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THERMOCOUPLES, RESISTANCE THERMOMETERS AND THERMOWELLS



GEFRAN

BEYOND TECHNOLOGY



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More than fifty years of experience, an organisation with a strong focus on the customer's needs and constant technological innovation have made Gefran a benchmark in the design and production of sensors, systems and components for industrial process automation and control. Expertise, flexibility and process quality are the factors that distinguish Gefran in the production of integrated tools and systems for specific applications in various fields of industry, with consolidated know-how in the plastics, mobile hydraulics, heating and lift sectors.

Technology, innovation and versatility represent the catalogue's added value, in addition to the ability to create specific application solutions in association with the world's leading machine manufacturers.

PRESENTATION

EXPERIENCE

Gefran has been designing and manufacturing its own thermocouples and thermistors for over 35 years, covering a wide temperature range (-200 ÷ +2000 °C) in all application sectors. The experience gained by the technical and production staff, thanks to more than 5000 special versions produced in the last 10 years alone, makes Gefran the ideal partner for the production of customised probes and those using special materials.

QUALITY

All Gefran thermocouples and thermistors are made in Italy, in the Provaglio d'Iseo plant in the province of Brescia, in thermally controlled departments. Some special versions are made directly in the SIT in-house laboratory, to control temperature and humidity conditions.

The use of high-quality raw materials also results in reliable and safe sensors. For instance, all thermocouples with mineral oxide insulation are made with tolerance class 1 thermoelements (ref. IEC60584-2). In regard to thermistors, it is possible to manufacture sensors with a tolerance class of up to 1/10 °C with an accuracy of 0.03 °C at 0 °C (ref. DIN43760, IEC751).

APPLICATION SECTORS



PHARMACEUTICAL



INDUSTRIAL FURNACES



CLIMATE CELLS



FOOD AND CANNING



INJECTION-EXTRUSION
BLOW MOULDING



PROCESSES FOR ALUMINIUM,
CERAMICS, HEAT TREATMENTS



WOODWORKING



METALLURGICAL INDUSTRY
HEAT PROCESSING



MEDICAL /
LABORATORIES



GLASS
PRODUCTION

OPERATING PRINCIPLES

THERMOELECTRIC THERMOMETERS (THERMOCOUPLES)

Thermoelectric thermometers, commonly referred to as thermocouples (TC), consist of two metal conductors made of different materials which, toer temperature, generate a fem electromotive force. The principle behind thermocouples is Seebeck's thermoelectric effect, who discovered that, in a circuit formed by two different metal conductors A and B, when the two junctions are at different temperatures T1 and T2, a current I circulates in the circuit, produced by an electromotive force, the magnitude of which is directly proportional to the temperature difference between the two junctions.

Gefran thermocouples cover all of the most common types of temperature sensors, from low-temperature versions to those with a thermoelectric couple made of platinum and protective sheaths made of ceramic material. Gefran is also able to manufacture thermocouples in the three tolerance CLASSs 1, 2 and 3 in compliance with IEC 60584-2 standards.



TC9/AC9



TC10

TGefran thermocouple model TC9/AC9 and TC10 for use at high temperatures (e.g. heat treatment furnaces) or for direct immersion (e.g. aluminium casting furnaces).

TEMPERATURE LIMITS OF THE THERMOCOUPLE READING ELEMENT MADE OF MGO OR CERAMIC INSULATORS IN ACCORDANCE WITH SHEATH DIAMETER

CERAMIC INSULATOR CONSTRUCTION						
Ø	TC6/AC6		Ø	TC8/AC8		TC9
Element	J	K	Element	J	K	K
5mm	480°C	980°C	16mm	690°C	1090°C	1060°C
6mm	500°C	1000°C	3/8"	690°C	1090°C	1060°C
8mm	500°C	1000°C	1/2"	760°C	1250°C	1060°C
10mm	500°C	1000°C	3/4"	760°C	1250°C	1060°C
12mm	600°C	1060°C				
CABLE CONSTRUCTION			PVC	GSC	TES	TTS
SERIES	TC1/TC3/T4F/T4A/TC5		-30°C 95°C	-60°C 200°C	-60°C 250°C	-60°C 350°C

MgO MINERAL OXIDE CONSTRUCTION					
Ø	TC1M/TC5M TC6M/AC6M TC7M		Ø	TC2/AC2	
Element	J	K	Element	J	K
1mm	320°C	750°C	10mm	550°C	1050°C
1,5mm	340°C	870°C	12mm	550°C	1050°C
2mm	370°C	960°C	14mm	550°C	1050°C
3mm	390°C	970°C	16mm	550°C	1050°C
4,5mm	480°C	980°C	3/8"	550°C	1050°C
6mm	550°C	1050°C	1/2"	550°C	1050°C
8mm	640°C	1090°C	3/4"	550°C	1050°C

OPERATING PRINCIPLES

HOW TO SELECT THE MOST SUITABLE SENSOR

METAL RESISTANCE THERMOMETERS (THERMISTORS)

Metal resistance thermometers, commonly referred to as TR thermistors, are based on the principle that the resistance R of a metal conductor depends on the relationship.

$$R = \rho \cdot \frac{l}{A}$$

WHERE

R = conductor resistance
A = conductor area
l = conductor length
ρ = conductor resistivity

As the temperature varies, the resistance of the conductor Rt varies, which, with respect to the initial resistance Ro, can be formulated using the following relatione:
Rt = Ro*(1+αt):

WHERE

Rt = resistance at temperature t °C
Ro = resistance at temperature 0 °C
α = temperature coefficient
t = temperature in °C

Coefficient of temperature α depends on the type of metal used to make the resistance thermometer.
The most commonly used material in the production of metal thermistors is platinum (Pt), due to its greater resistance to oxidation, electrical resistivity and reproducibility in a wide variety of applications.
The most common elements have a value of 100 ohms at 0 °C and are therefore referred to as Pt100.

Gefran thermistors cover all of the most common types of metal thermistors, with two-, three- or four-wire connections, in tolerance CLASSs 1 DIN, 1/2 DIN, 1/3 DIN, 1/5 DIN and 1/10 DIN in compliance with IEC 751-DIN 43760 standards.



TRM



TR6M/ AR6M

Gefran thermistor models TRM and TR6M/AR6M for use in the plastics industry or for various industrial sectors.

- The choice of a temperature sensor must be made on the basis of several variables, including:
- Characteristics of the application (temperature range, pressure range, process fluid, explosive environment, need to use anti-corrosive materials, etc.).
 - Dimensional characteristics (outer diameter of the protective sheath, material of the protective sheath, immersion length, process connection, type of cold junction, etc.)
 - Precision class:
 - Sensor feedback time

The following is a useful diagram for the initial choice between a thermocouple and a thermistor:

CONSIDERATIONS	THERMOCOUPLE	THERMISTOR
TEMPERATURE RANGE	from -200 to 2000 °C	from 200 to 550 °C
POWER SUPPLY	not required	required
SELF-HEATING	not present	present
STABILITY	good	excellent
ROBUSTNESS	excellent	good
PRECISION	good	high
DIMENSIONS	very small	> 3mmMgO
MEASUREMENT	at the tip (hot junction)	on the average length of the TR itself
RESISTANCE TO VIBRATIONS	excellent execution in MgO	more fragile
COST	cheaper	

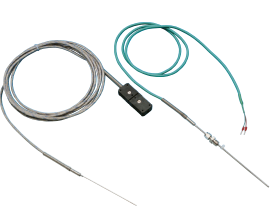




Gefran produces its thermocouples and thermistors in-house, taking care of both the production aspects, thanks to specialised personnel and high- quality raw materials, as well as the design aspects thanks to over 35 years' experience in the sector.

GUIDE TO READING THE CODE

TC = Thermocouple
TR = Thermistor
A = Amplified thermocouple or thermistor
M = Mineral oxide thermocouple or thermistor (MgO)

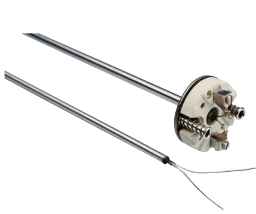
THERMOCOUPLES

MAIN TECHNICAL CHARACTERISTICS

								
MODEL	TC1	TC1M	TC3	T4A	T4F	T4P	TC5/TC5N	TC5M
TYPE	J - K	T - J - K	J - K	J - K	J - K	J - K	J - K	J - K
TEMPERATURE RANGE	-40°C.....+350°C	-40...+640 °C for J -40...+1090 °C for K	-40...+350°C	-40.....+350°C	-40.....+350°C	-40.....+350°C	-40...+350°C	-40...+390 °C for J -40...+960 °C for K
TOLERANCE CLASS (REFERENCE)	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 1 to 2	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 1 to 2
PROTECTION RATING	-	-	-	-	-	-	-	-
MIN/MAX DIAMETER DIMENSIONS	3 to 8 mm	1 to 6 mm	4,8 mm	ø internal hole 4-10 mm ø external hole 8-20 mm	ø minimum 14-168 mm ø maximum 24-188 mm	ø 10 x 20 x 3 mm	5 to 8 mm	3 mm
END TYPE	TTS fibre glass cable GS silicone rubber cable Shielded rubber cable TES Teflon cable	TTS fibre glass cable GS silicone rubber cable Shielded rubber cable TES Teflon cable	TTS fibre glass cable TES Teflon cable	TTS fibre glass cable TES Teflon cable	TTS fibre glass cable TES Teflon cable	TTS fibre glass cable TES Teflon cable	TTS fibre glass cable GS silicone rubber cable Shielded rubber cable TES Teflon cable	TTS fibre glass cable TES Teflon cable GS silicone rubber cable Shielded rubber cable
ELECTRICAL CONNECTIONS	Free terminals Cable lugs Compensated connectors	Free terminals Cable lugs Compensated connectors	Free terminals Cable lugs Compensated connectors	Free terminals Cable lugs Compensated connectors	Free terminals Cable lugs Compensated connectors	Free terminals Cable lugs Compensated connectors	Free terminals Cable lugs Compensated connectors	Free terminals Cable lugs Compensated connectors
PROCESS COUPLING	Fixed, sliding threaded connection Stainless steel, nickel-plated brass, 1/8" to 1/2"	Fixed, sliding threaded connection Stainless steel, nickel-plated brass, 1/8" to 1/2"	M8 to 1/4" connection thread	With fixing screw	Fastening strap	With fixing screw	Galvanised steel screw or bayonet fitting M12 x 1/1.5 /1.75 to 1/4" G	Galvanised steel female bayonet threaded connection M10 to 1/4" G
MEASUREMENT TYPE	Immersion	Immersion	Contact	Contact on a flat surface	Contact measurements on pipes or cylindrical surfaces	Contact on a flat surface	Immersion with thrust spring	Immersion with thrust spring
MATERIALS	Stainless steel AISI 300 series	Stainless steel AISI 316 INCONEL 600 Others on request	Steel AISI 304 Brass	Steel AISI 304 Brass	Steel galvanised carbon AISI304	Steel AISI304 Copper	Stainless steel AISI 303	Stainless steel AISI 316 for J INCONEL 600 for K
INSULATION RESISTANCE (AT ROOM TEMPERATURE)	> 1000 MΩ at 500Vcc	per ø < 1,5 > 500 MΩ at 50Vcc > 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc
APPLICATIONS	Plastics Food ovens Household appliances	Various industries Food Chemist Engineering	Plastic extrusion	Machine surfaces Flat surfaces in general	Heating system piping Monitoring	Machine surfaces Flat surfaces in general	Plastic extrusion	Newly developed plastic extrusion

THERMOCOUPLES

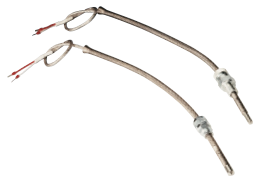
MAIN TECHNICAL CHARACTERISTICS



MODEL	TCM	TC6/AC6	TC6M/AC6M	TC7M	TC2/AC2	TCI	TC8/AC8	TC9/AC9	TC10
TYPE	J - K	T - J - K - E	J - K - T - E	T - J - E - K	T - J - E - K	T - J - E - K	J - E - K	K - S - R - B	J - K
TEMPERATURE RANGE	-40...+400 °C	-40...+1000 °C	J -80 +640°C K -80..... + 1050°C	J -80 +640°C K -80..... + 960°C	J -80 +640°C K -80..... + 960°C	J -80.....+550 °C K -80..... 1050 °c	-40...+1000 °C	-40...+1600 °C	-40...+1200 °C
TOLERANCE CLASS (REFERENCE)	IEC584 - 2 CLASS 1 and 2	IEC584 - 2 CLASS 1 and 2	IEC584 - 2 CLASS 1 and 2	IEC584 - 2 CLASS 1 and 2	IEC584 - 2 CLASS 1 and 2	IEC584 - 2 CLASS 1 and 2	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 1 and 2	*IEC584 - 2 CLASS 1 and 2*
PROTECTION RATING	IP 55 excluding the connector area	IP 44 - IP 65	IP 44 - IP 65	-	IP 44 - IP 65	Thermometric insert	IP 44 - IP 65	IP 44 - IP 65	IP 44 - IP 65
MIN/MAX DIAMETER DIMENSIONS	12,7 to 17,8 mm	5 to 12 mm	2 to 8 mm	1 to 6 mm	10 mm to 3/4"	1 to 6 mm	16 mm to 3/4"	10 to 26 mm	1/2" to 55 mm
END TYPE	Flexible sheath Rigid stem	DIN model and explosion-proof connection head with 4...20mA transmitter or base plate	DIN model and explosion-proof connection head with 4...20mA transmitter or base plate	Rigid stem	DIN model and explosion-proof connection head with 4...20mA base plate or transmitter	-	DIN model and explosion-proof connection head with 4...20mA base plate or transmitter	DIN model and explosion-proof connection head with 4...20mA base plate or transmitter	DIN and DIN BUS model Connection heads
ELECTRICAL CONNECTIONS	Compensated connector LEMO series connector	Ceramic terminal block Ryton Sealed	Ceramic terminal block Ryton Sealed	Compensated connectors	Ceramic terminal block Ryton Sealed	Ceramic terminal block Ryton Sealed	Ceramic terminal block Ryton Sealed	Ceramic terminal block Ryton Sealed	Ceramic terminal block Ryton Sealed
PROCESS COUPLING	Thread 1/2" - 20UNF M18 x 1,5	Fixed, sliding 1/8 to 1/2 threaded connection	Fixed, sliding stainless steel, nickel-plated brass 1/8 to 1/2 threaded connection	Fixed, sliding 1/8 to 1/2 threaded connection	Fixed, sliding 1/8 to 1/2 threaded connection	-	Fixed 1/2 to 1 threaded connection Sliding flange	Sleeve	-
MEASUREMENT TYPE	Immersion Contact Elliptical tip	Immersion	Immersion	Immersion Contact	Immersion	Immersion	Immersion	Immersion	Immersion
MATERIALS	AISI 316 Ti stainless steel AISI 304 stainless steel Others on request	Stainless steel AISI 300 series INCONEL 600 Others on request	Stainless steel AISI 300 series INCONEL 600 Others on request	Stainless steel AISI 300 series INCONEL 600	Stainless steel AISI 300 series INCONEL 600	Stainless steel AISI 300 series INCONEL 600	Stainless steel AISI 300 AISI 446 INCONEL 600	Ceramics with different degrees of purity KER 530/ 610 / 710	AISI 310/316 Silicon carbide Cast iron AISI 446 stainless steel INCONEL 600
INSULATION RESISTANCE (AT ROOM TEMPERATURE)	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc
APPLICATIONS	High-pressure plastic and abrasive extrusion	Process measurements in pipelines Industrial plants	Industrial processes Ovens Chimneys Boilers	Process measures Test laboratories	On pressurised pipes Industrial plants	Thermometric insert	Industrial processes Ovens Chimneys Boilers	Ceramic Firing Furnaces Glass oven vaults Chimneys	Infused baths of non-ferrous alloys Molten salt baths

TERMOMETRI A RESISTENZA PT100

MAIN TECHNICAL CHARACTERISTICS



MODEL	TR1	TR1M	TR5/TR5N	TRM	TRD
TYPE	Thin film	Wire wound	Thin film	Wire wound	Wire wound
TEMPERATURE RANGE	-40...+350 °C	-40...+600 °C	-40...+350 °C	-40...+400 °C	-40...+150 °C
TOLERANCE CLASS (REFERENCE)	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X t CLASS A: 0,15 + 0,002 X t	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X t CLASS A: 0,15 + 0,002 X t 1/3 DIN	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X t CLASS A: 0,15 + 0,002 X t	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X t CLASS A: 0,15 + 0,002 X t 1/3 DIN	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X t CLASS A: 0,15 + 0,002 X t 1/3 DIN
PROTECTION RATING	-	-	-	IP 55	IP 65
MIN/MAX DIAMETER DIMENSIONS	3 to 8 mm	3 to 6 mm	5 to 8 mm	12,7 to 17,8 mm	6 mm
END TYPE	Shielded silicone rubber cable TTS fibre glass cable GS silicone rubber cable PVC-Teflon TES cable	Shielded silicone rubber cable TTS fibre glass cable GS silicone rubber cable PVC-Teflon TES cable	Shielded silicone rubber cable TTS fibre glass cable GS silicone rubber cable PVC-Teflon TES cable	Flexible sheath Rigid stem	Tin-plated copper extension cable
ELECTRICAL CONNECTIONS	Free terminals Cable lugs Compensated connectors	Free terminals Cable lugs Compensated connectors	Free terminals Cable lugs Compensated connectors	Compensated connector LEMO series connector	Free terminals
PROCESS COUPLING	Fixed, sliding stainless steel, nickel-plated brass 1/8 to 1/2 threaded connector	Fixed, sliding stainless steel, nickel-plated brass 1/8 to 1/2 threaded connector	Galvanised steel M12 x 1 /1.5 /1.75 to 1/4" G threaded connection with screw or bayonet coupling	Thread 1/2" - 20UNF M18 x 1,5"	Direct immersion
MEASUREMENT TYPE	Immersion	Immersion	Immersion with thrust spring	Immersion Contact Elliptical tip	Submerged in concrete
MATERIALS	Stainless steel AISI 300 series	Stainless steel AISI 316 series	Stainless steel AISI 303 series	AISI 316 Ti stainless steel AISI 304 stainless steel Others on request	Annealed stainless steel
INSULATION RESISTANCE (AT ROOM TEMPERATURE)	> 100 MΩ with voltages from 10 to 100Vdc	> 100 MΩ with voltages from 10 to 100Vdc	> 100 MΩ with voltages from 10 to 100Vdc	> 1000 MΩ at 500Vcc	> 100 MΩ with voltages from 10 to 100Vdc
APPLICATIONS	Plastics Food ovens Household appliances	Various industries Chemical Food Engineering	Low-vibration plastic extrusion	High-pressure plastic a nd abrasive extrusion	Dam monitoring Civil installations

PT100 THERMISTORS



MAIN TECHNICAL CHARACTERISTICS



MODEL	TR6/AR6	TR6M/AR6M	TR7M	TR2/AR2	TRI
TYPE	encapsulated thin film	Wire wound	Wire wound	Wire wound	Wire wound
TEMPERATURE RANGE	-40...+450 °C	-80...+600 °C	-40...+600 °C	-40...+600 °C	-40...+600 °C
TOLERANCE CLASS (REFERENCE)	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X t CLASS A: 0,15 + 0,002 X t 1/3 DIN	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X t CLASS A: 0,15 + 0,002 X t 1/3 DIN	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X t CLASS A: 0,15 + 0,002 X t 1/3 DIN	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X t CLASS A: 0,15 + 0,002 X t 1/3 DIN	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X t CLASS A: 0,15 + 0,002 X t 1/3 DIN
PROTECTION RATING	IP 45 - IP 65	IP 44 - IP 65	-	IP 44 - IP 65	-
MIN/MAX DIAMETER DIMENSIONS	5 to 12 mm	3 to 6 mm	3 to 6 mm	10 mm to 3/4"	3 to 6 mm
END TYPE	DIN model and explosion-proof connection head with 4...20mA transmitter or base plate	DIN model and explosion-proof connection head with 4...20mA transmitter or base plate	Metal stem	DIN model and explosion-proof connection head with 4...20mA transmitter or base plate	-
ELECTRICAL CONNECTIONS	Fixed, sliding 1/8" to 1/2" threaded connection	Fixed, sliding 1/8" to 1/2" threaded connection	Standard and mignon connectors with 2 and 3 contacts	Ceramic terminal block with suspension Ryton Sealed	Ceramic terminal block with suspension Ryton Sealed
PROCESS COUPLING	Fixed, sliding 1/8" to 1/2" threaded connection	Fixed, sliding 1/8" to 1/2" threaded connection	1/8" to 1/2" sliding threaded connection	Fixed 3/8" to 1" threaded connection Sliding flange	-
MEASUREMENT TYPE	Immersion	Immersion	Immersion	Immersion in direct contact with the process element	Immersion in direct contact with the process element
MATERIALS	Stainless steel AISI 300 series INCONEL 600	Stainless steel AISI 300 series	Stainless steel AISI 316	Stainless steel AISI 300 series INCONEL 600	Stainless steel AISI 316
INSULATION RESISTANCE (AT ROOM TEMPERATURE)	>100 MΩ with voltages from 10 to 100Vdc	>100 MΩ with voltages from 10 to 100Vdc	>100 MΩ with voltages from 10 to 100Vdc	>100 MΩ with voltages from 10 to 100Vdc	>100 MΩ with voltages from 10 to 100Vdc
APPLICATIONS	Measurements in fluid pipelines Electrical machines	Measurements in fluid pipelines Electrical machines	Process measures Test laboratories	On large pipes In tanks	Thermometer coupling

PT100 THERMISTORS

MAIN TECHNICAL CHARACTERISTICS

									
MODELL	TCC	TCP	TCGK	TCE/ACE	TR4	TR8M	TR9M	TRA	TRP
TYP	T - J - E - K - N	T - J - E - K	T - J - E - K - N	J - E - K	Thin film Wire wound*	Wire wound	Wire wound	Thin film	Wire wound
TEMPERATURBEREICH	-80...+1250 °C	-40...+300 °C	-40...+1050 °C	-40...+1000 °C	-40...+200 °C	-40...+600 °C	-40...+600 °C	-40...+80 °C	-80...+300 °C
TOLERANZCLASS	IEC584 - 2 CLASS 1 and 2	UNI 7938 IEC584 - 2 CLASS 1 and 2	UNI 7938 IEC584 - 2 CLASS 1 and 2	IEC584 - 2 CLASS 2	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X ltl CLASS A: 0,15 + 0,002 X ltl	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X ltl CLASS A: 0,15 + 0,002 X ltl 1/3 DIN	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X ltl CLASS A: 0,15 + 0,002 X ltl	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X ltl CLASS A: 0,15 + 0,002 X ltl	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X ltl CLASS A: 0,15 + 0,002 X ltl
SCHUTZART	IP 65	IP 65	IP 55	IP 44 - IP 65	IP 54	IP 44 - IP 65	IP 44 - IP 65	IP 54	IP 65
DURCHMESSER	3 to 6 mm	4,5 mm	3 to 6 mm	16 mm to 3/4"	to be defined	3 to 6 mm	6 mm	14 mm	4,5 mm
KABELTYP	Watertight adapter or with gasket	Handle with extension cable	Explosion-proof connection head	DIN model and explosion-proof connection head with 4...20mA transmitter or base plate	DIN and explosion-proof connection head	Socket adapter with gasket, screwed	Socket adapter with gasket, screwed	Polycarbonate box 110 x 80 x 65 mm	Handle with extension cable
ELEKTRISCHER ANSCHLUSS	Military series connector with polycarbonate alloy contacts 110 x 80 x 65 mm	Free terminals Compensated connectors	Ceramic terminal block	Ceramic terminal block Ryton Sealed	Ceramic terminal block Ryton Sealed	Connectors with MIL standard contacts	Connectors with MIL standard contacts	Screw clamp terminal blocks	Free terminals Compensated connectors
PROZESSANSCHLUSS	Suspension threaded connection	-	Fixed 1/4" to 3/4" threaded connection	Fixed 1/2" to 1" threaded connection Sliding flange	Stainless steel fixed 1/2" to 3/4" threaded connection	Sliding stainless steel, nickel-plated brass 1/4" to 1/2" threaded connection with drive spring.	Sliding stainless steel, nickel-plated brass 1/4" to 1/2" threaded connection with drive spring.	With wall-mount screws Metal brackets	-
MESSTVP	Immersion Contact	Penetration	Fixed contact	Immersion	Immersion in fluid	Immersion	Immersion with tip contact	Immersion	Penetration
MATERIALIEN	Stainless steel AISI 300 series INCONEL 600	Stainless steel AISI 316 INCONEL 600	Stainless steel AISI 316 INCONEL 600	Stainless steel AISI 300 series AISI 446 stainless steel INCONEL 600	Stainless steel AISI 300 series	Stainless steel AISI 316	Acciaio inox AISI 316 con puntale in argento	Stainless steel AISI 304	Stainless steel AISI 316
ISOLATIONSWIDERSTAND (BEI UMGEBUNGSTEMPE- RATUR)	> 1000 MΩ to 500Vcc	> 1000 MΩ to 500Vcc	> 1000 MΩ to 500Vcc	> 1000 MΩ to 500Vcc	> 100 MΩ with voltages from 10 to 100Vdc	> 100 MΩ with voltages from 10 to 100Vdc	> 100 MΩ with voltages from 10 to 100Vdc	> 100 MΩ with voltages from 10 to 100Vdc	> 100 MΩ with voltages from 10 to 100Vdc
ANWENDUNGEN	Multi-fuel boilers District heating Energy sector AISI 304	Food sector Various applications	Boiler tube bundles Heat exchangers	Industrial processes Ovens Chimneys Boilers	Air ducts Environmental measures	Test laboratories Chemical plants	Thermo-hydroelectric power stations Turbines	Monitoring Weather stations Room temperature	Food sector Various applications

THERMOWELLS

MAIN TECHNICAL CHARACTERISTICS

											
MODEL	TWB1	TWT1	TWB2	TWT2	TWB3		TWB4	TWT4	TWB5	TWB6	TWB7
TYPE	Cylindrical bar thermowell	Cylindrical bar thermowell	Flanged cylindrical bar thermowell	Flanged cylindrical pipe thermowell	Conical bar thermowell		Bar thermowell with reduced end	Tube thermowell with reduced end	Conical bar thermowell	Flanged cylindrical bar thermowell	Weld-on bar thermowell
EXTERNAL DIMENSIONS Min/max Diameter	12 to 20 mm	12 to 21,3 mm	16 to 22 mm	> 10 mm	16 to 24 mm with 16 mm taper		Fixed 14/7	Fixed 14/7	18 to 24 mm with a 14 mm taper	12 to 20 mm	Min. diameter: 14 to 19 mm Max. diameter: 17 to 30 mm
INTERNAL HOLE DIMENSIONS Diameter	7 to 9 mm	Standard 8 (for 12 mm) Others > 10 mm	7 to 9 mm	7 to 9 mm	7 to 9 mm		7 to 9 mm	10 mm	7 mm	7 to 9 mm	7 mm
PROBE COUPLING	1/4" to 1/2" threaded connection	1/4" to 1/2" threaded connection	1/4" to 1/2" threaded connection	1/4" to 1/2" threaded connection	1/4" to 1/2" threaded connection		1/4" to 1/2" threaded connection	1/4" to 1/2" threaded connection	1/4" to 1/2" threaded connection	Attacco filettato da 1/4" a 3/4"	1/4" to 1/2" threaded connection
PROCESS COUPLING	Stainless steel AISI 300 series INCONEL 600	Stainless steel AISI 300 series INCONEL 601	Stainless steel AISI 300 series ASTM A105	Stainless steel AISI 300 series ASTM A105	Stainless steel AISI 300 series INCONEL 600		Stainless steel AISI 300 series INCONEL 600	Stainless steel AISI 300 series INCONEL 600	Stainless steel AISI 300 series INCONEL 600 ASTM A182 F11 and F22	Stainless steel AISI 300 series INCONEL 600 ASTM A182 F11 and F22	Stainless steel AISI 300 series INCONEL 600 ASTM A182 F11 and F22

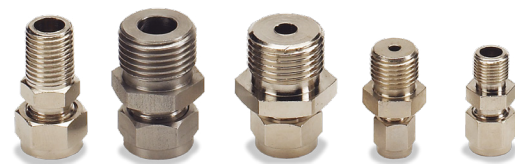
ACCURACY CLASS FOR THERMOCOUPLES (RIF. IEC 584-2)

MAIN TECHNICAL CHARACTERISTICS

TYPE	T	E	J	K/N	R/5	B
TOLERANCE CLASS 1 Tolerance Temperature Range	$^{-40...+125}^{\circ}\text{C}$ $\pm 0,5^{\circ}\text{C}^{\circ}$	$^{-40...+375}^{\circ}\text{C}$ $\pm 1,5^{\circ}\text{C}^{\circ}$	$^{-40...+375}^{\circ}\text{C}$ $\pm 1,5^{\circ}\text{C}^{\circ}$	$^{-40...+375}^{\circ}\text{C}$ $\pm 1,5^{\circ}\text{C}^{\circ}$	$^{0...+1100}^{\circ}\text{C}$ $\pm 1^{\circ}\text{C}^{\circ}$	-
Tolerance Temperature Range	$^{125...+350}^{\circ}\text{C}$ $\pm 0,004 \cdot [t]^{\circ}$	$^{375...+800}^{\circ}\text{C}$ $\pm 0,004 \cdot [t]^{\circ}$	$^{375...+800}^{\circ}\text{C}$ $\pm 0,004 \cdot [t]^{\circ}$	$^{375...+800}^{\circ}\text{C}$ $\pm 0,004 \cdot [t]^{\circ}$	$^{+1100...+1600}^{\circ}\text{C}$ $\pm [1+0,003 \cdot (t-1100)]^{\circ}\text{C}^{\circ}$	-
TOLERANCE CLASS 2 Tolerance Temperature Range	$^{-40...+133}^{\circ}\text{C}$ $\pm 1^{\circ}\text{C}^{\circ}$	$^{-40...+333}^{\circ}\text{C}$ $\pm 2,5^{\circ}\text{C}^{\circ}$	$^{-40...+333}^{\circ}\text{C}$ $\pm 2,5^{\circ}\text{C}^{\circ}$	$^{-40...+333}^{\circ}\text{C}$ $\pm 2,5^{\circ}\text{C}^{\circ}$	$^{0...+600}^{\circ}\text{C}$ $\pm 1,5^{\circ}\text{C}^{\circ}$	
Tolerance Temperature Range	$^{+133...+350}^{\circ}\text{C}$ $\pm 0,0075 \cdot [t]^{\circ}$	$^{+333...+900}^{\circ}\text{C}$ $\pm 0,0075 \cdot [t]^{\circ}$	$^{+333...+900}^{\circ}\text{C}$ $\pm 0,0075 \cdot [t]^{\circ}$	$^{+333...+900}^{\circ}\text{C}$ $\pm 0,0075 \cdot [t]^{\circ}$	$^{+600...+1600}^{\circ}\text{C}$ $\pm 0,0025 \cdot [t]^{\circ}$	$^{+600...+1700}^{\circ}\text{C}$ $\pm 0,0025 \cdot [t]^{\circ}$
TOLERANCE CLASS 3 Tolerance Temperature Range	$^{-67...+40}^{\circ}\text{C}$ $\pm 1^{\circ}\text{C}^{\circ}$	$^{-167...+40}^{\circ}\text{C}$ $\pm 2,5^{\circ}\text{C}^{\circ}$	-	$^{-167...+40}^{\circ}\text{C}$ $\pm 2,5^{\circ}\text{C}^{\circ}$	-	$^{+600...+800}^{\circ}\text{C}$ $+4^{\circ}\text{C}^{\circ}$
Tolerance Temperature Range	$^{-200...-67}^{\circ}\text{C}$ $\pm 0,015 \cdot [t]^{\circ}$	$^{-200...-167}^{\circ}\text{C}$ $\pm 0,015 \cdot [t]^{\circ}$	-	$^{-200...-167}^{\circ}\text{C}$ $\pm 0,015 \cdot [t]^{\circ}$	-	$^{800...1700}^{\circ}\text{C}$ $\pm 0,005 \cdot [t]^{\circ}$

WELL ACCESSORIES

IN STAINLESS STEEL AND BRASS
COMPRESSION FITTINGS



PC PROGRAMMABLE
SIGNAL AMPLIFIER



SIGNAL AMPLIFIERS 4÷20MA
AND FOR PT100 THERMISTOR



ELECTRICAL CONNECTION
HEADS



DIN B



EEX- d



DIN A



BUZ- H



DIN BUS



DIN J

THERMOCOUPLES - THERMISTORS

ADAPTOR FOR DIN BAR



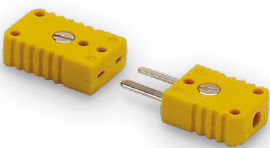
TDP DISPLAY



CONNECTORS



STANDARD COMPENSATED



MIGNON COMPENSATED



LEMO

WELLS



DIN BUS

TWB1
Cylindrical bar thermowell



DIN J

TWB1
Cylindrical bar thermowell



DIN J

TWB1
Cylindrical bar thermowell



DIN J

TWB1
Cylindrical bar thermowell

