PROBES AND TRANSMITTERS

Index

Tekon

Tekon Electronics is a European brand based in Portugal, specialized in the development and manufacture of technology innovative wireless sensors, temperature probes and level probes. It's a business unit of Bresimar Automação, S.A., a company with more than 40 years of experience in automation, industrial control solutions and engineering.

Bresimar Automação started its activity in 1982 focusing on the distribution of equipment and systems for industrial automation. Over the years, Bresimar Automação leveraged knowledge, delivering high-quality products and automation solutions, representing several valued brands. We have a specialized and dedicated professional team providing services in several fields of industrial automation and engineering projects.

Tekon Electronics develops and manufactures wireless solutions for measurement and monitoring applications, focusing on trends like the Internet of Things and Industry 4.0. A qualified R&D team and a planned manufacturing process are the pillars of a complete product development strategy.

100% Portuguese Production

Temperature and level measurement solutions developed by Tekon Electronics are 100% Portuguese production. The experience and knowledge of the technicians responsible for probes production, guarantee a product quality recognized nationally and internationally.

The production of electronic equipment for measuring and monitoring ensures a complete offer of solutions for temperature monitoring, where all the components of the solution are produced and developed by Tekon Electronics.

The probe production department of Tekon Electronics provides added value that certifies the offer of measurement solutions, able to match customer requirements and needs.

Among the capital gains, we highlight the following:

- Customization/personalization;
- Development of custom solutions;
- Short deadlines;
- In-house production;
- Short Response time;
- No minimum production quantities;
- Probe calibration services.

Wireless monitoring solution for composting applications or remote temperature measurement. By including wireless power systems (solar panels or batteries), it is possible to ensure wireless monitoring with a low risk of downtime.

Production equipment

Inconel drying chamber

The drying chamber guarantees the quality of the inconel production process, ensuring increment and better material performance.

Calibration furnace

Dry and oil bath furnaces are high-precision and stability equipment used for validations and internal characterizations.

Quality Control

Range of equipment suitable for verification and validation measurement procedures to ensure product quality and constant optimization of probes and transmitters.

Industry

Cement plants

Solar

Oil companies

Laboratories

Ceramic

Food beverages

Steel

Cork

Composting

Autoclaves

Chemical

Industrial kitchens

Probes

Choosing a temperature probe

Temperature range

The different categories of temperature probes in the market have a range in which they can operate properly, where the exposure on this temperature range cause no damage to the various probe elements. The use of probes in applications with temperatures out of the recommended range may cause serial damages, making the probes unrecoverable or causing a reduction in the lifetime of this equipment.

Maximum temperature

Exposure of the probe to temperatures above the range can impact its durability and correct operation.

Response time

The response time of a probe to temperature consists of the time elapsed between the temperature change of the medium and the time that sensor needs to reflect this change of temperature. This response time can be conditioned by various factors such as the type of sensor, sheaths, insulating materials and other components of the physical construction. Processes with quick temperature variations require the use of probes with a reduced response time otherwise, temperature fluctuations will not be properly detected.

Precision and accuracy

The precision and accuracy of temperature probes has distinct meanings. Precision is the exactness between recorded measurements. Accuracy refers to the degree of match between the registered values and the real / nominal temperature value, used as a reference. Different accuracy and precision needs will help to define the best probe for the application under consideration.

Stability

The stability of a temperature probe is the ability to keep a consistent output to a determined temperature. Probe materials play a fundamental role in sensor stability.

Sensitivity

The sensitivity of temperature probes represents the ease of detecting temperature variations. Temperature probes with a higher sensitivity are composed of sensors able to detect differences temperature of fractions of a degree. For applications with wider temperature variations, a probe with a reduced sensitivity may be enough.

Dimensions

One of the deciding factors in choosing the correct temperature probe is the depth of immersion of the probe in the intended to be measured temperature.

Application environment

The environment in which the temperature probe will be used influences the type of components used in its assembly, requiring compatibility between materials and the environment. It is imperative to make an in-depth survey on the atmospheric composition of the application - sulphurous, gaseous, corrosive, chemical, etc. - and assess the presence of mechanical vibrations - that influence the stability of the probe.

Anatomy of a temperature probe

Key elements of a probe

Temperature probes are composed of several interconnected elements. The industries where the application of temperature probes is essential for the process determine the type of probes needed and the combinations of elements for the probe assembly.

1 Connection head

Component with several composition materials for the protection of the signal acquisition and electrical connection.

2 Adjustable accessory for connection to the process

Accessory to fix the probe to the measurement process. Threaded systems adjustable, welded connectors and sealed.

3 Metal or ceramic protection sheath

A material whose function is to protect sensor elements from chemical and mechanical interferences.

4 Isolated thermocouples elements

Point of temperature measurement with the union of two conducting wires.

Thermocouple

Thermocouples

Temperature measurement using thermocouples is based on the Seebeck effect, which consists of two fused conductive elements (hot joints), of different materials. IEC 60584.1 (BS EN 60584.1) standard defines the values of the thermo-electric voltage and maximum tolerances of thermocouples.

Thermocouples can be divided into groups of base metals and noble metals. Thermocouples E, J, K, N, and T belong to the group base metals, which are used most frequently and are relatively cheaper than the others. Thermocouples B, R, and S are characterized by noble metals.

Regarding lifetime, in base metal thermocouples, it's difficult to predict as it depends on temperature, wire diameter and working cycles, where oxidation is the main problem. The general rule is: for every 50ºC above 500ºC, lifetime expectancy is reduced to half. In addition, it is essential to choose insulation, protection sheath as well as a selection of the thermocouple adapted to the type of environment, to avoid corrosion problems of the entire atmospheric spectrum.

For noble metal thermocouples, the main limitations are the formation of grains or volatilization, which can cause malfunctions and contamination, resulting in deviations in the calibration. Regarding contamination, the use of aluminum insulators is recommended to protect thermocouple elements and the outer protection with the same type of material. Never use this type of thermocouple directly in metal tubes, they must be protected from various metallic and non-metallic vapors.

Cautions on thermocouple installation

Thermocouples can be incorporated in many types, however, there are some aspects to take into account on installation that influence its correct functioning:

- Self temperature: the thermocouples measure their own temperature, therefore the metallic junction of measurement has the same temperature as the medium or process that we intend to monitor;

- Immersion: metals are conductors of heat. In immersion applications, to have a more accurate measurement, the sensor must be submerged to a depth 10 times greater than the diameter of the sheath, to reduce the conduction of heat by your body.

- Thermal shock: if the thermocouple is inserted in an environment with high temperatures, it is advisable to gradually preheat the thermocouples to avoid breakage due to thermal shock.

- Environment: the environment surrounding the thermocouples must be clean of oils, sulfur, phosphorous constituents to avoid a rapid degradation of the thermocouples.

- Cables: thermocouples are composed by negative and positive wires. It is important to observe the color codes to keep the polarity of the connections during the installation. Always use color coded extensions or compensation cables corresponding to the thermocouple in use.

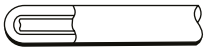
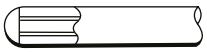
Types of Thermocouples Temperature range

Type	Metals		Continuous	Temporary
	Positive Element	Negative Element		
T	Cu	Constantan	-185... +300ºC	-250 ºC to +400 ºC
E	NiCr	Constantan	0... +800ºC	-40 ºC to +900 ºC
K	NiCr	NiAl	0... +1100ºC	-180 ºC to +1350 ºC
N	Nicrosil	Nisil	0... +1150ºC	-270ºC to +1300ºC
S	Pt10%Rh	Pt	0... +1550ºC	-50 ºC to +1750 ºC
R	Pt13%Rh	Pt	0... +1600ºC	-50 ºC to +1700 ºC
J	Fe	Constantan	+20... +700ºC	-180 ºC to +750 ºC
B	Pt30%Rh	Pt	100... +1600ºC	+100 ºC to +1820 ºC
C	Tungsten/5%Rhenium	Tungsten /25%Rhenium	+50 to 1820ºC	+20 to 2300ºC

Thermocouple Nominal sensitivity

Type	Positive Element	Negative Element	Temperature range	Nominal sensitivity
T	Copper	Constantan	-184 ºC to 400 ºC	45 µV/ºC
E	Nickel-Chromium	Constantan	0 ºC to 982 ºC	76 µV/ºC
K	Nickel-Chromium	Nickel-Aluminium	-184 ºC to 1260 ºC	39 µV/ºC
N	Nickel-Chromium-Silicon	Nickel-Silicon	0 ºC to 1100 ºC	10,4 µV/ºC
S	Platinum (10%) / Rhodium	Platinum	0 ºC to 1538 ºC	10,4 µV/ºC
R	Platinum (13%) / Rhodium	Platinum	0 ºC to 1593 ºC	6 µV/ºC
J	Iron	Constantan	0 ºC to 760 ºC	55 µV/ºC
B	Platinum (6%) / Rhodium	Platinum (30%) / Rhodium	38ºC to 1800 ºC	7,7 µV/ºC

Types of thermocouple junction

Layout	Type of junction	Description
	Insulated	Hot joint electric or mechanically insulated from the sheath. Provides a floating output with an insulation resistance over than 100MΩ. Allows the use in aggressive environments, with vibration or under thermal shocks. This joint system is recommended for 99% of applications.
	Grounded	A hot welded joint at the end of the sheath, to get a quick response to temperature variations. It can be subjected to wet places, pressures and mechanical stresses. Used in special applications.
	Exposed	Recommended for a faster response. Restricted to maximum operating temperature of 300ºC and must not be exposed to corrosive environments. The exposure of the sensor element makes it a solution of low durability.

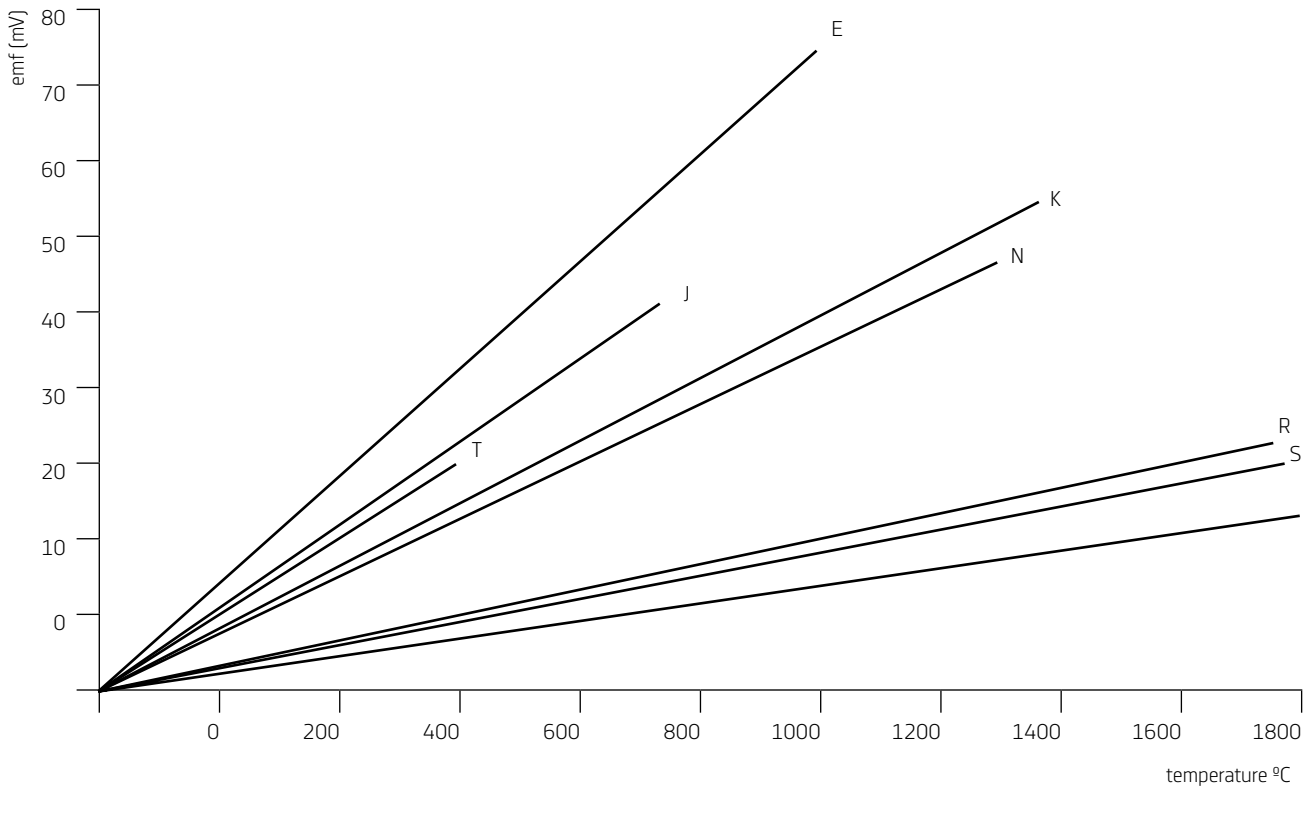
Types of Thermocouples Wire diameter Vs Working temperature comparison

Maximum operating temperatures for standard noble metal thermocouples				
Ø	Ø 0,35mm		Ø 0,5mm	
Thermocouple	Continuous	Temporary	Continuous	Temporary
S	1400ºC	1550ºC	1550ºC	1650ºC
R	1400ºC	1550ºC	1500ºC	1650ºC
B	1500ºC	1700ºC	1600ºC	1800ºC

Maximum continuous operating temperatures for standard base metal thermocouples								
Thermocouple	Insulation	Ø 0,25mm	Ø 0,3mm	Ø 0,5mm	Ø 0,8mm	Ø 1,0mm	Ø 1,6mm	Ø 3,3mm
T	without insulation	220 ºC	250 ºC	280 ºC	320 ºC	360 ºC	400 ºC	-
	mineral insulation	270 ºC	300 ºC	330 ºC	370 ºC	410 ºC	450 ºC	-
E	without insulation	580 ºC	620 ºC	660 ºC	700 ºC	750 ºC	800 ºC	890 ºC
	mineral insulation	690 ºC	730 ºC	770 ºC	810 ºC	860 ºC	910 ºC	1000 ºC
K	without insulation	710 ºC	750 ºC	800 ºC	860 ºC	900 ºC	930 ºC	1050 ºC
	mineral insulation	820 ºC	860 ºC	910 ºC	970 ºC	1050 ºC	1080 ºC	1150 ºC
N	without insulation	800 ºC	840 ºC	890 ºC	930 ºC	960 ºC	1010 ºC	1100 ºC
	mineral insulation	910 ºC	950 ºC	1000 ºC	1040 ºC	1110 ºC	1180 ºC	1250 ºC
J	without insulation	560 ºC	600 ºC	650 ºC	680 ºC	720 ºC	760 ºC	760 ºC
	mineral insulation	670 ºC	710 ºC	760 ºC	760 ºC	760 ºC	760 ºC	760 ºC

	Resistance in Ω/m between the thermocouple/cable compensated at 20ºC													
	Num. of cond./Ø	K	KCB	T	J	N	E	R	S	RCA/B	B	GC (W)	DC (W3)	CC (W5)
unifilar	1/0.2mm	31.8	16.2	16.2	19.1	43.6	38.5	10.5	10.2	2.2	12.4	10.8	12.1	12.7
	1/0.3mm	14.1	7.2	7.2	8.5	19.4	17.1	4.7	4.5	1.0	5.5	4.8	5.4	5.7
	1/0.5mm	5.1	2.6	2.6	3.1	7.0	6.2	1.7	1.6	0.4	2.0	1.7	1.9	2.0
	1/0.8mm	2.0	1.0	1.0	1.2	2.7	2.4	-	-	0.1	-	-	-	-
	1/1.29mm	0.8	0.4	0.4	0.5	1.0	0.9	-	-	0.05	-	-	-	-
multifilar	7/0.2mm	4.5	2.3	2.3	2.7	6.2	5.5	-	-	0.3	-	-	-	-
	14/0.2mm	2.3	1.2	1.2	1.4	3.1	2.8	-	-	0.2	-	-	-	-
	16/0.2mm	2.0	1.0	1.0	1.2	2.7	2.4	-	-	0.1	-	-	-	-
	24/0.2mm	1.3	0.7	0.7	0.8	1.8	1.6	-	-	0.1	-	-	-	-
	32/0.2mm	1.0	0.5	0.5	0.6	1.4	1.2	-	-	0.07	-	-	-	-
	40/0.2mm	0.8	0.4	0.4	0.5	1.1	1.0	-	-	0.06	-	-	-	-
	7/0.3mm	2.0	1.0	1.0	1.2	2.7	2.4	-	-	0.1	-	-	-	-
	3/0.91mm	0.5	0.3	0.3	0.3	0.7	0.6	-	-	0.04	-	-	-	-

EMF - Temperature correlation



Type	Conductors (+)	Conductors (-)	International standards for thermocouple conductors outputs (based on IEC584.1: 1995 & ITS-90)	Operating temperature range (ºC) Continuous	Operating temperature range (ºC) Temporary
T	Copper	Copper - Nickel	BS EN 60584-1 (replace BS 4937 Pt 5) ANSI/MC96.1 DIN EN 60584-1: 1996 NF EN 60 584.1:1996 JISC 1602	-185 to +300	-250 to +400
E	Nickel - Chromium	Copper - Nickel	BS EN 60584-1 (replace BS 4937 Pt 6) ANSI/MC96.1 DIN EN 60584-1: 1996 NF EN 60 584.1:1996 JISC 1602	0 to +800	-40 to +900
K	Nickel - Chromium	Nickel - Aluminium	BS EN 60584-1 (replace BS 4937 Pt 4) ANSI/MC96.1 DIN EN 60584-1: 1996 NF EN 60 584.1:1996 JISC 1602	0 to +1100	-180 to +1350
J	Iron	Copper - Nickel	BS EN 60584-1 (replace BS 4937 Pt 3) ANSI/MC96.1 DIN EN 60584-1: 1996 NF EN 60 584.1:1996 JISC 1602	+20 to +700	-180 to +750
N	Nickel – Chromium - Silicon	Nickel – Silicon - Magnesium	BS EN 60584-1 (replace BS 4937 Pt 8) ANSI/MC96.1 DIN EN 60584-1: 1996 NF EN 60 584.1:1996 JISC 1602	0 to +1150	-270 to +1300
S	Platinum – 10% Rhodium	Platinum	BS EN 60584-1 (replace BS 4937 Pt 1) ANSI/MC96.1 DIN EN 60584-1: 1996 NF EN 60 584.1:1996 JISC 1602	0 to +1550	-50 to +1750
R	Platinum – 13% Rhodium	Platinum	BS EN 60584-1 (replace BS 4937 Pt 2) ANSI/MC96.1 DIN EN 60584-1: 1996 NF EN 60 584.1:1996 JISC 1602	0 to +1600	-50 to +1700
B	Platinum 30% Rhodium	Platinum 6% Rhodium	BS EN 60584-1 (replace BS 4937 Pt 7) ANSI/MC96.1 DIN EN 60584-1: 1996 NF EN 60 584.1:1996 JISC 1602	+100 to +1600	+100 to +1820
C	Tungsten 5% Rhenium	Platinum - Tungsten 26% Rhenium	BS EN 60584-1 DIN EN 60584-1 NF EN 60584-1 JIS C 1602 ASTM E 230	+50 to +1820	+20 to +2300
D	Tungsten 3% Rhenium	Tungsten 25% Rhenium	There are no standards officially approved for type D	0 to +2100	0 to +2600
G	Tungsten	Tungsten 26% Rhenium	There are no standards officially approved for type G	+20 to +2320	0 to +2600

Thermocouple output tolerance IEC 60584-1

Type	Tol. Class 1	Tol. Class 2	Tol. Class 3	Type
Temp. Range	–40°C to +125°C	–40°C to +133°C	–67°C to +40°C	T
Tol. Value	±0.5°C	±1.0°C	±1.0°C	
Temp. Range	125°C to 350°C	133°C to 350°C	–200°C to –67°C	
Tol. Value	±0.004 ·|t|	±0.0075 . |t|	±0.015 . |t|	
Temp. Range	–40°C to +375°C	–40°C to +333°C	–167°C to +40°C	E
Tol. Value	±1.5°C	±2.5°C	±2.5°C	
Temp. Range	375°C to 800°C	333°C to 900°C	–200°C to –167°C	
Tol. Value	±0.004 . |t|	±0.0075 . |t|	±0.015 . |t|	
Temp. Range	-40ºC to +375ºC	-40ºC to +333ºC	-167ºC to +40ºC	K
Tol. Value	±1,5ºC	±2,5ºC	±2,5ºC	
Temp. Range	+375ºC to +1000ºC	+333ºC to +1200ºC	-200ºC to -167ºC	
Tol. Value	±0,004 ·|t|	±0,0075 ·|t|	±0,015 ·|t|	
Temp. Range	–40°C to +375°C	–40°C to +333°C		J
Tol. Value	±1.5°C	±2.5°C		
Temp. Range	375°C to 750°C	333°C to 750°C		
Tol. Value	±0.004 . |t|	±0.0075 . |t|		
Temp. Range	–40°C to +375°C	–40°C to +333°C	–167°C to +40°C	N
Tol. Value	±1.5°C	±2.5°C	±2.5°C	
Temp. Range	375°C to 1000°C	333°C to 1200°C	–200°C to –167°C	
Tol. Value	±0.004 . |t|	±0.0075 . |t|	±0.015 . |t|	
Temp. Range	0°C to +1100°C	0°C to +600°C	-	S
Tol. Value	±1.0°C	±1.5°C	-	
Temp. Range	1100°C to 1600°C	600°C to 1600°C	-	
Tol. Value	±(1 +0.003 (t . 1100)°C	±0.0025 . |t|	-	
Temp. Range	0°C to +1100°C	0°C to +600°C	-	R
Tol. Value	±1.0°C	±1.5°C	-	
Temp. Range	1100°C to 1600°C	600°C to 1600°C	-	
Tol. Value	±(1 +0.003 (t . 1100)°C	±0.0025 . |t|	-	
Temp. Range	-	-	600°C to +800°C	B
Tol. Value	-	-	±4.0°C	
Temp. Range	-	600°C to 1700°C	800°C to 1700°C	
Tol. Value	-	± 0.0025 . |t|	±0.005 . |t|	
Temp. Range	-	-	-	C
Tol. Value	-	-	-	
Temp. Range	-	426°C to 2315°C	-	
Tol. Value	-	±1.0%	-	
Temp. Range	-	0°C to +400°C	-	D
Tol. Value	-	±4.5°C	-	
Temp. Range	-	400°C to 2320°C	-	
Tol. Value	-	±1.0%	-	
Temp. Range	-	0°C to +425°C	-	G
Tol. Value	-	±4.5°C	-	
Temp. Range	-	425°C to 2320°C	-	
Tol. Value	-	± 0.01 . |t|	-	

Color code

	Type of cable		Internationals	Internationals	England	E.U.A.
	extension	compensation	IEC 60584.3:2007 BS EN 60584.3:2008	IEC 60584.3:2007 BS EN 60584.3:2008 for circuits of intrinsic security	BS 1843	ANSI/MC96.1
K	KX					
K		KCA				
K		KCB				
T	TX					
J	JX					
N	NX					
N		NC				
E	EX					
R		RCA				
R		RCB				
S		SCA				
S		SCB				
B		BC				
G		GC				
C		CC				
D		DC				

Germany	France	Japan	Tolerance values according to IEC 60584.3: 2007 (BSEN 60584.3: 2008) for the indicated temperature range.			
DIN 43714	NFC 42324	IIS C1610-1981	Class of tolerance 1	Class of tolerance 2	Cable temperature range in ºC	
			± 60 µV(±1.5ºC)	± 100 µV(±2.5ºC)	-25ºC to + 200ºC	K
				± 100 µV(±2.5ºC)	0ºC to + 150ºC	K
				± 100 µV(±2.5ºC)	0ºC to + 100ºC	K
			± 30 µV(±0.5ºC)	± 60 µV(±1.0ºC)	-25ºC to+ 100ºC	T
			± 85 µV(±1.5ºC)	± 140 µV(±2.5ºC)	-25ºC to+ 200ºC	J
			± 60 µV(±1.5ºC)	± 100 µV(±2.5ºC)	-25ºC to + 200ºC	N
				± 100 µV(±2.5ºC)	0ºC to + 150ºC	N
			± 120 µV(±1.5ºC)	± 200 µV(±2.5ºC)	-25ºC to + 200ºC	E
				± 30 µV(±2.5ºC)	0ºC to + 100ºC	R
				± 60 µV(±5.0ºC)	0ºC to + 200ºC	R
				± 30 µV(±2.5ºC)	0ºC to + 100ºC	S
				± 60 µV(±5.0ºC)	0ºC to + 200ºC	S
						B
						G
						C
						D

Temperature values and electromotive force

Thermocouple T (Cu-Const) values in µV										
ºC (t90)	0	-10	-20	-30	-40	-50	-60	-70	-80	-90
-100	-3378	-3656	-3923	-4117	-4419	-4648	-4865	-5069	-5261	-5439
0	0	-0383	-0757	-1121	-1475	-1819	-2152	-2475	-2788	-3089

ºC	0	10	20	30	40	50	60	70	80	90
0	0	0391	0789	1196	1611	2035	2467	2908	3357	3813
100	4277	4749	5227	5712	6204	6702	7207	7718	8235	8757
200	9286	9820	10360	10905	11456	12011	12572	13137	13707	14281
300	14860	15443	16030	16621	17217	17816	18420	19027	19638	20252

Thermocouple J (FeConst) values in µV										
ºC (t90)	0	-10	-20	-30	-40	-50	-60	-70	-80	-90
-100	-4632	-5036	-5426	-5801	-6159	-6499	-6821	-7122	-7402	-7659
0	0	-0501	-0995	-1481	-1960	-2431	-2892	-3344	-3785	-4215

ºC	0	10	20	30	40	50	60	70	80	90
0	0	0507	1019	1536	2058	2585	3115	3649	4186	4725
100	5268	5812	6359	6907	7457	8008	8560	9113	9667	10222
200	10777	11332	11887	12442	12998	13553	14108	14663	15217	15771
300	16325	16879	17432	17984	18537	19089	19640	20192	20743	21295
400	21846	22397	22949	23501	24054	24607	25161	25716	26272	26829
500	27388	27949	28511	29075	29642	30210	30782	31356	31933	32513
600	33096	33683	34273	34867	35464	36066	36671	37280	37893	38510
700	39130	39754	40382	41013	41647	42283	42922	43563	44207	44852

Thermocouple K (NiCr-NiAl) values in µV										
ºC (t90)	0	-10	-20	-30	-40	-50	-60	-70	-80	-90
-100	-3553	-3852	-4138	-4410	-4669	-4912	-5141	5354	-5550	-5730
0	0	-0.392	-0777	-1156	-1527	-1889	-2243	-2586	-2920	-3242

ºC	0	10	20	30	40	50	60	70	80	90
0	0	0397	0798	1203	1611	2022	2436	2850	3266	3681
100	4095	4508	4919	5327	5733	6137	6539	6939	7338	7737
200	8137	8537	8938	9341	9745	10151	10560	10969	11381	11793
300	12207	12623	13039	13456	13874	14292	14712	15132	15552	15974
400	16395	16818	17241	17664	18088	18513	18938	19363	19788	20214
500	20640	21066	21493	21919	22346	22772	23198	23624	24050	24476
600	24902	25327	25751	26176	26599	27022	27445	27867	28288	28709
700	29128	29547	29965	30383	30799	31214	31629	32042	32455	32866
800	33277	33686	34095	34502	34909	35314	35718	36121	36524	36925
900	37325	37724	38122	38519	38915	39310	39703	40096	40488	40879
1000	41269	41657	42045	42432	42817	43202	43585	43968	44349	44729
1100	45108	45486	45863	46238	46612	46985	47356	47726	48095	48462
1200	48828	49192	49555	49916	50276	50633	50990	51344	51697	52049

Thermocouple S (Pt10%Rh-Pt) values in µV										
ºC (t90)	0	10	20	30	40	50	60	70	80	90
0	0	55	113	173	235	299	365	432	502	573
100	645	719	795	872	950	1029	1109	1190	1273	1356
200	1440	1525	1611	1698	1785	1873	1962	2051	2141	2232
300	2323	2414	2506	2599	2692	2786	2880	2947	3069	3164
400	3260	3356	3452	3549	3645	3743	3840	3938	4036	4135
500	4234	4333	4432	4532	4632	4732	4832	4933	5034	5136
600	5237	5339	5442	5544	5648	5751	5855	5960	6064	6169
700	6274	6380	6486	6592	6699	6805	6913	7020	7128	7236
800	7345	7454	7563	7672	7782	7892	8003	8114	8225	8336
900	8448	8560	8673	8786	8899	9012	9126	9240	9355	9470
1000	9585	9700	9816	9932	10048	10165	10282	10400	10517	10635
1100	10745	10872	10991	11110	11229	11348	11467	11587	11707	11827
1200	11947	12067	12188	12308	12429	12550	12671	12792	12913	13034
1300	13155	13276	13397	13519	13640	13761	13883	14004	14125	14247
1400	14368	14489	14610	14731	14852	14973	15094	15215	15336	15456
1500	15576	15697	15817	15937	16057	16176	16296	16415	16534	16653

Thermocouple R (Pt13%Rh-Pt) values in µV										
ºC (t90)	0	10	20	30	40	50	60	70	80	90
0	0	54	111	171	232	296	363	431	501	573
100	647	723	800	879	959	1041	1124	1208	1294	1380
200	1468	1557	1647	1738	1830	1923	2017	2111	2207	2303
300	2400	2498	2596	2695	2795	2896	2997	3099	3201	3304
400	3407	3511	3616	3721	3826	3933	4039	4146	4254	4362
500	4471	4580	4689	4799	4910	5021	5132	5244	5356	5469
600	5582	5696	5810	5925	6040	6155	6272	6388	6505	6623
700	6741	6860	6979	7098	7218	7339	7460	7582	7703	7826
800	7949	8072	8196	8320	8445	8570	8696	8822	8949	9076
900	9203	9331	9460	9589	9718	9848	9978	10109	10240	10371
1000	10503	10636	10768	10902	11035	11170	11304	11439	11574	11710
1100	11846	11983	12119	12257	12394	12532	12669	12808	12946	13085
1200	13224	13363	13502	13642	13782	13922	14062	14202	14343	14483
1300	14624	14765	14906	15047	15188	15329	15470	15611	15752	15893
1400	16035	16176	16317	16458	16599	16741	16882	17022	17163	17304
1500	17445	17585	17726	17866	18006	18146	18286	18425	18564	18703

Mineral Insulation in Thermocouples

Mineral Insulation Thermocouples are extremely useful because wires are isolated from aggressive environments that may cause the deterioration of thermocouples, in addition to the robust mechanical resistance, which means that mineral insulation thermocouple can be used in a large number of applications. Mineral insulation also provides greater electrical insulation (resistive and capacitive) when compared to air, which adds immunity to electromagnetic noise.

The pair of wires are encapsulated in a metal sheath, which can be made of Stainless Steel, Inconel, Aisi 310, Aisi321, Nicrobel, or Platinum, compacted with magnesium oxide (excellent thermal conductor), with which the wires are completely protected from the surrounding environment.

Magnesium oxide provides excellent resistive and capacitive electrical insulation between the conductive elements and the metal sheath.

The stability of the thermocouple's electromotive force is characterized by the fact that the conductors are completely protected against the action of gases and other environmental conditions, which normally cause oxidation and consequently the degradation of the generated electromotive force.

Mineral Insulation Thermocouples ensure some advantages compared to conventional ones:

- Great stability and durability;
- Great response time in temperature reading;
- Can be manually modeled cold in any format;
- Available with standard diameters from 0.25 to 10.8mm;
- Good mechanical and abrasion resistance;
- Greater immunity to electromagnetic disturbances;

THERMOCOUPLE PROBES | PROBE CONFIGURATION TABLE

BT Model			
Mi	Mineral insulation		Mi
*	Other	On request	*
Type			
J	FeConst o ... +500 ºC		J
K	NiCrNi 0 ... 1100 ºC		K
T	CucuNI - 185ºC ... +350 ºC		T
*	Other	On request	*
Number of probes			
1	Simple		1
2	Double		2
Sheath material			
1	AISI 316 +900 ºC)		1
2	INCONEL 600	Only for TMi	2
3	AISI 310	Only for TMi	3
4	AISI 321	Only for TMi	4
*	Other	On request	*
Ø Sheath diameter (mm)			
1	Diameter: 1 mm		1
2	Diameter: 2 mm		2
3	Diameter: 3 mm		3
4	Diameter: 4 mm	Only for T	4
5	Diameter: 5 mm	Only for T	5
6	Diameter: 6 mm	Only for T	6
8	Diameter: 8 mm	Only for T	8
10	Diameter: 10 mm	Only for T	10
*	Diameter: * mm	On request	*
L Sheath length (mm)			
*	Maximum length* mm	* / mm	*
Electrical connection			
Cable (mm)			
S	Silicone cable: *mt	/ mt	S*
T	Metal braided cable *mt	/ mt	T*
P	Cable in PTFE / MFA: *mt	/ mt	MFA*
PVC	PVC *mt	/ mt	PVC*
*	Others	/ mt	*
Connection head			
MA	Aluminum MA miniature, type MAA		MA
KM	Aluminum KM, type B		KM
KNN	Plastic KNN (PA), type B		KNN
KH	Inox KH, Type B		KH
EX	v Aluminum XDA, type B, ATEX		EX
*	Others	On request	*
Enclosure			
CP1	Plastic enclosure (plate 53x55x36)	Plate	CP1
CP2	Plastic enclosure (transmitter 53x63x36)	4.. 20 mA	CP2
CM	Aluminum enclosure (58x64x37)		CM
Connectors			
FS	Standard thermocouple plug		FS
FM	Mini thermocouple plug		FM
*	Others		*
Process connection			
0		Without accessory	0
1		Fixed accessory	
	11	1/8 BSP	11
	12	M10X1	12
	13	1/4 BSP	13
	14	1/2 BSP	14
	15	3/4 BSP	15
	16	1 BSP	16
	17	Other	1.*
2		Moveable accessory (bicone)	
	21	1/8 BSP	21
	22	M10X1	22
	23	1/4 BSP	23
	24	1/2 BSP	24
	25	3/4 BSP	25
	26	1 BSP	26
	27	Other	2.*
3		Strength accessory	
	31	1/8 BSP	31
	32	M10X1	32
	33	1/4 BSP	33
	34	Other	3.*
4		Rotating moveable accessory	
	41	1/8 BSP	41
	42	M10X1	42
	43	1/4 BSP	43
	44	1/2 BSP	44
	45	3/4 BSP	45
	46	1 BSP	46
	47	Other	4.*
9		Other accessories	90
Transmitter options			
C */*	In head (temperature range */* ºC)		C */*
CI */*	In head - Galvanic Isolation (temperature range */* ºC)		CI */*
D */*	DIN rail (temperature range */* ºC)		D */*

			-	-	-	-	-	-	-	-	-
* to be defined by the customer	Example / Reference: BT	Mi	K	1	2	6	350	KM	24	C

Pyrometric Rods in Thermocouples

Pyrometric rods are temperature probes with ceramic protection sheaths. Probes built with ceramic sheaths are more suitable for applications with high temperatures (up to 1700º C), compared to probes with metal sheaths.

In applications with high temperature fluctuations that can have a direct impact on the process, pyrometric rods will be a valuable measurement option, as they react with higher speed and sensitivity to changes in temperature.

Protection classes of C610 or C799 type, ensure greater strength and durability of the equipment. Sheaths pyrometric rods can be single, double or mixed.

TYPE "S" · + Pt 10% Rh.Pt -

This thermocouple can be used, continuously, in oxidizing and inert atmospheres at temperatures from 0 to + 1550ºC. The continued use at high temperatures, the phenomenon of grain formation, or the volatilization of Rhodium in pure platin (fibrosis) can cause deterioration and cause damage and deviations. It is convenient, for working at high temperatures, to use insulation and sheaths made of highly purified aluminum (C799). Applications: ceramic industry, wood, cork, cellulose, foundry, glass.

TYPE "R" · + Pt 13% Rh.Pt -

Similar to the type S combination, it can be continuously used from 0 at +1600ºC. This thermocouple has the advantage of a slightly higher output voltage and improved stability.

Applications: ceramic industry, wood, cork, cellulose, foundry, glass.

TYPE "B" · + Pt 30%Rh. Pt 6%Rh -

Type "B" probes can be continuously used in applications with temperature ranges from +100 to +1600ºC, however, its output voltage is lower, so it is not normally used below +600ºC. Applications: applications identical to their "S", "R" similars above +900ºC.

TYPE "J" · + Fe.CuNi -

Usually referred to as Iron/Constantan this is one of the few thermocouples that can safely be used in reduced atmospheres. However, in oxidizing atmospheres above 550ºC, the degradation is quicker. The maximum temperature of continuous operation is around 700ºC, and for short-term uses, it can reach temperatures of around 750ºC.

Applications: It is an economic thermocouple, therefore popular, and widely used in the plastics and molds industry.

TYPE "K" · + NiCr.NiAl -

It's the most common thermocouple used in the industry and has been designed especially for oxidants atmospheres. However, take care to protect the sensor in these applications. The maximum temperature of continuous operation is around 1100ºC, although above 800ºC the oxidation causes variations. This type of thermocouple is also indicated for cryogenic applications up to -180ºC. Although the "K" type is widely used due to its application range and low cost, it is not as stable as other metal-based sensors for temperatures between 250º and 600ºC.

Applications: As a very versatile thermocouple, it is practically used in all kinds of applications.

PYROMETRIC RODS (Ceramic/Refratory Steel) | CONFIGURATION TABLE

BP Model											
Type											
J	Fe.CuNi 0 ºC ... +500 ºC		J								
K	NiCr.NiAl 0 ... 1100 ºC		K								
N	NiCrSi.NiSiMg 0 ºC ... 1150ºC		N								
S	Pt10%Rh.Pt 0 ºC ... +1550 ºC		S								
R	Pt13%Rh.Pt 0 ºC ... +1600 ºC		R								
B	Pt30%Rh.Pt6%Rh +100 ºC ... +1600 ºC		B								
*	Others		*								
Number of probes											
1	Single			1							
2	Double			2							
Ø Sheath diameter (mm)											
Ceramic											
C61.6	C610 Ø6mm				C61.6						
C61.8	C610 Ø8mm				C61.8						
C61.10	C610 Ø10mm				C61.10						
C61.15	C610 Ø15mm				C61.15						
C61.24	C610 Ø24mm				C61.24						
C79.10	C799 Ø10mm				C79.10						
C79.15	C799 Ø15mm				C79.15						
*	Other				*						
Refractory steel											
A14	Steel 310 / Steel 4C54	* / mm			A14						
A17	Steel 310 / Steel 4C54				A17						
A21,3	Steel 310 / Steel 4C54				A21						
*	Other	* / mm			*						
L Sheath length (mm)											
*	Maximum length* mm					*					
Metal sheath connecting to ceramic tube											
(By default - 150mm)	Maximum length* mm						150				
*	Other						*				
Electrical connection											
Connection head											
A	Aluminum A head, type A							A			
KM	Aluminum KM head, type B							KM			
BUZ	Aluminum BUZ head, type A (transmitter)							BUZ			
MA	Small aluminum MA head, type MAA							MA			
*	Other										
Transmitter options											
C */*	In head (temperature range */* ºC)								C */*		
CI */*	Galvanic Isolation (temperature range */* ºC)								CI */*		
D */*	DIN rail (temperature range */* ºC)								D */*		
			-	-	-	-	-	-	-		
* to be defined by the customer		Example / Reference: BP	S	1	C79/A14	12.400	100	KM	C		

RTD

The method of using resistances for temperature measurement had its beginning in 1835, with Faraday. However, it only started to be used, in industrial processes, in 1925. This type of sensor became unique in industrial processes due to its high mechanical and thermal stability conditions, low deviation rate due to aging, resistance to contamination and long life. Due to these features, this sensor is an international standard for temperature measurement in ranges of -200°C to 600°C.

These types of sensors are based on the principle of variation of electric resistance according to the temperature. The most used materials for the manufacture of this type of sensor are platin, copper or nickel. Metals with the following features:

- High resistivity, thus allowing a better sensibility of the sensor;
- High coefficient of resistance variation with temperature;
- Rigidity and ductility to be transformed into 0,007 mm filaments.

Nickel loses its properties, as well as its characteristics above 300ºC; compared to copper, it can oxidize at temperatures above 310 ° C.

The platin sensor consists of a platin and a metal filament, to achieve the standardized specifications of the IEC standards. Nowadays, the precision and stability of industrial RTDs converge to those achieved with laboratory sensors.

Essentially, there are two types of resistive sensors.

» RTDs (Resistance Temperature Detectors) - PT20, PT100, PT500, PT1000;
» Thermistors - PTC (Positive Temperature Coefficient) and NTC (Negative Temperature Coefficient);

Pt100 thermo resistances are the most used in the industry, due to their great stability, a wide range of use and high accuracy. An important factor in a Pt100 probe is its repeatability, this must be measured with consecutive temperature readings, verifying the variation found. Response time is important in applications where the temperature of the medium in which the measurement is made is exposed to sudden changes.

The difference between the several probes is in their ohmic value, and variation of resistive value with the temperature. For example, the sensor Pt100 at 0ºC will have 100 Ω resistance, at 100ºC this resistance will be 138,51 Ω. This type of sensor is divided into several classes of accuracy: B, A, 1/3, 1/5, 1/10.

Thermocouple vs RTD vs Thermistor Comparative board

Type of probe	Thermocouple	RTD	Thermistor
Parameter	Voltage vs Temperature	Resistance vs Temperature	Resistance vs Temperature
Advantages	• Simple • Versatile and robust • Very sensitive • Quick response • Wide operating range • Low cost	• Higher accuracy • Higher stability, repeatability and linearity • Longer lifetime • Better resolution in measurement • Better signal handling, easier over long distances	• High sensitivity • Fast • Measure with two wires
Disadvantages	• Long-term accuracy and stability • Lower precision • Need for junction of reference or cold junction • Required reference voltage • Lower voltage • Own cables	• Higher cost • Deteriorate more easily • Limited temperature range from 200ºC to +600ºC • Longer response time • Steam sensitive • Less robust • Current source required • Lower resistance • Self heating	• Non-linear • Small temperature range • Fragile • Current source required • Self-heating

Applications

Pharmaceutical

PT100

Construction of high precision PT100 probes for monitoring applications positioned in the pharmaceutical industry, for cryogenic processes or for monitoring ovens, in compliance with regulations related to hygiene and sterilization.

Process industry

PT100

Manufacture of PT100 temperature probes for integration in monitoring processes of heat treatments in wood derivatives for worm eradication and possible transmissions

HVAC systems

PT1000

Manufacture of PT1000 temperature measurement solutions for monitoring the temperature of the airflow.

PV applications

PT1000

Manufacture of PT1000 probes for temperature measurent in solar panels.

Advantages

More stability

Higher linearity

Higher accuracy

Easy verification and calibration

One of the technical advantages of using RTD probes is to provide a very stable signal output over a long period. It stands out from the thermocouples for its reading accuracy, as well as for the ease of verification and calibration.

Disadvantages

Reduced temperature range

Low sensibility

Expensive

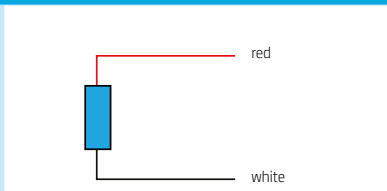
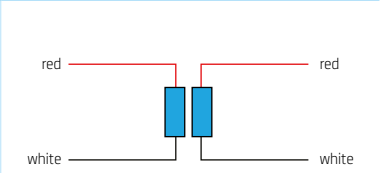
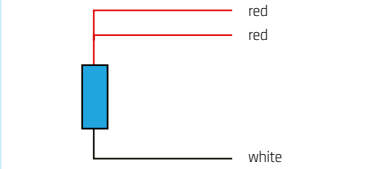
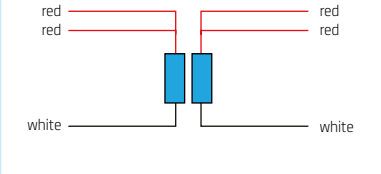
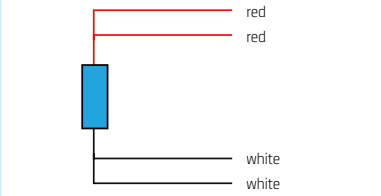
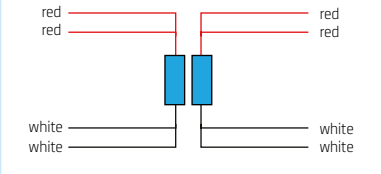
Response time

Sensible to self heating

Since the metals used in RTDs are in their purest state, these solutions are slightly more expensive than thermocouples. The supported reading temperature ranges are lower than those allowed by thermocouples. Its response time to temperature changes is longer compared to a thermocouple probe. The heat dissipated through the sensor element tends to create small errors in the readings.

Connection methods RTD

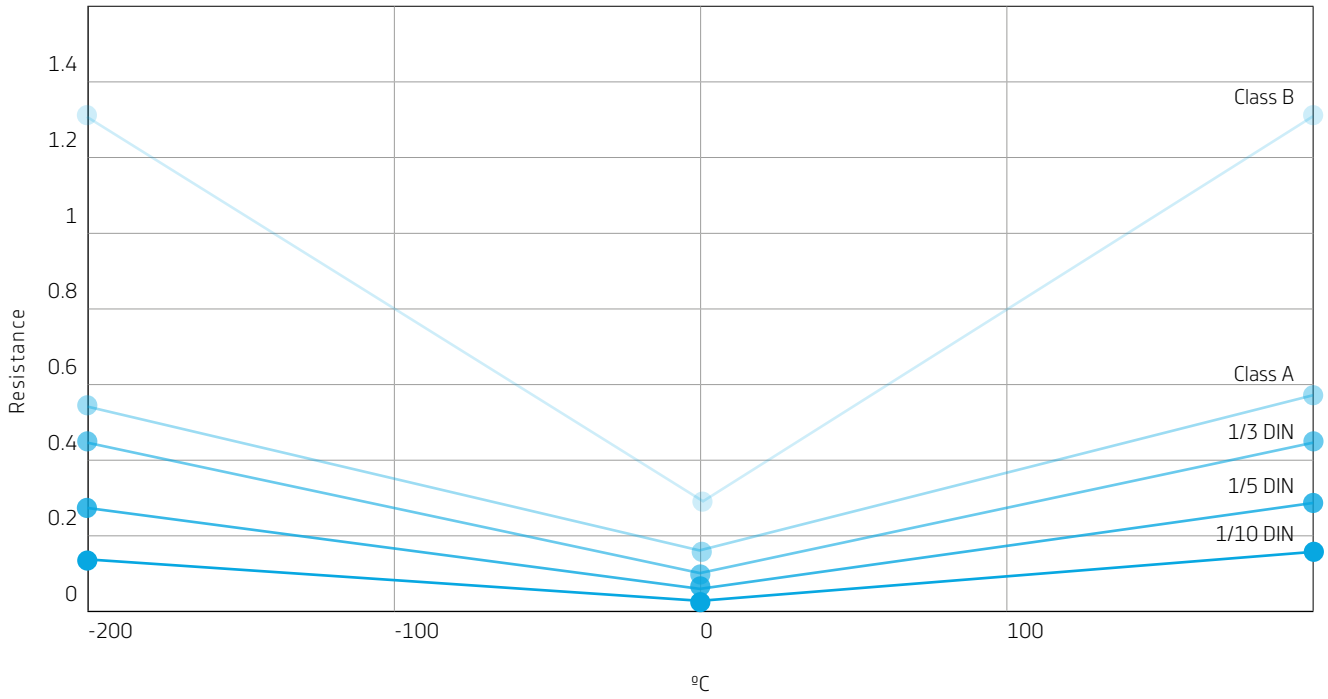
The measurement accuracy of RTD probes is specified by the type of application and subsequent probe construction. 2, 3 or 4 wires connections offer different degrees of measurement accuracy. The simpler the RTD connection options, the greater the degree of error.

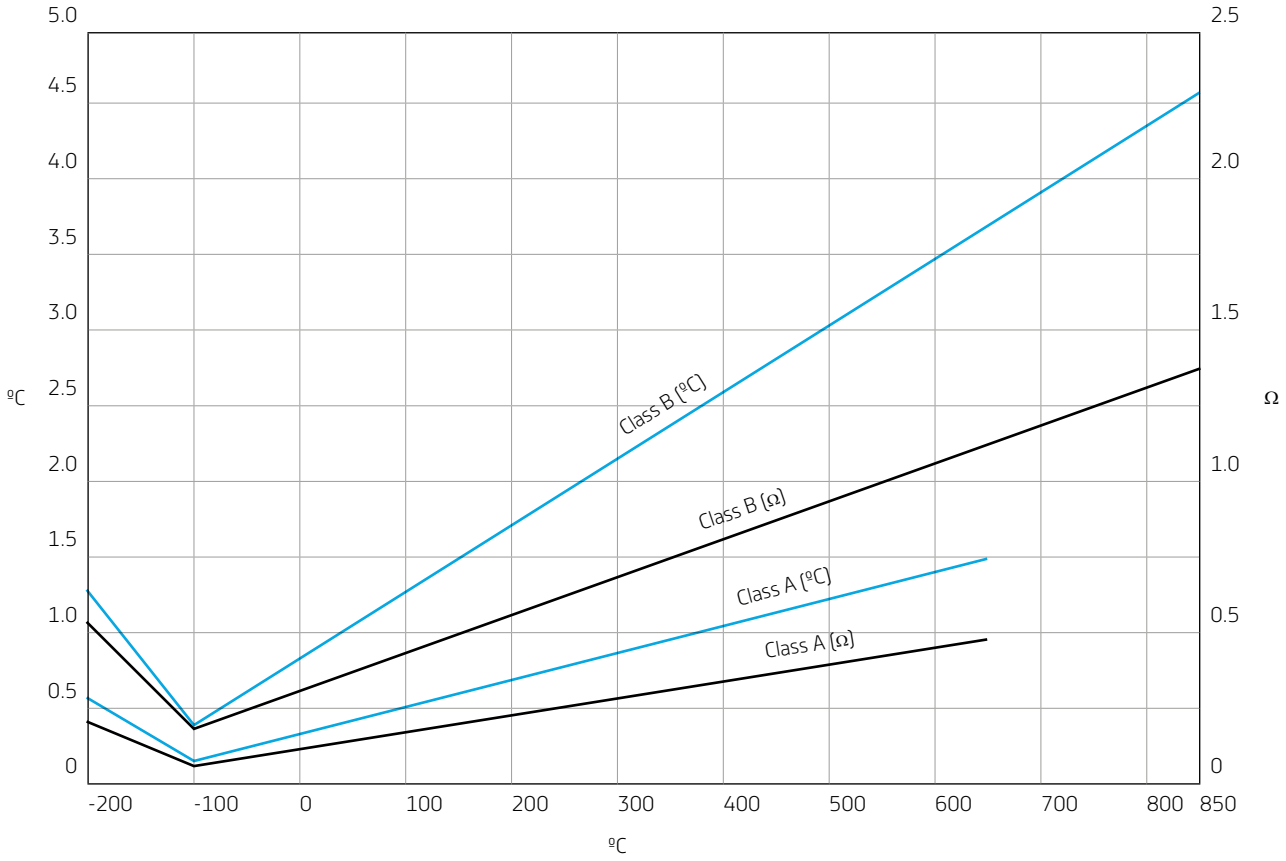
Diagram	Connection	Description
PT100 / PT500 / PT1000 	2 wires (without compensation)	The 2-wire connection is the simplest of all. The circuit does not have a mechanism to compensate, eliminate or calculate the resistance of the conductors. The accuracy of this connection is lower when compared to the 3-wire or 4-wire connections. The application of this solution is indicated for projects where the length of the connecting wires is necessarily short and where there is no need to measure with a high degree of accuracy or if the value of the resistance of the wires is known and the offset in the acquisition of the ohmic value of the sensor is compensated.
2 x PT100 		
PT100 / PT500 / PT1000 	3 wires (simple compensation)	RTDs with 3-wire connections are the most used of all the solutions. The presence of an additional wire in relation to the previous system is precisely to fill the main flaw it presents - removing the resistance from the sensor measurement cable. This configuration offers a current loop that can be used to remove the cable resistance from the measurement, always assuming that all conductors are identical in size and nature.
2 x PT100 		
PT100 / PT500 / PT1000 	4 wires (double compensation)	The need to choose this type of connection is related to the accuracy required in the temperature measurement process. It is the most complex solution to install and therefore the most expensive. This system is divided between 2 wires empowered for circulating the excitation current of the system and the other 2 wires empowered for reading the resistance in each wire and compensating the different resistance of the wires. The real resistance of each one of the wires is naturally eliminated by the physical connection of the wiring, taking into account that the acquisition system measures only the resistive element sensitive to temperature. It allows a faster sampling of the sensor by the transmitters, as well as cable configurations in different lengths and natures.
2 x PT100 		

Tolerance values for PT100

TOLERANCE
IEC 60751:2008 (BS EN 60751)

Temperature ºC	Class A		Class B		Class 1/3		Class 1/10	
	±ºC	± Ohms	±ºC	± Ohms	±ºC	± Ohms	±ºC	± Ohms
-200	0.55	0.24	1.3	0.56	0.44	0.19	0.13	0.06
-100	0.35	0.14	0.8	0.32	0.27	0.11	0.08	0.03
0	0.15	0.06	0.3	0.12	0.1	0.04	0.03	0.01
100	0.35	0.13	0.8	0.30	0.27	0.11	0.08	0.03
200	0.55	0.20	1.3	0.48	0.44	0.16	0.13	0.05
300	0.75	0.27	1.8	0.64	0.6	0.21	-	-
400	0.95	0.33	2.3	0.79	0.77	0.26	-	-
500	1.15	0.38	2.8	0.93	-	-	-	-
600	1.35	0.43	3.3	1.06	-	-	-	-
650	1.45	0.46	3.6	1.13	-	-	-	-
700	-	-	3.8	1.17	-	-	-	-
800	-	-	4.3	1.28	-	-	-	-
850	-	-	4.6	1.34	-	-	-	-





Mounting table

Number of elements	Cable configuration	Pipe diameter (mm)							
		2.0	2.38	3.0	4.5	6.0	8.0	10.0	12.7
1	2 wire	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	3 wire	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	4 wire	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	2 wire	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	3 wire	-	-	Yes	Yes	Yes	Yes	Yes	Yes
	4 wire	-	-	-	-	Yes	Yes	Yes	Yes

The precision of the sensor element of the RTD probes is related to the temperature deviation or degree of tolerance to a reference temperature. International standards define the tolerance limits and precision administered to regulate the production of these solutions.

PT100 probes are available in different accuracy classes. The most common precision classes on the market and with the greatest commercialization and/or application are the classes A, B, 1/3 DIN, 1/5 DIN and 1/10 DIN. It is also starting to be common to find new designations of accuracy classes:

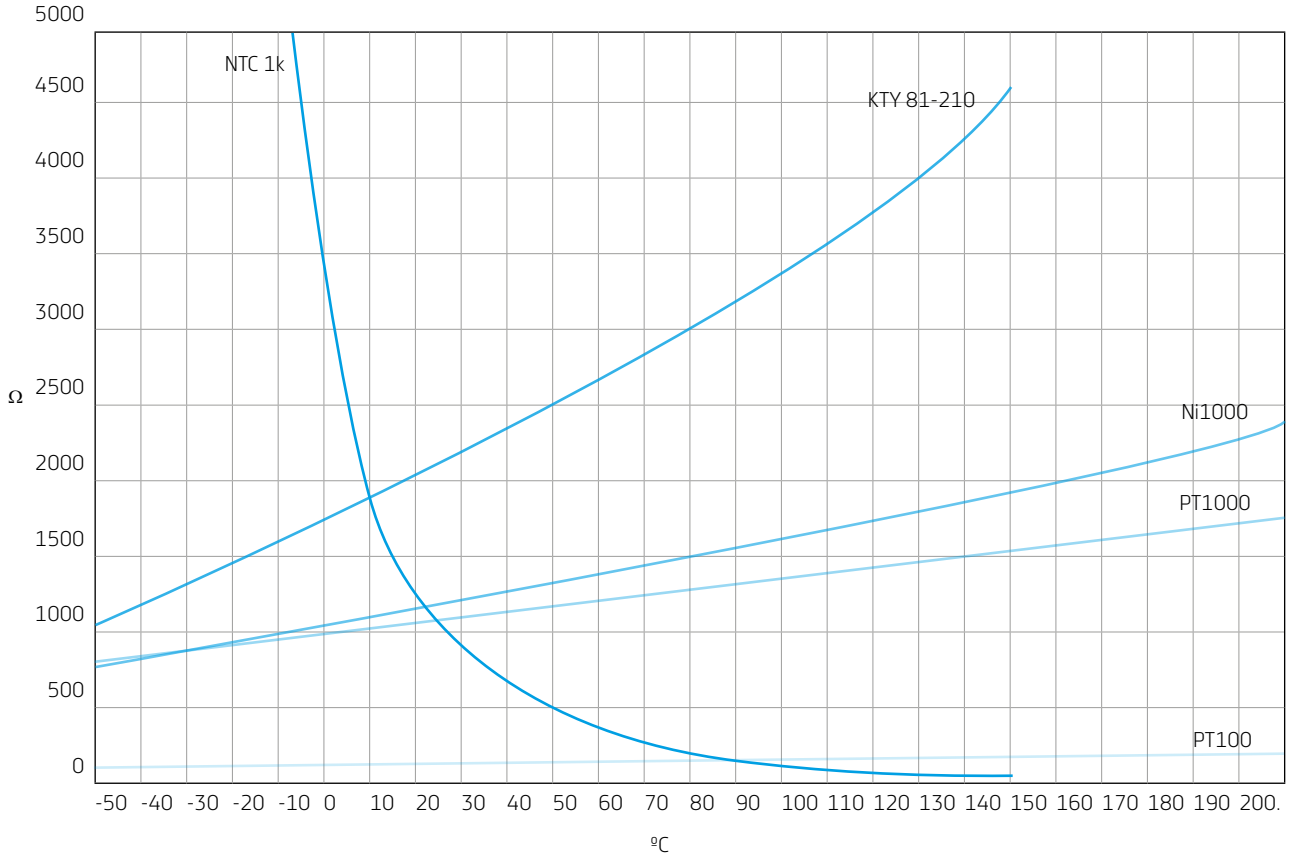
» A - W0,15 (-100ºC to 450ºC)
» B - W0,3 (-196ºC to 660ºC)
» 1/3 - W0,1 (-100ºC to 350ºC)
» 1/5 - W0,06 (-50ºC to 300ºC)
» 1/10 - W0,03L (-50ºC to 150ºC)
» 1/10 - W0,03 (-50ºC to 300ºC)

Tolerance classes 1/3 DIN, 1/5 DIN and 1/10 DIN are based on the accuracy of class B sensors, where the error is divided by the class number (3, 5 or 10).

The accuracy of these classes is proportional to the range of temperatures supported. A higher measurement accuracy is only possible in a lower temperature range.

Resistance (Ω) Vs Temperature (ºC) – Range -200ºC a +600ºC – PT100 platin elements

ºC (t90)	0	1	2	3	4	5	6	7	8	9	ºC (t90)
-200	18.52	-	-	-	-	-	-	-	-	-	**-200**
-190	22.83	22.40	21.97	21.54	21.11	20.68	20.25	19.82	19.38	18.95	**-190**
-180	27.10	26.67	26.24	25.82	25.39	24.97	24.54	24.11	23.68	23.25	**-180**
-170	31.34	30.91	30.49	30.07	29.64	29.22	28.80	28.37	27.95	27.52	**-170**
-160	35.54	35.12	34.70	34.28	33.86	33.44	33.02	32.60	32.18	31.76	**-160**
-150	39.72	39.31	38.89	38.47	38.05	37.64	37.22	36.80	36.38	35.96	**-150**
-140	43.88	43.46	43.05	42.63	42.22	41.80	41.39	40.97	40.56	40.14	**-140**
-130	48.00	47.59	47.18	46.77	46.36	45.94	45.53	45.12	44.70	44.29	**-130**
-120	52.11	51.70	51.29	50.88	50.47	50.06	49.65	49.24	48.83	48.42	**-120**
-110	56.19	55.79	55.38	54.97	54.56	54.15	53.75	53.34	52.93	52.52	**-110**
-100	60.26	59.85	59.44	59.04	58.63	58.23	57.82	57.41	57.01	56.60	**-100**
-90	64.30	63.90	63.49	63.09	62.68	62.28	61.88	61.47	61.07	60.66	**-90**
-80	68.33	67.92	67.52	67.12	66.72	66.31	65.91	65.51	65.11	64.70	**-80**
-70	72.33	71.93	71.53	71.13	70.73	70.33	69.93	69.53	69.13	68.73	**-70**
-60	76.33	75.93	75.53	75.13	74.73	74.33	73.93	73.53	73.13	72.73	**-60**
-50	80.31	79.91	79.51	79.11	78.72	78.32	77.92	77.52	77.12	76.73	**-50**
-40	84.27	83.87	83.48	83.08	82.69	82.29	81.89	81.50	81.10	80.70	**-40**
-30	88.22	87.83	87.43	87.04	86.64	86.25	85.85	85.46	85.06	84.67	**-30**
-20	92.16	91.77	91.37	90.98	90.59	90.19	89.80	89.40	89.01	88.62	**-20**
-10	96.09	95.69	95.30	94.91	94.52	94.12	93.73	93.34	92.95	92.55	**-10**
-0	100.00	99.61	99.22	98.83	98.44	98.04	97.65	97.26	96.87	96.48	**-0**
0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51	**0**
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40	**10**
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.29	**20**
30	111.67	112.06	112.45	112.83	113.22	113.61	114.00	114.38	114.77	115.15	**30**
40	115.54	115.93	116.31	116.70	117.08	117.47	117.86	118.24	118.63	119.01	**40**
50	119.40	119.78	120.17	120.55	120.94	121.32	121.71	122.09	122.47	122.86	**50**
60	123.24	123.63	124.01	124.39	124.78	125.16	125.54	125.93	126.31	126.69	**60**
70	127.08	127.46	127.84	128.22	128.61	128.99	129.37	129.75	130.13	130.52	**70**
80	130.90	131.28	131.66	132.04	132.42	132.80	133.18	133.57	133.95	134.33	**80**
90	134.71	135.09	135.47	135.85	136.23	136.61	136.99	137.37	137.75	138.13	**90**
100	138.51	138.88	139.26	139.64	140.02	140.40	140.78	141.16	141.54	141.91	**100**
110	142.29	142.67	143.05	143.43	143.80	144.18	144.56	144.94	145.31	145.69	**110**
120	146.07	146.44	146.82	147.20	147.57	147.95	148.33	148.70	149.08	149.46	**120**
130	149.83	150.21	150.58	150.96	151.33	151.71	152.08	152.46	152.83	153.21	**130**
140	153.58	153.96	154.33	154.71	155.08	155.46	155.83	156.20	156.58	156.95	**140**
150	157.33	157.70	158.07	158.45	158.82	159.19	159.56	159.94	160.31	160.68	**150**
160	161.05	161.43	161.80	162.17	162.54	162.91	163.29	163.66	164.03	164.40	**160**
170	164.77	165.14	165.51	165.89	166.26	166.63	167.00	167.37	167.74	168.11	**170**
180	168.48	168.85	169.22	169.59	169.96	170.33	170.70	171.07	171.43	171.80	**180**
190	172.17	172.54	172.91	173.28	173.65	174.02	174.38	174.75	175.12	175.49	**190**
200	175.86	176.22	176.59	176.96	177.33	177.69	178.06	178.43	178.79	179.16	**200**
210	179.53	179.89	180.26	180.63	180.99	181.36	181.72	182.09	182.46	182.82	**210**
220	183.19	183.55	183.92	184.28	184.65	185.01	185.38	185.74	186.11	186.47	**220**
230	186.84	187.20	187.56	187.93	188.29	188.66	189.02	189.38	189.75	190.11	**230**
240	190.47	190.84	191.20	191.56	191.92	192.29	192.65	193.01	193.37	193.74	**240**
250	194.10	194.46	194.82	195.18	195.55	195.91	196.27	196.63	196.99	197.35	**250**
260	197.71	198.07	198.43	198.79	199.15	199.51	199.87	200.23	200.59	200.95	**260**
270	201.31	201.67	202.03	202.39	202.75	203.11	203.47	203.83	204.19	204.55	**270**
280	204.90	205.26	205.62	205.98	206.34	206.70	207.05	207.41	207.77	208.13	**280**
290	208.48	208.84	209.20	209.56	209.91	210.27	210.63	210.98	211.34	211.70	**290**
300	212.05	212.41	212.76	213.12	213.48	213.83	214.19	214.54	214.90	215.25	**300**
310	215.61	215.96	216.32	216.67	217.03	217.38	217.74	218.09	218.44	218.80	**310**
320	219.15	219.51	219.86	220.21	220.57	220.92	221.27	221.63	221.98	222.33	**320**
330	222.68	223.04	223.39	223.74	224.09	224.45	224.80	225.15	225.50	225.85	**330**
340	226.21	226.56	226.91	227.26	227.61	227.96	228.31	228.66	229.02	229.37	**340**
350	229.72	230.07	230.42	230.77	231.12	231.47	231.82	232.17	232.52	232.87	**350**
360	233.21	233.56	233.91	234.26	234.61	234.96	235.31	235.66	236.00	236.35	**360**
370	236.70	237.05	237.40	237.74	238.09	238.44	238.79	239.13	239.48	239.83	**370**
380	240.18	240.52	240.87	241.22	241.56	241.91	242.26	242.60	242.95	243.29	**380**
390	243.64	243.99	244.33	244.68	245.02	245.37	245.71	246.06	246.40	246.75	**390**
400	247.09	247.44	247.78	248.13	248.47	248.81	249.16	249.50	249.85	250.19	**400**
410	250.53	250.88	251.22	251.56	251.91	252.25	252.59	252.93	253.28	253.62	**410**
420	253.96	254.30	254.65	254.99	255.33	255.67	256.01	256.35	256.70	257.04	**420**
430	257.38	257.72	258.06	258.40	258.74	259.08	259.42	259.76	260.10	260.44	**430**
440	260.78	261.12	261.46	261.80	262.14	262.48	262.82	263.16	263.50	263.84	**440**
450	264.18	264.52	264.86	265.20	265.53	265.87	266.21	266.55	266.89	267.22	**450**
460	267.56	267.90	268.24	268.57	268.91	269.25	269.59	269.92	270.26	270.60	**460**
470	270.93	271.27	271.61	271.94	272.28	272.61	272.95	273.29	273.62	273.96	**470**
480	274.29	274.63	274.96	275.30	275.63	275.97	276.30	276.64	276.97	277.31	**480**
490	277.64	277.98	278.31	278.64	278.98	279.31	279.64	279.98	280.31	280.64	**490**
500	280.98	281.31	281.64	281.98	282.31	282.64	282.97	283.31	283.64	283.97	**500**
510	284.30	284.63	284.97	285.30	285.63	285.96	286.29	286.62	286.95	287.29	**510**
520	287.62	287.95	288.28	288.61	288.94	289.27	289.60	289.93	290.26	290.59	**520**
530	290.92	291.25	291.58	291.91	292.24	292.56	292.89	293.22	293.55	293.88	**530**
540	294.21	294.54	294.86	295.19	295.52	295.85	296.18	296.50	296.83	297.16	**540**
550	297.49	297.81	298.14	298.47	298.80	299.12	299.45	299.78	300.10	300.43	**550**
560	300.75	301.08	301.41	301.73	302.06	302.38	302.71	303.03	303.36	303.69	**560**
570	304.01	304.34	304.66	304.98	305.31	305.63	305.96	306.28	306.61	306.93	**570**
580	307.25	307.58	307.90	308.23	308.55	308.87	309.20	309.52	309.84	310.16	**580**
590	310.49	310.81	311.13	311.45	311.78	312.10	312.42	312.74	313.06	313.39	**590**
600	313.71	314.03	314.35	314.67	314.99	315.31	315.64	315.96	316.28	316.60	**600**



Advantages and Disadvantages between the various temperature sensors (RTD)

	PT100	PT1000	NTC	PTC	Ni1000
Temperature Range	++	++	-	-	+
Accuracy	++	++	-	-	+
Linearity	++	++	-	-	+
Long-term stability	++	++	+	-	+
International Standards	++	++	-	-	+
Temperature Sensitivity	-	+	++	++	+
Influence Ø Signal Wire	-	+	++	+	+

Thermistors

The resistance of some semiconductors shows some exponential changes with temperature variation, in general, they are oxides such as copper, cobalt, iron, magnesium and nickel, mixed in certain proportions to obtain a proper constant.

There are basically two types of thermistors:

- NTC (Negative Temperature Coefficient) - thermistors whose coefficient of resistance variation with temperature is negative: resistance decreases with increasing temperature.
- PTC (Positive Temperature Coefficient) - thermistors whose coefficient of resistance variation with temperature is positive: resistance increases with increasing temperature.

According to the curve of the thermistor, its resistance may decrease or increase to a higher or lower degree in a certain temperature range.

Thermistors have a high thermal coefficient which gives them good sensitivity, causing great variations in resistance for small temperature variations.

NTC, PTC and PT PROBES (CODIFICATION) | PROBE CONFIGURATION TABLE

Model BR			
Pt			Pt
NTC			NTC
PTC			PTC

Type				
1	Pt100		1	
5	Pt500		5	
1000	Pt1000		10	
*	Others	On request	*	Kohm

Number of probes			
1	Single		1
2	Double		2

Sensor type				
C	Bulb sensor			C
F	Film sensor	Only for PT type		F

Number of wires (compensation)			
2	Without compensation		2
3	With compensation		3
4	Without compensation (double probe)		4
6	With compensation (double probe)		6

Ø Sheath diameter (mm)			
3	Diameter: 3 mm		3
4	Diameter: 4 mm		4
5	Diameter: 5 mm		5
6	Diameter: 6 mm		6
8	Diameter: 8 mm		8
10	Diameter: 10 mm		10
*	Diameter: * mm		*

L Sheath length (mm)			
*	Maximum length * mm	* / mm	*

Electrical connection			
Cable (mm)			
S	Silicone cable: *mt	/ mt	S*
T	Metal braided cable *mt	/ mt	T*
P	PTFE/MFA cable: *mt	/ mt	MFA*
PVC	PVC	/ mt	PVC*
*	Others	/ mt	*
Connection head			
MA	Aluminium MA miniature, type MAA		MA
KM	Aluminium KM, type B		KM
KNN	Plastic KNN (PA), type B		KNN
KH	Inox KH, Type B		KH
EX	Aluminium XDA, type B, ATEX		EX
*	Others	On request	*
Enclosure			
CP1	Plastic enclosure (plate 53x55x36)		CP1
CP2	Plastic enclosure (transmitter 53x63x36)		CP2
CM	Aluminium enclosure (58x64x37)		CM
Connectors			
M12	Male connector 4P M12x1		M12
D	Electrovalve type connector Electrovalve type connector		D
*	Others		*

Process connection			
0		Without accessory	0
1		Fixed accessory	
	11	1/8 BSP	11
	12	M10X1	12
	13	1/4 BSP	13
	14	1/2 BSP	14
	15	3/4 BSP	15
	16	1 BSP	16
	1*	Other	17
2		Moveable accessory (bicone)	
	21	1/8 BSP	21
	22	M10X1	22
	23	1/4 BSP	23
	24	1/2 BSP	24
	25	3/4 BSP	25
	26	1 BSP	26
	2*	Other	27
3		Strength adjustable accessory	
	31	1/8 BSP	31
	32	M10X1	32
	33	1/4 BSP	33
	3*	Other	34
4		Moveable accessory (male or female)	
	41	1/8 BSP	41
	42	M10X1	42
	43	1/4 BSP	43
	44	1/2 BSP	44
	45	3/4 BSP	45
	46	1 BSP	46
	4*	Other	47
9		Other accessories	90

Transmitter options			
C */*	In head (Temperature range */*ºC)		C */*
D */*	DIN rail (Temperature range */*ºC)		D */*

Class			
-	Class A		A
B	Class B		B
1/3	1/3		1/3
1/10	1/10		1/10

* to be defined by the customer	Example / Reference: BR	Pt	-	1	-	1	-	C	-	3	6	100	KM	14	C	A

Digital temperature probes

Tekon owns specialized know-how for the design and manufacture of digital temperature probes, from their specification, passing through electronic design, mechanical specifications, drafting, the materialization of prototypes and industrialization.

Our digital probes offer an I2C/SPI digital interface or other to be specified, adding to the probes the advantages inherent to the digital universe, from traceability to configurations customized to customer data.

The definition and construction of digital solutions go from choosing the digital sensor to choosing the best materials and the best physical adaptation to the application in question.

The portfolio of digital probes produced by Tekon has served several applications in a diversified context:

- Cooling and industrial freezing;
- Food processing;
- Wireless monitoring systems;
- Portable devices for temperature measurement

Find out more about our digital probes at tekonelectronics.com

Digital temperature probes for
wireless monitoring solutions.
Food Industry Application.

Level probes

Tekon Electronics is also dedicated to the production of magnetic level probes, with digital signal output, easy to install and oriented for vertical assemblies. Level probes can contain up to 5 detection points, with NO, NC and INV, operating in applications with temperatures up to 125ºC and 10 bar pressure. The robustness of the probe body has a high resistance to chemical products.

Electrical connection	Head / Cable / 3P+T Plug
Process connection	Teflon / Flange / Aisi 316 Thread 316
Maximum pressure	10 bar
Maximum temperature	125 ºC

LEVEL PROBES | PROBE CONFIGURATION TABLE

Model BN														
Cable (mm)														
S	Silicone cable: *mt							Sx						
P	PTFE/MFA cable: *mt							Px						
PVC	PVC							PVCx						
*	Others							*						
Head														
MA	Aluminium MA miniature, type MAA							MA						
KM	Aluminium KM, type B							KM						
KNN	Plastic KNN (PA), type B							KNN						
KH	Inox KH, Type B							KH						
*	Others							*						
Enclosure														
CP1	Plastic enclosure (plate 53x55x36)							CP1						
CP2	Plastic enclosure (transmitter 53x63x36)							CP2						
CM	Aluminium enclosure (58x64x37)							CM						
Connectors														
M12	Male connector 4P M12x1							M12						
D	Electrovalve type connector							D						
*	Others							*						

Process connection														
S	1/8"	Reversed							S					
T	1/4"	Reversed							T					
B	3/8"	Reversed							B					
A	1/2"	Reversed							A					
M	3/4" BSP								M					
C	1" BSP								C					
D	1" 1/4								D					
E	1" 1/2								E					
F	2"								F					
G	Flange Ø 80; 4 holes. 90º								G					
H	Flange Ø 80; 3 holes. 120º								H					
I	Flange Ø 52; 2 holes. 180º								I					
J	Flange Ø 50; 4 holes. 90º								J					
L	Flange Ø 60; 4 holes. 90º								L					

Number of floats														
1	1 float without retention									1				
2	2 floats and 2 levels with retention									2				
3	3 floats and 3 levels with retention									3				
4	4 floats and 4 levels with retention									4				
5	5 floats and 5 levels with retention									5				

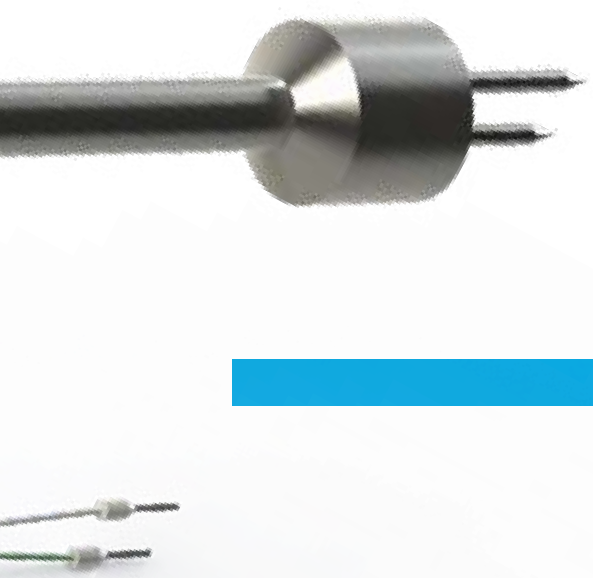
Types of floats / Ø Pipe (Stainless steel AISI 316)														
s1	Cylindric S1 28x28x9.5 (Ø 9mm pipe)										S1			
s2	Spherical S2 Ø 41x11 (Ø 10mm pipe)										S2			
s3	Cylindric S3 45x55x15 (Ø 14mm pipe)										S3			
s4	Spherical S4 Ø52x15 (Ø 14mm pipe)										S4			
*	Others										*			

Number of levels														
1	1 level											1		
2	2 levels											2		
3	3 levels											3		
4	4 levels											4		
5	5 levels											5		

Output types														
NO	Normally open												10	
NC	Normally closed												01	
INV	Inverter												11	

L Sheath length (mm)														
*	Maximum length * mm	* / mm												*

				-		-		-		-		-		-		-		-
* to be defined by the customer		Example / Reference: BN	KM		F		4		S4		4		10		3400			



Cables

Cables

Cables are essential components for conducting signals from the RTD sensor or thermocouple, with minimum noise, to the reading units.
The diversity of cable constructions ensures their adaptation to cryogenic applications, HVAC, and ATEX, for industries such as food, chemical, cement, steel, and pharmaceutical, among others.
The cables include protective and insulating elements that protect the conductors from interference in the application medium. The cables can be of simple configuration or paired, which support the connection of several RTDs or thermocouples.

Cables	Type	Ref. No.	Color code	Coating	Nº x mm²	Temperature (ºC)	Length (mm)
	KX	111950350	IEC	PVC / PVC	2x1.3	-30 to +105	4.5x7
	KX	111950329	IEC	MFA / MFA	2x0.2	-200 to +250	1.5x2.4
	KX	111950340	IEC	FV / FV / AISI	2x1.3	0 to +400	3.5x5
	JX	111950315	IEC	FV / FV / AISI	2x1.3	0 to +450	3.5x5
	BIBC	111950420	IEC "EEx"	Aluminium tape / Polyester tape / Tinned copper braid / LSOH	2x1	-40 to +90	Ø 7.5
	RTD	11195040		PFA / TM / PFA	4x0.22	-200 to +260	ø 3.6
	RTD	111950499		FV / FV / AISI	2x0.22	0 to +500	Ø 2.7
	RTD	111950501		FV / FV / AISI	3x0.25	0 to +500	Ø 4
	RTD	11195028		MFA / SIL	2x0.22	-40 to +200	Ø 2.7
	RTD	111950530		MFA / SIL	3x0.22	-40 to +200	Ø 3.7
	RTD	111950562		MFA / SIL	6x0.22	-40 to +200	Ø 5

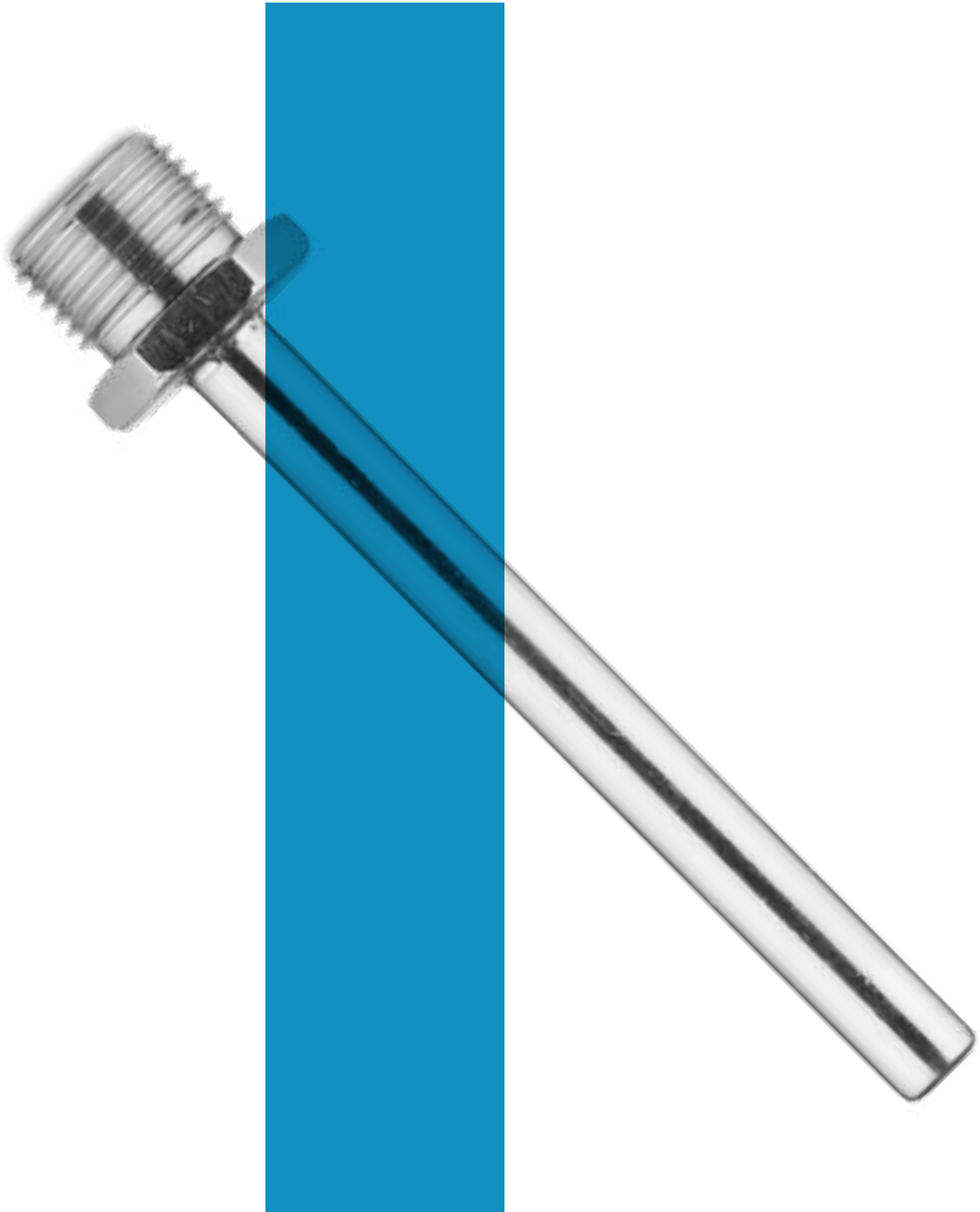
Connection Heads

Connection Heads

The connection heads of temperature probes offer a clean and protected area for the assembly of connection terminals and transmitters, as important elements in reading the measured values by the probes sensor element.

The physical composition with materials such as aluminium, polymers, and stainless steel and the supported working temperatures help to define the applications in which these components can be integrated.

Connections Heads		Material	Operating temperature	Cable input	Accessory input	Applications
		Aluminium alloy, MAA type, IP66	-40 ºC...+100 ºC	M16x1.5 Ø4...3	M10x1	General
		Aluminium alloy, B type, IP66	-40 ºC...+100 ºC	M20x1.5 Ø8...4	1/2" BSP	General
		PA plastic, B type, IP65, black	-40 ºC...+100 ºC	M20x1.5 Ø8...4	1/2" BSP	Food industry Textile industry
		Stainless steel AISI 316, B size, IP66	-40 ºC...+100 ºC	M20x1.5 Ø8...5	1/2" BSP	Food industry Textile industry Pharmaceutical industry
		Aluminium alloy, B type, IP66	-40 ºC...+100 ºC	M20x1.5 Ø8...4	1/2" BSP	General
		Aluminium alloy, A type, IP54	-40 ºC...+100 ºC	2 x M20x1.5 Ø8...5	1/2" BSP	General
		Aluminium alloy, Epoxy RAL 5005 paint BSI 07 ATEX 1532458U EEx d IIC T6 IP68, ExtD A21 T100ºC IP68	-	1/2" NPT Ø10..4	1/2" NPT	ATEX zone
		Aluminium alloy, A type, IP66	-40 ºC...+100 ºC	M20x1.5 Ø8...5	1/2" BSP	General



Sheaths

Sheaths

The sheaths are applied in order to protect the temperature sensor from the physical context. The selection of the type of sheath is based on the application working temperature, the type of substance in contact, and chemical reactions that may occur as corrosion, among other factors. Physically, metal sheaths can have various adaptations where they can be welded, machined or coated with resistant metal or polymer, resistant to chemicals and corrosive acids.

Metal	Maximum temperature	Operation properties
Nicrobell	+1250 ºC	Highly stable in oxidizing and vacuum atmospheres. Corrosion resistance is higher than stainless steel. It can be used in sulfurous atmospheres at low temperatures.
Inconel 600	+1100 ºC	Used in severely corrosive atmospheres at high temperatures. Good resistance to oxidation. Not recommended for use above 800 ° C when used with thermocouples of types R, S or B. Not recommended for atmospheres with sulfur and temperatures above 550 ° C.
AISI 446	+1100 ºC	Suitable for high temperatures in severely corrosive atmospheres. Particularly suitable for use in atmospheres with a high concentration of sulfur. The sensor must be mounted vertically at temperatures above 700 ° C.
AISI 316 L	+900 ºC	Good corrosion resistance and is ideal for atmospheres with the presence of sulfur. This metal offers high resistance to oxidation.
AISI 304	+900 ºC	Widely used in low-temperature applications, in the food and beverage, chemical and other industries where corrosion resistance is imperative.
AISI 321	+800 ºC	Excellent corrosion resistance over the entire operating temperature range. Suitable for a wide variety of industrial applications. Offers high ductility.

NICROBELL

INCONEL 600

AISI 446

AISI 316 L

AISI 304

AISI 321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Transmitters

Transmitters

The transmitters are responsible for transmitting the signal from the temperature sensor, either RTD or thermocouple. In the construction of probes with a connection head, the transmitter is incorporated in the probe head, housing the transmitter and the connection to the probe.

The technical support provided for the production of probes is complemented with a range of transmitters, produced by Tekon Electronics, which ensure the connection to the temperature probes already implemented or that will be integrated.

Wired

Tekon Electronics has a solid experience in the production of wired temperature transmitters, oriented towards temperature acquisition probe signals in the most diverse contexts. The output signals differentiate temperature measurements in several formats - 4..20mA, RS485/ Modbus or 0..10 V.

Model	Sensor	Output	Operating temperature	IP Protection	Galvanic Isolation
THP101	PT100	4 to 20 mA	-20ºC to 80ºC	IP40	No
THT201	Thermocouple E, J, K, N, R, S and T	4 to 20 mA	-20ºC to 80ºC	IP40	No
THU1102	PT100, PT500, PT1000 Thermocouple E, J, K, N, R, S and T Resistance, Potentiometer	4 to 20 mA	-20ºC to 80ºC	IP40	No
THM501	PT100	MODBUS RTU RS485	-20ºC to 80ºC	IP40	No
THM502-I	PT100, PT500, PT1000 Linear Resistance	MODBUS RTU RS485	-20ºC to 80ºC	IP40	Yes
THM602-I	Thermocouple C, J, K, N, R, S and T Linear Voltage	MODBUS RTU RS485	-20ºC to 80ºC	IP40	Yes
THP102-I	PT100	4 to 20 mA	-40ºC to 80ºC	IP40	Yes
THT202-I	Thermocouple J, K, N, R, S and T	4 to 20 mA	-40ºC to 80ºC	IP40	Yes
THU301-I	PT100, PT500, PT1000 Thermocouple J, K, N, R, S and T	4 to 20 mA	-40ºC to 80ºC	IP40	Yes
TDU301-I	PT100, PT500, PT1000 Thermocouple J, K, N, R, S and T	4 to 20 mA	-40ºC to 80ºC	IP40 (IP20 terminals)	Yes
TDU302-I	PT100, PT500, PT1000 Thermocouple J, K, N, R, S and T	0 to 10 V	-40ºC to 80ºC	IP40 (IP20 terminals)	Yes

Wireless

Tekon Electronics wireless solutions portfolio includes equipment with connectivity characteristics that make it possible to easily acquire the signals from the temperature probes. The acquisition can be configured via the conversion of an analog signal or by direct input from the sensor.

Model	Sensor	Operating temperature	IP Protection
TWPH-1UT	PT100 Thermocouple C, J, K, N, R, S and T	-40ºC to 80ºC	IP40
TWP-4AI4DI1UT	PT100 Thermocouple J, K, N, R, S and T	-30ºC to 80ºC	IP65
TWP-1UT	PT100 Thermocouple C, J, K, N, R, S and T	-30ºC to 80ºC	IP65
TWP-2UT	PT100 Thermocouple C, J, K, N, R, S and T	-30ºC to 80ºC	IP65
TWP-4AI	0..24 mA 0..12 V	-30ºC to 80ºC	IP65
TWP-2AI	0..24 mA 0..12 V	-30ºC to 80ºC	IP65
TWP-1AI	0..24 mA 0..12 V	-30ºC to 80ºC	IP65


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Components and Accessories

Components and Accessories

The manufacture of temperature probes implies the definition of other components that have increased relevance for their use. Fixing accessories provides the connection to the customer process. The electrical connections can be made to a wide variety of connectors, having direct dependence on the type of probe and application, where mini connectors, double, single, male, and female, among others, can be integrated.

Ceramic protection tubes

Ceramic protection tubes are used to protect thermocouples of noble metals (platinum) and base metals (I, K, ...), in processes, where the temperature to be measured exceeds the melting point of common metals. Also used in applications where there is a direct incidence of flame or areas of contamination by hostile environments and constant action of concentrates (oxidizing, sulfurous).

Metalic protection tubes & Sheaths of stainless steel AISI 316

Designed to protect thermo elements from physical damage, corrosion and contamination, metal protection tubes come in different forms of materials and diameters. Once selected with appropriate criteria, the purpose for which they are intended, in addition to an accurate measurement, allows a longer lifetime for the whole set.

Ceramic - isolators and clamps

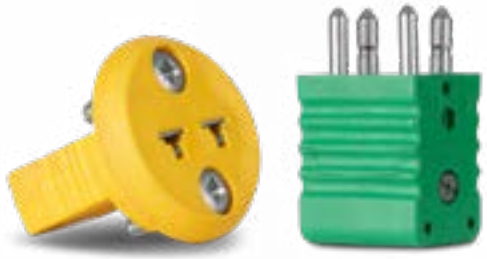
The ceramic insulators and capillaries are used to insulate the thermo-electric wires between themselves and the pair to the protective cover, avoiding the formation of a cold joint.

Connection plates

The connection plates with a ceramic construction base with nickel -plated brass contacts, connect the thermocouple with the extension or compensation cable, providing protection to elements. Ceramic terminals are generally available with 2 to 6 connection poles.

Connectors and Plugs

Male/female plugs are built to withstand severe applications with maximum useful life. Contacts are made with solid pins in various types of metal alloys (depending on the thermocouple), providing robust connections. These are injected with thermoplastics that withstand temperatures between 200ºC and 650 ° C. Designed for quick connections, the plugs are used in mineral insulation thermocouples, resistance thermometers with 3-wire connections and in extension or compensation cables.



Metallic fixing accessories

The metallic fixing accessories ensure the connection of the probes to elements of the process to be monitored. Adjustable to sheaths with diameters from 1.5 to 12 mm of mineral thermocouples or resistance thermometers.

Aisi 316	Moveable accessory – bicone	1/8 BSP, M10x1, 1/4
	Fixed accessory	BSP, 1/2 BSP, 3/4
	Fixed accessory - male or female	BSP, 1 BSP, outros
Nickel plated brass	Adjustable accessory	1/8 BSP, M10x1, 1/4 BSP, others
Others	Other fixing accessories with different sizes to provide a better fit to the process	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WIRELESS SENSORS TECHNOLOGY
WIRELESS
DEVICE STATUS
Plus TWP-2UT
WIRELESS TRANSMITTER

Use Case

Temperature probes for composting

Waste composting is a slow process, where temperature monitoring allows you to gauge when the process is complete. Tekon Electronics developed a complete solution that includes all the essential components for carrying out temperature monitoring. The wireless system provides long-range, secure and reliable remote monitoring.

How does wireless temperature monitoring work?

Tekon Electronics has developed a joint transmitter and probe solution with 1 or 2 measuring points. The entire solution is powered by internal batteries, rechargeable through a solar panel. In this way, continuous and sustainable remote monitoring of the entire application is ensured.

Temperature measurements are sent to the solution's gateway, which, via a module with an internet connection, will send data to the cloud, where they can be viewed and analyzed, in real-time, on the Tekon IoT Platform, the visualization platform and advanced data analysis from Tekon Electronics.

Note: the data can be made available in local automation systems. Consult our team to learn more about this option.

Tekon IoT Platform Real-time data analysis

The Tekon IoT Platform is a cloud-oriented solution for data visualization and analysis, fully developed by Tekon Electronics. Through this tool, you can consult the data of your transmitters and processes, at any time, from any device. You can configure alerts that focus on temperatures and other variables in the monitoring process, which will send you notifications by email or SMS, whenever the process reaches or exceeds the defined values.

Learn more about Tekon IoT Platform

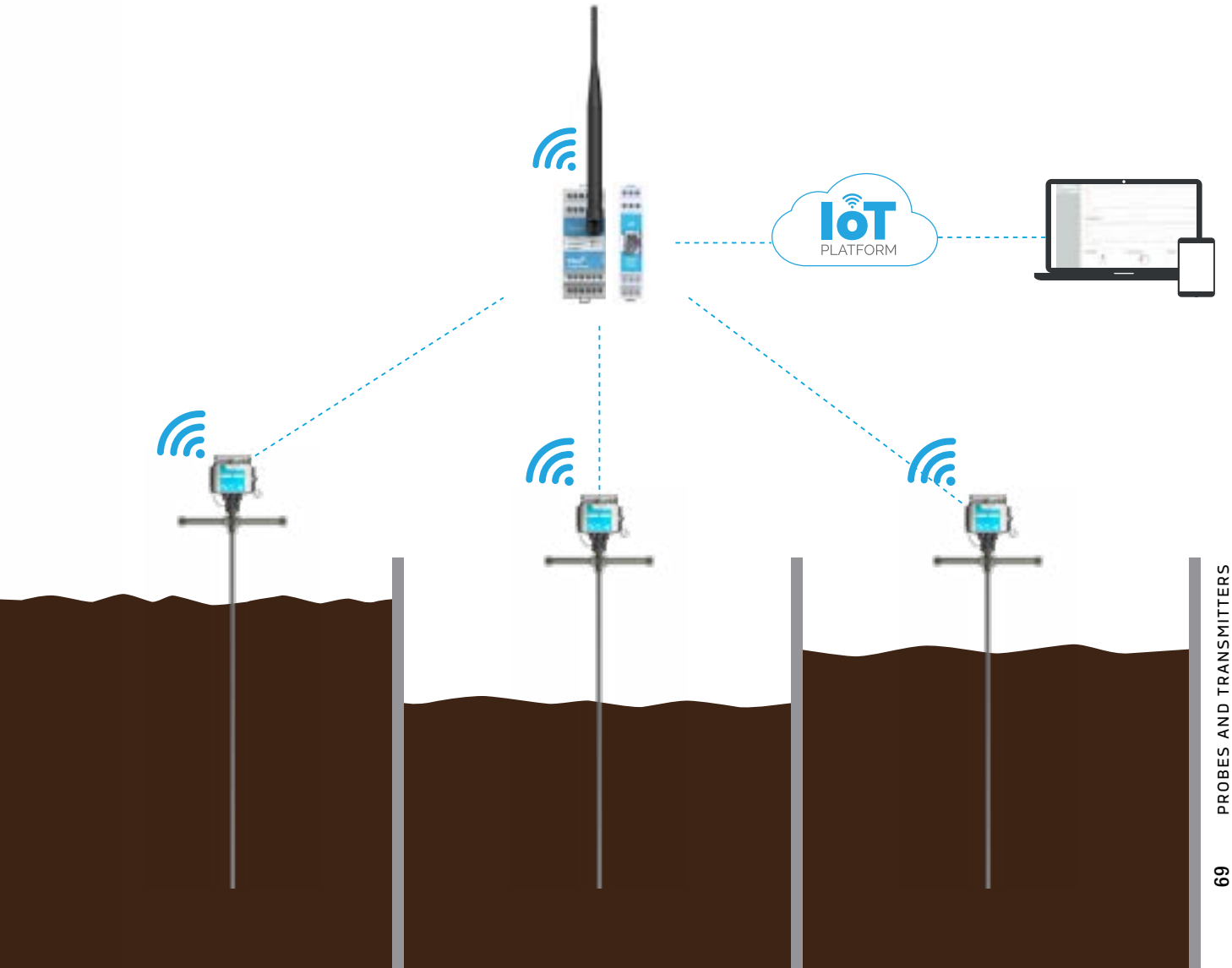
https://marketing.tekonelectronics.com/tekon-iot-platform

Fast, reliable and safe

Eliminate the manual process of measuring and recording temperatures from the composting process. Using the Tekon IoT Platform data analysis tool, you can quickly access data from any device and place. Reduce the risk of accidents at work, by avoiding contact with the fermentation atmosphere. Monitoring is done remotely and continuously.

Solution benefits

- Rapid implementation
- Low maintenance rate
- Turnkey solution
- Real-time monitoring
- Querying data anywhere
- Alarms and notifications about the status of the monitoring process
- Possibility of calibration by entities credited outside the process
- Installation scalability of up to 55 transmitters



For more information, visit our website at
tekonelectronics.com/en/product/probes

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TEKON ELECTRONICS
A brand of Bresimar Automação S.A.

Avenida Europa, 460
Quinta do Simão - Esgueira
3800-230 Aveiro
PORTUGAL

P.: +351 234 303 320
M.: +351 932 513 804
E.: probes@tekonelectronics.com

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