TEMPERATURE MEASUREMENT

PanelComponents

TO SWITCH ON YOUR SOLUTION

TEMPERATURE **MEASUREMENT**

Temperature sensors, commonly used in measurements for control and automation, can be divided into two macro groups:

1) Sensors that exploit the thermoelectric effect (also called the Seebeck effect after the name of the physicist who discovered it, Thomas Johann Seebeck) *"a circuit formed by two conductors made of different metals, joined together at one end to form a junction, generates a low voltage between the free ends of the two conductors. That voltage is proportional to real temperature at the junction. When the temperature changes, the voltage between the two free terminals, increase or decrease accordingly"*. This is the principle on which thermocouples are based.

2) Sensors that exploit the variation in resistivity of some materials to the variation of the temperature *"in particular for metals there is a linear relationship that links the value of resistivity of the metal itself with the temperature to which they are subjected"*. This is the principle on which resistance thermometers and thermistors are based.

THERMOCOUPLES

Thermocouples, often abbreviated in TC, are distinguished by the two conductors forming the junction, called "hot junction" The different types of thermocouples are chosen according to the field of application and average temperature value to be measured.

Type K thermocouples are the most widespread model, of general use and available in a wide variety of formats. The traditional measurement range goes from -200°C to 1260°C.

Type J thermocouples have the most limited measurement range, traditionally -40°C to 750°C, making them less widespread than K. They have high measurement sensitivity, but are more prone to oxidation. They are not suitable for measurements below 0°C.

Type T thermocouples have characteristics similar to type J thermocouples and good sensitivity. They are traditionally used in the temperature range between -200°C and 400°C.

Type E thermocouples have a high sensitivity that makes it very suitable for low temperature (cryogenic) applications.

Types B, R and S thermocouples, made of precious metals, have similar characteristics. They are the most stable, but their low sensitivity limits their use to high temperature measurements: from 300°C to 1800°C (types R and S) and up to 1800°C (type B).

Type N thermocouples are an evolution of type K, with a traditional measurement range from 650°C to 1250°C. Stability and resistance to hot oxidation make these an alternative to types R and S for high temperature measurements.

RESISTANCE THERMOMETERS

Resistance thermometers, often abbreviated in RTD (Resistance Temperature Detector), differ according to the resistive element (Pt, Ni, Cu) used for the measurement. Today, platinum is the most widely used sensitive element, particularly with a resistance value at 0°C equal to 100Ω (**Pt100**) or 1,000 Ω (**Pt1000**).

International standard IEC 751 classifies resistance thermometers depending on tolerance in the measurement. Class B is the most widespread in the field of automation. In applications requiring greater precision, class A, 1/3 DIN, 1/5 DIN sensors are used.

RTDs are built with **two different kind** of sensitive element: **wire type** which offers a slightly larger operating range (in the chosen precision class) and **thin film type** which offers greater endurance to the typical vibrations of industrial applications. Both models have two terminals for connection. The definition 2, 3 or 4 wire RTD refers to the number of conductors used to connect the sensitive element to the measuring equipment. These connections, made with standard electric cables, inevitably introduce additional resistance value in the measuring circuit.

This value, added to the resistance value of the sensor, generates a small error proportionate to the length of the cables. In some cases (short distance from sensor to measuring equipment, especially with Pt1000) the error is considered negligible therefore 2 wires connection is accepted and used. The 3 or 4 wires connection allows to reduce, or even to cancel, this error thanks to a specific measuring system inside the equipment. Best effectiveness is obtained with the 4 wires connection, but the most used is the 3 wires system which, over medium/long distances, grants good accuracy at lower cost.

THERMISTORS

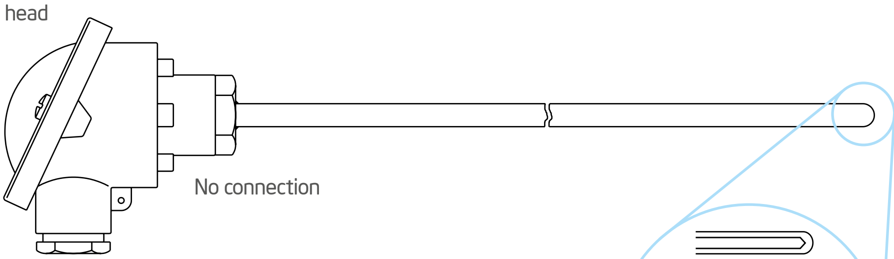
Thermistors (thermal resistors) are resistors made by semiconductors of which the resistance (Ω) changes significantly even with small temperature variations. In limited measuring ranges, at low temperature, thermistors represent a reliable and economic solution. Thermistors split in:

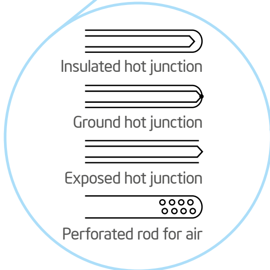
NTC (*Negative Temperature Coefficient*) in which the resistance value decrease with temperature increasing

PTC (*Positive Temperature Coefficient*) in which the resistance value increase with temperature increasing

Probes with standard head (watertight)

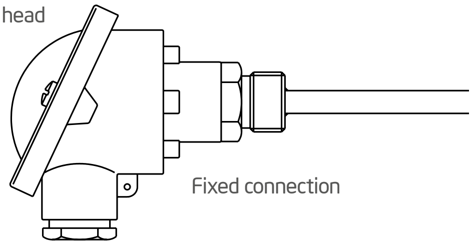
Type B head





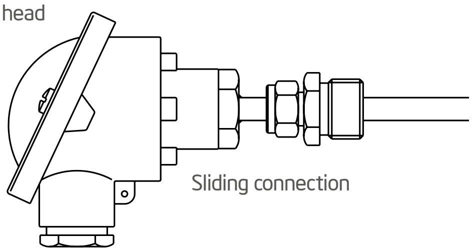
No connection

Type B head



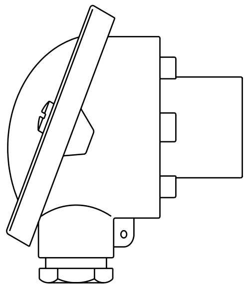
Fixed connection

Type B head

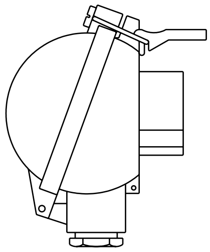


Sliding connection

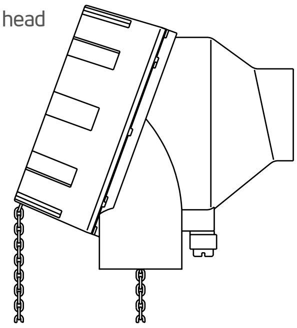
Type A head



Type C head



Type E head



Conventional insulation thermocouples and resistance thermometers, for immersion with connection head suitable for generic measurements and adjustments on systems. Fixing by means of a threaded connection welded directly on the sleeve (fixed) or by means of compression couplings or sliding couplings.
The electrical connection is made inside the connection head via a ceramic terminal block.
Also available with 4-20 mA analogue output.

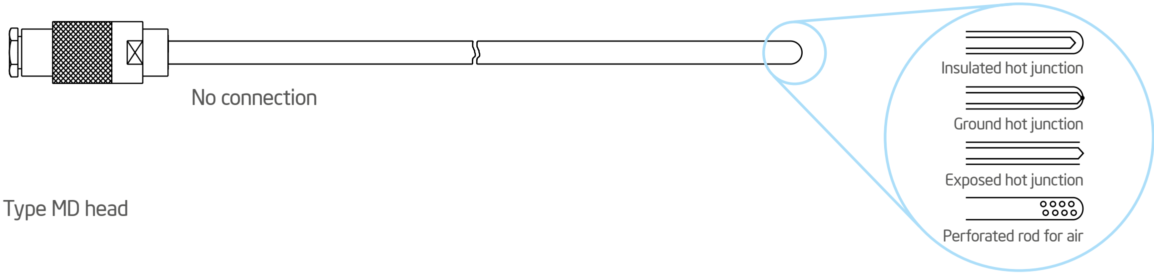
probe	calibration	model	metres of cable	rod material	rod diameter	rod length (see note*)	connection	execution 1	execution 2	transmitter	for execution
T thermocouple	**T**	**A** type A watertight head	**S** no cable	**0** AISI 310	**3** = 3 mm		**0** no connection	**S** simple with insulators	**0** only resistance thermometers and thermistors	**S** without transmitter	**- 0** catalogue execution
	U	**B** type B watertight head		**4** AISI 304	**4** = 4,5 mm		** with connection (see note)	**M** simple with mineral oxide	**1** insulated hot junction (only thermocouples)	**T** transmitter in mA	**- X** special execution
	J	**C** clamp closure watertight head		**6** AISI 316	**6** = 6 mm		**F** with flange	**Z** double with insulators	**2** ground hot junction (only thermocouples)	**I** transmitter in insulated mA	**- D** drawing execution
	L	**E** explosion-proof terminal block		**7** INCONELL	**8** = 8 mm		**C** with clamp	**G** double in mineral oxide	**3** hot junction or exposed sensor		
	E			**8** HASTELLOY	**0** = 10 mm				**4** perforated		
	K				**A** = 12 mm						
	N				**B** = 15 mm						
	R				**C** = 20mm						
	S										
R standard B class platinum resistance thermometer	**2** Pt 100 2 wires										
A class A platinum resistance termometer	**3** Pt 100 3 wires										
	4 Pt 100 4 wires										
	0 Pt 1000 2 wires										

* For lenghts up to 999mm numerical code (examples 250=250mm / 050=50mm / 006=6mm)
For lenghts between 1mt to 9mt alphanumeric code (examples 1M5=1,50mt / 3M0=3,00mt)
For lenghts from 10mt upwards alphanumeric code (examples 10M=10mt / 15M=15mt)

** fixed male connection: **A** = 1/4 gas; **B** = 1/4 NPT; **C** = 3/8 gas; **D** = 3/8 NPT; **E** = 1/2 gas; **F** = 1/2 NPT; **H** = 3/4 gas; **I** = 3/4 NPT; **X** = 1/8 gas; **Y** = 1/8 NPT
sliding male connection: **L** = 1/4 gas; **N** = 1/4 NPT; **P** = 3/8 gas; **Q** = 3/8 NPT; **R** = 1/2 gas; **T** = 1/2 NPT; **U** = 3/4 gas; **V** = 3/4 NPT; **W** = 1/8 gas; **Z** = 1/8 NPT

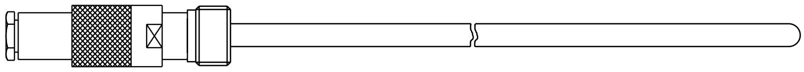
Probes with miniature head

Type MD head



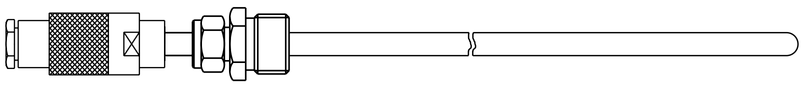
No connection

Type MD head



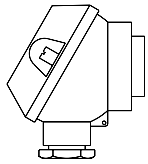
Fixed connection

Type MD head



Sliding connection

Type MA head



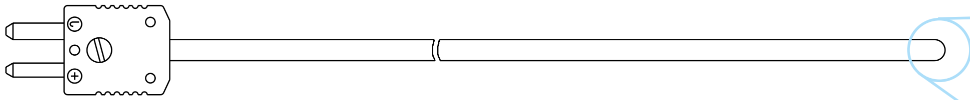
Conventional insulation thermocouples and resistance thermometers, for immersion with miniature connection head suitable for generic measurements and adjustments on systems. Fixing by means of a threaded connection welded directly on the sleeve (fied) or by means of compression couplings or sliding couplings. The electrical connection is made inside the connection head via a ceramic terminal block.

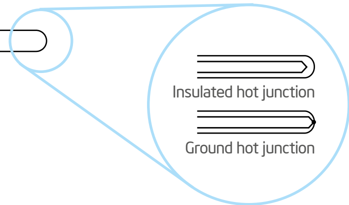
probe	calibra-tion	model	metres of cable	rod material	rod diameter	rod length (see note*)	connection	execution 1	execution 2	transmitter	- x esecuzione
T thermocouple	**T** **U** **J** **L** **E** **K** **N** **R** **S**	**M** Type MA head **D** Type MD head	**S** no cable	**0** AISI 310 **4** AISI 304 **6** AISI 316 **7** INCONELL **8** HASTEL-LOY	**1** = 1 mm **2** = 2 mm **3** = 3 mm **4** = 4,5 mm **6** = 6 mm **8** = 8 mm **0** = 10 mm **A** = 12 mm **B** = 15 mm **C** = 20mm		**0** no connection ** with connection (see note) **C** with clamp	**S** simple with insulators **M** simple with mineral oxide **Z** double with insulators **G** double in mineral oxide	**0** only resistance thermome-ters and thermistors **1** insulated hot junction (only thermo-couples) **2** ground hot junction (only thermocou-ples) **3** hot junction or exposed sensor **4** perforated	**S** without transmitter	**- 0** catalogue execution **- X** special execution **- D** drawing execution
R standard B class platinum resistance thermometer **A** class A platinum resistance termometer	**2** Pt 100 2 wires **3** Pt 100 3 wires **4** Pt 100 4 wires **0** Pt 1000 2 wires										

* For lenghts up to 999mm numerical code (examples 250=250mm / 050=50mm / 006=6mm)
For lenghts between 1mt to 9mt alphanumeric code (examples 1M5=1,50mt / 3M0=3,00mt)
For lenghts from 10mt upwards alphanumeric code (examples 10M=10mt / 15M=15mt)

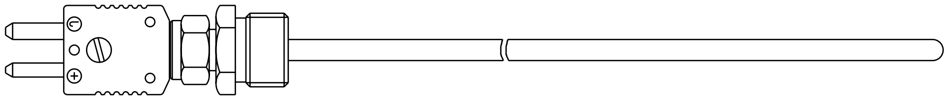
** fixed male connection: **A** = 1/4 gas; **B** = 1/4 NPT; **C** = 3/8 gas; **D** = 3/8 NPT; **E** = 1/2 gas; **F** = 1/2 NPT; **H** = 3/4 gas; **I** = 3/4 NPT; **X** = 1/8 gas; **Y** = 1/8 NPT
sliding male connection: **L** = 1/4 gas; **N** = 1/4 NPT; **P** = 3/8 gas; **Q** = 3/8 NPT; **R** = 1/2 gas; **T** = 1/2 NPT; **U** = 3/4 gas; **V** = 3/4 NPT; **W** = 1/8 gas; **Z** = 1/8 NPT

Probes with quick connection (plug/socket)

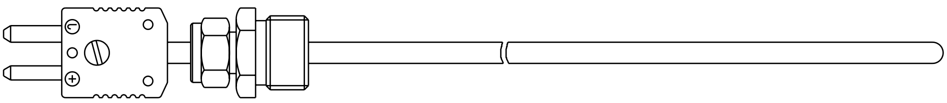




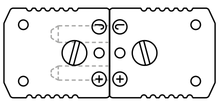
With plug, no connection



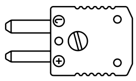
With plug,, fixed connection



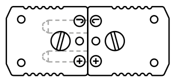
With plug,, sliding connection



With socket and plug



Miniaturised plug



Miniaturised socket and plug

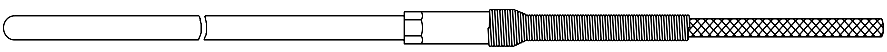
Sensors with integrated connectors are ideal for applications requiring sensors that can be easily disconnected. These probes are usually coated in metal and are available in a variety of diameters, lengths, types of thermocouples and resistance thermometers, and types of connector.

probe	calibra-tion	model	metres of cable	rod material	rod diameter	rod length (see note*)	connection	execution 1	execution 2	transmitter	for execution
T thermocouple	**T** **U** **J** **L** **E** **K** **N** **R** **S**	**N** with plug and female jack **P** with female jack **T** with miniaturised plug and female jack **Z** with miniaturised female jack	**S** no cable	**0** AISI 310 **4** AISI 304 **6** AISI 316	**1** = 1 mm **2** = 2 mm **3** = 3 mm **4** = 4,5 mm **6** = 6 mm **8** = 8 mm		**0** no connection ****** with connection (see note)	**M** simple with mineral oxide	**1** insulated hot junction (only thermo-couples) **2** ground hot junction (only thermocou-ples)	**S** without transmitter	**- 0** catalogue execution **- X** special execution **- D** drawing execution

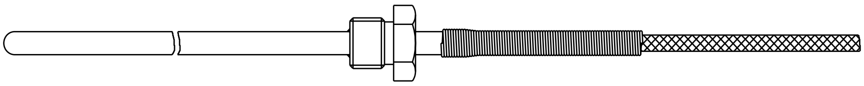
* For lenghts up to 999mm numerical code (examples 250=250mm / 050=50mm / 006=6mm)
For lenghts between 1mt to 9mt alphanumeric code (examples 1M5=1,50mt / 3M0=3,00mt)
For lenghts from 10mt upwards alphanumeric code (examples 10M=10mt / 15M=15mt)

** fixed male connection: **A** = 1/4 gas; **B** = 1/4 NPT; **C** = 3/8 gas; **D** = 3/8 NPT; **E** = 1/2 gas; **F** = 1/2 NPT; **H** = 3/4 gas; **I** = 3/4 NPT; **X** = 1/8 gas; **Y** = 1/8 NPT
sliding male connection: **L** = 1/4 gas; **N** = 1/4 NPT; **P** = 3/8 gas; **Q** = 3/8 NPT; **R** = 1/2 gas; **T** = 1/2 NPT; **U** = 3/4 gas; **V** = 3/4 NPT; **W** = 1/8 gas; **Z** = 1/8 NPT

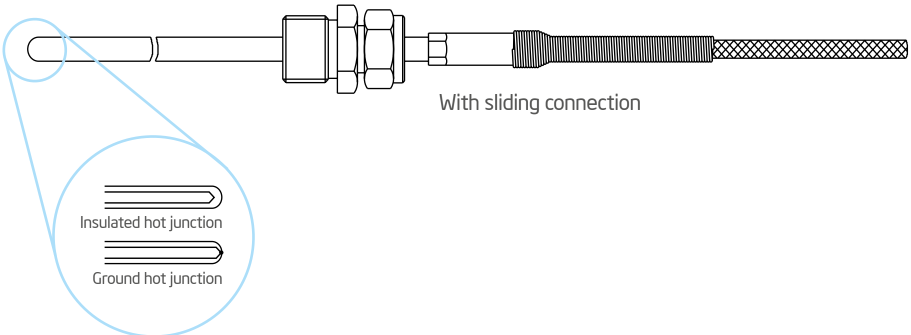
Cable probes



No connection

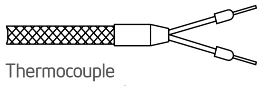


With fixed connection

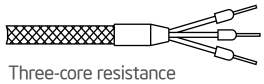


With sliding connection

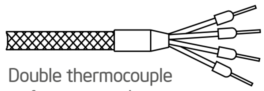
Cable terminals



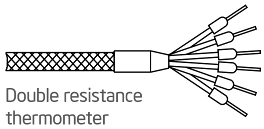
Thermocouple or two-core resistance thermometer or thermistor



Three-core resistance thermometer



Double thermocouple or four-core resistance thermometer



Double resistance thermometer

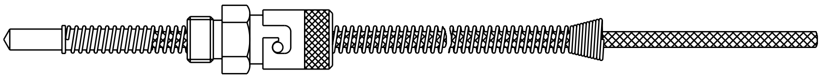
Cylindrical thermocouple and resistance thermometer with sleeve in AISI 316 stainless steel, suitable for generic measurements and adjustments.
The exit of the cable from the sleeve is protected by a stainless steel spring.

probe	calibration	model	metres of cable	rod material	rod diameter	rod length (see note*)	connection	execution 1	execution 2	transmitter	for execution
T thermocouple	**T** **U** **J** **L** **E** **K** **N** **R** **S**	**G** with spring, silicone rubber cable **Y** with spring, vetrotex cable **H** with spring, PVC cable **W** with spring, teflon cable	**1** = 1 m **2** = 2 m **3** = 3 m **4** = 4 m **5** = 5 m **6** = 6 m **7** = 7 m **8** = 8 m **9** = 9 m **0** = 10 m **E** = 15 m **F** = 20 m **G** = 30 m **H** = 40 m **V** = 50 m **C** = 100 m	**0** AISI 310 **4** AISI 304 **6** AISI 316 **7** INCONELL **8** HASTEL-LOY	**1** = 1 mm **2** = 2 mm **3** = 3 mm **4** = 4,5 mm **6** = 6 mm **8** = 8 mm		**0** no connection ****** with connection (see note)	**M** simple with mineral oxide **G** double in mineral oxide	**0** only resistance thermometers and thermistors **1** insulated hot junction (only thermocouples) **2** ground hot junction (only thermocouples) **3** hot junction or exposed sensor **4** perforated	**S** without transmitter	**- 0** catalogue execution **- X** special execution **- D** drawing execution
R standard B class platinum resistance thermometer **A** class A platinum resistance termometer	**2** Pt 100 2 wires **3** Pt 100 3 wires **4** Pt 100 4 wires **0** Pt 1000 2 wires										
N NTC thermistor	**1** 10 kΩ **2** 20 kΩ										
P PTC thermistor											

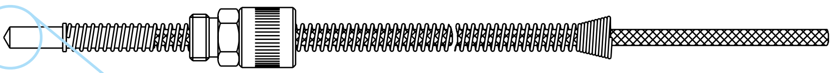
* For lenghts up to 999mm numerical code (examples 250=250mm / 050=50mm / 006=6mm)
For lenghts between 1mt to 9mt alphanumeric code (examples 1M5=1,50mt / 3M0=3,00mt)
For lenghts from 10mt upwards alphanumeric code (examples 10M=10mt / 15M=15mt)

** fixed male connection: **A** = 1/4 gas; **B** = 1/4 NPT; **C** = 3/8 gas; **D** = 3/8 NPT; **E** = 1/2 gas; **F** = 1/2 NPT; **H** = 3/4 gas; **I** = 3/4 NPT; **X** = 1/8 gas; **Y** = 1/8 NPT
sliding male connection: **L** = 1/4 gas; **N** = 1/4 NPT; **P** = 3/8 gas; **Q** = 3/8 NPT; **R** = 1/2 gas; **T** = 1/2 NPT; **U** = 3/4 gas; **V** = 3/4 NPT; **W** = 1/8 gas; **Z** = 1/8 NPT

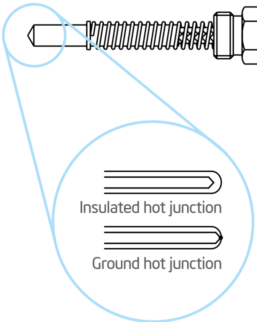
Probes with connection sliding on spring



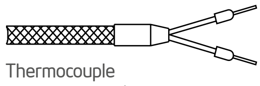
Bayonet lock



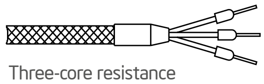
Screw lock



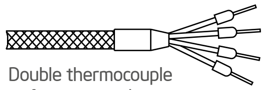
Cable terminals



Thermocouple
or two-core resistance
thermometer or thermistor



Three-core resistance
thermometer



Double thermocouple
or four-core resistance
thermometer

Spring-loaded thermocouple and resistance thermometer for measurements in metal plates. Fixing by means of threaded connection with bayonet mounting.
The immersion depth is adjustable; the tip and push spring are in stainless steel.

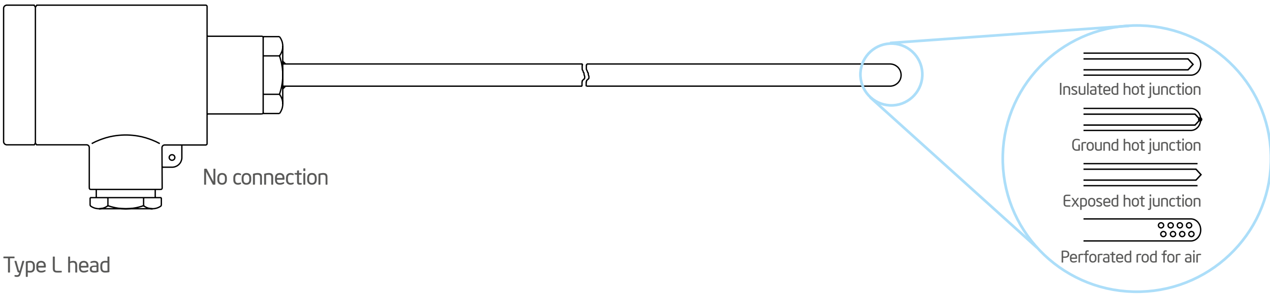
probe	calibration	model	metres of cable	rod material	diametro stelo	rod length (see note*)	connection	execution 1	execution 2	transmitter	for execution
T thermocouple	**T** **U** **J** **L** **E** **K** **N** **R** **S**	**S** bayonet mount with spring, silicone rubber cable **V** bayonet mount with spring, vetrotex cable **Q** screw mount with spring, silicone rubber cable **R** screw mount with spring, vetrotex cable	**1** = 1 m **2** = 2 m **3** = 3 m **4** = 4 m **5** = 5 m **6** = 6 m **7** = 7 m **8** = 8 m **9** = 9 m **0** = 10 m **E** = 15 m **F** = 20 m **G** = 30 m **H** = 40 m **V** = 50 m **C** = 100 m	**0** AISI 310 **4** AISI 304 **6** AISI 316	**1** = 1 mm **2** = 2 mm **3** = 3 mm **4** = 4,5 mm **6** = 6 mm **8** = 8 mm		** with connection (see note)	**M** simple with mineral oxide **G** double in mineral oxide	**0** only resistance thermometers and thermistors **1** insulated hot junction (only thermocouples) **2** ground hot junction (only thermocouples)	**S** without transmitter	**- 0** catalogue execution **- X** special execution **- D** drawing execution
R standard B class platinum resistance thermometer **A** class A platinum resistance termometer	**2** Pt 100 2 wires **3** Pt 100 3 wires **4** Pt 100 4 wires **0** Pt 1000 2 wires										
N NTC thermistor	**1** 10 kΩ **2** 20 kΩ										
P PTC thermistor											

* For lenghts up to 999mm numerical code (examples 250=250mm / 050=50mm / 006=6mm)
For lenghts between 1mt to 9mt alphanumeric code (examples 1M5=1,50mt / 3M0=3,00mt)
For lenghts from 10mt upwards alphanumeric code (examples 10M=10mt / 15M=15mt)

** sliding male connection: **L** = 1/4 gas; **N** = 1/4 NPT; **P** = 3/8 gas; **Q** = 3/8 NPT; **R** = 1/2 gas; **T** = 1/2 NPT; **U** = 3/4 gas; **V** = 3/4 NPT; **W** = 1/8 gas; **Z** = 1/8 NPT

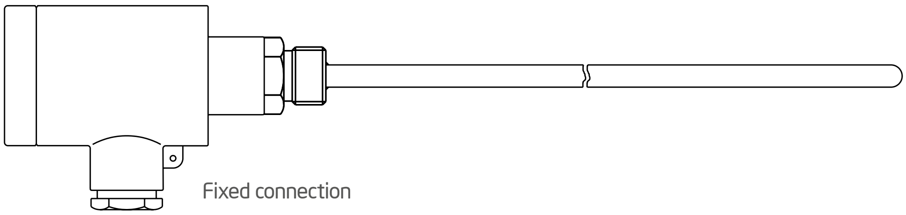
Probes with stainless steel head

Type L head



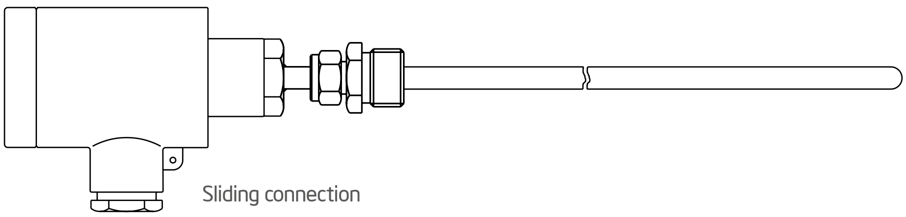
No connection

Type L head



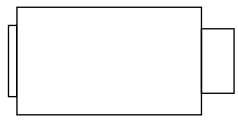
Fixed connection

Type L head



Sliding connection

Type I head



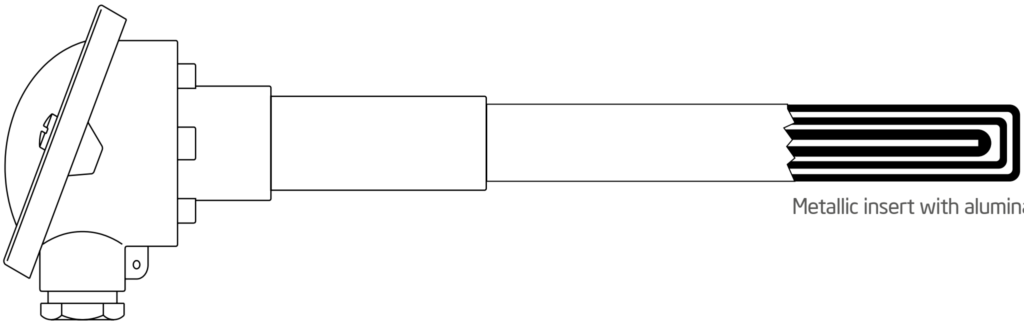
Thermocouples and resistance thermometers designed for use in sanitary or hygiene applications in the food, dairy, beverage and biopharmaceutical sectors. These sensors are made with 316L stainless steel casings.
Also available with 4-20 mA analogue output.

probe	calibration	model	metres of cable	rod material	rod diameter	rod length (see note*)	connection	execution 1	execution 2	transmitter	for execution
T thermocouple	**T** **U** **J** **L** **E** **K** **N** **R** **S**	**I** stainless steel head **L** 90° stainless steel head	**S** no cable	**0** AISI 310 **4** AISI 304 **6** AISI 316 **7** INCONELL **8** HASTEL-LOY	**3** = 3 mm **4** = 4,5 mm **6** = 6 mm **8** = 8 mm **0** = 10 mm **A** = 12 mm **B** = 15 mm **C** = 20mm		**0** no connection ****** with connection (see note) **F** with flange **C** with clamp	**S** simple with insulators **M** simple with mineral oxide **Z** double with insulators **G** double in mineral oxide	**0** only resistance thermometers and thermistors **1** insulated hot junction (only thermocouples) **2** ground hot junction (only thermocouples) **3** hot junction or exposed sensor **4** perforated	**S** without transmitter **T** transmitter in mA **I** transmitter in insulated mA	**- 0** catalogue execution **- X** special execution **- D** drawing execution
R standard B class platinum resistance thermometer **A** class A platinum resistance termometer	**2** Pt 100 2 wires **3** Pt 100 3 wires **4** Pt 100 4 wires **0** Pt 1000 2 wires										

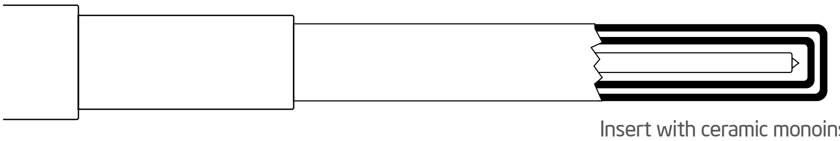
* For lenghts up to 999mm numerical code (examples 250=250mm / 050=50mm / 006=6mm)
For lenghts between 1mt to 9mt alphanumeric code (examples 1M5=1,50mt / 3M0=3,00mt)
For lenghts from 10mt upwards alphanumeric code (examples 10M=10mt / 15M=15mt)

** fixed male connection: **A** = 1/4 gas; **B** = 1/4 NPT; **C** = 3/8 gas; **D** = 3/8 NPT; **E** = 1/2 gas; **F** = 1/2 NPT; **H** = 3/4 gas; **I** = 3/4 NPT; **X** = 1/8 gas; **Y** = 1/8 NPT
sliding male connection: **L** = 1/4 gas; **N** = 1/4 NPT; **P** = 3/8 gas; **Q** = 3/8 NPT; **R** = 1/2 gas; **T** = 1/2 NPT; **U** = 3/4 gas; **V** = 3/4 NPT; **W** = 1/8 gas; **Z** = 1/8 NPT

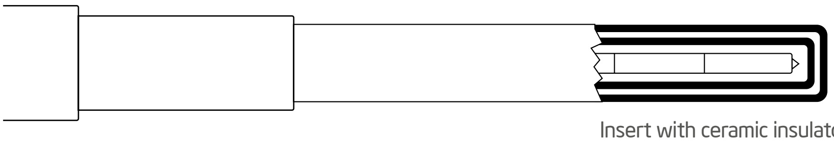
High temperature probes



Metallic insert with alumina insulation



Insert with ceramic monoinsulator



Insert with ceramic insulators

Thermocouple for high temperatures with double or triple alumina sleeve and connection head.
Also available with 4-20 mA analogue output.

probe	calibra-tion	model	metres of cable	insulator material	rod diame-ter***	rod length (see note*)	connection	execution 1	execution 2	transmitter	for execution
T thermocouple	**B** **N** **K** **R** **S**	**A** type A watertight head	**S** no cable	**1** middle layer PYTHAGORAS external layer SYLLIMANTIN 60 **2** middle layer ALUMINA external layer SYLLIMANTIN 60 **3** middle layer PYTHAGORAS external layer SYLLIMANTIN NG **5** middle layer ALLUMINA external layer SYLLIMANTIN NG --- internal layer still PYTHAGORAS	**0** (see note)		**0** no connection **F** with flange	**A** with monoblock Alumina **B** with monoblock ceramic insulators **C** with monoblock ceramic	**1** insulated hot junction (only thermo-couples)	**S** without transmitter **T** transmitter in mA **I** transmitter in insulated mA	**- 0** catalogue execution **- X** special execution **- D** drawing execution

* For lenghts up to 999mm numerical code (examples 250=250mm / 050=50mm / 006=6mm)
For lenghts between 1mt to 9mt alphanumeric code (examples 1M5=1,50mt / 3M0=3,00mt)

*** Rod diameter: in the code will stay 0, the diameters of the different layers will be indicated in the description.

Standard probes in special version

Sensors referable to the catalogue models with few simple modifications from the standard ones.

Examples

- rod with 2 different diameters: for 100mm underhead diam.= 10mm For the remaining 300mm diam.= 6mm
- probes with female connection (standard always male)
- standard design RTD probe with Pt100 resistive element class AA – 1/3DIN or 1/5DIN

To identify the special version probes last digit code will be -X instead of -0 followed by the special charateristics description.

Customised probes

Probes with significantly different characteristics from the standard catalogue models. Produced with sizes and materials capable to satisfy the requirements of specific applications. These sensors will be identified with a detailed description, with drawings and characteristics defined together with the customer.

Certified – metrological traceability - compliant sensors

The probes for measuring temperature, used in particular fields of application, must ensure the **metrological traceability** of national & international primary references. Usually certified or documented by accredited calibration laboratories **ACCREDIA which are Italian competent body (worldwide accredited by mutual recognition between national accreditation authority).**
In some cases the use of specific materials and processes performed according to the quality procedures must be guaranteed for construction. This compliance is **certified by the manufacturer.**
The sensors can therefore be supplied, on request, with:

Calibration certificate issued by a calibration laboratory accredited by the competent national authority.

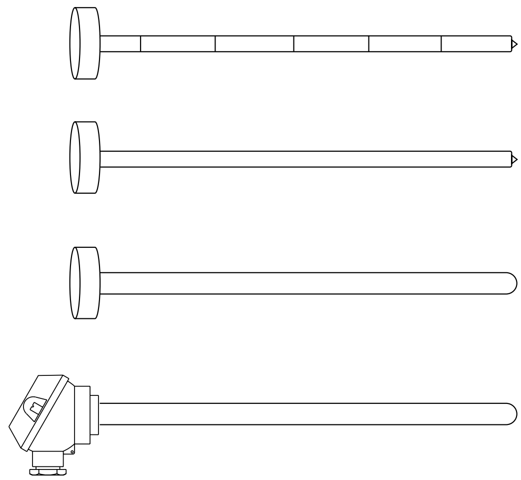
Metrological traceability calibration certificate issued by a calibration laboratory accredited by the competent national authority.

Certificate of conformity prepared by the manufacturer.

Certificate of Calibration (copy)

Certificate of Conformity (copy)

Inserts



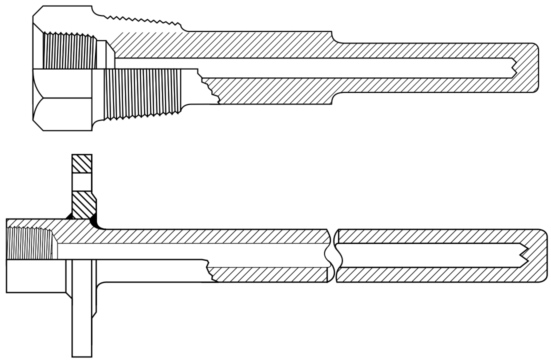
A range of inserts, made with the various types of thermocouple, suitable for any thermowell model.

The most common insert models are:

- With ceramic insulators and connection base
- With ceramic single insulator and connection base
- With ceramic alumina insulators and connection base
- With steel casing and mignon head type MA

Removable MgO mineral insulated thermometric insert suitable for insertion within thermometric assemblies.The thrust springs ensure constant pressure on the bottom of the thermowell, while the mineral insulation gives excellent vibration resistance as well as good insulation resistance.
Also available with 4-20 mA analogue output.

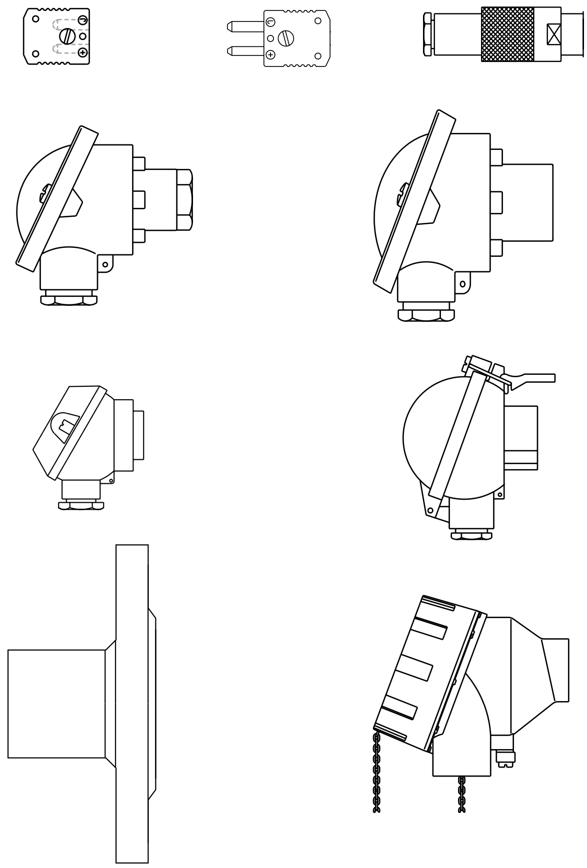
Thermowells



Range of thermowells constructed according to standard drawings or developed according to the specific requirements of the customer:

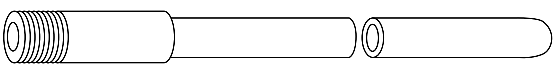
- Turned from solid bar or made with tube
- Constructed from metallic materials (Hastelloy, Inconell, AISI)
- Constructed with ceramic materials (Syllimantin)
- No connection, with threaded connection, with flange
- Fixed and sliding connections, flanges

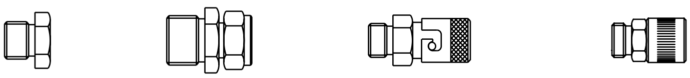
Accessories



Complete line of accessories and components for the construction, maintenance and repair of sensors:

- Metallic threads of the various alloys for the construction of thermocouples
- Stainless steel cables with conductors and mineral oxide insulation
- Wire or thin film sensors for the construction of resistance thermometers
- Resistors for the construction of NTC or PTC thermistors
- Ceramic insulators and bases
- Connection heads: watertight, mignon, EExd, stainless steel
- Sockets and plugs for the various types of thermocouple





Signal converters/transmitters

Complete range of signal converters & transmitters DIN rail or head mounting.
Models fully configurable from PC or by dip-switch and models with fix-range.
Version with input/output insulation or input/output/supply insulation. Version without insulation.
Fixed or configurable (mA or Vdc) output. Alarm threshold model (only for DIN rail mounting).

- Input: mV - V - mA - TC - RTD - potentiometer
- Accuracy: from 0,1% full scale range
- Fully configurable from PC and via dip switch
- Retransmition output: mA – V – RS485
- RS485 & Ethernet comunications
- TTL port for download upload configurabile

More information: please contact info@panelsrl.com

Instruments and automation systems

Wide range of: hand-held & panel indicators, paper & paperless recorders, alarm units, data acquisition & supervisory systems, , controllers & programmer-controllers, multichannel control & automation systems.

- Input: mV - V - mA - TC - RTD - NTC/PTC
- Output: relay - SSR drive - mA - V - servomotor drive
- Fully configurabile by pc or keyboard
- RS485 & Ethernet comunications
- TTL port for download/upload configuration

More informations: please contact info@panelsrl.com

Handheld calibrators and reference probes

Temperature dry blocks, smart reference probes and multifunctional calibrators: in different models from easly portables in field to high accuracy for laboratory. Specific calibration software which, combined with a dry block and a calibrator, provides automated and paperless calibration system.

Temperature dry block that delivers excellent accuracy, to calibrate temperature sensors and temperature loops. Easily portable and fast dry blocks for field use and high accuracy temperature blocks for laboratory.

- Different model with ranges between -55°C and 700°C
- Temperature stability up to 0,005°C
- Radial & axial thermal uniformity up to 0,001°C
- Model with or without external reference probe
- USB port to download datas and calibration certificates
- Programmable automatic procedure of calibration

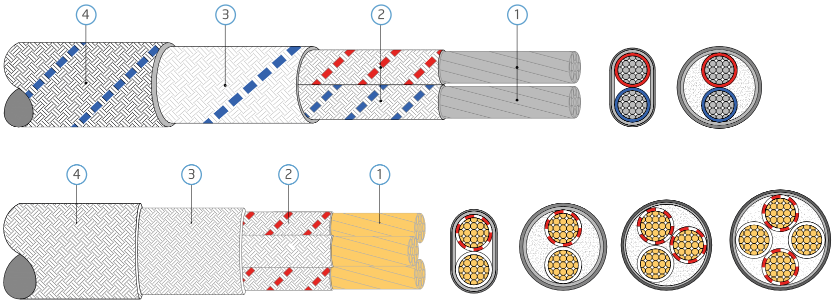
SPRT (Standard Platinum Resistance Thermometer) are high-accuracy smart reference temperature probes with excellent quality and long-term stability. Perfect to combine with temperature dry blocks & calibrators.

- Secondary reference thermometers
- Precision industrial thermometer
- Available with metal or quarz sheath
- Available straight or 90 degree bent versions
- Built-in memory for storing the individual probe coefficients

Multifunctional documenting compact field calibrators for temperature, pressure and electrical signals. Which can also be used as a field communicator for HART, Fieldbus Foundation and Profibus PA protocols. Functions as calibrator, data logger and much more remaining safe for hazardous areas.

- Simoultaneusly measurement and generation
- Input/output signals: Thermocouples, RTD, voltage, resistance, current, frequency, pulse
- Intrinsically-safe version and hazardous areas (ATEX and IECEx) certified version
- Accuracy up to 0,005% f.s.
- Internal power supply for transmitters
- Digital comunication for HART, PROFIBUS PA and FIELDBUS Foundation
- Programmable multichannel datalogger function

Cables with fibreglass insulation and tinned copper sheath

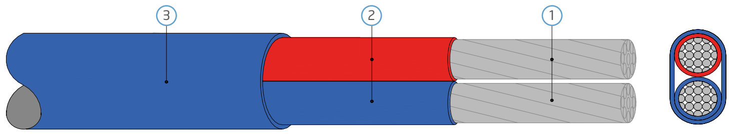


1. Flexible conductor
2. Fibreglass sleeve impregnated with silicone rubber
3. Oval type: fibreglass sleeve. Round type: fibreglass sleeve impregnated with silicone rubber
4. Tin-plated copper sleeve

CHARACTERISTICS:

- Operating temperature of insulation materials: – 25°C + 250°C. Tips: 280°C
- Flame resistance: self-extinguishing (does not spread the flame)
- Impermeability: not suitable in the presence of moisture
- Colouring of the cable according to standard DIN43714 ANSI MC96.1 IEC 584-3
- Bending radius: 6 times the cable diameter
- The silicone rubber impregnation of the fibreglass sleeve makes it soft and mechanically flexible

Cables with PVC sheath

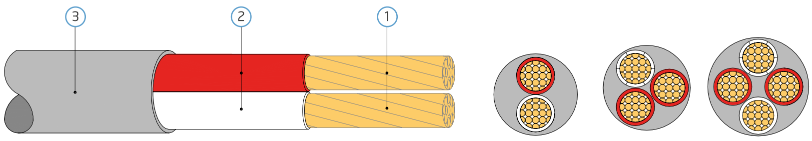


1. Flexible conductor
2. PVC insulation
3. PVC casing

CHARACTERISTICS:

- Operating temperature of insulation materials: – 30°C + 80°C. Tips: 90°C
- Flame resistance: self-extinguishing (does not spread the flame)
- Impermeability: excellent water resistance
- Cable colouring according to standard DIN43714 ANSI MC96.1 IEC 584-3
- Bending radius: 6 times the cable diameter

Cables with Silicone Rubber sheath



1. Flexible conductor in red copper
2. Rubber silicone insulation
3. Rubber silicone casing

CHARACTERISTICS:

- Operating temperature of insulation materials: - 60°C + 180°C. Tips: 230°C
- Flame resistance: self-extinguishing (does not spread the flame)
- Impermeability: excellent water resistance
- Bending radius (for fixed wiring): 3 times the cable diameter
- Cable colouring: grey
- Conductor colouring:
  - Two-core cable: one red conductor and one white conductor
  - Three-core cable: two red conductors and one white conductor
  - Four-core cable: two red conductors and two white conductors

Special cables

In addition to the standard cables described above, special cables can be supplied for specific applications. Construction may differ: by size and number of conductors, by the material of the sheath and/or of each conductor, by the type of insulation between conductors itself and/or the outside. For more information contact our specialists at info@panelsrl.com

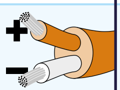
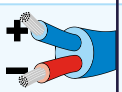
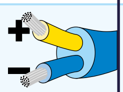
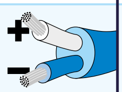
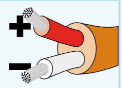
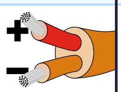
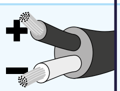
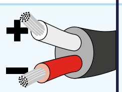
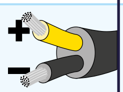
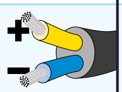
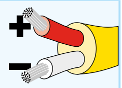
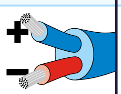
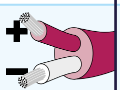
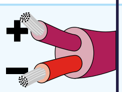
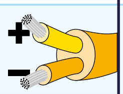
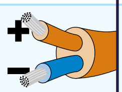
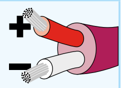
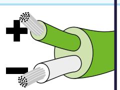
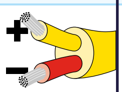
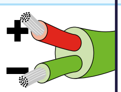
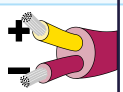
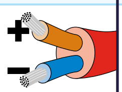
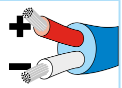
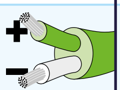
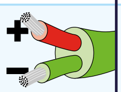
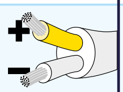
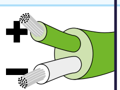
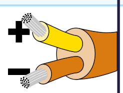
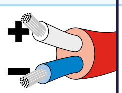
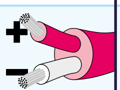
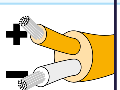
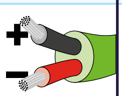
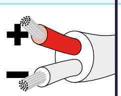
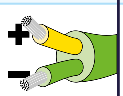
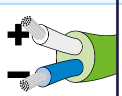
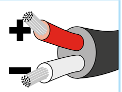
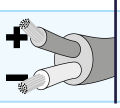
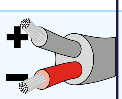
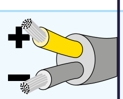
Extension cables & compensating cables

The cables used for resistive temperature sensors (TR-PTC-NTC) are standard electrical connection cables. While for thermocouple, cables with specific metal alloys must be used for each model (T-U-J-L-E-K-N-R-S-B). These cables are divided into two categories: extension cables and compensating cables.

Extension cables – *made by same materials used for the construction of the specific thermocouple.*

Compensating cables – *made from alloys developed to give very similar characteristics of the construction materials of the specific thermocouple.*

Research on materials and new production technologies have made less and less significant the differences in performance between the two types, leading to the substantial use of compensating cables. A colour code distinguishes the type of thermocouples (T-U-J-L-E-K-N-R-S-B) and the positive terminal from the negative terminal. The colour code differs according to the various international and national rules. Unless otherwise indicated or requested, cables will be conforming to international standard IEC 584-3.
The table below shows the colour codes according to IEC – ANSI – DIN – NFE – BS – JIS

			INTERNATIONAL IEC 584-3	ANSI MC 96.1	DIN 43710 43713-43714	NFE 42-324	BS 4937	JIS C1610-1981
T	Cu	Cu Ni						
U	Cu	Cu Ni						
J	Fe	Cu Ni						
L	Fe	Cu Ni						
E	Ni Cr	Cu Ni						
K	Ni Cr	Ni						
	Fe	Cu Ni						
	Cu	Cu Ni						
N	Ni Cr Si	Ni Si						
R **S**	Pt 13 Rh Pt 10 Rh	Pt Pt						
B	Pt 30 Rh	Pt 6 Rh						

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