSoft program version 3.4.0 or later and the firmware in the USB Interface must have a version number 1.2.07 or later.
OPTICHECK Temperature Mobile	The app OPTICHECK Temperature Mobile for portable devices (smartphones) is a versatile and user-friendly tool for wireless configuration through Bluetooth® or NFC™ technology. Communication via Bluetooth® requires the Bluetooth® configuration kit - TT-CON BT, which can be ordered from the manufacturer.

Approvals and certifications

CE	The device fulfils the statutory requirements of the EU directives. The manufacturer certifies that these requirements have been met by applying the CE marking.
Ex approvals	
Standard version	Without
Intrinsically safe (IS) version	Refer to Ex approvals in the next table.
Other standards and approvals	
Electromagnetic compatibility	Directive: 2014/30/EU
	Harmonized standards: EN 61326-1 and EN 61326-2-3
	NAMUR NE 21
	EN 61326-1 and -2-3: Criteria A NE 21: <0.5% of span
RoHS	Directive: 2011/65/EU Harmonized standard: EN 50581
Vibration resistance	According to IEC 60068-2-6, test Fc, 10...2000 Hz, 10 g for in-head mounted / 5 g for rail mounted transmitter
Radio Equipment Directive	This product contains NFC™ communication and conforms to the requirements of the Radio Equipment Directive (RED) 2014/53/EU

Table 2-1: Technical data

TT 33 C Ex (intrinsically safe)		
ATEX	KIWA 16ATEX0039 X	II 1 G Ex ia IIC T6...T4 Ga
IECEx	IECEx KIWA 16.0017X	Ex ia IIC T6...T4 Ga
TT 33 R Ex (intrinsically safe)		
ATEX	KIWA 16ATEX0041 X	II 1 G Ex ia IIC T6...T4 Ga
IECEx	IECEx KIWA 16.0019X	Ex ia IIC T6...T4 Ga

Table 2-2: Ex approvals

2.2 Dimensions

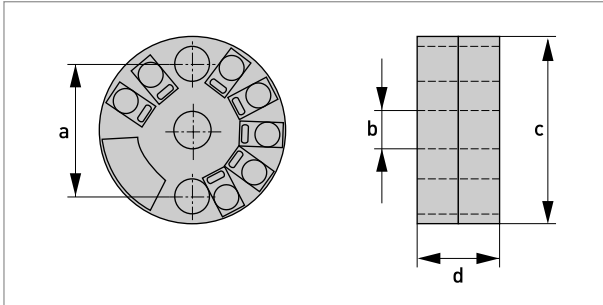


Figure 2-1: In-head transmitter

	Dimensions	
	[mm]	[inch]
a	33.0	1.30
b	7.0	0.28
c	44.5	1.75
d	19.7	0.78

Table 2-3: Dimensions in mm and inch

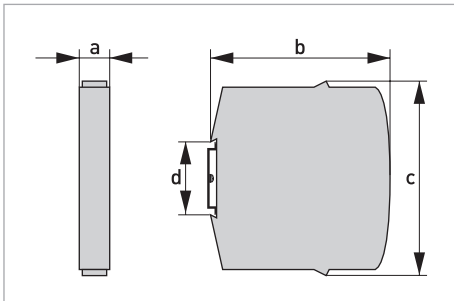


Figure 2-2: Rail-mount transmitter

	Dimensions	
	[mm]	[inch]
a	17.5	0.69
b	81.3	3.20
c	90.0	3.54
d	35	1.38

Table 2-4: Dimensions in mm and inch

2.3 Temperature data for areas with potentially explosive atmospheres

In-head transmitter and rail-mount transmitter

Pi	Temperature class	Maximum allowed ambient temperature
900 mW	T6	$-40^{\circ}\text{C} \leq T_a \leq +55^{\circ}\text{C}$ / $-40^{\circ}\text{F} \leq T_a \leq +131^{\circ}\text{F}$
	T5	$-40^{\circ}\text{C} \leq T_a \leq +70^{\circ}\text{C}$ / $-40^{\circ}\text{F} \leq T_a \leq +158^{\circ}\text{F}$
	T4	$-40^{\circ}\text{C} \leq T_a \leq +85^{\circ}\text{C}$ / $-40^{\circ}\text{F} \leq T_a \leq +185^{\circ}\text{F}$
700 mW	T6	$-40^{\circ}\text{C} \leq T_a \leq +60^{\circ}\text{C}$ / $-40^{\circ}\text{F} \leq T_a \leq +140^{\circ}\text{F}$
	T5	$-40^{\circ}\text{C} \leq T_a \leq +75^{\circ}\text{C}$ / $-40^{\circ}\text{F} \leq T_a \leq +167^{\circ}\text{F}$
	T4	$-40^{\circ}\text{C} \leq T_a \leq +85^{\circ}\text{C}$ / $-40^{\circ}\text{F} \leq T_a \leq +185^{\circ}\text{F}$

Table 2-5: Temperature data for intrinsically safe transmitter

2.4 Output load diagram

Formula for the maximum permissible output load:
 permissible $R_{Load} [\Omega] = (U - 8.0) / 0.022$

Standard transmitter

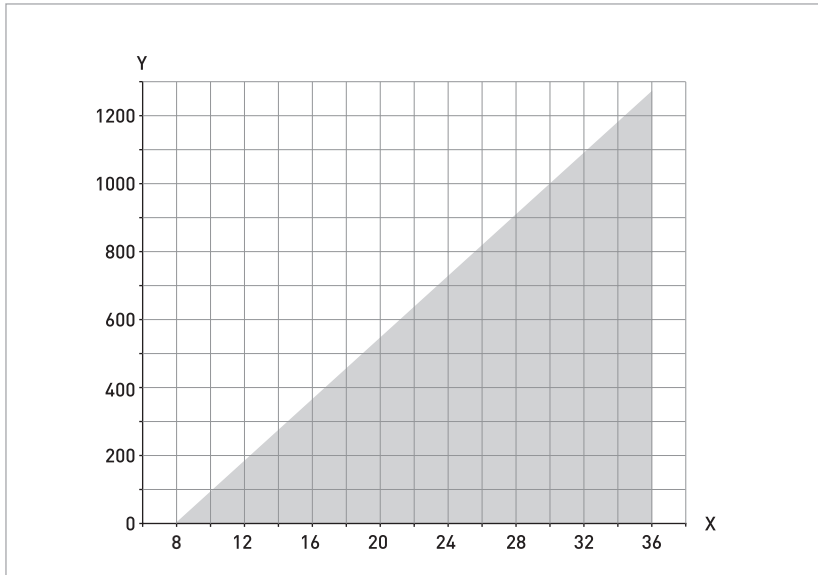


Figure 2-3: Output load diagram

X: Power supply U [VDC]
 Y: Total output load R [Ω]

Formula for the maximum permissible output load:
 permissible $R_{Load} [\Omega] = (U - 8.0) / 0.022$

Intrinsically safe transmitter

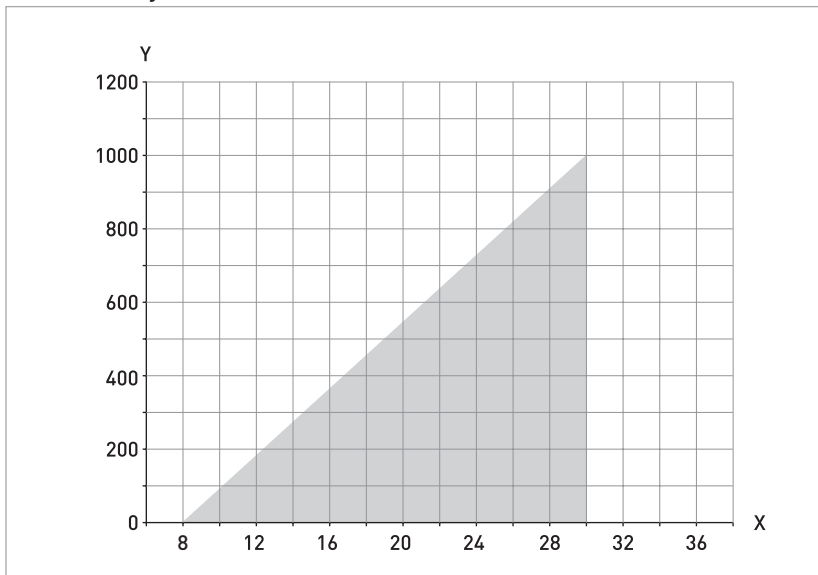


Figure 2-4: Output load diagram

X: Power supply U [VDC]
 Y: Total output load R [Ω]

2.5 Electrical data for outputs and inputs

In-head transmitter

Output terminals 6, 7		Input terminals 1, 2, 3, 4	
$U_i = V_{\max}$	≤ 30 VDC	$U_o = U_{0C}$	≤ 6.5 VDC
$I_i = I_{\max}$	≤ 100 mA	$I_o = I_{SC}$	≤ 11.7 mA
$P_i = P_{\max}$	≤ 900 mW	P_o	≤ 19.1 mW
L_i	20 μ H	L_o	400 mH
C_i	23.1 nF	C_o	24 μ F

Table 2-6: Intrinsically safe transmitter, TT 33 C Ex

Rail-mount transmitter

Output terminals 21, 22		Input terminals 1, 2, 3, 4	
$U_i = V_{\max}$	≤ 30 VDC	$U_o = U_{0C}$	≤ 6.5 VDC
$I_i = I_{\max}$	≤ 100 mA	$I_o = I_{SC}$	≤ 11.7 mA
$P_i = P_{\max}$	≤ 900 mW	P_o	≤ 19.1 mW
L_i	20 μ H	L_o	400 mH
C_i	23.1 nF	C_o	24 μ F

Table 2-7: Intrinsically safe transmitter, TT 33 R Ex

2.6 RTD and T/C accuracy table

Typical accuracy $\pm 0.08\%$ of span, max. of ± 0.1 K or $\pm 0.1\%$ of span (Pt100, 3-wire or 4-wire connection)

Conformance level 95% (2σ)

CJC = Cold Junction Compensation

Input type	Temp. range	Min. span	Accuracy (maximum of)	Temp. influence (Dev. from ref. temp. 20°C)
	[°C]		[°C]	
RTD Pt100	-200...+850	10	$\pm 0.08^\circ\text{C}$ or $\pm 0.08\%$ of span ①	$\pm 0.01\%$ of span per °C
RTD PtX ②	Corresp. to max. 4 k Ω	10	$\pm 0.1^\circ\text{C}$ or $\pm 0.1\%$ of span ①	$\pm 0.01\%$ of span per °C ③
RTD Ni100	-60...+250	10	$\pm 0.1^\circ\text{C}$ or $\pm 0.1\%$ of span ①	$\pm 0.01\%$ of span per °C
RTD Ni120	-60...+250	10	$\pm 0.1^\circ\text{C}$ or $\pm 0.1\%$ of span ①	$\pm 0.01\%$ of span per °C
RTD Ni1000	-50...+180	10	$\pm 0.1^\circ\text{C}$ or $\pm 0.1\%$ of span ①	$\pm 0.01\%$ of span per °C ③
RTD Cu10	-50...+200	83	$\pm 1.5^\circ\text{C}$ or $\pm 0.2\%$ of span ①	$\pm 0.02\%$ of span per °C
T/C type B	+400...+1800	700	$\pm 1.0^\circ\text{C}$ or $\pm 0.2\%$ of span ④	$\pm 0.01\%$ of span per °C
T/C type C	0...+2315	200	$\pm 1.0^\circ\text{C}$ or $\pm 0.2\%$ of span ④	$\pm 0.01\%$ of span per °C
T/C type D	0...+2315	200	$\pm 1.0^\circ\text{C}$ or $\pm 0.2\%$ of span ④	$\pm 0.01\%$ of span per °C
T/C type E	-270...+1000	50	$\pm 0.5^\circ\text{C}$ or $\pm 0.1\%$ of span ④	$\pm 0.01\%$ of span per °C
T/C type J	-210...+1200	50	$\pm 0.5^\circ\text{C}$ or $\pm 0.1\%$ of span ④	$\pm 0.01\%$ of span per °C
T/C type K	-270...+1300	50	$\pm 0.5^\circ\text{C}$ or $\pm 0.1\%$ of span ④	$\pm 0.01\%$ of span per °C
T/C type N	-100...+1300	100	$\pm 0.5^\circ\text{C}$ or $\pm 0.1\%$ of span ④	$\pm 0.01\%$ of span per °C
T/C type N	-270...-100	100	$\pm 1.0^\circ\text{C}$ ④	$\pm 0.1\%$ of span per °C
T/C type R	-50...+1750	300	$\pm 1.0^\circ\text{C}$ or $\pm 0.1\%$ of span ④	$\pm 0.01\%$ of span per °C
T/C type S	-50...+1750	300	$\pm 1.0^\circ\text{C}$ or $\pm 0.1\%$ of span ④	$\pm 0.01\%$ of span per °C
T/C type T	-270...+400	50	$\pm 0.25^\circ\text{C}$ or $\pm 0.2\%$ of span ④	$\pm 0.01\%$ of span per °C

Table 2-8: Accuracies in °C

① Valid for 3-wire and 4-wire connection. For factory settings Pt100, 3-wire connection, 0..100°C applies $\pm 0.05^\circ\text{C}$

② ($10 \leq X \leq 1000$)

③ For 2-wire connection and span $> 2000 \Omega$ applies $\pm 0.02\%$ of span per °C

④ CJC error not included. $\leq 0.5^\circ\text{C}$ within ambient temperature range

Input type	Temp. range	Min. span	Accuracy (maximum of)	Temp. influence (Dev. from ref. temp. 68°F)
	[°F]	[°F]	[°F]	
RTD Pt100	-328...+1562	18	±0.14°F or ±0.08% of span ①	±0.006% of span per °F
RTD PtX ②	Corresp. to max. 4 kΩ	18	±0.18°F or ±0.1% of span ①	±0.006% of span per °F ③
RTD Ni100	-76...+482	18	±0.18°F or ±0.1% of span ①	±0.006% of span per °F
RTD Ni120	-76...+482	18	±0.18°F or ±0.1% of span ①	±0.006% of span per °F
RTD Ni1000	-58...+356	18	±0.18°F or ±0.1% of span ①	±0.006% of span per °F ③
RTD Cu10	-58...+392	149	±2.7°F or ±0.2% of span ①	±0.006% of span per °F
T/C type B	+752...+3272	1260	±1.8°F or ±0.1% of span ④	±0.006% of span per °F
T/C type C	+32...+4199	360	±1.8°F or ±0.1% of span ④	±0.006% of span per °F
T/C type D	+32...+4199	360	±1.8°F or ±0.1% of span ④	±0.006% of span per °F
T/C type E	-454...+1832	90	±0.9°F or ±0.1% of span ④	±0.006% of span per °F
T/C type J	-346...+2192	90	±0.9°F or ±0.1% of span ④	±0.006% of span per °F
T/C type K	-454...+2372	90	±0.9°F or ±0.1% of span ④	±0.006% of span per °F
T/C type N	-148...+2372	180	±0.9°F or ±0.1% of span ④	±0.006% of span per °F
T/C type N	-454...-148	180	±1.8°F ④	±0.18% of span per °F
T/C type R	-58...+3182	540	±1.8°F or ±0.1% of span ④	±0.006% of span per °F
T/C type S	-58...+3182	540	±1.8°F or ±0.1% of span ④	±0.006% of span per °F
T/C type T	-454...+752	90	±0.9°F or ±0.1% of span ④	±0.006% of span per °F

Table 2-9: Accuracies in °F

① Valid for 3-wire and 4-wire connection. For factory settings Pt100, 3-wire connection, 32...212°F applies ±0.09°F

② (10 ≤ X ≤ 1000)

③ For 2-wire connection and span >2000 Ω applies ±0.02% of span per 1.8°F

④ CJC error not included. ≤ 0.9°F within ambient temperature range

3.1 Intended use

The OPTITEMP TT 33 is a universal 2-wire transmitter intended to be used in industrial environments and designed for measurements of:

- Temperature measurements with resistance thermometers
- Temperature measurements with thermocouples
- Voltage measurements in a range up to 1000 mV
- Resistance measurement up to 10 k Ω
- Measurements with potentiometers

OPTITEMP TT 33 C / TT 33 C Ex is intended for installation in a DIN B-head or larger according to EN 50446.

OPTITEMP TT 33 R / TT 33 R Ex is intended for installation on a 35 mm / 1.38" DIN-rail according to EN 60715 / DIN 50022.

The transmitters are configured from a PC by using the ConSoft program and a transmitter configuration kit (USB connection), or by a smartphone with built-in NFC™ support.

You may only use transmitters labelled with the "Ex" symbol in potentially explosive areas or connect them to a sensor located in those areas. Additionally always note the zone(s) for which the devices have an approval. Otherwise the transmitters might cause an explosion that can result in fatal injuries.

Responsibility for the correct use of the devices with special regard to suitability, intended use and the field of application lies solely with the operator.

The transmitters do not contain any serviceable parts inside. Any substitution of components may impair the intrinsic safety of the versions with an Ex approval. Always send defective devices to the manufacturer or the local distributor for repair or exchange. If this is the case, attach a clear description of the malfunction for warranty claims.

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

This device is a Group 1, Class A device as specified within CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

3.2 In-head transmitter

The TT 33 C Ex must be installed in an enclosure having an ingress protection suitable for the actual use but at least IP20.

The transmitter is intended for installation in DIN B connection head or larger. For detailed information refer to *Dimensions* on page 12.

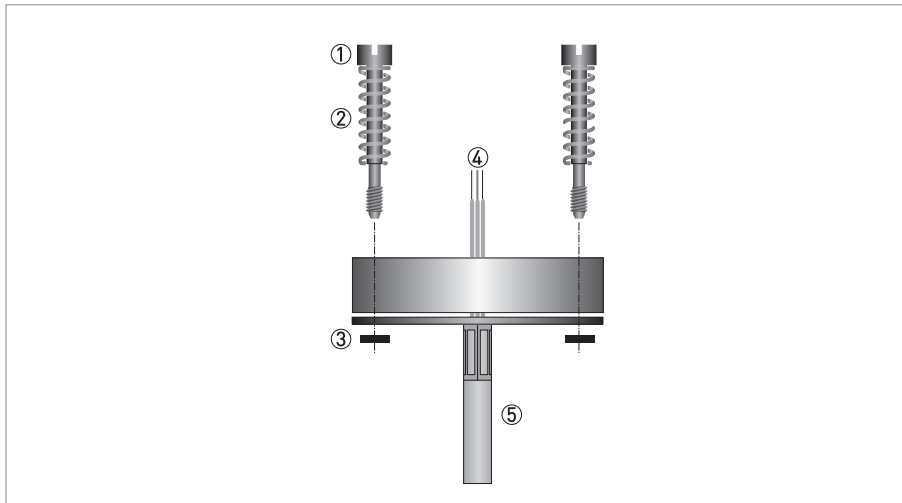


Figure 3-1: Connection head installation kit

- ① M4 screw
- ② Spring
- ③ Lock washer
- ④ Wires from the measuring insert.
- ⑤ MI cable

The connection head installation kit does not belong to the standard scope of delivery of the transmitter, you have to order it separately.

The transmitter is optionally available in an intrinsically safe version (zone 0, 1 and 2) for installation in potentially explosive atmospheres. The intrinsically safe version must be supplied by an intrinsically safe power supply unit or Zener barrier placed outside of the potentially explosive zone.

The transmitter has been developed for an operating temperature of $-40...+85^{\circ}\text{C}$ / $-40...+185^{\circ}\text{F}$. To avoid destruction or damage of the device, always assure that the operating temperature or ambient temperature does not exceed the permissible range. The thermowell also transfer the process temperature to the transmitter housing. If the process temperature is close to or exceeds the maximum temperature of the transmitter, then the temperature in the transmitter housing can rise above the maximum permissible temperature. One way to decrease the heat transfer via thermowell is to install the transmitter further away from the heat source. Inversely similar measurements can be done if the temperature gets below specified minimum temperature.

3.3 Rail-mount transmitter

The TT 33 R Ex must be installed in an enclosure having an ingress protection suitable for the actual use but at least IP20.

These transmitters are intended for installation on a 35 mm / 1.38" rail according to EN 60715 / DIN 50022.

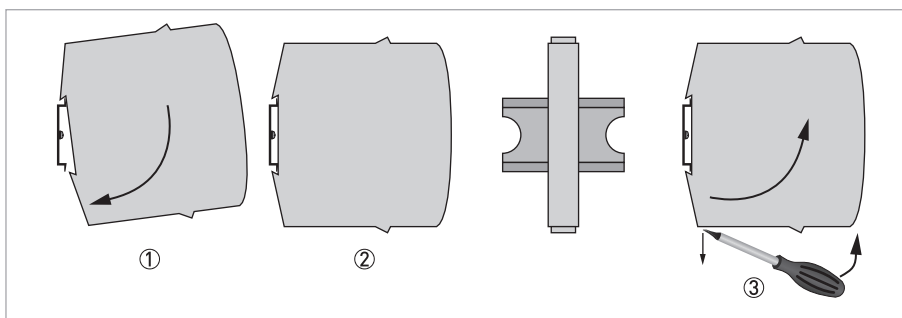


Figure 3-2: Rail installation

- ① Fix the upper part of the transmitter onto the rail.
- ② Press the lower part of the transmitter against the rail.
- ③ To remove the transmitter, bend the locking device using a small screwdriver. Carefully pull the transmitter in the forward direction.

The manufacturer has developed the TT 33 R for an operating temperature range of -40...+85°C / -40...+185°F.

To avoid destruction or damage of the device, always note the following items:

- *Assure that the operating temperature or the ambient temperature does not exceed the permissible range.*

4.1 Notes on installation

Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

Do a check of the packing list to make sure that you have all the elements given in the order.

Look at the device nameplate to ensure that the device is delivered according to your order.

4.2 Electrical connections of in-head transmitter

The input and output signals and the power supply must be connected in accordance with the following illustrations. The transmitter is easy to install with the connection head installation kit. To avoid measuring errors, all cables must be connected properly and the screws tightened correctly.

Pt100...Pt1000, Ni100, Ni120, Cu10 2-wire connection	Pt100...Pt1000, Ni100, Ni120, Cu10 3-wire connection	Pt100...Pt1000, Ni100, Ni120, Cu10 4-wire connection
Resistance, 2-wire connection	Resistance, 3-wire connection	Resistance, 4-wire connection
Potentiometer, 3-wire slide wire		

Table 4-1: RTD and potentiometer measurement

Thermocouple	Voltage	Thermocouple with external CJC (Pt100)

Table 4-2: Thermocouple and voltage measurement

4.3 Connection diagram of in-head transmitter

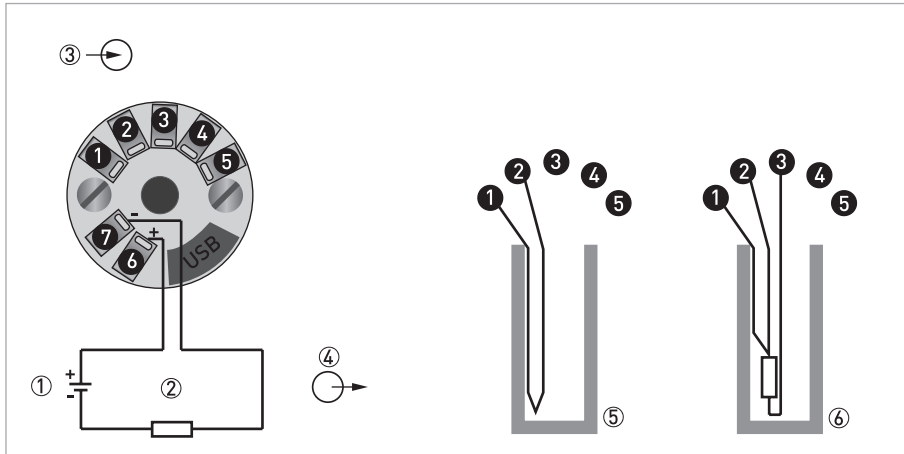


Figure 4-1: Connection diagram

- ① Voltage supply VDC (terminals 6, 7)
- ② R_{Load}
- ③ Input
- ④ Output
- ⑤ Thermocouple
- ⑥ Pt100 3-wire connection

4.4 Connection diagram of in-head transmitter (intrinsically safe)

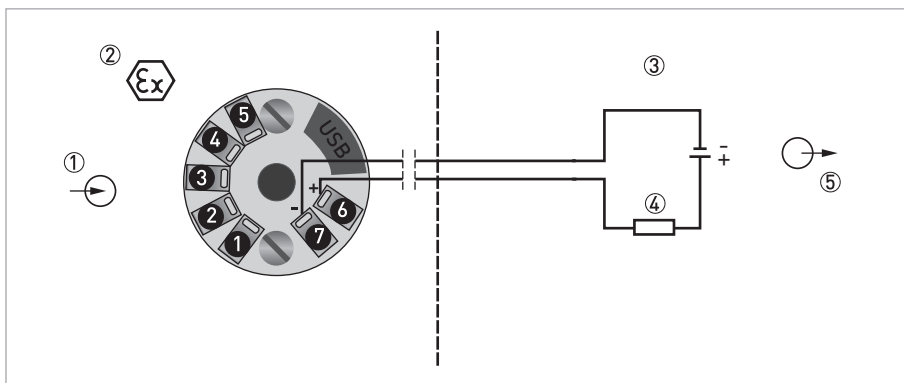


Figure 4-2: Connection diagram

- ① Input (intrinsically safe)
- ② Classified hazardous area (potentially explosive area e.g. zone 0, 1 and 2)
- ③ Safe area
- ④ R_{Load} (intrinsically safe)
- ⑤ Zener barrier / voltage supply 8.0...30 VDC (intrinsically safe) and output 4...20 mA

The transmitter may be operated in areas with potentially explosive atmospheres if the voltage supply is ensured by means of an associated apparatus.

4.5 Electrical connections of rail-mount transmitter

The input and output signals and the power supply must be connected in accordance with the following illustrations. To avoid measuring errors, all cables must be connected properly and the screws tightened correctly.

Pt100...Pt1000, Ni100, Ni120, Cu10 2-wire connection	Pt100...Pt1000, Ni100, Ni120, Cu10 3-wire connection	Pt100...Pt1000, Ni100, Ni120, Cu10 4-wire connection
Resistance, 2-wire connection	Resistance, 3-wire connection	Resistance, 4-wire connection
Potentiometer, 3-wire slide wire		

Table 4-3: RTD and potentiometer measurement

Thermocouple	Voltage	Thermocouple with external CJC (Pt100)

Table 4-4: Thermocouple and voltage measurement

4.6 Connection diagram of rail-mount transmitter

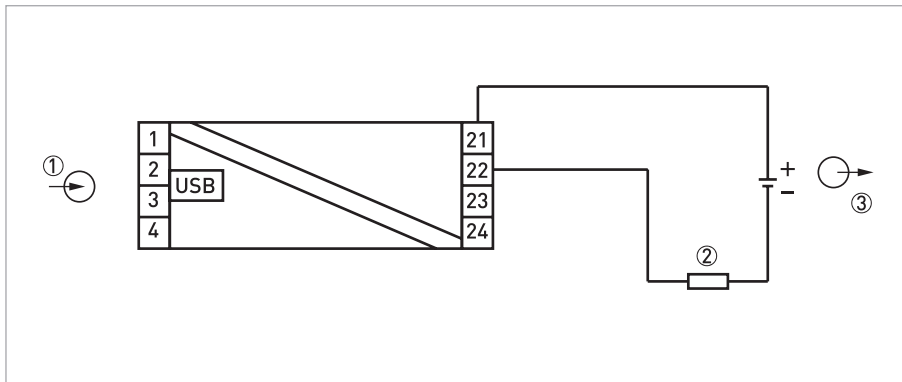


Figure 4-3: Connection diagram

- ① Input
- ② R_{Load}
- ③ Voltage supply 8...36 VDC and output 4...20 mA

4.7 Connection diagram of rail-mount transmitter (intrinsically safe)

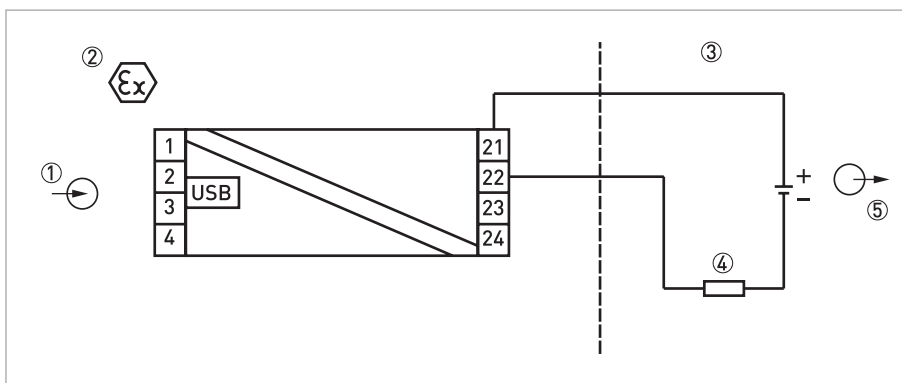


Figure 4-4: Connection diagram

- ① Input (intrinsically safe)
- ② Classified hazardous area (potentially explosive area e.g. zone 0, 1 and 2)
- ③ Safe area
- ④ R_{Load} (intrinsically safe)
- ⑤ Zener barrier / voltage supply 8.0...30 VDC (intrinsically safe) and output signal (4...20 mA)

The transmitter may be operated in areas with potentially explosive atmospheres if the voltage supply is ensured by means of an associated apparatus.

5.1 Order code

The characters of the order code highlighted in light gray describe the standard.

VTT1	4	Design
	1	Head mounting (type C)
	2	DIN-rail mounting, 35 mm / 1.38" (type R)
		Type
	C	TT 33, digital, standard, 4...20 mA
		Approvals
	0	Without
	2	IECEX: Ex ia IIC T6...T4 Ga / ATEX: II 1 G Ex ia IIC T6...T4 Ga
		Sensor
	0	Without
	1	Pt 10
	2	Pt 50
	3	Pt100 ($\alpha = 0.00385$)
	4	Pt100 ($\alpha = 0.003902$)
	5	Pt100 ($\alpha = 0.003916$)
	8	Pt1000 ($\alpha = 0.00385$)
	A	Potentiometer
	B	Thermocouple type B
	C	Thermocouple type C
	E	Thermocouple type E
	H	Thermocouple type J
	K	Thermocouple type K
	L	Thermocouple type L
	N	Thermocouple type N
	R	Thermocouple type R
	S	Thermocouple type S
	T	Thermocouple type T
	U	Cu 10
	V	Ni 50
	W	Ni 100
	X	Ni 120
	Y	Ni 1000
	Z	Customized
VTT1	4	Continued on next page

							Wiring
							0 Without
							2 2-wire (1 x sensor)
							3 3-wire (1 x sensor)
							4 4-wire (1 x sensor)
							Measuring range
							0 Without
							1 -50...+50°C / -58...+122°F
							2 -50...+100°C / -58...+212°F
							3 -50...+150°C / -58...+302°F
							4 0...+50°C / +32...+122°F
							5 0...+100°C / +32...+212°F
							6 0...+150°C / +32...+302°F
							7 0...+200°C / +32...+392°F
							8 0...+250°C / +32...+482°F
							A 0...+300°C / +32...+572°F
							B 0...+350°C / +32...+662°F
							C 0...+400°C / +32...+752°F
							D 0...+450°C / +32...+842°F
							E 0...+500°C / +32...+932°F
							F 0...+600°C / +32...+1112°F
							G 0...+800°C / +32...+1472°F
							H 0...+1000°C / +32...+1832°F
							K 0...+1200°C / +32...+2192°F
							Z Customized
							Certificates
							0 Without
							Accessories / phys. characteristics
							0 Without
							1 Head-mounted transmitter assembled to DIN-rail clip, 35 mm / 1.38"
							2 Assembly kit for in-head mounting (spring-load)
							F Transmitter mounted into a plastic-housing 82x80x55 mm, 2x M16x1.5 / IP65
VTT1		4					Continued on next page

											Calibration certificate											
											0	Without										
											2	2 points (0 and 100%)										
											3	3 points (0, 50 and 100%)										
											4	5 points (0, 25, 50, 75 and 100%)										
											5	11 points (0, 10, ..., 100%)										
											Z	Customized										
											Manuals											
											0	Without										
											1	German										
											3	English										
											4	French										
											5	Spanish										
											G	German / English										
											Private label											
											0	KROHNE standard version										
											VTT1	4	Complete order code									

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Head Office KROHNE Messtechnik GmbH
Ludwig-Krohne-Str. 5
47058 Duisburg (Germany)
Tel.: +49 203 301 0
Fax: +49 203 301 10389
info@krohne.com

The current list of all KROHNE contacts and addresses can be found at:
www.krohne.com

