



## OPTITEMP TT 22 C/R Technical Datasheet

PC-programmable two-wire transmitters for Pt100

- High accuracy
- Adjustable filtering level
- 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 PC-programmable two-wire temperature transmitter for Pt100

The TT 22 is a Pt100 optimized transmitter for general purpose for measurements of solids, fluids and gases in industrial environments.

The transmitter TT 22 is available in two versions. TT 22 C primarily intended to be mounted in a DIN-B housing whereas TT22 R is the rail-mount version. Together with a special adapter TT 22 C can be mounted in a DIN Rail too. With the ConSoft software the transmitter can easily be configured from a computer and without any power supply since it will be powered from the computer.

The TT 22 combines competitive cost with easy and user friendly functionality and configuration in robust environments with reliable accuracy during the lifetime.



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

## Highlights

- Downscale/upscale for sensor break or short circuit
- Floating zero point and variable range setting
- Sensor error correction
- Vibration and chock proof design up to 10g for in-head version
- Adjustable filtering level
- In-head version available with IECEx / ATEX Ex ia approval
- For service purpose, Set fix current output for 15 min

## Industries

Typical industrial applications are in:

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

## 1.2 Options and variants

### TT 22 C: in-head transmitter



The TT 22 C is an intelligent, 2-wire in-head transmitter for temperature, resistance measurements in industrial environments.

The TT 22 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 EN 50446.

### TT 22 R: rail-mount transmitter



The TT 22 R is an intelligent, 2-wire DIN-rail transmitter for temperature, resistance measurements in industrial environments.

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 only supports resistance thermometer.

### 1.3.1 Resistance temperature sensor

The measuring insert with a temperature-sensitive sensor made from a platinum 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).

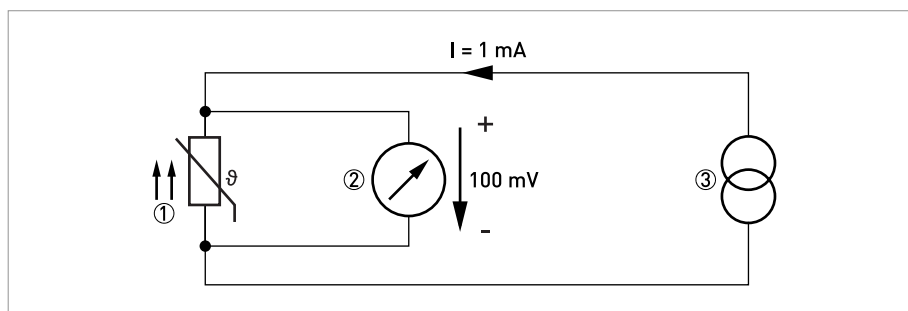


Figure 1-1: Pt100 resistance temperature sensor in 4-wire connection at 0°C / +32°F, schematic.

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

## 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 22 C	In-head transmitters which are intended for installation in a "B connection head" or larger according to EN 50446. This transmitter is optionally available in an intrinsically safe version (zone 0, 1 and 2) for installation in potentially explosive atmospheres.
TT 22 R	Rail-mount transmitters which are intended for installation on a rail according to DIN 50022 / EN 60715.
Features	
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.
PC programmable	Measuring ranges are set from PC.
	Full accuracy is provided without any need for calibration.
	Configuration without external power.
	Edit/Read configuration offline, i.e. without power supply, by just connecting to a USB port of a PC.
Runtime counter	Hour counter for elapsed operational time
Simulated output	Fixed current output during a maximum time of 15 min

### Measuring accuracy

Accuracy & Stability	Basic accuracy is max. of $\pm 0.1^{\circ}\text{C}$ or $\pm 0.1\%$ of span.
Ambient temperature influence	Deviation from $+20^{\circ}\text{C}$ / $+68^{\circ}\text{F}$ Max. of $\pm 0.25^{\circ}\text{C}$ / $25^{\circ}\text{C}$ or $\pm 0.25\%$ / $25^{\circ}\text{C}$ Max. of $\pm 0.5^{\circ}\text{F}$ / $50^{\circ}\text{F}$ or $\pm 0.28\%$ / $50^{\circ}\text{F}$
Supply voltage influence	Negligible
Long-term drift	$\pm 0.1\%$ of span per year

### Operating conditions

Temperature	
In-head transmitter	<b>Operating and storage temperature:</b> Standard version: -40...+85°C / -40...+185°F IS version: for detailed information refer to Temperature data for areas with potentially explosive atmospheres on page 11
Rail-mount transmitter	<b>Operating and storage temperature:</b> Standard version: -40...+85°C / -40...+185°F
Humidity	0...98% RH (non-condensing)
Protection category	
In-head transmitter	Housing: IP65 Terminals: IP00
Rail-mount transmitter	Housing: IP20 Terminals: IP00

### Installation conditions

Mounting	In-head transmitter: DIN B-head or larger, DIN-rail (with adapter)
	Rail-mount transmitter: rail acc. to DIN 50022 / EN 60715, 35 mm / 1.38"
	For detailed information refer to <i>Installation</i> on page 14.
Weight	In-head transmitter: 32 g / 0.07 lb
	Rail-mount transmitter: 50 g / 0.11 lb
Dimensions	For detailed information refer to <i>Dimensions</i> on page 10.

### Materials

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

### Electrical connections

Power supply	Standard version: 6...32 VDC
	IS version: 8...30 VDC
Isolation	Not galvanically isolated
Connection	Single/stranded wires: max. 1.5 mm <sup>2</sup> / AWG 16
Reverse Polarity Protection	Yes

### Inputs / Outputs

Input - RTD	
Pt100 (IEC 60751, $\alpha=0.00385$ )	-200... +850°C / -328...+1562°F
Sensor current	≤0.5 mA
Maximum sensor wire resistance	20 Ω/wire
Adjustment	Minimum span 20°C / 36°F
	Sensor error compensation ±10% of span for span <100°C/180°F, otherwise ±10°C/±18°F



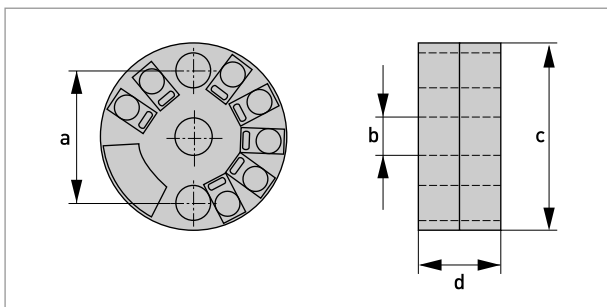
<b>Output</b>	
Output signal	4...20 mA Temperature linear
Permissible load	Standard version: (Supply voltage-6)/0.022 IS version: (Supply voltage-8)/0.022
NAMUR compliance	Output limits and failure currents acc. to NAMUR NE 43
Adjustable filtering level	0.13 to 54 s, (default 0.9 s)
Monitoring	Combined sensor break and short circuit monitoring, selectable, upscale $\geq 21.0$ mA or downscale $\leq 3.6$ mA action
<b>Configuration</b>	
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 ICON, which also contains a USB Interface and necessary cables. Full functionality of the transmitter is achieved with ConSoft program version 3.1.0 or later and the firmware in the USB Interface must have a version number 1.2.06 or later.

### Approvals and certifications

CE	The device fulfils the statutory requirements of the EC directives. The manufacturer certifies that these requirements have been met by applying the CE marking.
<b>EX approvals</b>	
Standard version	Without
Intrinsically safe (IS) version	ATEX: II 1 G Ex ia IIC T6...T4 Ga (only in-head transmitter)
	IECEx: Ex ia IIC T6...T4 Ga (only in-head transmitter)
<b>Other standards and approvals</b>	
Electromagnetic compatibility	Directive: 2004/108/EC (until 2016-04-19) / 2014/30/EU (from 2016-04-20)
	Harmonized standards: EN 61326-1 and EN 61326-2-3
	ESD, Radiated EM-field: Criteria A Magnetic fields: Criteria A Burst, conducted RF: Criteria A Surge: standard deviation 1% of span
Vibration resistance	Acc. to IEC 60068-2-6, test Fc, 10...2000 Hz, 10 g

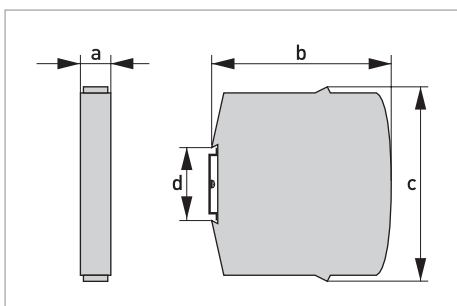
## 2.2 Dimensions

### In-head transmitter



	Dimensions	
	[mm]	[inch]
a	33.0	1.30
b	7.0	0.28
c	44.5	1.75
d	18.5	0.72

### 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

## 2.3 Temperature data for areas with potentially explosive atmospheres

### In-head transmitter

#### Intrinsically safe transmitter

Temperature class	Ambient temperature $T_a$
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	$-40^{\circ}\text{C} \leq T_a \leq +85^{\circ}\text{C} / -40^{\circ}\text{F} \leq T_a \leq +185^{\circ}\text{F}$

## 2.4 Output load diagram

Formula for the maximum permissible output load:  
 permissible  $R_{Load} [\Omega] = (U-6)/0.022$

### Standard transmitter

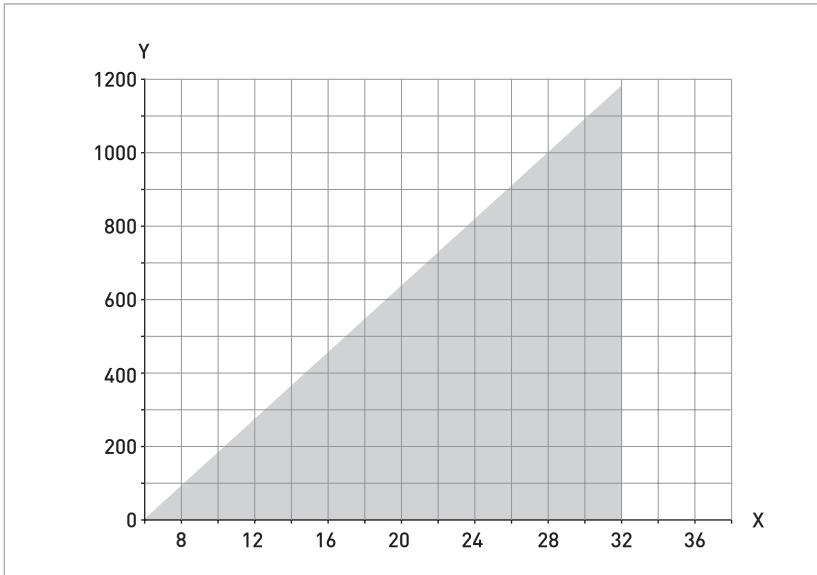


Figure 2-1: Output load diagram

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

Formula for the maximum permissible output load:  
 permissible  $R_{Load} [\Omega] = (U-8)/0.022$

### Intrinsically safe transmitter

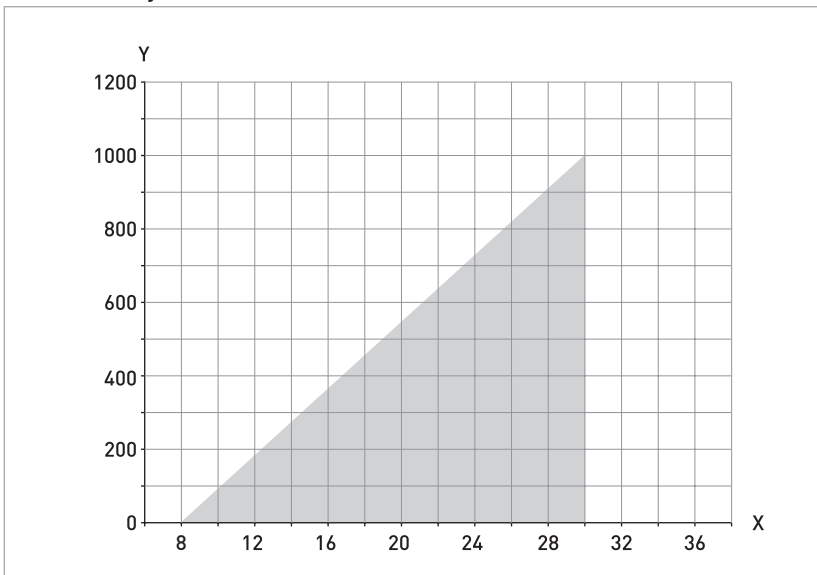


Figure 2-2: Output load diagram

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

## 2.5 Electrical data for outputs and inputs

### In-head transmitter

#### Intrinsically safe transmitter TT 22 C Ex

Output terminals 6, 7		Input terminals 1, 2, 3	
$U_i = V_{\max}$	$\leq 30 \text{ VDC}$	$U_0 = U_{0c}$	$\leq 30 \text{ VDC}$
$I_i = I_{\max}$	$\leq 100 \text{ mA}$	$I_0 = I_{sc}$	$\leq 40 \text{ mA}$
$P_i = P_{\max}$	$\leq 900 \text{ mW}$	$P_0$	$\leq 300 \text{ mW}$
$L_i$	$10 \mu\text{H}$	$L_0$	$10 \text{ mH}$
$C_i$	$23.1 \text{ nF}$	$C_0$	$9 \text{ nF}$

### 3.1 Intended use

The transmitter is a two-wire non-isolating PC configured transmitter designed for Pt100 temperature sensors and intended to be used in industrial environments.

The TT 22 C / TT 22 C Ex is intended for installation in a B connection head or larger according to EN 50446. It's designed for a three wire sensor connection.

The TT 22 R is intended for installation on a 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) ICON without external power supply. Calibration of the transmitter, after the PC configuration is not necessary.

*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. To avoid any kind of incorrect use, also note the information in the chapter "Device description".*

*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. To avoid any kind of incorrect use, also note the information in the chapter "Device description"!*

*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 transmitter is intended for installation in DIN B connection heads or larger. The large  $\varnothing 7$  mm / 0.28 inch center hole facilitates the electrical connection of the sensor and the installation. For detailed information refer to *Dimensions* on page 10.

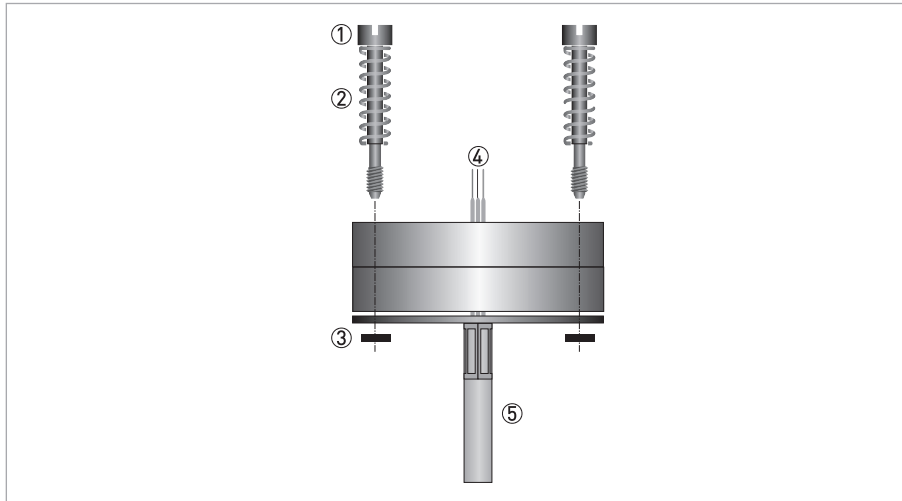


Figure 3-1: Connection head installation kit

- ① M4 screw
- ② Spring
- ③ Lock washer
- ④ Wires from the measuring inserts
- 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 Ex transmitter must be installed in a housing with the protection rating IP20 or better according to EN 60529 / IEC 60529.*

*The transmitter has been developed for an operating temperature of  $-40...+85^{\circ}\text{C}$  /  $-40^{\circ}\text{F}...+185^{\circ}\text{F}$ . 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

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

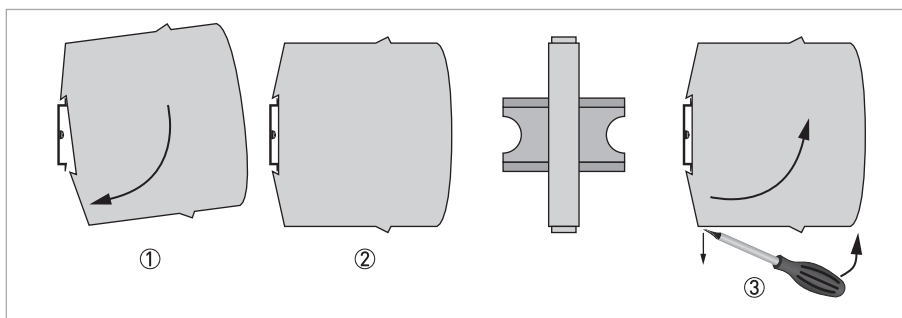


Figure 3-2: Rail installation

- 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, use a screwdriver to bend the locking device using a small screwdriver. Carefully pull the transmitter in the forward direction.

*The manufacturer has developed the TT 22 R for an operating temperature range of  $-40...+85^{\circ}\text{C}$  /  $-40...+185^{\circ}\text{F}$ . 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.*

The rail-mount transmitter is intended for installation on a rail according to EN 60715 / DIN 50022.



## 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 connection diagram of in-head transmitter

*To avoid measuring errors, all cables must be connected properly and the screws tightened correctly.*

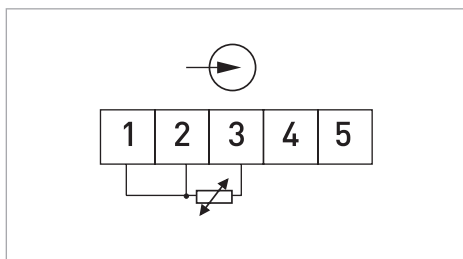


Figure 4-1: Pt100, 3-wire connection

*The transmitter has a polarity protection, connecting the power supply with wrong polarity will not harm the transmitter.*

### 4.3 Connection diagram of in-head transmitter

Always establish the electrical connections according to the following diagrams. Otherwise it can come to destruction or damage of the transmitter. Note that the maximum output load always depends on the power supply. If the maximum output load is exceeded, then the measured value will become incorrect. For further information refer to the output load diagram in the chapter "Technical data" on page 12.

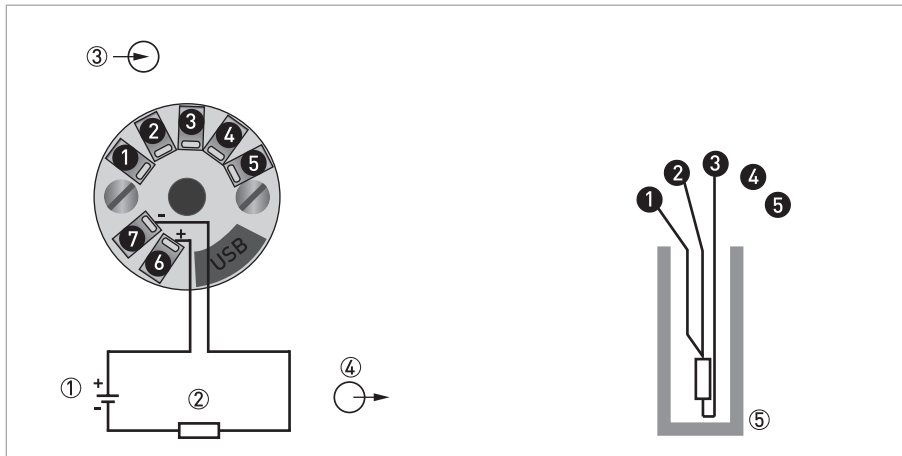


Figure 4-2: Connection diagram

- ① Voltage supply 6...32 VDC (terminals 6,7)
- ②  $R_{Load}$
- ③ Input
- ④ Output signal (4...20mA)
- ⑤ Pt100 3-wire connection

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

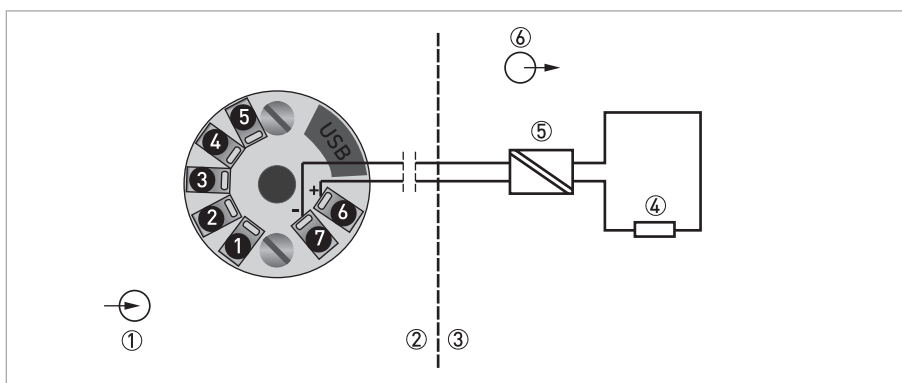


Figure 4-3: Connection diagram

- ① Input (No 4 and 5 not used)
- ② Potentially explosive area
- ③ Safe area
- ④  $R_{Load}$
- ⑤ Zener barrier or voltage supply 8...30 VDC (intrinsically safe)
- ⑥ Output signal (4...20mA)

## 4.5 Electrical connections of rail-mount transmitter

### RTD measurement

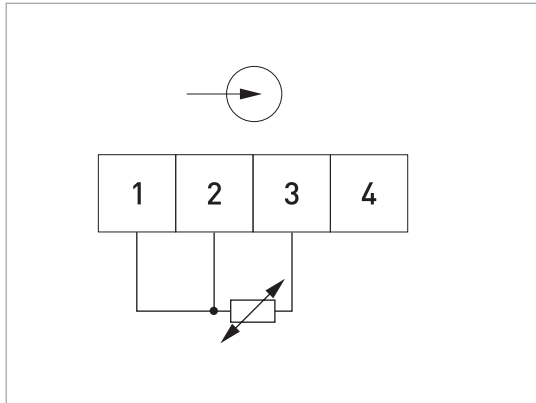


Figure 4-4: Pt100, 3-wire

## 4.6 Connection diagram of rail-mount transmitter

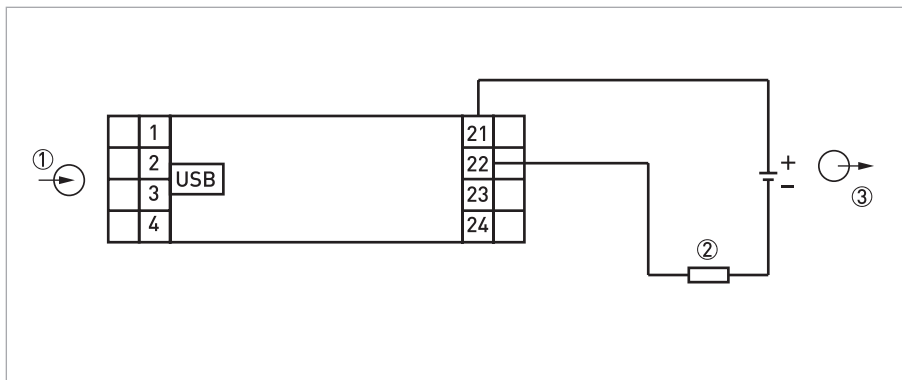


Figure 4-5: Connection diagram

- ① Input
- ②  $R_{Load}$
- ③ Voltage supply 6...32 VDC

## 5.1 Order code

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

VTT1	4	<b>Design</b>
	1	Head mounting (type C)
	2	Rail mounting (type R)
		<b>Type</b>
	7	TT 22, digital, 4...20 mA, only Pt100
		<b>Approvals</b>
	0	Without
	2	ATEX: II 1 G Ex ia IIC T6...T4 Ga (only type C) IECEX: Ex ia IIC T6...T4 Ga (only type C)
		<b>Sensor</b>
	3	Pt100 ( $\alpha = 0.00385$ )
		<b>Wiring</b>
	3	3-wire (1 x sensor)
		<b>Measuring range</b>
	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
VTT1	4	Continued on next page

							<b>Certificates</b>
							0 Without
							<b>Accessories / phys. characteristics</b>
							0 Without
							1 Head-mounted transmitter assembled to DIN-rail clip, 35mm
							2 Assembly kit for in-head mounting (spring-load)
							F Transmitter mounted into a plastic-housing 82x80x55mm, 2x M16x1,5 / IP65
							<b>Calibration certificate</b>
							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
							<b>Manuals</b>
							0 Without
							1 German
							3 English
							4 French
							5 Spanish
							G German/English
<b>VTT1</b>	<b>4</b>						Complete order code