ENG

THERMOCOUPLES, RESISTANCE THERMOMETERS AND THERMOWELLS

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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.

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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, toer controlled 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 din with an accuracy of 0.03 C at 0 C (ref. DIN43760, IEC751

APPLICATION SECTORS

PHARMACEUTICAL

INDUSTRIAL FURNACES

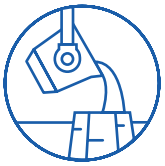
CLIMATE CELLS

FOOD AND CANNING INDUSTRY

INJECTION-EXTRUSION BLOW MOULDING

PROCESSES FOR ALUMINIUM, CERAMICS, HEAT TREATMENTS

WOODWORKING



METALLURGICAL INDUSTRY HEAT PROCESSING

MEDICAL / LABORATORIES

GLASS PRODUCTION

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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.

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

TC9/AC9

TC10

Gefran 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).

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

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OPERATING PRINCIPLES

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.

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

WHERE

R = conductor resistance
l = conductor length
A = conductor area
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
α = temperature coefficient
Ro = resistance at temperature 0 °C
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.

HOW TO SELECT THE MOST SUITABLE SENSOR

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	> 3mmMg 0
MEASUREMENT	at the tip (hot junction)	on the average length of the TR itself
RESISTANCE TO VIBRATIONS	excellent execution in Mg0	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)

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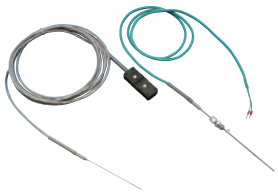
THERMOCOUPLES

MAIN TECHNICAL CHARACTERISTICS



MODEL	TC1	TC1M	TC3
TYPE	J - K	T - J - K	J - K
TEMPERATURE RANGE	-40°C....+350°C	-40...+640 °C for J -40...+1090 °C for K	-40...+350°C
TOLERANCE CLASS (REFERENCE)	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 1 to 2	IEC584 - 2 CLASS 2
PROTECTION RATING	-	-	-
MIN/MAX DIAMETER DIMENSIONS	3 to 8 mm	1 to 6 mm	4,8 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
ELECTRICAL CONNECTIONS	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
MEASUREMENT TYPE	Immersion	Immersion	Contact
MATERIALS	Stainless steel AISI 300 series	Stainless steel AISI 316 INCONEL 600 Others on request	Steel AISI 304 Brass
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
APPLICATIONS	Plastics Food ovens Household appliances	Various industries Food Chemist Engineering	Plastic extrusion





T4A	T4F	T4P	TC5/TC5N	TC5M
J - K	J - K	J - K	J - K	J - K
-40....+350°C	-40.....+350°C	-40....+350°C	-40...+350°C	-40...+390 °C for J -40...+960 °C for K
IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 1 to 2
-	-	-	-	-
Ø internal hole 4-10 mm Ø external hole 8-20 mm	Ø internal hole 14-168 mm Ø external hole 24-188 mm	ø 10 x 20 x 3 mm	5 to 8 mm	3 mm
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	Cavo fibra di vetro TTS Cavo Teflon TES Cavo gomma siliconica GS Cavo gomma schermato
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
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
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
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
>1000 MΩ at 500Vcc	>1000 MΩ at 500Vcc	>1000 MΩ at 500Vcc	>1000 MΩ at 500Vcc	>1000 MΩ at 500Vcc
Machine surfaces Flat surfaces in general	Heating system piping Monitoring	Machine surfaces Flat surfaces in general	Plastic extrusion	Newly developed plastic extrusion

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THERMOCOUPLES

MAIN TECHNICAL CHARACTERISTICS




MODEL	TCM	TC6/AC6	TC6M/AC6M	TC7M
TYPE	J - K	T - J - K - E	J - K - T - E	T - J - E - 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
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
PROTECTION RATING	IP 55 excluding the connector area	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
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
ELECTRICAL CONNECTIONS	Compensated connector LEMO series connector	Ceramic terminal block Ryton Sealed	Ceramic terminal block Ryton Sealed	Compensated connectors
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
MEASUREMENT TYPE	Immersion Contact Elliptical tip	Immersion	Immersion	Immersion Contact
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
INSULATION RESISTANCE (AT ROOM TEMPERATURE)	> 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





TC2/AC2	TCI	TC8/AC8	TC9/AC9	TC10
T - J - E - K	T - J - E - K	J - E - K	K - S - R - B	J - K
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
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"
IP 44 - IP 65	Thermometric insert	IP 44 - IP 65	IP 44 - IP 65	IP 44 - IP 65
10 mm to 3/4"	1 to 6 mm	16 mm to 3/4"	10 to 26 mm	1/2"toa 55 mm
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	DIN model and explosion-proof connection head with 4...20mA transmitter or base plate	DIN and DIN BUS model Connection heads
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
Fixed 3/8" to 1" threaded connection Sliding flange	-	Fixed 1/2" to 1" threaded connection Sliding flange	Sleeve	-
Immersion	Immersion	Immersion	Immersion	Immersion
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
>1000 MΩ at 500Vcc	>1000 MΩ at 500Vcc	>1000 MΩ at 500Vcc	>1000 MΩ at 500Vcc	>1000 MΩ at 500Vcc
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

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PT100 THERMISTORS

MAIN TECHNICAL CHARACTERISTICS

MODEL	TR1	TR1M
TYPE	Thin film	Wire wound
TEMPERATURE RANGE	-40...+350°C	-40...+600 °C
TOLERANCE CLASS (REFERENCE)	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"
PROTECTION RATING	-	-
MIN/MAX DIAMETER DIMENSIONS	3 to 8 mm	3 to 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
ELECTRICAL CONNECTIONS	Free terminals Cable lugs Compensated connectors	Free terminals Cable lugs Compensated connectors
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
MEASUREMENT TYPE	Immersion	Immersion
MATERIALS	Stainless steel AISI 300 series	Stainless steel AISI 316 series
INSULATION RESISTANCE (AT ROOM TEMPERATURE)	>100 MΩ with voltages from 10 to 100Vdc	>100 MΩ with voltages from 10 to 100Vdc
APPLICATIONS	Plastics Food ovens Household appliances	Various industries Chemical Food Engineering

TR5/TR5N	TRM	TRD
Thin film	Wire wound	Wire wound
-40...+350°C	-40...+400°C	-40...+150 °C
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 1/3 DIN
-	IP 55	IP 65
5 to 8 mm	12,7 to 17,8 mm	6 mm
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
Free terminals Cable lugs Compensated connectors	Compensated connector LEMO series connector	Free terminals
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
Immersion with thrust spring	Immersion Contact Elliptical tip	Submerged in concrete
Stainless steel AISI 303 series	AISI 316 TI stainless steel AISI 304 stainless steel Others on request	Annealed stainless steel
> 100 MΩ with voltages from 10 to 100Vdc	> 1000 MΩ at 500Vcc	> 100 MΩ with voltages from 10 to 100Vdc
Low-vibration plastic extrusion	High-pressure plastic and abrasive extrusion	Dam monitoring Civil installations

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PT100 THERMISTORS

MAIN TECHNICAL CHARACTERISTICS

MODEL	TR6/AR6	TR6M/AR6M
TYPE	encapsulated thin film	Wire wound
TEMPERATURE RANGE	-40...+450°C	-80...+600 °C
TOLERANCE CLASS (REFERENCE)	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 1/3 DIN
PROTECTION RATING	IP 45 - IP 65	IP 44 - IP 65
MIN/MAX DIAMETER DIMENSIONS	5 to 12 mm	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
ELECTRICAL CONNECTIONS	Fixed, sliding 1/8" to 1/2" threaded connection	Fixed, sliding 1/8" to 1/2" threaded connection
PROCESS COUPLING	Fixed, sliding 1/8" to 1/2" threaded connection	Fixed, sliding 1/8" to 1/2" threaded connection
MEASUREMENT TYPE	Immersion	Immersion
MATERIALS	Stainless steel AISI 300 series INCONEL 600	Stainless steel AISI 300 series
INSULATION RESISTANCE (AT ROOM TEMPERATURE)	>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

TR7M	TR2/AR2	TRI
Wire wound	Wire wound	Wire wound
-40...+600 °C	-40...+600 °C	-40...+600 °C
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 1/3 DIN	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X ltl CLASS A: 0,15 + 0,002 X ltl 1/3 DIN
-	IP 44 - IP 65	-
3 to 6 mm	10 mm to 3/4"	3 to 6 mm
Metal stem	DIN model and explosion-proof connection head with 4...20mA transmitter or base plate	-
Standard and mignon connectors with 2 and 3 contacts	Ceramic terminal block with suspension Ryton Sealed	Ceramic terminal block with suspension Ryton Sealed
Sliding 1/8" to 1/2" threaded connection	Fixed 3/8" to 1" threaded connection Sliding flange	-
Immersion	Immersion in direct contact with the process element	Immersion in direct contact with the process element
Stainless steel AISI 316	Stainless steel AISI 300 INCONEL 600	Stainless steel AISI 316
> 100 MΩ with voltages from 10 to 100Vdc	> 100 MΩ with voltages from 10 to 100Vdc	> 100 MΩ with voltages from 10 to 100Vdc
Process measures Test laboratories	On large pipes In tanks	Thermometer coupling

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SPECIAL EXECUTIONS ON REQUEST

MAIN TECHNICAL CHARACTERISTICS





MODEL	TCC	TCP	TCGK	TCE/ACE	TR4
TYPE	T - J - E - K - N	T - J - E - K	T - J - E - K - N	J - E - K	Thin film Wire wound
TEMPERATURE RANGE	-80...+1250 °C	-40...+300 °C	-40...+1050 °C	-40...+1000 °C	-40...+200 °C
TOLERANCE CLASS (REFERENCE)	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
PROTECTION RATING	IP 65	IP 65	IP 55	IP 44 - IP 65	IP 54
MIN/MAX DIAMETER DIMENSIONS	3 to 6 mm	4,5 mm	3 to 6 mm	16 mm to 3/4"	to be defined
END TYPE	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
ELECTRICAL CONNECTIONS	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
PROCESS COUPLING	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
MEASUREMENT TYPE	Immersion Contact	Penetration	Fixed contact	Immersion	Immersion in fluid
MATERIALS	Stainless steel AISI 300 series INCONEL 600	Stainless steel AISI 316 series INCONEL 600	Stainless steel AISI 316 series INCONEL 600	Stainless steel AISI 300 series AISI 446 stainless steel INCONEL 600	Stainless steel AISI 300 series
INSULATION RESISTANCE (AT ROOM TEMPERATURE)	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 100 MΩ with voltages from 10 to 100Vdc
APPLICATIONS	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

TR8M	TR9M	TRA	TRP
Wire wound	Wire wound	Thin film	Wire wound
-40...+600 °C	-40...+600 °C	-40...+80 °C	-80...+300 °C
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
IP 44 - IP 65	IP 44 - IP 65	IP 54	IP 65
3 to 6 mm	6 mm	14 mm	4,5 mm
Socket adapter with gasket, screwed	Socket adapter with gasket, screwed	Polycarbonate box 110 x 80 x 65 mm	Handle with extension cable
Connectors with MIL standard contacts	Connectors with MIL standard contacts	Screw clamp terminal blocks	Free terminals Compensated connectors
Sliding stainless steel, nickel-plated brass 1/4" to 1/2" threaded connection	Sliding stainless steel, nickel-plated brass 1/4" to 1/2" threaded connection with drive spring	With wall-mount screws Metal brackets	-
Immersion	Immersion with tip contact	Immersion	Penetration
Stainless steel AISI 316 series	AISI 316 stainless steel with silver tip	Stainless steel AISI 304 series	Stainless steel AISI 316
> 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
Test laboratories Chemical plants	Thermo-hydroelectric power stations Turbines	Monitoring Weather stations Room temperature	Food sector Various applications

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THERMOWELLS

MAIN TECHNICAL CHARACTERISTICS





MODEL	TWB1	TWT1	TWB2	TWT2	TWB3
TYPE	Cylindrical bar thermowell	Cylindrical bar thermowell	Flanged cylindrical bar thermowell	Flanged cylindrical pipe thermowell	Conical bar thermowell
EXTERNAL DIMENSIONS Diameter Min/max	12 to 20 mm	12 to 21,3 mm	16 to 22 mm	>10 mm	16 to 24 mm with 16 mm taper
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
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
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

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

MAIN TECHNICAL CHARACTERISTICS

TYPE	T	E
TOLLERANCE CLASS 1 Tolerance temperature range	-40...+125 °C ±0,5 °C"	-40...+375 °C ±1,5 °C"
Tolerance temperature range	125...+350 °C ±0,004 · [t]"	375...+800 °C ±0,004 · [t]"
TOLLERANCE CLASS 2 Tolerance temperature range	-40...+133 °C ±1 °C"	-40...+333 °C ±2,5 °C"
Tolerance temperature range	+133...+350 °C ±0,0075 · [t]"	+333...+900 °C ±0,0075 · [t]"
TOLLERANCE CLASS 3 Tolerance temperature range	-67...+40 °C ±1 °C"	-167...+40 °C ±2,5 °C"
Tolerance temperature range	-200...-67 °C ±0,015 · [t]"	-200...-167 °C ±0,015 · [t]"





TWB4	TWT4	TWB5	TWB6	TWB7
Bar thermowell with reduced end	Tube thermowell with reduced end	Conical bar thermowell	Flanged cylindrical bar thermowell	Weld-on bar thermowell
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
7 to 9 mm	10 mm	7 mm	7 to 9 mm	7 mm
1/4" to 1/2" threaded connection	1/4" to 1/2" threaded connection	1/4" to 1/2" threaded connection	1/4" to 3/4" threaded connection	1/4" to 1/2" threaded connection
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 F23	Stainless steel AISI 300 series INCONEL 600 ASTM A182 F11 and F24

J	K/N	R/S	B
-40...+375 °C ±1,5 °C"	-40...+375 °C ±1,5 °C"	0...+1100 °C ±1 °C"	-
375...+800 °C ±0,004 · [t]"	375...+800 °C ±0,004 · [t]"	+1100...+1600 °C ±[1+0,003 (t-1100)] °C"	-
-40...+333 °C ±2,5 °C"	-40...+333 °C ±2,5 °C"	0...+600 °C ±1,5 °C"	
+333...+900 °C ±0,0075 · [t]"	+333...+900 °C ±0,0075 · [t]"	+600...+1600 °C ±0,0025 · [t]"	+600...+1700 °C ±0,0025 · [t]"
-	-167...+40 °C ±2,5 °C"	-	+600...+800 °C +4 °C"
-	-200...-167 °C ±0,015 · [t]"	-	800...1700 °C ±0,005 · [t]"

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DIN J

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CONNECTORS

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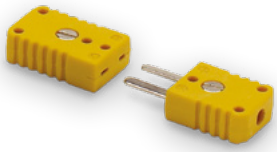


MIGNON COMPENSATED

LEMO

WELLS

DIN BUS

TWB1
Cylindrical bar thermowell

DIN J

TWB1
Cylindrical bar thermowell

DIN J

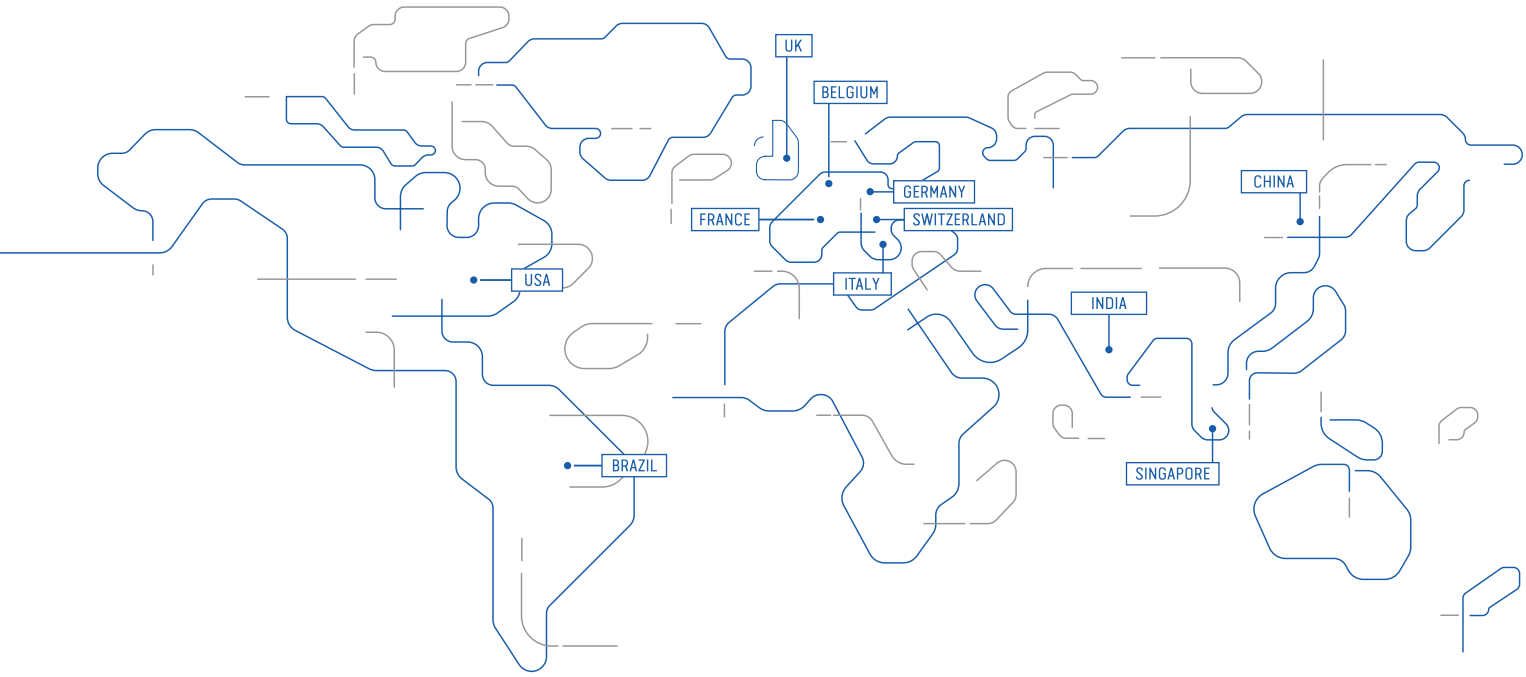
TWB1
Cylindrical bar thermowell

DIN J

TWB1
Cylindrical bar thermowell

COD. 81231E

FM 608910



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