KROHNE

measure the facts

Temperature measurement

Product overview

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measure the facts

technology driven by KROHNE

Letter from the Corporate Management

Dear Customers,

Communication techniques are becoming ever more complex, from the field through to the control level. At the same time the demands for recording physical measured variables such as flow rates, fill levels, temperature, pressure and analysis parameters are constantly growing. The principal requirement in this respect is absolute reliability of the measured values. This means the measuring equipment, even when subjected to disruptive influences such as changing flow profiles or inclusion of gas bubbles, must always deliver reliable values, and above all must guarantee virtually 100 % security against failure.

"Measure the facts" means not only reliable measurement of standard process variables – even under the most difficult process conditions – but also clear and precise process diagnostics right through to the material composition of the medium. Both of these contribute to improved process control and allow remarkable increases in process efficiency and production.

In order to guarantee this for you, more than 400 engineers in the worldwide KROHNE Group are continuously engaged in research into promising technologies for the future, in pursuit of improved measurement and further developments. We are a family-owned enterprise and we take our responsibilities seriously. We have permanent representation in more than 130 countries and employ more than 3,500 people in order to bring you highly innovative products from a single source, and tailor-made technical solutions to your measurement requirements, now and in the future.

Michael Rademacher-Dubbick

Stephan Neuburger

Temperature assembly selection

These tables will help you select the right measuring solution for your application, a selection from our product portfolio

	Industrial			High temperature	Advanced requirements		
	OPTITEMP TRA/TCA-P10	OPTITEMP TRA/TCA-S12, -S22	OPTITEMP TRA/TCA-F13, -F42	OPTITEMP TCA-P62, -P64	OPTITEMP TRA/TCA-S34, -TS35, -S50, -TS53, -TS54	OPTITEMP TRA/TCA-TF31, -TF33, -TF56, -TF57	OPTITEMP TRA/TCA-T30
Page	8/18	8/18	8/19	9/19	10/11/20/21	10/11/20/21	10/20
Design							
Process connection	Plug-in	Screw-in	Flange	Plug-in	Screw-in	Flange	Weld-in
Standard material	Stainless steel	Stainless steel	Stainless steel	Kantahl ceramic	Stainless steel*	Stainless steel*	Stainless steel*
Operating temperature	⩽+600°C; +1100°F	⩽+600°C; +1100°F	⩽+600°C; +1100°F	P62: ⩽+750...+1150°C; +1350...+2100°F P64: ⩽+750...+1600°C; +1350...+2900°	⩽+600°C; +1100°F	⩽+600°C; +1100°F	⩽+600°C; +1100°F
High pressure	–	–	–	–	x	x	x
High flow	–	–	–	–	x	x	x
Ex approvals	x	S12: x S22: -	x	–	x	x	x
Medium							
Solid	x	x	–	–	x	–	–
Liquid	x	x	x	–	x	x	x
Gas	x	x	x	x	x	x	x
Steam	–	x	–	–	x	x	x
Accessories							
	Compression fittings	Weld-in fittings	Coatings and covers	Gas-tight threaded sleeves, sliding flange	Weld-in fittings	Coatings and covers	Thermowell in different material

Compact			Hygienic	Mineral insulated	Cable		HVAC	
OPTITEMP TRA-C10	OPTITEMP TRA-C20	OPTITEMP TRA-C30	OPTITEMP TRA-H20	OPTITEMP TCA-M50, -M70	OPTITEMP TRA-W30, -W40	OPTITEMP TRA-W50, -W70	OPTITEMP TRA-V20	OPTITEMP TRA-V30
12/22	12/22	12/22	12/22	12/23	13/22/23	13/22	13/23	13/23
DN25/38 acc. to ISO 2852	Screw-in	Screw-in	DN25/38 acc. to ISO 2852	Plug-in	Skin sensor	W50: screw-in W70: bayonet	Wall mount	Plug-in
Stainless steel	Stainless steel	Stainless steel	Stainless steel	Inconel®	Copper	Stainless steel	Brass	Brass
with transmitter -50...+150°C; -58...+302°F without transmitter -50...+200°C; -58...+400°F	with transmitter -50...+150°C; -58...+302°F without transmitter -50...+200°C; -58...+400°F	with transmitter -50...+150°C; -58...+302°F without transmitter -50...+200°C; -58...+400°F	⩽+200°C; +400°F	⩽+750...+1250°C; +1350...+2300°F	⩽+200...+300°C; +400...+550°F	⩽+200°C; +400°F	⩽+75°C; +170°F	⩽+75°C; +167°F
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	x	x	–	x	x	x	–	–
x	x	x	x	x	–	–	–	–
x	x	x	x	x	–	–	x	x
–	x	x	–	–	–	–	–	–
Cable with M12 connector	Cable with valve connector EN175301-803	Cable with M12 connector	–	Compression fitting, connectors	Clamp-on connection	Bayonet nipple	–	Compression fitting, slide on flange

x = suitable , – = not suitable , * also available in Barstock

Temperature transmitter selection

These tables will help you to select the right transmitter for your application.
For technical details, datasheets can be found at www.krohne.com

	Conventional		Programmable		
	OPTITEMP TT 10	OPTITEMP TT 11	OPTITEMP TT 20	OPTITEMP TT 30	OPTITEMP TT 31
Page	24/30/32	24/30/32	24/30	24/30/32	25/32
Design (powered by)					
Head-mounted transmitter	x	x	x	x	–
Intrinsically-safe head-mounted transmitter, Ex	x	–	–	x	–
Rail-mounted transmitter	x	x	–	x	x
Intrinsically-safe rail-mounted transmitter, Ex	–	–	–	x	x
SIL2	–	–	–	–	–
Input					
Resistance thermometer	3-wire	3-wire	3-wire	3- or 4-wire	3- or 4-wire
Thermocouples	J, L, T, K, N	–	–	B, C, E, J, K, L, N, R, S, T, U	B, C, E, J, K, L, N, R, S, T, U
Other	–	–	–	mV, Ω	mV, Ω
Channels/inputs					
1 measuring channel	x	x	x	x	x
2 measuring channels	–	–	–	–	x
2 inputs	–	–	–	–	x
Output					
4–20 mA	x	–	x	x	x
0–10 V	–	x	–	–	–
PROFIBUS® PA	–	–	–	–	–
HART®	–	–	–	–	–
Accuracy					
Accuracy classes	±0.15%	±0.15%	±0.10%	±0.10%	±0.10%
Circuit design					
Galvanic isolation	–	–	–	1500 VAC	1500 VAC
Power supply					
24 VDC	x	x	x	x	x
230 VAC	–	–	–	–	–
Accessoires					
Loop powered LED und LCD display, loop powered isolator and repeaters, transmitter configuration kit	–	–	x	x	x

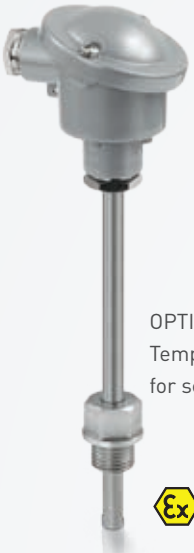
x = available, – = not available

	Programmable		Smart	
	OPTITEMP TT 32	OPTITEMP TT 40	OPTITEMP TT 51	OPTITEMP TT 60
Page	25/33	25/31/33	25-27/31/33	25/31/33
Design (powered by)				
Head-mounted transmitter	–	x	x	x
Intrinsically-safe head-mounted transmitter, Ex	–	–	x	x
Rail-mounted transmitter	x	x	x	x
Intrinsically-safe rail-mounted transmitter, Ex	–	–	x	–
SIL2	–	–	x	–
Input				
Resistance thermometer	3- or 4-wire	3- or 4-wire	3- or 4-wire	3- or 4-wire
Thermocouples	B, C, E, J, K, L, N, R, S, T, U	B, C, E, J, K, L, N, R, S, T, U	B, C, D, E, J, K, N, R, S, T	B, C, D, E, J, K, L, N, R, S, T, U
Other	mV, Ω	mV, Ω	mV, Ω	mV, Ω
Channels/inputs				
1 measuring channel	x	x	x	x
2 measuring channels	–	–	x **	x ***
2 inputs	–	–	x	x
Output				
4–20 mA	x	x	x	–
0–10 V	x	–	–	–
PROFIBUS® PA	–	–	–	x
HART®	–	–	x	–
Accuracy				
Accuracy classes	±0.10%	±0.05%	±0.05%	±0.10%
Circuit design				
Galvanic isolation	4000 VAC	3750 VAC	1500 VAC	1500 VAC
Power supply				
24 VDC	x	x	x	– *
230 VAC	x	–	–	– *
Accessoires				
Loop powered LED und LCD display, loop powered isolator and repeaters, transmitter configuration kit	x	x	x	x

x = available, – = not available
*PROFIBUS® power supply, ** able to read 2 channels via HART®, *** able to read 2 channels via PROFIBUS®

Industrial temperature assemblies

OPTITEMP TRA/TCA-P10
Temperature assembly
for compression fitting



OPTITEMP TRA/TCA-S12
Temperature assembly
for screw-in

OPTITEMP TRA/TCA-F13
Temperature assembly
with process flange

OPTITEMP TRA/TCA-S22
Temperature assembly
for screw-in

OPTITEMP TRA/TCA-F42
Temperature assembly
with process flange

High temperature assemblies

OPTITEMP TCA-P62
High temperature
assembly for plug-in

OPTITEMP TCA-P64
High temperature
assembly for plug-in

Temperature assemblies – Selection from our product portfolio

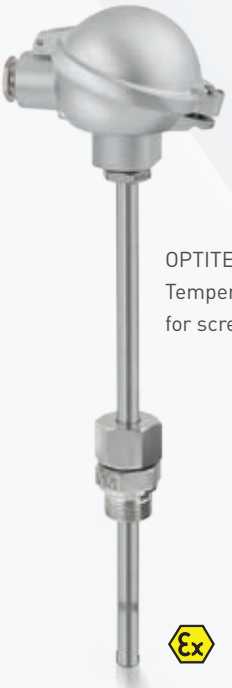
Temperature assemblies for advanced requirements, DIN standard

OPTITEMP TRA/TCA-T30
Temperature assembly
for weld-in

OPTITEMP TRA/TCA-S34
Temperature assembly
without thermowell

OPTITEMP TRA/TCA-TF33
Temperature assembly
with process flange

OPTITEMP TRA/TCA-TF31
Temperature assembly
with process flange



OPTITEMP TRA/TCA-TS35
Temperature assembly
for screw-in

Temperature assemblies for advanced requirements, ASME standard

OPTITEMP TRA/TCA-S50
Temperature assembly
without thermowell

OPTITEMP TRA/TCA-TS54
Temperature assembly
for screw-in

OPTITEMP TRA/TCA-TF57
Temperature assembly
with process flange

OPTITEMP TRA/TCA-TS53
Temperature assembly
for screw-in

OPTITEMP TRA/TCA-TF56
Temperature assembly
with process flange

Compact sensors

OPTITEMP TRA-C10
Hygienic compact sensor
with flange

OPTITEMP TRA-C20
Compact sensor
for screw-in with
valve connector

OPTITEMP TRA-C30
Compact sensor
for screw-in with
M12 connector

Hygienic temperature assemblies

OPTITEMP TRA-H20
Hygienic temperature assembly
with replaceable insert

Mineral insulated thermocouples

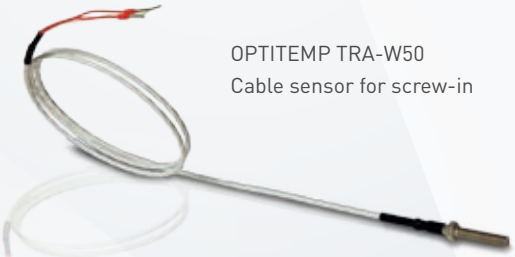
OPTITEMP TCA-M70
Mineral insulated cable thermocouple

OPTITEMP TCA-M50
Mineral insulated thermocouple
with mini thermo plug

Cable sensors and HVAC temperature sensors

OPTITEMP TRA-W30
Cable sensor for clamp-on

OPTITEMP TRA-W40
Cable sensor for screw-on



OPTITEMP TRA-W50
Cable sensor for screw-in

OPTITEMP TRA/TCA-W70
Cable sensor with bayonet fitting

OPTITEMP TRA-V20
HVAC temperature sensor
for wall mounting

OPTITEMP TRA-V30
HVAC temperature sensor for
air ducts/pipes applications

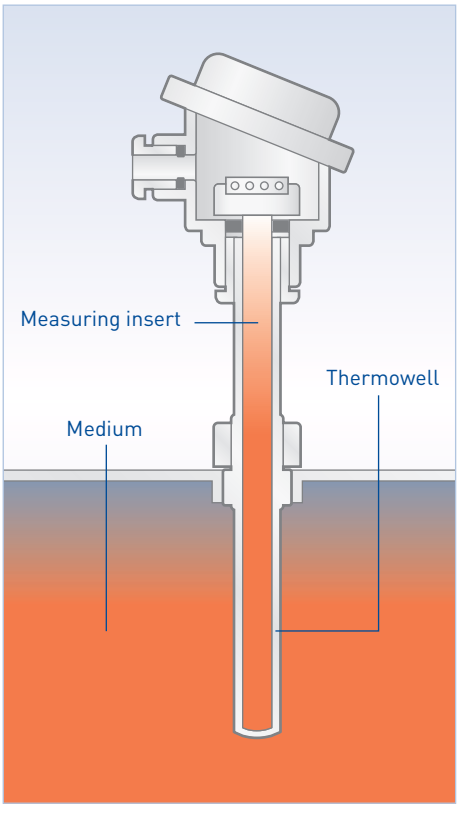
Highlights:

- Wide range of products
- Standardised and customer-specific temperature assemblies
- Thermowells made from both standard and special materials
- Coated thermowells for use in aggressive media
- Replaceable measuring inserts made of mineral insulated cable
- Pt100 RTD and thermocouples stable over the long term
- Connection heads for a wide variety of requirements
- Extensive accessories

Exact temperature measurement: Perfect interaction of elements

The history of temperature measurement starts at the end of the 16th century: In 1596, the thermoscope of none other than Galileo Galilei becomes one of the first devices designed to measure temperature. It functioned by heating up and expanding water in small glass tubes and considered the predecessor to today's temperature assembly.

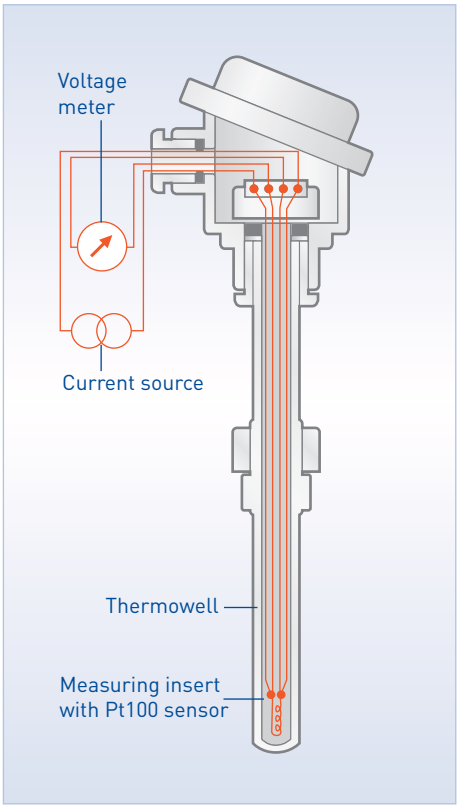
The technology behind temperature measurement has been refined and improved over the centuries and the interaction of the elements, especially when it comes to extremely demanding, industrial applications, has been continuously perfected. KROHNE has played a special role in the research and development of this field.



The measuring principle

Contact temperature assemblies that come into direct contact with the product to be measured are predominantly used in industry today. The physical foundation for its function is described by the zeroth law of thermodynamics.

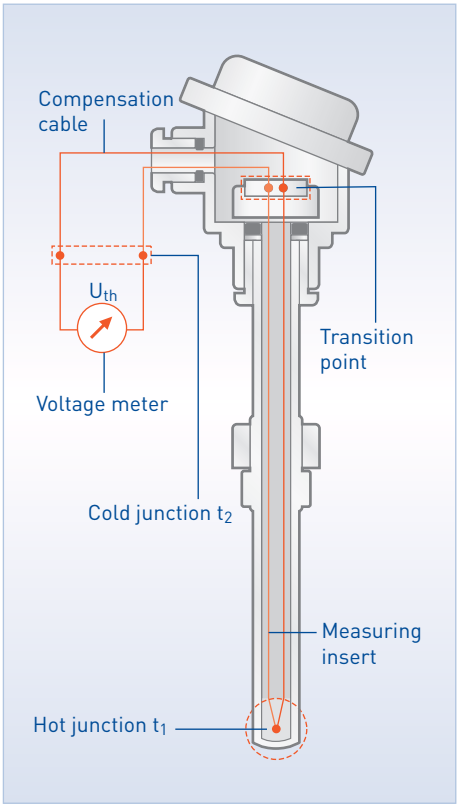
When measuring temperature, the temperature assembly must assume the temperature of the medium – the medium, thermowell and the measuring insert with the sensor element must be brought into thermal equilibrium. The precondition for this is good and above all rapid heat exchange amongst all components involved. Since temperature can only be indirectly measured as, for example, via the temperature dependency of the electrical resistance of metals or via thermoelectric effects, this can be used to construct sensor elements: these are usually Pt resistance sensors or thermocouples built into the appropriate measuring insert.



Resistance sensor

For a measuring insert with a Pt100 resistance sensor, the temperature-sensitive sensor element is made from a platinum RTD whose value at 0 °C / +32 °F is 100 Ω. The electrical resistance of metals increases according to a mathematical function as the temperature rises.

This effect is used with resistance temperature assembly to measure the temperature: a constant current I flows through the Pt100 RTD, creating a voltage drop U. The resistance "R" follows Ohm's law: R = U / I and corresponds to a specific temperature. The temperature dependency is repeatable and is standardised in a characteristic curve.



Thermocouples

With a thermocouple, two different electrical conductors are connected at one end to the measuring point, the hot junction. The free ends at the transition point are connected to the measuring device with a compensation cable via the so-called cold junction. Only when the hot junction t_1 and the cold junction t_2 have different temperatures is a thermovoltage U_{th} measured. The thermovoltage is then dependent on the difference $t_2 - t_1$ as well as on the material combination of the thermocouple.

Very simply put, think of the thermocouple as a voltage source whose voltage increases with the temperature. The temperature, dependent on the thermovoltage, is standardised and can thus be precisely determined.

Optimal solutions:
For any industry and any application

Whether it's reliable temperature measurement in steam pipelines at power plants or the exact determination of process temperatures in chemical plants, KROHNE temperature assemblies are as versatile as the requirements and specific applications of our customers need them to be. Both tried and tested methods and the latest in production technology come into play. Thanks to this unique connection, we ensure that we can provide our customers not only with standard temperature assemblies but that we can also meet our customers' requirements for customised temperature measurement equipment.

Highly resistant and gas-tight thermocouples in the OPTITEMP series are highly insensitive to rapid temperature changes and boast good stability in reducing atmospheres. This means that the enormous thermal and mechanical loads occurring on a daily basis in many industries pose no problems.

OPTITEMP flue gas thermocouples are used in combustion processes such as those found e.g. in the iron and steel industry. They are highly resistant to abrasion. Similar elements can also be used in ovens.

Industries:

- Chemical
- Petrochemical
- Oil and gas
- Energy supply
- Machine building
- Pharmaceutical
- Food and beverage
- Water and wastewater
- Iron and steel
- Pulp and paper
- Heating, Ventilation & Air Conditioning (HVAC)

It makes no difference if there are high temperatures, extreme pressures or high flow velocities: KROHNE meets virtually every need when it comes to temperature measuring technology, ensuring maximum process certainty at the same time. Thermowells with tapered tips are as much a part of the line as metallic thermowells featuring an additional titanium or tantalum casing used, for example, in the event of high chemical exposure.

Suitable temperature assembly materials are always selected based on the various process media as regards corrosion and abrasion. Strength calculations when it comes to customer-specific thermowells can always be performed on an individual basis.

Other features such as the explosion-proof characteristic through intrinsic safety and flameproof enclosures or the SIL compliant design, contribute to the technical reliability of a wide variety of installations.

With the compact sensor range we are also able to provide advanced temperature measuring in tight areas due to its small form factor. Another benefit is no moving parts. The fast build-in transmitter is already set by factory and therefore easy to order and install without any configuration or training.

Temperature assemblies

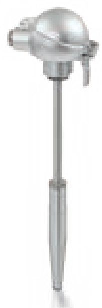
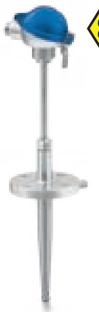
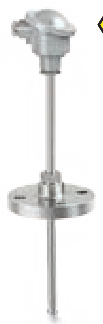
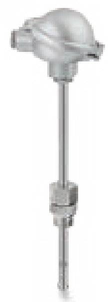
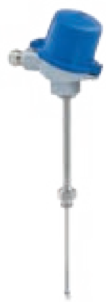
Selection from our product portfolio

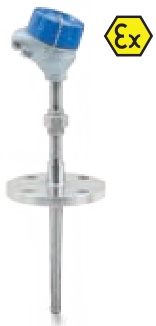
	Industrial temperature assemblies		
	Temperature assembly for compression fitting. Welded multipart thermowell, form 2.	Temperature assembly for screw-in. Welded multipart thermowell, form 2G.	Temperature assembly for screw-in. Welded multipart thermowell with reduced tip.
	OPTITEMP TRA/TCA-P10	OPTITEMP TRA/TCA-S12	OPTITEMP TRA/TCA-S22
			
Connection head			
Models	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, BUZ-HK	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, BUZ-HK	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, BUZ-HK
Cable gland/conduit thread	M20 x 1.5	M20 x 1.5	M20 x 1.5
Process thread	M24 x 1.5	M24 x 1.5	M24 x 1.5
Sensitive element			
Sensor	1, 2x Pt100 or 1, 2x TC J, K	1, 2x Pt100 or 1, 2x TC J, K	1, 2x Pt100 or 1, 2x TC J, K
Circuit type	3- or 4-wire, 3-wire with SmartSense	3- or 4-wire, 3-wire with SmartSense	3- or 4-wire, 3-wire with SmartSense
Tolerance class	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584
Design	Replaceable spring loaded mineral isolated measuring insert	Replaceable spring loaded mineral isolated measuring insert	Replaceable spring loaded mineral isolated measuring insert
Connection type	Ceramic terminal block, flying leads or temperature transmitter	Ceramic terminal block, flying leads or temperature transmitter	Ceramic terminal block, flying leads or temperature transmitter
Thermowell			
Process connection	Plug-in	G1/2, 3/4, 1, 1/2", 3/4" NPT	G1/2, 3/4, 1, 1/2", 3/4" NPT
Diameter/dimensions	Ø9, 10, 11, 12 mm; 0.35, 0.39, 0.43, 0.47"	Ø9, 10, 11, 12 mm; 0.35, 0.39, 0.43, 0.47"	Ø11, 12 mm; 0.43, 0.47"
Material	1.4571/316Ti, 1.4404/316L	1.4571/316Ti, 1.4404/316L	1.4571/316Ti, 1.4404/316L
Standard length	305, 395, 545 mm; 12, 15.5, 21.5"	160, 250, 400 mm; 6.3, 9.8, 15.8"	160, 250, 400 mm; 6.3, 9.8, 15.8"
Neck tube/holding tube			
Length	-	145 mm; 5.7" (other on request)	145 mm; 5.7" (other on request)
Connection thread	-	-	-
Approvals			
	ATEX Ex-i, (IECEx Ex-i in preparation)	ATEX Ex-i, (IECEx Ex-i in preparation)	-

Industrial temperature assemblies		High temperature assemblies	
Temperature assembly with process flange. Welded multi-part thermowell, form 2F.	Temperature assembly with process flange. Welded multi-part thermowell, form 3F.	High temperature assembly for plug-in. Metal welded multipart thermowell, t≤+1150°C; +2102°F.	High temperature assembly for plug-in. Ceramic thermowell, t≤+1600°C; +2912°F.
OPTITEMP TRA/TCA-F13	OPTITEMP TRA/TCA-F42	OPTITEMP TCA-P62	OPTITEMP TCA-P64
			
BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, BUZ-HK	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, BUZ-HK	BUZ-T, BUZ-S, AA	BUZ-T, AA
M20 x 1.5	M20 x 1.5	M20 x 1.5	M20 x 1.5
M24 x 1.5	M24 x 1.5	Ø22.3 mm; 0.9"	Ø22.3 mm; 0.9"
1, 2x Pt100 or 1, 2x TC J, K	1, 2x Pt100 or 1, 2x TC J, K	1, 2x TC J, K	1, 2x TC S, K
3- or 4-wire, 3-wire with SmartSense	3- or 4-wire, 3-wire with SmartSense	2-wire TC	2-wire TC
Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584	Class 1 acc. EN 60584	Class 1 acc. EN 60584
Replaceable spring loaded mineral isolated measuring insert	Replaceable spring loaded mineral isolated measuring insert	Replaceable spring loaded mineral isolated measuring insert	Replaceable spring loaded mineral isolated measuring insert and ceramic insert
Ceramic terminal block, flying leads or temperature transmitter	Ceramic terminal block, flying leads or temperature transmitter	Ceramic connection block, flying leads or temperature transmitter	Ceramic connection block, flying leads or temperature transmitter
DN25/PN40, DN50/PN40, ASME 1", 1 1/2", 150 lbs, 300 lbs	DN25/PN40, DN50/PN40, ASME 1", 1 1/2", 150 lbs, 300 lbs	Mounting flange acc. EN 50446 or gas tight compression fitting G3/4, 1	Mounting flange acc. EN 50446 or gas tight compression fitting G3/4, 1
Ø9, 10, 11, 12 mm; 0.35, 0.40, 0.43, 0.47"	Ø12 mm; 0.5"	Ø19, 22 mm; 0.75, 0.9"	Ø15 mm; 0.6"
1.4571/316Ti, 1.4404/316L	1.4571/316Ti	1.4762, 1.4767	C799, C610
225, 315, 465 mm; 8.9, 12.4, 18.3"	225, 315, 465 mm; 8.9, 12.4, 18.3"	500, 710, 1000, 1400, 2000 mm; 19.7, 27.9, 39.4, 55.1, 78.7"	500, 710, 1000, 1400, 2000 mm; 19.7, 27.9, 39.4, 55.1, 78.7"
80 mm; 3.1" (other on request)	82 mm; 3.2" (other on request)	-	150 mm; 5.9" (other on request)
-	-	-	-
ATEX Ex-i, (IECEx Ex-i in preparation)	(ATEX Ex-i in preparation)	-	-

Temperature assemblies

Selection from our product portfolio

	Temperature assemblies for advanced requirements, DIN standard				
	Temperature assembly for weld-in. Barstock thermowell, form 4.	Temperature assembly with process flange. Barstock thermowell, form 4F.	Temperature assembly with process flange. Welded multipart thermowell.	Temperature assembly for screw-in. Welded multipart thermowell, form 8 for union nut.	Temperature assembly without thermowell.
	OPTITEMP TRA/TCA-T30	OPTITEMP TRA/TCA-TF31	OPTITEMP TRA/TCA-TF33	OPTITEMP TRA/TCA-TS35	OPTITEMP TRA/TCA-S34
					
Connection head					
Models	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, AXD, BUZ-HK, SXD	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, AXD, BUZ-HK, SXD	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, AXD, BUZ-HK, SXD	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, AXD, BUZ-HK, SXD	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, AXD, BUZ-HK, SXD
Cable gland/ conduit thread	M20 x 1.5	M20 x 1.5	M20 x 1.5	M20 x 1.5	M20 x 1.5
Process thread	M24 x 1.5	M24 x 1.5	M24 x 1.5	M24 x 1.5	M24 x 1.5
Sensitive element					
Sensor	1, 2x Pt100 or 1, 2x TC J, K	1, 2x Pt100 or 1, 2x TC J, K	1, 2x Pt100 or 1, 2x TC J, K	1, 2x Pt100 or 1, 2x TC J, K	1, 2x Pt100 or 1, 2x TC J, K
Sensor connection	3- or 4-wire, 3-wire with SmartSense	3- or 4-wire, 3-wire with SmartSense	3- or 4-wire, 3-wire with SmartSense	3- or 4-wire, 3-wire with SmartSense	3- or 4-wire, 3-wire with SmartSense
Tolerance class	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584
Design	Replaceable spring loaded mineral isolated measuring insert	Replaceable spring loaded mineral isolated measuring insert	Replaceable spring loaded mineral isolated measuring insert	Replaceable spring loaded mineral isolated measuring insert	Replaceable spring loaded mineral isolated measuring insert
Connection type	Ceramic terminal block, flying leads or temperature transmitter	Ceramic terminal block, flying leads or temperature transmitter	Ceramic terminal block, flying leads or temperature transmitter	Ceramic terminal block, flying leads or temperature transmitter	Ceramic terminal block, flying leads or temperature transmitter
Thermowell					
Process connection	Weld-in fitting	DN25/PN40, DN50/PN40 ASME 1", 1 1/2", 150 lbs, 300 lbs	DN25/PN40, DN50/PN40 ASME 1", 1 1/2", 150 lbs, 300 lbs	G 1/2, 3/4, 1, 1/2" NPT, 3/4" NPT	-
Diameter/ dimensions	Ø24 mm; 0.94"	Ø24 mm; 0.94"	Ø9, 10, 11, 12 mm; 0.35, 0.39, 0.43, 0.47"	Ø9, 10, 11, 12 mm; 0.35, 0.39, 0.43, 0.47"	Ø6 mm; 0.24"
Material	1.4571/316Ti, 1.4404/316L, 1.7335/13CrMo44, 1.0460/C22.8	1.4571/316Ti, 1.4404/316L, 1.7335/13CrMo44, 1.0460/C22.8	1.4571/316Ti, 1.4404/316L	1.4571/316Ti, 1.4404/316L	1.4404/316L, Inconel® 600
Standard length	140, 200, 260 mm; 5.51, 7.87, 10.24"	130, 190 mm; 5.12, 7.48"	100, 170, 260, 410 mm; 3.94, 6.69, 10.24, 16.14"	100, 170, 260, 410 mm; 3.94, 6.69, 10.24, 16.14"	100, 140, 200, 260, 300, 350, 400 mm; 3.94, 5.51, 7.87, 10.24, 11.81, 13.78, 15.75"
Neck tube/holding tube					
Length	80, 145, 165, 200 mm; 3.15, 5.71, 6.50, 7.87"	80, 145, 165, 200 mm; 3.15, 5.71, 6.50, 7.87"	80, 145, 165, 200 mm; 3.15, 5.71, 6.50, 7.87"	80, 145, 165, 200 mm; 3.15, 5.71, 6.50, 7.87"	80, 145, 165, 200 mm; 3.15, 5.71, 6.50, 7.87"
Connection thread	M18 x 1.5, G1/2	M18 x 1.5, G1/2	M18 x 1.5, G1/2	G1/2, 3/4 cap nut	M18 x 1.5, G1/2, 3/4 cap nut
Approvals					
	ATEX Ex-i (-d, IECEx-i, -d in preparation)	ATEX Ex-i (-d, IECEx-i, -d in preparation)	ATEX Ex-i (IECEx-i in preparation)	ATEX Ex-i (IECEx-i in preparation)	ATEX Ex-i (IECEx-i in preparation)

	Temperature assemblies for advanced requirements, ASME standard				
	Temperature assembly without thermowell.	Temperature assembly for screw-in. Tapered barstock tip.	Temperature assembly for screw-in. Reduced barstock tip.	Temperature assembly with process flange. Tapered barstock tip.	Temperature assembly with process flange. Reduced barstock tip.
	OPTITEMP TRA/TCA-S50	OPTITEMP TRA/TCA-TS53	OPTITEMP TRA/TCA-TS54	OPTITEMP TRA/TCA-TF56	OPTITEMP TRA/TCA-TF57
					
Connection head					
Models	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, AXD, SXD	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, AXD, SXD	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, AXD, SXD	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, AXD, SXD	BA, BUZ-T, BUZ-S, BUZ-H, BUZ-HW (display), BGK, BBK, BVA, AXD, SXD
Cable gland/ conduit thread	1/2" NPT, M20 x 1.5	1/2" NPT, M20 x 1.5	1/2" NPT, M20 x 1.5	1/2" NPT, M20 x 1.5	1/2" NPT, M20 x 1.5
Process thread	1/2" NPT, G1/2	1/2" NPT, G1/2	1/2" NPT, G1/2	1/2" NPT, G1/2	1/2" NPT, G1/2
Sensitive element					
Sensor	1, 2x Pt100 or 1, 2x TC J, K	1, 2x Pt100 or 1, 2x TC J, K	1, 2x Pt100 or 1, 2x TC J, K	1, 2x Pt100 or 1, 2x TC J, K	1, 2x Pt100 or 1, 2x TC J, K
Sensor connection	3- or 4-wire, 3-wire with SmartSense	3- or 4-wire, 3-wire with SmartSense	3- or 4-wire, 3-wire with SmartSense	3- or 4-wire, 3-wire with SmartSense	3- or 4-wire, 3-wire with SmartSense
Tolerance class	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584	Class A, B, 1/3 DIN B, 1/10 DIN B acc. EN 60751, class 1 acc. EN 60584
Design	Replaceable spring loaded mineral isolated measuring insert	Replaceable spring loaded mineral isolated measuring insert	Replaceable spring loaded mineral isolated measuring insert	Replaceable spring loaded mineral isolated measuring insert	Replaceable spring loaded mineral isolated measuring insert
Connection type	Ceramic terminal block, flying leads or temperature transmitter	Ceramic terminal block, flying leads or temperature transmitter	Ceramic terminal block, flying leads or temperature transmitter	Ceramic terminal block, flying leads or temperature transmitter	Ceramic terminal block, flying leads or temperature transmitter
Thermowell					
Process connection	G1/2, 1/2" NPT	G1/2, 3/4, 1, 1/2" NPT, 3/4" NPT	G1/2, 3/4, 1, 1/2" NPT, 3/4" NPT	DN25/PN40, DN50/PN40, ASME 1", 1 1/2", 2", 150, 300, 600 lb	DN25/PN40, DN50/PN40, ASME 1", 1 1/2", 2", 150, 300, 600 lb
Diameter/ dimensions	Ø6 mm; 0.24"	Ø16, 22 mm; 0.63, 0.87"	Ø16, 22 mm; 0.63, 0.87"	Ø22, 25 mm; 0.87, 0.98"	Ø12, 19, 23 mm; 0.47, 0.75, 0.91"
Material	1.4404/316L, Inconel® 600	1.4571/316Ti, 1.4404/316L	1.4571/316Ti, 1.4404/316L	1.4571/316Ti, 1.4404/316L	1.4571/316Ti, 1.4404/316L
Standard length	100, 150, 200, 250, 300, 350, 400 mm; 3.94, 5.91, 7.87, 9.84, 11.81, 13.78, 15.75"	100, 150, 200, 250, 300, 350, 400 mm; 3.94, 5.91, 7.87, 9.84, 11.81, 13.78, 15.75"	100, 150, 200, 250, 300, 350, 400 mm; 3.94, 5.91, 7.87, 9.84, 11.81, 13.78, 15.75"	100, 150, 200, 250, 300, 350, 400 mm; 3.94, 5.91, 7.87, 9.84, 11.81, 13.78, 15.75"	100, 150, 200, 250, 300, 350, 400 mm; 3.94, 5.91, 7.87, 9.84, 11.81, 13.78, 15.75"
Neck tube/holding tube					
Length	76, 102, 152, 165 mm; 3, 4, 6, 6.5"	76, 102, 152, 165 mm; 3, 4, 6, 6.5"	76, 102, 152, 165 mm; 3, 4, 6, 6.5"	76, 102, 152, 165 mm; 3, 4, 6, 6.5"	76, 102, 152, 165 mm; 3, 4, 6, 6.5"
Connection thread	G1/2, 1/2" NPT	G1/2, 1/2" NPT	G1/2, 1/2" NPT	G1/2, 1/2" NPT	G1/2, 1/2" NPT
Approvals					
	ATEX Ex-i (-d, IECEx-i, -d in preparation)	ATEX Ex-i (-d, IECEx-i, -d in preparation)	ATEX Ex-i (-d, IECEx-i, -d in preparation)	ATEX Ex-i (-d, IECEx-i, -d in preparation)	ATEX Ex-i (-d, IECEx-i, -d in preparation)

Temperature assemblies

Selection from our product portfolio

	Compact sensors			Hygienic temperature assemblies	Cable sensors
	Hygienic compact sensor with flange.	Compact sensor for screw-in with valve connector.	Compact sensor for screw-in with M12 connector.	Hygienic temperature assembly with replaceable insert.	Cable sensor for clamp-on. Surface temperature t≤+200°C; +392°F.
	OPTITEMP TRA-C10	OPTITEMP TRA-C20	OPTITEMP TRA-C30	OPTITEMP TRA-H20	OPTITEMP TRA-W30
					
Connection head					
Models	With or without integrated transmitter	With or without integrated transmitter	With or without integrated transmitter	BA, BVA	No head required
Cable gland/ electrical connection	M12 connector	Valve connector EN 175301-803	M12 connector	M20 x 1.5	-
Process thread	-	-	-	M24 x 1.5	-
Sensitive element					
Sensor connection	1 x Pt100	1 x Pt100	1 x Pt100	1, 2 x Pt100	1, 2 x Pt100 / 1 x Pt1000
Circuit type	3-wire RTD, 4-wire on request	3-wire RTD, 4-wire on request	3-wire RTD, 4-wire on request	3- or 4-wire RTD	3- or 4-wire RTD
Tolerance class	Class A acc. EN 60751	Class A acc. EN 60751	Class A acc. EN 60751	Class A acc. EN 60751	Class A acc. EN 60751
Design	Non replaceable RTD	Non replaceable RTD	Non replaceable RTD	Replaceable spring loaded mineral isolated measuring insert	Non replaceable RTD sensor
Connection type	-	-	-	Ceramic terminal block, flying leads or temperature transmitter	Flying leads, Teflon cable
Thermowell					
Process connection	ISO 2852 DN25/38	G1/2 (other on request)	G1/2 (other on request)	ISO 2852 DN25/38	Clamp-on
Diameter/dimensions	Ø6 mm; 0.24"	Ø6 mm; 0.24"	Ø6 mm; 0.24"	Ø6, 10 mm; 0.24, 0.39"	Block 26x18x50 mm; 1.02x0.71x1.97"
Material	1.4404/316L Ra ≤0.8 µm, Ra ≤0.4 µm on request	1.4404/316L	1.4404/316L	1.4404/316L	PTFE/Copper
Standard length	50, 100 mm; 2, 4" (other on request)	50, 100 mm; 2, 4" (other on request)	50, 100 mm; 2, 4" (other on request)	50, 100 mm; 2, 4" (other on request)	-
Neck tube/holding tube					
Length	-	-	-	50 mm; 2"	-
Connection thread	-	-	-	-	-
Approvals					
	-	-	-	-	-

Cable sensors			HVAC temperature sensors		Mineral insulated thermocouples	
Cable sensor for screw-on. Surface temperature t≤+300°C; +572°F.	Cable sensor for screw-in. M6 or M8 bolt.	Cable sensor with bayonet fitting.	HVAC temperature sensor for wall mounting.	HVAC temperature sensor for air ducts/ pipes applications.	Mineral insulated thermocouple with mini thermo plug.	Mineral insulated cable thermocouple.
OPTITEMP TRA-W40	**OPTITEMP TRA-W50**	**OPTITEMP TRA-W70**	**OPTITEMP TRA-V20**	**OPTITEMP TRA-V30**	**OPTITEMP TCA-M50**	**OPTITEMP TCA-M70**
						
No head required	No head required	No head required	64x58x34 mm; 2.52x2.28x1.34", Alu box, IP65	64x58x34 mm; 2.52x2.28x1.34", Alu box, IP65	No head required	No head required
-	-	-	PG9	PG9	-	-
Ø5.5 mm; 0.22'' assembly hole	-	Bayonet nipple	-	-	-	-
1, 2 x Pt100 / 1 x Pt1000	1, 2 x Pt100 or 1 x Pt1000	1 x Pt100	1 x Pt100 / Pt1000	1 x Pt100 / Pt1000	1, 2 x TC J, K, N, grounded/isolated	1, 2 x TC J, K, N, grounded/isolated
3-, 4-wire RTD	2-, 3-, 4-wire RTD	3-wire RTD	3-wire RTD	3-wire RTD	2-wire TC	2-wire TC
Class A, acc. EN 60751	Class A, acc. EN 60751	Class A, acc. EN 60751	Class A, acc. EN 60751	Class A, acc. EN 60751	Class 1 acc. EN 60584	Class 1 acc. EN 60584
Non replaceable RTD sensor	Non replaceable RTD sensor	Non replaceable RTD sensor	Non replaceable RTD sensor	Non replaceable RTD sensor	Non replaceable TC sensor	Non replaceable TC sensor
Flying leads, Elexar cable	Flying leads, PVC, Silicon, Teflon cables	Flying leads, Teflon cable	Ceramic terminal block or temperature transmitter	Ceramic terminal block or temperature transmitter	Mini thermo plug	Flying leads or thermo plug
Screw-on	Screw-in bolt	Bayonet nipple M12 x 1	Wall-mounted	Plug-in, compression fitting, thermowell (G1/2 connection), bushing, mounting flange	Plug-in, compression fitting M8, G1/8, 1/4, 1/2	Plug-in, compression fitting M8, G1/8, 1/4, 1/2
Block 8x10x40 mm; 0.31x0.39x1.57"	M6, M8	Ø6 mm; 0.24"	Ø6 mm; 0.24"	Ø6 mm; 0.24"	Ø1, 1.5, 3 mm; 0.04, 0.06, 0.12"	Ø1, 1.5, 3, 4.5, 6 mm; 0.04, 0.06, 0.12, 0.16, 0.20, 0.24"
Copper, 1.4404/316L	1.4404/316L	Brass, Ni-coated	Brass (perforated as option)	Brass	AISI 310/ 1.4841, Inconel® 600/ 2.4816, Pyrosil®	AISI 310/ 1.4841, Inconel® 600/ 2.4816, Pyrosil®
-	15, 25, 30 mm; 0.6, 1.0, 1.2"	25 mm; 1.0"	50, 150 mm; 2, 6"	50, 100, 150, 200, 300 mm; 2, 4, 6, 8, 12"	500, 1000, 1500, 2000, 2500, 3000, 5000, 7500, 10000 mm; 20, 40, 59, 79, 98, 118, 197, 295, 394"	500, 1000, 1500, 2000, 2500, 3000, 5000, 7500, 10000 mm; 20, 40, 59, 79, 98, 118, 197, 295, 394"
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	–	-	-	-	-

OPTITEMP TT 10 C, TT 10 C Ex OPTITEMP TT 10 R
Analogue, adjustable 2-wire transmitters for Pt100
or thermocouple with current output

OPTITEMP TT 11 C OPTITEMP TT 11 R
Analogue, adjustable 3-wire transmitters
for Pt100 or Pt1000 with voltage output

OPTITEMP TT 20 C
Analogue, programmable
2-wire transmitter for Pt100
with current output

OPTITEMP TT 30 C, TT 30 C Ex OPTITEMP TT 30 R, TT 30 R Ex
Universal, programmable 2-wire transmitters for thermocouples
and resistance sensors with current output

OPTITEMP TT 50 R OPTITEMP TT 50 C, TT 50 C Ex
Universal, programmable 2-wire HART® transmitters for themocouples
and resistance sensors with current output

OPTITEMP TT 31 R, TT 31 R Ex
1- or 2-channel universal, programmable 2-wire transmitters for thermocouples and resistance sensors with current output

OPTITEMP TT 40 C OPTITEMP TT 40 R
Highly precise, universal, programmable 2-wire transmitters for thermocouples and resistance sensors with current output

OPTITEMP TT 32 R
Universal, programmable 4-wire transmitter for thermocouples and resistance sensors with current and voltage output

OPTITEMP TT 51 C, TT 51 C Ex OPTITEMP TT 51 R, TT 51 R Ex
Highly precise, universal, programmable 2-wire HART® transmitters for thermocouples and resistance sensors with current output, full assessment on SIL2 according to IEC 61508:2010

OPTITEMP TT 60 C, TT 60 C Ex OPTITEMP TT 60 R
Highly precise, universal, programmable PROFIBUS® transmitters for thermocouples and resistance sensors

Temperature transmitters

Precision that stands the test of time

Our engineers are constantly researching and developing with the goal of combining innovative technology, superior user friendliness and above all, long-lasting reliability. The success is tangible! With the new generation of OPTITEMP TT 51 temperature transmitters, KROHNE has once again set the standard when it comes to measuring accuracy and maximum measurement stability.

Just one of many good examples

Thanks to its rugged design and the sensor backup function, the OPTITEMP TT 51 temperature transmitter fulfils its duties reliably and precisely, especially over the long term. External influences such as the ambient temperature, vibrations, moisture or electromagnetic interference have almost no influence on the measuring result.

Right down to the smallest detail, KROHNE's innovative measurement technology comes out on top in market comparisons. This holds true whether it comes to simple configuration, installation, maintenance or the currently one-of-a-kind isolation resistance monitoring (SmartSense) used to detect moisture in the isolation. SIL2 approval and NAMUR compatibility mean that the OPTITEMP TT 51 can be used without difficulty over the long term, even in safety-oriented applications.

OPTITEMP TT 51 C OPTITEMP TT 51 R

Visit **optitempTT51.krohne.com** for more information.

Minimal tolerance for maximum accuracy

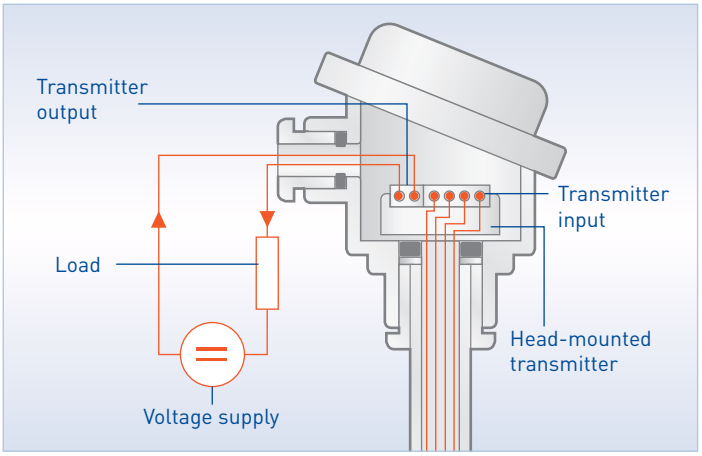
In 1974, INOR launched the world's first temperature transmitter that could be built into the connection head of a temperature assembly. This breakthrough made it possible to convert the sensitive sensor signal directly at the measuring station into a fail-safe current and to relay it undisturbed over long distances. This also meant that special compensating lines and thermo-couple wires could be eliminated for thermocouples.

Highlights:

- Fits any B-connection head and on the rail
- Analogue temperature transmitters for simple, low cost applications
- Digital, universally programmable state-of-the-art transmitters for demanding applications
- HART® 6 compatible transmitter variants
- Transmitters with PROFIBUS® interface
- SIL2-approved design
- High accuracy, reliability and long-term stability
- Extensive diagnostics functions
- Intrinsically safe design with ATEX, FM and CSA approval
- High galvanic isolation
- Easy installation
- Rugged design

The measuring principle

Temperature assemblies have just one small, sensitive output signal. Temperature transmitters convert that signal into a standardised current signal, proportional to the temperature, that can be transported over long distances without problem. 2-wire transmitters get the required energy from the loop. Their output current of 4...20 mA corresponds to the measuring signal and is always proportional to the temperature. Resistance sensors and different types of thermocouples can be connected to the transmitter input. Head-mounted transmitters are built into the connection head of a temperature assembly. If the ambient temperature is too high, a rail-mounted variant is used for the control cabinet.



Industries:

- Chemical
- Petrochemical
- Oil and gas
- Energy supply
- Machine building
- Pharmaceutical
- Food and beverage
- Water and wastewater
- Iron and steel
- Pulp and paper
- Heating, Ventilation & Air Conditioning (HVAC)

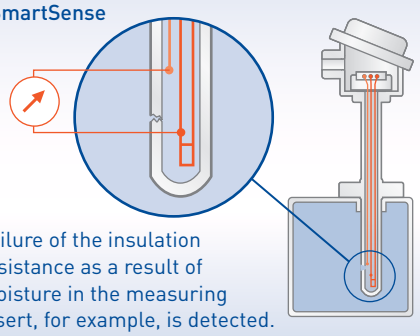
Maximum reliability for permanent best results

With the OPTITEMP series, KROHNE always offers customers more than just temperature measuring devices. Depending on the type, our transmitters feature a variety of diagnostic functions which allow users to address the following problems with a high degree of certainty:

- low sensor isolation resistance
- sensor break
- sensor short-circuit
- sensor drift

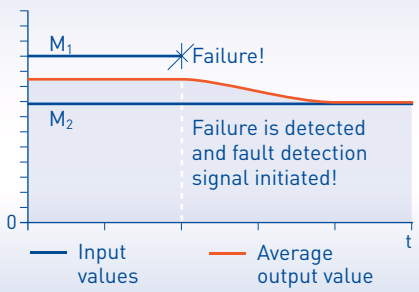
In addition, our dual-input transmitters feature a sensor backup function which allows them to actively intervene in the case of a malfunction of one sensor by automatically switching to the other sensor. With the help of the sensor error correction, temperature measurement errors can be corrected by adjusting the transmitter. Furthermore, depending on the type of transmitter there is the option of an individual linearisation of characteristics to help achieve maximum compliance to any connected sensor.

Insulation resistance monitoring SmartSense



Failure of the insulation resistance as a result of moisture in the measuring insert, for example, is detected.

Sensor backup with dual measurement



Head-mounted transmitters

	Analogue, adjustable 2-wire transmitter for Pt100 with current output.	Analogue, adjustable 3-wire transmitter for Pt100 or Pt1000 with voltage output.	Analogue, programmable 2-wire transmitter for Pt100 with current output.	Universally, programmable 2-wire transmitters for thermocouples and resistance sensor with current output.
	OPTITEMP TT 10 C, OPTITEMP TT 10 C Ex	**OPTITEMP TT 11 C**	**OPTITEMP TT 20 C**	**OPTITEMP TT 30 C, OPTITEMP TT 30 C Ex**
				
Resistance sensor	Pt100	Pt100, Pt1000	Pt100	Pt100, Pt1000, Ni100, Ni120, Ni1000, Cu10
Input	3-wire	3-wire	3-wire	3- and 4-wire
Thermocouples	J, L, T, K, N	-	-	B, C, E, J, K, L, N, R, S, T, U
Miscellaneous	-	-	-	-10...+500 mV, potentiometer 0...2000 Ω
2nd input	-	-	-	-
Smallest measuring span	+50°C; +122°F	+50°C; +122°F	+20°C; +68°F	+10°C; +50°F
Outputs	4...20 mA	0...10 V	4...20 mA	4...20 mA/20...4 mA
Communication	-	-	-	-
Measurement accuracy	0.15% of the measuring span	0.15% of the measuring span	0.1% of the measuring span	0.1% of the measuring span
Galvanic isolation	-	-	-	1500 VAC
Power supply	6.5...32 VDC	15...30 VDC	8.5...32 VDC	6.5...36 VDC
Configuration	Solder bridges	Solder bridges	PC configuration	PC configuration
Ambient temperature	-40...+85°C; -40...+185°F	-40...+85°C; -40...+185°F	-40...+85°C; -40...+185°F	-40...+85°C; -40...+185°F
Diagnostic functions				
Sensor failure detection	x	x	x	x
Isolation monitoring SmartSense	-	-	-	x
Sensor drift detection	-	-	-	-
Sensor backup function	-	-	-	-
Sensor error correction	-	-	x	x
NAMUR conformity	NE 21*	NE 21*	NE 21*	NE 21*, 43
Approvals	Ex	-	-	Ex
	OPTITEMP TT 10 C Ex			**OPTITEMP TT 30 C Ex**
ATEX	II 1 G Ex ia IIB T4-T6	-	-	II 1 G Ex ia IIC T4-T6
FM	-	-	-	-
CSA	-	-	-	-
Ex power supply	8.5...30 VDC	-	-	8...30 VDC

	Highly precise, universally, programmable 2-wire transmitters for thermocouples and resistance sensors with current output.	Universally programmable 2-wire HART® transmitters for thermocouples and resistance sensors with current output.	Highly precise, universally, programmable 2-wire HART® transmitters for thermocouples and resistance sensors with current output, full assessment on SIL2 according to IEC 61508:2010	Highly precise, universally programmable PROFIBUS® transmitters for thermocouples and resistance sensors.
	OPTITEMP TT 40 C	**OPTITEMP TT 50 C, OPTITEMP TT 50 C Ex**	**OPTITEMP TT 51 C, OPTITEMP TT 51 C Ex**	**OPTITEMP TT 60 C, OPTITEMP TT 60 C Ex**
				
Resistance sensor	Pt100, Pt1000, Ni100, Ni120, Ni1000, Cu10	Pt100/1000, Ni100/1000	Pt10/50/100/200/500/1000, Ni100/120/1000, Cu10	Pt10/50/100/200/500/1000, Ni50/100/120/1000
Input	3- and 4-wire	2-, 3- and 4-wire	2-, 3- and 4-wire	2-, 3- and 4-wire
Thermocouples	B, C, E, J, K, L, N, R, S, T, U	B, E, J, K, L, U, N, R, S, T	B, C, D, E, J, K, L, N, R, S, T, U	B, C, D, E, J, K, L, N, R, S, T, U
Miscellaneous	-10...+500 mV, potentiometer 0...2000 Ω	-10...+500 mV, potentiometer 0...2000 Ω	-10...+1000 mV, potentiometer 0...4000 Ω 2 x Pt100 (2/3-wire)	-10...+1000 mV, potentiometer 0...4000 Ω 2 x Pt100 (2/3-wire)
2nd input	-	-	x	x
Smallest measuring span	+10°C; +50°F	+10°C; +50°F	+10°C; +50°F	-
Outputs	4...20 mA/20...4 mA	4...20 mA/20...4 mA	4...20 mA/20...4 mA	Digital
Communication	-	HART®	HART®	PROFIBUS®
Measurement accuracy	0.05% of the measuring span	0.1% of measuring span	0.05% of the measuring span	Pt100: 0.1°C; 32.2°F, T/C J, K, N, T: 0.2°C; 32.4°F, T/C R, S: 0.7°C; 33.3°F
Galvanic isolation	3750 VAC	1500 VAC	1500 VAC	1500 VAC
Power supply	6.5...36 VDC	10...42 VDC	10...36 VDC	PROFIBUS® supply
Configuration	PC configuration	PC configuration/HART®	PC configuration/HART®	PC configuration/ PROFIBUS®
Ambient temperature	-40...+85°C; -40...185°F	-40...+85°C; -40...185°F	-40...+85°C; -40...185°F	-40...+85°C; -40...185°F
Diagnostic functions				
Sensor failure detection	x	x	x	x
Insulation monitoring SmartSense	x	x	x	x
Sensor drift detection	-	-	x	x
Sensor backup function	-	-	x	x
Sensor error correction	x	-	x	x
NAMUR conformity	NE 21*, 43	NE 21*, 43	NE 21, 43, 53, 89, 107	NE 21*
Approvals	-	-	Ex, SIL2	Ex
		OPTITEMP TT 50 C Ex	**OPTITEMP TT 51 C Ex**	**OPTITEMP TT 60 C Ex**
ATEX	-	II 1 G Ex ia IIC T4-T6	II 1 G Ex ia IIC T4-T6	II 1 G Ex ia IIC T4-T6
FM	-	-	In preparation	-
CSA	-	-	In preparation	-
Ex power supply	-	12...30 VDC	10...30 VDC	PROFIBUS® supply

x = available, - = not available

* Tested from 150 kHz in accordance with EN 61000-4-6

Rail-mounted transmitters

	Analogue, adjustable, 2-wire transmitters for Pt100 with current output.	Analogue, adjustable 3-wire transmitters for Pt100 or Pt1000 with voltage output.	Universally, programmable 2-wire transmitters for thermocouples and resistance sensors with current output.	1- or 2-channel universally programmable 2-wire transmitters for thermocouples and resistance sensors with current output.
	OPTITEMP TT 10 R	**OPTITEMP TT 11 R**	**OPTITEMP TT 30 R, TT 30 R Ex**	**OPTITEMP TT 31 R, TT 31 R Ex**
				
Resistance sensor	Pt100	Pt100, Pt1000	Pt100, Pt1000, Ni100, Ni120, Ni1000, Cu10	Pt100, Pt1000, Ni100, Ni120, Ni1000, Cu10
Input	3-wire	3-wire	3- and 4-wire	3- and 4-wire
Thermocouples	-	-	B, C, E, J, K, L, N, R, S, T, U	B, C, E, J, K, L, N, R, S, T, U
Miscellaneous	-	-	-10...+ 500 mV, potentiometer 0...2000 Ω	-10...+ 500 mV, potentiometer 0...2000 Ω
2nd input	-	-	-	1 or 2 separate channels
Smallest measuring span	+50°C; +122°F	+50°C; +122°F	+10°C; +50°F	+10°C; +50°F
Outputs	4...20 mA	0...10 V	4...20 mA/20...4 mA	4...20 mA/20...4 mA
Communication	-	-	-	-
Measuring accuracy	0.15% of the measuring span	0.15% of the measuring span	0.1% of the measuring span	0.1% of the measuring span
Galvanic isolation	-	-	1500 VAC	1500 VAC
Power supply	6.5...32 VDC	15...30 VDC	7.5...36 VDC	8...36 VDC
Configuration	Solder bridges	Solder bridges	PC configuration	PC configuration
Ambient temperature	-20...+70°C; -4...+158°F	-20...+70°C; -4...+158°F	-20...+70°C; -4...+158°F	-20...+70°C; -4...+158°F
Diagnostic functions				
Sensor failure detection	x	x	x	x
Isolation monitoring SmartSense	-	-	-	-
Sensor drift detection	-	-	-	-
Sensor backup function	-	-	-	-
Sensor error correction	-	-	x	x
NAMUR conformity	NE 21*	NE 21*	NE 21*, 43	NE 21*, 43
Approvals	-	-	Ex	Ex
			OPTITEMP TT 30 R Ex	**OPTITEMP TT 31 R Ex**
ATEX	-	-	II (1) G [Ex ia] IIC	II (1) G [Ex ia] IIC II (1) D [Ex iaD]
FM	-	-	-	-
CSA	-	-	-	-
Ex ambient temperature	-	-	-20...+70°C; -4...+158°F	-20...+60°C; -4...+140°F
Ex power supply	-	-	8...30 VDC	8...36 VDC

Universally programmable 4-wire transmitter for thermocouples and resistance sensors with current and voltage output.	Highly precise, universally, programmable 2-wire transmitters for thermocouples and resistance sensors with current output.	Universally programmable 2-wire HART® transmitters for thermocouples and resistance sensors with current output.	Highly precise, universally, programmable 2-wire HART® transmitters for thermocouples and resistance sensors with current output, full assessment on SIL2 according to IEC 61508:2010	Highly precise, universally programmable PROFIBUS® transmitters for thermocouples and resistance sensors.
OPTITEMP TT 32 R	**OPTITEMP TT 40 R**	**OPTITEMP TT 50 R, TT 50 R**	**OPTITEMP TT 51 R, TT 51 R Ex**	**OPTITEMP TT 60 R**
				
Pt100, Pt1000, Ni100, Ni120, Ni1000, Cu10	Pt100, Pt1000, Ni100, Ni120, Ni1000, Cu10	Pt100/1000, Ni100/1000	Pt10/50/100/200/ 500/1000, Ni100/120/1000, Cu10	Pt10/50/100/200/ 500/1000, Ni 50/100/120/1000
3- and 4-wire	3- and 4-wire	2-, 3- and 4-wire	2-, 3- and 4-wire	2-, 3- and 4-wire
B, C, E, J, K, L, N, R, S, T, U	B, C, E, J, K, L, N, R, S, T, U	B, E, J, K, L, U, N, R, S, T	B, C, E, J, K, L, N, R, S, T, U	B, C, D, E, J, K, L, N, R, S, T, U
-10...+ 500 mV, -10...+50 V, -1...50 mA, potentiometer 0...8000 Ω	-10...+ 500 mV, potentiometer 0...2000 Ω	-10...+500 mV, potentiometer 0...2000 Ω	-10...+ 1000 mV, potentiometer 0...4000 Ω; 2 x Pt100 (2/3/4-wire)	-10...+ 1000 mV, potentiometer 0...4000 Ω; 2 x Pt100 (2/3-wire)
-	-	-	x	x
+10°C; +50°F°	+10°C; +50°F	+10°C; +50°F	+10°C; +50°F	-
4...20 mA/20...4 mA; 0/2...10 V/10...2/0 V	4...20 mA/20...4 mA	4...20 mA/20...4 mA	4...20 mA/20...4 mA	Digital
-	–	HART®	HART®	PROFIBUS®
0.10% of the measuring span	0.05% of the measuring span	0.1% of measuring span	0.05% of the measuring span	Pt100: 0.1°C; 32.2°F, T/C J, K, N, T: 0.2°C; 32.4°F, T/C R, S: 0.7°C; 33.3°F
4000 VAC	3750 VAC	1500 VAC	1500 VAC	1500 VAC
20 ... 30 VDC, 110 ... 220 VDC, 90 ... 250 VAC	7.5...36 VDC	10...42 VDC	10...36 VDC	PROFIBUS® supply
PC configuration	PC configuration	PC configuration/HART®	PC configuration/HART®	PC configuration/ PROFIBUS®
-20...+70°C; -4...+158°F	-20...+70°C; -4...+158°F	-20...+70°C; -4...+158°F	-20...+70°C; -4...+158°F	-20...+70°C; -4...+158°F
x	x	x	x	x
x	x	x	x	x
-	-	-	x	x
-	-	-	x	x
x	x	-	x	x
NE 21*, 43	NE 21*, 43	NE 21*, 43	NE 21, 43, 53, 89, 107	NE 21*
-	-	-	Ex, SIL2	-
			OPTITEMP TT 51 R Ex	
-	-	-	II 2(1) G Ex ia IIC T4-T6	-
-	-	-	In preparation	-
-	-	-	In preparation	-
-	-	-	-20...+70°C; -4...+158°F	-
-	-	-	10...30 VDC	-

x = available, - = not available

* Tested from 150 kHz in accordance with EN 61000-4-6

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KROHNE services

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Beyond the highest requirements

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Communicaton at KROHNE: Open for the future

Industrial automation in the process industry has been undergoing rapid change for the past twenty years. This has also affected industrial measurement technology. Where it was once centralized and largely self-contained structures that dominated, today the pace is set by intelligent, decentralized architectures. Thus, system concepts in which the products of a variety of manufacturers work harmoniously together are becoming a reality via open, standard interfaces such as HART®, PROFIBUS® and FOUNDATION™ fieldbus.

KROHNE has been actively following this development for years. Whether we are talking about flow measurement, level measurement, temperature measurement or analytical measuring technology, KROHNE field devices are open for the future. They communicate reliably with controllers, control systems and PCs and can also be used for a variety of control and regulating tasks.

Online configurator
To select your temperature transmitter down to the last detail, take advantage of our online platform Configure It. It allows you to quickly and conveniently find the product that is right for you, check its availability and request a non-binding quote. For more information on Configure It go to **www.krohne-direct.com**

Integration is a top priority at KROHNE

But KROHNE field devices are capable of much more. They meet all of the prerequisites for integration into plant asset management systems. And they allow the supplying of serious integration technologies such as DD/EDD and FDT/DTM.

What's so special about FDT/DTM? For the first time, open, bus-independent integration of field technology into the plant asset management system is possible – this is without a doubt a milestone for industrial communication and KROHNE, a long-standing member of PACTware™ and the FDT group, has played and continues to play a significant role. So it is no wonder that, we have made DTMs available for our field units with HART® and/or PROFIBUS® interfaces since the beginning of 2003.

KROHNE proved: Expect more – achieve more

Every one of our temperature assemblies is given a thorough inspection before leaving one of our global manufacturing facilities.

We call these specific measurements, tests and factory inspections "KROHNE proved". They go well beyond any legal requirements, thus guaranteeing our customers not only compliance with specified technical data but also the precise and reliable use of our devices under extremely difficult conditions.

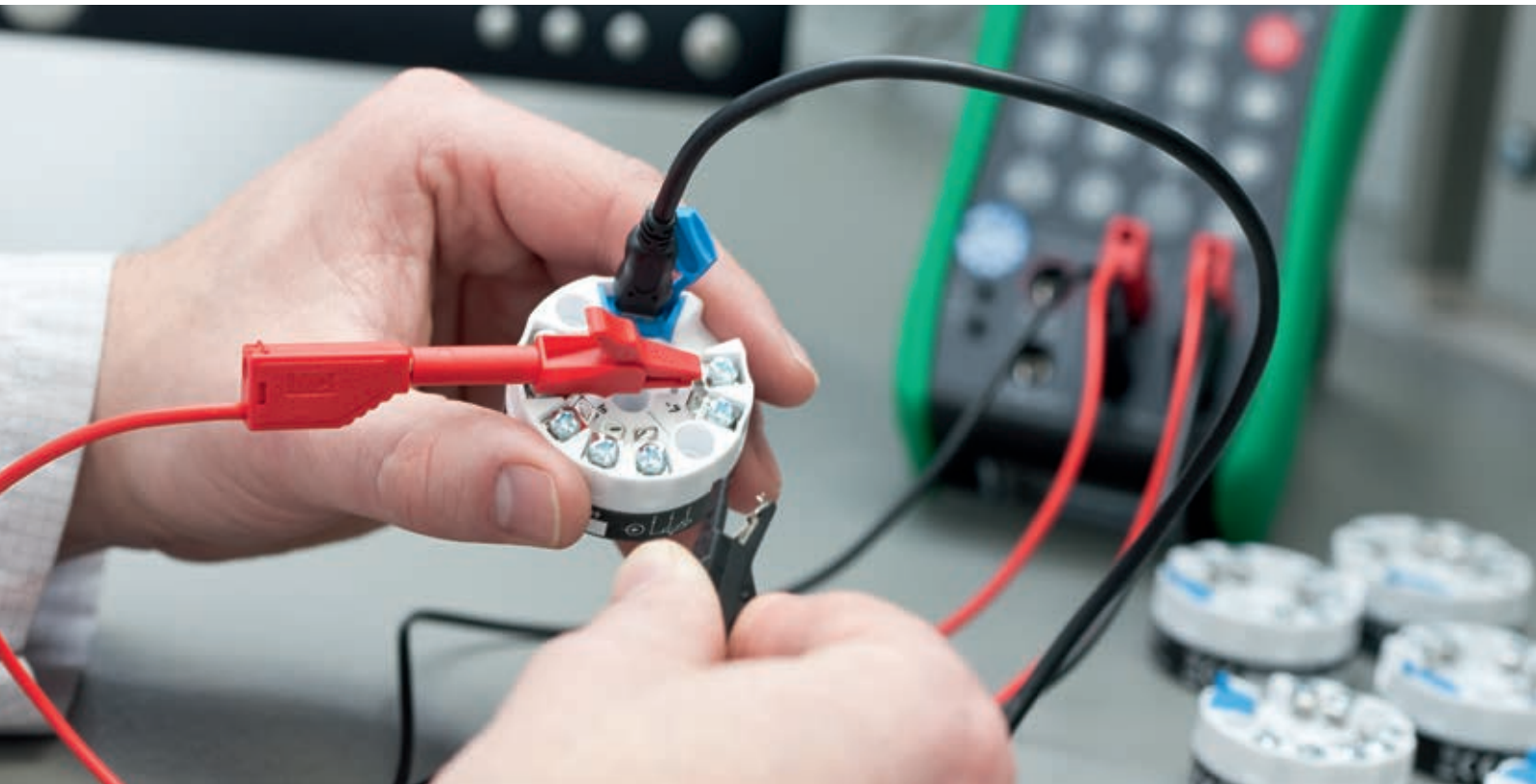
The true quality of a temperature assembly can only be judged under the most difficult conditions such as rapid temperature changes, high ongoing temperatures, vibration, high pressures and flow velocities as well as aggressive products. That is why we at KROHNE do everything to ensure that our temperature assemblies come out shining even in extreme conditions, demonstrating maximum accuracy, reliability and repeatability.

And we pay special attention to the careful manufacture of our measuring inserts as they are instrumental to the accuracy of our temperature assemblies. They are manufactured using mineral isolated cables and are subject to strict quality controls including the measurement of insulation resistance and checking for adherence to the required tolerance class.

Customising temperature assemblies have for a long time been our expertise area, everything from high volume OEM sensor to multipoint sensors for advanced applications.

So not only can we support you with quality assured production of sensor but also design solutions for your temperature measurement. Welcome, challenge us.

Configuring an OPTITEMP transmitter



KROHNE – Process instrumentation and Measurement solutions

- Flow
- Level
- Temperature
- Pressure
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