Thermocouples, Resistance Thermometers, Thermowells ...

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GEFRAN

Our Know how,
Your Solution.

THERMOCOUPLES, RESISTANCE THERMOMETERS AND THERMOWELLS

WHY YOU SHOULD CHOOSE GEFRAN

Experience

For over 35 years, Gefran has been designing and producing thermocouples and resistance thermometers in-house, covering a wide range of temperatures (-200 … +2000°C) in all sectors of application.
The experience accumulated by its technical and production staff, thanks to over 5000 special versions in just the past 10 years, makes Gefran the ideal partner for creating custom sensors using special materials.

Quality

All Gefran thermocouples and resistance thermometers are built in temperature-controlled rooms at the company's facilities in Provaglio d'Iseo in the province of Brescia, Italy.
Some special versions are built directly in the on-site SIT laboratory, in temperature- and humidity-controlled rooms.
We use top-quality raw materials for reliable, safe sensors. Specifically, all of our thermocouples with mineral oxide isolation are made with heat-sensitive elements in tolerance class 1 (ref.: IEC60584-2).
And for resistance thermometers, we can produce sensors with tolerance class up to 1/10 DIN and precision of ± 0.03°C at 0°C (ref.: DIN43760, IEC751).

SIT calibration and certification

Gefran is one of the few manufacturers of thermocouples and resistance thermometers with an on-site SIT center. In addition to offering certification and calibration at the customer's premises, this lab is an essential tool for checking the instrumentation used in Gefran's production departments, for preliminary inspection of incoming raw materials, and for final checks of finished sensors.

The SIT calibration center is part of the national calibration service (SNT) and a reference point for the following quantities:

- Temperature, in measurement range -80 to … +1550°C.
- Relative humidity, in measurement range 10..90% RH for air temperature from 5 to 40°C.
- Pressure, in measurement range 0 …100Mpa, 0 …1000 bar.

Other services and related products:

- External calibration, performed directly on plants.
- Calibrated and certified thermometrical sampling.
  The certificate can be accompanied by a tabulation of results, with minimum step of 0.1°C.
- Vertical and horizontal calibration baths and ovens for comparative calibrations.
- Portable instruments with SIT certificate generate a metrological chain that is indispensable for production and laboratory uses.
- Temperature calibrators: extremely versatile instruments that indicate/simulate thermoelectric sensors (TC, RTD) in mV, mA and ohms.
- Thermohygrometers and hygrometers to monitor temperature and RH %
- Manometers for pressure control in industrial processes.

OPERATING PRINCIPLE OF THERMOCOUPLES

Thermocouples (TC) are formed of two different metallic conductors which, under the effect of temperature, generate an electromotive force.
Thermocouples exploit the principles of the Seebeck thermoelectric effect. Seebeck discovered that in a circuit formed of two different metallic conductors A and B, when the two junctions are at different temperatures T1 and T2, current I, generated by an electromotive force, flows in the circuit, the quantity of which is directly proportional to the temperature difference between the two junctions.

Gefran thermocouples cover all the most common types of temperature sensors, from low-temperature versions to versions with platinum thermoelectric couple and ceramic sheathing. Gefran also produces thermocouples in the three tolerance classes (1, 2 and 3) in conformity to IEC 60584-2 standards.

TEMPERATURE LIMITS

Symbol	Thermocouple type	Field of application	Temperature limit based on ø of wires							
ANSI	Calibration	°C	0.35	0.51	0.81	1.02	1.29	1.63	2.30	3.26
T	Copper-Constantan	-200 ÷ +390°C	/	200°	260°	/	/	390°	/	/
J	Iron-Constantan	-200 ÷ +760°C	/	370°	480°	500°	540°	590°	690°	760°
E	Chromium-Constantan	-200 ÷ +990°C	/	430°	540°	570°	600°	650°	900°	990°
K	Chromium-Aluminium	-200 ÷ +1270°C	/	960°	980°	1000°	1040°	1060°	1090°	1270°
S	Platinum 10% Rhodium-Platinum	0 ÷ +1450°C	1380°	1760°	/	/	/	/	/	/
R	Platinum 13% Rhodium-Platinum	0 ÷ +1760°C	1380°	1760°	/	/	/	/	/	/
B	Platinum 30% Rhodium-Platinum 6% Rhodium	0 ÷ +1820°C	1460°	1820°	/	/	/	/	/	/

TC9/AC9

TC10

Gefran thermocouples model TC9/AC9 and TC10 are designed for high-temperature applications (for example, heat-treatment furnaces) or for direct immersion (for example, aluminum smelting furnaces).

THERMOCOUPLES, RESISTANCE THERMOMETERS AND THERMOWELLS

OPERATING PRINCIPLE OF METAL RESISTANCE THERMOMETERS

Metal resistance thermometers, commonly called RTs, are based on the principle that the resistance R of a metal conductor is expressed by the following formula:

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

Where:
R = resistance of conductor
ρ = resistivity of conductor
l = length of conductor
A = area of conductor

When the temperature varies, the resistance of conductor Rt varies as well, which, compared to initial resistance Ro, can be expressed by the following formula:
$Rt = Ro*(1+\alpha t)$
Where:
Rt = resistance at temperature t°C
Ro = resistance at temperature 0°C
α = coefficient of temperature
t = temperature in °C

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

Gefran produces all of the most common types of metal resistance thermometers, with 2, 3, or 4 wires, in tolerance classes 1 DIN, 1/2 DIN, 1/5 DIN and 1/10 DIN in conformity to IEC 751-DIN 43760 standards.

TRM

TR6M/AR6M

Gefran resistance thermometers model TRM and TR6M/AR6M are designed for use in the plastics industry and for various other industrial applications

HOW TO CHOOSE THE MOST APPROPRIATE SENSOR

A temperature sensor is chosen on the basis of many variables, including:

- Characteristics of the application (temperature range, pressure range, process fluid, atmosphere at risk of explosion, need to use corrosion-proof materials, etc.).
- Size characteristics (external diameter of sheath, sheath material, length of immersion, process connection, type of cold junction, etc.)
- Class of precision
- Sensor response times

The following chart will be useful for choosing between a thermocouple and a resistance thermometer:

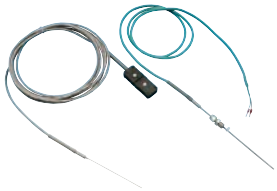
CONSIDERATION	THERMOCOUPLE	RESISTANCE THERMOMETER
Temperature range	-200 to 2000°C	-200 to 550°C
Power supply	Not required	Required
Self-heating	Not present	Present
Stability	Good	Excellent
Sturdiness	Excellent	Good
Precision	Good	High
Size	Very compact	> 3mm MgO
Measurement	At tip (hot junction)	At midpoint of RT
Resistance to vibration	Excellent (execution in MgO)	More fragile
Cost	More economical	

Gefran designs and produces its thermocouples and resistance thermometers in-house, using top-quality raw materials.

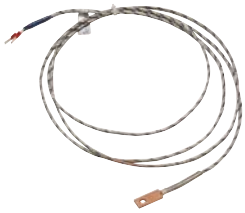
Our expert staff has over 35 years of experience and know-how.

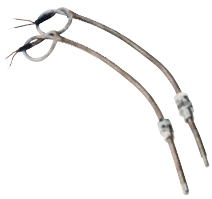
CODE LEGEND

TC = Thermocouple
TR = Resistance thermometer
A = Amplified thermocouple or resistance thermometer
M = Mineral oxide (MgO) thermocouple or resistance thermometer



MODEL	TC1	TC1M	TC3
TYPE	J - K	T - J - K	J - K
TEMPERATURE RANGE	-40...+250 °C	-80...+1050 °C	-40...+250 °C
CLASS OF TOLERANCE (Reference)	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 1 e 2	IEC584 - 2 CLASS 2
GRADE OF PROTECTION	-	-	-
DIMENSIONS min/max diameter	from 3 to 8 mm	from 1 to 6 mm	4,8 mm
TYPE OF TERMINATION	GSC silicon rubber cable Screened GSC silicon rubber cable TTS glass fibre cable TES Teflon cable	GSC silicon rubber cable Screened GSC silicon rubber cable TTS glass fibre cable TES Teflon cable	TTS glass fibre cable TES Teflon cable
ELECTRICAL CONNECTIONS	Free wires Cable terminals Compensated connectors	Free wires Cable terminals Compensated connectors	Free wires Cable terminals Compensated connectors
PROCESS CONNECTIONS	Nickel-plated brass or stainless steel adjustable or welded fitting with thread from 1/8" to 1/2"	Nickel-plated brass or stainless steel adjustable or welded fitting with thread from 1/8" to 1/2"	Connection thread from M8 to 1/4"
TYPE OF MEASUREMENT	By immersion	By immersion	By contact
MATERIALS	AISI 300 series stainless steel	AISI 316 stainless steel INCONEL 600 Others on request	AISI 304 stainless steel Brass
ISOLATION RESISTANCE (at ambient temperature)	> 1000 MΩ at 500Vcc	for diameter < 1,5 > 500 MΩ a 50Vcc > 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc
APPLICATIONS	Plastics materials Food processing ovens Domestic Appliances	Wide range of industrial uses in the chemical, food and engineering industries	Plastics extruders





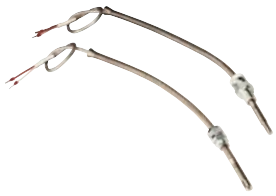
T4A	T4F	T4P	TC5/TC5N	TC5M
J - K	J - K	J - K	J - K	J - K
-40...+250 °C	-40...+250 °C	-40...+250 °C	-40...+250 °C	-40...+390 °C for J -40...+960 °C for K
IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 1 and 2
-	-	-	-	-
hole int. ø 4-10 mm hole ext. ø 8-20 mm	ø min 14-168 mm ø max 24-188 mm	ø 10 x 20 x 3 mm	from 5 to 8 mm	3 mm
TTS glass fibre cable TES Teflon cable	TTS glass fibre cable TES Teflon cable	TTS glass fibre cable TES Teflon cable	GSC silicon rubber cable Screened GSC silicon rubber cable TTS glass fibre cable TES Teflon cable	GSC silicon rubber cable Screened GSC silicon rubber cable TTS glass fibre cable TES Teflon cable
Free wires Cable terminals Compensated connectors	Free wires Cable terminals Compensated connectors	Free wires Cable terminals Compensated connectors	Free wires Cable terminals Compensated connectors	Free wires Cable terminals Compensated connectors
With fixing screws	Fixing band	With fixing screws	AVP zinc-plated iron bayonet or screw fitting with thread from M12 x 1 / 1,5 / 1,75 to 1/4"G	AVP zinc-plated iron female bayonet fitting with thread from M10 to 1/4"G
By contact on a flat surface	By contact on piping or cylindrical surface	By contact on a flat surface	By immersion with compression spring	By immersion with compression spring
AISI 304 stainless steel Brass	Galvanised carbon steel AISI 304 stainless steel	AISI 304 stainless steel Copper	AISI 303 stainless steel	AISI 316 stainless steel for J type INCONEL 600 for K type
> 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	Piping in heating plants Monitoring	Machine surfaces Flat surfaces in general	Plastics extruders	Extruders for the new concept plastics materials



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	-80...+1100 °C	-80...+1050 °C
CLASS of TOLERANCE (Reference)	IEC584 - 2 CLASS 1 / 2	IEC584 - 2 CLASS 1 / 2	IEC584 - 2 CLASS 1 / 2	IEC584 - 2 CLASS 1 / 2
GRADE of PROTECTION	IP 55 except the connector	IP 44 - IP 65	IP 44 - IP 65	-
DIMENSIONS min/max diameter	from 12,7 to 17,8 mm	from 5 to 12 mm	from 2 to 8 mm	from 1 to 6 mm
TYPE of TERMINATION	Flexible sleeve Rigis stem	DIN and explosion-proof connection head with ceramic socket or 4...20mA transmitter	DIN and explosion-proof connection head with ceramic socket or 4...20mA transmitter	Rigid stem
ELECTRICAL CONNECTIONS	Compensated connector LEMO series connector	Watertight, ryton ceramic socket	Watertight, ryton ceramic socket	Compensated connector
PROCESS CONNECTIONS	1/2" - 20UNF M18 x 1,5 Thread	Adjustable or welded fitting with thread from 1/8" to 1/2"	Nickel-plated brass or stainless steel adjustable or welded fitting with thread from 1/8" to 1/2"	Adjustable compression fitting with thread from 1/8" to 1/2"
TYPE of MEASUREMENT	By immersion By contact Elliptic tips	By immersion	By immersion	By immersion By contact
MATERIALS	AISI 316 TI stainless steel AISI 304 stainless steel Other on request	AISI 300 series stainless steel INCONEL 600 Other on request	AISI 300 series stainless steel INCONEL 600 Other on request	AISI 300 series stainless steel INCONEL 600
ISOLATION RESISTANCE (At ambient temperature)	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc
APPLICATIONS	Extrusion of plastics at high pressure and with abrasive materials	On pressurised piping Industrial plant	Industrial processes Ovens Chimneys Boilers	Process measurements 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
-40...+1050 °C	-40...+1050 °C	-40...+1000 °C	-40...+1600 °C	-40...+1200 °C
IEC584 - 2 CLASS 1 / 2	IEC584 - 2 CLASS 1 / 2	IEC584 - 2 CLASS 2	IEC584 - 2 CLASS 1 / 2	IEC584 - 2 CLASS 1 / 2
IP 44 - IP 65	Thermometric insert	IP 44 - IP 65	IP 44 - IP 65	IP 44 - IP 65
from 10 mm to 3/4"	from 1 to 6 mm	from 16 mm to 3/4"	from 10 to 26 mm	from 1/2" to 55 mm
DIN and explosion-proof connection head with ceramic socket or 4...20mA transmitter	-	DIN and explosion-proof connection head with ceramic socket or 4...20mA transmitter	DIN and explosion-proof connection head with ceramic socket or 4...20mA transmitter	DIN and DIN BUS connection head
Watertight, ryton ceramic socket	Watertight, ryton ceramic socket	Watertight, ryton ceramic socket	Watertight, ryton ceramic socket	Watertight, ryton ceramic socket
Welded fitting with thread from 3/8" to 1" Adjustable flange	-	Welded fitting with thread from 1/2" to 1" Adjustable flange	Support coupling	-
By immersion	By immersion	By immersion	By immersion	By immersion
AISI 300 series stainless steel INCONEL 600	AISI 300 series stainless steel INCONEL 600	AISI 300 series AISI 446 series stainless steel INCONEL 600	Ceramics with different grades of purity KER 530 / 610 / 710	AISI 310/316 INCONEL 600 Spheroidal Cast Iron Graphite AISI 446
> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc	> 1000 MΩ at 500Vcc
On pressurised piping Industrial plant	Thermometric insert	Industrial processes Ovens Chimneys Boilers	Baking ovens for ceramics Glass vault furnaces Chimneys	Non ferrous metal smelting furnaces Molten salt baths





MODEL	TR1	TR1M	TR5/TR5N
TYPE	Thin film	Wirewound	Thin film
TEMPERATURE RANGE	-40...+250 °C	-40...+600 °C	-40...+250 °C
CLASS of TOLERANCE (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	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X ltl CLASS A: 0,15 + 0,002 X ltl
GRADE of PROTECTION	-	-	-
DIMENSIONS min/max diameter	from 3 to 8 mm	from 3 to 6 mm	from 5 to 8 mm
TYPE of TERMINATION	GSC silicon rubber cable Screened GSC silicon rubber cable TTS glass fibre cable TES Teflon cable	GSC silicon rubber cable Screened GSC silicon rubber cable TTS glass fibre cable TES Teflon cable	GSC silicon rubber cable Screened GSC silicon rubber cable TTS glass fibre cable TES Teflon cable
ELECTRICAL CONNECTIONS	Free wires Cable terminals Compensated connectors	Free wires Cable terminals Compensated connectors	Free wires Cable terminals Compensated connectors
PROCESS CONNECTIONS	Nickel-plated brass or stainless steel adjustable or welded fitting with thread from 1/8" to 1/2"	Nickel-plated brass or stainless steel adjustable or welded fitting with thread from 1/8" to 1/2"	AVP zinc-plated iron bayonet or screw fitting with thread from M12 x 1 / 1,5 / 1,75 to 1/4" GAS
TYPE of MEASUREMENT	By immersion	By immersion	By immersion with compression spring
MATERIALS	AISI 300 stainless steel	AISI 316 stainless steel	AISI 303 stainless steel
ISOLATION RESISTANCE (At ambient temperature)	> 100 MΩ with voltage from 10 to 100Vcc	> 100 MΩ with voltage from 10 to 100Vcc	> 100 MΩ with voltage from 10 to 100Vcc
APPLICATIONS	Plastics machinery Food processing ovens Domestic appliances	Wide range of industrial applications Chemical, Food Engineering	Plastic extruders with low vibration

TRM	TRD	TR6/AR6	TR6M/AR6M
Wirewound	Wirewound	Encapsulated thin film	Wirewound
-40...+600 °C	-40...+150 °C	-40...+600 °C	-80...+600 °C
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
IP 55	IP 65	IP 45 - IP 65	IP 44 - IP 65
from 12,7 to 17,8 mm	6 mm	from 5 to 12 mm	from 3 to 6 mm
Flexible sleeve Rigid stem	Tinned copper extension cable Silicon rubber sleeve	DIN and explosion-proof connection head with ceramic socket or 4...20mA transmitter	DIN and explosion-proof connection head with ceramic socket or 4...20mA transmitter
Compensated connector LEMO series connector	Free terminals	Watertight, ryton ceramic socket	Watertight, ryton ceramic socket
1/2" - 20UNF M18 x 1,5 Thread	Direct immersion	Adjustable or welded fitting with thread from 1/8" to 1/2"	Adjustable or welded fitting with thread from 1/8" to 1/2"
By immersion By contact Elliptic tips	Buried in cement	By immersion	By immersion
AISI 316 TI steel AISI 304 steel Other on request	Stainless steel	AISI 300 series stainless steel INCONEL 600	AISI 300 stainless steel
> 1000 MΩ to 500Vcc	> 100 MΩ with voltage from 10 to 100Vcc	> 100 MΩ with voltage from 10 to 100Vcc	> 100 MΩ with voltage from 10 to 100Vcc
Extrusion of plastics at high pressure and with abrasive materials	Monitoring of dykes Civil plant	Measurement of fluids in conduits Electrical machines	Measurement of fluids in conduits Electrical machines

MODEL	TR7M	TR2/AR2	TRI
TYP	Wirewound	Wirewound	Wirewound
TEMPERATURE RANGE	-40...+600 °C	-40...+600 °C	-40...+600 °C
CLASS of TOLERANCE (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	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X ltl CLASS A: 0,15 + 0,002 X ltl 1/3 DIN
GRADE of PROTECTION	-	IP 44 - IP 65	-
DIMENSIONS min/max diameter	from 3 to 6 mm	from 10 mm to 3/4"	from 3 to 6 mm
TYPE of TERMINATION	Rigid stem	DIN and explosion-proof connection head with ceramic socket or 4...20mA transmitter	-
ELECTRICAL CONNECTIONS	Compensated connector 2 /3 contacts	Watertight, ryton, sprung, ceramic socket	Watertight, ryton, sprung, ceramic socket
PROCESS CONNECTIONS	Adjustable fitting with thread from 1/8" to 1/2"	Welded fitting with thread from 3/8" to 1" Adjustable flange	-
TYPE of MEASUREMENT	By immersion	By immersion direct contact with the process element	By immersion direct contact with the process element
MATERIALS	AISI 316 stainless steel	AISI 300 series stainless steel INCONEL 600	AISI 316 stainless steel
ISOLATION RESISTANCE (At ambient temperature)	> 100 MΩ with voltage from 10 to 100Vcc	> 100 MΩ with voltage from 10 to 100Vcc	> 1000 MΩ with voltage from 10 to 100Vcc
APPLICATIONS	Process measurements Test laboratoires	On large diameter piping In tanks	Thermometric insert

MODEL	TCMG	TCV	TCMK	TCMM
				
TYP	T - J - E - K - N Multilevel up to 24 points of measurement	S - R - B Single or Multilevel up to 3 points of measurement	T - J - E - K - N	T - J - E - K - N Multilevel up to 5 points of measurement
TEMPERATURE RANGE	-80...+600 °C	-600...+1600 °C	-80...+1050 °C	-40...+1100 °C
CLASS of TOLERANCE (Reference)	IEC584 - 2 CLASS 1 / 2	IEC584 - 2 CLASS 1 / 2	IEC584 - 2 CLASS 1 / 2	IEC584 - 2 CLASS 1 / 2
GRADE of PROTECTION	IP 54	IP 55	-	IP 54
DIMENSIONS min/max diameter	from 4 to 6 mm	from 10 to 24 mm Ceramic sleeve	from 3 to 6 mm	from 1 to 4,5 mm Single sleeve
TYPE of TERMINATION	Explosion-proof connection box	DIN connection heads	Metal sleeve	Explosion-proof connextion box
ELECTRICAL CONNECTIONS	Multipole terminal block Screw terminals	Ceramic terminal block	Free terminals	Multipole terminal block Screw terminals
PROCESS CONNECTIONS	Fitting Flange	Immersion in the refractory seat	Compression fitting with thread from 1/8" to 3/4"	Fixed flange
TYPE of MEASUREMENT	By differential immersion	By immersion	Fixed superficial contact measurement	By differential immersion
MATERIALS	AISI 300 series stainless steel INCONEL 600	Stabilised platinum sleeve	AISI 316 series stainless steel INCONEL 600	AISI 300 series stainless steel INCONEL 600
ISOLATION RESISTANCE (At ambient temperature)	> 1000 MΩ to 500Vcc	> 1000 MΩ to 500Vcc	> 1000 MΩ to 500Vcc	Diameter < 1,5 mm: 500 MΩ at 50Vcc Diameter > 1,5 mm: > 1000 MΩ at 500Vcc
APPLICATIONS	Chemical reactors Fermentation silos Refining towers	Molten glass baths	Boiler internal piping Heat exchangers	Molten glass baths




MODEL	TCC	TCP	TCGK	TCE/ACE
TYP	T - J - E - K - N	T - J - E - K	T - J - E - K - N	J - E - K
TEMPERATURE RANGE	-80...+1250 °C	-40...+300 °C	-40...+1050 °C	-40...+1000 °C
CLASS of TOLERANCE (Reference)	IEC584 - 2 CLASS 1 / 2	UNI 7938 IEC584 - 2 CLASS 1 / 2	UNI 7938 IEC584 - 2 CLASS 1 / 2	IEC584 - 2 CLASS 2
GRADE of PROTECTION	IP 65	IP 65	IP 55	IP 44 - IP 65
DIMENSIONS min/max diameter	from 3 to 6 mm	4,5 mm	from 3 to 6 mm	from 16 mm to 3/4"
TYPE of TERMINATION	Weather proof adaptor or with gasket	Hand held with extension cable	Explosion-proof connection head	DIN and explosion-proof connection head with ceramic socket or 4...20mA transmitter
ELECTRICAL CONNECTIONS	Military series connector with alloy contacts	Free terminals Compensated connectors	Ceramic socket	Ceramic terminal block Ryton Airtight
PROCESS CONNECTIONS	Threaded spring fitting	-	Welded fitting with thread from 1/4" to 3/4"	Welded stainless steel fitting with thread from 1/2" to 1"
TYPE of MEASUREMENT	By immersion By contact	By penetration	By fixed contact	By immersion
MATERIALS	AISI 300 series stainless steel INCONEL 600	AISI 316 series stainless steel INCONEL 600	AISI 316 series stainless steel INCONEL 600	AISI 300 series stainless steel AISI 446 INCONEL 600
ISOLATION RESISTANCE (At ambient temperature)	>1000 MΩ to 500Vcc	>1000 MΩ to 500Vcc	>1000 MΩ to 500Vcc	>1000 MΩ to 500Vcc
APPLICATIONS	Multifuel boilers Community heating systems Energy generation	Food industry Sundry applications	Boiler tubes Heat exchangers	Industrial processes Ovens Chimneys Boilers

					
TR4	**TR8M**	**TR9M**	**TR9S/TR9D**	**TRA**	**TRP**
Thin film Wirewound	Wirewound	Wirewound	Thin film	Thin film	Wirewound
-40...+200 °C	-40...+600 °C	-40...+600 °C	-40...+150 °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	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	UNI 7937 IEC 751 CLASS B: 0,3 + 0,005 X ltl CLASS A: 0,15 + 0,002 X ltl
IP 54	IP 44 - IP 65	IP 44 - IP 65	IP 65	IP 54	IP 65
to define	from 3 to 6 mm	6 mm	10 x 10 mm	14 mm	4,5 mm
DIN and explosion-proof connection head	Plug adaptor with screwed gasket	Plug adaptor with screwed gasket	Metal stem	Polycarbonate cassette 110 x 80 x 65 mm	Handle with extension cable
Ceramic terminal block Ryton Airtight	Connectors with MIL. standard contacts	Connectors with MIL. standard contacts.	Free terminals	Screw fixing terminal box	Free terminals Compensated connectors
Welded stainless steel fitting with thread from 1/2" to 3/4"	Stainless steel or nickel plated brass compression fitting with thread from 1/4" to 1/2"	Sliding threaded fitting in stainless steel nickel plated brass with 1/4" to 1/2" compression spring	Resin sealed in suitable seat	With fixing screws on the walls Metal brackets	-
By immersion in the fluid	By immersion	By immersion with point contact	By contact	By immersion	By penetration
AISI 300 stainless steel	AISI 316 stainless steel	AISI 316 stainless steel with silver plated tip	Needle probe in tinned brass	AISI 304 stainless steel	AISI 316 stainless steel
> 100 MΩ with voltage from 10 to 100Vcc	> 100 MΩ with voltage from 10 to 100Vcc	> 100 MΩ with voltage from 10 to 100Vcc	> 100 MΩ with voltage from 10 to 100Vcc	> 100 MΩ with voltage from 10 to 100Vcc	> 100 MΩ with voltage from 10 to 100Vcc
Air conduits Ambient measurement	Test laboratories Chemical plant	Hydroelectric and thermal power generation Pumps	Bearing temperature measurement on electric motors	Monitoring Metrology laboratories Ambient temperature measurement	Food industry Sundry applications




MODEL	TWB1	TWT1	TWB2	TWT2
TYP	Thermowell from cylindrical bar stock	Thermowell from cylindrical bar stock	Flanged thermowell from cylindrical bar stock	Flanged thermowell from cylindrical bar stock
EXTERNAL DIMENSIONS min/max diameter	from 12 to 20 mm	from 12 to 21,3 mm	from 16 to 22 mm	> 10 mm
INTERNAL HOLE DIMENSIONS Diameter	from 7 to 9 mm	Standard 8 (for 12 mm) Others > 10 mm	from 7 to 9 mm	from 7 to 9 mm
PROBE CONNECTIONS	Threaded fitting from 1/4" to 1/2"	Threaded fitting from 1/4" to 1/2"	Threaded fitting from 1/4" to 1/2"	Threaded fitting from 1/4" to 1/2"
PROCESS CONNECTIONS	Threaded fitting from 1/2" to 1"	Threaded fitting from 1/2" to 1"	UNI - ASA threaded fitting	UNI - ASA threaded fitting
MATERIALS	AISI 300 series stainless steel INCONEL 600	AISI 300 series stainless steel INCONEL 600	AISI 300 series stainless steel ASTM A105	AISI 300 series stainless steel ASTM A105

Precision class for thermocouples (Rif. IEC 584-2)

TYP	T	E	J	K/N	R/S	B
TOLERANCE CLASS 1						
Temperature range	-40...+125 °C	-40...+375 °C	-40...+375 °C	-40...+375 °C	0...+1100 °C	-
Tolerance	±0,5 °C	±1,5 °C	±1,5 °C	±1,5 °C	±1 °C	-
Temperature range	125...+350 °C	375...+800 °C	+375...+750 °C	+375...+1000 °C	+1100...+1600 °C	-
Tolerance	±0,004 • [t]	±0,004 • [t]	±0,004 • [t]	±0,004 • [t]	±[1+0,003 [t-1100]] °C	-
TOLERANCE CLASS 2						
Temperature range	-40...+133 °C	-40...+333 °C	-40...+333 °C	-40...+333 °C	0...+600 °C	-
Tolerance	±1 °C	±2,5 °C	±2,5 °C	±2,5 °C	±1,5 °C	-
Temperature range	+133...+350 °C	+333...+900 °C	+333...+750 °C	+333...+1200 °C	+600...+1600 °C	+600...+1700 °C
Tolerance	±0,0075 • [t]	±0,0075 • [t]	±0,0075 • [t]	±0,0075 • [t]	±0,0025 • [t]	±0,0025 • [t]
TOLERANCE CLASS 3						
Temperature range	-67...+40 °C	-167...+40 °C	-	-167...+40 °C	-	+600...+800 °C
Tolerance	±1 °C	±2,5 °C	-	±2,5 °C	-	+4 °C
Temperature range	-200...-67 °C	-200...-167 °C	-	-200...-167 °C	-	800...1700 °C
Tolerance	±0,015 • [t]	±0,015 • [t]	-	±0,015 • [t]	-	±0,005 • [t]






TWB3	TWB4	TWT4	TWB5	TWB6	TWB7
Thermowell from conical bar stock	Thermowell from bar stock with narrowed tip	Thermowell from tube stock with narrowed tip	Thermowell from conical bar stock	Flanged thermowell from conical bar stock	Thermowell from bar stock for welding
from 16 to 24 mm with taper to 16 mm	Fixed 14/7	Fixed 14/7	from 18 to 24 mm with taper to 14 mm	from 12 to 20 mm	min diameter: from 14 to 19 mm max. diameter: from 17 to 30 mm
from 7 to 9 mm	from 7 to 9 mm	10 mm	7 mm	from 7 to 9 mm	7 mm
Threaded fitting from 1/4" to 1/2"	Threaded fitting from 1/4" to 1/2"	Threaded fitting from 1/4" to 1/2"	Threaded fitting from 1/4" to 1/2"	Threaded fitting from 1/4" to 1/2"	Threaded fitting from 1/4" to 1/2"
Threaded fitting from 1/2" to 1"	Threaded fitting from 1/2" to 1"	Threaded fitting from 1/2" to 1"	Threaded fitting from 3/4" to 1"	UNI - ASA type flanged fitting	Fitting to weld
AISI 300 series stainless steel INCONEL 600	AISI 300 series stainless steel INCONEL 600	AISI 300 series stainless steel INCONEL 600	AISI 300 series stainless steel INCONEL 600 ASTM A182 F11 & F22	AISI 300 series stainless steel INCONEL 600 ASTM A182 F11 & F22	AISI 300 series stainless steel INCONEL 600 ASTM A182 F11& F22

Precision class for PT 100 resistance thermometers

DIN 43760 IEC 751		PRECISION A 0°C
B	1 DIN	± 0,3°C
A	1/2 DIN	± 0,15°C
-	1/3 DIN	± 0,1°C
-	1/5 DIN	± 0,06°C
-	1/10 DIN	± 0,03°C

STAINLESS STEEL OR BRASS PRESSURE FITTINGS

ELECTRICAL CONNECTOR HEADS

DIN B

DIN A

DIN BUS

EEx-d

BUZ-H

DIN J

SIGNAL AMPLIFIERS 4-20mA AND PT100 FOR RESISTANCE THERMOMETER

SIGNAL AMPLIFIERS PROGRAMMABLE FROM PC

DIN BAR ADAPTER

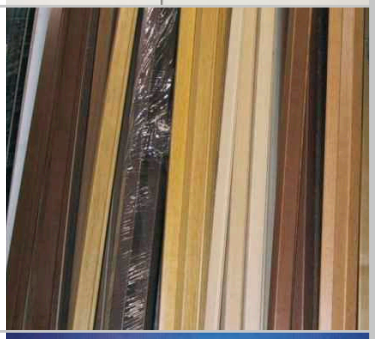
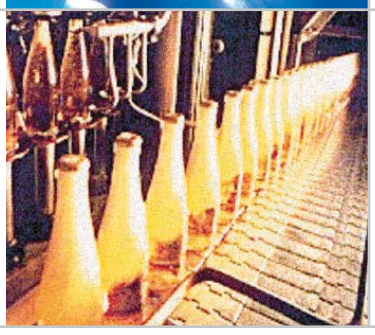
TDP DISPLAY

CONNECTORS

STANDARD COMPENSATED CABLES

MIGNON COMPENSATED CABLES

LEMO connectors

FURNACES FOR ALUMINUM, CERAMICS, HEAT TREATMENTS		INJECTION-EXTRUSION, BLOWING	
CHEMICAL AND PETROCHEMICAL INDUSTRY		WOODWORKING	
STEEL INDUSTRY AND HEAT TREATMENT		CLIMATE-CONTROLLED ROOMS	
PHARMACEUTICAL INDUSTRY		FOOD AND CANNING INDUSTRY	
GLASSWORKS		STEEL INDUSTRY, FOUNDRIES, FURNACES	

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