



## OPTITEMP TT 20 **Technical Datasheet**

Analog PC-programmable two-wire transmitters for Pt100

- Efficient PC-configuration without recalibration
- Very stable output
- Very fast response time

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

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## 1.1 The analogue, PC-programmable two-wire temperature transmitter

The OPTITEMP TT20 is an analogue, multirange 2-wire temperature transmitter for temperature measurement with a Pt100 resistance sensor. The main field of application is industrial environment, therefore the device has a high reliability and an excellent industrial performance.

The transmitters can easily be configured from a PC by using the optionally available ConSoft program and a transmitter configuration kit ICON. Easily set and re-set the parameters like temperature measurement range, TAG identity and failure indication. When transmitters are configured from PC no calibration is necessary.

The TT20 combines competitive cost with easy and user friendly functionality and configuration in robust environments with reliable accuracy during the lifetime.

### Highlights

- Sensor break monitoring
- Sensor error correction
- Configuration without external power
- Temperature linear output for PT100
- Patent applied moulding technology to protect the electronics from rough environment
- Set temperature range

### Industries

Typical industrial applications are in:

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

## 1.2 Options and variants

The transmitters are delivered with a factory configuration Pt100 ( $\alpha = 0.00385$ ), 3-wire connection 0...+100 °C / +32...+212 °F or configured according to customer's requirements.

There are two different installation situations for the transmitter. Primarily it is intended to be mounted in a "B connection head" or larger according to DIN 43729. As an alternative you can also mount it on a DIN rail according to DIN 50022 / EN 60715 with the help of an optionally available rail mounting kit.

The transmitter will indicate sensor break according to selected value high (> 21.0 mA) or low (< 3.6 mA). Short circuit will always be indicated as low output (< 3.6 mA).

## 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 thermometer

The measuring insert with a resistance thermometer features 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 thermometers to measure temperature. The "Pt100" thermometer 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 thermometer is 100 Ω ( $100 \text{ mV} / 1 \text{ mA} = 100 \text{ Ω}$ ).

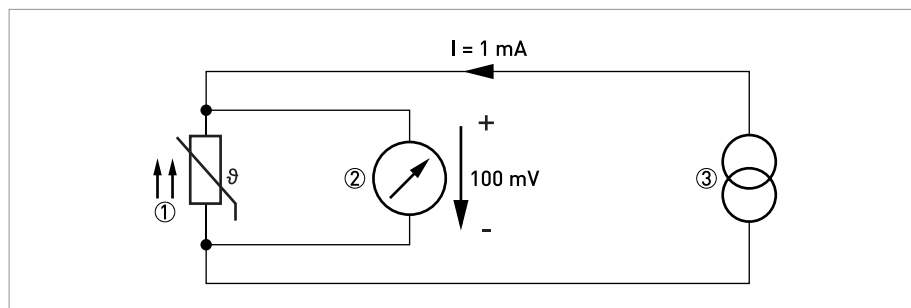


Figure 1-1: Pt100 resistance thermometer in 4-wire connection at 0°C / +32°F, schematic.

- 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 representative.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Download Center).*

### Measuring system

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

<b>Versions</b>	
TT 20	In-head transmitters which are intended for installation in a "B connection head" or larger according to DIN 43729.
<b>Features</b>	
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	Input type and 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.

### Measuring accuracy

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

### Operating conditions

<b>Temperature</b>	
In-head transmitter	<b>Operating and storage temperature:</b> Standard version: -40...+85°C / -40...+185°F
Humidity	0...100% RH (non-condensing)
<b>Protection category</b>	
In-head transmitter	Protection housing: IP65
	Protection terminals: IP10

### Installation conditions

Mounting	In-head transmitter: DIN B-head or larger, DIN-rail (with adapter)
	For detailed information refer to <i>Installation</i> on page 10.
Weight	In-head transmitter: 32 g / 0.07 lb
Dimensions	For detailed information refer to <i>Dimensions</i> on page 9.

**Materials**

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

**Electrical connections**

Power supply	Standard: 8.5...32 VDC
Isolation	Not galvanically isolated
Connection	Single/stranded wires: max. 1.5 mm <sup>2</sup> / AWG 16
Polarity Protection	Standard

**Inputs / Outputs**

<b>Input - RTD</b>	
Pt100 (IEC 60751, $\alpha=0.00385$ )	-50... +850°C / -58...+1562°F
Pt100 (JIS C 1604-8, $\alpha=0.003916$ )	
Pt100 (US, $\alpha=0,003902$ )	
Sensor current	≤0.5 mA
Maximum sensor wire resistance	20 Ω/wire
Adjustment	Zero adjustment -50, -25, 0, +25, +50°C / -58, -13, +32, +77, +122°F
	Minimum span +20°C / +68°F
	Sensor error compensation ±1% of span
<b>Output</b>	
Output signal	4...20 mA Temperature linear
Permissible load	700 Ω at 24 VDC
NAMUR compliance	Failure currents acc. to NAMUR NE 43 except short circuit detection were downscale is the only option.
Response time	<50 ms
Monitoring	Sensor break monitoring, selectable, upscale ≥21.0 mA or downscale ≤3.6 mA action Sensor short-circuit, fixed, downscale ≤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 2000 (SP3), Windows XP (SP2+), Windows Vista, and Windows 7.
	ConSoft is part of the complete configuration kit ICON, which also contains a USB Interface and necessary cables.

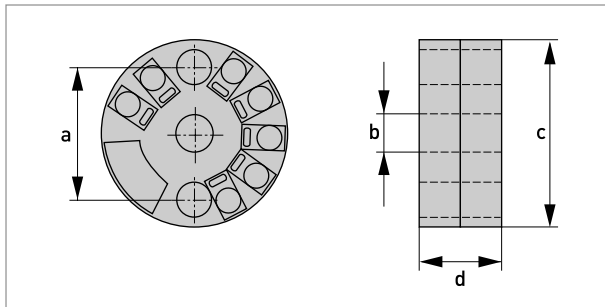
## Approvals and certifications

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>Other standards and approvals</b>	
Electromagnetic compatibility	Directive: 2004/108/EC
	Harmonized standards: EN 61326-1:2006
	ESD, Radiated EM-field: Criteria A Surge: ~3% of span Burst, conducted RF: ~1% of span
Vibration resistance	Acc. to IEC 60068-2-6, test Fc, 84...2000 Hz, 10 g
Shock resistance	Acc. to IEC 60068-2-31, test Ec



## 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

## 2.3 Output load diagram

Formula for the maximum permissible output load:

$$\text{permissible } R_{\text{Load}} [\Omega] = (U - 8.5) / 0.022$$

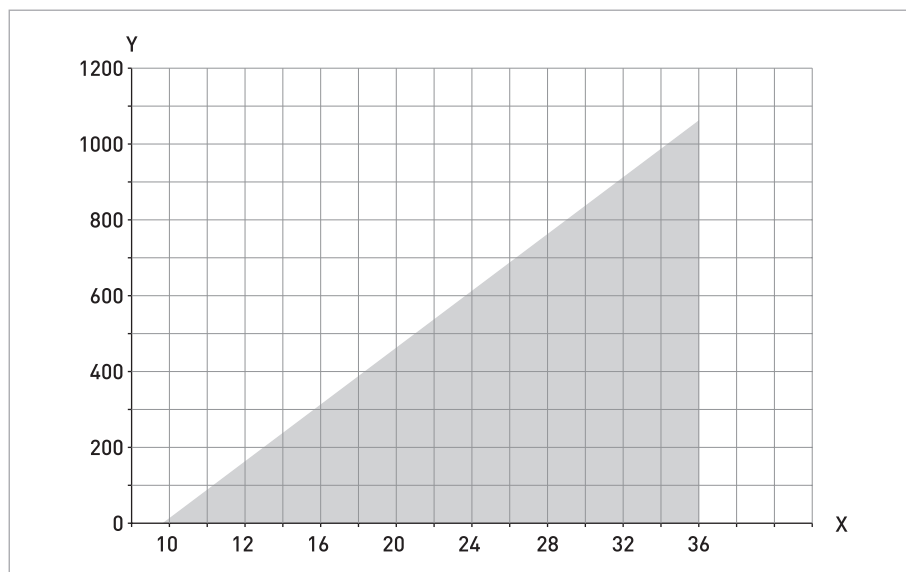


Figure 2-1: Output load diagram

X: Power supply U [VDC]

Y: Total output load R [Ω]

### 3.1 Notes on installation

*Inspect the cartons 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.*

### 3.2 Intended use

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

The transmitter is intended for installation in a B connection head or larger according to DIN 43729. It's designed for a three wire sensor connection.

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.

### 3.3 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 9.

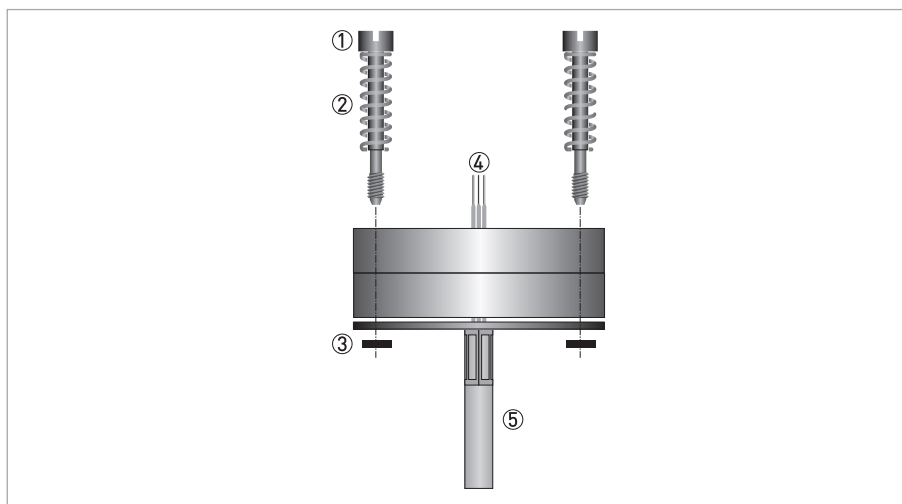


Figure 3-1: Connection head installation kit

- 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 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.*

### 3.4 Rail mounting kit for in-head transmitters

The rail mounting kit allows to install the in-head transmitter on a rail according to DIN 50022. The kit does not belong to the standard scope of delivery. You have to order it separately.

The screws in the kit is not to be used with this transmitter.

#### Rail mounting kit for in-head transmitters

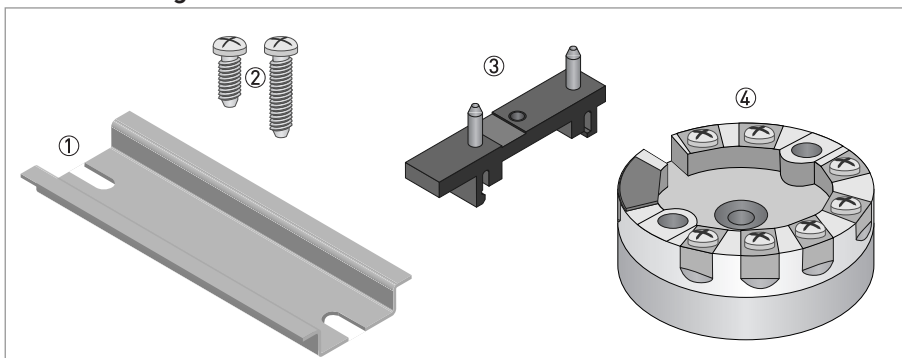
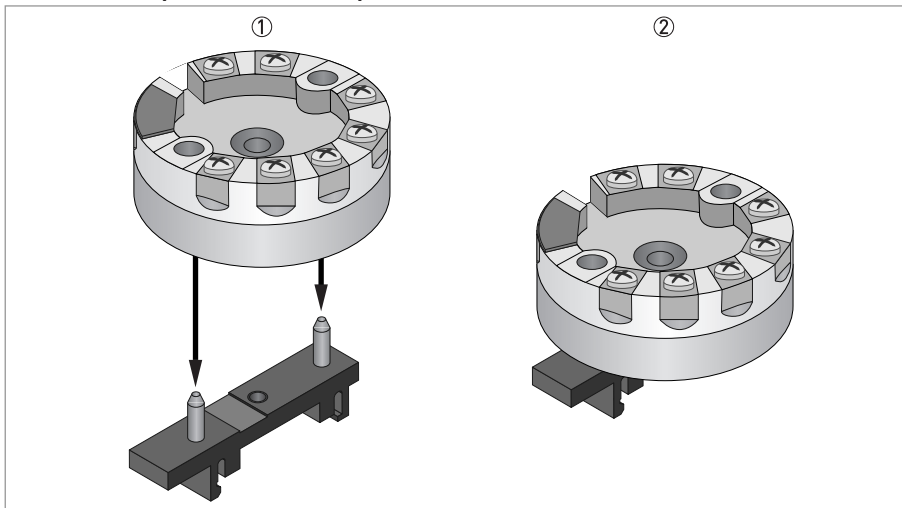


Figure 3-2: Rail mounting kit for in-head transmitters

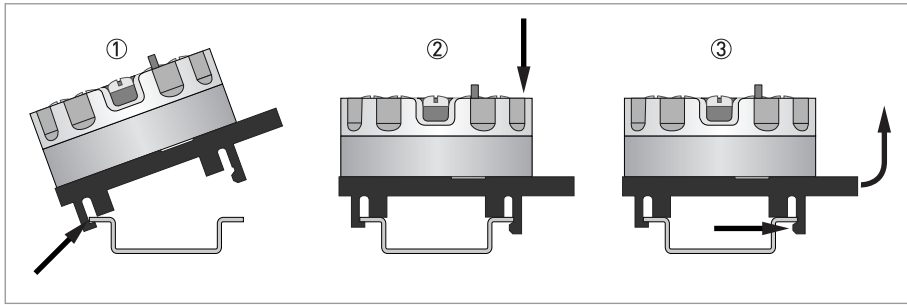
- ① Rail (not included in the kit)
- ② Screws (not needed)
- ③ Clamp
- ④ Transmitter

#### Installation procedure: Step 1



- ① Place the transmitter on the rail mounting kit as shown above.
- ② Push the transmitter down until it reaches the plate and is attached.

## Installation procedure: Step 2



- ① Hook one end of the installation the kit into the rail as shown above.
- ② Push the other end of the the kit down until it snaps onto the rail.
- ③ Release by pushing the hook, shown in the picture, and at the same time lift the clip out of the rail.

## 4.1 Safety instructions

*All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!*

*Observe the national regulations for electrical installations!*

*Before you connect and operate a transmitter, always note the following items to avoid an electric shock:*

- *For all work on the electrical connections use an electrostatic safe (i.e. grounded) workplace! In this way you minimize the risk of electrostatic discharge (ESD).*

*Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.*

*Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.*

*The transmitter is protected against polarity reversal. No damage will occur to the device if the polarity of the supply voltage is switched. The output will then indicate 0 mA.*

## 4.2 Electrical connection diagram

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

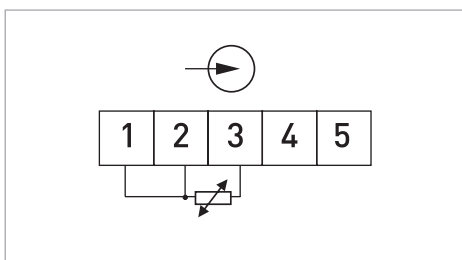


Figure 4-1: Pt100, 3-wire connection

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

## 4.3 Connection diagram

*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 9.*

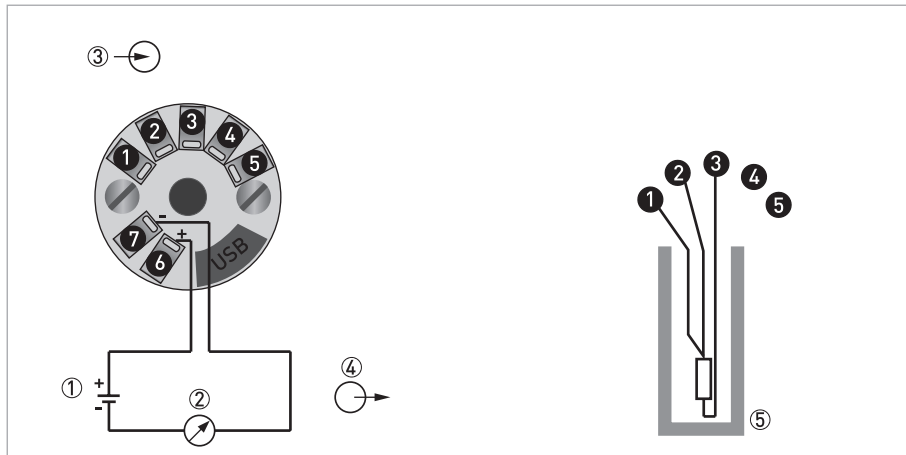


Figure 4-2: Connection diagram

- ① Voltage supply 8.5...32 VDC (terminals 6,7)
- ②  $R_{Load}$
- ③ Input
- ④ Output signal (4...20mA)
- ⑤ Pt100 3-wire connection

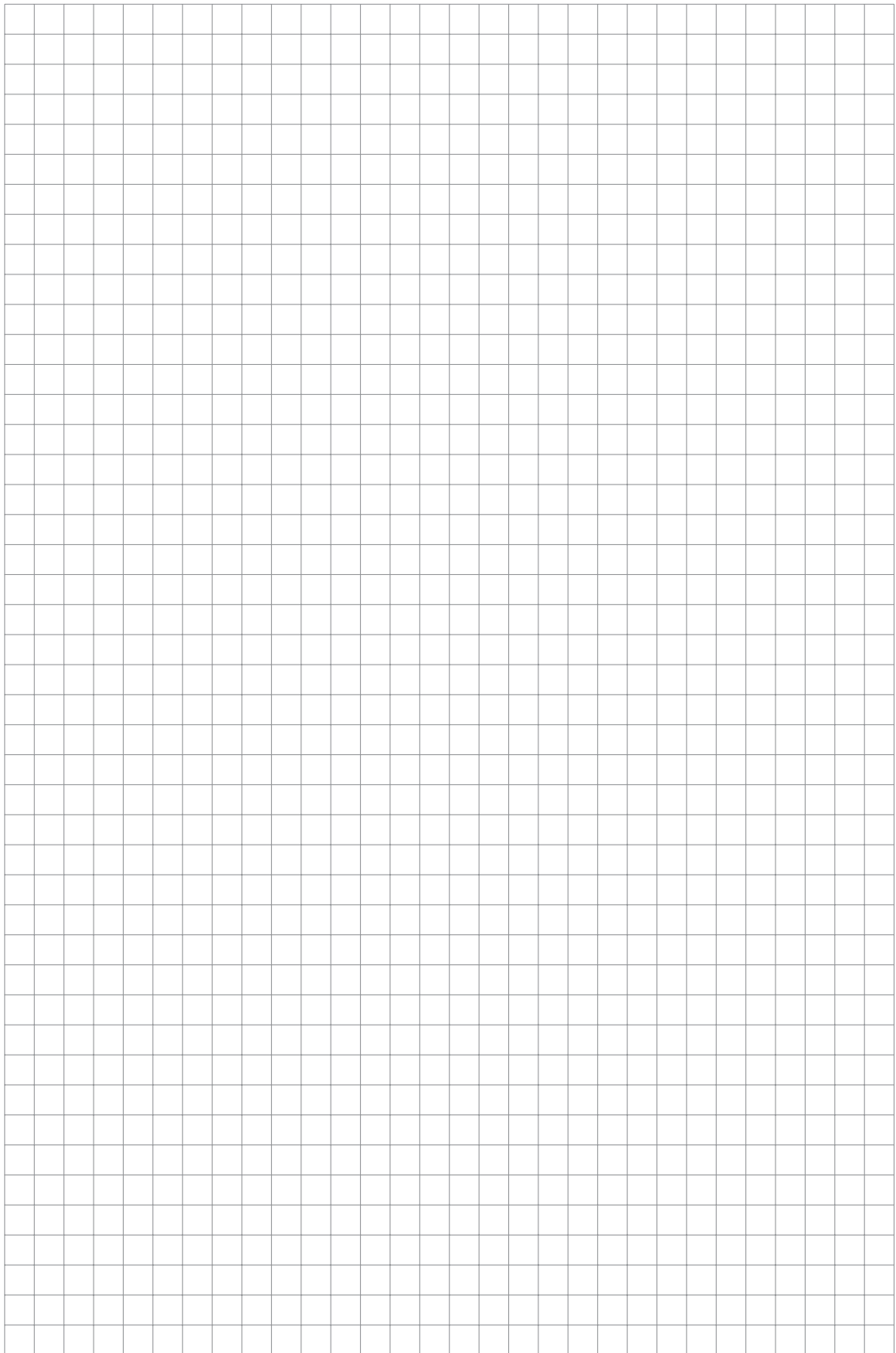
## 5.1 Order code

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

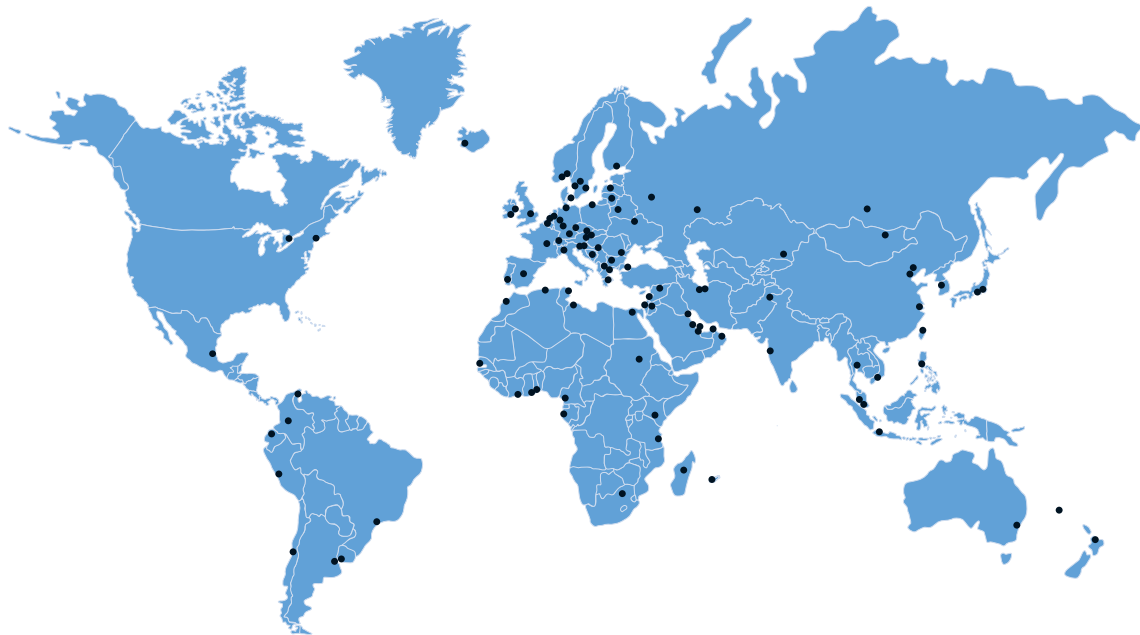
VTT1	4	<b>Design</b>
	1	Head mounting (type C)
		<b>Type</b>
	6	TT 20, analogue, 4...20 mA, only Pt100
		<b>Approvals</b>
	0	Without
		<b>Sensor</b>
	0	Without
	3	Pt100 ( $\alpha = 0.00385$ )
	4	Pt100 ( $\alpha = 0,003902$ )
	5	Pt100 ( $\alpha = 0,003916$ )
		<b>Wiring</b>
	0	Without
	2	2-wire (1 x sensor)
	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
	Z	Customized
VTT1	4	Continued on next page











## KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature meters
- Pressure meters
- Analysis products
- Products and systems for the oil & gas industry
- Measuring systems for the marine industry

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