OPTITEMP TR/TC 100 Technical Datasheet

Measuring inserts: TR 100 resistance thermometers and TC 100 thermocouples

- Flexible, mineral insulated design
- Fully universal
- Spring loaded design

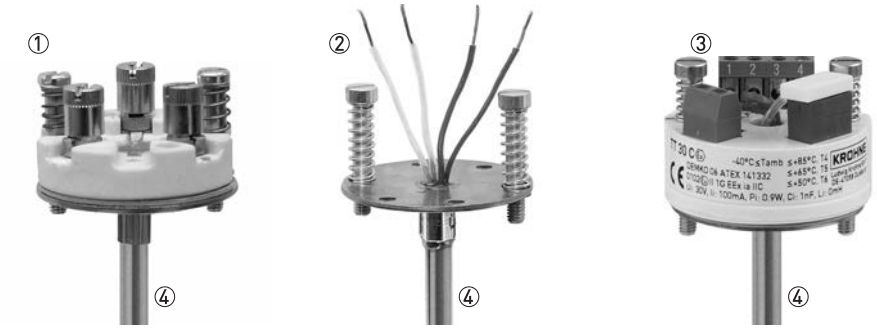
KROHNE

1.1 Heavy-duty mineral insulated measuring inserts

The **OPTITEMP TR/TC 100** measuring inserts are intended for installation in thermometer assemblies and are made using mineral insulated mantle cable. They feature flexibility, superior insulation resistance and a high degree of shock resistance.

The **TR 100** version contains a Pt100 RTD with a characteristic curve according to DIN EN 60751. The **TC 100** version features a thermocouple according to DIN EN 60584.

Thermocouple measuring inserts come in type "K" or "J", other types are available on request.



① Measuring insert with flying wires
② Measuring insert with terminal block
③ Measuring insert with transmitter
④ Sheath

Highlights

- Versions: With terminal block, with flying wires or with OPTITEMP head-mounted transmitter
- Intrinsically safe versions for use in hazardous areas
- Quick-response versions with a diameter of 3 mm / 0.12"
- Spring-loaded version ensures secure contact with the bottom of the thermowell and good heat transfer
- Maximum measuring range TR 100: -200...+600°C / -328...1112°F
- Maximum measuring range TC 100: -40...+1000°C / -40...1832°F

Industries:

- Chemical and Petrochemical
- Oil and Gas
- Power Supply
- Machinery
- Pharmaceuticals and Food & Beverage
- Water and Wastewater
- Iron and Steel
- Paper and Pulp

Applications

Different process connections allow thermometer assemblies to be adapted for use in almost all industrial sectors:

- Insertion-type thermometer
- Threaded thermometer
- Flange thermometer
- Weld-in thermometer

1.2 Options and variants

Variant with ceramic terminal block

- Fully sealed solder joints
- Pt100 connection in 2, 3 and 4-wire connection
- Available with 2, 3, 4, 6 or 8 connection terminals
- Sheath diameter: 3 + 0 - 0.1 mm
- Sheath diameter: 6 + 0 - 0.1 mm
- Washer disc with 2 screws, 2 springs and 2 locking rings

Variant with flying wire ends

Excepting the following points, the features correspond to those of the version with ceramic terminals:

- Colour-coded, Teflon-insulated lead wires
- Lead wires measuring 50 mm / 1.97" in length for the first measuring point
- Lead wires measuring 100 mm / 3.94" in length for the second measuring point

Variant with head-mounted transmitter

The features correspond to those of the version with flying wire ends. A mounted temperature transmitter is also included in delivery:

- TT10/20: Analogue, Pt100 RTD without galvanic isolation
- TT30/40: Digital, Pt100/1000, Ni100, thermocouple
- TT50/51: Digital, HART, SIL2
- TT60: Profibus PA

All three variants (with terminal block, with flying wire ends, with head-mounted transmitter) are available with the following sheath diameters and sensor types:

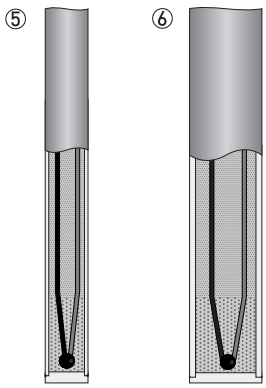
Pt100 measuring insert, Ø 3 mm

- Sheath diameter 3 mm / 0.12": Available with thin film RTD (①) and wire-wound RTD (②)
- Mineral insulated mantle cable (material 1.4404)
- Magnesium oxide insulation (MgO)
- 1 x Pt100 in 2, 3 or 4-wire connection
- 2 x Pt100 in 2-wire connection

Pt100 measuring insert, Ø 6 mm

- Sheath diameter 6 mm / 0.24": Available with thin film RTD (③) and wire-wound RTD (④)
- Mineral insulated mantle cable (material 1.4404)
- Magnesium oxide insulation (MgO)
- 1 x Pt100 in 2, 3 or 4-wire connection
- 2 x Pt100 in 2, 3 or 4-wire connection

Thermocouple measuring insert



- Available with sheath diameters of 3 mm / 0.12" (⑤) and 6 mm / 0.24" (⑥)
- Mineral insulated mantle cable (Inconel 600®)
- Magnesium oxide insulation (MgO)
- Measuring point insulated against housing
- 1 x thermocouple, type "J" or "K"
- 2 x thermocouples, type "J" or "K"
- Other thermocouples on request

All three variants (with terminal block, with flying wire ends, with head-mounted transmitter) are also available as **intrinsically safe measuring inserts**. The ATEX marking is:

II 1 G Ex ia IIC T6

The intrinsically safe measuring inserts always have a sheath diameter of 6 mm / 0.24". The following options are available:

- Sensor: 1 x Pt100 RTD (wire-wound, ceramic) or 1 x thermocouple ("K" or "J")
- Tolerance class A (Pt100) or 1 (thermocouple)

1.3 Measuring principle

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 x 10^{-3} K^{-1} in the range from 0...+100°C / +32...+212°F.

During operation, a constant current I (≤ 1 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 mV / 1 mA = 100 Ω).

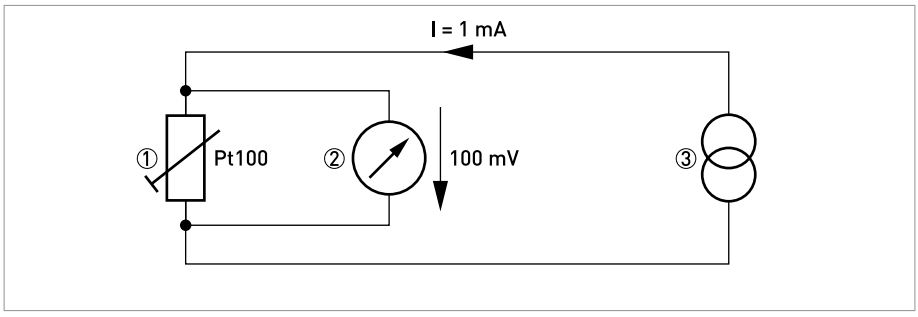


Figure 1-1: Pt100 resistance thermometer in 4 wire connection at 0°C / +32°F, schematic.

① Pt100 RTD
② Voltage meter
③ Current source

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 (hot junction) and the point at which the compensation cables connect to the conductors of the millivolt meter is called the reference junction (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 reference 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 reference 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.

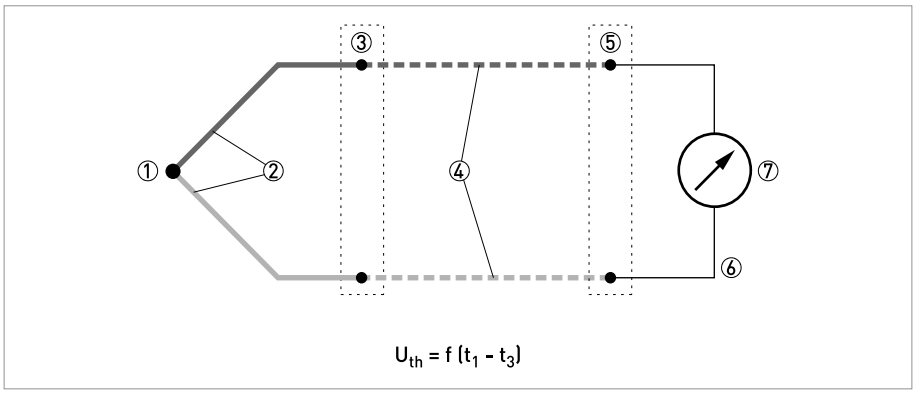


Figure 1-2: Thermocouple measuring circuit, schematic.

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 tables

2.1.1 Technical data TR 100

- *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).*

	Thin film Pt100 (TF)	Wire-wound Pt100 (WW)

Measuring system

Measuring principle	Resistance thermometer measuring insert acc. to DIN 43735-1.
Type of sensor	Pt100 acc. to DIN EN 60751.

Measuring accuracy

Measuring accuracy varies with the temperature and is described in terms of a tolerance class. Values for the individual tolerance classes are as follows:		
Tolerance class A	± (0.15 + 0.002 x |t|) °C	
Tolerance class B	± (0.3 + 0.005 x |t|) °C	
1/3 tolerance class B	±1/3 (0.3 + 0.005 x |t|) °C	
ø 3 mm / 0.12"	Tolerance class A -50…+300°C / -58…+572°F	Tolerance class A -200…+600°C / -328…+1112°F
	Tolerance class B -70…+500°C / -94…+932°F	
	1/3 tolerance class B at 0...150°C / +32...302°F, otherwise tolerance class A	
ø 6 mm / 0.24"	Tolerance class A -50…+300°C / -58…+572°F	Tolerance class A -200…+600°C / -328…+1112°F
	Tolerance class B -70…+500°C / -94…+932°F	
	Tolerance class B -50...+600°C / -50...+1112°F Shock resistant	
	1/3 tolerance class B at 0°C / +32°F, otherwise tolerance class A	
Calibration of the measuring inserts	Under normal operating conditions we recommend annual recalibration.	

Insulation resistance R_{iso}

The insulation resistance was measured with 250 VDC (measuring insert: 3 mm) or 500 VDC (measuring insert: 6 mm).	
20°C ± 15°C / 68°F ± 27°F	> 1000 MΩ
100°C ± 15°C / 212°F ± 27°F	> 500 MΩ
500°C ± 15°C / 932°F ± 27°F	> 50 MΩ

Operating conditions

Shock and vibration	acc. to DIN EN 60751 (10...500 Hz)	
	≤10 g, ≤20 g for shock resistant version	≤3 g

Materials

Mineral insulated mantle cable	Insulated with magnesium oxide (MgO)
Inner conductor	Copper (Cu) or nickel (Ni)
Tauchrohr	Chromium-nickel steel (CrNi), e.g. 316L

Approvals

ATEX (pending)	II 1/2 GD EEx ia 2C T6...T1 (+85...+450°C / +185...+842°F)

2.1.2 Technical data TC 100

- *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).*

	Thermocouple type J	Thermocouple type K

Measuring system

Measuring principle	Thermocouple measuring insert acc. to DIN 43735-1.
Type of sensor	Thermocouples acc. to DIN EN 60584.

Measuring accuracy

Measuring accuracy varies with the temperature and is described in terms of a tolerance class. They are as follows:		
Tolerance class 1 (acc. to DIN EN 60584-2)	-40...+375°C: ±1.5°C, +375...+750°C: ±0.004 x ItI	-40...+375°C: ±1.5°C, +375...+1000°C: ±0.004 x ItI
ø 3 mm / 0.12"	Tolerance class 1 (-40...+750°C)	Tolerance class 1 (-40...+1000°C)
ø 6 mm / 0.24"		
Calibration	Under normal operating conditions we recommend annual recalibration of the measuring inserts.	

Insulation resistance R_{iso}

The insulation resistance was measured with 250 VDC (measuring insert: 3 mm) or 500 VDC (measuring insert: 6 mm).	
20°C ± 15°C / 68°F ± 27°F	> 1000 MΩ
500°C ± 15°C / 932°F ± 27°F	> 5 MΩ

Operating conditions

Shock and vibration	acc. to DIN EN 60751 (10...500 Hz)
	60 g

Materials

Mineral insulated mantle cable	Insulated with magnesium oxide (MgO)
Inner conductor	Respective thermocouple material of the sensor e. g. K-material (NiCr-Ni)
Tauchrohr	Inconel 600®

Approvals

ATEX (pending)	II 1/2 GD EEx ia 2C T6...T1 (85...450 °C / 185...842°F)

2.2 Measuring ranges and tolerances

2.2.1 Measuring insert with Pt100 resistance thermometers

Pt100: basic values and tolerances

Temperature (T90) in °C / °F	Basic value in Ω	Sensitivity in Ω/K	Tolerances acc. to DIN EN 60751			
			Class A		Class B	
			Ω	°C / F°	Ω	°C / F°
-200 / -328	18.5	0.425	±0.24	±0.55 / 0.99	±0.56	±1.30 / 2.34
-100 / -148	60.3	0.405	±0.14	±0.35 / 0.63	±0.32	±0.80 / 1.44
-50 / -58	80.3	0.396	±0.10	±0.25 / 0.45	±0.22	±0.55 / 0.99
0 / +32	100.0	0.390	±0.06	±0.15 / 0.27	±0.12	±0.30 / 0.54
+50 / +122	119.4	0.384	±0.10	±0.25 / 0.45	±0.21	±0.55 / 0.99
+100 / +212	138.5	0.378	±0.13	±0.35 / 0.63	±0.30	±0.80 / 1.44
+200 / +392	212.1	0.369	±0.20	±0.55 / 0.99	±0.48	±1.30 / 2.34
+300 / +572	212.1	0.355	±0.27	±0.75 / 1.35	±0.64	±1.80 / 3.24
+400 / +752	247.1	0.344	±0.33	±0.95 / 1.71	±0.79	±2.30 / 4.14
+500 / +932	281.0	0.332	±0.38	±1.15 / 2.07	±0.93	±2.80 / 5.04
+600 / +1112	313.7	0.321	±0.43	±1.35 / 2.43	±1.06	±3.30 / 5.94

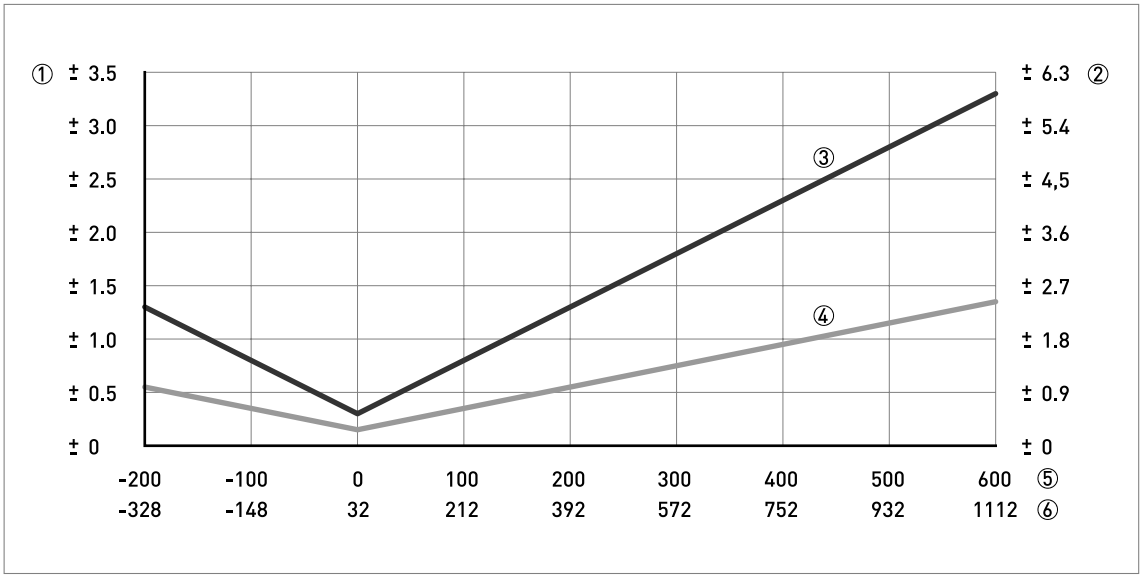


Figure 2-1: Pt100 tolerances

① Tolerances in °C
② Tolerances in °F
③ Tolerance class B
④ Tolerance class A
⑤ Temperature in °C
⑥ Temperature in °F

2.2.2 Measuring insert with type J thermocouples

Type J: basic values and tolerances

Temperature (T90) in °C / °F	Basic value in mV	Thermal EMF in mV/K	Tolerances acc. to DIN EN 60584-2			
			Class 1		Class 2	
			mV	°C / F°	mV	°C / F°
-40 / -40	-1.961	0.046	±0.07	±1.5 / 2.7	±0.12	±2.5 / 4.5
0 / +32	0	0.053	±0.08	±1.5 / 2.7	±0.13	±2.5 / 4.5
+100 / +212	5.269	0.055	±0.08	±1.5 / 2.7	±0.14	±2.5 / 4.5
+200 / +392	10.779	0.055	±0.08	±1.5 / 2.7	±0.14	±2.5 / 4.5
+300 / +572	16.327	0.055	±0.08	±1.5 / 2.7	±0.14	±2.5 / 4.5
+400 / +752	21.848	0.055	±0.09	±1.6 / 2.9	±0.17	±3.0 / 5.4
+500 / +932	27.393	0.057	±0.11	±2.0 / 3.6	±0.21	±3.8 / 6.8
+600 / +1112	33.102	0.056	±0.13	±2.4 / 4.3	±0.25	±4.5 / 8.1
+700 / +1292	39.132	0.064	±0.18	±2.8 / 5.0	±0.34	±5.3 / 9.5
+750 / +1382	42.281	0.064	±0.19	±3.0 / 5.4	±0.36	±5.6 / 10.1

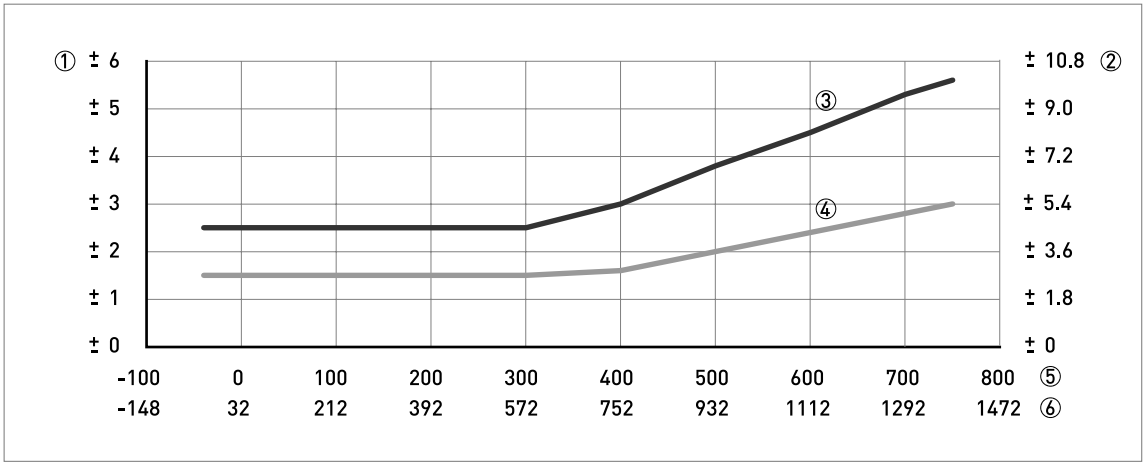


Figure 2-2: Type J tolerances

① Tolerances in °C
② Tolerances in °F
③ Tolerance class 2
④ Tolerance class 1
⑤ Temperature in °C
⑥ Temperature in °F

2.2.3 Measuring insert with type K thermocouples

Type K: basic values and tolerances

Temperature (T90) in °C / °F	Basic value in mV	Thermal EMF in mV/K	Tolerances acc. to DIN EN 60584-2			
			Class 1		Class 2	
			mV	°C / F°	mV	°C / F°
-40 / -40	-1.527	0.037	±0.06	±1.5 / 2.7	±0.09	±2.5 / 4.5
0 / +32	0	0.039	±0.06	±1.5 / 2.7	±0.10	±2.5 / 4.5
+100 / +212	4.096	0.042	±0.06	±1.5 / 2.7	±0.11	±2.5 / 4.5
+200 / +392	8.138	0.040	±0.06	±1.5 / 2.7	±0.10	±2.5 / 4.5
+300 / +572	12.209	0.042	±0.06	±1.5 / 2.7	±0.11	±2.5 / 4.5
+400 / +752	16.397	0.042	±0.07	±1.6 / 2.9	±0.13	±3.0 / 5.4
+500 / +932	20.644	0.043	±0.09	±2.0 / 3.6	±0.16	±3.8 / 6.8
+600 / +1112	24.905	0.043	±0.10	±2.4 / 4.3	±0.19	±4.5 / 8.1
+800 / +1472	33.275	0.041	±0.13	±3.2 / 5.8	±0.25	±6.0 / 10.8
+1000 / +1832	41.276	0.039	±0.16	±4.0 / 7.2	±0.29	±7.5 / 13.5
+1200 / +2192	48.838	0.036	±0.17	±4.8 / 8.6	±0.32	±9.0 / 16.2

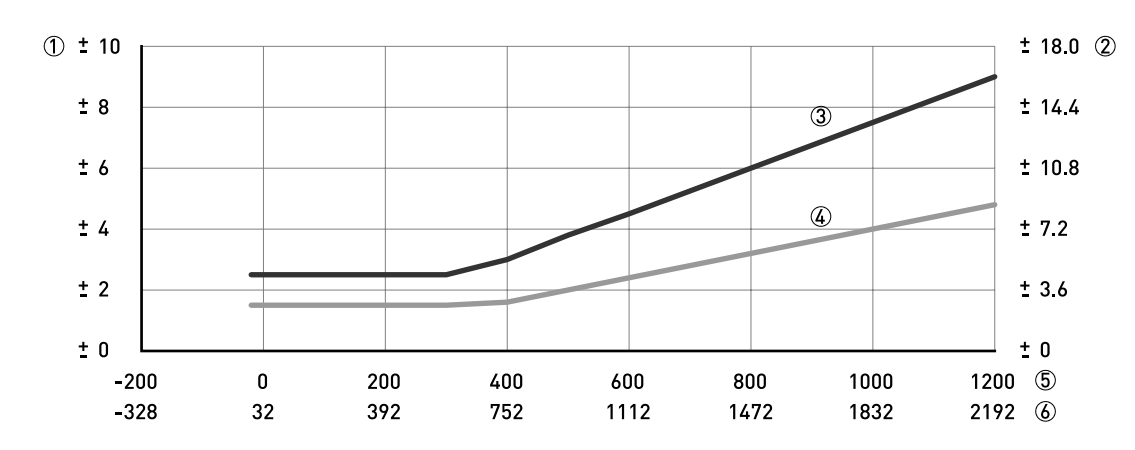


Figure 2-3: Tolerances type K

① Tolerances in °C
② Tolerances in °F
③ Tolerance class 2
④ Tolerance class 1
⑤ Temperature in °C
⑥ Temperature in °F

2.3 Permissible flow speed

The maximum permissible flow speed for the measuring insert depends on its immersion depth and on the density of the product. The greater the immersion depth and the higher the density, the larger the load.
If the measuring insert is used in the thermowell, the flow speed is irrelevant. If, however, the flow goes against an unprotected measuring insert, its load must be calculated individually. If this is the case, the manufacturer will offer further support.

2.4 Permissible operating pressure

The maximum permissible load of the measuring inserts through the static operating pressure may not exceed 0.8...1.1 bar.

2.5 Response times

The response times t_{50} (50% time) and t_{90} (90% time) were calculated in water acc. to VDE/VDI 3522 with 0.4 m/s, corresponding to 78.7 ft/min:

Type of measuring insert	t_{50} [s]	t_{90} [s]
TR 100, Ø 6 mm / 0.236"	3.5	8
TR 100, Ø 3 mm / 0.118"	2	5
TC 100, Ø 6 mm / 0.236"	2.5	7
TC 100, Ø 3 mm / 0.118"	1	2.5

2.6 Dimensions

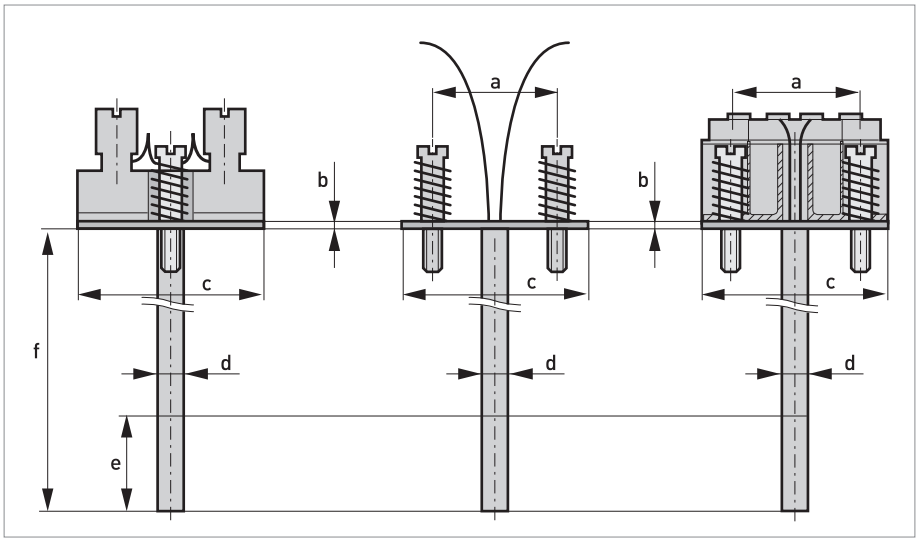


Figure 2-4: Measuring insert with terminal block, without terminal block, with transmitter (from left to right).

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	Designation	TR/TC 100, Ø 3 mm / 0.118"		TR/TC 100, Ø 6 mm / 0.236"	
		[mm]	[inches]	[mm]	[inches]
a	Distance between fixing screws	33	1.3	33	1.3
b	Washer disc thickness	1.5	0.06	1.5	0.06
c	Washer disc diameter	40	1.58	40	1.58
d	Sheath diameter	3	0.12	6	0.24
e	Sensitive sensor length	10...35	0,39...1.38	10...35	0,39...1.38
f	Measuring insert length	120	4.72	120	4.72
		145	5.71	145	5.71
		160	6.3	160	6.3
		205	8.07	205	8.07
		255	10.04	255	255
		275	10.83	275	10.83
		315	12.4	315	12.4
		345	13.58	345	13.58
		375	14.76	375	14.76
		405	15.94	405	15.94
		435	17.13	435	17.13
		525	20.67	525	20.67
		555	21.85	555	21.85
		585	23.03	585	23.03
		655	25.97	655	25.97
		735	28.94	735	28.94

The length of the connection wires is the same (40 mm / 1.58") for both variants (TR and TC 100).

Different installation lengths are available on request.

3.1 Intended use

The operator himself bears the sole responsibility for the intended use of the measuring device regarding the suitability and the corrosion resistance of the used materials against the measured fluid.

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose. Intended use is when the measuring insert is operated in a suitable thermometer assembly allowing for incorporation of replaceable measuring inserts. In every instance, the sheath length must be adapted to the thermowell.

For more information about adjusting the thermowell and the sheath, see the manual entitled "Industrial thermometers with replaceable measuring inserts". Your local representative can help with further technical documentation as required.

3.2 Notes on installation

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

Check the packing list to check if you received completely all that you ordered.

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.

3.3 Storage

The measuring inserts must be stored in a dry place, protected from dust.

The permissible storage temperatures for standard devices are -40...+80° C / -40...+176° F and -20...+55 ° C / -4...+131° F for the version with ATEX approval (pending).

3.4 How the conditions of use affect the selection of the sensor element

Depending on the measuring range, measuring inserts can be used with different RTDs. The wire-wound Pt100 RTDs, WW type for short (wire-wound), allow for a wide measuring range from -200...+600°C / -328...+1112°F. In contrast, thin film Pt100 RTDs, so-called TF types, have a smaller temperature range of use of -70...+500°C / -94...+932°F. However, they have a higher degree of shock resistance and smaller sensitive lengths are possible. This should be taken into account when planning a measuring point.

Barring the facts previously mentioned, when planning a measuring point it should be taken into account that vibration often occurs in pipelines. These vibrations are often transferred to the temperature sensor (e.g. behind pumps). The same is true for measuring points on machines with rotating parts.

3.5 Transport

When possible, transport the device in its original packing. The information that applies to storage also applies to transport.

3.6 Installation without thermowell

In 90% of the cases, the TR 100 and TC 100 measuring inserts are installed in thermometer fittings consisting of a thermowell with process connection, a connection head and, if necessary, an extension length. An insert without thermowell and with only a connection head is also possible, e.g. with type TRA-P35 thermometers or
TCA-P35 (see manual entitled "Industrial thermometers with replaceable measuring inserts"). In this case, the measuring insert sheath is immersed directly into the product to be measured, so that the thermometer can react more quickly to changes in temperature. This can be very important, especially when measuring gas temperatures and extremely slow-flowing products.

A compression fitting with an inner diameter of 3 mm / 0.118" or 6 mm / 0.236" and an outer thread of G ¼" or G ½" is suitable to use for attachment. Except for the bottom 50 mm / 1.97", measuring inserts can be bent.

Ensure that when bending the sheath, the smallest bending radius is at least three times the diameter of the sheath! Otherwise you may damage or destroy the mineral insulated sheathed cable and thus the measuring insert.

Do not bend the bottom 50 mm / 2" of the sheath! This may damage or destroy the RTD or the thermocouple.

3.7 Installation with thermowell

For measuring inserts with a sheath diameter of 3 mm / 0.118", only thermowells with a certain shape are suitable (as a rule this means thermowells with reduced tips). Otherwise the thermometer reacts more slowly and it measures incorrect. The thermometer reads too low when above room temperature and too high when below.

The sheath length of the measuring insert must be measured so the tip of the sheath touches the bottom of the thermowell of the thermometer fitting. In addition, the diameter of the sheath should be big enough that the side air gap between the sheath and the thermowell is as small as possible. This ensures the heat transfer from the bottom and wall of the thermowell to the sheath and reduces the response time of the thermometer.

To guarantee optimal temperature transfer, two springs press the measuring insert to the bottom of the thermowell. The displacement is approx. 5 mm / 0.197", so that measuring inserts with minimally varying lengths can be used.

Inserting the measuring insert into the thermometer assembly

- Open the cover of the connection head on the thermometer assembly and ensure that the gasket does not get damaged or lost (contact the local representative for new gaskets).
- Slide the measuring insert completely into the thermowell until the washer disc on the measuring insert almost touches the floor of the connection head.
- Tighten the two M4 screws on the measuring insert by hand.
- Close the cover of the connection head of the enclosure.

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!

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

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.

4.2 Grounding

It is not necessary for the measuring insert to be grounded separately.

4.3 Protection category

The measuring insert itself, with its open connection terminals, is unprotected. The protection category of the thermometer fitting depends on the design of the connection head used.

For more information on the connection heads, please refer to the manual entitled "Industrial thermometer with replaceable measuring inserts".

4.4 Power supply

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

Supply voltage is only relevant to measuring inserts when they are used in conjunction with a transmitter. Typically, the supply voltage of the transmitter is 24 VDC. The documentation on the transmitter used contains details about the supply voltage.

4.5 Wiring variants

4.5.1 Pt100 measuring inserts

Resistance thermometers are connected in accordance with DIN EN 60751 in three different wiring variants. Of the three, the 3-wire connection is the most frequently used in the industry:

TR 100: wiring

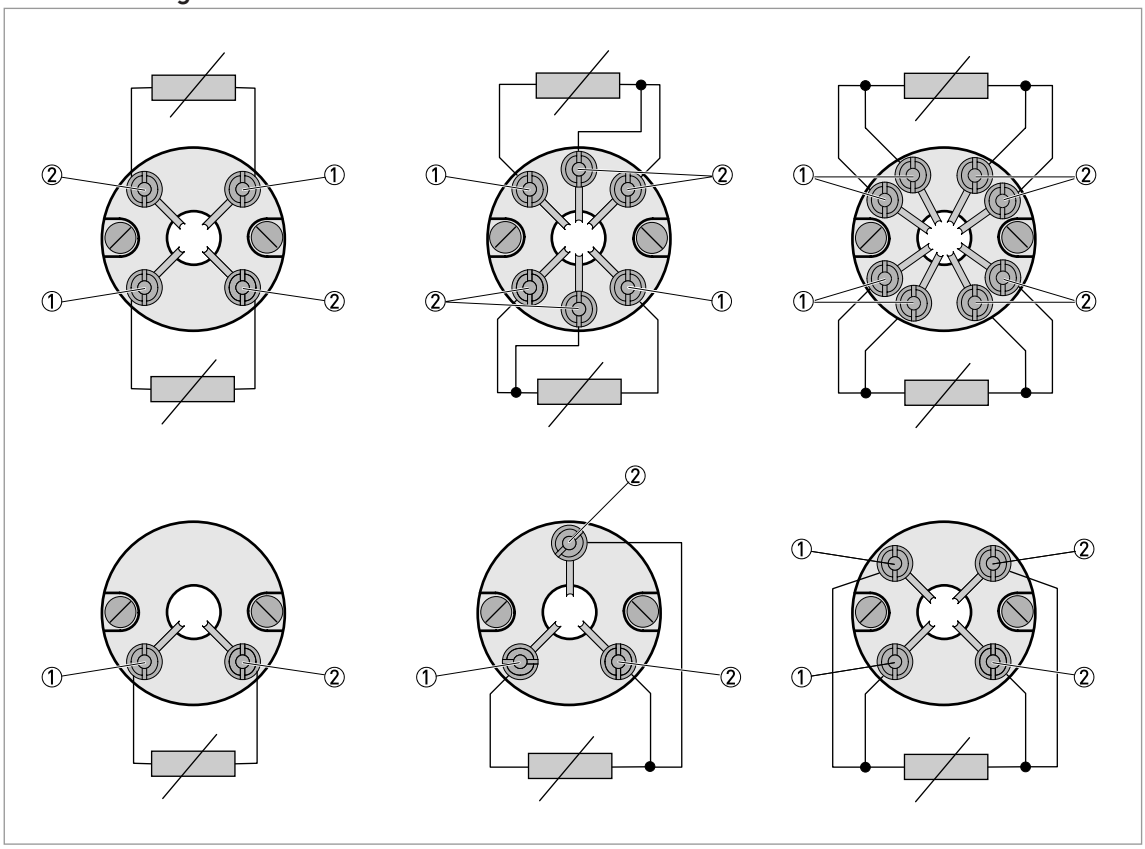


Figure 4-1: Double (top row) and single version (bottom row). From left to right: 2, 3 and 4-wire connection.

① white
② red

Applications and features

- The 2-wire connection is used with short cable connections and minimal requirements for accuracy.
- The 3-wire connection is the industry standard and largely eliminates the effect of supply resistance.
- The 4-wire connection completely eliminates the distorting influences of the supply resistance and guarantees minimal measuring uncertainty.

TR 100: Wiring depending on sheath diameter

Diameter [mm] / [inches]	single Pt100	Double Pt100
3 / 0.12	2-, 3- or 4-wire connection	2-wire connection
6 / 0.24	2-, 3- or 4-wire connection	2-, 3- or 4-wire connection

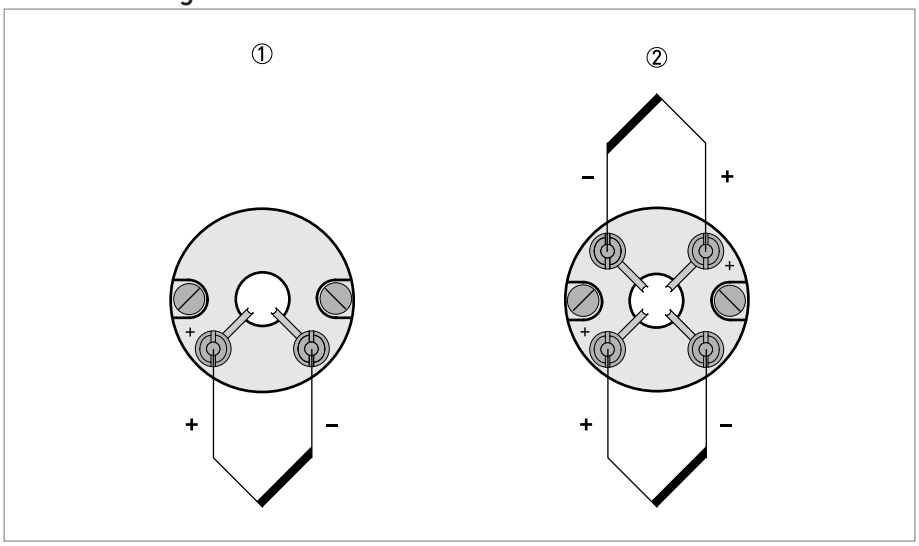
TR 100: Wiring depending on type of sensor

	Thin film Pt100 (TF)		Wire-wound Pt100 (WW)	
	ø 3 mm / 0.12"	ø 6 mm / 0.24"	ø 3 mm / 0.12"	ø 6 mm / 0.24"
Single Pt100, tolerance class 1/3 B	3 or 4-wire	3 or 4-wire	-	-
Single Pt100, tolerance class A	3 or 4-wire	3 or 4-wire	3 or 4-wire	3 or 4-wire
Single Pt100, tolerance class B	2, 3 or 4-wire	2, 3 or 4-wire	-	-
Single Pt100, tolerance class B, shock resistant	-	2, 3 or 4-wire	-	-
Double Pt100, tolerance class A	-	-	-	2, 3 or 4-wire

4.5.2 Thermocouple measuring inserts

Wiring of a thermocouple measuring insert is done in accordance with DIN EN 60584.

TC 100: Wiring



① Single design
② Double design

TC 100: Wiring depending on sheath diameter

Diameter [mm] / [inches]	Single thermocouple	Double thermocouple
3 / 0.118	Type J (Fe-CuN) and Type K (NiCr-Ni)	Type J (Fe-CuN) and Type K (NiCr-Ni)
6 / 0.236	Type J (Fe-CuN) and Type K (NiCr-Ni)	Type J (Fe-CuN) and Type K (NiCr-Ni)

The TC 100 thermocouple measuring inserts are available in element types J (Fe-CuN) and K (NiCr-Ni).

Thermocouple measuring inserts are delivered in tolerance class 1 acc. to DIN EN 60584-2.

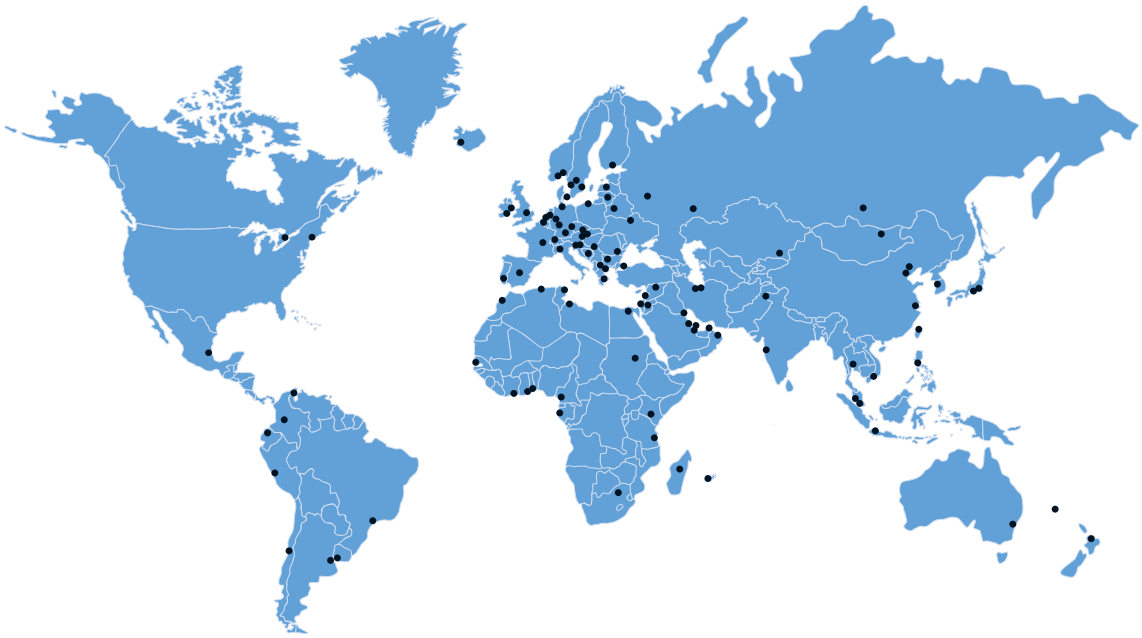
5.1 TR 100 and TC 100 type codes

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

VGC0	4	**Type**					
		C	TC 100: Thermocouple measuring insert				
		R	TR 100: Pt100 resistance thermometer measuring insert				
			Approval				
			0	none			
			1	ATEX - Ex (pending)			
				Measuring insert diameter			
				3	3 mm / 0.118"		
				6	6 mm / 0.236"		
					Sensor / connection configuration		
					1	1 x Pt100, 2-wire connection (only tolerance class B)	
					2	1 x Pt100, 3-wire connection	
					3	1 x Pt100, 4-wire connection	
					4	2 x Pt100, 3-wire connection	
					5	2 x Pt100, 4-wire connection	
					6	2 x Pt100, 2-wire connection	
					8	1 x Pt100, 3-wire connection + SmartSense (only Ø 6 mm / 0.236")	
					A	1 x thermocouple type J (Fe-CuNi)	
					B	1 x thermocouple type K (NiCr-Ni)	
					D	2 x thermocouple type J (Fe-CuNi)	
					E	2 x thermocouple type K (NiCr-Ni)	
						Measuring insert / class	
						1	Tolerance class B, mineral insulated (Mi), thin film (TF), -70...+500°C / -94...+932°F
						2	Tolerance class A, mineral insulated (Mi), thin film (TF), -50...+300°C / -58...+572°F
						3	Tolerance class B, shock-resistant, mineral insulated (Mi), thin film (TF), -50...+600°C / -58...+1112°F
						4	Tolerance class A, mineral insulated (Mi), wire-wound (WW), -200...+600°C / -328...+1112°F
						5	Tolerance class 1/3 DIN B at -50...+150°C / -58...+302°F, Mineral insulated (Mi), thin film (TF), over and above tolerance class A up to +300°C / +572°F
						7	Tolerance class 1/10 DIN B at 0°C / 32°F, mineral insulated (Mi), wire-wound (WW), over and above better than tolerance class A between -50…+300°C / -58…+572°F
						A	Tolerance class 1
VGC0	**4**						Continued on next page

	Length of measuring insert			
	1	120 mm / 4.72"		
	2	145 mm / 5.71"		
	3	160 mm / 6.30"		
	4	205 mm / 8.07"		
	5	255 mm / 10.04"		
	6	275 mm / 10.83"		
	7	315 mm / 12.40"		
	8	345 mm / 13.58"		
	A	375 mm / 14.76"		
	B	405 mm / 15.95"		
	C	435 mm / 17.13"		
	D	525 mm / 20.67"		
	E	555 mm / 21.85"		
	F	585 mm / 23.03"		
	G	655 mm / 25.79"		
	H	735 mm / 28.94"		
	Z	Special length		
		Connection type / head-mounted transmitter		
		0	Version with flying wires for transmitter assembly	
		1	Standard version with terminal block	
		2	With TT 10 C head-mounted transmitter, analog	
		3	With TT 11 C head-mounted transmitter, analog, 0...10 V	
		5	With TT 20 C head-mounted transmitter, analog, programmable.	
		7	With TT 30 C head-mounted transmitter, digital, standard.	
		A	With TT 40 C head-mounted transmitter, digital, precise	
		D	With TT 50 C head-mounted transmitter, digital, HART	
		E	with TT 51 C head-mounted transmitter, digital, HART (pending)	
		F	With TT 60 C head-mounted transmitter, digital, Profibus	
			Transmitter configuration	
			0	Without (Standard 0...100°C / 32...212°F)
			1	Configuration
Carried over from previous page				Continued on next page

	Certificate		
	0	None	
	1	1 point, room temperature (single or double sensor)	
	2	2 points: 0°C / 32°F and 100°C / 212°F (single sensor)	
	3	2 points: 0°C / 32°F and 100°C / 212°F (double sensor)	
	4	3 points: 0°C / 32°F, 100°C / 212°F and 200°C / 392°F (single sensor)	
	5	3 points: 0°C / 32°F, 100°C / 212°F and 200°C / 392°F (double sensor)	
	6	Calibration according to customer specifications (single sensor)	
	7	Calibration according to customer specifications (double sensor)	
	A	2 points: 0 and 100% (single sensor & transmitter)	
	B	3 points: 0, 50 and 100% (single sensor & transmitter)	
	C	5 points: 0, 25, 50, 75 and 100% (single sensor & transmitter)	
	E	2 points: 0 and 100% (single sensor & transmitter), including adjustment	
	F	3 points: 0, 50 and 100% (single sensor & transmitter), including adjustment	
	G	5 points: 0, 25, 50, 75 and 100% (single sensor & transmitter), including adjustment	
	H	Calibration according to customer specifications (single sensor & transmitter), including adjustment	
		Operating instructions	
		0	none
		1	German
		3	English
		4	French
Carried over from the previous pages			



KROHNE product overview

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

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

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

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