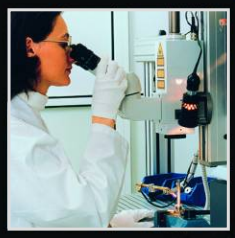


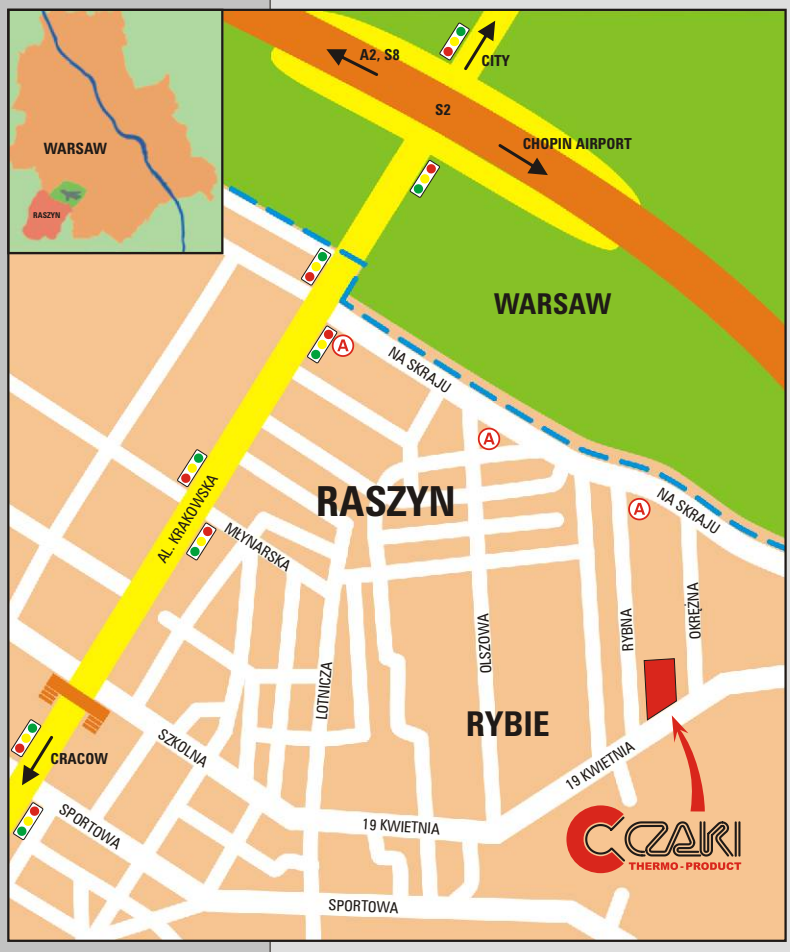
THERMO - PRODUCT

5.7.1
EDITION

C A T A L O G

WE OFFER

- Thermoelectric temperature sensors: Cu-CuNi (T), Fe-CuNi (J), NiCr-NiAl (K), NiCrSi-NiSi (N), PtRh-Pt (S), PtRh-Pt (R), PtRh-PtRh (B)
- Resistance temperature sensors: Pt100, Pt500, Pt1000, Ni100, Ni1000
- Temperature sensors for hazardous areas **ATEX**
- Special versions and customized designs of temperature sensors
- Portable electronic thermometers
- Panel mount digital thermometers
- Process monitors for standard analog signals
- Temperature controllers
- Temperature transmitters 0-20 mA, 4-20 mA, 0-10 V for installation in head and on rail
- Power supply units and multi-channel switches
- Temperature loggers
- Dew point temperature meters with chilled mirror
- Dew point temperature transmitters, monitors and portable hygrometers
- Temperature and humidity loggers
- RTD sensor elements: Pt100, Pt500, Pt1000, Ni100, Ni1000
- Compensating cables
- Thermowells
- Accessories
- as well as calibration services for sensors, meters and temperature controllers



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SENSORS WITH SPECIALIZED SHEATHS AND FOR HEATING AND AIR CONDITIONING

TEMPERATURE SENSORS FOR HAZARDOUS AREAS

PORTABLE AND PANEL MOUNTING THERMOMETERS AND PROCESS MONITORS

TEMPERATURE CONTROLLERS

TEMPERATURE TRANSMITTERS

TEMPERATURE LOGGERS, MULTI-CHANNEL SWITCHES, TEMPERATURE MONITORING SYSTEMS

TEMPERATURE AND HUMIDITY LOGGERS, HYGROMETERS, DEW POINT TRANSMITTERS

COMMUNICATION INTERFACES

POWER SUPPLY UNITS

ACCESSORIES FOR TEMPERATURE SENSORS

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TECHNICAL INFORMATION

PLATINUM AND NICKEL RESISTANCE TEMPERATURE SENSORS

Resistance sensors react to changes in temperature by changes in the resistance of a built-in resistor. The protection sleeve of the sensor houses, apart from the temperature measurement resistor, internally isolated conductors and external connectors to electrical measurement instruments. These may include installation components or a connecting heads.

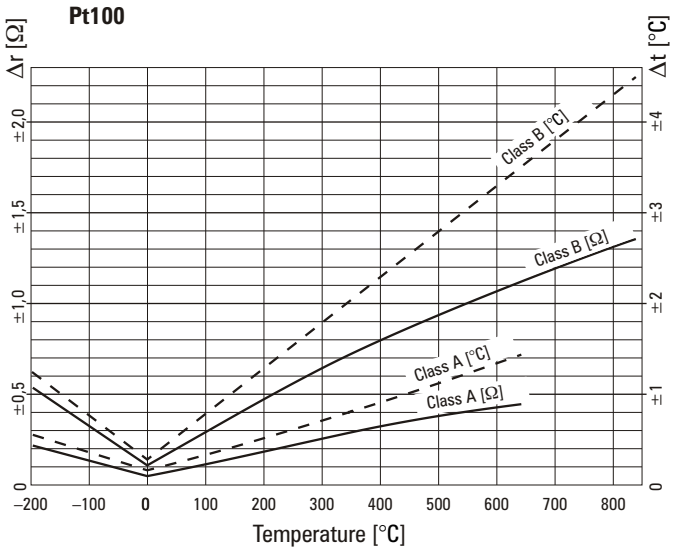
Standard EN 60751: 2009 gives the relationship between temperature and resistance for platinum resistance elements:
- in the range -200°C to 0°C: $R_t = R_0 [1 + At + B t^2 + C (t - 100°C) t^3]$
- in the range 0°C to 850°C: $R_t = R_0 (1 + At + B t^2)$

For platinum of the quality usually specified in industrial temperature sensors the relationship values of the above are:
$A = 3{,}9083 \times 10^{-3}\ °C^{-1}$ $B = -5{,}775 \times 10^{-7}\ °C^{-2}$ $C = -4{,}183 \times 10^{-12}\ °C^{-4}$
The temperature coefficient is given as α, defined as :
$\alpha = (R_{100} - R_0) / (100 \times R_0) = 0{,}00385 °C^{-1}$ (for calculations $0{,}00385055\ °C^{-1}$)
R_{100} - resistance at temperature 100°C, R_0 - resistance at temperature 0°C , t - temperature in °C

For nickel over the entire operating range (-60 to 250°C) the following relationship between temperature and resistance is applied:
$R_t = R_0 (1 + 0{,}5485 \times 10^{-2} t + 0{,}665 \times 10^{-5} t^2 + 2{,}805 \times 10^{-11} t^4 - 2 \times 10^{-17} t^6)$
R_0 - resistance at temperature 0°C, R_t - resistance at temperature t , t - temperature in °C
In the temperature range - 60 °C do 180 °C the component $- 2 \times 10^{-17} t^6$ may be omitted.

CHARACTERISTICS OF THERMOMETRIC RESISTORS (short form)

Pt100 resistor EN 60751 (Pt500 = 5xPt100, Pt1000 = 10xPt100)									
T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)	T (°C)	R (Ω)
-100	60,26	10	103,90	120	146,07	230	186,84	340	226,21
-90	64,30	20	107,79	130	149,83	240	190,47	350	229,72
-80	68,33	30	111,67	140	153,58	250	194,10	360	233,21
-70	72,33	40	115,54	150	157,33	260	197,71	370	236,70
-60	76,33	50	119,40	160	161,05	270	201,31	380	240,18
-50	80,31	60	123,24	170	164,77	280	204,90	390	243,64
-40	84,27	70	127,08	180	168,48	290	208,48	400	247,09
-30	88,22	80	130,90	190	172,17	300	212,05	450	264,18
-20	92,16	90	134,71	200	175,86	310	215,61	500	280,98
-10	96,09	100	138,51	210	179,53	320	219,15	550	297,49
0	100,00	110	142,29	220	183,19	330	222,68	600	313,71



Permitted resistance (Δr) and temperature (Δt) deviation

Tolerance class	Tolerance
A	$\pm(0{,}15 + 0{,}002 \times \lvert t \rvert)$
B	$\pm(0{,}3 + 0{,}005 \times \lvert t \rvert)$

where $\lvert t \rvert$ is the absolute value in degrees Celsius (without defining the sign)

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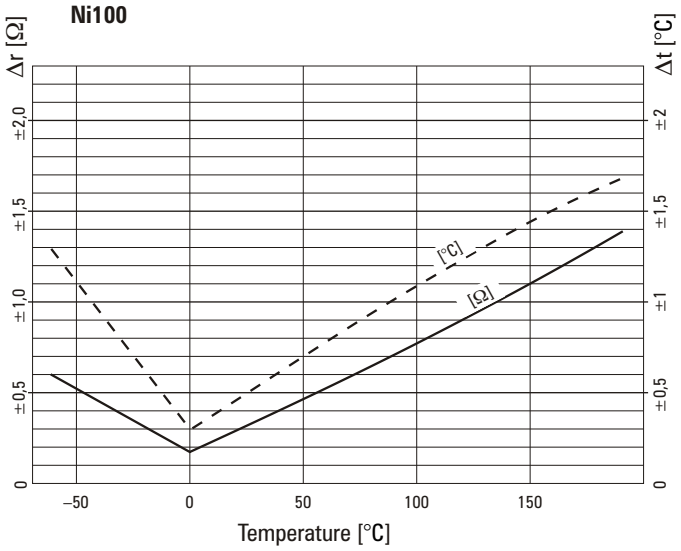
Ni100 resistor PN-83/M-53852 (Ni1000 = 10xNi100)									
T (ºC)	R ( )	T (ºC)	R ( )	T (ºC)	R ( )	T (ºC)	R ( )	T (ºC)	R ( )
-60	69,46	-10	94,54	40	123,07	90	154,89	140	190,90
-50	74,24	0	100,00	50	129,14	100	161,73	150	198,69
-40	79,12	10	105,60	60	135,34	110	168,73	160	206,68
-30	84,12	20	111,30	70	141,69	120	175,92	170	214,86
-20	89,25	30	117,12	80	148,21	130	183,31	180	223,10



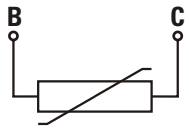
RESISTANCE TEMPERATURE SENSORS WITH ATTACHED CABLE

These temperature sensors comprise a resistor housed in a protection tube which is joined by a connecting cable. The maximum operating temperature of such an assembly is dictated by the type of isolation of the connecting cable. Sensors are made of wires with insulation:

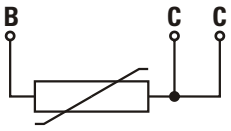
PVC Tmax +80°C	silicone Tmax +180°C	PTFE Tmax +260°C	glass fiber Tmax +400°C

The external isolation may be enclosed by a stainless steel braid or a stainless steel armored hose.
The most commonly applied resistance measurement in practice is a 2-wire arrangement. In longer conductors the resistance of the conductor may amount to many ohms and may therefore cause a significant shift the measurement value. In such cases a 3-wire arrangement is used, which considerably reduces measurement inaccuracies or a 4-wire arrangement which completely eliminates them.

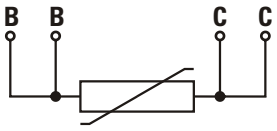
Colors of conductor isolation in resistance sensors are: B – white, C- red



2-wire arrangement



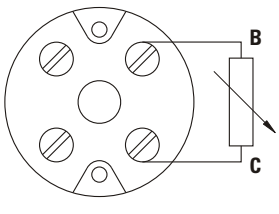
3-wire arrangement

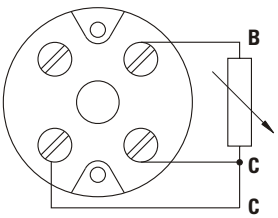


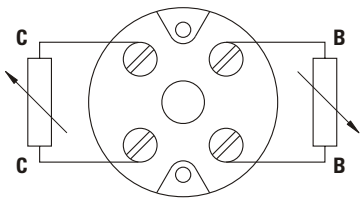
4-wire arrangement

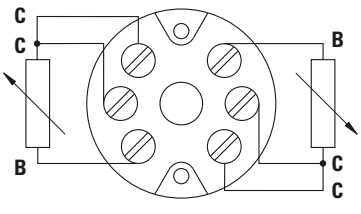
RESISTANCE TEMPERATURE SENSORS WITH CONNECTION HEAD

These temperature sensors comprise of a protection tube, measurement insert and a connection head with an internal terminal block. The insert may be a replaceable element of the sensor or not. Sensors are available with heads in several arrangements, which differ according to form, material of construction and dimensions. 2, 3 and 4 – wire sensors are available.









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THERMOELECTRIC TEMPERATURE SENSORS

Thermoelectric temperature sensors react to changes in temperature through a change in the electromotive force of their thermocouples. The thermocouples are two conductors made of different materials connected with each other at one end and thus forming an arrangement which takes advantage of a thermo-electric effect to measure temperature (the Seebeck effect). The thermo-electric effect depends on the generation of an electromotive force resulting from a temperature difference between two fused measurement ends (the connected ends of the thermocouple), which are influenced by the temperature being measured at one end and a reference temperature at the other end (usually 0°C).

TYPES OF THERMOCOUPLES

Marking	Type of thermocouple	Temperature range for long term application [°C]	Temperature range for short term application [°C]
T Cu-CuNi	copper-copper/nickel or copper/constantan	-100 ... +400	-200 ... +600
E NiCr-CuNi	nickel/chrome-copper/nickel or nickel/chrome-constantan	-100 ... +700	-200 ... +1000
J Fe-CuNi	iron-copper/nickel or iron-constantan	-100 ... +700	-200 ... +900
K NiCr-NiAl	nickel/chrome-nickel/aluminum	-100 ... +1000	-200 ... +1300
N NiCrSi-NiSi	nickel/chrome/silicon-nickel/silicon	-100 ... +1000	-200 ... +1300
S PtRh10-Pt	platinum/rhodium 10%-platinum	0 ... +1300	0 ... +1600
R PtRh13-Pt	platinum/rhodium 13%-platinum	0 ... +1300	0 ... +1600
B PtRh30-PtRh6	platinum/rhodium 30%-platynum/rhodium 6%	0 ... +1300	0 ... +1800

Thermocouples for very high temperatures

Marking	Type of thermo-element	Temperature range [°C]	Maximum error [°C]
G W-W26Re	tungsten-tungsten/rhenium 26%	0...+2320	0...425 ± 4,5°C 425...2320 ± 1%
D W3Re-W26Re	tungsten/rhenium 3%-tunsten/rhenium 26%		
C W5Re-W26Re	tungsten/rhenium 5%-tungsten/rhenium 26%		

THERMO-ELECTRIC CHARACTERISTICS OF THERMOCOUPLES (short-form data) /EN 60584-1/

T [°C]	Thermo-electric potential [mV]						
	T	**J**	**K**	**N**	**S**	**R**	**B**
-100	-3,379	-4,633	-3,554	-2,407			
-80	-2,788	-3,786	-2,920	-1,972			
-60	-2,153	-2,893	-2,243	-1,509			
-40	-1,475	-1,961	-1,527	-1,023	-0,194	-0,188	
-20	-0,757	0,995	-0,778	-0,518	-0,103	-0,100	
0	0	0	0	0	0	0	0
20	0,790	1,019	0,798	0,525	0,113	0,111	-0,003
40	1,612	2,059	1,612	1,065	0,235	0,232	0
60	2,468	3,116	2,436	1,619	0,365	0,363	0,006
80	3,358	4,187	3,267	2,189	0,502	0,501	0,017
100	4,279	5,269	4,096	2,774	0,646	0,647	0,033
120	5,228	6,360	4,920	3,374	0,795	0,800	0,053
140	6,206	7,459	5,735	3,989	0,950	0,959	0,078
160	7,209	8,562	6,540	4,618	1,110	1,124	0,107
180	8,237	9,669	7,340	5,259	1,273	1,294	0,141
200	9,288	10,779	8,138	5,913	1,441	1,469	0,178
220	10,362	11,889	8,940	6,579	1,612	1,648	0,220
240	11,458	13,000	9,747	7,255	1,786	1,831	0,267
260	12,574	14,110	10,561	7,941	1,962	2,017	0,317
280	13,709	15,219	11,382	8,637	2,141	2,207	0,372
300	14,862	16,327	12,209	9,341	2,323	2,401	0,431
320	16,032	17,434	13,040	10,054	2,507	2,597	0,494
340	17,219	18,538	13,874	10,774	2,692	2,796	0,561
360	18,422	19,642	14,713	11,501	2,880	2,997	0,632
380	19,641	20,745	15,596	12,234	3,069	3,201	0,707
400	20,872	21,848	16,439	12,974	3,259	3,408	0,787
420		22,952	17,243	13,719	3,451	3,616	0,870
440		24,057	18,091	14,469	3,645	3,827	0,957
460		25,164	18,941	15,255	3,840	4,040	1,048
480		26,276	19,792	15,984	4,036	4,255	1,143
500		27,393	20,644	16,748	4,233	4,471	1,242
520		28,516	21,497	17,515	4,432	4,690	1,344
540		29,647	22,350	18,286	4,632	4,910	1,451

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THERMO-ELECTRIC CHARACTERISTICS OF THERMOCOUPLES (short-form data) /EN 60584-1/ - c.d.

T [°C]	Thermo-electric potential [**mV**]						
	T	**J**	**K**	**N**	**S**	**R**	**B**
560		30,788	23,203	19,059	4,833	5,133	1,561
580		31,939	24,055	19,835	5,035	5,357	1,675
600		33,102	24,905	20,613	5,239	5,583	1,792
620		34,279	25,755	21,393	5,443	5,812	1,913
640		35,470	26,602	22,175	5,649	6,041	2,037
660		36,675	27,447	22,958	5,857	6,273	2,165
680		37,896	28,289	23,742	6,065	6,507	2,296
700		39,132	29,129	24,527	6,275	6,743	2,431
720		40,382	29,965	25,312	6,486	6,980	2,569
740		41,645	30,798	26,098	6,699	7,220	2,710
760		42,919	31,628	26,883	6,913	7,461	2,854
780		44,203	32,453	27,669	7,128	7,705	3,002
800		45,494	33,275	28,455	7,486	7,950	3,154
820		46,786	34,093	29,239	7,563	8,197	3,308
840		48,074	34,908	30,024	7,783	8,446	3,466
860		49,353	35,718	30,807	8,003	8,697	3,626
880		50,622	36,524	31,590	8,226	8,950	3,790
900		51,877	37,326	32,371	8,449	9,205	3,957
920		53,119	38,124	33,151	8,674	9,461	4,127
940		54,347	38,918	33,930	8,900	9,720	4,299
960		55,561	39,708	34,707	9,128	9,980	4,475
980		56,763	40,494	35,482	9,357	10,242	4,653
1000		57,953	41,276	36,256	9,587	10,506	4,834
1020		59,134	42,053	37,027	9,819	10,771	5,018
1040		60,307	42,826	37,795	10,051	11,039	5,205
1060		61,473	43,595	38,562	10,285	11,307	5,394
1080		62,634	44,397	39,326	10,520	11,578	5,585
1100		63,792	45,119	40,087	10,757	11,850	5,780
1120		64,948	45,873	40,845	10,994	12,123	5,976
1140		66,102	46,623	41,600	11,232	12,397	6,175
1160		67,255	47,367	42,352	11,471	12,673	6,377
1180		68,406	48,105	43,101	11,710	12,950	6,580
1200		69,553	48,838	43,846	11,951	13,228	6,786
1220			49,565	44,588	12,191	13,507	6,995
1240			50,286	45,326	12,433	13,786	7,205
1260			51,000	46,060	12,554	14,066	7,417
1280			51,708	46,789	12,917	14,347	7,632
1300			52,410	47,513	13,159	14,629	7,848
1320			53,106		13,402	14,911	8,066
1340			53,795		13,644	15,193	8,286
1360			54,479		13,887	15,475	8,508
1380					14,130	15,758	8,731
1400					14,373	16,040	8,956
1420					14,615	16,323	9,182
1440					14,857	16,605	9,410
1460					14,978	16,887	9,639
1480					15,341	17,169	9,868
1520					15,822	17,732	10,331
1540					16,062	18,012	10,563
1560					16,301	18,292	10,796
1580					16,539	18,571	11,029
1600					16,777	18,849	11,263
1620					17,013	19,126	11,497
1640					17,249	19,402	11,731
1660					17,483	19,667	11,965
1680					17,717	19,951	12,199
1700					17,947	20,222	12,433

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TOLERANCES FOR THERMOCOUPLES (EN 60584-2)

Class	Permissible deviations of thermocouples									
	type **K**, **N**		type **J**		type **S**, **R**		type **T**		type **B**	
	Temperature [°C]	Δt	Temperature [°C]	Δt	Temperature [°C]	Δt	Temperature [°C]	Δt	Temperature [°C]	Δt
1	-40 do 375	1,5ºC	-40 do 375	1,5ºC	0 do 1100	1ºC	-40 do 125	0,5 ºC	--	--
	375 do 1000	0,4%	375 do 750	0,4%	1100 do 1600	(*)	125 do 350	0,4%	--	--
2	-40 do 333	2,5ºC	-40 do 333	2,5ºC	0 do 600	1,5ºC	-44 do 133	1ºC	--	--
	333 do 1200	0,75%	333 do 750	0,75%	600 do 1600	0,25%	133 do 350	0,75%	600 do 1700	0,25%

(*) For thermocouples type S and R permissible deviation is calculated according to the formula: [1+(t-1100)×0,003]ºC

SHEATHED THERMOCOUPLES

Sheathed thermocouples are shielded by a nickel-chromium steel tube within which are housed the thermo-electric wires and isolation material in the form of heavily compressed manganese oxide (MgO).
The material of the sheath provides the mechanical and chemical shield for the fused measurement end and high resistance to many aggressive environments.
At one end the thermocouple is welded creating the fused end for measurement. The external shield is hermetically sealed by welding.
The other end of the thermocouple is connected to a compensating cable, plug- socket connector or connector block in the sensor head.
Due to the heavily compressed isolating layer and the metallurgical structure of the thermo-electrode and sleeve, the thermo-elements are bendable and can be bent to a minimum radius of five times their external diameter.
The main advantage of sheathed thermocouples are: small external diameters, long service life and flexibility permitting them to be bent and screwed in place, high resistance to shock and vibration and low thermal inertia.

The following table shows the materials most used for thermocouple sheaths.

Marking	Properties
INCONEL 600 (75%Ni, 16%Cr, 8%Fe)	• good general resistance to corrosion • very good resistance to oxidation • not recommended for atmospheres containing CO2 and sulfur >550°C • not recommended for atmospheres containing sodium > 750°C • maximum operating temperature in air 1150°C
NICROBELL (73%Ni, 22%Cr, 3%Mo, 1,4%Si)	• excellent resistance to oxidation • maximum operating temperature in air 1250°C remaining parameters as for Inconel
PtRh10 (90%Pt, 10%Rh)	• very good resistance to collagens, acetic acids, solutions of Na-HCl • high resistance to oxidation to 1300°C • resistant to 1200°C in atmospheres containing sulfur and silicon • not recommended for atmospheres containing phosphor • maximum working temperature to 1600°C
TANTALUM (Ta)	• very prone to oxidation above 300°C • very resistant to corrosion • resistant to most acids and alkalis • reacts to cold solutions of fluoride and hydrofluoric acid • reacts with chlorine at high temperatures • very high thermal resistance in vacuum, in neutral and reducing atmospheres • maximum working temperature to 2200°C
TUNGSTEN (W)	• low chemical reactivity • high mechanical strength and hardness • resistance to sulfuric and hydrochloric acids • at high temperatures reacts with oxygen, hydrogen, nitrogen,carbon and water vapor • maximum operating temperature 3300°C

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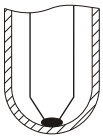
DYNAMIC PROPERTIES OF SHEATHED THERMOCOUPLES

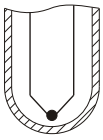
Time constants for sheathed thermocouples of different diameters.
(Time to reach 63% of actual thermocouple temperature
after step change of the temperature of gas or liquid)

sheath diameter [mm]	isolated measuring junction (type b)	grounded measuring junction (type a)
0,25	5 ms	2 ms
0,5	14 ms	8 ms
1,0	0,18 s	0,14 s
1,5	0,2 s	0,15 s
3,0	0,5 s	0,4 s
4,5	1,2 s	0,7 s
6,0	2,4 s	1,2 s
8,0	3,9 s	2,1 s

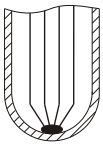
THERMOCOUPLE MEASURING JUNCTIONS



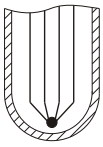
1a Single measuring junction (single thermocouple), with galvanic ground connection with sheath. Short time constant. Measuring junction isolated from chemical and mechanical environmental influences. Applied in non-conducting environments.



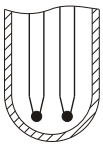
1b Single measuring junction, galvanically isolated from sensor sleeve. Longer time constant. Applied in conducting environments or where electric isolation from the measurement system is required.



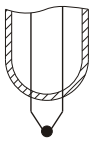
2a Twin measuring junction (twin thermocouple), with galvanic ground connection with sheath. Short time constant. Measuring junction isolated from chemical and mechanical environmental influences. Applied in non-conducting environments. May be applied in demanding situations allowing continuous measurement of process temperature (damage to one measuring circuit does not cause failure).



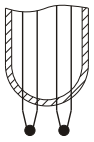
2ab Twin measuring junction., isolated from sheath and connected together. Longer time constant. Applied in conducting environments and when isolation from the measurement system is required.



2b Twin measuring junction, isolated from sheath and from each other. Longer time constant. Applied in electrically conducting environments and when isolation from the measurement system is required.



1c Single measuring junction, not protected or protruding outside the sheath, exposed.
Shortest time constant.
Measuring junction sensitive to mechanical damage and not resistant to atmospheric corrosion.



2c Twin measuring junction , not protected or protruding outside the sheath, exposed. Shortest time constant. Measuring junction sensitive to mechanical damage and not resistant to atmospheric corrosion. May be applied in demanding situations allowing continuous measurement of process temperature (damage to one measuring circuit does not cause failure).

COMPENSATING CABLES (EN 60584-3)

Compensating cables are made of the same materials as thermocouple or an alloy substitute that is not identical to the thermocouple, but have the same properties as a thermocouple.
Alternative materials are used for K and N-type thermocouples and for thermocouples of precious metals type R and S (for B-type thermocouples are applied copper wires in the temperature range up to + 100 ° C).
Compensating cables can be used in the temperature range up to 200 ° C.
Wires for compensating cables are standardized in EN 60584-3.
The thermoelectric voltages within acceptable operating temperatures correspond to the thermoelectric voltage for thermocouples according to standard EN 60584-1. Deviation limits for compensation wires are given in standard EN 60584-3.
Compensating cables are manufactured in two classes.
Class 1 - compensation cables made from the same materials as the thermocouple.
Class 2 - compensation cables made of the same materials as the thermocouple or substitute materials.
Colour coding of compensating cables is in accordance with EN 60584-3.
We supply cables to class 1.

THERMO-ELECTRIC TEMPERATURE SENSORS MADE OF THERMOCOUPLE WIRES

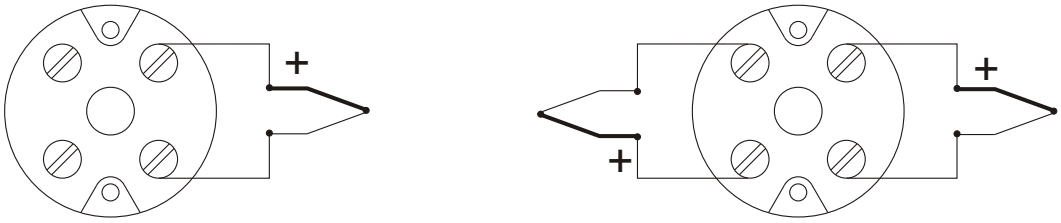
These temperature sensors comprise a thermocouple conductor in a protection sheath. The maximum operating temperature of such a sensor is dependent on the type of isolation of the conductor. Thermocouple sensors are made with the following isolating materials:

PVC Tmax +80°C	silicone Tmax +180°C	PTFE Tmax +260°C	glass fiber Tmax +400°C

The external cable isolation may be enclosed by a stainless steel braid or a stainless steel armored hose.
As sensor core we apply thermocouple solid wires (diameter 0.5mm) or thermocouple stranded wires 0,22mm^2, 0,35mm^2 or 0,50mm^2.

THERMO-ELECTRIC TEMPERATURE SENSORS WITH CONNECTION HEAD

These temperature sensors comprises of a protection tube, measurement insert and a connection head with an internal terminal block. The insert may be a replaceable element of the sensor or not. Sensors are available with heads in several arrangements, which differ according to form, material of construction and dimensions.



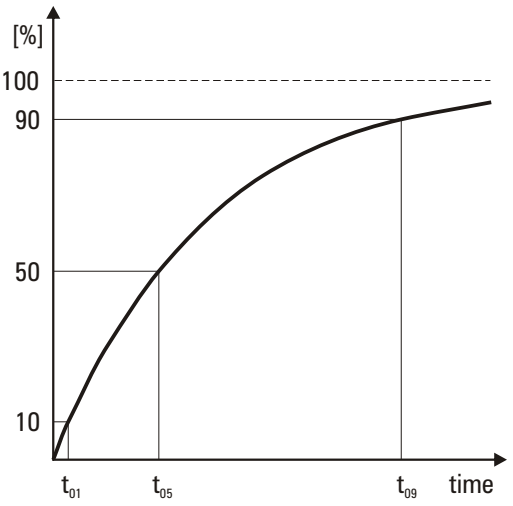
DYNAMIC PROPERTIES OF TEMPERATURE SENSORS

Time constant (t) is the time, after a step change in temperature, which the sensor needs to reach a defined reading.

Time constant (t_{05}), is the time required to reach 50% of the step change in temperature.

Time constant (t_{09}) is the time required to reach 90% of the step change in temperature.

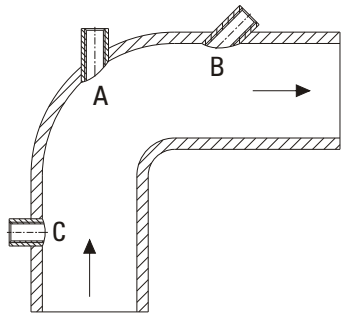
Time constants are given for air or water under flow conditions.



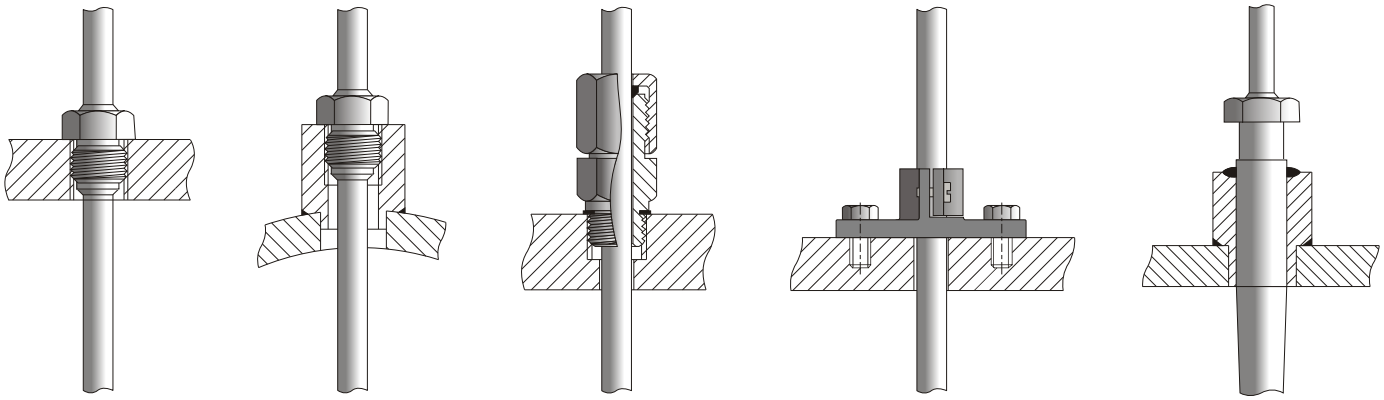
MOUNTING OF TEMPERATURE SENSORS

Sensors should be installed to allow ease of access and maintenance.
Sensors should be installed such that the measuring tip is always immersed in the medium which is being measured.

Examples of sensor installations:



A - installation in a pipe elbow
B - installation at an angle to flow
C - installation at right angles to flow



SHEATH MATERIALS OF TEMPERATURE SENSORS

Sheathes protect the temperature sensors from influences such as: pressure, corrosion, mechanical and chemical action. Depending on the application we offer temperature sensors with sheathes made from different materials.

CORROSION RESISTANT STEELS

Steels resistant to corrosion belong to a group of steel alloys with specific physical and chemical properties.
These can be divided into:

- stainless steels – resistant to corrosion in atmospheric air and water,
- austenitic steels - resistant to the action of most acids.

Resistance of steels to corrosion depends mainly on:

- the steel's chemical composition,
- its structure,
- its surface finish.

The basic constituent of corrosion resistant steels is chromium. Chrome steel alloys are resistant to oxidizing environments e.g. nitric acid, but these are not resistant to reducing environments e.g. hydrochloric or sulfuric acid. The second most important constituent of corrosion resistant steels is nickel, which increases the resistance to corrosion of steels to many corrosive environments, in particular to sulfuric acid, solutions containing chlorine (sea water) etc. Steels containing nickel are not resistant to gases containing Sulfur compounds.

Corrosion resistant steels have ferritic, austenitic and martensitic structures. The most corrosion resistant steel is austenitic, followed by ferritic, while martensitic offers the lowest resistance.

Corrosion resistance of steels depends to a great extent on its surface finish. Steels with a high polish are always more resistant than steels with a rough surface.

Dependent on the proportion of added chromium, stainless steels are classified into three groups:

- high chrome steels,
- chrome-nickel steels,
- chrome-nickel-manganese steels.

High chrome steels are mainly resistant to chemical corrosion. This includes atmospheric oxidation, naturally occurring water, steam; the corrosive action of cold alkaline solutions, dilute acids and salts - with the exception of chlorine salts; sulfur and iodine and the action of petroleum spirits and its vapors, fuels, alcohols and on food substances.

Chrome nickel steels are mainly resistant to electro-chemical corrosion in organic and inorganic acid environments, nitrogen compounds and salt solutions and aggressive food substances. Most often steel containing 18%Cr and 8%Ni is used, for example 1.4301, 1.4310. These steels are exceptionally resistant to the corrosive action of nitric acid, concentrated sulfuric acid, phosphoric acid and others. To increase resistance to sulfuric and acetic acids molybdenum is added in proportions of 1.5% do 2.5% e.g. 1.4571.

Chrome-nickel-manganese steels are mainly resistant to electrochemical corrosion in organic and inorganic acid environments, nitrogen compounds and salt solutions and aggressive food substances. They have the structure of austenitic steel, however their resistance to corrosion is no less than chrome-nickel steels. In environments such as solutions of lactic and acetic acids and others which are found in fruit juices they display good resistance. They are widely applied in the milk industry.
The chemical composition and some physical parameters of corrosion resistant steels are contained in the EN 10088-1 standard.

The tables below lists the most popular grades of stainless steels

Steel grade	Resistance to corrosion
1.4301 (0H18N9) 1.4310 (1H18N9) 1.4541 (1H18N9T)	Steels resistant to: • atmospheric corrosion, • naturally occurring water (including sea water), • alkaline solutions, • inorganic acids with the exception of hydrochloric, sulfuric, hydrofluoric, mixtures of nitric and hydrochloric, ionic, bromic and humid chlorine, • organic acids with the exception of formic (of strength >5%), boiling lactic and hot oxalic acids, salt solutions of any strength and temperature, with the exception of strong solutions of chlorides, oxalates, chlorates etc. • all food substances
1.4571 (H17N13M2T) 1.4404 (00H17N14M2)	Steels resistant to: • atmospheres containing Sulfur dioxide, • all naturally occurring waters, • sulfuric acid <20% strength at temperature 40°C, <5% strength at temperature 50°C, • cold phosphoric acid of any strength, • mixtures of sulfuric and nitric acids, • hot solutions of sulfuric acid, • boiling solutions of organic acids, • textile and paper bleaching solutions, acidic and basic dying agents, pinhole corrosion, • hydrochloric and halic acids

HEAT AND CREEP RESISTANT STEELS

Heat resistance is defined as resistance of a steel alloy to chemical attack (mainly atmospheric) and combustion gases and their aggressive components at temperatures above 600°C.
Creep resistance is defined as resistance of a steel alloy to deformation, resulting from mechanical loading at temperatures above 600°C.
Heat resistance is strictly connected with the tendency for steel to form scale. Scale should provide a continuous layer in intimate contact with the core metal.
These conditions are met in low carbon steels containing considerable quantities of Cr, Ni and added Si and Al.
Heat resistance at temperatures above 600°C is mainly dependent on resistance to creep.
High heat resistance is offered by austenitic steels.
Chromium is the basic element which increases heat resistance of steels.
The addition of about 30% of chromium provides heat resistance to about 1100°C.
Creep resistance is provided by the addition of alloying elements which increase melt temperatures. Examples of these elements are Mo, W, V, Co, Ti, Cr and Si. The chemical composition and basic properties of heat and creep resistant steels are provided in the EN 10095 and EN 10302 standards.

The table below gives selected properties of the most common grades of heat and creep resistant steels:

Steel grade	Heat resistance in air [°C]	Creep resistance [°C]	Type of steel
1.4762 (H24JS)	1200	800	ferritic
1.4749Ti (H25T)	1100	800	ferritic
1.4828 (H23N13)	1100	1000	austenitic

Al_2O_3 CERAMICS

Ceramic sheaths are employed as a rule for measurement of high temperatures.
They have, in comparison to metal sheaths, lower resistance to mechanical influences and lower resistance to changes in temperature.
Advantages of ceramic sheaths are vacuum and leak tightness, very good abrasion resistance and excellent electrical insulation properties.
Depending on the aluminum oxide content, ceramic sheaths are differentiated as follows:

C 610 - Al_2O_3 content 60%
C 799 - Al_2O_3 content 99.7%

Grade	Thermal resistance for most common environments
C 610	• to 1000°C - alkalis and gases not containing liquid acids • to 1400°C - air
C 799	• to 1000°C - sulfur furnace environments • to 1200°C - coke oven environments • to 1300°C - industrial gases, acetylene, hydrogen • to 1800°C - air

QUARTZ GLASS

Sheaths made from quartz glass are manufactured with a minimum Si02 content of 99.8% and have the following characteristics:
- high resistance to chemical attack by organic and inorganic acids with the exception of phosphoric acid (above 200°C) and hydrofluoric acid,
- significant resistance to alkalis,
- resistance to sharp temperature changes,

Are applied as sheathing for temperature sensors in galvanic and chemical metal processing.

SILICON CARBIDE

Sheaths made from silicon carbide (SiC) are resistant to corrosive actions of molten metals Zn, Sn, Pb, Al, Cu and casting alloys of zinc, aluminum and copper.

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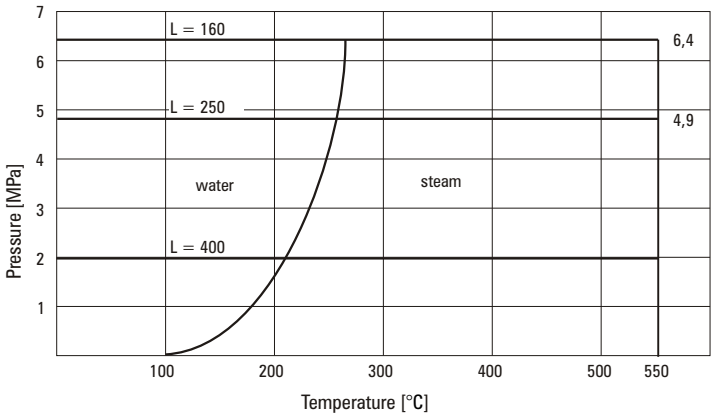
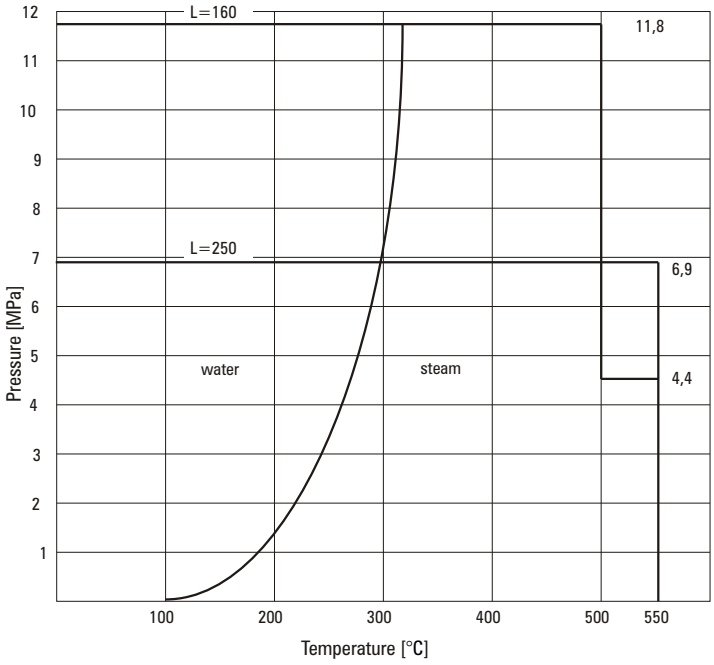
PRESSURE LOADING OF SHEATHES

Allowable pressure loading of temperature sensor sheathes under working conditions is dependent on: the pressure of the environment in which measurement takes place, its temperature and fluid flow rate as well as the diameter ∅, and length L of the sheath and its material of construction.
Values given in the graphs are calculated for water and steam where the sheath is mounted at right angles to the pipe or channel axis.



Sheath diameters: ∅6,∅8, ∅9, ∅10
Allowable flow rate: steam – 25 m/s, water – 3 m/s
Allowable spanner torque – 49 Nm



Sheath diameters: ∅11, ∅12, ∅15
Allowable flow rate: steam – 40 m/s, water – 5 m/s
Allowable spanner torque – 98 Nm

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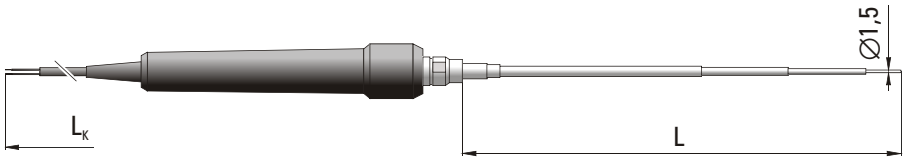
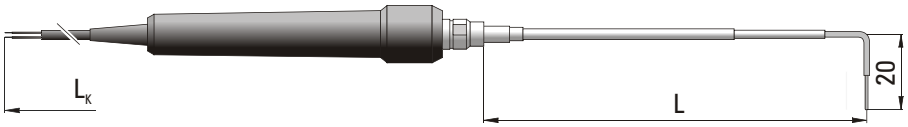
TEMPERATURE SENSOR

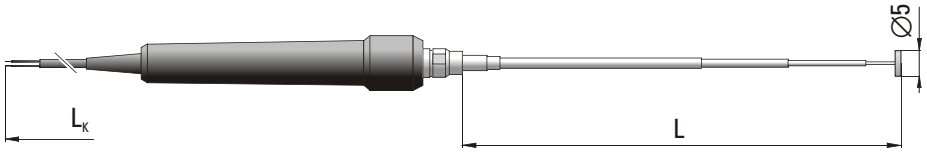
type 101



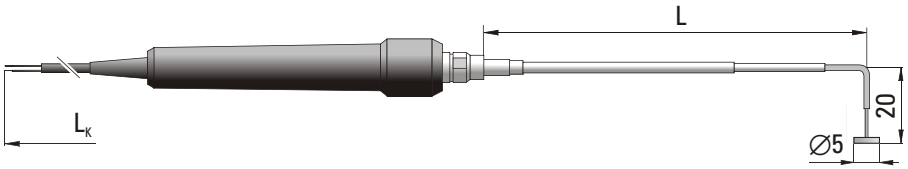
type 102



type 103



type 104

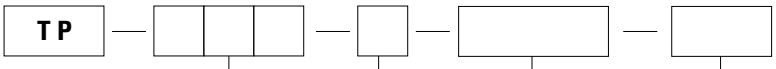


SPECIFICATION

Application	temperature measurement of liquid, gases and surfaces
Temperature range	–40°C...+1100°C
Sheathed thermocouple	NiCr-NiAl **(K)**[1]
Class of thermocouple	1
Thermocouple outer diameter	∅1,5 mm[2]
Measuring junction	grounded (type a), insulated (type b)
Sensor length L	120, 180, 300, 630, 800, 1000, 1500, 2000 mm[2]
Compensation cable L_K	spiral 1,5 m[2]
Sheath material	Inconel
Handle operating temperature	–20°C...+80°C
Additional accessories	plug type MT-K (for use with hand held thermometers)[2]

[1] Other thermocouples on demand
[2] Other parameters according to customer requirements

ORDERING CODE



Sensor type **101**, **102**, **103**, **104**
Measuring junction **a** or **b**
Sensor length L=**120, 180, 300, 630, 800, 1000, 1500, 2000 mm**[2]
Additional accessories: plug type **MT-K**

Example for order: TP-101-b-630 sensor based on sheathed thermocouple NiCr-NiAl (K), measuring junction galvanically insulated from the sheath (type b), length L= 630 mm and length of compensation cable L_K = 1,5m.

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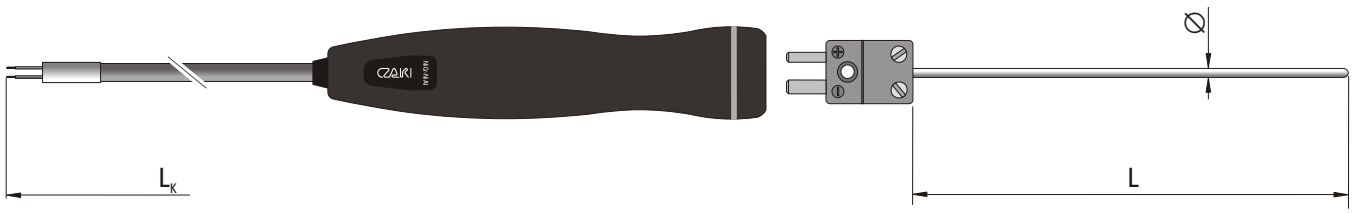
TEMPERATURE SENSOR

type 105

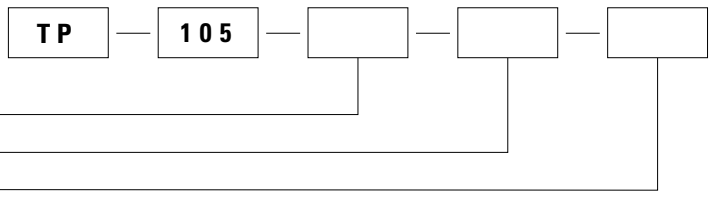


SPECIFICATION

Application	all purpose temperature sensor with interchangeable measuring inserts
Temperature range	–40°C ... +1000°C
Sheathed thermocouple	NiCr-NiAl **(K)**[1]
Measuring junction	insulated[2] (grounded on demand)
Class of processing element	1
Sheath material	Inconel
Length of compensation cable L_K	spiral 1,5 m[2]
Handle and cable operating temperature	–20°C...+80°C
Additional accessories	plug type MT-K (for use with hand held thermometers)[2]

[1] Other thermocouples on demand
[2] Other parameters according to customer requirements

ORDERING CODE



Outer diameter ∅ = **1,5**, **2** or **3** mm[2]
Sensor length L = **100** ... **1000** mm[2]
Additional accessories plug type **MT-K**

Example for order: TP-105-2-300-MT-K temperature sensor with interchangeable sheathed thermocouple NiCr-NiAl (K) of outer diameter ∅ = 2 mm, length L = 300 mm; compensating cable with plug type MT-K.

Additional interchangeable thermocouples please order according to example:

Interchangeable insert: TP-233K-b-800 means interchangeable sheathed thermocouple NiCr-NiAl (K) of outer diameter ∅ = 1,5 mm and length L = 800 mm.

Attention: Temperature sensors NiCr-NiAl (K) type 231, 232, 233, 234 also can be used.

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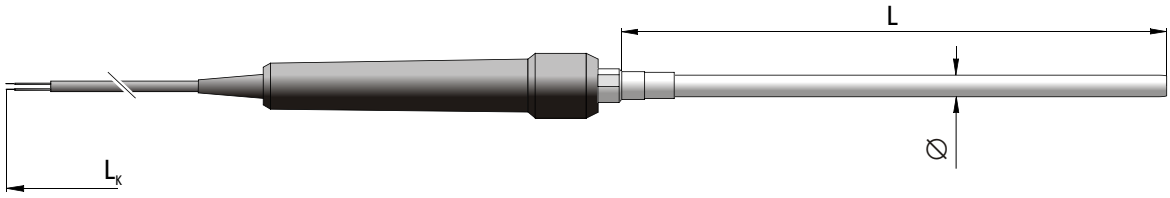
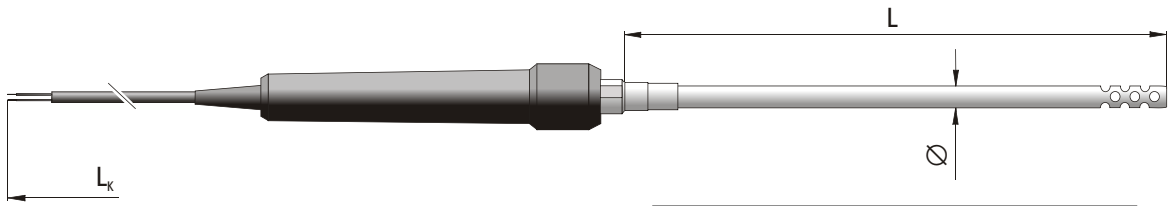
TEMPERATURE SENSOR

type 111
112
113



type 141
142



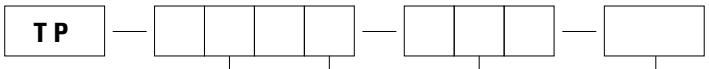
Type		∅ (mm)
TP-111	**TP-141**	4
TP-112		5
TP-113	**TP-142**	6

SPECIFICATION

Application	temperature measurement of liquid and semi-fluid masses	(**TP-111**, **TP-112**, **TP-113**)
	temperature measurement of gases	(**TP-141**, **TP-142**)
Temperature range	–40°C...+900°C	(**K**)
	–40°C...+550°C	(**Pt100**)
Measuring element	thermocouple NiCr-NiAl	(**K**)[1]
	platinum resistor	(**Pt100**)[1]
Measuring junction	insulated[2]	
Class of processing element	2 (B)[2]	
Sheath material	steel 1.4541	
Length of cable L_K	spiral 1,5 m[2]	
Handle and cable operating temperature	–20°C...+80°C	
Additional accessories	plug type MT-K and MP (for use with hand held thermometers)[2]	

[1] Pt500, Pt1000, Ni100, Ni1000 and other thermocouples on demand
[2] Other parameters according to customer requirements

ORDERING CODE



Sensor type **111**, **112**, **113**, **141**, **142**
Measuring element **Pt100** or **K**[1]
Sensor length L = **200**, **300**, **400**, **600** or **800** mm[2]
Additional accessories: plug type **MT-K** or **MP**[2]

Example for order: TP-112Pt100-200-MP Pt100 resistance sensor of outer diameter ∅ = 5 mm, length L = 200 mm and length of cable L_K = 1,5 m with plug type MP.

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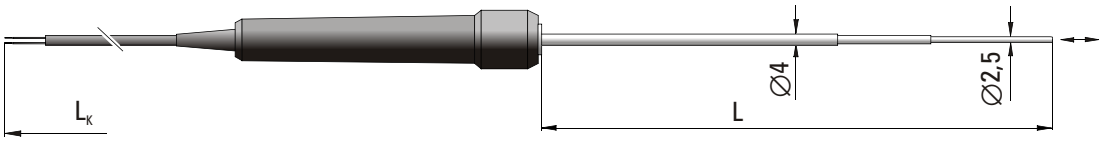
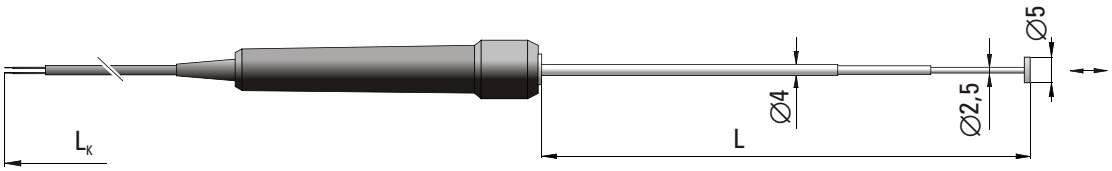
TEMPERATURE SENSOR

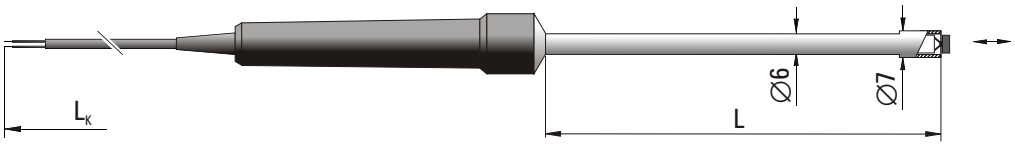
type 121



type 122



type 123

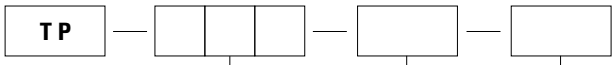


SPECIFICATION

Application	temperature measurement of surfaces	
Temperature range	–40°C...+800°C	(**TP-121**), (**TP-122**)
	–40°C...+400°C	(**TP-123**)
Measuring element	thermocouple NiCr-NiAl **(K)**[1]	
Class of processing element	2	
Measuring junction	grounded[2]	
Sensor length L	100, 150, 200, 250, 300 mm[2]	
Length of compensation cable L_K	spiral 1,5 m[(2)]	
Sheath material	steel 1.4541	
Handle and cable operating temperature	–20°C...+80°C	
Additional accessories	plug type MT-K (for use with hand held thermometers)[2]	

[1] Other thermocouples on demand
[2] Other parameters according to customer requirements

ORDERING CODE



Sensor type **121**, **122**, **123**
Sensor length L = **100**, **150**, **200**, **250** or **300** mm[2]
Additional accessories: plug type **MT-K**

Example for order: TP-121-300-MT-K sensor based on sheathed thermocouple NiCr-NiAl (K), length L = 300 mm and length of compensation cable L_K = 1,5 m with plug type MT-K.

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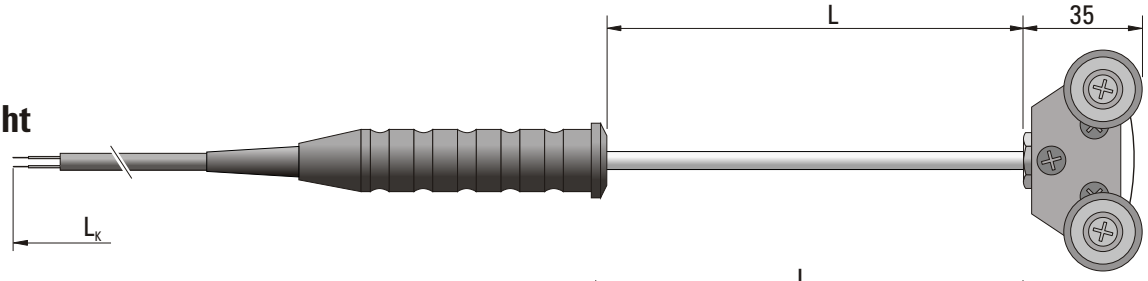
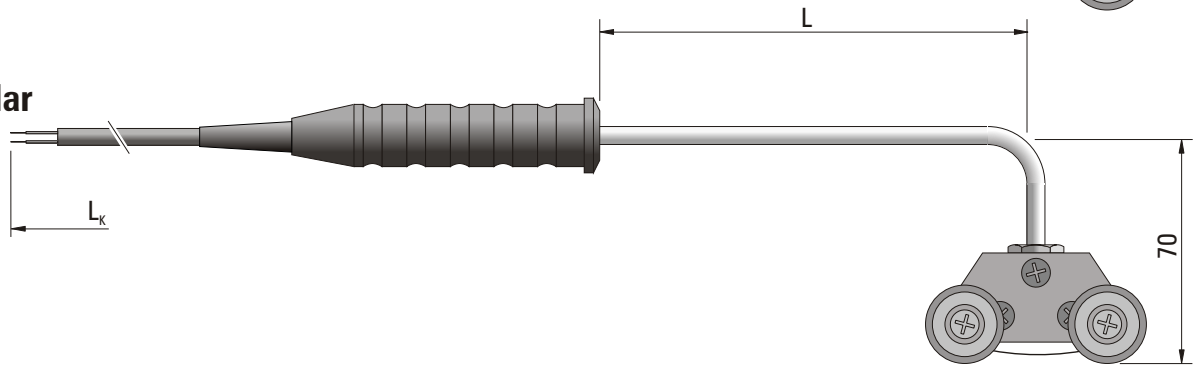
TEMPERATURE SENSOR

type 124

Straight



Angular



SPECIFICATION

Application	temperature measurement on surfaces of moving cylindrical elements of outer diameter in range from 60mm to 120mm. Rollers built in the head enables measurement during rotation. The sensor is very useful to measure temperature of pipe's surface within welding process.
Temperature range	–40°C...+250°C (PTFE head) –40°C...+400°C (steel head)
Measuring element	**sprung ribbon thermocouple** NiCr-NiAl **(K)**
Sensor length L	50, 100, 200, 300, 400 mm[(1)]
Length of compensation cable L_K	spiral 1,5 m[(1)]
Handle and cable operating temperature	–20°C...+80°C
Additional accessories	plug type MT-K (for use with hand held thermometers)[(1)]

[(1)] Other parameters according to customer requirements

ORDERING CODE

TP	—	124	—		—		—		—	

Sensor length L = **50**, **100**, **200**, **300** or **400** mm[(1)]
Option: straight **(P)**, angular **(K)**
Max. temperature **250°C** or **400°C**
Additional accessories: plug type **MT-K**

Example for order: TP-124-50-K-400-MT-K sensor based on springy ribbon thermocouple NiCr-NiAl (K) length L = 50 mm, angular option (K), for temperature measurement to +400°C,
Compensation cable L_k = 1,5m with plug type MT-K.

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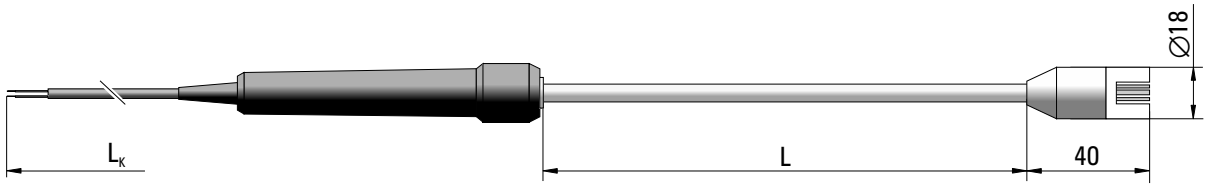
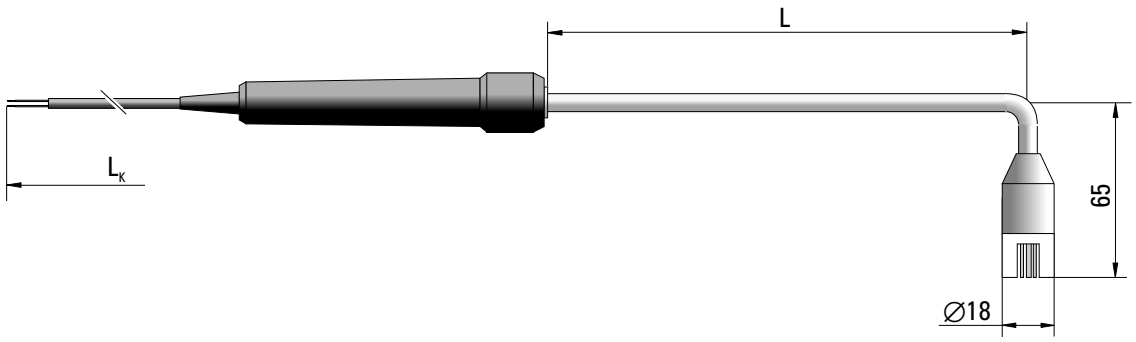
TEMPERATURE SENSOR

type 125



type 126

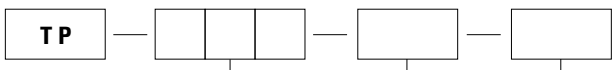


SPECIFICATION

Application	temperature measurement of surfaces. Flexible and springy sensor measuring ribbon with very good thermal conductivity.
Temperature range	–50°C...+700°C
Measuring element	**ribbon thermocouple** NiCr-NiAl **(K)**
Class of processing element	2
Sensor length L	100, 200, 300, 400 mm[(1)]
Response time	$T_{0,9}$ < 5 sec.
Length of compensation cable L_K	spiral 1,5 m[(1)]
Handle and cable operating temperature	–20°C...+80°C
Additional accessories	plug type MT-K (for use with hand held thermometers)[(1)]

[(1)] Other parameters according to customer requirements

ORDERING CODE



Sensor type **125**, **126**
Sensor length L = **100**, **200**, **300** or **400** mm[(1)]
Additional accessories: plug type **MT-K**

Example for order:

TP-125-300 sensor based on ribbon thermocouple NiCr-NiAl (K) length L = 300 mm, length of compensation cable L_k = 1,5m.

TP-125-400-MT-K sensor based on ribbon thermocouple NiCr-NiAl (K) length L=400 mm, compensation cable L_k = 1,5m with plug type MT-K.

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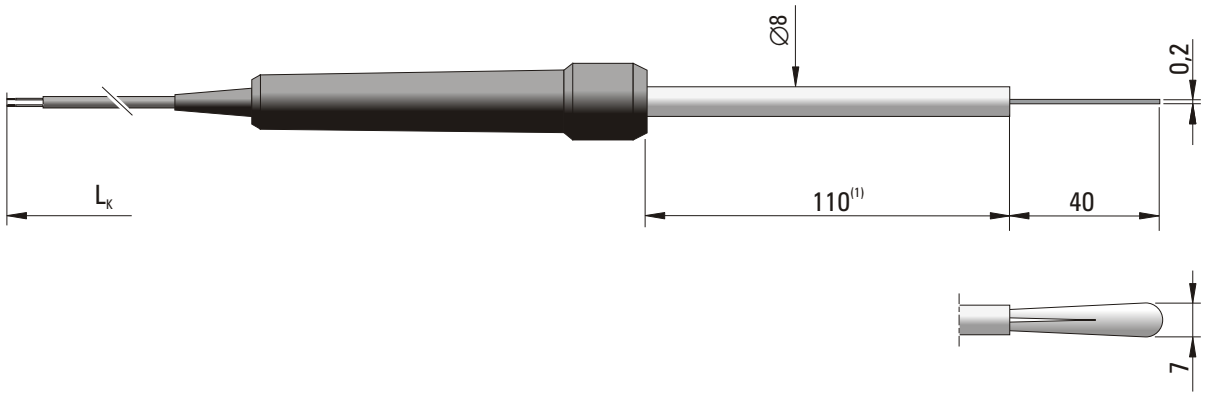
TEMPERATURE SENSOR

type 127



SPECIFICATION

Application	temperature measurement of surfaces. Flexible, springy measurement tip of sensor (leaf) with very good thermal conductivity.
Temperature range	–50°C...+600°C
Measuring element	**leaf thermocouple** NiCr-NiAl **(K)**
Class of thermocouple	2
Response time $T_{0,9}$	<5 sec.
Length of compensation cable L_K	spiral 1,5 m(2)
Handle and cable operating temperature	–20°C...+80°C
Additional accessories	plug type MT-K (for use with hand held thermometers)(2)

(1) Other sensor lenghts on demand
(2) Other parameters according to customer requirements

ORDERING CODE

TP	—	129	—	

Additional accessories: plug type **MT-K**

Example for order: TP-127-MT-K temperature sensor based on leaf thermocouple NiCr-NiAl (K), length of spiral compensation cable L_K = 1,5m with plug type MT-K.

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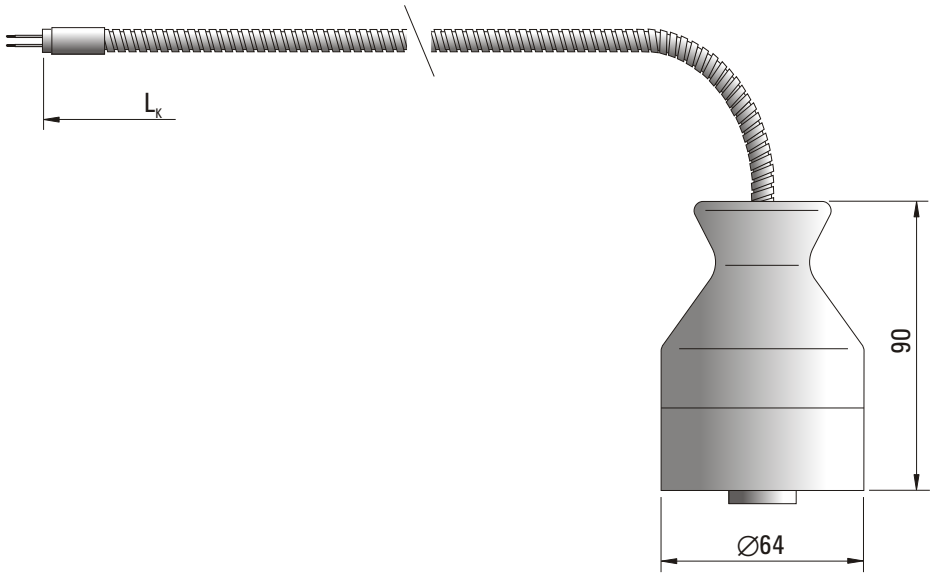
TEMPERATURE SENSOR

type 129



SPECIFICATION

Application	temperature measurement of surfaces Sensor built into weight for placing on surface.
Temperature range	–40°C...+200°C
Measuring element	NiCr-NiAl **(K)**
Class of thermocouple	1
Compensation cable protection	stainless steel armored cable
Response time $T_{0,9}$	<5 sec.
Body material	PTFE
Measuring tip and cable armour material	steel 1.4541
Additional accessories	plug type MT-K (for use with hand held thermometers)[1]

[1] Other parameters according to customer requirements

ORDERING CODE

TP	—	129	—		—	

Length of compensation cable L_K = **1,5** or **2,5** m.. [1]
Additional accessories: plug type **MT-K**

Example for order: TP-129-1,5-MT-K temperature sensor built into weight, length of compensation cable L_K = 1,5 m with plug type MT-K.

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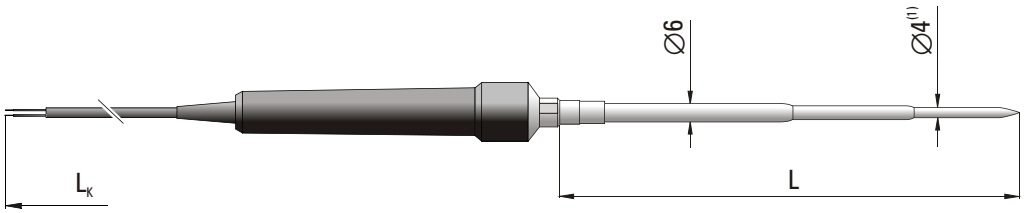
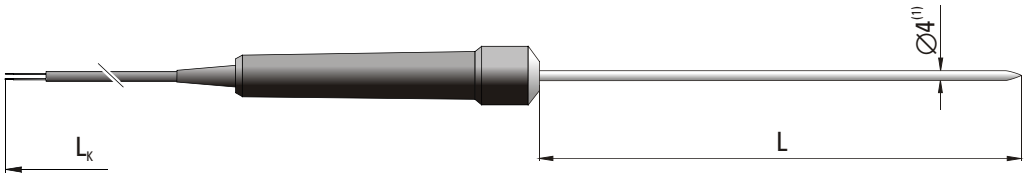
TEMPERATURE SENSOR

type 131



type 132

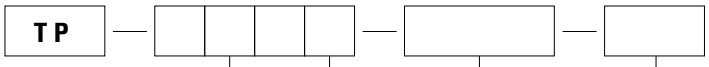


SPECIFICATION

Application	temperature measurement of soft pastes, allows measuremant by penetration
Temperature range	–40°C...+400°C
Measuring element	thermocouple NiCr-NiAl **(K)** (2)
	platinum resistor **(Pt100)** (2)
Measuring junction	insulated (3)
Class of processing element	2 (B) (3)
Sheath material	steel 1.4541
Length of cable L_K	spiral 1,5 m (3)
Handle and cable operating temperature	–20°C...+80°C
Additional accessories	plug type MT-K or MP (for use with hand held thermometers)(3)

(1) Other diameter of penetration needle on demand
(2) Pt500, Pt1000, Ni100, Ni1000 and other thermocouples on demand
(3) Other parameters according to customer requirements

ORDERING CODE



Sensor type **131**, **132**
Measuring element **Pt100** or **K** (2)
Sensor length L = **100**, **200**, **300** or **400** mm (3)
Additional accessories: plug type **MT-K** or **MP** (3)

Example for order: TP-131Pt100-200-MP Pt100 resistance sensor of outer diameter ∅ = 4 mm / 6 mm length L = 200 mm and length of cable L_K = 1,5 m with plug type MP.

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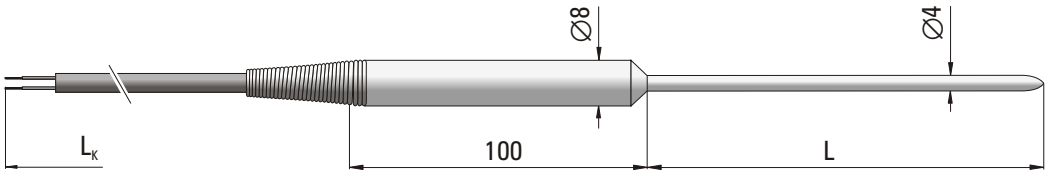
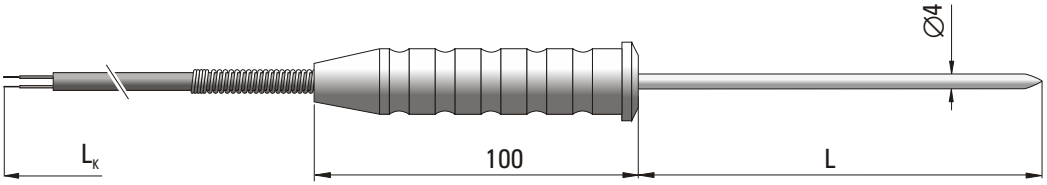
TEMPERATURE SENSOR

type 151



type 152

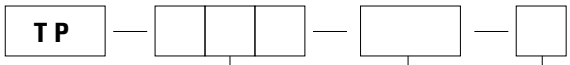


SPECIFICATION

Application	temperature measurement of meat and cured meat products in food industries, allows measurement by penetration.
Temperature range	–40°C ... +180°C
Measuring element	platinum resistor **(Pt100)**[1]
Class of processing element	B[2]
Handle and sheath material	steel 1.4541 **(TP-151)** PTFE, steel 1.4541 **(TP-152)**
Sensor length L	50, 100, 150, 200 mm[3]
Length of cable$_K$	2, 3, 4 m[2]
Handle and cable operating temperature	0°C ... +180°C[4]

[1] Ni100, Ni1000, Pt500, Pt1000 on demand
[2] Other parameters according to customer requirements
[3] Angled version on demand
[4] Cable with PTFE isolation on demand (Tmax = +250°C)

ORDERING CODE



Sensor type **151**, **152**
Sensor length L= **50**, **100**, **150** or **200** mm[2]
Length of compensation cable L_K = **2**, **3** or **4** m[2]

Example for order: TP-152-200-3 Pt100 resistance sensor of outer diameter ∅ = 4 mm, length L = 200 mm and length of cable L_K = 3 m.

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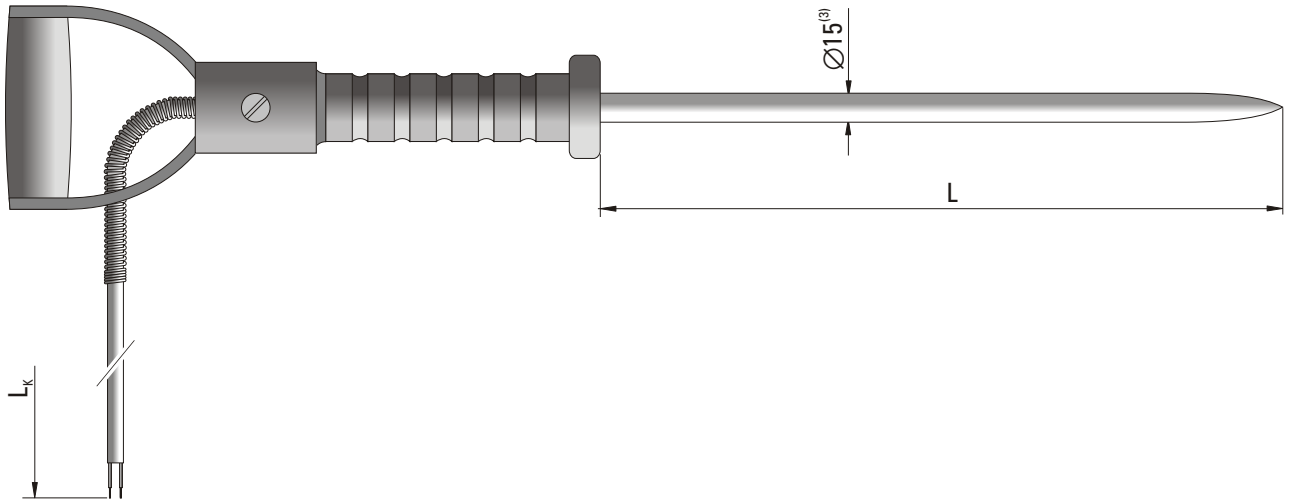
TEMPERATURE SENSOR

type 155



SPECIFICATION

Application or	penetration sensor for temperature measurement of loose materials in bulk storage heaps such as: carbon, coke, peat, sawdust and biomass.
Temperature range	0°C ... +150°C
Measuring element	platinum resistor **(Pt100)**(1)
Class of processing element	A
Sheath material	steel 1.4541
Sensor length L	1000, 1500, 2000, 2500 mm(2)
Length of cable L_k	1,5 m(2)
Handle and cable operating temperature	-20°C ... +80°C
Additional accessories	plug type MP (for use with hand held thermometers)(2)

(1) Ni100, Ni1000, Pt500, Pt1000 and other thermocouples on demand
(2) Other parameters according to customer requirements
(3) Other diameter of penetration needle on demand

ORDERING CODE

TP	—	155	—		—	

Sensor length L= **1000**, **1500**, **2000** or **2500** mm(2)
Additional accessories: plug type **MP**(2)

Example for order: TP-155-2000 penetration Pt100 resistance sensor, length L = 2000 mm and length of cable L_k = 1,5m.

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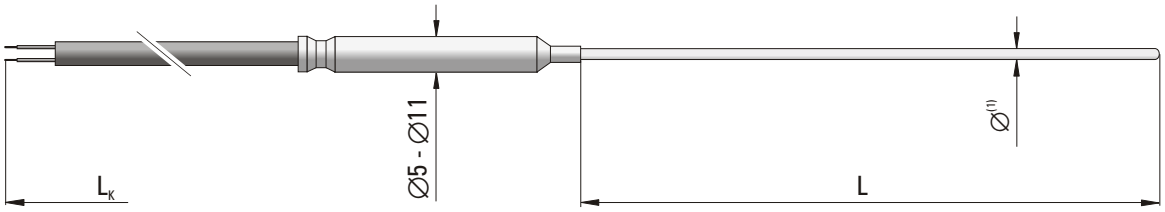
TEMPERATURE SENSOR

Type: 201, 202, 203, 204, 205, 206



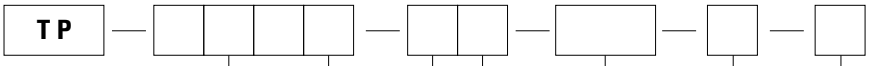
SPECIFICATION

Sheathed thermocouple	Cu-CuNi	**(T)**
	Fe-CuNi	**(J)**
	NiCr-NiAl	**(K)**
	NiCrSi-NiSi	**(N)**
Measuring junction	grounded (type a), insulated (type b), exposed (type c)	
Class of thermocouple	1	
Sheath material	Inconel (T, J, K), Nicrobell (N)	
Operating temperature of intermediate bush and cable	–20°C...+80°C[3]	
Cable insulation	PVC[3]	
Additional accessories	compression gland KP	
	plug type MT (for use with hand held thermometers)[2]	

[1] Thermocouple of outer diameter ∅ = 2 mm on demand
[2] Other parameters according to customer's requirements
[3] Other cable insulation: silicon, PTFE, fiber glass, stainless steel armored sheath on demand

Sensor type	Outer diameter ∅ (mm)		Maximum temperature for thermocouple type **T** (°C)	Maximum temperature for thermocouple type **J** (°C)	Maximum temperature for thermocouple type **K** (°C)	Maximum temperature for thermocouple type **N** (°C)
	Single	Double				
TP-201	0,5	– –	300	400	600	700
TP-202	1	– –	400	600	900	1000
TP-203	1,5	1,5	400	600	1000	1100
TP-204	3	3	400	700	1100	1250
TP-205	4,5	4,5	– –	800	1100	1250
TP-206	6	6	– –	800	1100	1250

ORDERING CODE



Sensor type **201, 202, 203, 204, 205, 206**
Measuring element **T, J, K** or **N**
Single **(1)** or double **(2)** sheathed thermocouple
Measuring junction **a**, **b** or **c**
Sensor length L = **100, 200, 300, 400, 600** or **800** mm[2]
Length of compensation cable L_K = **1, 1,5, 2,5** m[2]
Additional accessories: compression gland **KP**, plug type **MT**

Example for order: TP-204K-1b-200-1,5 single sheathed thermocouple sensor NiCr-NiAl (K) of diameter ∅ = 3 mm with measuring junction galvanically insulated from the sheath (typ b), length L = 200 mm and length of compensation cable L_K = 1,5 m.

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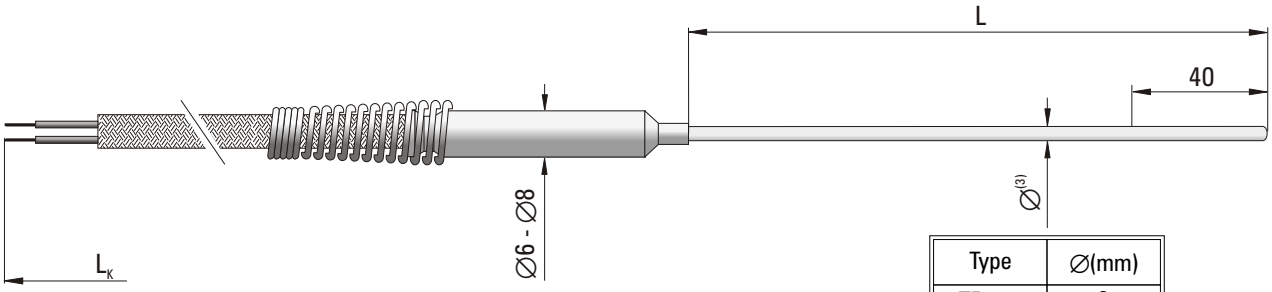
TEMPERATURE SENSOR

Type: 207, 208, 209



Type	∅(mm)
TP-207	3
TP-208	5
TP-209	6

These sensors are made using mineral insulated cable. The outer sheath is from acid resistant steel and conductors are from copper with added zirconium. Lead insulation is magnesium oxide. The addition of zirconium to the copper ensures constant conductor resistance over a wide range of operating temperature. A platinum resistor is employed as the measuring element. This sensor construction combines the advantages of high resolution found in platinum resistance thermometers together with the **elastic properties** of mineral insulation which gives a **high degree of resistance to shock and vibration** in difficult industrial applications.

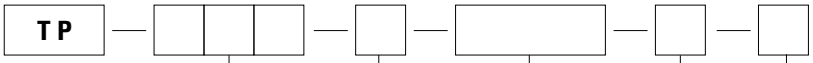
Note: rigid sensor tip with a length of 40 mm.

SPECIFICATION

Temperature range	–100°C...+550°C
Measuring element	platinum resistor **(Pt100)**[1]
Class of processing element	B[2]
Outer diameter of mineral insulated cable ∅	3, 5 or 6 mm[3]
Assembly	2, 3 or 4 wires
Sheath material	steel 1.4541
Operating temperature of intermediate bush and cable	–20°C...+300°C
Cable insulation	fibre glass and steel braid[4]
Additional accessories	plug type MP (for use with hand held thermometers)[2]

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Outer diameter ∅1,5mm on demand
[4] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE



Sensor type **207**, **208**, **209**
Single (**1**) or double (**2**) measuring element
Sensor length L = **100**, **200**, **300**, **400**, **600**, **800** or **1000** mm[2]
Length of cable L_K = **1**, **1,5** or **2,5** m.[2]
Additional accessories: plug type **MP**

Example for order: TP-207-1-400-2,5 Pt100 resistance sensor in mineral insulated cable of outer diameter ∅ = 3 mm , length L = 400 mm and length of cable L_K = 2,5 m.

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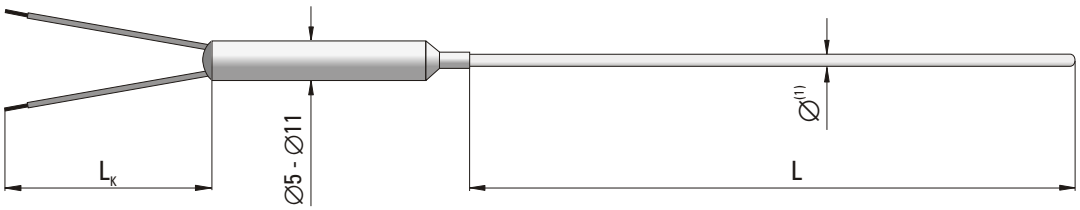
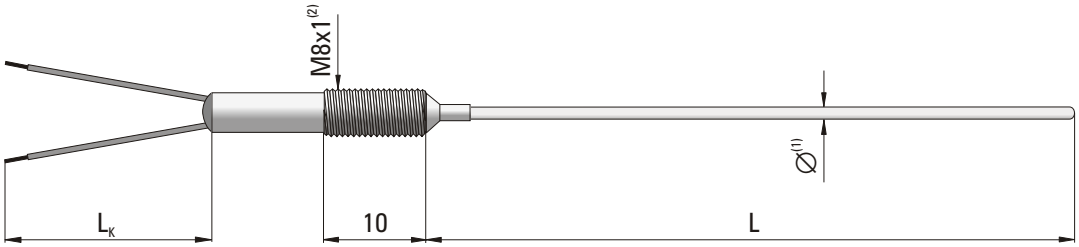
TEMPERATURE SENSOR

type 211
212
213
214



type 215
216
217
218



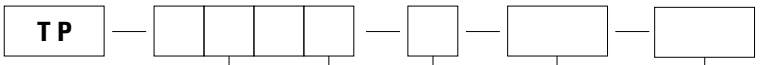
SPECIFICATION

Sheathed thermocouple	Cu-CuNi	**(T)**
	Fe-CuNi	**(J)**
	NiCr-NiAl	**(K)**
	NiCrSi-NiSi	**(N)**
Measuring junction	grounded (type a), insulated (type b), exposed (type c)	
Class of thermocouple	1	
Sheath material	Inconel (T, J, K), Nicrobell (N)	
Operating temperature of intermediate bush and cable	–20°C...+80°C(2)	

(1) Thermocouple of outer diameter ∅ = 2 mm on demand
(2) Other parameters according to customer requirements

Sensor type		Outer diameter of thermocouple ∅ (mm)	Maximum temperature for thermocouple type **T** (°C)	Maximum temperature for thermocouple type **J** (°C)	Maximum temperature for thermocouple type **K** (°C)	Maximum temperature for thermocouple type **N** (°C)
Bush	Thread M8x1(2)					
TP-211	**TP-215**	0,5	300	400	600	700
TP-212	**TP-216**	1	400	600	900	1000
TP-213	**TP-217**	1,5	400	700	1000	1100
TP-214	**TP-218**	3	400	700	1100	1250

ORDERING CODE



Sensor type **211**, **212**, **213**, **214**, **215**, **216**, **217**, **218**
Measuring element **T**, **J**, **K** or **N**
Measuring junction **a**, **b** or **c**
Sensor length L = **100**, **200**, **300**, **400**, **600** or **800** mm(2)
Length of compensation cable L_K = **50**, **100**, **200** mm(2)

Example for order: TP-214K-b-200-100 sheathed thermocouple sensor NiCr-NiAl (K) of diameter ∅ = 3 mm with measuring junction galvanically insulated from sheath (type b), length L = 200 mm and length of compensation cable L_K = 100 mm.

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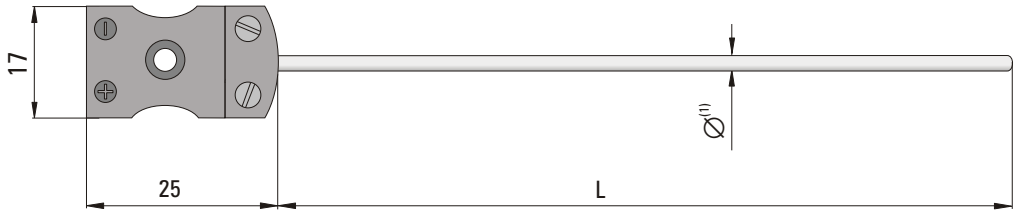
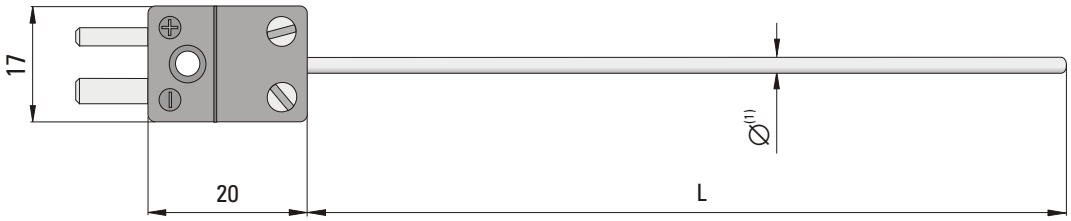
TEMPERATURE SENSOR

type 221
222
223
224



type 231
232
233
234



SPECIFICATION

Sheathed thermocouple	Cu-CuNi	**(T)**
	Fe-CuNi	**(J)**
	NiCr-NiAl	**(K)**
	NiCrSi-NiSi	**(N)**
Measuring junction	grounded (type a), insulated (type b), exposed (type c)	
Class of thermocouple	1	
Sheath material	Inconel (T, J, K), Nicrobell (N)	
Plug and socket operating temperature	–20°C...+150°C (–20°C...+600°C on demand)	
Additional accessories	plug type **MT-**x or socket type **MT-G**x	
	compensation cable type **L2**x	(x - type of thermocouple)
	compression gland **KP**	

(1) Thermocouple of outer diameter ∅ = 2 mm on demand
(2) Other parameters according to customer requirements

Sensor type		Outer diameter of thermocouple ∅ (mm)	Maximum temperature for thermocouple type **T** (°C)	Maximum temperature for thermocouple type **J** (°C)	Maximum temperature for thermocouple type **K** (°C)	Maximum temperature for thermocouple type **N** (°C)
TP-221	**TP-231**	0,5	300	400	600	700
TP-222	**TP-232**	1	400	600	900	1000
TP-223	**TP-233**	1,5	400	600	1000	1150
TP-224	**TP-234**	3	400	700	1100	1250

ORDERING CODE

Sensor type **221**, **222**, **223**, **224**, **231**, **232**, **233**, **234**
Measuring element **T**, **J**, **K or N**
Measuring junction **a**, **b** or **c**
Sensor length L = **100**, **200**, **300**, **400**, **600** or **800** mm(2)

Example for order: TP-224K-b-200 sheathed thermocouple sensor NiCr-NiAl (K) of outer diameter ∅ = 3 mm with measuring junction galvanically insulated from the sheath (type b) and length L = 200 mm.

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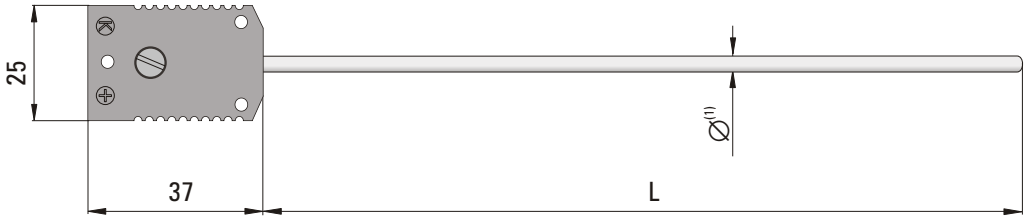
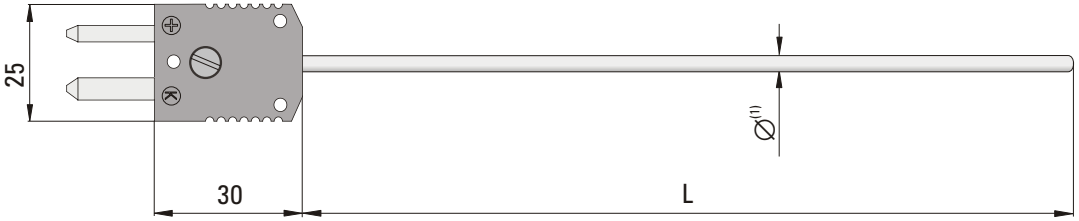
TEMPERATURE SENSOR

type 241
242
243



type 251
252
253



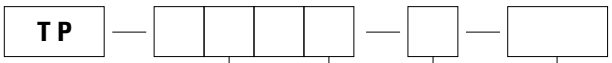
SPECIFICATION

Sheathed thermocouple	Cu-CuNi **(T)** Fe-CuNi **(J)** NiCr-NiAl **(K)** NiCrSi-NiSi **(N)**
Measuring junction	grounded (type a), insulated (type b), exposed (type c)
Class of thermocouple	1
Sheath material	Inconel (T, J, K), Nicrobell (N)
Plug and socket opating temperature	–20°C...+150°C (–20°C...+600°C on demand)
Additional accessories	plug type **ST-**x or socket type **ST-G**x compensation cable type **L2**x (x - type of thermocouple) compression gland **KP**

(1) Thermocouple of outer diameter ∅ = 2 mm on demand
(2) Other parameters according to customer requirements

Sensor type		Outer diameter of thermocouple ∅ (mm)	Maximum temperature for thermocouple **T** (°C)	Maximum temperature for thermocouple **J** (°C)	Maximum temperature for thermocouple **K** (°C)	Maximum temperature for thermocouple **N** (°C)
TP-241	**TP-251**	3	400	700	1100	1250
TP-242	**TP-252**	4,5	– –	800	1100	1250
TP-243	**TP-253**	6	– –	800	1100	1250

ORDERING CODE



Sensor type **241**, **242**, **243**, **251**, **252**, **253**
Measuring element **T**, **J**, **K** or **N**
Measuring junction **a**, **b** or **c**
Sensor length L = **100**, **200**, **300**, **400**, **600** or **800** mm(2)

Example for order: TP-251K-b-200 sheathed thermocouple sensor NiCr-NiAl (K) of outer diameter ∅ = 3 mm with measuring junction galvanically insulated from the sheath (type b) and length L = 200 mm.

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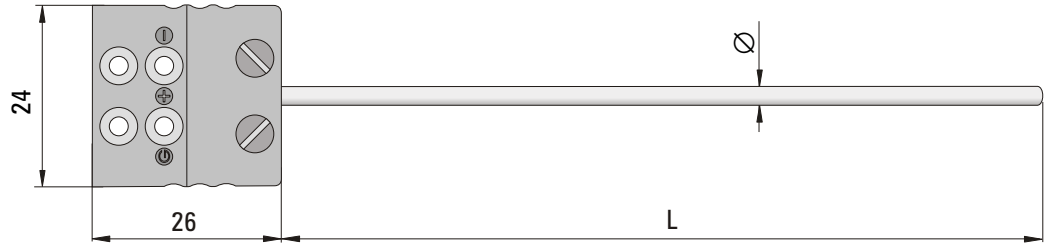
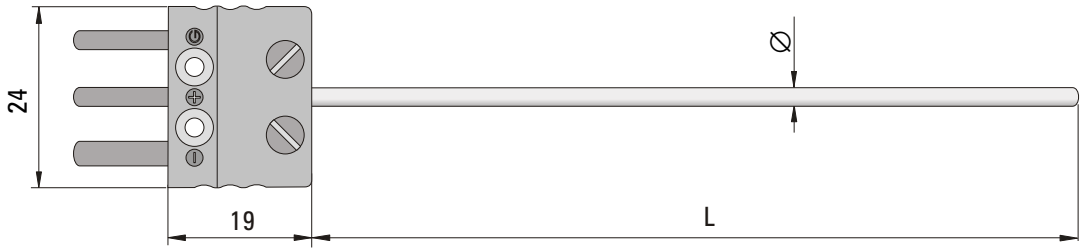
TEMPERATURE SENSOR

type 261
262
263



type 271
272
273



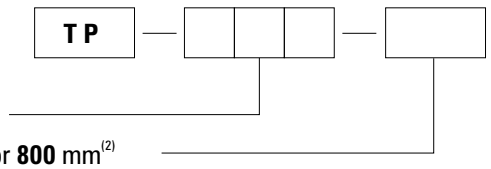
Type		∅ (mm)
TP-261	**TP-271**	3
TP-262	**TP-272**	4
TP-263	**TP-273**	5

SPECIFICATION

Temperature range	–40°C...+400°C
Measuring element	platinum resistor **(Pt100)**[1]
Class of processing element	B[2]
Assembly	3 wire
Sheath material	steel 1.4541
Plug and socket operating temperature	–20°C...+150°C
Additional accessories	plug type **MP** or socket type **MP-G** Compression gland **KP**

[1] Pt500,Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements

ORDERING CODE



Sensor type **261**, **262**, **263**, **271**, **272**, **273**
Sensor length L = **100**, **200**, **300**, **400**, **600** or **800** mm[2]

Example for order: TP-261-200 Pt100 resistance sensor of outer diameter ∅ = 3 mm and length L = 200 mm.

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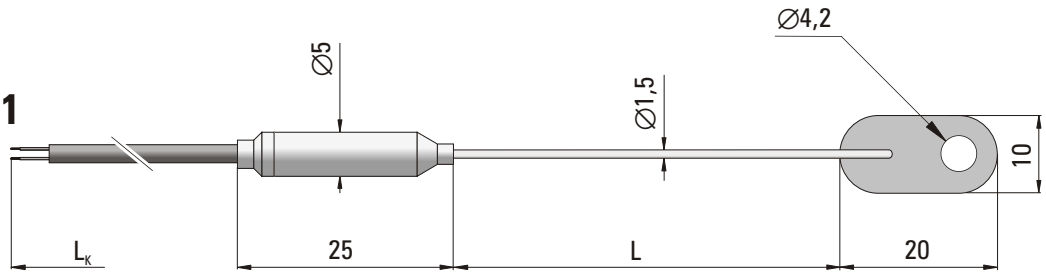
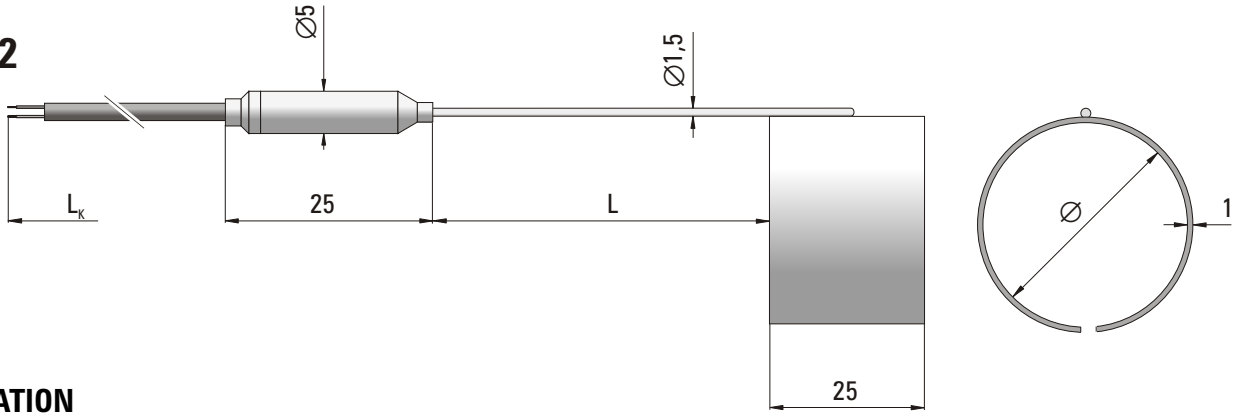
TEMPERATURE SENSOR

type 291



type 292

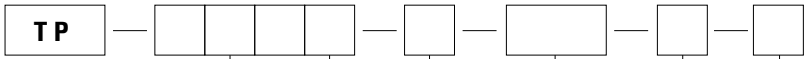


SPECIFICATION

Application	temperature measurement of solid surfaces, parts of machinery or other constructional elements
Temperature range	–40°C...+700°C
Sheathed thermocouple	Fe-CuNi **(J)** NiCr-NiAl **(K)**
Measuring junction	grounded (type a), insulated (type b)
Class of thermocouple	2
Measuring tip material	Cu
Sheath material	Inconel
Length of compensation cable L_K	1,5 m[(1)]
Operating temperature of intermediate bush and cable	–20°C...+80°C[(1)]
Additional accessories	plug type MT (for use with hand held thermometers)

[(1)] Other parameters according to customer requirements

ORDERING CODE



Sensor type **291**, **292**
Sheathed thermocouple **J** or **K**
Measuring junction **a** or **b**
Sensor length L = **100**, **200**, **300**, **400**, **600** or **800** mm[(1)]
Embracing diameter ∅ in mm (for TP-292)
Additional accessories: plug type **MT-J**, **MT-K**

Example for order: TP-292K-b-200-30-MT-K sheathed thermocouple NiCr-NiAl(K) with measuring junction galvanically insulated from the sheath (type b), length L = 200 mm, embracing diameter ∅ = 30 mm, length of compensation cable L_K = 1,5 m and plug type MT-K.

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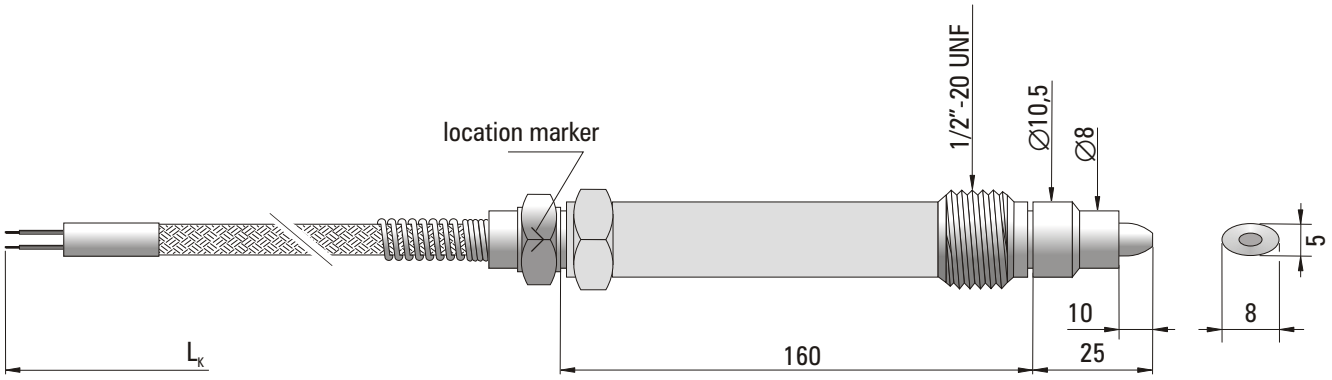
TEMPERATURE SENSOR

type 293



SPECIFICATION

Application	temperature measurement of feed cylinders extruding presses and injection molds. The location marker enables orientation setting of the oval measuring tip.
Temperature range	0°C...+500°C
Measuring element	Fe-CuNi **(J)** NiCr-NiAl **(K)**
Class of thermocouple	2[1]
Measuring junction	grounded[1]
Sheath material	steel 1.4541[1]

[1] Other parameters according to customer requirements
[2] Other sensor dimensions on demand

ORDERING CODE

TP	—	293		—	

Measuring element **J** or **K**
Length of compensation cable L_K = **1**, **2** or **3** m[1]

Example for order: TP-293J-3,0 thermocouple sensor Fe CuNi (J), length of compensation cable L_K = 3 m.

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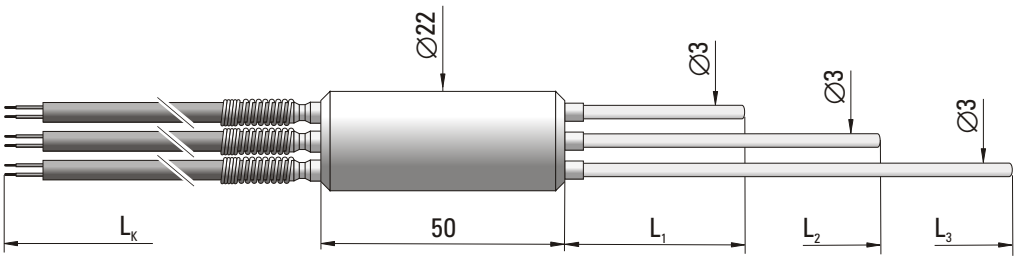
TEMPERATURE SENSOR

type 294

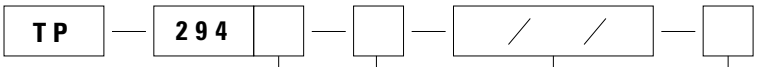


SPECIFICATION

Application	multi-sensor for measuring temperature of liquids and gases at different immersion depths	
Sheathed thermocouples [1]	Fe-CuNi	**(J)**
	NiCr-NiAl	**(K)**
	NiCrSi-NiSi	**(N)**
Temperature range	–40°C...+700 °C	**(J)**
	–40°C...+1100°C	**(K)**
	–40°C...+1250°C	**(N)**
Measuring junctions	insulated	
Class of thermocouples	1	
Sheath material	Inconel (J, K), Nicrobell (N)	
Outer diameter of thermocouples	∅ 3 mm[2]	
Intermediate bush	steel 1.4828 ∅ 22[2]	
Operating temperature of intermediate bush and cable	–20°C...+80°C[2]	

[1] Double measuring elements on demand
[2] Other parameters according to customer requirements

ORDERING CODE



Measuring elements **J** , **K** or **N**
Number of sheathed thermocouples (**2**) or (**3**)
Immersion length L_1, L_2, L_3 in mm
Length of compensation cables L_K = **0,5**...**2,5** m[2]

Example for order: TP-294K-3-500/1000/1500-2,0 sensor with three sheathed thermocouples NiCr-NiAl (K) ∅ 3mm, lengths: L_1 = 500 mm, L_2 = 1000 mm, L_3 = 1500 mm with compensation cables L_K = 2 m.

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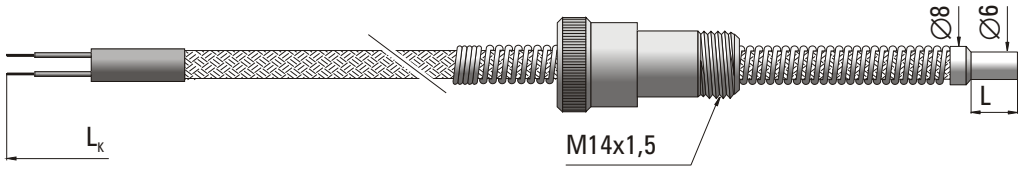
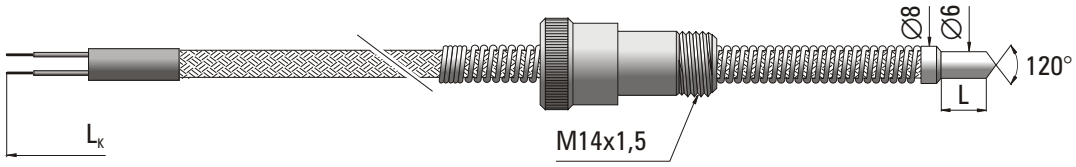
TEMPERATURE SENSOR

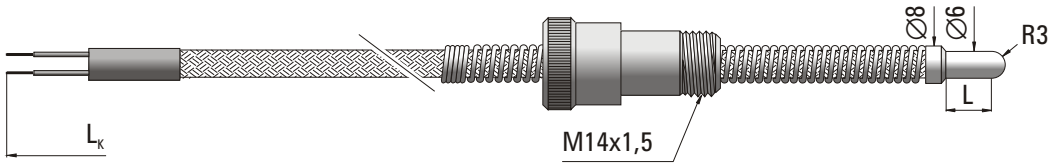
type 301



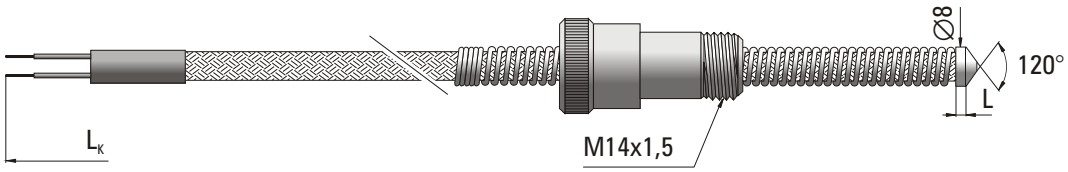
type 302



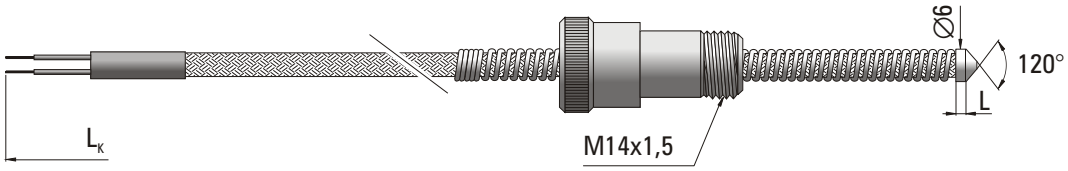
type 303



type 304



type 305

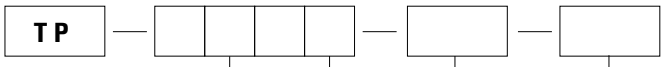


SPECIFICATION

Application	temperature measurement of feed cylinders extruding presses and injection molds	
Temperature range	0°C...+400°C	
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Measuring junction	insulated[2]	
Cable insulation	fiber glass and steel braid[3]	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Other cable insulation : PVC, silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE



Sensor type **301**, **302**, **303**, **304**, **305**
Measuring element **Pt100**, **J** or **K**[1]
Sensor length L = **1**, **5**, **10**, **15**, **20**, **25**, **30**, **35**, **40**, **45** or **50** mm[2]
Length of compensation cable L_K = **1,5** or **2,5** m[2]

Example for order: TP-301J-10-1,5 thermocouple sensor Fe-CuNi (J), length L=10 mm with cable of length L_K = 1,5 m and fitting with thread M14x1,5.

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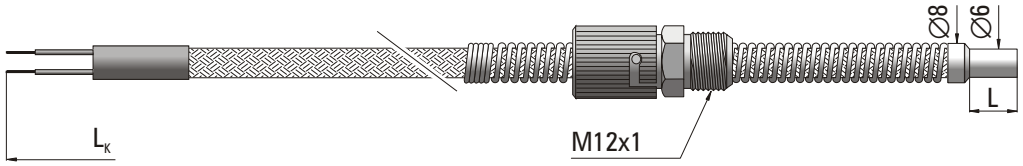
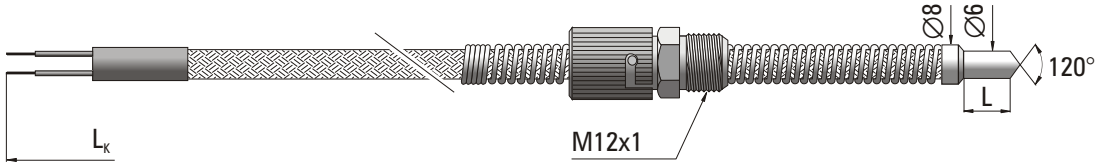
TEMPERATURE SENSOR

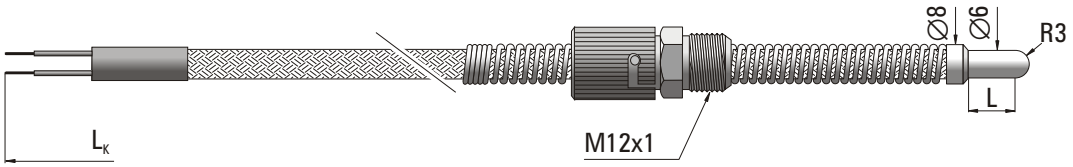
type 311



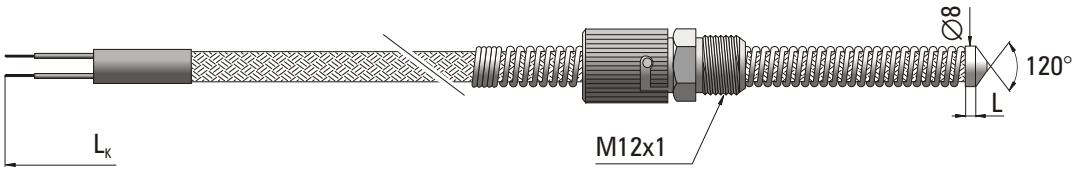
type 312



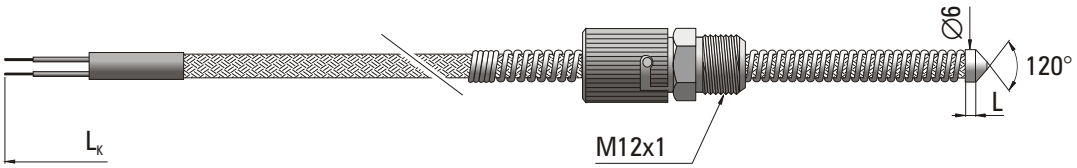
type 313



type 314



type 315

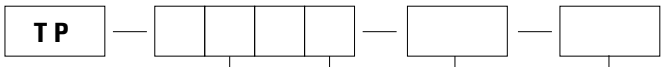


SPECIFICATION

Application	temperature measurement of feed cylinders extruding presses and injection molds	
Temperature range	0°C...+400°C	
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Measuring junction	insulated[2]	
Cable insulation	fiber glass and steel braid[3]	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE



Sensor type **311**, **312**, **313**, **314**, **315**
Measuring element **Pt100**, **J** or **K**[1]
Sensor length L = **1**, **5**, **10**, **15**, **20**, **25**, **30**, **35**, **40**, **45** or **50** mm[2]
Length of compensation cable L_K = **1,5** or **2,5** m[2]

Example for order: TP-311J-10-1,5 thermocouple sensor Fe-CuNi (J), length L=10 mm with cable of length L_K= 1,5 m and fitting with thread M12x1.

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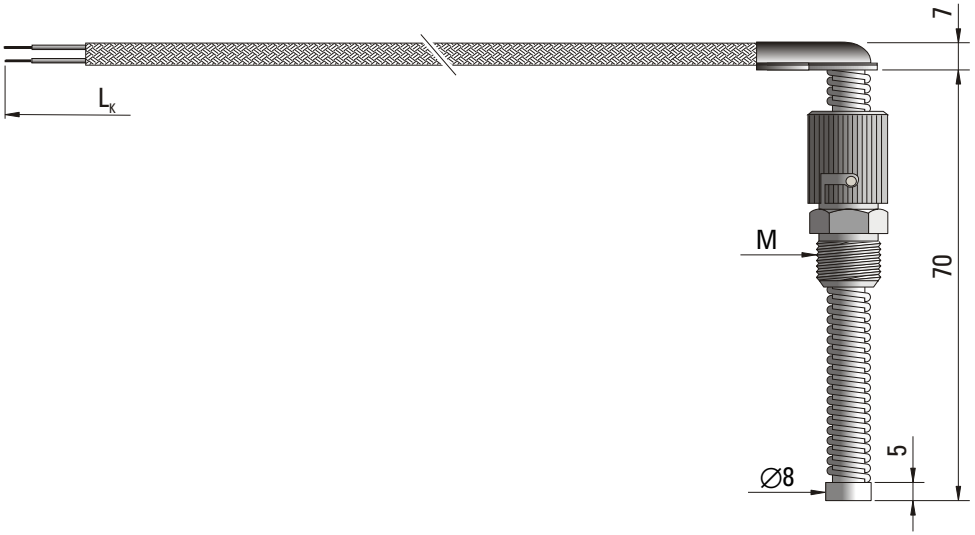
TEMPERATURE SENSOR

type 335



SPECIFICATION

Application	temperature measurment of feed cylinders extruding presses and injection moulds	
Temperature range	0°C...+400°C	
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2(B)[2]	
Measuring junction	insulated[2]	
Fitting thread (M)	M12x1, M14x1,5[3]	
Connection cable	2x0,35 mm^2, fiber glass and steel braid[4]	
Response time $T_{0,9}$	about 30 sec.	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Other dimensions and threads on demand
[4] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE

T P	—	3 3 5		—		—	

Measuring element **Pt100**, **J** or **K**[1]
Fitting thread M = **M12x1**, **M14x1,5**[3]
Length of compensation cable L_K = **0,5** ... **5** m[2]

Example for order: TP-335J-M12x1-1,5 thermocouple sensor Fe-CuNi (J) with cable of legth L_K = 1,5 m and fitting with thread M12x1.

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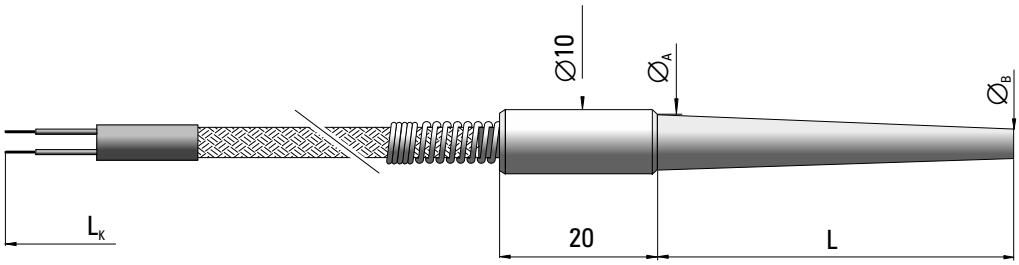
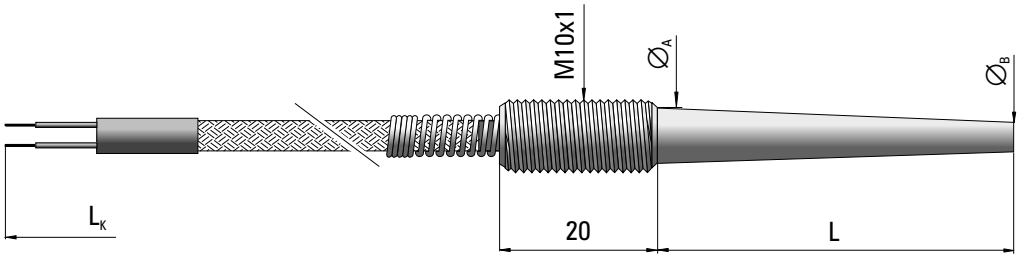
TEMPERATURE SENSOR

type 341



type 342

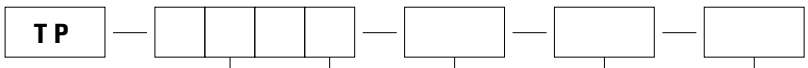


SPECIFICATION

Application	temperature measurement of feed cylinders extruding presses and injection molds	
Temperature range	0°C...+400°C	
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouplet Fe-CuNi	**(J)**
	thermocouplet NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Measuring junction	insulated [2]	
Length of cable L_K	1,5 m[2]	
Cable insulation	fiber glass and steel braid[3]	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath

ORDERING CODE



Sensor type **341**, **342**
Measuring element **Pt100**, **J** or **K**[1]
Sensor length L in mm
Sheath outer diameter $\varnothing_A$ in mm
Sheath outer diameter $\varnothing_B$ in mm

Example for order: TP-342J-30-8-6 thermocouple sensor Fe-CuNi (J) of length L = 30 mm with cable of length L_k = 1,5 m, fitting with thread M10x1 and sheath outer diameter $\varnothing_A$ = 8 mm, $\varnothing_B$ = 6 mm.

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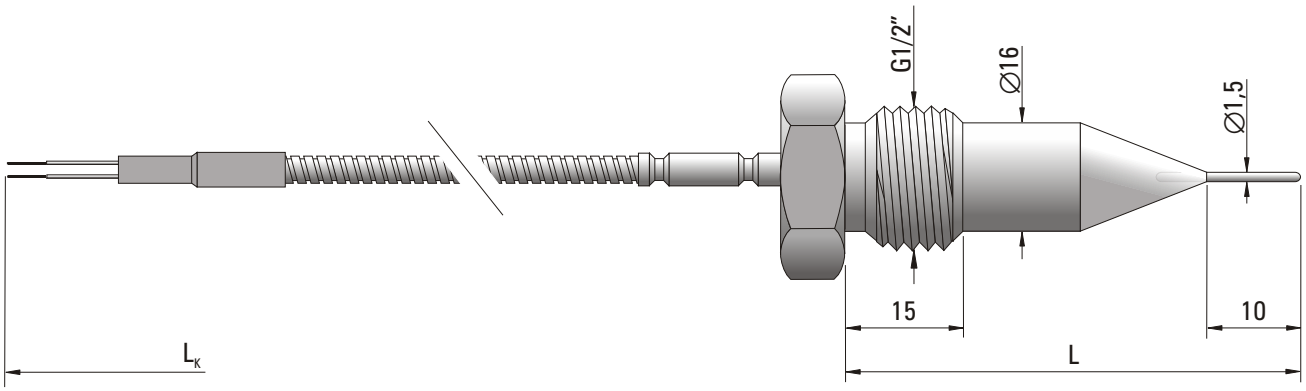
TEMPERATURE SENSOR

type 343



SPECIFICATION

Application	temperature measurement of feed cylinders extruding presses and injection molds
Temperature range	0°C...+700°C
Measuring element	Fe-CuNi **(J)** NiCr-NiAl **(K)**
Class of thermocouple	2[1]
Measuring junction	insulated[1]
Sheath material	steel 1.4541
Cable insulation	fiber glass with stainless steel armored cable

[1] Other parameters according to customer requirements
[2] Other sheath dimensions and threads on demand

ORDERING CODE

TP	—	343		—		—	

Measuring element **J** or **K**
Sensor length L = **50** ... **150** mm[1]
Length of compensation cable L_K = **0,5** ... **2,5** m[1]

Example for order: TP-343K-50-1,5 thermocouple sensor NiCr-NiAl (K) of length L= 50 mm and cable of length L_K =1,5 m.

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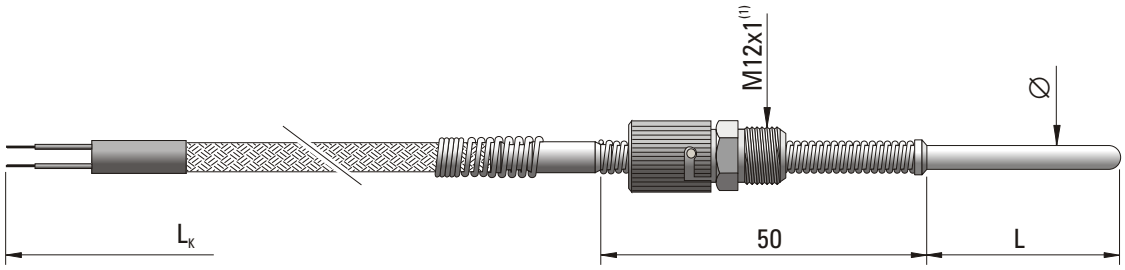
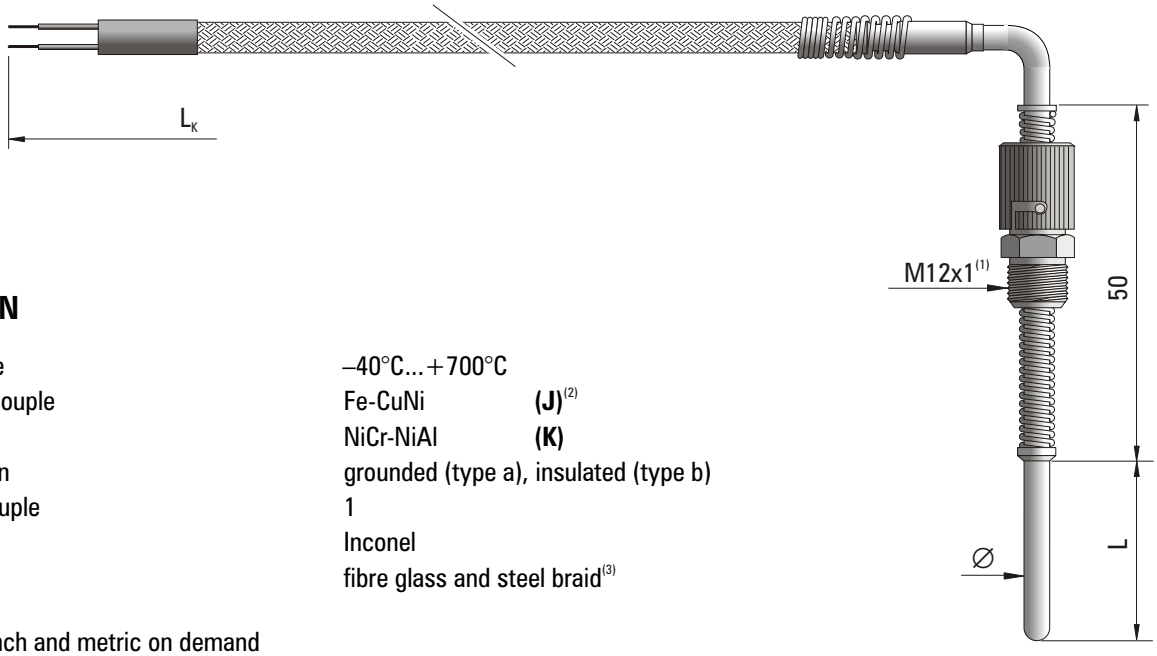
TEMPERATURE SENSOR

type 351



type 352

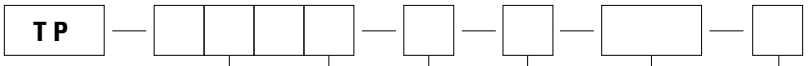


SPECIFICATION

Temperature range	–40°C...+700°C	
Sheathed thermocouple	Fe-CuNi	**(J)**[2]
	NiCr-NiAl	**(K)**
Measuring junction	grounded (type a), insulated (type b)	
Class of thermocouple	1	
Sheath material	Inconel	
Cable insulation	fibre glass and steel braid[3]	

(1) Other threads inch and metric on demand
(2) Pt100, Pt500, Pt1000, Ni100, Ni1000 on demand
(3) Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand
(4) Other parameters according to customer requirements

ORDERING CODE



Sensor type **351**, **352**
Measuring element **J** or **K**[2]
Measuring junction **a** or **b**
Sheath outer diameter ∅ = **1,5**, **2**, **3**, **4,5** or **6** mm[4]
Sensor length L = **20**...**200** mm[4]
Length of compensation cable L_K = **0,5**...**5,0** m[4]

Example for order: TP-351J-a-2-150-1,5 sheathed thermocouple sensor Fe-CuNi (J) with measuring junction grounded (type a) of outer diameter ∅ = 2 mm, length L = 150 mm and length of compensation cable L_K = 1,5 m.

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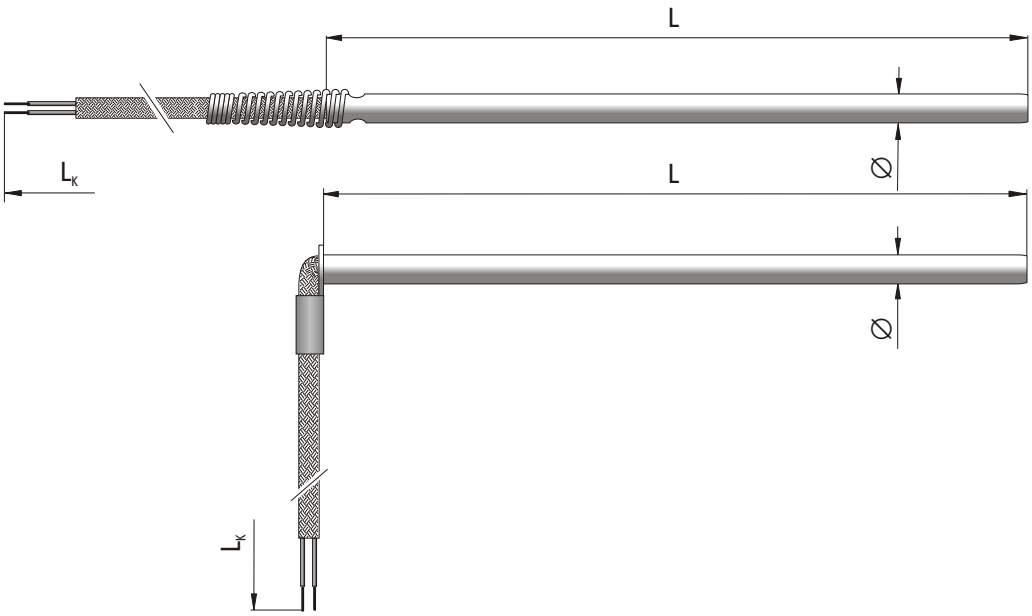
TEMPERATURE SENSOR

type 361

type 362



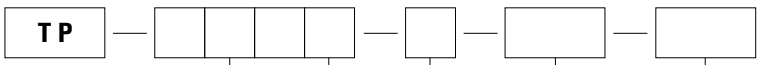
SPECIFICATION

Temperature range	–40°C...+400°C	
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)	
Measuring junction	insulated[2]	
Sheath material	steel 1.4541	
Cable insulation	fiber glass and steel braid[3]	
Additional accessories	compression gland **KP**	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath

Option	**W1**	**W2**	**W3**	**W4**	**W5**	**W6**	**W7**
Sensor length L(mm)[2]	50	100	200	300	400	600	800
Length of the cable L_K(m)[2]	0,5	1	1	1	1,5	1,5	1,5

ORDERING CODE



Sensor type **361**, **362**
Measuring element **Pt100**, **T**, **J** or **K** [1]
Sheath outer diameter ∅= **2,5**, **3**, **4**, **5**, **6**, or **8** mm
Option **W1**...**W7**
Additional accessories: compression gland type **KPM8x1**, **KPM10x1**, **KPM12x1,5** [2]

Example for order: TP-361J-5-W5 thermocouple sensor Fe-CuNi (J) of diameter ∅ =5 mm, length L = 400 mm and length of the cable L_K = 1,5 m.

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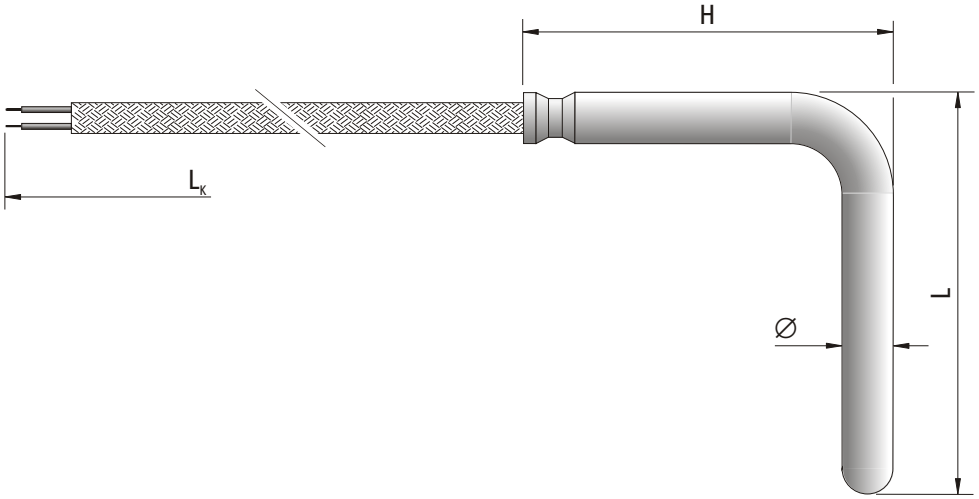
TEMPERATURE SENSOR

type 363



SPECIFICATION

Temperature range	–40°C...+400°C	
Measuring element	platinum resistor	**(Pt100)**[1],[2]
	thermocouple Cu-CuNi	**(T)**[2]
	thermocouple Fe-CuNi	**(J)**[2]
	thermocouple NiCr-NiAl	**(K)**[2]
Class of processing element	2 (B)[3]	
Measuring junction	insulated[3]	
Cable insulation	fiber glass and steel braid[4]	
Sheath material	steel 1.4541	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Double version on demand
[3] Other parameters according to customer requirements
[4] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE

TP	—	363		—		—		—		—	

Measuring element **Pt100**, **T**, **J** or **K** [1],[2]
Sheath outer diameter ∅ = **4**, **5**, **6** or **8** mm
Sensor length L = **50** mm ... **1000** mm[3]
Sensor length H = **50** mm ... **1000** mm[3]
Length of the cable L_K = **0,15** m ... **2,5** m[3]

Example for order: TP-363K-4-200-50-1,5 thermocouple sensor NiCr-NiAl (K) of outer diameter ∅ = 4 mm, lengths L = 200 mm, H = 50 mm and length of the cable L_K = 1,5 m.

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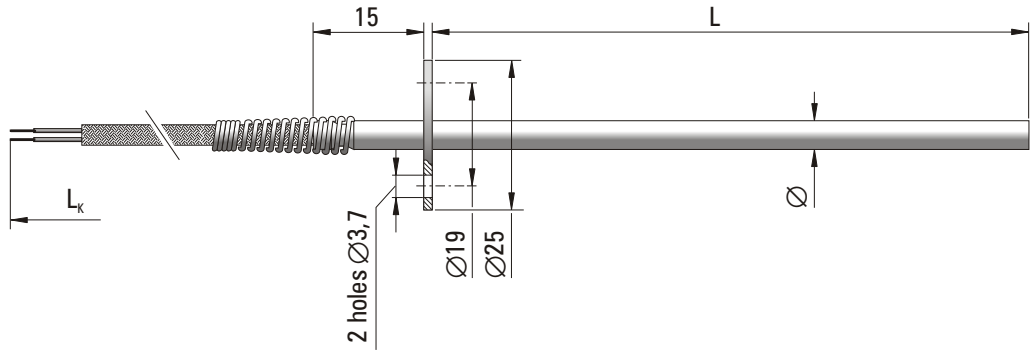
TEMPERATURE SENSOR

type 364

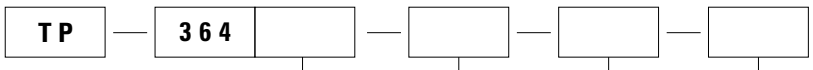


SPECIFICATION

Application	temperature measurement of air in ventilation ducts and systems	
Temperature range	–40°C...+250°C	
Measuring element	platinum resistor	**(Pt100)**[1]
	platinum resistor	**(Pt500)**
	platinum resistor	**(Pt1000)**
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Measuring junction	insulated[2]	
Class of processing element	2 (B)[2]	
Sheath material	steel 1.4541	
Sheath outer diameter ∅	3, 4, 5 or 6 mm[2]	
Sensor length L	50 mm...1000 mm[2]	
Length of the cable L_k	0,15 m...2,5 m[2]	

[1] Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements

ORDERING CODE



Measuring element **Pt100**, **Pt500**, **Pt1000**, **J**, **K**, **T** [1]
Sheath outer diameter ∅ = **3**, **4**, **5** or **6** mm[2]
Sensor length L = **50** mm ... **1000** mm[2]
Length of the cable L_k = **0,15** m ... **2,5** m[2]

Example for order: TP-364Pt100-3-150-0,5 Pt100 resistance sensor of outer diameter ∅ = 3 mm, length L = 150 mm and length of the cable L_k = 0,5 m.

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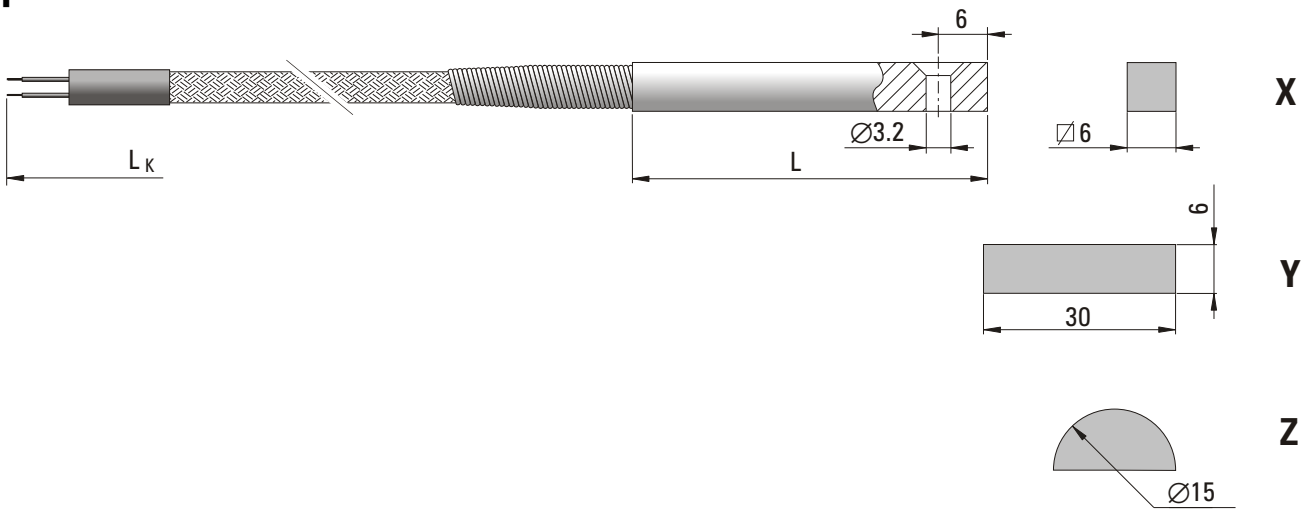
TEMPERATURE SENSOR

type 365



SPECIFICATION

Temperature range	–40°C...+400°C	
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Measuring junction	insulated[2]	
Sheath material	brass	
Sheath shape	square 6 x 6 mm	**(X)**
	rectangle 6 x 30 mm	**(Y)**
	semicircle ⌓ 15 mm	**(Z)**
Cable insulation	fiber glass and steel braid[3]	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE

TP	—	365		—		—		—	

Measuring element **Pt100**, **T**, **J** or **K** [1]
Sheath shape (**X**) **6 x 6** mm, (**Y**) **6 x 30** mm, (**Z**) semicircle ⌓ **15** mm
Sensor length L = **30** mm ... **200** mm[2]
Length of the cable L_K = **0,15** m . . . **2,5** m[2]

Example for order: TP-365Pt100-X-30-1,5 Pt100 resistance sensor in square sheath 6x6 mm, length L = 30 mm and length of the cable L_K = 1,5 m.

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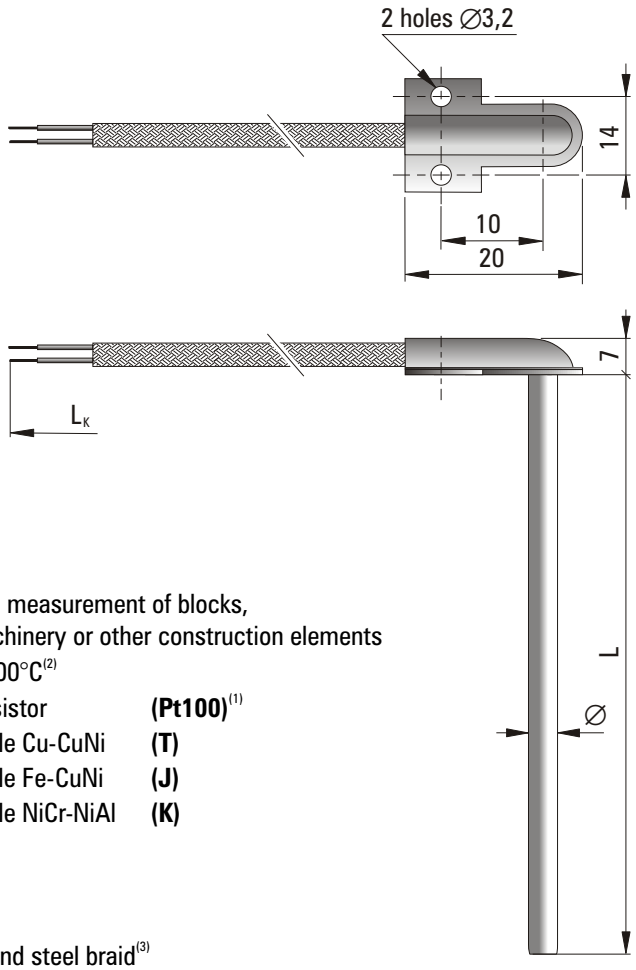
TEMPERATURE SENSOR

type 366

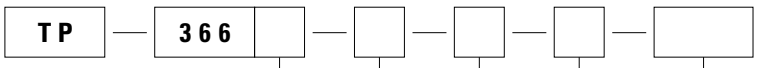


SPECIFICATION

Application	temperature measurement of blocks, parts of machinery or other construction elements	
Temperature range	–40°C...+400°C[2]	
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Measuring junction	insulated[2]	
Class of processing element	2 (B)[2]	
Sheath material	steel 1.4541	
Cable insulation	fiber glass and steel braid[3]	
Additional accessories	compression gland **KP**	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE



Measuring element **Pt100**, **T**, **J** or **K** [1]
Sheath outer diameter ∅ = **2,5**, **3**, **4**, **5** or **6** mm[2]
Sensor length L = **20** ... **1000** mm[2]
Length of the cable L_K = **0,5** ... **2,5** m[2]
Additional accessories: compression gland type **KPM8x1**, **KPM10x1**, **KPM12x1,5**[2]

Example for order: TP-366J-5-50-1,5 thermocouple sensor Fe-CuNi (J) of outer diameter ∅ = 5 mm, length L = 50 mm and length of the cable L_K = 1,5 m.

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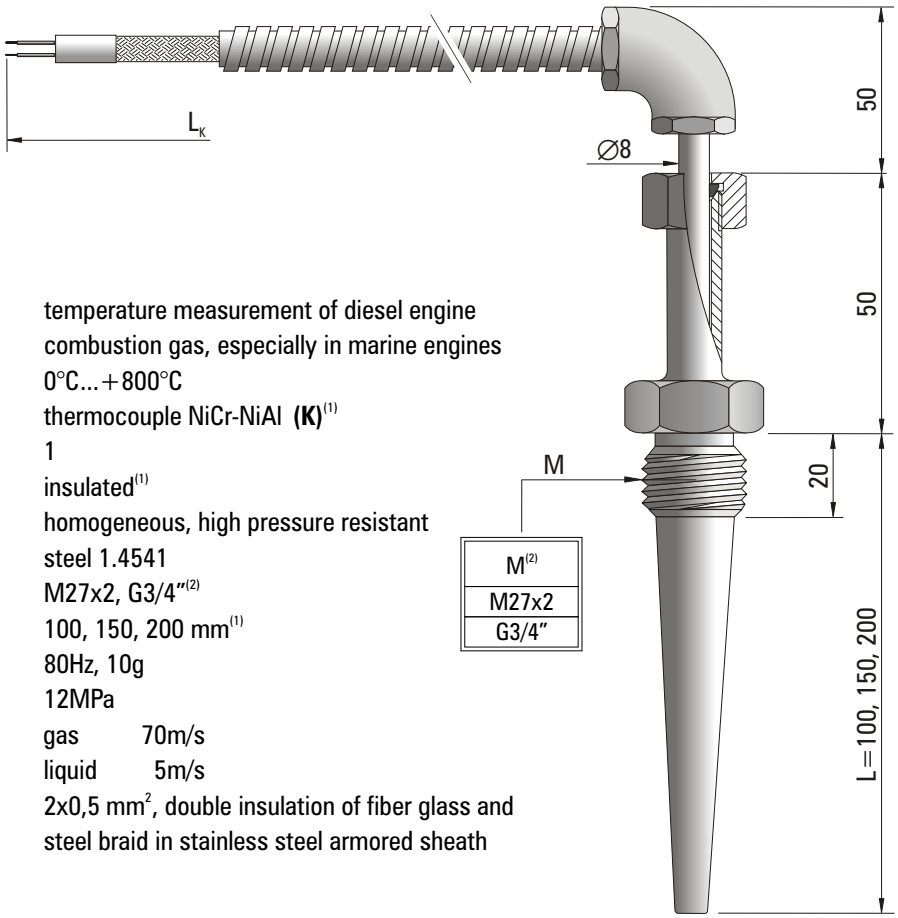
TEMPERATURE SENSOR

type 368



SPECIFICATION

Application	temperature measurement of diesel engine combustion gas, especially in marine engines
Temperature range	0°C...+800°C
Measuring element	thermocouple NiCr-NiAl **(K)**[1]
Class of thermocouple	1
Measuring junction	insulated[1]
Sheath construction	homogeneous, high pressure resistant
Sheath material	steel 1.4541
Fitting M	M27x2, G3/4"[2]
Sensor length L	100, 150, 200 mm[1]
Admissible vibrations	80Hz, 10g
Maximum operating pressure	12MPa
Maximum speed of flow	gas 70m/s liquid 5m/s
Connecting cable	2x0,5 mm^2, double insulation of fiber glass and steel braid in stainless steel armored sheath

[1] Other parameters and dimensions on demand
[2] Other threads inch and metric on demand

ORDERING CODE

TP	—	368	—		—		—	

Sensor length: L = **100**, **150** or **200** mm[1]
Thread M = **M27x2**, **G3/4"**[2]
Length of compensation cable L_K = **1,5** ... **5** m[1]

Example for order: TP-368-100-M27x2-2,5 thermocouple sensor NiCr-NiAl (K) with sheath length L=100mm, thread M27x2 and cable length L_K = 2,5 m.

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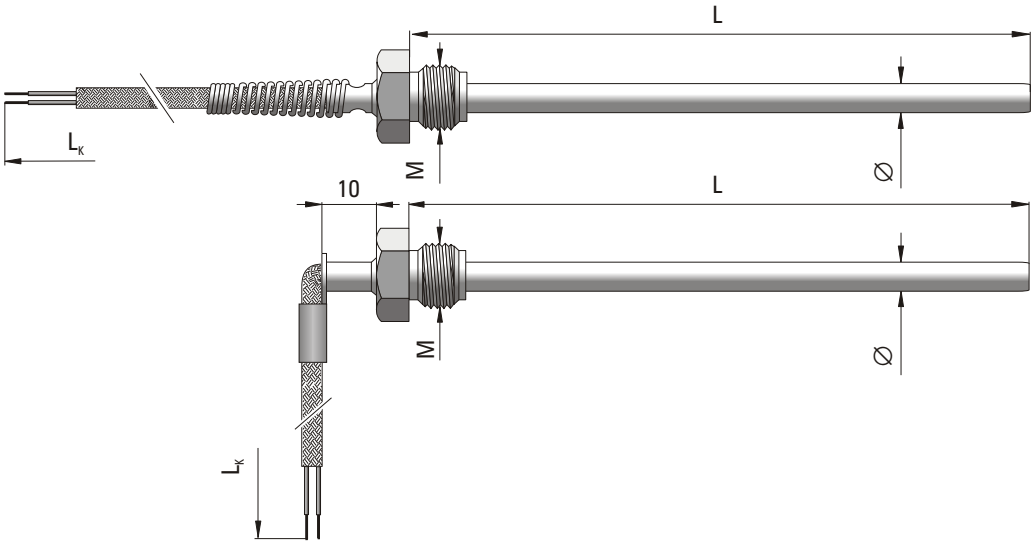
TEMPERATURE SENSOR

type 371

type 372



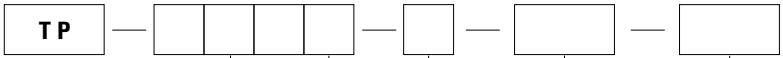
SPECIFICATION

Temperature range	–40°C...+400°C	
Measuring element	platinum resistor	(**Pt100**)[2]
	thermocouple Cu-CuNi	(**T**)
	thermocouple Fe-CuNi	(**J**)
	thermocouple NiCr-NiAl	(**K**)
Class of processing element	2 (B)	
Measuring junction	insulated[1]	
Sheath material	steel 1.4541	
Fitting (M)	welded stationary fitting with thread M6, M8x1, M10x1, M12x1,5, M20x1,5, G1/2"[1]	
Cable insulation	fiber glass and steel braid[3]	

[1] Other parameters according to customer requirements
[2] Pt500, Pt1000, Ni100, Ni1000 on demand
[3] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand

Option	W1	W2	W3	W4	W5	W6	W7
Sensor length L (mm)[1]	50	100	200	300	400	600	800
Length of the cable L_k (m)[1]	0,5	1	1	1	1,5	1,5	1,5

ORDERING CODE



Sensor type **371**, **372**
Measuring element **Pt100**, **T**, **J** or **K**
Sheath outer diameter ∅ = **2,5**, **3**, **4**, **5**, **6**, or **8** mm
Option **W1** ... **W7**
Welded stationary fitting with thread **M6**, **M8x1**, **M10x1**, **M12x1,5**, **M20x1,5**, **G1/2"**[1]

Example for order: TP-371J-5-W5-M10x1 thermocouple sensor Fe-CuNi (J) of outer diameter ∅ = 5 mm, length L = 400 mm, length of the cable L_K = 1,5 m with welded stationary fitting with metric thread M10x1.

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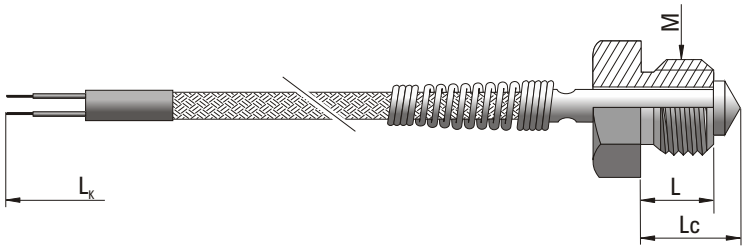
TEMPERATURE SENSOR

type 373



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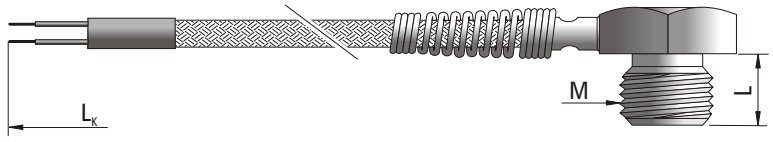
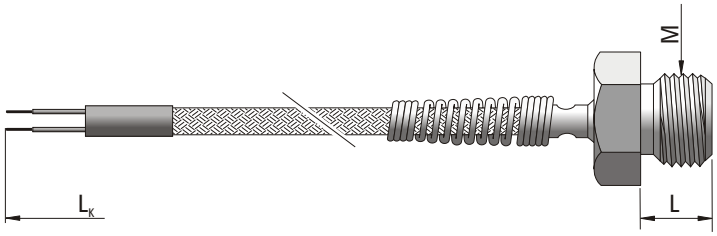


type 375



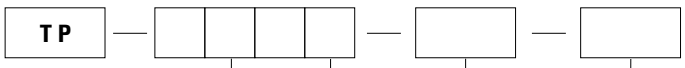
M [2]	L [2]	Lc [2]
M6	10	16,5
M8x1	12	19
M10x1	15	22,5
M12x1,5	20	29
M20x1,5	30	43
G1/2"	30	43
1/4"-20	15	21,5

SPECIFICATION

Temperature range	–40°C...+400°C	
Measuring element	platinum resistor	(**Pt100**) [1]
	thermocouple Cu-CuNi	(**T**)
	thermocouple Fe-CuNi	(**J**)
	thermocouple NiCr-NiAl	(**K**)
Class of processing element	2 (B)[2]	
Measuring junction	insulated[2]	
Sheath material	steel 1.4541	
Cable insulation	fiber glass and steel braid[3]	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE



Sensor type **373**, **374**, **375**
Measuring element **Pt100**, **T**, **J** or **K**
Length of the cable L_K = **0,5** , **1,5** or **2,5** m [2]
Thread of sensor **M6, M8x1, M10x1, M12x1,5, M20x1,5, G1/2", 1/4"-20**

Example for order: TP-375J-1,5-M10x1 thermocouple sensor Fe-CuNi (J), length L = 15 mm, length of the cable L_K = 1,5 m with metric thread M10x1.

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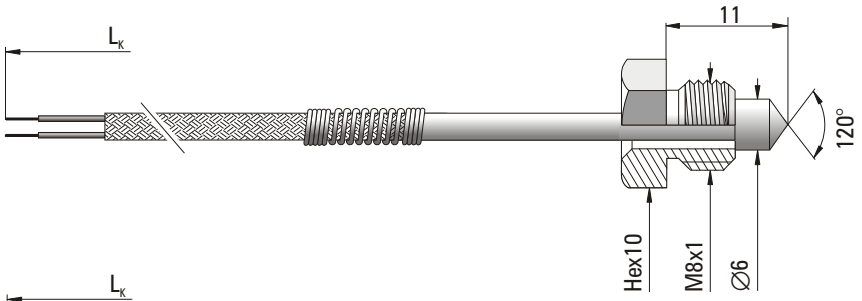
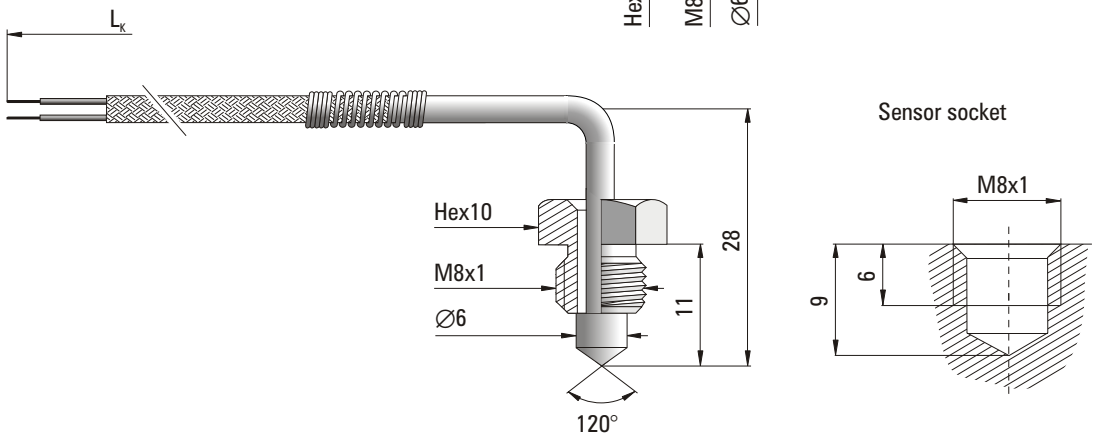
TEMPERATURE SENSOR

type 376

Straight



Angular

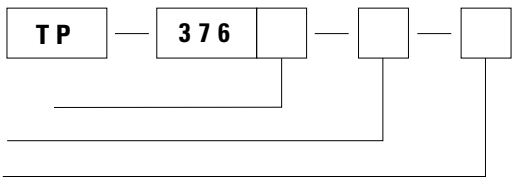


SPECIFICATION

Application	temperature measurement of feed cylinders extruding presses and injection molds	
Temperature range	–40°C...+500°C	
Measuring element	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
	platinum resistor	**(Pt100)**
Measuring junction	insulated [1]	
Class of processing element	2 (B) [1]	
Sheath material	steel 1.4541	
Cable insulation	fiber glass and steel braid [2]	

[1] Other parameters according to customer requirements
[2] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE



Measuring element **J, K** or **Pt100**
Length of the cable L_K = **0,5**, **1,5** or **2,5** m [3]
Option: straight (**P**), angular (**K**)

Example for order: TP-376J-1,5-K thermocouple sensor Fe-CuNi (J) with cable of length L_K = 1,5 m, angular option.

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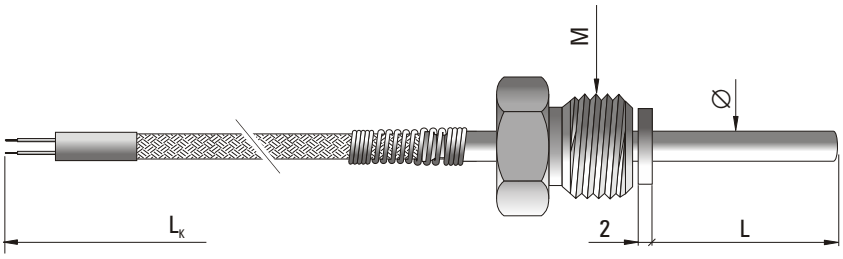
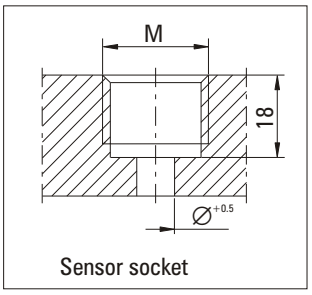
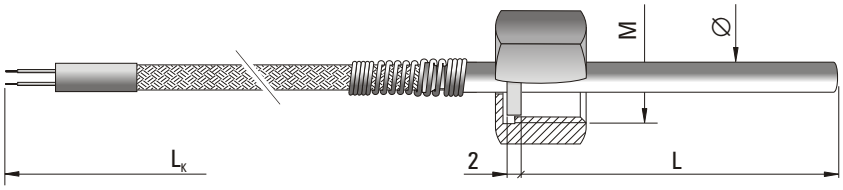
TEMPERATURE SENSOR

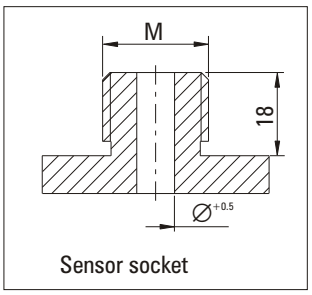
type 377





type 378



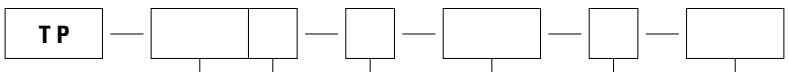


SPECIFICATION

Application	temperature measurement of blocks, parts of machinery or other constructional elements	
Temperature range	–40°C...+400°C	
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Measuring junction	insulated [2]	
Class of processing element	2 (B) [2]	
Fitting	movable handle with external thread	**(TP-377)**
	movable handle with internal thread	**(TP-378)**
Sheath material	steel 1.4541	
Connecting cable	2x0,22 mm^2, fiber glass and steel braid [3]	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters and dimensions according to customer requirements
[3] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE



Sensor type **377**, **378**
Measuring element **Pt100**, **T**, **J K** [2]
Sheath outer diameter ∅ = **4**, **5** or **6** mm [2]
Sensor length L = **20** ... **1000** mm [2]
Length of the cable L_K = **0,5** ... **5** m [2]
Thread M = **M20x1,5**, **G1/2"** [2]

Example for order: TP-377Pt100-6-50-1,0-G1/2" Pt100 resistance sensor of outer diameter ∅ = 6mm, length L=50mm, cable length L_K = 1m, with external thread G1/2".

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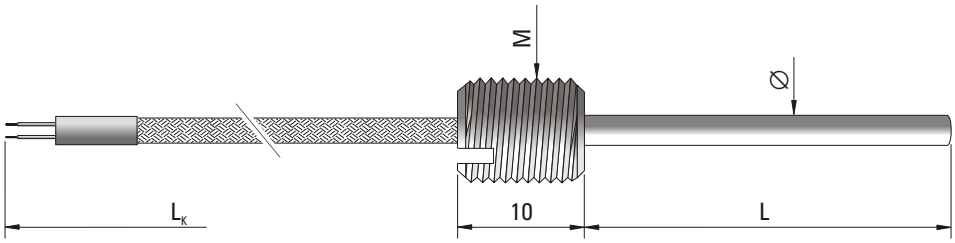
TEMPERATURE SENSOR
type 379

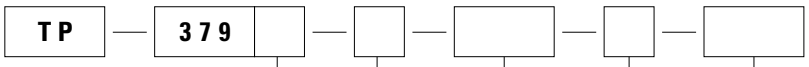


SPECIFICATION

Application	temperature measurement of engine bearings, parts of machinery and other constructional elements	
Temperature range	–40°C...+400°C	
Measuring element	platinum resistor	**(Pt100)** [1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Measuring junction	insulated [2]	
Class of processing element	2 (B) [2]	
Fitting (M)	M8x1, M10x1, M12x1,5 [2]	
Sheath	pipe ∅3, ∅4, ∅5, steel 1.4541	
Connecting cable	2x0,22 mm^2, fiber glass and steel braid [3]	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE



Measuring element **Pt100** [1], **T**, **J** or **K**
Sheath outer diameter ∅ = **3**, **4** or **5** mm [2]
Sensor length L = **30** ... **200** mm [2]
Length of the cable L_K = **0,5** ... **5** m [2]
Thread M = **M8x1**, **M10x1**, **M12x1,5** [2]

Example for order: TP-379Pt100-3-30-0,5-M8x1 Pt100 resistance sensor of outer diameter ∅3mm, length L=30mm, cable length L_K = 0,5m, with thread M8x1.

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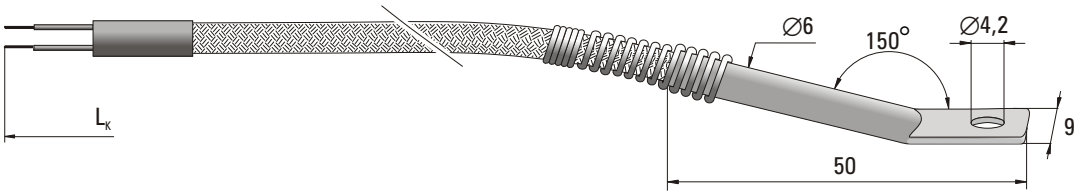
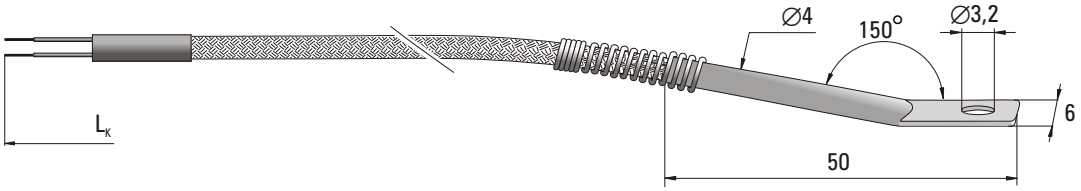
TEMPERATURE SENSOR

type 381



type 382

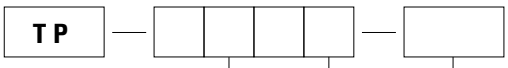


SPECIFICATION

Application	surface temperature measurement of blocks, parts of machinery or other constructional elements	
Temperature range	–40°C...+400°C	
Measuring element	platinum resistor	**(Pt100)** [1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)	
Measuring junction	insulated [2]	
Sheath material	steel 1.4541	
Cable insulation	fiber glass and steel braid [3]	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Double measuring elements on demand
[3] Other cable insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand
[4] Angle 90° instead of 150°
[5] Other parameters according to customer requirements

ORDERING CODE



Sensor type **381**, **382**
Measuring element **Pt100**, **T**, **J** or **K**
Cable length L_K = **0,5**, **1** or **1,5** m [5]

Example for order: TP-381J-0,5 thermocouple sensor Fe-CuNi (J) of opening diameter ∅ = 4,2 mm and cable length L_K = 0,5 m.

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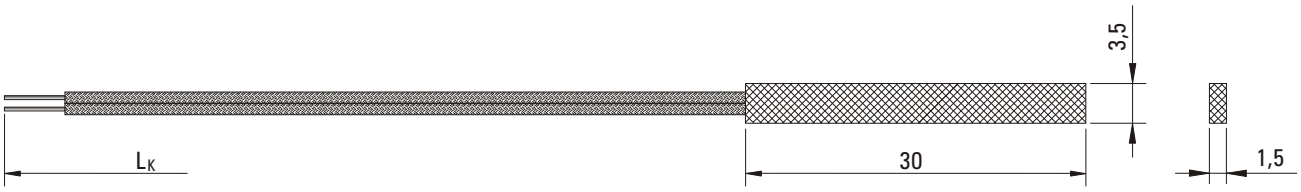
TEMPERATURE SENSOR
type 383

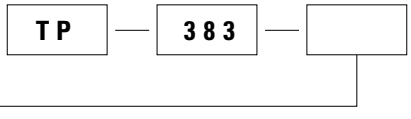


SPECIFICATION

Application	temperature measurement of electric motor windings
Temperature range	–40°C...+150°C
Measuring element	platinum resistor **(Pt100)** [1][3]
Class of processing element	B [2]
Maximum operating current	2 mA
Response time $T_{0,9}$	5 sec.
Cable	2x0,5mm [4] in fiber glass insulation [5]

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Double version on demand
[4] Other conductor diameters on demand
[5] Other cable insulation: silicon, PTFE, steel braid on demand

ORDERING CODE



Length of the cable L_K = **0,1...2,5** m [2]

Example for order: TP-383-0,2 Pt100 resistance sensor, length of the cable L_K = 0,2 m.

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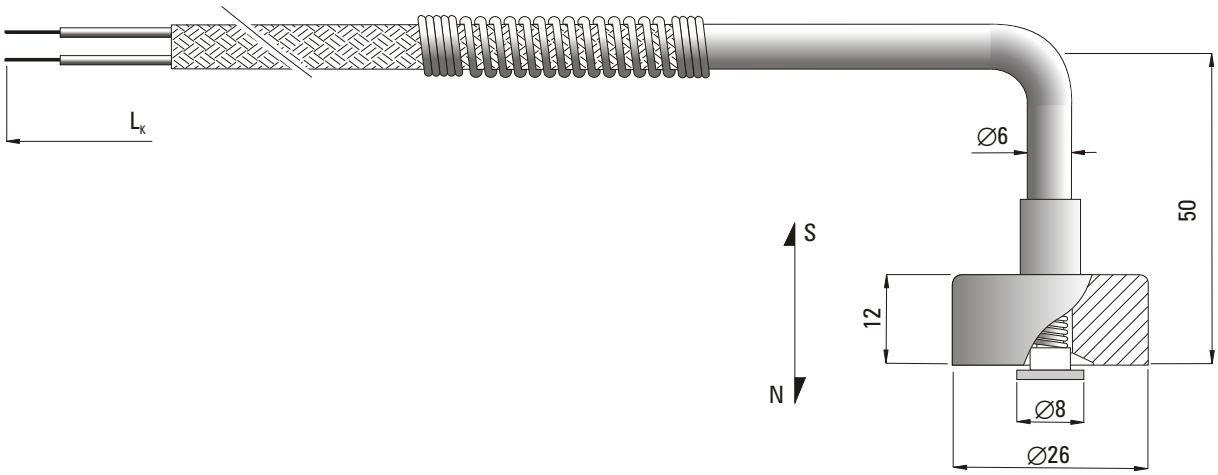
TEMPERATURE SENSOR

type 384

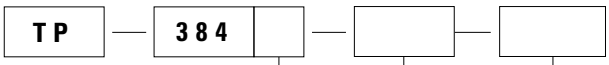


SPECIFICATION

Application	surface temperature measurement of blocks, parts of machinery or construction elements made from magnetic materials
Temperature range	0°C...+400°C
Measuring element	thermocouple Cu-CuNi **(T)** thermocouple Fe-CuNi **(J)** thermocouple NiCr-NiAl **(K)**
Class of thermocouple	2
Measuring junction	grounded
Magnetic material	Alnico
Sheath material	steel 1.4541
Cable insulation	fibre glass and steel braid [2]
Additional accessories	plug type **MT**

[1] Other parameters according to customer requirements
[2] Other insulation of the cable: PVC, silicon, teflon, stainless steel armoured sheath on demand

ORDERING CODE



Measuring element **T, J, K**
Cable length L_K = **0,5**, **1,5** or **2,5** m [1]
Additional accessories: plug type **MT**

Example for order: TP-384J-1,5 thermocouple sensor Fe-CuNi (J), length of the cable L_K = 1,5 m.

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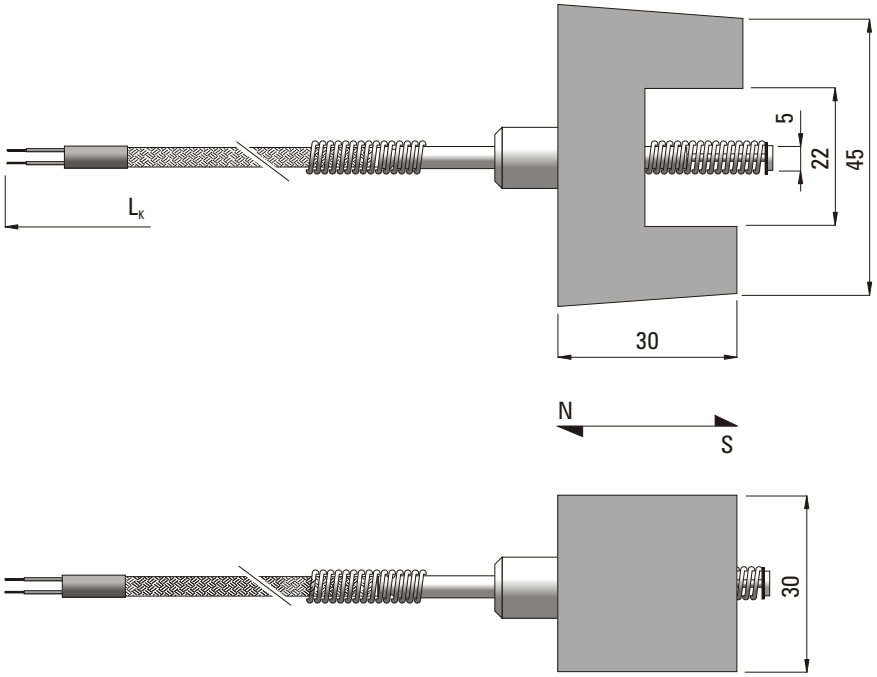
TEMPERATURE SENSOR
type 385

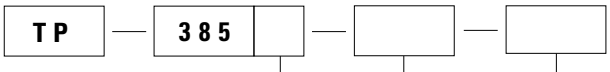


SPECIFICATION

Application	surface temperature measurement of blocks, parts of machinery or construction elements made from magnetic materials
Temperature range	0°C...+400°C
Measuring element	thermocouple Cu-CuNi **(T)** thermocouple Fe-CuNi **(J)** thermocouple NiCr-NiAl **(K)**
Class of thermocouple	2 [1]
Measuring junction	insulated [1]
Magnetic material	Alnico
Sheath material	steel 1.4541
Cable insulation	fibre glass and steel braid [2]
Additional accessories	plug type **MT**

[1] Other parameters according to customer requirements
[2] Other insulation: PVC, silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE



Measuring element **T, J, K**
Cable length L_K = **0,5**, **1,5** or **2,5** m [1]
Additional accessories: plug type **MT**

Example for order: TP-385J-1,5 thermocouple sensor Fe-CuNi (J), length of compensation cable L_K = 1,5 m.

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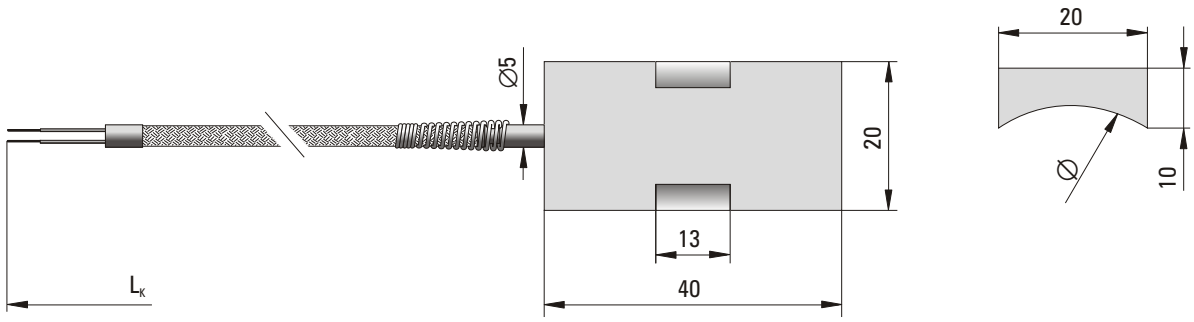
TEMPERATURE SENSOR
type 386



SPECIFICATION

Application	temperature measurement of pipelines and other cylindrical elements. Sensor is fastened by hose-clip.	
Temperature range	–40 °C...+400 °C	
Measuring element	platinum resistor	**(Pt100)** [1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B) [4]	
Measuring junction	insulated [2]	
Heatsink material	brass	
Cable insulation	fiber glass and steel braid [3]	
Additional accessories	hose-clip **OZ**	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Double version on demand
[3] Other insulation of the cable: PVC, silicon, PTFE, stainless steel armored sheath on demand
[4] Other parameters according to customer requirements

ORDERING CODE

TP	—	386		—		—		—	

Measuring element **Pt100**, **T**, **J** or **K**
Pipeline (cylindrical element) outer diameter ∅ (mm)
Length of the cable L_K = **0,5**, **1,5** or **2,5** m [4]
Additional accessories: hose-clip **OZ**

Example for order: TP-386Pt100-50-2,5 Pt100 resistance sensor for pipeline of outer diameter ∅ 50 mm, length of the cable L_K = 2,5 m.

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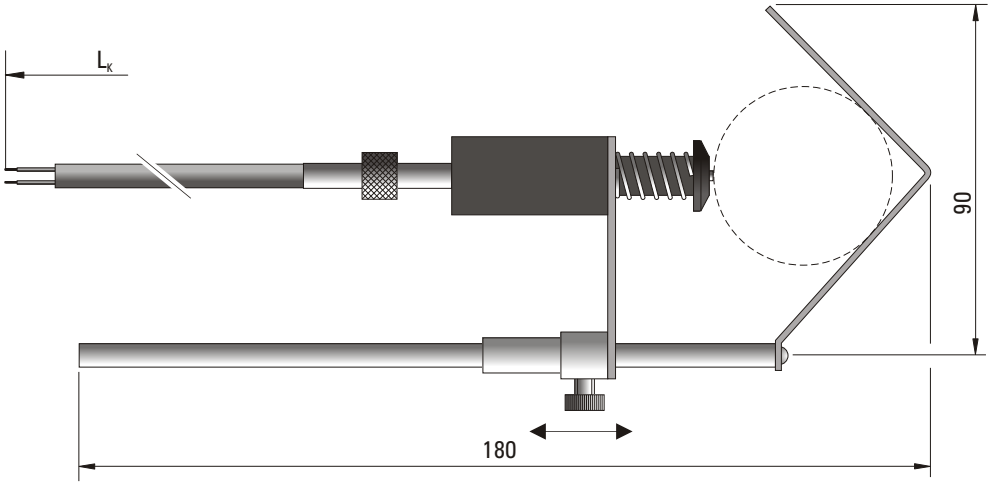
TEMPERATURE SENSOR

type 387



SPECIFICATION

Application	temperature measurement of pipelines and other cylindrical elements of outer diameter in range **from 25 mm to 80 mm**
Temperature range	–40°C...+150°C
Measuring element	Cu-CuNi **(T)** Fe-CuNi **(J)** NiCr-NiAl **(K)**
Class of thermocouple	2 [1]
Measuring junction	grounded [1]
Response time $T_{0,9}$	25 sec.
Cable operating temperature	–30°C...+80°C
Additional accessories	plug type **MT**

[1] Other parameters according to customer requirements

ORDERING CODE

TP	—	387		—		—	

Measuring element **T**, **J**, **K**
Length of compensation cable L_K = **0,5**, **1,5** or **2,5** m [1]
Additional accessories: plug type **MT**

Example for order: TP-387J-1,5 thermocouple sensor Fe-CuNi (J), length of compensation cable L_K = 1,5 m.

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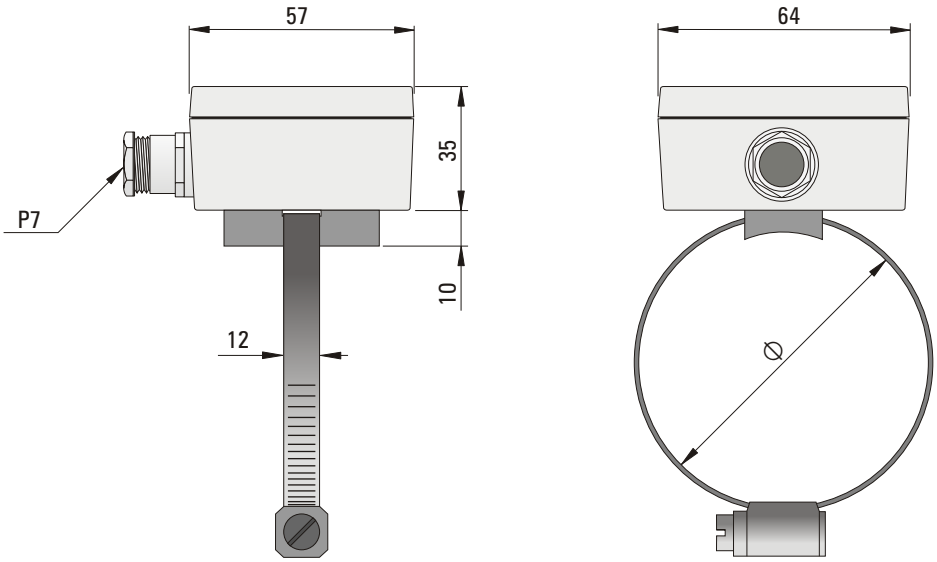
TEMPERATURE SENSOR
type 388

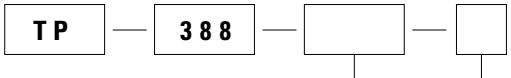


SPECIFICATION

Application	temperature measurement of pipelines and ventilation ducts of outer diameter in range from **32 mm** to **130 mm** [1]. Equipped with heatsink and hose-clip.
Temperature range	-30°C...+90°C [1]
Measuring element	platinum resistor **(Pt100)** [2]
Class of processing element	B
Maximum operating current	1mA
Case material	PC
Protection class	IP54
Additional accessories	temperature transmitter: analogue with fixed processing range specified on ordering code or programmable via **IF-2013U** interface (parameters are set as in the case of transmitters **TEH-27** and **TED-27**)

[1] Other parameters according to customer requirements
[2] Pt500, Pt1000, Ni100, Ni1000 and thermocouples on demand

ORDERING CODE



Pipeline outer diameter ∅ in mm
Option with temperature transmitter: fixed range **T**, programmable range **TE**

Example for order:

TP-388-34	Pt100 resistance sensor for pipeline of outer diameter ∅ = 34 mm.
TP-388-34-T; -30°C+90°C/4-20mA	sensor as above with analogue 4-20 mA temperature transmitter.
TP-388-34-TE; 0°C+70°C/4-20mA	sensor as above with programmable 4-20 mA temperature transmitter, factory-set range 0...70°C.

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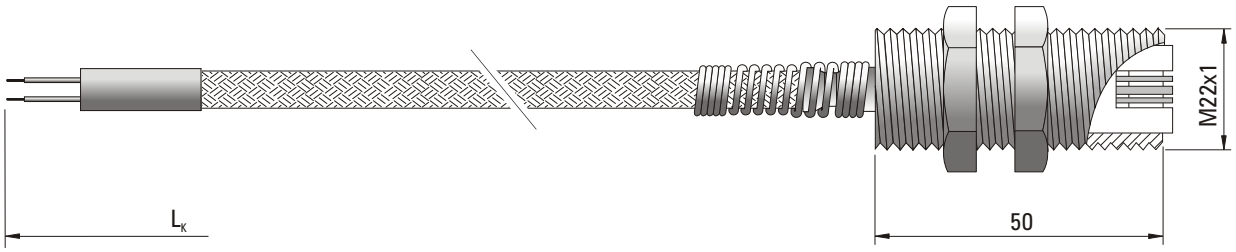
TEMPERATURE SENSOR

type 389



SPECIFICATION

Application	surface temperature measurement of blocks and machinery parts Long thread with nuts secures the sensor so that the measuring ribbon accurately measures the surface temperature.
Temperature range	0°C...+400°C
Measuring element	**ribbon thermocouple** NiCr-NiAl **(K)**
Class of thermocouple	1
Fitting	M22x1 and two nuts [1]
Fitting material	steel 1.4541
Connecting cable	2x0,35mm^2, fibre glass and steel braid
Response time $T_{0,9}$	about 3 sec.

[1] Other parameters and dimensions according to customer requirements

ORDERING CODE

TP	—	389	—	

Length of compensation cable L_K = **0,5** ... **5** m [1]

Example for order: TP-389-1,5 ribbon thermocouple sensor NiCr-NiAl (K), length of compensation cable L_K = 1,5 m.

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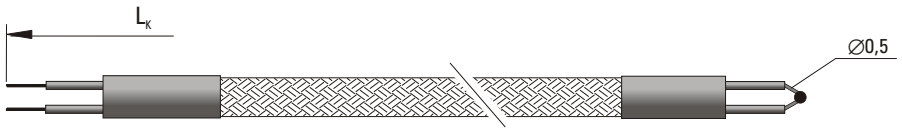
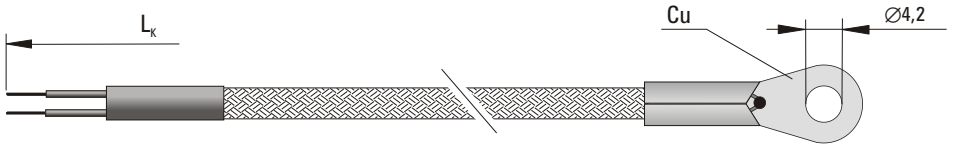
TEMPERATURE SENSOR

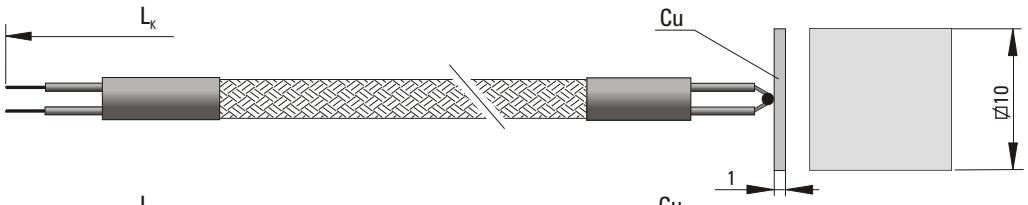
type 391



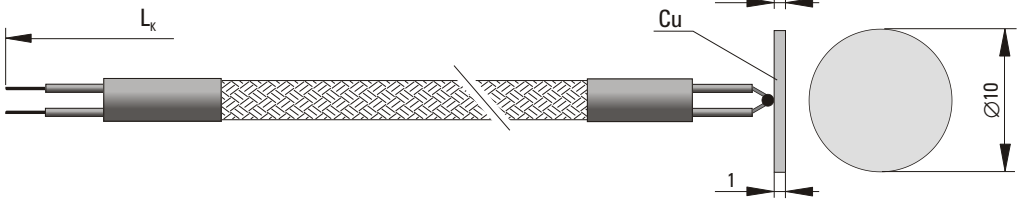
type 392



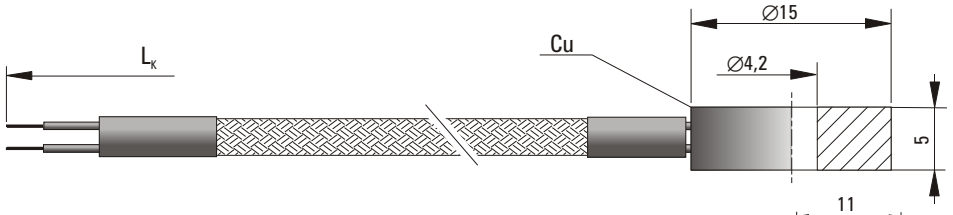
type 393



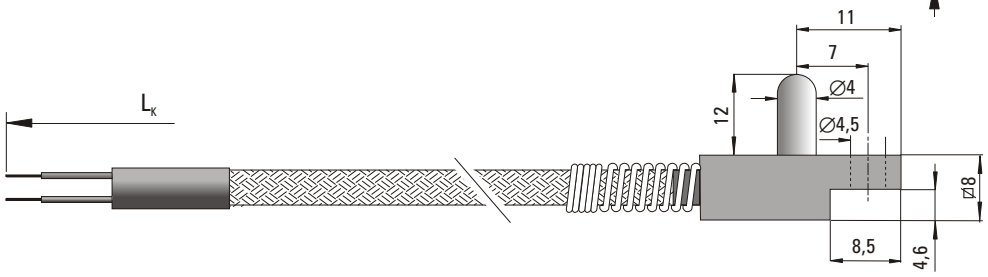
type 394



type 395



type 396

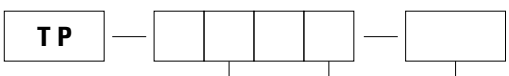


SPECIFICATION

Application	surface temperature measurement of blocks and machinery parts
Temperature range	–40°C...+400°C
Measuring element	Cu-CuNi **(T)**, Fe-CuNi **(J)**, NiCr-NiAl **(K)**
Class of thermocouple	2
Measuring junction	grounded
Cable insulation	fiber glass[2]

[1] Other parameters according to customer requirements

ORDERING CODE



Sensor type **391**, **392**, **393**, **394**, **395**, **396**
Measuring element **T**, **J** or **K**
Sensor length L_K = **0,5**, **1,5** or **2,5** m [1]

Example for order: TP-392J-0,5 thermocouple sensor Fe-CuNi (J), of opening diameter ∅ = 4,2 mm and length of compensation cable L_K = 0,5 m.

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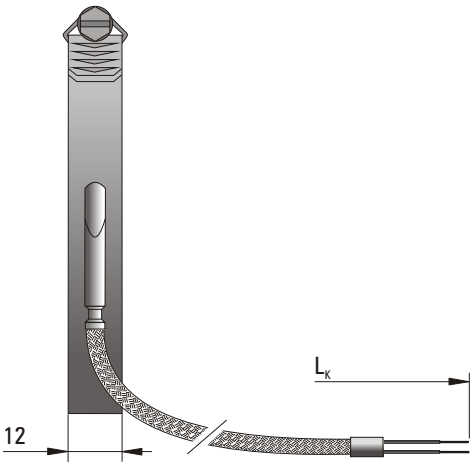
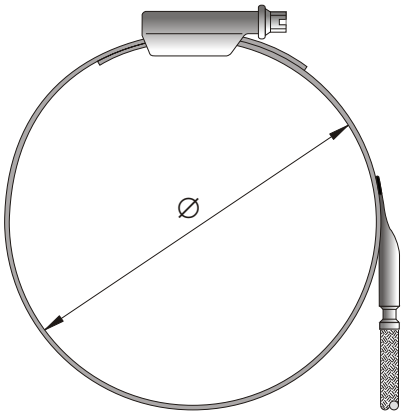
TEMPERATURE SENSOR

type 397





SPECIFICATION

Application	temperature measurment of pipelines and other cylindrical elements
Temperature range	–40°C...+250°C
Measuring element	Cu-CuNi **(T)**
	Fe-CuNi **(J)**
	NiCr-NiAl **(K)**
Class of thermocouple	2
Measuring junction	grounded [1]
Hose-clip material	steel 1.4016
Hose-clip opening diameter ∅	32 – 50 mm
	50 – 70 mm
	70 – 90 mm
	90 – 110 mm
	110 – 130 mm
Length of compensation cable L_K	0,5 ... 2,5 m [1]
Cable insulation	fiber glass and steel braid [2]

[1] Other parameters according to customer requirements
[2] Other insulation of the cable: PVC, silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE

TP	—	397		—		—	

Measuring element **T**, **J** or **K**
Hose-clip opening diameter ∅ = **32–50**, **50–70**, **70–90**, **90–110**, **110–130** mm [1]
Length of compensation cable L_K = **0,5 ... 2,5** m [1]

Example for order: TP-397K-50-70-1,5 thermocouple sensor NiCr-NiAl (K) with hose-clip of opening diameter ∅ = 50-70 mm, length of compensation cable L_K = 1,5 m.

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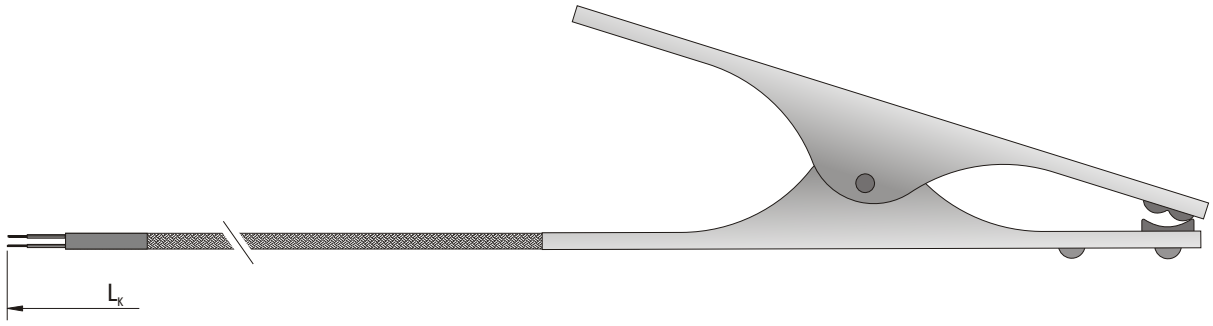
TEMPERATURE SENSOR

type 398



SPECIFICATION

Application	temperature measurement of pipelines and cylindrical elements of outer diameter to 50mm [1]	
Temperature range	-40°C ... +300°C	
Measuring element	platinum resistor	(**Pt100**) [1]
	thermocouple Cu-CuNi	(**T**)
	thermocouple Fe-CuNi	(**J**)
	thermocouple NiCr-NiAl	(**K**)
Class of processing element	2 (B) [1]	
Measuring junction	grounded [1]	
Pliers material	zinc galvanized steel	
Cable length L_K	0,5 ... 5 m [1]	
Cable insulation	fiber glass and steel braid [2]	
Additional accessories	plug type **MP** or **MT**	

[1] Other parameters according to customer's requirements
[2] Other insulation of the cable: silicon, PTFE, stainless steel armored sheath on demand

ORDERING CODE

T P	—	3 9 8		—		—	

Measuring element **Pt100**, **T**, **J** or **K**
Length of the cable L_K = **0,5** ... **5** m
Additional accessories: plug type **MP** or **MT**

Przykład zamawiania: TP-398K-2,5 sensor with thermocouple NiCr-NiAl (K) and length of the cable L_K = 2,5m.

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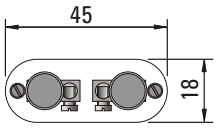
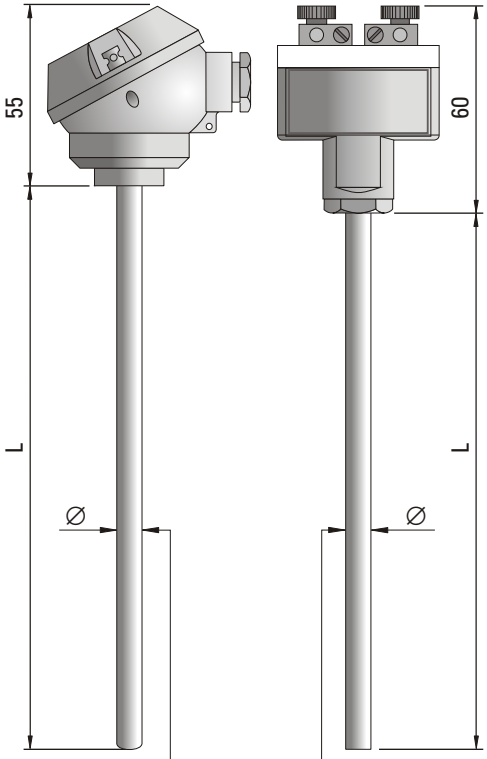
TEMPERATURE SENSOR

type 401, 402, 403, 404, 405, 406, 407, 408





SPECIFICATION

Temperature range	–40°C...+550°C	**(Pt100)**
	–40°C...+400°C	**(T)**
	–40°C...+600°C	**(J)**
	–40°C...+900°C	**(K)**
Measuring element	platinum resistor	**(Pt100)** [1]
	Cu-CuNi	**(T)**
	Fe-CuNi	**(J)**
	NiCr-NiAl	**(K)**
Class of procesing element	2 (B) [1]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated [1]	
Sheath material	steel 1.4541	
Connection head type	MA or B [4] , oval opened	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$ [2]	
Head operating temperature	–40°C...+100°C	
Additional accessories	compression gland type **KP**	
	clamping plate **UZ**	
	temperature transmitter	
	compensation cable	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resistant on demand
[4] Protection tube of outer diameter ∅9 and ∅11 mm on demand

Type	∅ (mm)[4]	Type
TP-401	6	**TP-406**
TP-402	8	**TP-407**
TP-403	10	**TP-408**
TP-404	12	
TP-405	15	

ORDERING CODE

Sensor type **401**, **402**, **403**, **404**, **405**, **406**, **407**, **408**
Measuring element **Pt100**, **T**, **J**, or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L = **200**, **300**, **400**, **600**, **800** or **1000** mm[5]
Additional accessories: compression gland type **KP**, clamping plate type **UZ**
Option with the head-mount transmitter **T**

Example for order: TP-401K-1-400 sensor with single thermocouple NiCr-NiAl (K), with connection head type MA, sheath outer diameter ∅ = 6mm and length L = 400mm.
TP-401K-1-400-T; TCH-2140-K sensor with single thermocouple NiCr-NiAl (K), with connection head type B, option with head-mount transmitter type TCH-2140-K.

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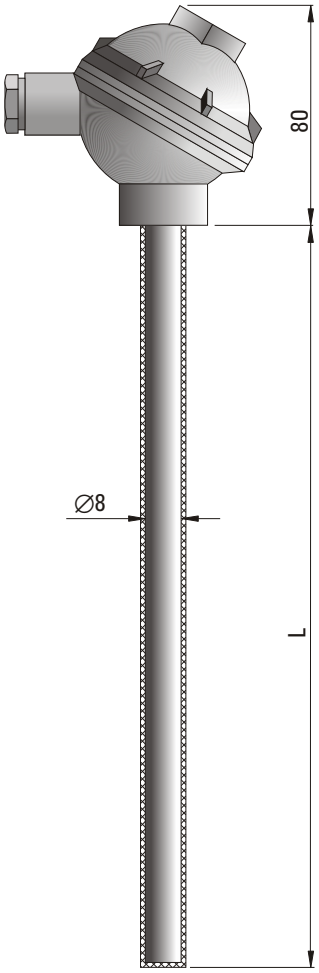
TEMPERATURE SENSOR

type 409

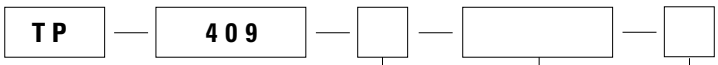


SPECIFICATION

Application	temperature measurement in galvanizing tanks, in chemical laboratories, in aggressive environments
Temperature range	0°C...+200°C
Measuring element	platinum resistor **Pt100** [1]
Class of processing element	B [2]
Assembly	2, 3 or 4 wires
Sensor length L	100 ... 2000 mm [2]
Connection head type, material	NS, PA
Sheath material	**steel 1.4541, PTFE coated**
Head operating temperature	–20°C...+80°C
Additional accessories	compression gland **KP** temperature transmitter

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Acid resistant connection head on demand

ORDERING CODE



Measuring element single(**1**) or double (**2**)
Sensor length L = **100 ... 2000** mm [2]
Additional accessories: compression gland **KP**, temperature transmitter **T**

Example for order: TP-409-1-1200 sensor with single Pt100 resistor, in teflon coated sheath of outer diameter ∅8 mm and length L=1200mm.

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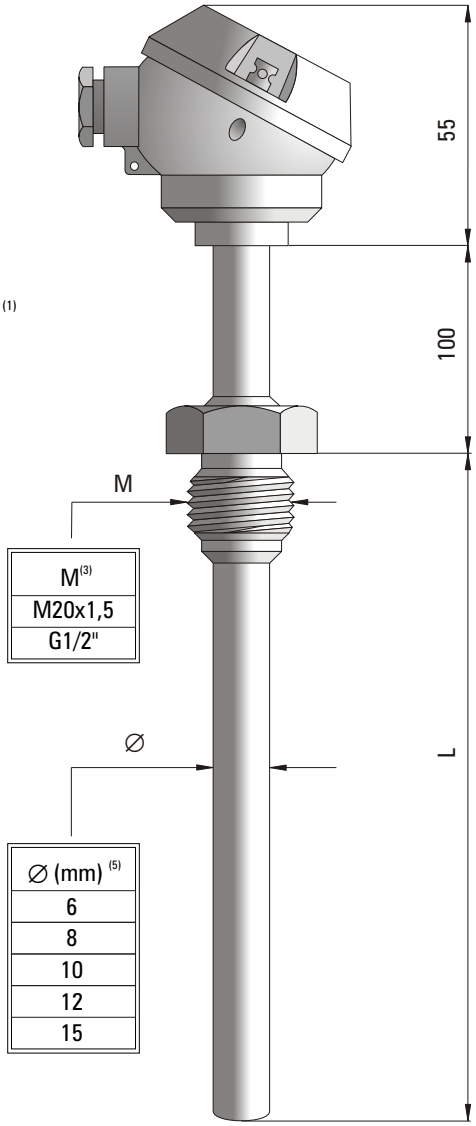
TEMPERATURE SENSOR

type 411, 412, 413, 414, 415
type 421, 422, 423, 424, 425

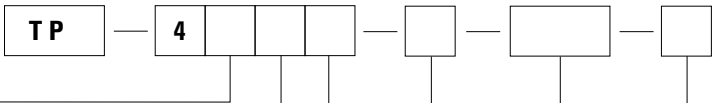


SPECIFICATION

Temperature range	–40°C...+550°C	(**Pt100**)
	–40°C...+400°C	(**T**)
	–40°C...+600°C	(**J**)
	–40°C...+900°C	(**K**)
Measuring element	platinum resistor	(**Pt100**) [1]
	thermocouple Cu-CuNi	(**T**)
	thermocouple Fe-CuNi	(**J**)
	thermocouple NiCr-NiAl	(**K**)
Class ofprocessing element	2 (B) [1]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated [1]	
Sheath material	steel 1.4541	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$ [2]	
Maximum operating pressure	see the Sheath Operating Loads information	
Connection head type	MA or B [4]	
Head operating temperature	–40°C...+100°C	
Fitting	welded stationary with thread M20x1,5 or G1/2" [3]	
Additional accessories	thermowell for welding	
	temperature transmitter	
	compensation cable	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Other inch and metric threads on demand
[4] Connection head with protection class IP65 or acid resistant on demand
[5] Protection tube of outer diameter ∅9 and ∅11mm on demand

ORDERING CODE



Thread: M 20x1,5 (**1**) or G1/2" (**2**)
Outer diameter: ∅6 (**1**), ∅8 (**2**), ∅10 (**3**), ∅12 (**4**), ∅15 (**5**)
Measuring element **Pt100**, **T**, **J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L = **50**, **100**, **200**, **300**, **400**, **600**, **800** or **1000** mm [2]
Option with the head-mount transmitter **T**

Example for order: TP-411K-1-400 sensor with single thermocouple NiCr-NiAl (K), with connection head type MA, of outer diameter ∅ = 6mm and length L=400mm with welded stationary fitting with thread M20x1,5.
TP-411K-1-400-T; TCH-2140-K sensor with connection head type B, option with the head-mount transmitter type TCH-2140-K.

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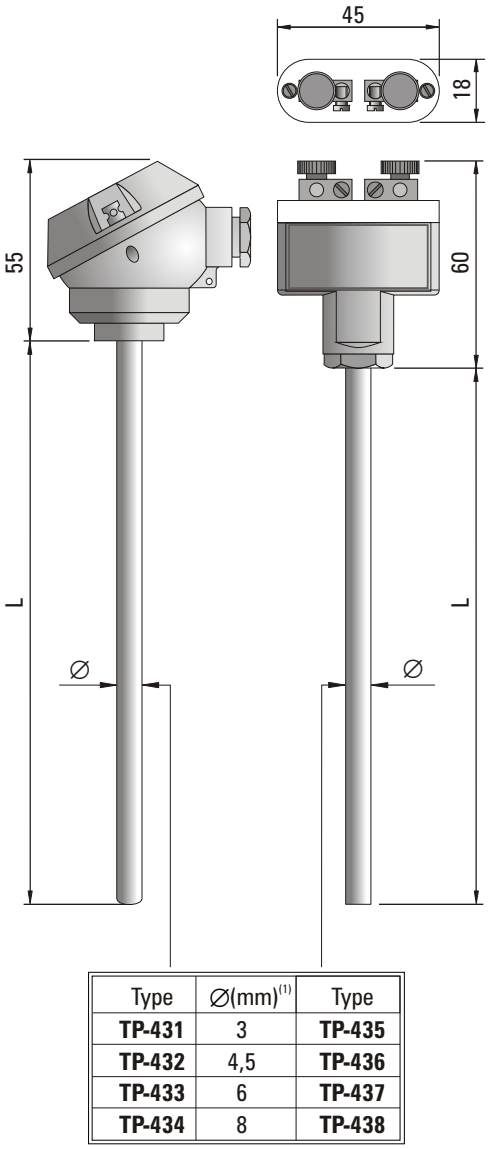
TEMPERATURE SENSOR

type 431, 432, 433, 434, 435, 436, 437, 438



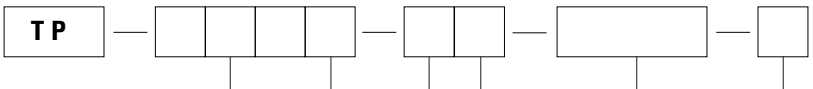
SPECIFICATION

Temperature range	–40°C...+800°C	(**J**)
	–40°C...+1100°C	(**K**)
	–40°C...+1250°C	(**N**)
Sheathed thermocouple	Fe-CuNi	(**J**)
	NiCr-NiAl	(**K**)
	NiCrSi-NiSi	(**N**)
Measuring junction	grounded	(type **a**)
	insulated	(type **b**)
	Exposed	(type **c**)
Class of thermocouple	1	
Sheath material	Inconel (J, K), Nicrobell (N)	
Connection head type	MA or B [4], oval opened	
Head operating temperature	-40°C...+100°C	
Additional accessories	compression gland type **KP**	
	compensation cable	
	temperature transmitter	

[1] Thermocouples of outer diameter ∅ = 1, 1,5 or 2 mm on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resistant on demand

Type	∅(mm)[1]	Type
TP-431	3	**TP-435**
TP-432	4,5	**TP-436**
TP-433	6	**TP-437**
TP-434	8	**TP-438**

ORDERING CODE



Sensor type **431**, **432**, **433**, **434**, **435**, **436**, **437**, **438**
Sheathed thermocouple type **J**, **K** or **N**
Single (**1**) or double (**2**) thermocouple
Measuring junction **a**, **b** or **c**
Sensor length L = **200**, **300**, **400**, **600**, **800** or **1000** mm [2]
Option with the head-mount transmitter **T**

Example for order: TP-431K-1b-200 sensor with connection head type MA, with single sheathed thermocouple NiCr-NiAl (K) of outer diameter ∅ = 3mm, measuring junction galvanically insulated from sheath (type b), length L=200mm.
TP-431K-1b-200-T; TCH-2140-K sensor with connection head type B, option with the head-mount transmitter type TCH-2140-K.

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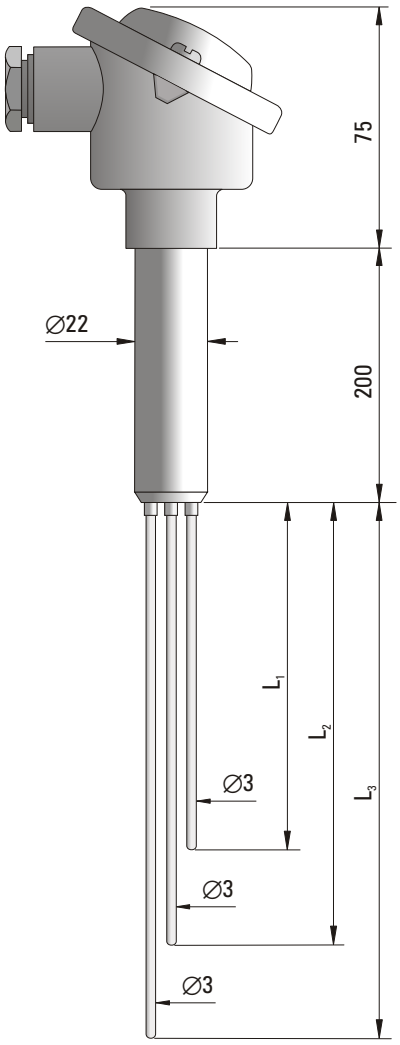
TEMPERATURE SENSOR

type 439

SPECIFICATION

Application	multi-sensor for measuring temperature of liquids and gases at different immersion depth	
Sheathed thermocouples	Fe-CuNi	**(J)**
	NiCr-NiAl	**(K)**
	NiCrSi-NiSi	**(N)**
Temperature range	–40°C...+700°C	**(J)**
	–40°C...+1100°C	**(K)**
	–40°C...+1250°C	**(N)**
Thermocouples outer diameter	∅ 3mm [1]	
Measuring junctions	insulated [2]	
Class of thermocouples	1	
Sheath material	Inconel (J, K), Nicrobell (N)	
Spacer material	steel 1.4828 ∅ 22 [1]	
Connection head type	B or DA [3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	clamping plate **UZ-22**	
	compensation cable	

[1] Other parameters according to customer requirements
[2] Double measuring elements on demand
[3] Connection head with protection class IP65 or acid resistant on demand



ORDERING CODE

Measuring elements **J**, **K** or **N**
Number of sheathed thermocouples **2** or **3**
Immersion length $\mathbf{L_1}$, $\mathbf{L_2}$, $\mathbf{L_3}$ in mm
Additional accessories: clamping plate type **UZ-22**

Example for order: TP-439K-3-500/1000/1500 sensor with three sheathed thermocouples NiCr-NiAl (K) ∅ 3 mm, lengths L_1 = 500 mm, L_2 = 1000 mm and L_3 = 1500 mm.

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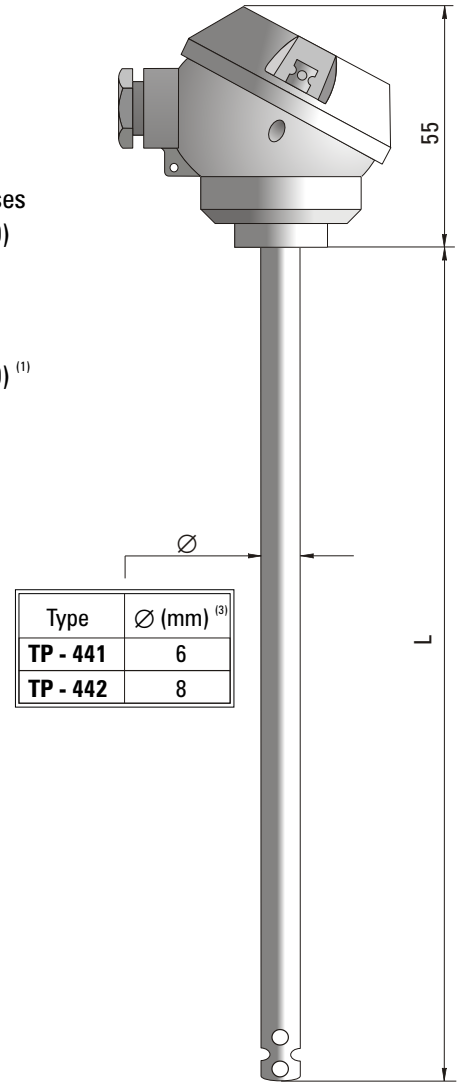
TEMPERATURE SENSOR

type 441, 442



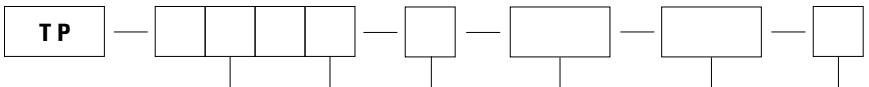
Type	∅ (mm) [3]
TP - 441	6
TP - 442	8

SPECIFICATION

Application	temperature measurement of gases	
Temperature range	–40°C...+400°C	(**Pt100**)
	–40°C...+400°C	(**T**)
	–40°C...+400°C	(**J**)
	–40°C...+600°C	(**K**)
Measuring element	platinum resistor	(**Pt100**) [1]
	thermocouple Cu-CuNi	(**T**)
	thermocouple Fe-CuNi	(**J**)
	thermocouple NiCr-NiAl	(**K**)
Class of processing element	1 (A)	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	3-wire (for Pt100) [2]	
Measuring junction	insulated	
Sheath material	steel 1.4541	
Connection head type	MA or B [4]	
Head operating temperature	–40°C...+100°C	
Additional accessories	compression gland type **KP**	
	temperature transmitter	
	compensation cable	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Other sheath diameter on demand
[4] Connection head with protection class IP65 or acid resistant on demand

ORDERING CODE



Sensor type **441**, **442**
Measuring element **Pt100**, **T**, **J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L = **50**, **100**, **200**, **300**, **400**, **600**, **800** or **1000** mm[2]
Additional accessories: compression gland type **KPM10x1**, **KPM12x1,5**
Option with the head-mount transmitter **T**

Example for order: TP-441K-1-400 sensor with connection head type MA, with single thermocouple NiCr-NiAl (K) of outer diameter ∅ = 6mm and length L=400mm.
TP-441K-1-400-T; TCH-2140-K sensor with connection head type B, option with the head-mount transmitter type TCH-2140-K.

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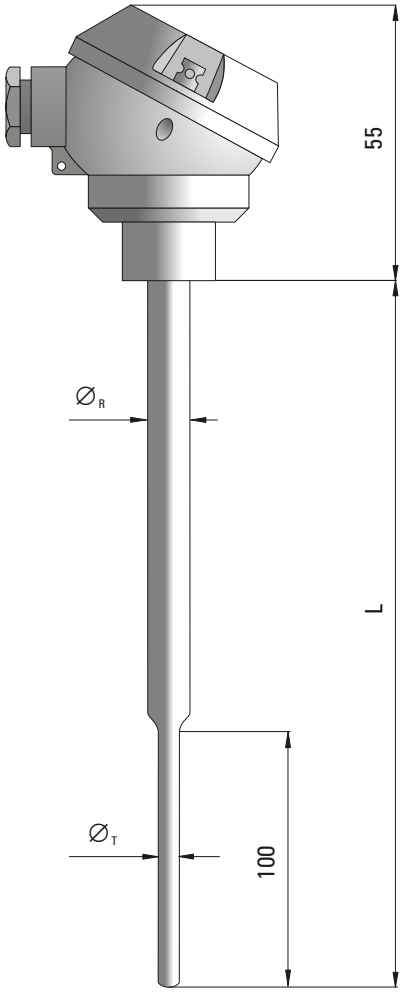
TEMPERATURE SENSOR

type 451, 452, 453

SPECIFICATIONS

Temperature range	–40°C...+800°C	(**J**)
	–40°C...+1100°C	(**K**)
	–40°C...+1250°C	(**N**)
Sheathed thermocouple	Fe-CuNi	(**J**)
	NiCr-NiAl	(**K**)
	NiCrSi-NiSi	(**N**)
Class of thermocouple	1	
Measuring junction	grounded	(type **a**)
	insulated	(type **b**)
	exposed	(type **c**)
Sheath material	Inconel (J, K), Nicrobell (N)	
Connection head type	MA or B [3]	
Head operating temperature	-40°C...+100°C	
Additional accessories	compression gland type **KP**	
	compensation cable	
	temperature transmitter	

[1] Other parameters according to customer requirements
[2] Connection head with protection class IP65 or acid resistant on demand



Sensor type	Sheathed thermocouple diameter $\varnothing_T$	Sheath outer diameter $\varnothing_R$
TP-451	3,0 mm	4,0 mm
TP-452	4,5 mm	6,0 mm
TP-453	6,0 mm	8,0 mm

ORDERING CODE

T P — [ ][ ][ ][ ][ ] — [ ][ ] — [ ] — [ ] — [ ]

Sensor type **451**, **452**, **453**
Sheathed thermocouple **J**, **K** or **N**
Single (**1**) or double (**2**) thermocouple
Measuring junction **a** , **b** or **c**
Sensor length L = **200, 300, 400, 600, 800** or **1000** mm [1]
Additional accessories: compression gland type **KPM8x1**, **KPM10x1**, **KPM12x1,5**
Option with the head-mount transmitter **T**

Example for order:

TP-451K-1b-200 sensor with connection head type MA, with single sheathed thermocouple NiCr-NiAl (K) of diameter $\varnothing_T$=3mm with measuring junction galvanically insulated from the sheath (type b) and length L=200mm.
TP-451K-1b-200-T; TCH-2140-K sensor with connection head type B, option with the head-mount transmitter type TCH-2140-K.

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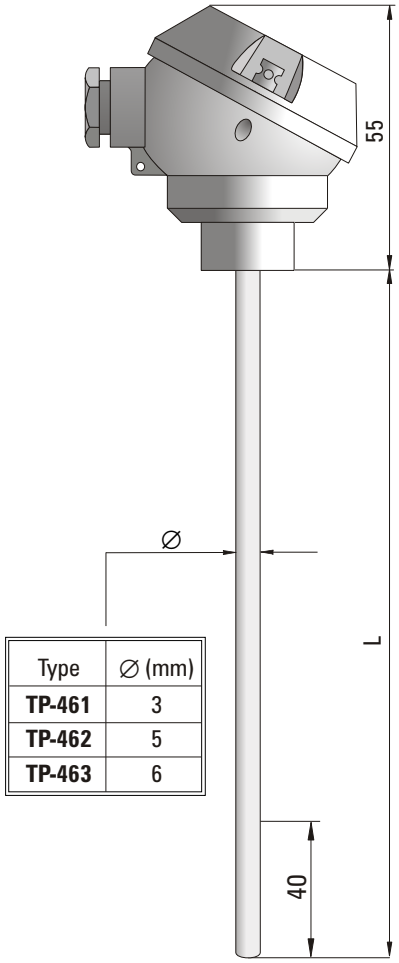
TEMPERATURE SENSOR

type 461, 462, 463

These sensors are made using mineral insulated cable. The outer sheath is from acid resistant steel and conductors are from copper with added zirconium. Lead insulation is magnesium oxide. The addition of zirconium to the copper ensures constant conductor resistance over a wide range of operating temperature. A platinum resistor is employed as the measuring element. This sensor construction combines the advantages of high resolution found in platinum resistance thermometers together with the **elastic properties** of mineral insulation which gives a **high degree of resistance to shock and vibration** in difficult industrial applications.

Note: rigid sensor tip with a length of 40 mm.

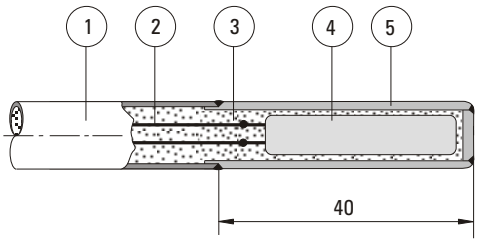


Type	∅ (mm)
TP-461	3
TP-462	5
TP-463	6

SPECIFICATION

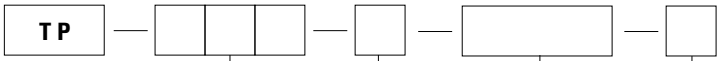
Temperature range	–100°C...+550°C	
Measuring element	platinum resistor	(**Pt100**) [1]
Class of processing element	B [2]	
Conductor resistance	wire CuZr 0,15 Ω/m	(TP-461)
	0,07 Ω/m	(TP-462)
	0,04 Ω/m	(TP-463)
Assembly	2 ,3 or 4 wires	
Sheath material	steel 1.4541	
Connection head type	MA or B [3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	compression gland **KP**	
	temperature transmitter	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resistant on demand



1 – mineral insulated cable - flexible
2 – wire CuZr
3 – insulation – MgO
4 – platinum resistor
5 – sheath material - rigid

ORDERING CODE



Sensor type **461**, **462, 463**
Single (**1**) or double (**2**) measuring element
Sensor length L = **200**, **400**, **600**, **800** or **1000** mm [2]
Option with the head-mount transmitter **T**

Example for order: TP-461-1-800 sensor with connection head type MA, with single Pt100 resistor, sheath outer diameter ∅ = 3mm and length L=800mm
TP-461-1-800-T; TCH-2140-Pt100 sensor with connection head type B, option with the head-mount transmitter type TCH-2140-Pt100

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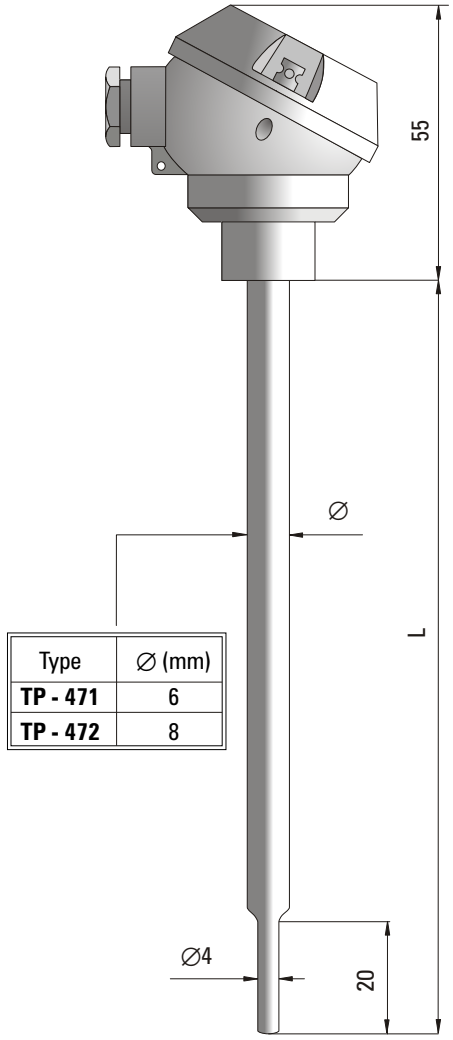
TEMPERATURE SENSOR

type 471, 472

SPECIFICATION

Temperature range	–40°C...+550°C	(**Pt100**)
	–40°C...+400°C	(**T**)
	–40°C...+600°C	(**J**)
	–40°C...+700°C	(**K**)
Measuring ement	platinum resistor	(**Pt100**) [1]
	thermocouple Cu-CuNi	(**T**)
	thermocouple Fe-CuNi	(**J**)
	thermocouple NiCr-NiAl	(**K**)
Class of processing element	2 (B) [2]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated [2]	
Sheath material	steel 1.4541	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$ [2]	
Maximum operating pressure	1,6 MPa	
Connection head type	MA or B [3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	compression gland type **KP**	
	temperature transmitter	
	compensation cable	



Type	∅ (mm)
TP - 471	6
TP - 472	8

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resistant on demand

ORDERING CODE

T P — ☐☐☐☐ — ☐ — ☐☐☐☐ — ☐☐☐☐ — ☐

Sensor type **471**, **472**
Measuring element **Pt100**, **T**, **J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L = **100**, **200**, **300**, **400**, **600**, **800** or **1000** mm [2]
Additional accessories: compression gland type **KPM10x1**, **KPM12x1,5**
Option with the head-mount transmitter **T**

Example for order: TP-471K-1-400 sensor with connection head type MA, with single thermocouple NiCr-NiAl (K) of outer diameter ∅ = 6mm and length L=400mm.
TP-471K-1-400-T; TCH-2140-K sensor with connection head type B, option with the head-mount transmitter type TCH-2140-K

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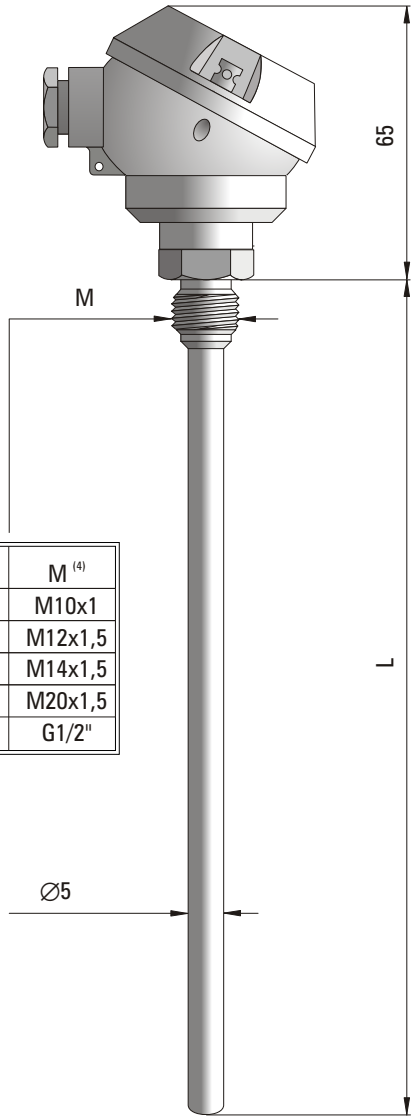
TEMPERATURE SENSOR

type 481, 482, 483, 484, 485

SPECIFICATION

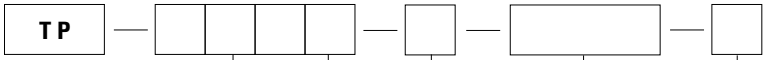
Temperature range	–40°C...+150°C	
Measuring element	platinum resistor	**(Pt100)** [1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B) [2]	
Conductor material	wire Cu/Ag (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated [2]	
Sheath material	steel 1.4541	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$ [2]	
Maximum operating pressure	1,6 MPa	
Outer sheath diameter	∅5 mm [2]	
Connection head type	MA or B [3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	thermowell for welding	
	temperature transmitter	
	compensation cable	



Type	M [4]
TP-481	M10x1
TP-482	M12x1,5
TP-483	M14x1,5
TP-484	M20x1,5
TP-485	G1/2"

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resistant on demand
[4] Other inch and metric threads on demand

ORDERING CODE



Sensor type **481**, **482**, **483**, **484**, **485**
Measuring element **Pt100**, **T**, **J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L = **50**, **100**, **200**, **300**, **400**, **600**, **800** or **1000** mm[2]
Option with the head-mount transmitter **T**

Example for order: TP-482Pt100-1-400 sensor with connection head type MA, with single Pt100 resistor, sheath outer diameter ∅ = 5mm and length L=400mm with welded stationary fitting with thread M12x1,5.
TP-482Pt100-1-400-T; TCHF-2120 sensor with connection head type B, option with the head-mount transmitter type TCHF-2120.

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TEMPERATURE SENSOR

type 488, 489

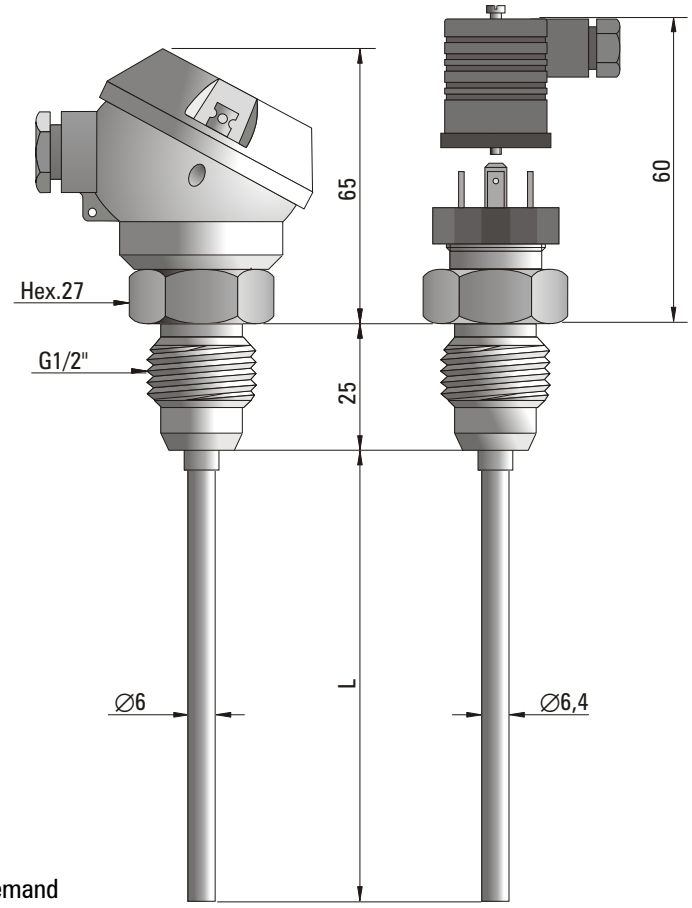
type 488 type 489

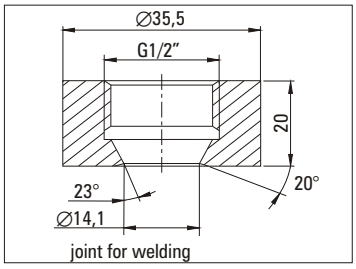
SPECIFICATION

Application: temperature measurement in pharmaceutical and food industry. **The sensor is equipped with a hygienic joint (for welding) based on metal-to-metal seal with conical surface .**

Temperature range	–40°C...+150°C
Measuring element	platinum resistor **Pt100** [1]
Class of processing element	B [2]
Conductor material	wire Cu/Ni
Assembly	2, 3 or 4 wires
Sheath material	steel 1.4541
Maximum operating pressure	1,6 MPa
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$ [2]
Connection head type (for 488)	MA or B [3]
Connector type (for 489)	Hirschmann
Head and connector operating temperature	–40°C...+100°C
Additional accessories (for 488)	temperature transmitter

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resistant on demand





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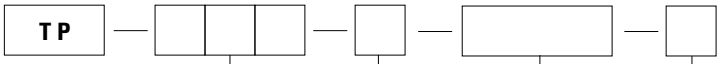

Sensor type **488, 489**
Single (**1**) or double (**2**) measuring element
Sensor length L = **0** ... **200** mm [2]
Option with the head-mount transmitter (for 488) **T**

Example for order: TP-488-1-50 sensor with connection head type MA, with single Pt100 resistor of length L=50mm.
TP-488-1-50-T; TCHF-2120 sensor with connection head type B, option with the head-mount transmitter type TCHF-2120.

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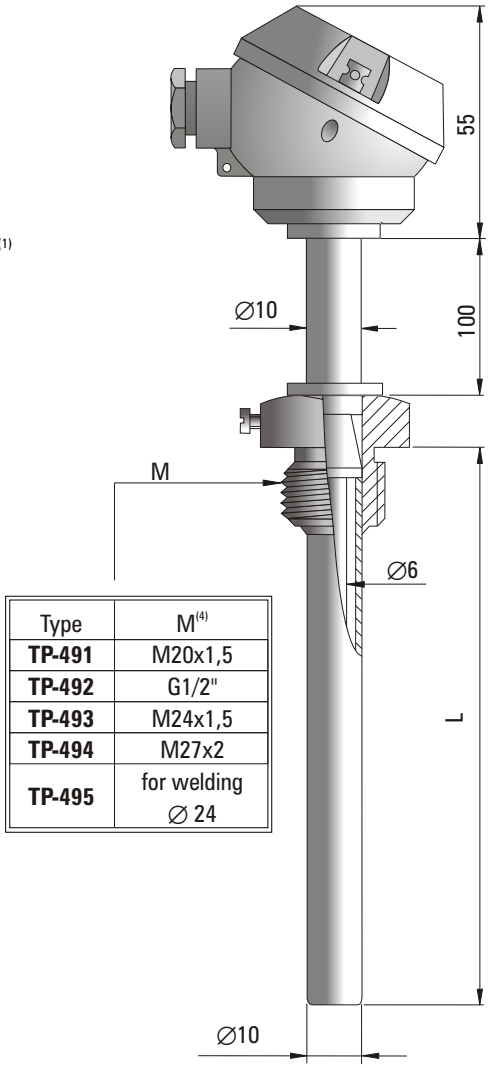
TEMPERATURE SENSOR

type 491, 492, 493, 494, 495

SPECIFICATION

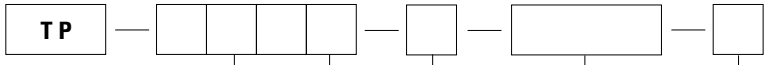
Application	temperature measurement in receptacles and pipelines	
Temperature range	–40°C...+550°C	**(Pt100)**
	–40°C...+400°C	**(T)**
	–40°C...+600°C	**(J)**
	–40°C...+900°C	**(K)**
Measuring element	platinum resistor	**(Pt100)** [1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B) [2]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated [2]	
Sheath material	steel 1.4541	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$ [2]	
Connection head type	MA or B [3]	
Maximum operating pressure	see the Sheath Operating Loads information	
Head operating temperature	–40°C...+100°C	
Additional accessories	thermowell for welding	
	temperature transmitter	
	compensation cable	



Type	M [4]
TP-491	M20x1,5
TP-492	G1/2"
TP-493	M24x1,5
TP-494	M27x2
TP-495	for welding ∅ 24

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resistant on demand
[4] Other inch and metric threads on demand

ORDERING CODE



Sensor type **491**, **492**, **493**, **494**, **495**
Measuring element **Pt100**, **T**, **J** or **K**
Single (**1**) or double (**2**) measuring element
Immersion length L = **50**, **100**, **200**, **300**, **400**, **600**, **800** or **1000** mm [2]
Option with the head-mount transmitter **T**

Example for order: TP-491K-1-400 sensor with connection head type MA, with single thermocouple NiCr-NiAl (K) with sheath of immersion length L=400mm and thread M20x1,5.
TP-491K-1-400-T; TCH-2140-K sensor with connection head type B, option with the head-mount transmitter type TCH-2140-K

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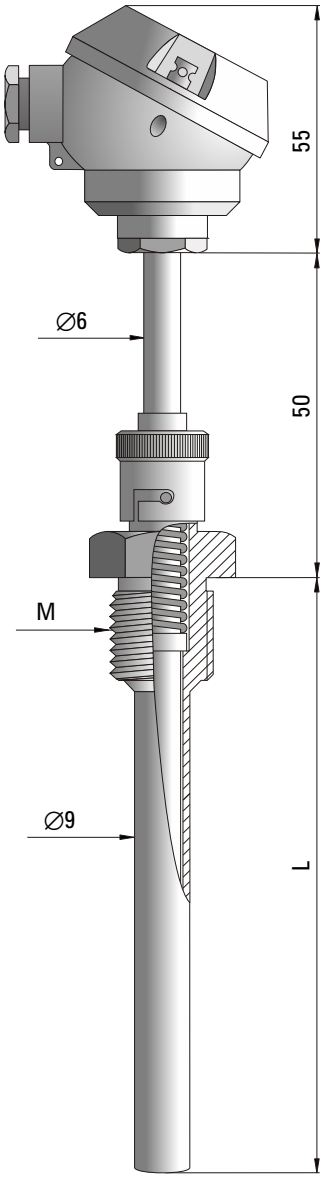
TEMPERATURE SENSOR

type 496



SPECIFICATION

Application	temperature measurement in receptacles and pipelines	
Temperature range	–40°C...+400°C	
Measuring element	platinum resistor	(**Pt100**) [1]
	thermocouple Cu-CuNi	(**T**)
	thermocouple Fe-CuNi	(**J**)
	thermocouple NiCr-NiAl	(**K**)
Class of processing element	2 (B) [2]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated [2]	
Sheath material	steel 1.4541	
Maximum operating pressure	see Sheath Operating Loads information	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$ [2]	
Connection head type	MA or B [3]	
Fitting (M)	M20x1,5 , M27x2, G1/2", G3/4" [4]	
	or ∅ 24 for welding	
Head operating temperature	–40°C...+100°C	
Additional accessories	thermowell for welding	
	temperature transmitter	
	compensation cable	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resistant on demand
[4] Other inch and metric threads on demand

ORDERING CODE

TP	—	496		—		—		—	

Sensor type **Pt100**, **T**, **J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L = **50** ... **1000** mm [2]
Fitting (M) **M20x1,5**, **M27x2**, **G1/2"**, **G3/4"** [4] or ∅ **24** for welding
Option with the head-mount transmitter **T**

Example for order: TP-496Pt100-1-50-G1/2" sensor with connection head type MA, with single Pt100 resistor, with sheath of length L=50mm and thread G1/2".
TP-496Pt100-1-50-G1/2"-T; TCHF-2120 sensor with connection head type B, option with the head-mount transmitter type TCHF-2120.

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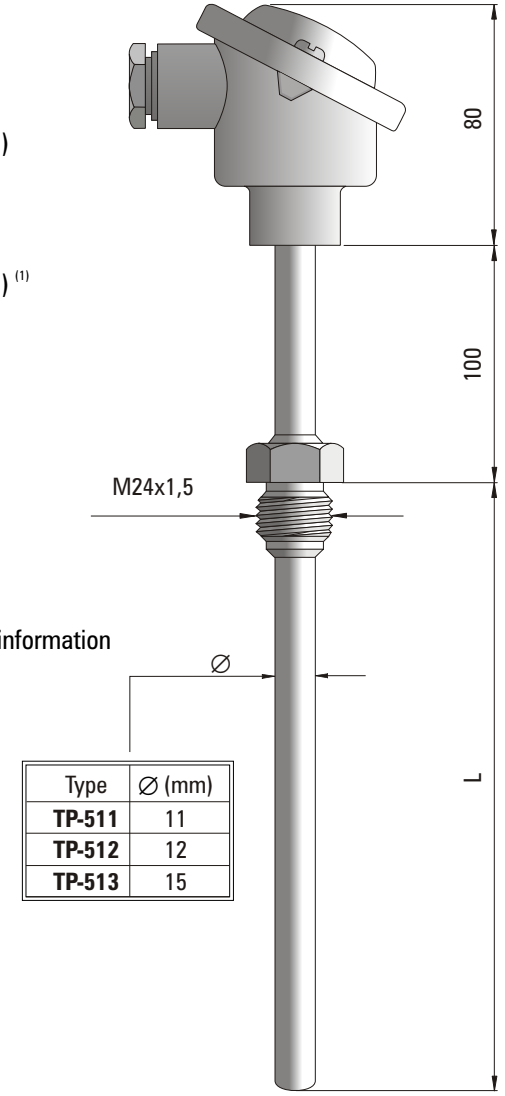
TEMPERATURE SENSOR

type 511, 512, 513

SPECIFICATION

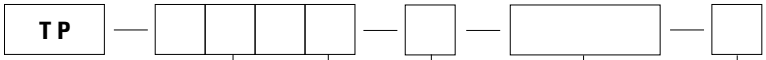
Temperature range	–40°C...+550°C	**(Pt100)**
	–40°C...+400°C	**(T)**
	–40°C...+600°C	**(J)**
	–40°C...+900°C	**(K)**
Measuring element	platinum sensor	**(Pt100)** [1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B) [2]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated [2]	
Sheath material	steel 1.4541	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$ [2]	
Maximum operating pressure	see Sheath Operating Loads information	
Connection head type	B [3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	thermowell for welding	
	temperature sensor	
	compensation cable	



Type	∅ (mm)
TP-511	11
TP-512	12
TP-513	15

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resistant on demand
[4] Other inch and metric threads on demand

ORDERING CODE



Sensor type **511**, **512**, **513**
Measuring element **Pt100**, **T**, **J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L = **100**, **200**, **400**, **600**, **800** or **1000** mm [2]
Option with the head-mount transmitter **T**

Example for order: TP-511K-1-400 sensor with single thermocouple NiCr-NiAl (K) of outer diameter ∅ = 11mm, length L=400mm with thread M24x1,5.
TP-511K-1-400-T; TCH-2140-K sensor with the head-mount transmitter type TCH-2140-K

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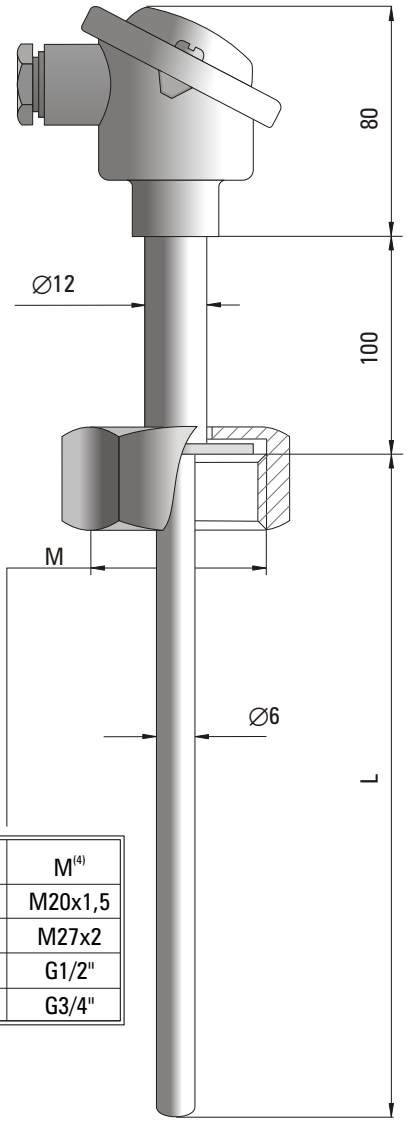
TEMPERATURE SENSOR

type 521, 522, 523, 524

SPECIFICATION

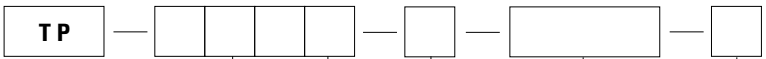
Temperature range	–40°C...+550°C	**(Pt100)**
	–40°C...+800°C	**(J)**
	–40°C...+1100°C	**(K)**
	–40°C...+1250°C	**(N)**
Measuring element	platinum resistor	**(Pt100)** [2]
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
	thermocouple NiCrSi-NiSi	**(N)**
Class of processing element	2 (B) [1]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated [1]	
Sheath material ∅6	steel 1.4541 (Pt100)	
	Inconel (J, K) Nicrobell (N)	
Maximum operating pressure	1,6 MPa	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$ [1]	
Connection head type	B [4]	
Head operating temperature	–40°C...+100°C	
Hexagon nut	mobile with internal thread	
	M20x1,5, M27x2, G1/2", G3/4" [3]	
	(welded hexagon nut on demand)	
Additional accessories	temperature transmitter	
	compensation cable	



Type	M[4]
TP-521	M20x1,5
TP-522	M27x2
TP-523	G1/2"
TP-524	G3/4"

[1] Other parameters according to customer requirements
[2] Pt500, Pt1000, Ni100, Ni1000 on demand
[3] Other inch and metric threads on demand
[4] Connection head with protection class IP65 or acid resistant on demand

ORDERING CODE



Sensor type **521, 522, 523, 524**
Measuring element **Pt100**, **J**, **K** or **N**
Single (**1**) or double (**2**) measuring element
Sensor length L = **100**, **200**, **400**, **600**, **800** or **1000** mm [1]
Option with the head-mount transmitter **T**

Example for order: TP-523Pt100-1-200 sensor with single Pt100 resistor with mobile hexagon nut, internal thread G1/2" and length L = 200 mm.
TP-523Pt100-1-200-T; TCH-2120-Pt100 sensor with the head-mount transmitter type TCH-2120-Pt100.

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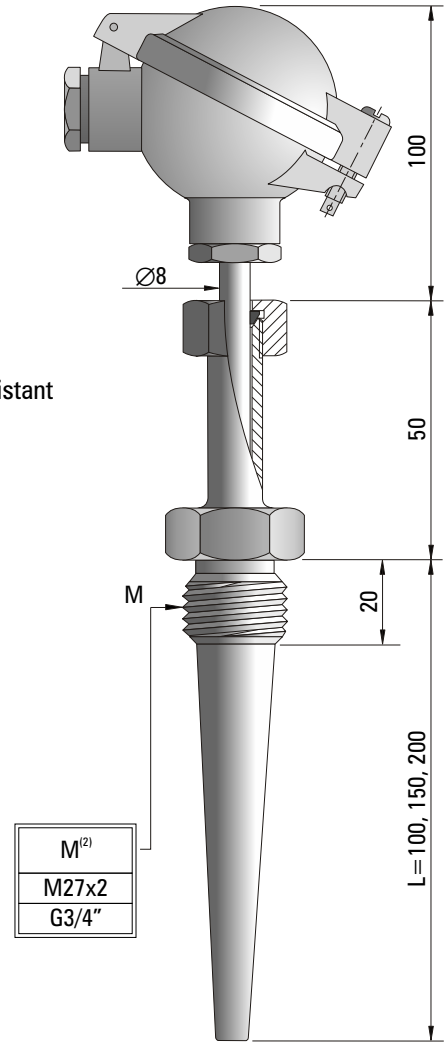
TEMPERATURE SENSOR

type 528

SPECIFICATION

Application	temperature measurement of diesel engine exhaust gas, especially in shipping engines
Temperature range	–40 °C...+800 °C
Measuring element	thermocouple NiCr-NiAl **(K)**[1]
Class of thermocouple	1
Measuring junction	insulated [1]
Sheath	drilled thermowell, high pressure resistant
Sheath material	steel 1.4541
Fitting (M)	M27x2, G3/4" [2]
Immersion length (L)	100, 150, 200 mm [1]
Admissible vibrations	80Hz, 5g
Maximum operating pressure	12MPa
Maximum speed of flow	
gas	70m/s
liquid	5m/s
Connection head type	NA, IP54, 100 °C
Additional accessories	compensation cable temperature transmitter



[1] Other parameters and dimensions according to customer requirements
[2] Other inch and metric threads on demand
[3] Connection head with protection class IP65 or acid resistant on demand

ORDERING CODE

TP	—	528	—		—		—		—	

Single (**1**) or double (**2**) measuring element
Sensor length L = **100**, **150** or **200** mm[1]
Thread size M = **M27x2**, **G3/4"**[1]
Option with the head-mount transmitter **T**

Example for order: TP-528-1-100-M27x2 sensor with single thermocouple NiCr-NiAl (K) with sheath of length L=100mm and thread M27x2.
TP-528-1-100-M27x2-T; TCH-2160-K sensor with the head-mount transmitter type TCH-2160-K.

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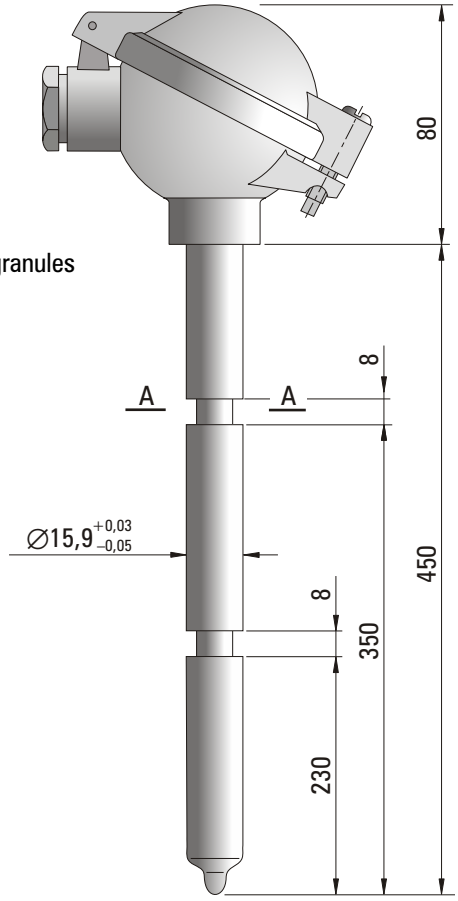
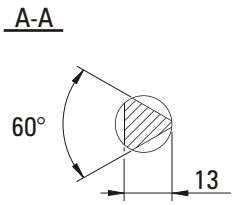
TEMPERATURE SENSOR

type 529



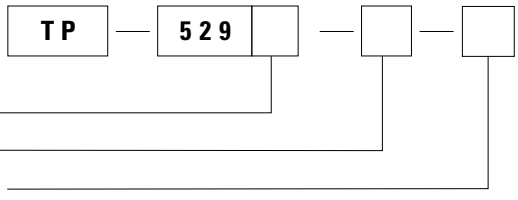


SPECIFICATION

Application	temperature measurement of rubber granules in crushing and grinding equipment
Temperature range	–40°C...+400 °C
Measuring element	NiCr-NiAl **(K)**
	Fe-CuNi **(J)**
Class of thermocouple	2[1]
Measuring junction	grounded
Sheath material	steel 1.4541
Sheath outer diameter	∅ 15,9 $^{+0,03}_{-0,05}$ mm
Connestion head type	DAN[2]
Head operating temperature	–40°C...+100°C
Additional accessories	temperature transmitter
	compensation cable

[1] Other parameters and dimensions according to customer requirements
[2] Connection head with protection class IP65 or acid resistant on demand

ORDERING CODE



Measuring element **J** or **K**
Single (**1**) or double (**2**) thermocouple
Option with the head-mount transmitter **T**

Example for order: TP-529J-1 sensor with single thermocouple Fe-CuNi (J).
TP-529J-1-T; TCH-2140-J sensor with the head-mount transmitter type TCH-2140-J.

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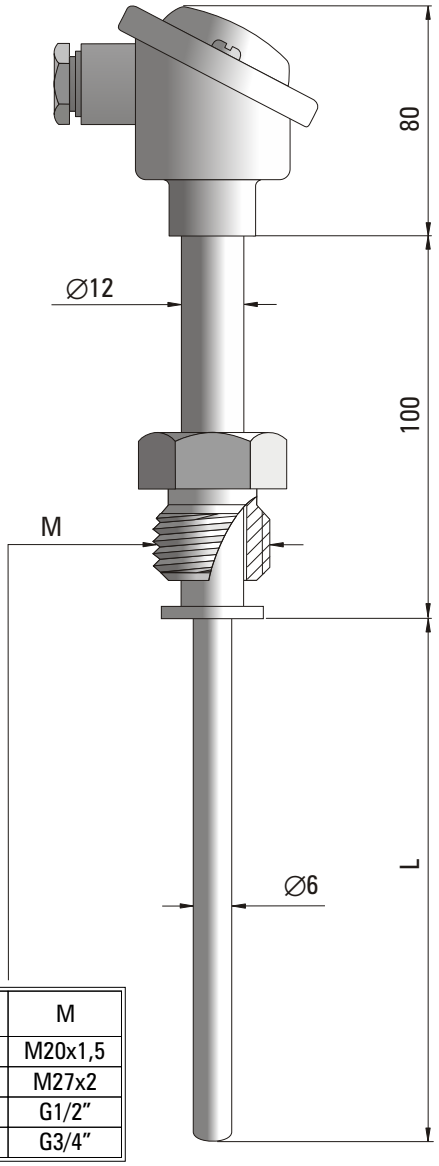
TEMPERATURE SENSOR

type 531, 532, 533, 534

SPECIFICATION

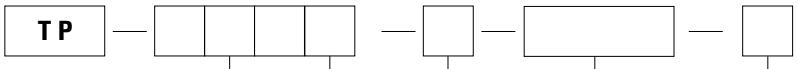
Temperature range	–40°C...+550°C	**(Pt100)**
	–40°C...+800°C	**(J)**
	–40°C...+1100°C	**(K)**
	–40°C...+1250°C	**(N)**
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
	thermocouple NiCrSi-NiSi	**(N)**
Class of processing element	2 (B)[2]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated[2]	
Sheath material ∅6	steel 1.4541 (Pt100)	
	Inconel (J, K) Nicrobell (N)	
Maximum operating pressure	1,6 MPa	
Roughness of sheath surface	$R_a < 0,8\ \mu m$ [2]	
Connection head type	B[3]	
Head operating temperature	–40°C ... +100°C	
Hexagon nut	movable with external thread	
	M20x1,5, M27x2, G1/2", G3/4"[4]	
Additional accessories	temperature transmitter	
	thermowell for welding	
	compensation cable	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand
[4] Other inch and metric threads on demand



Type	M
TP-531	M20x1,5
TP-532	M27x2
TP-533	G1/2"
TP-534	G3/4"

ORDERING CODE



Sensor type **531, 532, 533, 534**
Measuring element **Pt100, J, K** or **N**
Single (**1**) or double (**2**) measuring element
Sensor length L=**100, 200, 400, 600, 800** or **1000** mm[2]
Option with the head-mount transmitter **T**

Example for order: TP-533Pt100-1-200 sensor with single Pt100 resistor with mobile nut, external thread G1/2" and length L= 200 mm.

TP-533Pt100-1-200-T; TCH-2120-Pt100 sensor with the head-mount transmitter type TCH-2120-Pt100.

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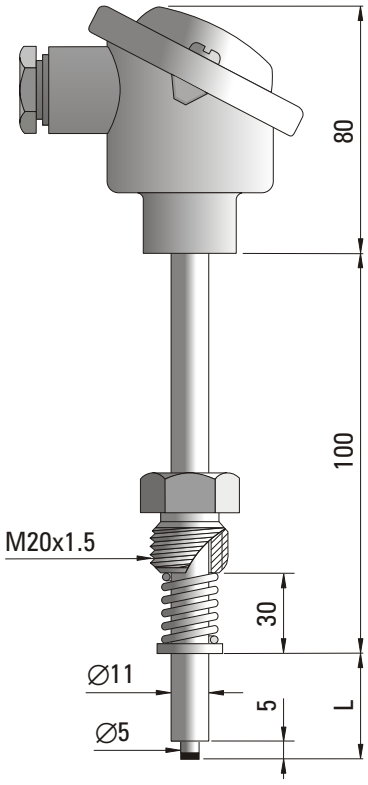
TEMPERATURE SENSOR

type 535

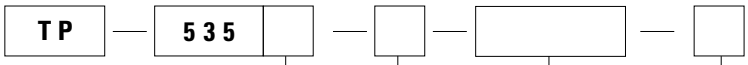
SPECIFICATION

Application	temperature measurment of surfaces of bearings, cylinders, bushes, receptacles
Temperature range	–40°C...+250°C
Measuring element	platinum resistor (**Pt100**)[1]
	thermocouple Cu-CuNi (**T**)
	thermocouple Fe-CuNi (**J**)
	thermocouple NiCr-NiAl (**K**)
Class of processing element	2 (B)[2]
Conductor material	wire Cu/Ni (for Pt100)
Assembly	2, 3 or 4 wires (for Pt100)
Measuring junction	grounded [2]
Sheath material	steel 1.4541
Connection head type	B[3]
Head operating temperature	–40°C...+100°C
Fitting	mobile with thread M20x1,5[4]
Additional accessories	temperature transmitter
	thermowell for welding
	compensation cable



[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand
[4] Other inch and metric threads on demand

ORDERING CODE



Measuring element **Pt100, T, J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L=**10 ... 500** mm
Option with the head-mount transmitter **T**

Example for order: TP-535Pt100-1-15 sensor with single Pt100 resistor of length L = 15 mm.
TP-535Pt100-1-15-T; TCHF-2120 sensor with head-mount transmitter type TCHF-2120.

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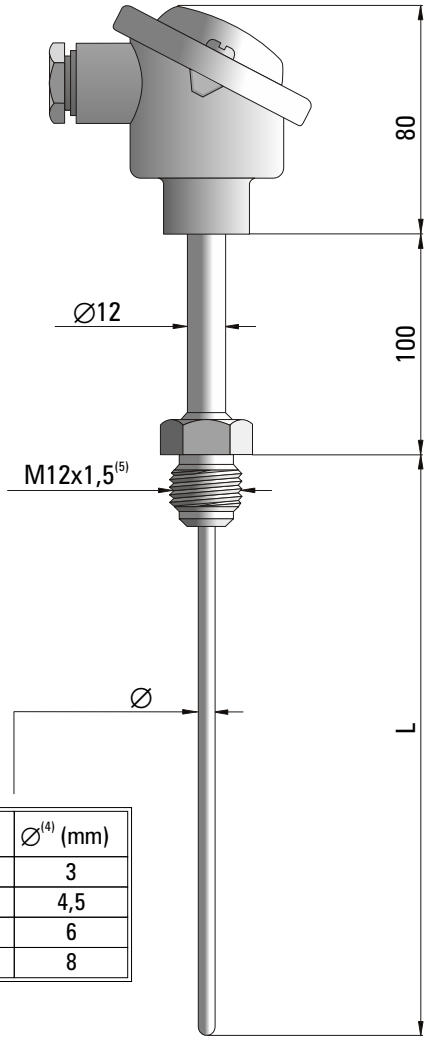
TEMPERATURE SENSOR

type 551, 552, 553, 554

SPECIFICATION

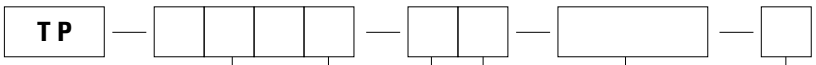
Temperature range	–40°C...+800°C	**(J)**
	–40°C...+1100°C	**(K)**
	–40°C...+1250°C	**(N)**
Sheathed thermocouple	Fe-CuNi	**(J)**[1]
	NiCr-NiAl	**(K)**
	NiCrSi-NiSi	**(N)**
Measuring junction	grounded	(type **a**)
	insulated	(type **b**)
	Exposed	(type **c**)
Class of thermocouple	1	
Sheath material	Inconel (J, K), Nicrobell (N)	
Maximum operating pressure	10 MPa	
Connecting head type	B[3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	temperature transmitter	
	thermowell for welding	
	compensation cable	



Type	∅[4] (mm)
TP-551	3
TP-552	4,5
TP-553	6
TP-554	8

[1] Pt100 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand
[4] Thermocouples of outer diameter ∅ = 1, 1,5 or 2 mm on demand
[5] Other inch and metric threads on demand

ORDERING CODE



Sensor type **551, 552, 553, 554**
Sheathed thermocouple **J, K** or **N**
Single (**1**) or double (**2**) thermocouple
Measuring junction **a**, **b** or **c**
Sensor length L=**100, 200, 400, 600, 800** or **1000** mm[2]
Option with the head-mount transmitter **T**

Example for order: TP-551K-1b-200 sensor with single sheathed thermocouple NiCr-NiAl (K) of outer diameter ∅ = 3 mm, measuring junction galvanically insulated from the sheath (type b) and length L = 200 mm.
TP-551K-1b-200-T; TCH-2140-K sensor with the head-mount transmitter type TCH-2140-K.

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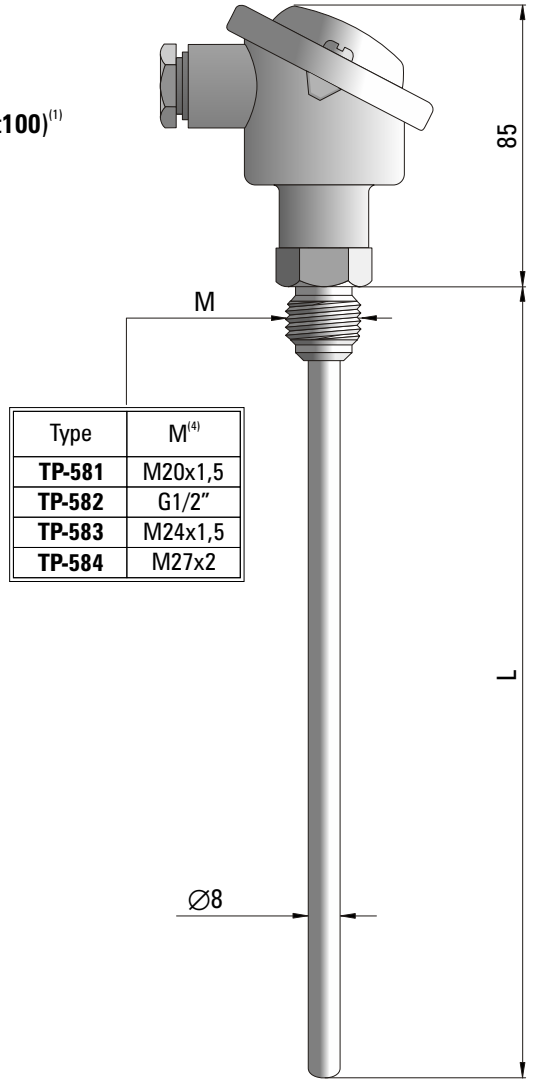
TEMPERATURE SENSOR

type 581, 582, 583, 584

SPECIFICATION

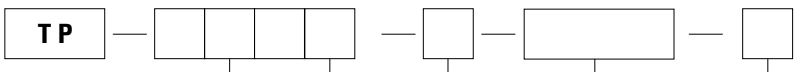
Temperature range	–40°C...+150°C	
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Conductor material	wire Cu/Ag (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated[2]	
Sheath material	steel 1.4541	
Outer sheath diameter	∅8mm[2]	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$ [2]	
Maximum operating pressure	1,6 MPa	
Connection head type	B[3]	
Head operating temperature	–40°C ... +100°C	
Additional accessories	temperature transmitter	
	thermowell for welding	
	compensation cable	



Type	M[4]
TP-581	M20x1,5
TP-582	G1/2"
TP-583	M24x1,5
TP-584	M27x2

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand
[4] Other inch and metric threads on demand

ORDERING CODE



Sensor type **581, 582, 583, 584**
Measuring element **Pt100, T, J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L=**100, 200, 400, 600, 800** or **1000** mm[2]
Option with the head-mount transmitter **T**

Example for order: TP-582Pt100-1-400 sensor with single Pt100 resistor with sheath of outer diameter ∅ = 8 mm and length L= 400 mm, welded stationary fitting with thread G 1/2".
TP-582Pt100-1-400; TCH-2120-Pt100 sensor with the head-mount transmitter type TCH-2120-Pt100.

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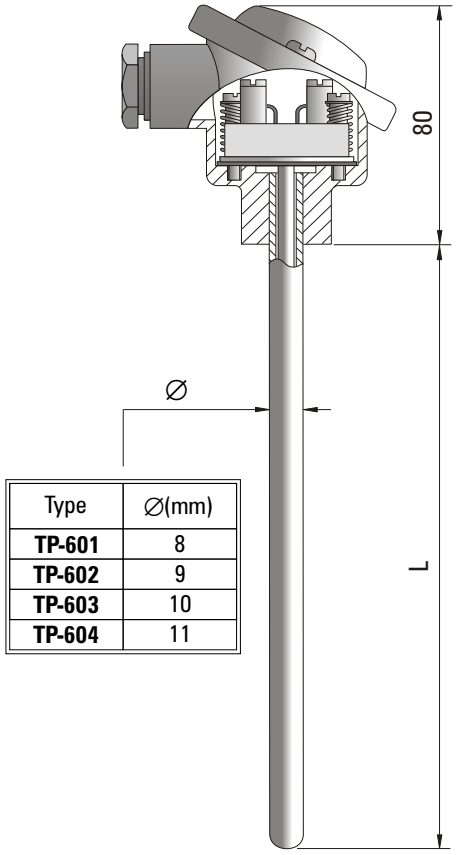
TEMPERATURE SENSOR

type 601, 602, 603, 604

SPECIFICATION

Temperature range	–40°C...+550°C	**(Pt100)**
	–40°C...+400°C	**(T)**
	–40°C...+600°C	**(J)**
	–40°C...+900°C	**(K)**
Measuring element - insert type TP-701	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated[2]	
Sheath material	steel 1.4541	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$ [2]	
Connecting head type	B or NA[3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	temperature transmitter	
	compression gland type **KP**	
	compensation cable	

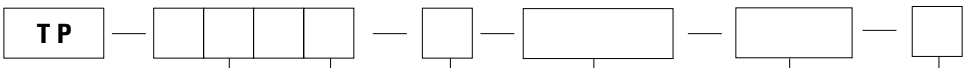


Type	∅(mm)
TP-601	8
TP-602	9
TP-603	10
TP-604	11

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand

Sensor length L (mm)	200	300	400	600	800	1000
Length of insert TP-701 (mm)	230	330	430	630	830	1030

ORDERING CODE



Sensor type **601, 602, 603, 604**
Measuring element **Pt100, T, J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L=**200, 300, 400, 600, 800** or **1000** mm[2]
Additional accessories: compression gland type **KPM12x1,5**, **KPM20x1,5** or **KPG1/2"**
Option with the head-mount transmitter **T**

Example for order: TP-601K-1-400 sensor (with measuring insert type TP-701K-1-430) with single thermocouple NiCr-NiAl (K) of outer diameter ∅ = 8 mm and length L = 400 mm.
TP-601K-1-400-T; TCH-2140-K sensor with the head-mount transmitter type TCH-2140-K.

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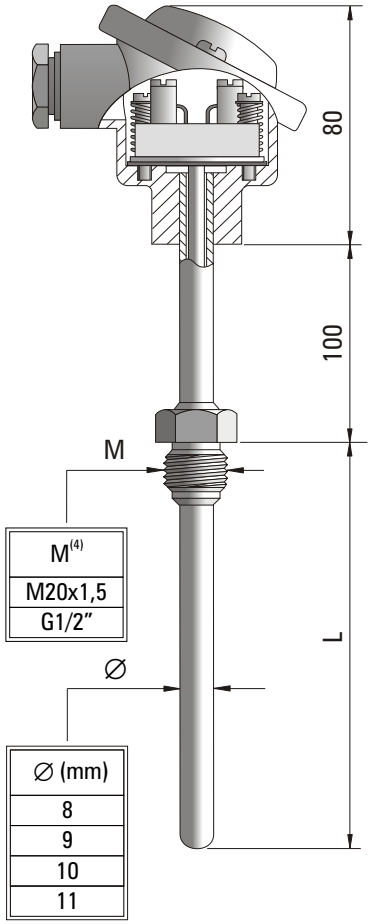
TEMPERATURE SENSOR
type 611, 612, 613, 614
type 621, 622, 623, 624

SPECIFICATION

Temperature range	–40°C...+550°C	**(Pt100)**
	–40°C...+400°C	**(T)**
	–40°C...+600°C	**(J)**
	–40°C...+900°C	**(K)**
Measuring element - insert type TP-701	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated[2]	
Sheath material	steel 1.4541	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$[2]	
Maximum operating pressure	see Sheath Operating Loads information	
Connection head type	B or NA[3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	temperature transmitter	
	thermowell for welding	
	compensation cable	



[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand
[4] Other inch and metric threads on demand

Sensor length L (mm)	100	200	300	400	600	800	1000
Length of insert TP-701 (mm)	230	330	430	530	730	930	1130

ORDERING CODE

T P	—	6				—		—		—	

Thread M20x1,5 (**1**) or G1/2" (**2**)
Outer diameter ∅8 (**1**), ∅9 (**2**), ∅10 (**3**), ∅11 (**4**)
Measuring element **Pt100, T, J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L = **100, 200, 300, 400, 600, 800** or **1000** mm[2]
Option with the head-mount transmitter **T**

Example for order: TP-611K-1-400 sensor (with measuring insert TP-701K-1-530) with single thermocouple NiCr-NiAl (K) of outer diameter ∅ = 8 mm and length L = 400 mm with thread M20x1,5.
TP-611K-1-400-T; TCH-2140-K sensor with the head-mount transmitter type TCH-2140-K.

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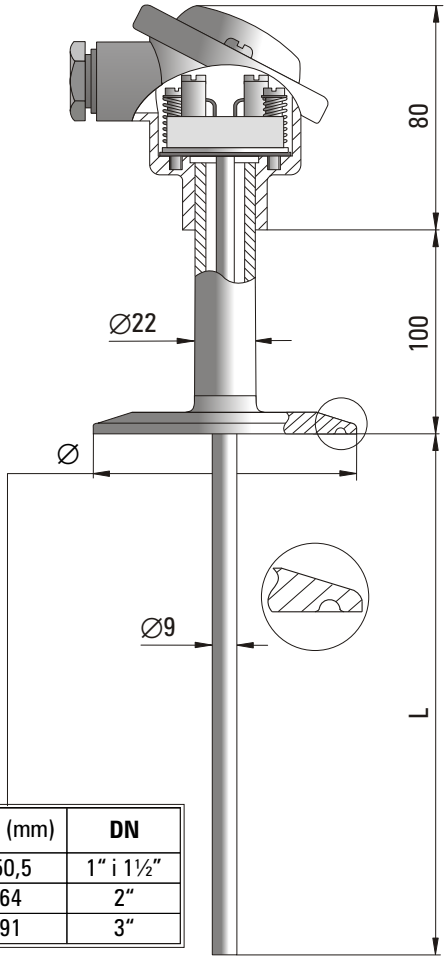
TEMPERATURE SENSOR

type 631, 632, 633

SPECIFICATION

Application	temperature measurment in **pharmaceutical and food industry**. The sensor is equipped with a special hygenic leak-proof joint.
Temperature range	0°C...+150°C
Measuring element - insert type TP-701	platinum resistor **(Pt100)**[1]
Assembly	2, 3 or 4 wires
Class of processing element	B[2]
Sheath material	steel 1.4541[2]
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$[2]
Connecting head type	B or NA[3]
Head operating temperature	–40°C...+100°C
Fitting	acc. ISO 2852
Maximum operating pressure	1,6 MPa
Additional accessories	temperature transmitter silicone sealing ring clamp

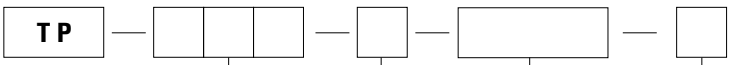
[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand



Type	∅ (mm)	DN
TP-631	50,5	1" i 1½"
TP-632	64	2"
TP-633	91	3"

Sensor length L (mm)	50	100	200
Length of insert TP-701 (mm)	180	230	330

ORDERING CODE



Sensor type **631, 632, 633**
Single (**1**) or double (**2**) measuring element
Sensor length L=**50, 100** or **200** mm[2]
Option with the head-mount transmitter **T**

Example for order: TP-632-1-200 sensor with single Pt100 resistor (with measuring insert type TP-701Pt100-1-330) with flange of outer diameter ∅ = 64 mm and length L = 200 mm.
TP-632-1-200-T; TCH-2120-Pt100 sensor with the head-mount transmitter type TCH-2120-Pt100.

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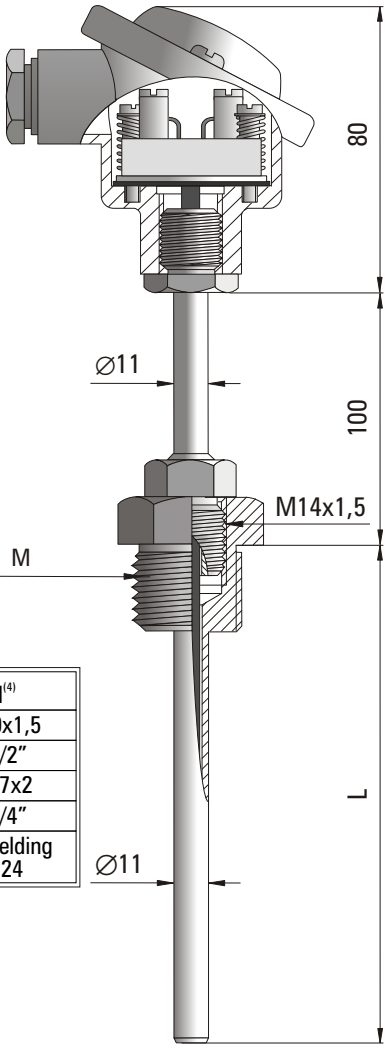
TEMPERATURE SENSOR

type 641, 642, 643, 644, 645



SPECIFICATIONS

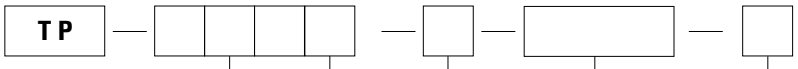
Application	sensor with replaceable measuring insert for temperature measurment in industrial pipelines and receptacles under pressure	
Temperature range	–40°C...+550°C	**(Pt100)**
	–40°C...+400°C	**(T)**
	–40°C...+600°C	**(J)**
	–40°C...+900°C	**(K)**
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated[2]	
Sheath material	steel 1.4541	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$[2]	
Maximum operating pressure	see Sheath Operating Loads information	
Connecting head type	B or NA[3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	temperature transmitter	
	thermowell for welding	
	compensation cable	

Type	M[4]
TP-641	M20x1,5
TP-642	G1/2"
TP-643	M27x2
TP-644	G3/4"
TP-645	for welding ∅24

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand
[4] Other lengths, diameters, inch and metric threads on demand

Sensor length L (mm)	50	100	200	300	400	600	800	1000
Length of insert TP-701 (mm)	180	230	330	430	530	730	930	1130

ORDERING CODE



Sensor type **641, 642, 643, 644, 645**
Measuring element **Pt100, T, J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L=**50, 100, 200, 300, 400, 600, 800** or **1000** mm[2]
Option with the head-mount transmitter **T**

Example for order: TP-641Pt100-1-50 sensor with single Pt100 resistor (with measuring insert type TP-701Pt100-1-180), sheath outer diameter ∅11 mm and length L= 50 mm with thread M20x1,5.
TP-641Pt100-1-50-T; TCHF-2120 sensor with the head-mount transmitter type TCHF-2120.

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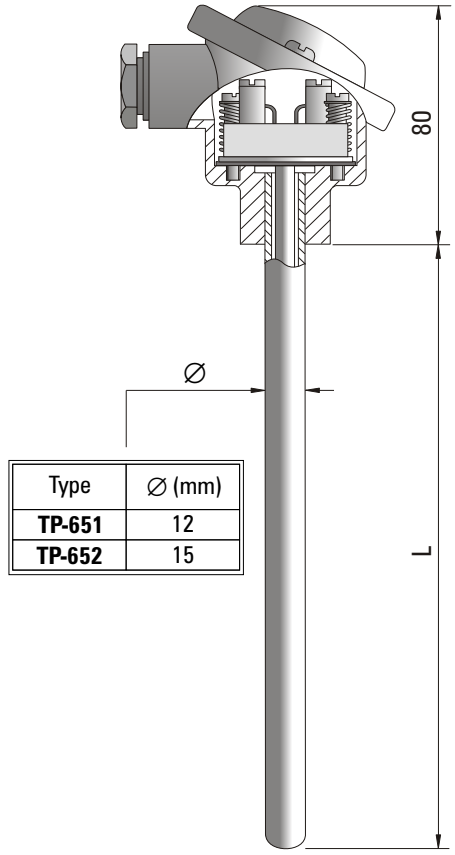
TEMPERATURE SENSOR

type 651, 652

SPECIFICATION

Temperature range	–40°C...+550°C	**(Pt100)**
	–40°C...+400°C	**(T)**
	–40°C...+600°C	**(J)**
	–40°C...+900°C	**(K)**
Measuring element - insert type TP-702	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated[2]	
Sheath material	steel 1.4541	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$[2]	
Connection head type	B or NA[3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	temperature transmitter	
	compression gland type **KP**	
	clamping plate type **UZ**	
	compensation cable	



Type	∅ (mm)
TP-651	12
TP-652	15

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand

Sensor length L (mm)	200	300	400	600	800	1000
Length of insert TP-702 (mm)	230	330	430	630	830	1030

ORDERING CODE

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Sensor type **651, 652**
Measuring element **Pt100, T, J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L=**200, 300, 400, 600, 800** or **1000** mm[2]
Additional accessories: compression gland type **KP** or clamping plate **UZ**
Option with the head-mount transmitter **T**

Exemple for order: TP-651K-1-400 sensor with single thermocouple NiCr-NiAl (K) (with measuring insert TP-702K-1-430), sheath outer diameter ∅ = 12 mm and length L = 400 mm.
TP-651K-1-400-T; TCH-2140-K sensor with the head-mount transmitter type TCH-2140-K.

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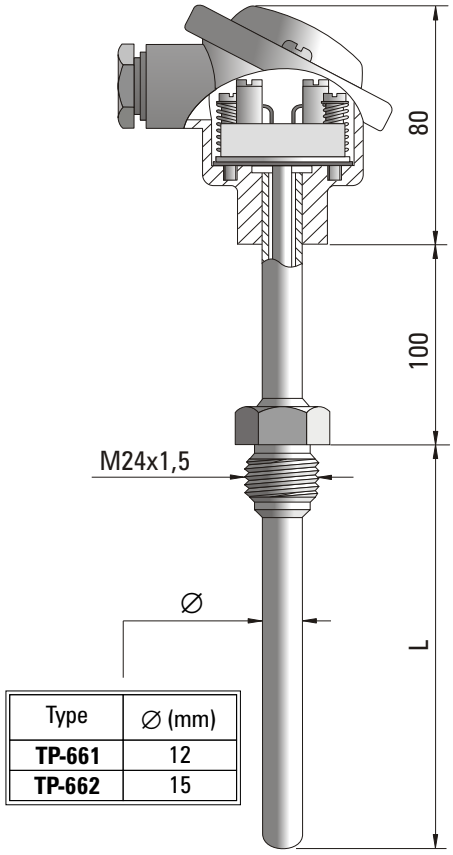
TEMPERATURE SENSOR

type 661, 662

SPECIFICATION

Temperature range	–40°C...+550°C	**(Pt100)**
	–40°C...+400°C	**(T)**
	–40°C...+600°C	**(J)**
	–40°C...+900°C	**(K)**
Measuring element - insert type TP-702	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated[2]	
Sheath material	steel 1.4541	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$[2]	
Maximum operating pressure	see Sheath Operating Loads information	
Connection head type	B or NA[3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	temperature transmitter	
	thermowell for welding	
	compensation cable	

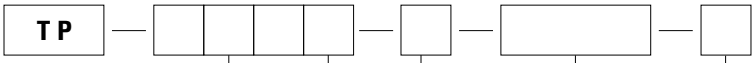


Type	∅ (mm)
TP-661	12
TP-662	15

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand
[4] Other inch and metric threads on demand

Sensor length L (mm)	100	200	300	400	600	800	1000
Length of insert TP-702 (mm)	230	330	430	530	730	930	1130

ORDERING CODE



Sensor type **661, 662**
Measuring element **Pt100, T, J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L = **100, 200, 300, 400, 600, 800** or **1000** mm[2]
Option with the head-mount transmitter **T**

Example for order: TP-661K-1-400 sensor with single thermocouple NiCr-NiAl (K) (with measuring insert type TP-702K-1-530), sheath of outer diameter ∅ = 12 mm and length L = 400 mm with thread M24x1,5.
TP-661K-1-400-T; TCH-2140-K sensor with the head-mount transmitter type TCH-2140-K.

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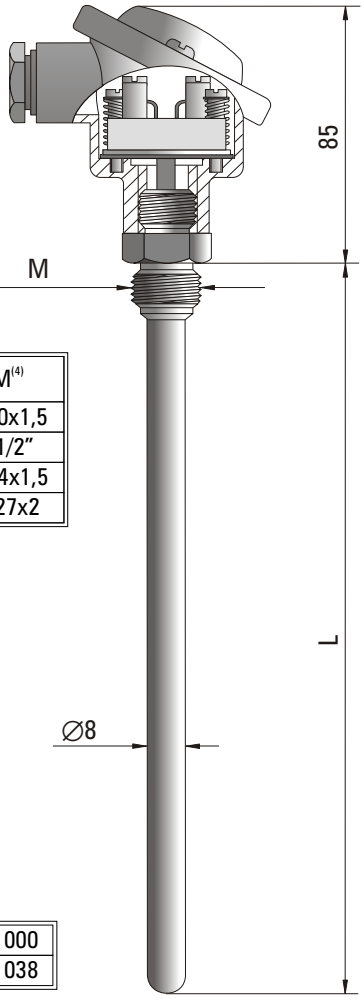
TEMPERATURE SENSOR

type 681, 682, 683, 684

SPECIFICATION

Temperature range	–40°C...+150°C	
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Conductor material	wire Cu/Ag (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated[2]	
Sheath material	steel 1.4541	
Roughness of sheath surface	$R_a < 0,8\ \mu m$[2]	
Maximum operating pressure	1,6 MPa	
Connecting head type	B or NA[3]	
Head operating temperature	–40°C ... +100°C	
Additional accessories	temperature transmitter	
	thermowell for welding	
	compensation cable	

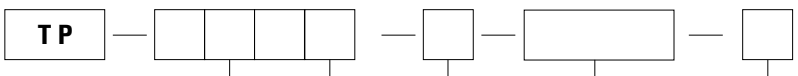


Type	M[4]
TP-681	M20x1,5
TP-682	G1/2"
TP-683	M24x1,5
TP-684	M27x2

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand
[4] Other inch and metric threads on demand

Sensor length L (mm)	50	100	200	300	400	600	800	1000
Length of insert TP-701 (mm)	88	138	238	338	438	638	838	1038

ORDERING CODE



Sensor type **681, 682, 683, 684**
Measuring element **Pt100, T, J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L=**50, 100, 200, 300, 400, 600, 800** or **1000** mm[2]
Option with the head-mount transmitter **T**

Example for order: TP-681Pt100-1-400 sensor with single Pt100 resistor (with measuring insert type TP-701Pt100-1-438), sheath of outer diameter ∅ = 8 mm and length L = 400 mm with thread M20x1,5.
TP-681Pt100-1-400-T; TCH-2120-Pt100 sensor with the head-mount transmitter type TCH-2120-Pt100.

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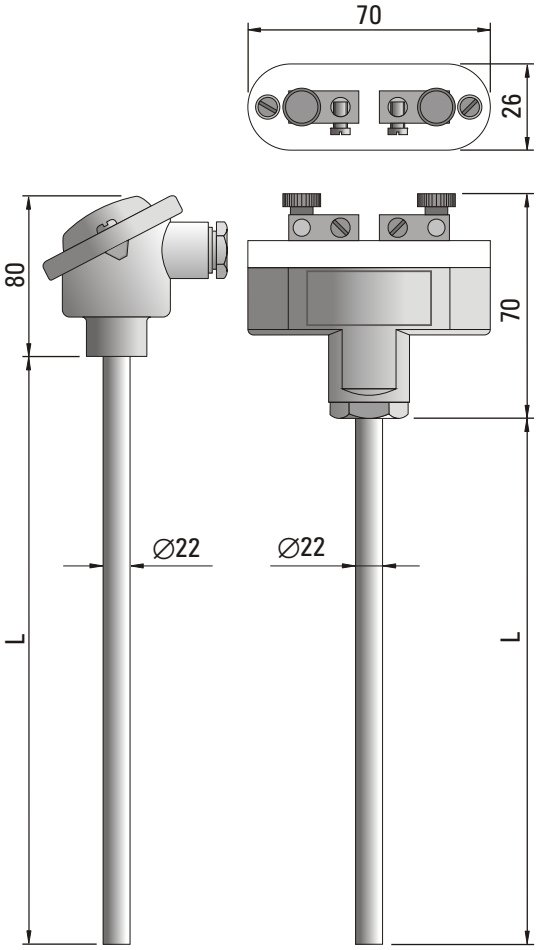
TEMPERATURE SENSOR

type 691, 692

SPECIFICATION

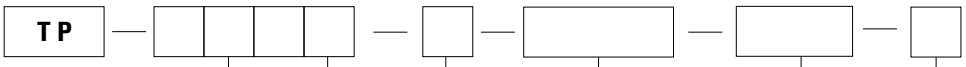
Temperature range	–40°C...+700°C	**(J)**
	–40°C...+1100°C	**(K)**
Measuring element	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2[1]	
Measuring junction	insulated[1]	
Sheath material	heat-resistant steel 1.4749[2]	
Outer sheath diameter	∅22 mm	
Connection head type	B or DA[3], oval opened	
Head operating temperature	–40°C...+100°C	
Additional accessories	temperature transmitter	
	clamping plate type **UZ**	
	compensation cable	

[1] Other parameters according to customer requirements
[2] Sheath made of steel 1.4762 on demand
[3] Connection head with protection class IP65 or acid resitant on demand



type 691 **type 692**

ORDERING CODE



Sensor type **691, 692**
Measuring element **J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L=**400, 600, 800, 1000, 1200, 1600** or **2000** mm[1]
Additional accessories: clamping plate type **UZ-22**
Option with the head-mount transmitter **T**

Example for order: TP-691K-1-800 sensor with single thermocouple NiCr-NiAl (K) of outer diameter ∅ = 22 mm and length L = 800 mm.
TP-691K-1-800-T; TCH-2170-K sensor with the head-mount transmitter type TCH-2170-K.

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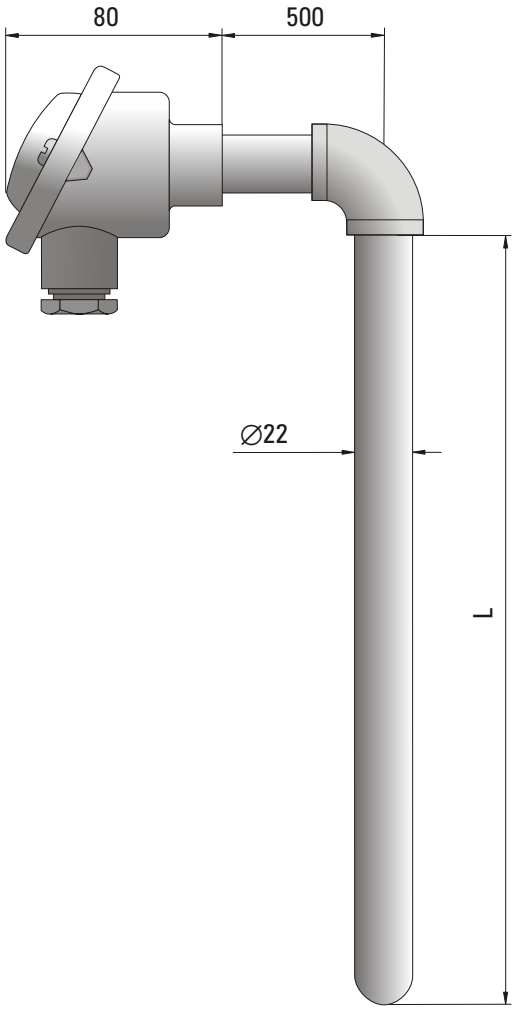
TEMPERATURE SENSOR

type 695

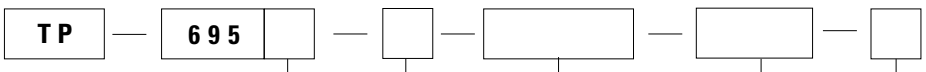
SPECIFICATION

Temperature range	–40°C...+700°C	**(J)**
	–40°C...+1100°C	**(K)**
Measuring element	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2[1]	
Measuring junction	insulated[1]	
Sheath material	heat-resistant steel 1.4749[3]	
Connecting head type	B or DA[2]	
Head operating temperature	–40°C...+100°C	
Additional accessories	temperature transmitter	
	clamping plate type **UZ**	
	compensation cable	



[1] Other parameters according to customer requirements
[2] Connection head with protection class IP65 or acid resitant on demand
[3] Sheath made of steel 1.4762 on demand
[4] Sheath with a diameter of 20 mm on demand

ORDERING CODE



Measuring element **J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L=**400, 600, 800, 1000, 1200, 1600** or **2000** mm[1]
Additional accessories: clamping plate type **UZ-22**
Option with the head-mount transmitter **T**

Example for order: TP-695K-1-800 sensor with single thermocouple NiCr-NiAl (K) of outer diameter ∅ = 22 mm and length L = 800 mm.
TP-695K-1-800-T; TCH-2170-K sensor with the head-mount thansmitter type TCH-2170-K.

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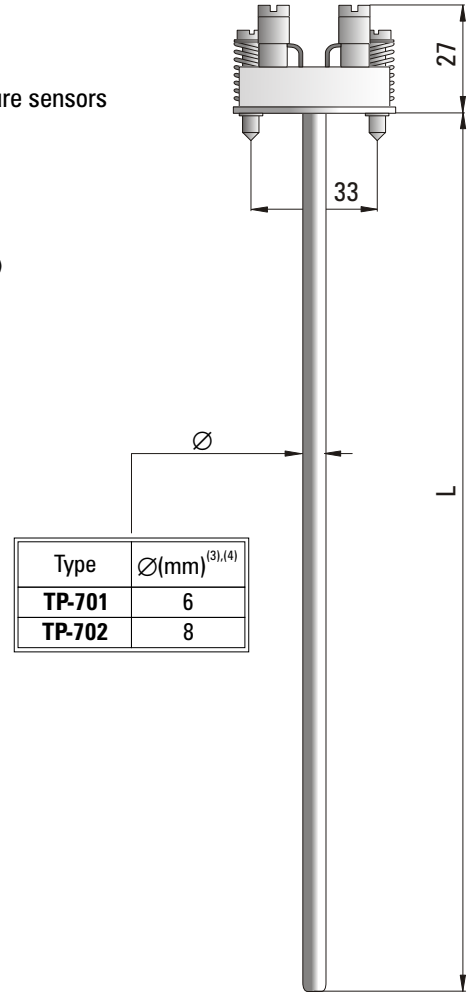
TEMPERATURE SENSOR

type 701, 702

SPECIFICATION

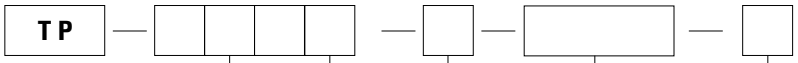
Application	replaceable measuring insert for temperature sensors	
Temperature range	–40°C...+550°C	**(Pt100)**
	–40°C...+400°C	**(T)**
	–40°C...+600°C	**(J)**
	–40°C...+900°C	**(K)**
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated[2]	
Sheath material	steel 1.4541	
Additional accessories	temperature transmitter	
	compensation cable	



Type	∅(mm)[3],[4]
TP-701	6
TP-702	8

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Sheathed thermocouples ∅ = 1.5, 2, 3, 4.5, 6, 8 mm on demand
[4] Mineral insulated cable for Pt100 ∅ = 3, 5, 6 mm on demand

ORDERING CODE



Sensor type **701, 702**
Measuring element **Pt100, T, J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L=**80, 130, 230, 330, 430, 530, 630, 730, 830, 930, 1030** or **1130** mm[2]
Option with the head-mount transmitter **T**

Example for order: TP-701K-1-430 sensor with single thermocouple NiCr-NiAl (K) of outer diameter ∅ = 6 mm and length L = 430 mm.
TP-701K-1-430-T; TCH-2140-K sensor with the head-mount transmitter type TCH-2140-K.

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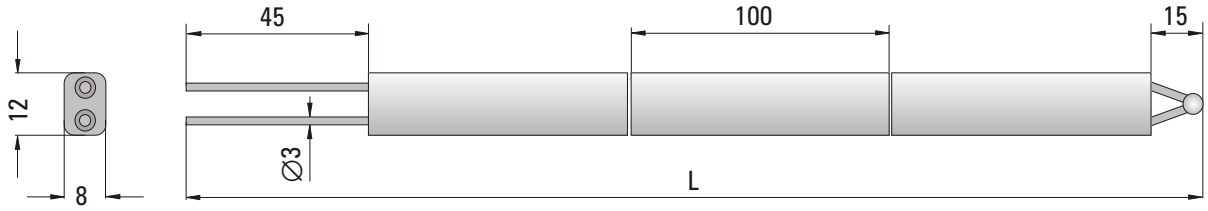
TEMPERATURE SENSOR

type 711



DSPECIFICATION

Application	temperature measurment in chamber furnaces
Temperature range	0°C...+1200°C
Measuring element	NiCr-NiAl **(K)**[1]
Class of thermocouple	2[2]
Sheath material	ceramic C610 ($Al_2O_3$60%)
Additional accessories	compensation cable

[1] Thermocouple Fe-CuNi (J) on demand
[2] Other parameters according to customer requirements
[3] Other dimensions of thermocouple wires and isolators on demand

ORDERING CODE

TP	—	711	K	—	

Sensor length L=**160, 260, 360, 460, 560, 660, 860, 1060, 1560** or **2060** mm[3]

Example for order: TP-711K-1060 sensor with thermocouple NiCr-NiAl (K) and length L = 1060 mm.

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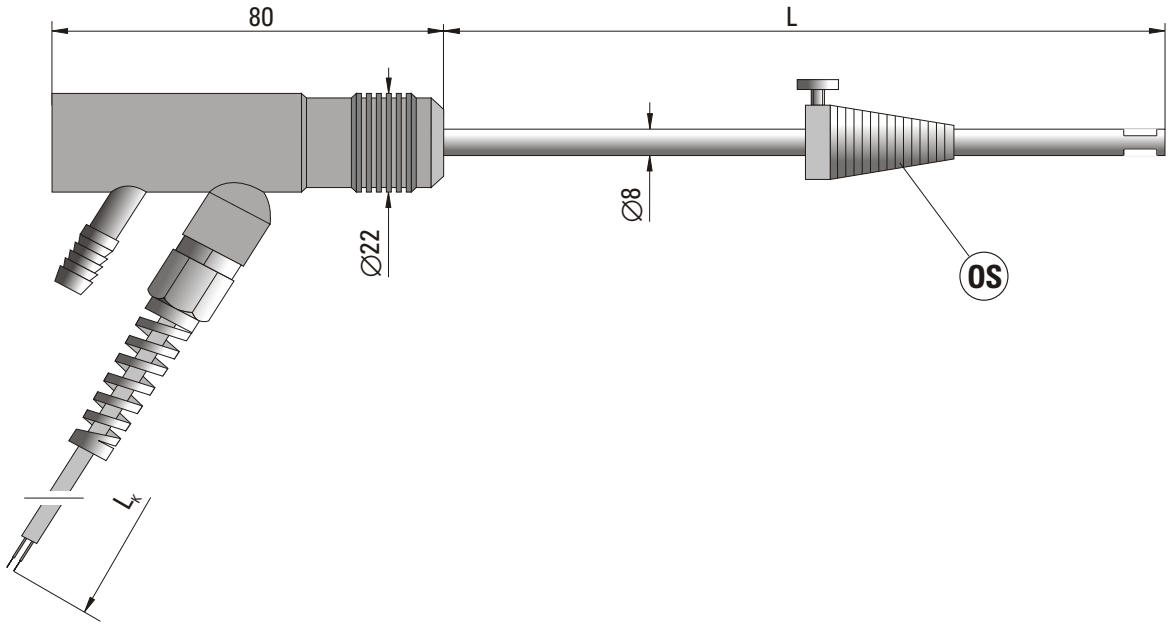
TEMPERATURE SENSOR

type 791

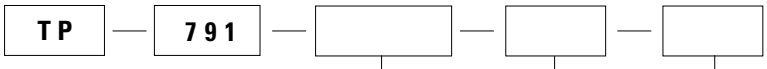


SPECIFICATION

Application	temperature measurment of exhaust gas, for use with the gas analyzers
Temperature range	0°C...+1000°C
Measuring element	NiCr-NiAl **(K)**
Class of thermocouple	1
Measuring junction	insulated
Handle and cable operating temperature	–20°C...+80°C
Sheath material	steel 1.4541
Sensor length L	300, 500 or 700 mm[(1)]
Length of compensation cable L_K	2, 3 or 4 m[(1)]
Additional accessories	conical limiter for sensor immersion depth type **OS**

[(1)] Other parameters according to customer requirements

ORDERING CODE



Sensor length L = **300, 500** or **700** mm[(1)]
Length of compensation cable L_K = **2, 3** or **4** m[(1)]
Additional accessories: conical limiter for sensor immersion depth type **OS**

Example for order: TP-791-300-3 sensor of length L = 300 mm with compensation cable of length L_K = 3 m.
TP-791-700-4-OS sensor of length L = 700 mm with compensation cable of length L_K = 4 m and with conical limiter type OS.

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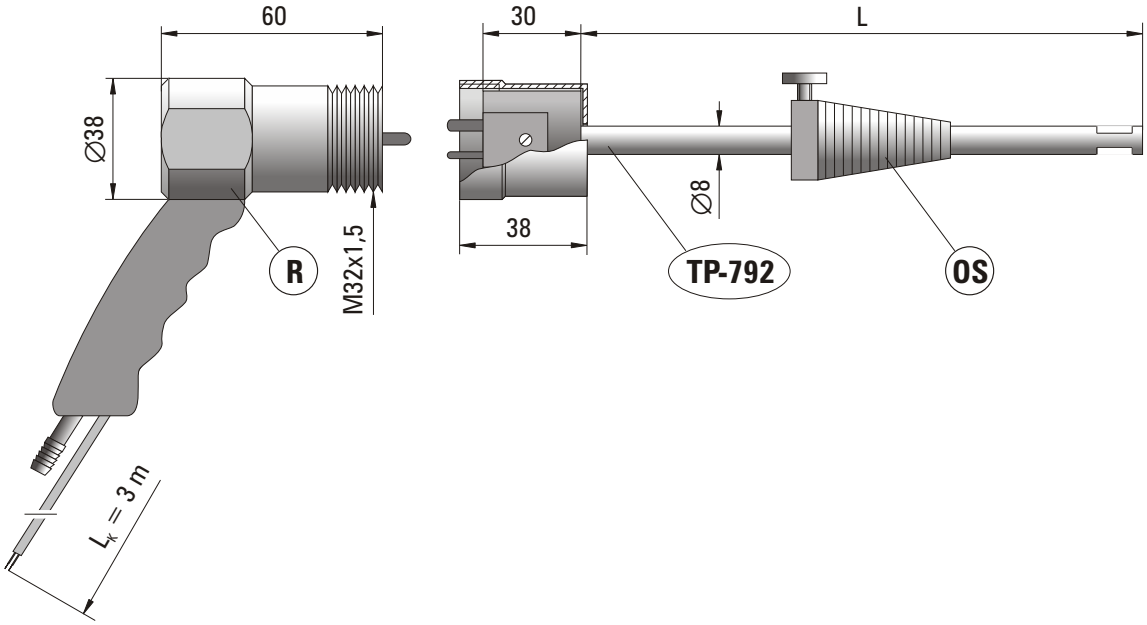
TEMPERATURE SENSOR

type 792

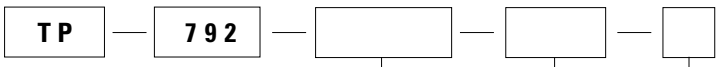


SPECIFICATION

Application	temperature measurment of exhaust gas, for use with the gas analyzers
Temperature range	0°C...+1000°C
Measuring element	NiCr-NiAl **(K)**
Class of thermocouple	1
Measuring junction	insulated
Handle and cable operating temperature	–20°C...+80°C
Sheath material	steel 1.4541
Sensor length L	500, 700, 1000 or 1500 mm[(1)]
Additional accessories	sensor handle type **R**
	conical limiter for sensor immersion length type **OS**

[(1)] Other parameters according to customer requirements

ORDERING CODE



Sensor length L = **500, 700, 1000** or **1500** mm[(1)]
Additional accessories: conical limiter for sensor's immersion depth type **OS**
sensor handle type **R**

Example for order:
TP-792-1500 sensor of length L = 1500 mm.
TP-792-700-OS sensor of length L = 700 mm with conical limiter type OS.
TP-792-700-OS-R sensor of length L=700 mm with conical limiter type OS, handle type R and compensation cable of length L_k =3 m.

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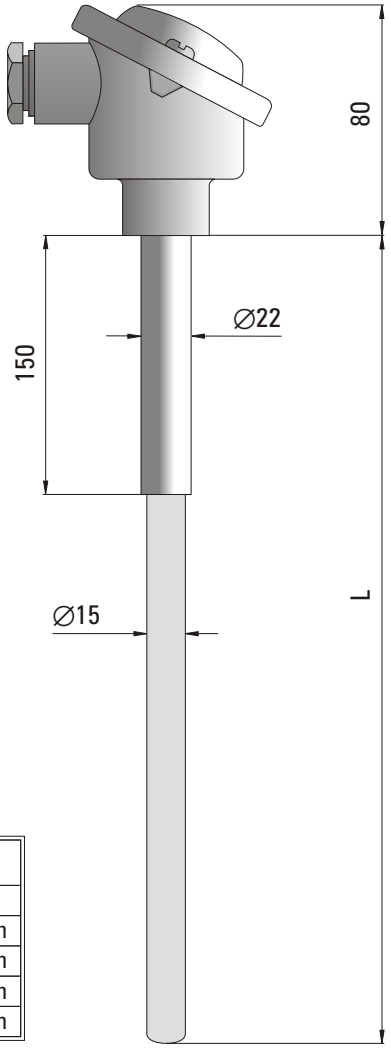
TEMPERATURE SENSOR

type 801, 802, 803, 804, 805

DSPECIFICATION

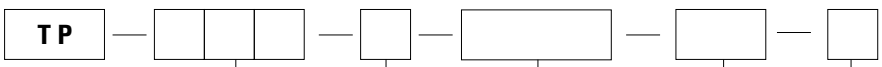
Measuring element	NiCr-NiAl	**(K)**[1]
	PtRh90/10%-Pt	**(S)**
	PtRh70/30%-PtRh94/6%	**(B)**
Class of thermocouple	2[2]	
Spacer diameter	∅22 mm	
Ceramic sheath diameter	∅15 mm	
Sheath material	ceramic C610 ($Al_2O_3$60%)	
	ceramic C799 ($Al_2O_3$99,7%)	
Connection head type	B or NA[3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	clamping plate type **UZ**	
	temperature transmitter	
	compensation cable	



[1] Thermocouple PtRh87/13%-Pt (R) or NiCrSi-NiSi (N) on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand

Sensor type	Sheath material	Max. temperature (°C)	Type of thermocouple	
TP-801	ceramic C610	1200	NiCr-NiAl	
TP-802	ceramic C610	1300	PtRh90/10%-Pt	0,35 mm
TP-803	ceramic C610	1400	PtRh90/10%-Pt	0,50 mm
TP-804	ceramic C799	1500	PtRh90/10%-Pt	0,50 mm
TP-805	ceramic C799	1600	PtRh70/30%-PtRh94/6%	0,50 mm

ORDERING CODE



Sensor type **801, 802, 803, 804, 805**
Single (**1**) or double (**2**) measuring element
Sensor length L=**300, 500, 700 ,1000** or **1400** mm[2]
Additional accessories: clamping plate type **UZ-22**
Option with the head-mount transmitter **T**

Example for order: TP-801-1-500 sensor with thermocouple NiCr-NiAl (K) in ceramic sheath C610 of outer diameter ∅ = 15 mm and length L= 500 mm.
TP-801-1-500-T; TCH-2170-K sensor with the head-mount transmitter type TCH-2170-K.

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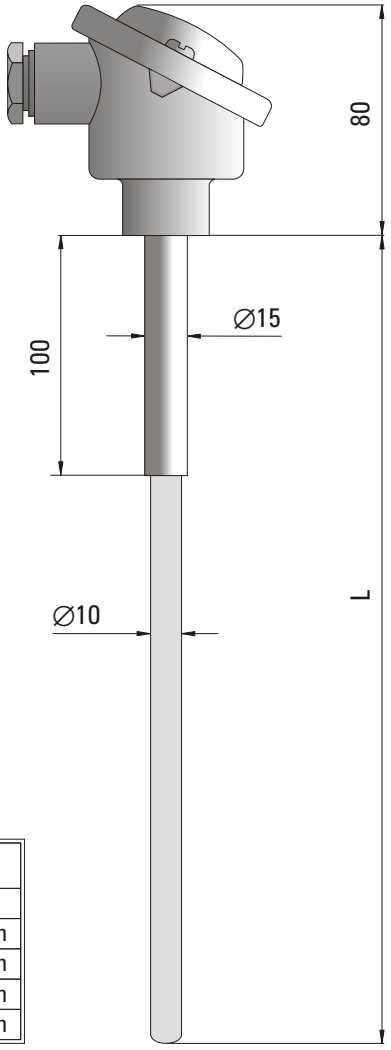
TEMPERATURE SENSOR

type 811, 812, 813, 814, 815

SPECIFICATIONS

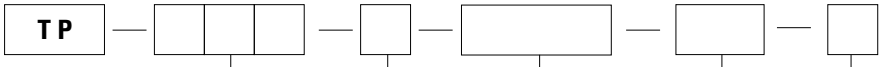
Measuring element	NiCr-NiAl	**(K)**[1]
	PtRh90/10%-Pt	**(S)**
	PtRh70/30%-PtRh94/6%	**(B)**
Class of thermocouple	2[2]	
Spacer diameter	∅15 mm	
Ceramic sheath diameter	∅10 mm	
Sheath material	ceramic C610 ($Al_2O_3$60%)	
	ceramic C799 ($Al_2O_3$99,7%)	
Connection head type	B or NA[3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	clamping plate type **UZ**	
	temperature transmitter	
	compensation cable	



[1] Thermocouple PtRh87/13%-Pt (R) or NiCrSi-NiSi (N) on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand

Sensor type	Sheath material	Max. temperature(°C)	Type of thermocouple	
TP-811	ceramic C610	1200	NiCr-NiAl	
TP-812	ceramic C610	1300	PtRh90/10%-Pt	0,35 mm
TP-813	ceramic C610	1400	PtRh90/10%-Pt	0,50 mm
TP-814	ceramic C799	1500	PtRh90/10%-Pt	0,50 mm
TP-815	ceramic C799	1600	PtRh70/30%-PtRh94/6%	0,50 mm

ORDERING CODE



Sensor type **811, 812, 813, 814, 815**
Single (**1**) or double (**2**) measuring element
Sensor length L=**300, 500** or **700** mm[2]
Additional accessories: clamping plate type **UZ-15**
Option with the head-mount transmitter **T**

Example for order: TP-811-1-500 sensor with thermocouple NiCr-NiAl (K) in ceramic sheath C610 of outer diameter ∅ = 10 mm and length L= 500 mm.
TP-811-1-500-T; TCH-2170-K sensor with the head-mount transmitter type TCH-2170-K.

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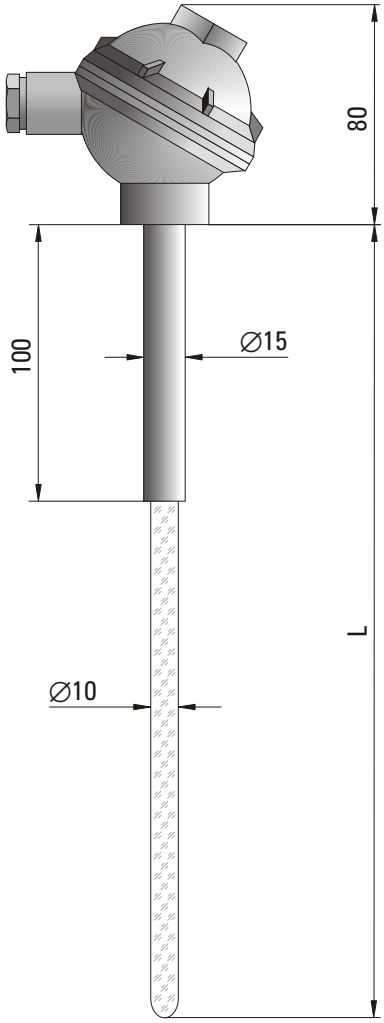
TEMPERATURE SENSOR

type 816

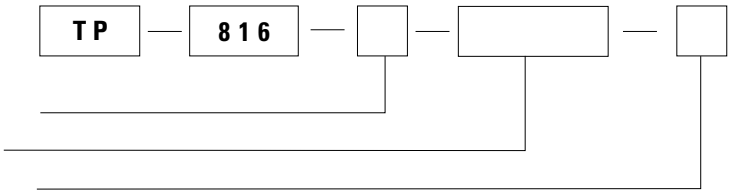
SPECIFICATION

Application	temperature measurment in **strongly caustic and aggressive** environments e.g. in alkali, salt, organic and mineral acids **with the exception of phosphoric and hydrofluoric acids**
Temperature range	0°C...+500°C
Measuring element	platinum resistor **(Pt100)**[1]
Class of processing element	B[2]
Conductor material	wire Cu/Ni
Assembly	2, 3 or 4 wires
Spacer diameter	∅15 mm
Glass sheath diameter	∅10 mm
Sensor length L	300, 500, 700 mm[2]
Connection head type	NS
Connection head material	plastics NORYL[3]
Sheath material	**glass SiO_2 99,98%**
Spacer material	plastics ERTALON
Head and spacer operating temperature	–40°C...+100°C
Additional accessories	temperature transmitter



[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Acid resitant connection head on demand

ORDERING CODE



Single (**1**) or double (**2**) measuring element
Sensor length L=**300, 500** or **700** mm[2]
Option with the head-mount transmitter **T**

Example for order: TP-816-1-300 sensor with single Pt100 resistor in glass sheath of outer diameter ∅=10 mm and length L = 300 mm.
TP-816-1-300-T; TCH-2120-Pt100 sensor with the head-mount transmitter type TCH-2120-Pt100.

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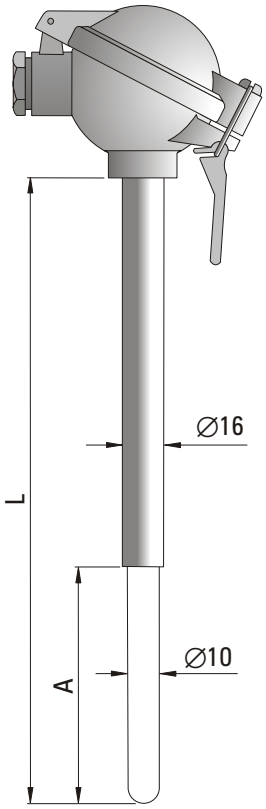
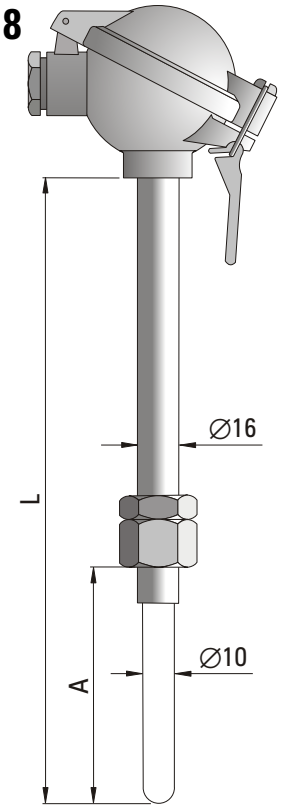
TEMPERATURE SENSOR

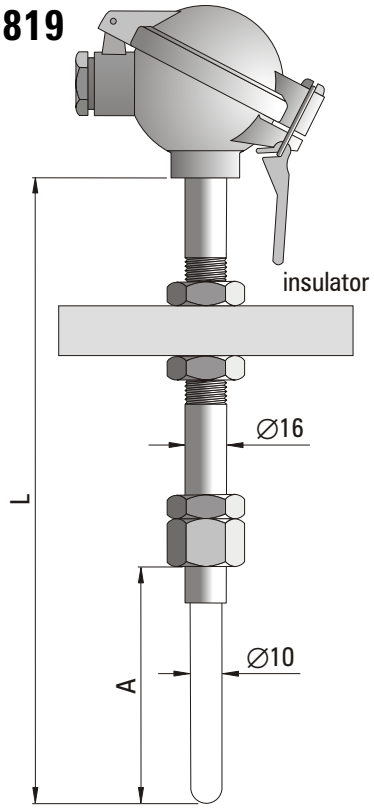
type 817



type 818



type 819

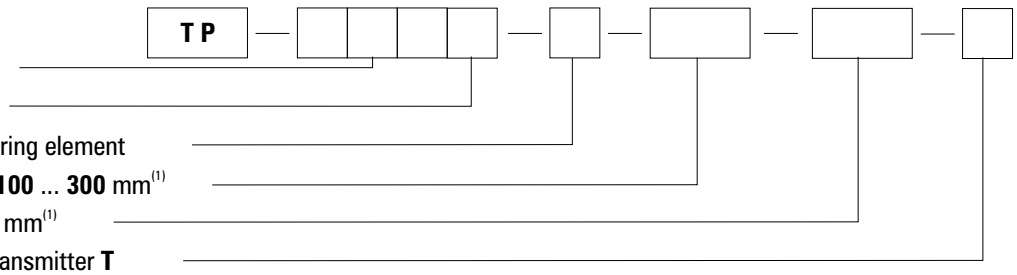


SPECIFICATION

Application	measurment of very high temperatures in difficult or severe industrial conditions. Construction of the sensor type TP-818 and TP-819 allows the installation of an external platinum-rhodium protection tube over the ceramic pipe. These sensors are designed mainly for temperature measurment in furnaces for glass heat treatment.		
Measuring element	PtRh90/10%-Pt	**(S)**	∅0,5 mm
	PtRh70/30%-PtRh94/6%	**(B)**	∅0,5 mm
Temperature range	600°C...+1600°C		
Class of thermocouple	2[1]		
Outer sheath	ceramic C799		∅10 mm[1]
Spacer material	steel 1.4541		∅16 mm[1]
Connection head type	NA[2]		
Head operating temperature	–40°C...+100°C		
Additional accessories	temperature transmitter compensation cable		

[1] Other parameters according to customer requirements
[2] Connection head with protection class IP65 or acid resitant on demand

ORDERING CODE



Example for order: TP-818S-1-250-1000 sensor with thermocouple PtRh-Pt (S) with ceramic sheath of length A=250 mm and sensor length L = 1000 mm.

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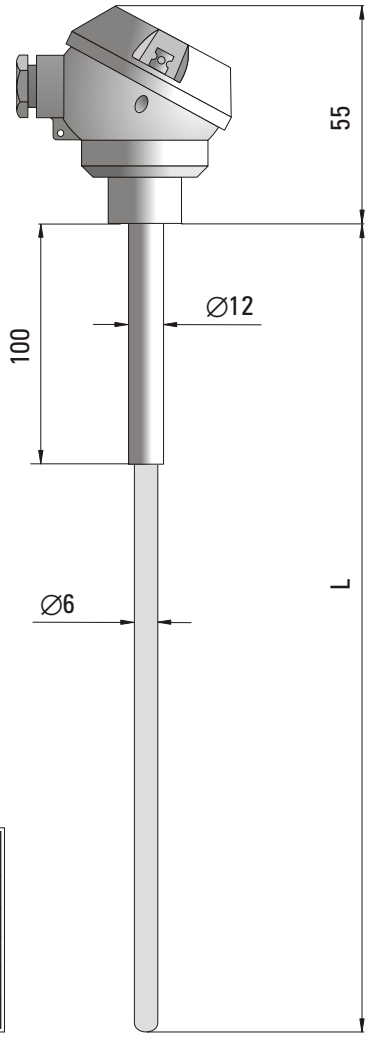
TEMPERATURE SENSOR

type 821, 822, 823, 824, 825

SPECIFICATION

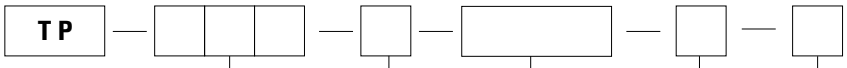
Measuring element	NiCr-NiAl	**(K)**[1]
	PtRh90/10%-Pt	**(S)**
	PtRh70/30%-PtRh94/6%	**(B)**
Class of thermocouple	2[2]	
Spacer diameter	∅12 mm	
Ceramic sheath diameter	∅6 mm	
Sheath material	ceramic C610 ($Al_2O_3$60%)	
	ceramic C799 ($Al_2O_3$99,7%)	
Connection head type	MA or B [3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	compression gland type **KP**	
	temperature transmitter	
	compensation cable	



[1] Thermocouple PtRh87/13%-Pt (R) or NiCrSi-NiSi (N) on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand

Sensor type	Sheath material	Max. temperature (°C)	Type of thermocouple	
TP-821	ceramic C610	1200	NiCr-NiAl	
TP-822	ceramic C610	1300	PtRh90/10%-Pt	0,35 mm
TP-823	ceramic C610	1400	PtRh90/10%-Pt	0,50 mm
TP-824	ceramic C799	1500	PtRh90/10%-Pt	0,50 mm
TP-825	ceramic C799	1600	PtRh70/30%-PtRh94/6%	0,50 mm

ORDERING CODE



Sensor type **821, 822, 823, 824, 825**
Single (**1**) or double (**2**) measuring element
Sensor length L=**300, 500** or **700** mm[2]
Additional accessories: compression gland type **KPM20x1,5**, **KPG1/2"**[2]
Option with the head-mount transmitter **T**

Example for order: TP-821-1-500 sensor with single thermocouple NiCr-NiAl (K) in ceramic sheath C610 of outer diameter ∅ = 6 mm and length L= 500 mm, connection head type MA.
TP-821-1-500-T; TCH-2170-K sensor with connection head type B, option with the head-mount transmitter type TCH-2170-K.

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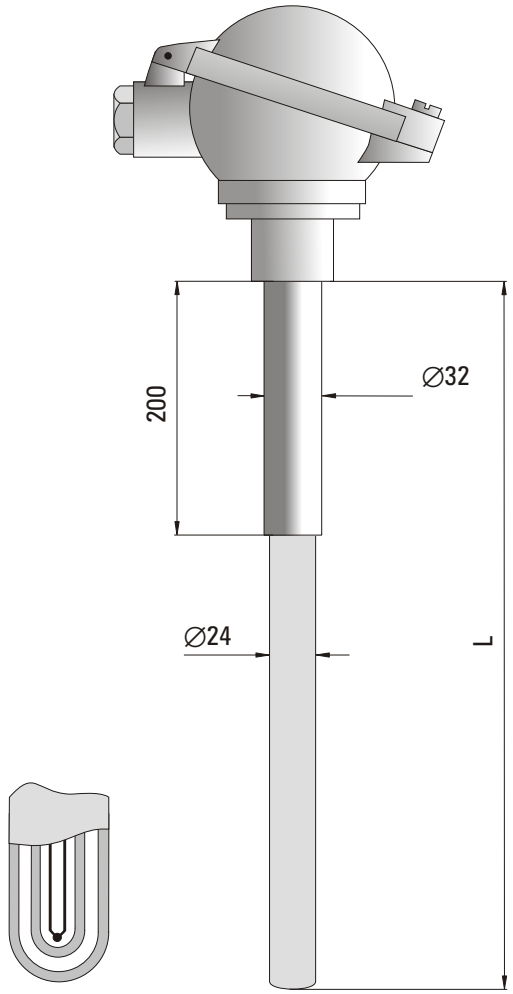
TEMPERATURE SENSOR

type 831, 832, 833

SPECIFICATION

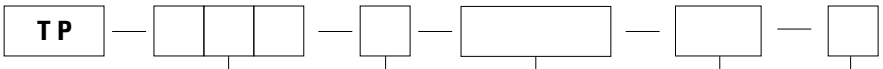
Application	measurment of very high temperatures. Uses a **double ceramic protection tube** to increase sensor life in difficult industrial conditions.	
Measuring element	PtRh90/10%-Pt	**(S)**[1]
	PtRh70/30%-PtRh94/6%	**(B)**
Class of thermocouple	2[2]	
Spacer diameter	∅ 32 mm	
Outer sheath	ceramic C610; ∅ 24x2,5	
	ceramic C799; ∅ 24x3,0	
Inner sheath	ceramic C610; ∅ 15x2,0	
	ceramic C799; ∅ 15x2,5	
Connection head type	A or DA[3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	clamping plate type **UZ**	
	temperature transmitter	
	compensation cable	



[1] Thermocouple PtRh87/13%-Pt (R) or NiCrSi-NiSi (N) on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resitant on demand

Sensor type	Sheath material		Max. operating temperature (°C)	Type of thermocouple	
	outer	inner			
TP-831	ceramic C610	ceramic C610	1400	PtRh90/10%-Pt (S)	0,50 mm
TP-832	ceramic C799	ceramic C799	1500	PtRh90/10%-Pt (S)	0,50 mm
TP-833	ceramic C799	ceramic C799	1600	PtRh70/30%-PtRh94/6% (B)	0,50 mm

ORDERING CODE



Sensor type **831, 832, 833**
Single (**1**) or double (**2**) measuring element
Sensor length L=**500, 700, 1000** or **1400** mm[2]
Additional accessories: clamping plate type **UZ-32**
Option with the head-mount transmitter **T**

Example for order: TP-832-1-700 sensor with single thermocouple PtRh90/10%-Pt (S), with outer and inner ceramic sheath type C799 and length L= 700 mm.
TP-832-1-700-T; TCH-2170-S sensor with the head-mount transmitter type TCH-2170-S.

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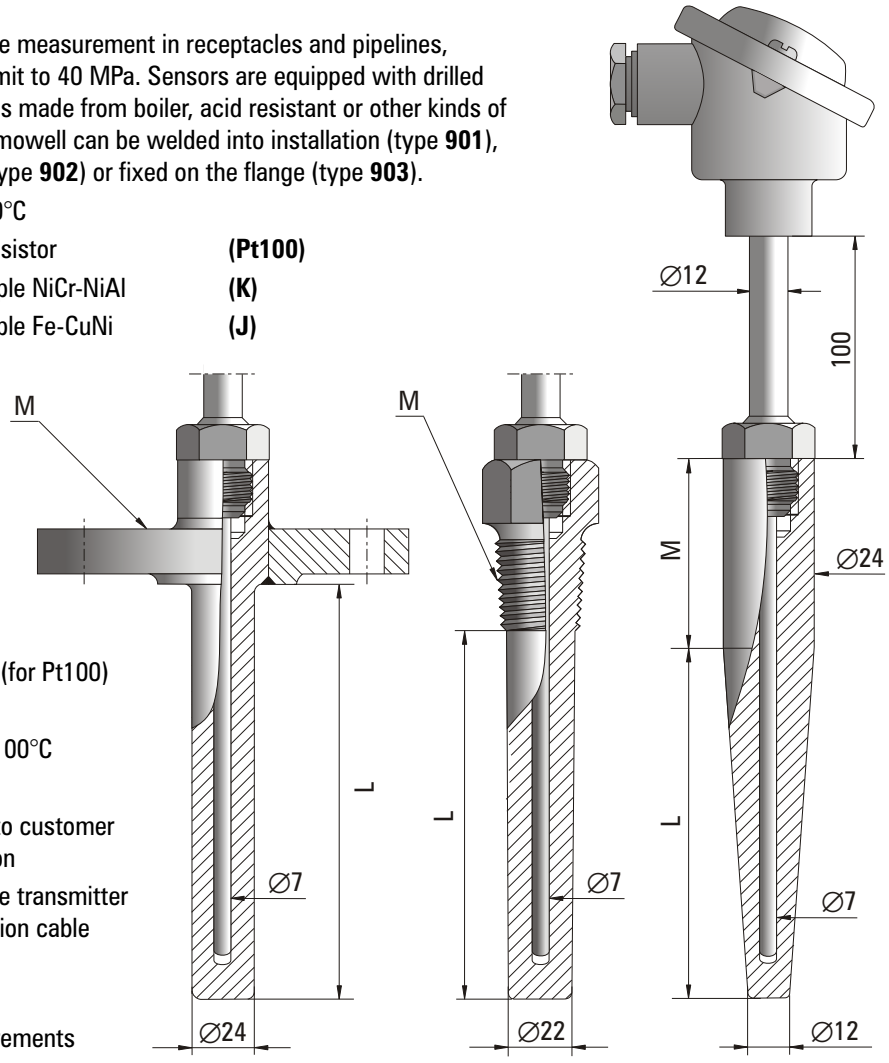
TEMPERATURE SENSOR

type 901, 902, 903

SPECIFICATION

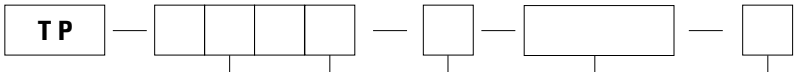
Application	temperature measurement in receptacles and pipelines, pressure limit to 40 MPa. Sensors are equipped with drilled thermowells made from boiler, acid resistant or other kinds of steel. Thermowell can be welded into installation (type **901**), screwed (type **902**) or fixed on the flange (type **903**).	
Temperature range	0°C...+550°C	
Measuring element	platinum resistor	**(Pt100)**
	thermocouple NiCr-NiAl	**(K)**
	thermocouple Fe-CuNi	**(J)**
Class of processing element	2 (B)[1]	
Conductor material	wire Cu/Ni (for Pt100)	
Connection head type	B or DA[2]	
Head operating temperature	–40°C...+100°C	
Thermowell dimensions and material	according to customer specification	
Additional accessories	temperature transmitter compensation cable	



type 903 **type 902** **type 901**

[1] Other parameters according to customer requirements
[2] Connection head with protection class IP65 or acid resitant on demand

ORDERING CODE



Sensor type **901, 902, 903**
Measuring element **Pt100, J** or **K**
Single (**1**) or double (**2**) measuring element
Thermowell parameters: **L, M, material**
Option with the head-mount transmitter **T**

Example for order: TP-901K-1-L= 200 mm, M = 50 mm, material 1.4541 sensor with single thermocouple NiCr-NiAl(K) with thermowell for welding into installation.
TP-901K-1-L= 200 mm, M =50 mm, material 1.4541-T; TCH-2140-K sensor with the head-mount transmitter type TCH-2140-K.

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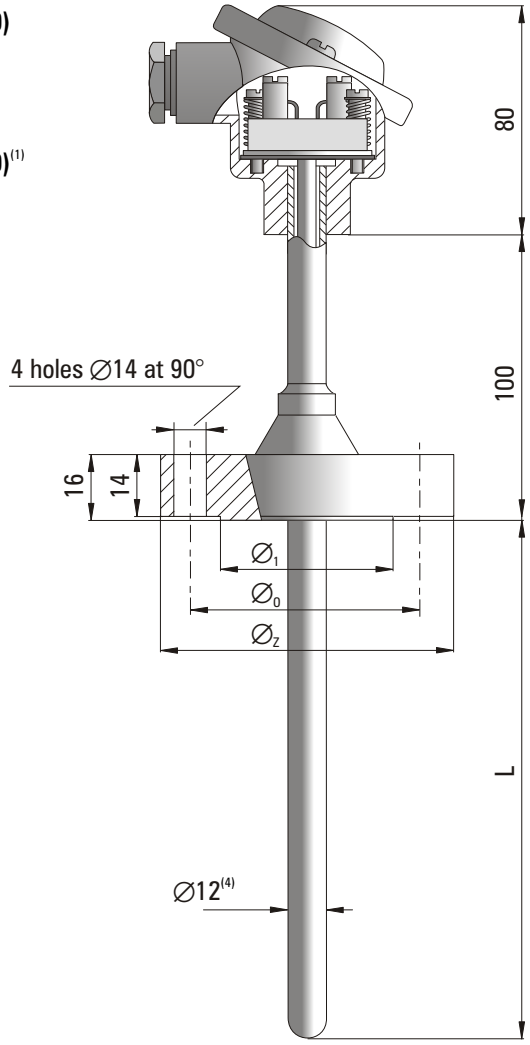
TEMPERATURE SENSOR

type 911, 912

SPECIFICATION

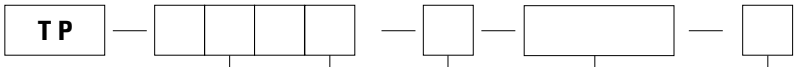
Temperature range	–40°C...+550°C	**(Pt100)**
	–40°C...+400°C	**(T)**
	–40°C...+600°C	**(J)**
	–40°C...+900°C	**(K)**
Measuring element - insert type TP-702	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-CuNi	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated[2]	
Sheath material	steel 1.4541	
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$[2]	
Flange	DN 20 or DN 25 according to ISO 7005-1 [5]	
Maximum operating pressure	see the Sheath Operating Loads	
Connection head type	B or NA[3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	temperature transmitter compensation cable	



[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resistant on demand
[4] Other outer sheath diameters on demand
[5] Other flanges on demand

Sensor type	Flange	$\varnothing_1$(mm)	$\varnothing_0$(mm)	$\varnothing_z$(mm)
TP-911	DN20	56	75	105
TP-912	DN25	65	85	115

ORDERING CODE



Sensor type **911, 912**
Measuring element **Pt100, T, J** or **K**
Single (**1**) or double (**2**) measuring element
Sensor length L=**200, 300, 400, 600, 800** or **1000** mm[2]
Option with the head-mount transmitter **T**

Example for order: TP-911K-1-400 sensor (with measuring insert TP-702K-1-530) with single thermocouple NiCr-NiAl (K) of outer diameter ∅ = 12 mm and length L = 400 mm with welded flange DN20.
TP-911K-1-400-T; TCH-2140-K sensor with head-mount transmitter type TCH-2140-K .

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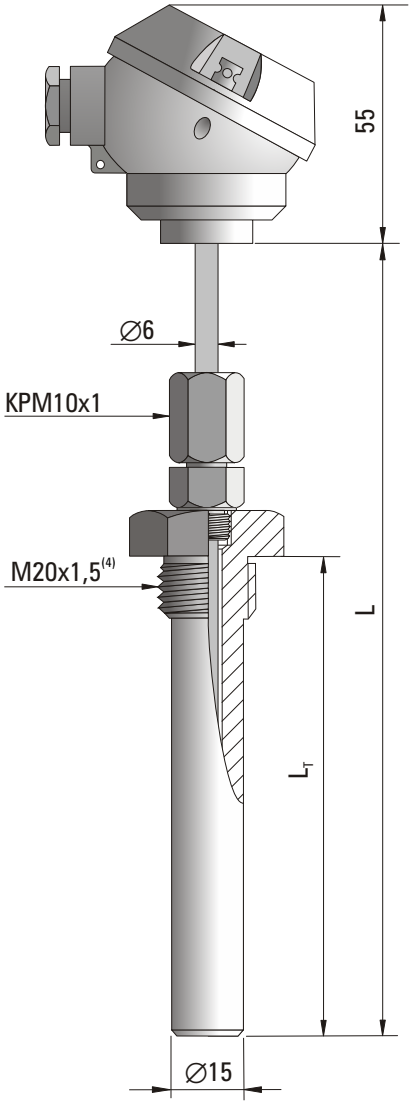
TEMPERATURE SENSOR

type 921, 922, 923, 924, 925

SPECIFICATION

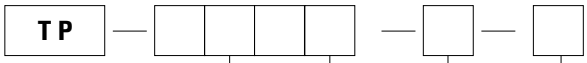
Application	temperature measurement in pressure receptacles and pipelines	
Maximum operating pressure	**10 MPa**	
Temperature range	–40°C...+550°C	**(Pt100)**
	–40°C...+400°C	**(T)**
	–40°C...+600°C	**(J)**
	–40°C...+900°C	**(K)**
Measuring element	platinum resistor	**(Pt100)**[1]
	thermocouple Cu-NiAl	**(T)**
	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of processing element	2 (B)[2]	
Conductor material	wire Cu/Ni (for Pt100)	
Assembly	2, 3 or 4 wires (for Pt100)	
Measuring junction	insulated[2]	
Sheath material ∅6	steel 1.4541	
Pressure sheath material	**toughened steel**[2]	
Connection head type	MA or B[3]	
Head operating temperature	–40°C...+100°C	
Additional accessories	temperature transmitter	
	thermowell for welding	
	compensation cable	



[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resistant on demand
[4] Other threads, sheathes or sheath for welding on demand

Sensor type	TP-921	TP-922	TP-923	TP-924	TP-925
Sheath length L_T (mm)*)	45	75	100	150	250
Sensor length L(mm)*)	100	150	200	250	300

ORDERING CODE



Sensor type **921, 922, 923, 924, 925**
Measuring element **Pt100, T, J** or **K**
Single (**1**) or double (**2**) measuring element
Option with the head-mount transmitter **T**

Example for order: TP-921K-1 sensor with connection head type MA, with single thermocouple NiCr-NiAl (K) of length L = 100 mm and with pressure sheath of length L_T = 45 mm.
TP-921K-1-T; TCH-2140-K sensor with connection head type B with head-mount transmitter type TCH-2140-K.

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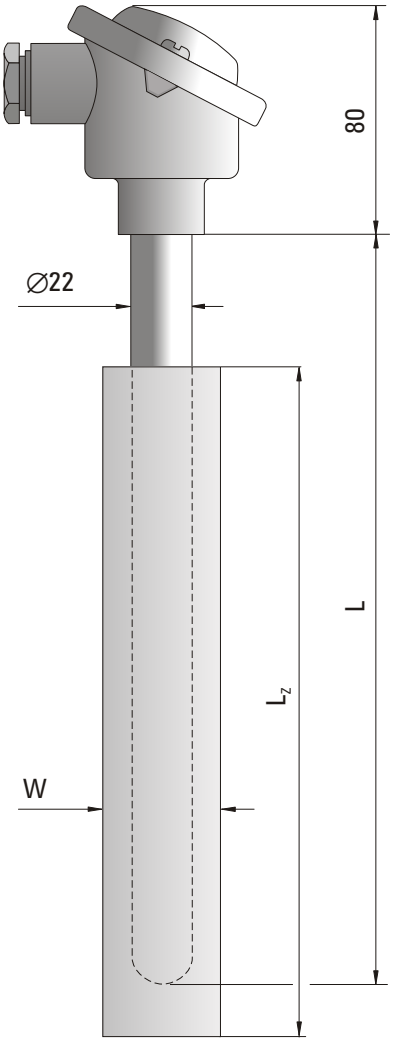
TEMPERATURE SENSOR

type 931, 932, 933, 934



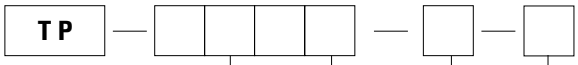
SPECIFICATION

Application	temperature measurement of liquid non-ferrous metals and alloys	
Temperature range	0°C...+600°C	**(J)**
	0°C...+900°C	**(K)**
Measuring element	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of thermocouple	2[1]	
Measuring junction	insulated	
Material of ceramic protection tube	**silicon carbide**	
Connection head type	B or DA[2]	
Head operating temperature	–40°C...+100°C	
Additional accessories	temperature transmitter compensation cable	

[1] Other parameters according to customer requirements
[2] Connection head with protection class IP65 or acid resistant on demand

Sensor type	TP-931	TP-932	TP-933	TP-934
Sensor length L(mm)[1]	600	800	1000	1200
Immersion length L_z(mm)	400	600	700	950
Ceramic protection tube shape W	round 45 mm	semi-round 52 mm		semi-round 57 mm

ORDERING CODE



Sensor type **931, 932, 933, 934**
Measuring element **J** or **K**
Single (**1**) or double (**2**) measuring element
Option with the head-mount transmitter **T**

Example for order: TP-931K-1 sensor with single thermocouple NiCr-NiAl (K) in round protection tube of silicon carbide W = 45 mm of length L_z = 400 mm and length L = 600 mm.
TP-931K-1-T; TCH-2160-K sensor with the head-mount transmitter type TCH-2160-K.

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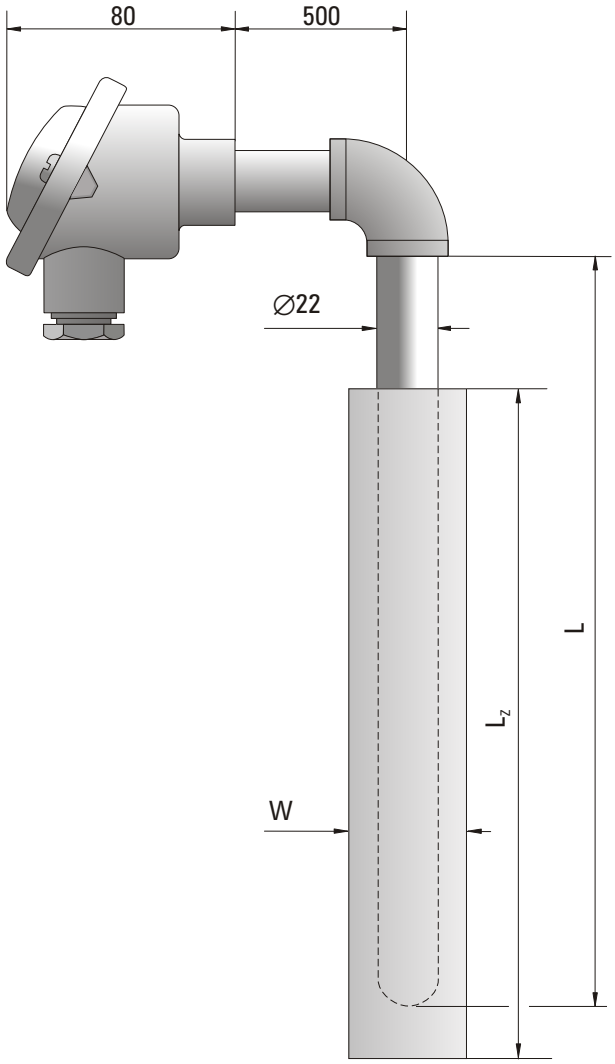
TEMPERATURE SENSOR

type 941, 942, 943, 944



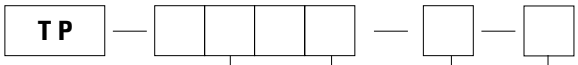
SPECIFICATION

Application	temperature measurement of liquid non-ferrous metals and alloys	
Temperature range	0°C...+600°C	**(J)**
	0°C...+900°C	**(K)**
Measuring element	thermocouple Fe-CuNi	**(J)**
	thermocouple NiCr-NiAl	**(K)**
Class of thermocouple	2[1]	
Measuring junction	insulated	
Material of ceramic protection tube	**silicon carbide**	
Connection head type	B or DA[2]	
Head operating temperature	–40°C...+100°C	
Additional accessories	temperature transmitter compensation cable	

[1] Other parameters according to customer requirements
[2] Connection head with protection class IP65 or acid resistant on demand

Sensor type	**TP-941**	**TP-942**	**TP-943**	**TP-944**
Sensor length L(mm)[1]	600	800	1000	1200
Immersion length L_z(mm)	400	600	700	950
Ceramic protection tube shape W	round 45 mm	semi-round 52 mm		semi-round 57 mm

ORDERING CODE



Sensor type **941, 942, 943, 944**
Measuring element **J** or **K**
Single (**1**) or double (**2**) measuring element
Option with the head-mount transmitter **T**

Example for order: TP-941K-1 sensor with single thermocouple NiCr-NiAl (K) in round protection tube of silicon carbide W = 45 mm of length L_z = 400 mm and length L = 600 mm.
TP-941K-1-T; TCH-2160-K sensor with the head-mount transmitter type TCH-2160-K.

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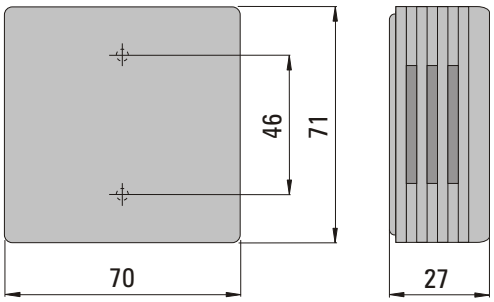
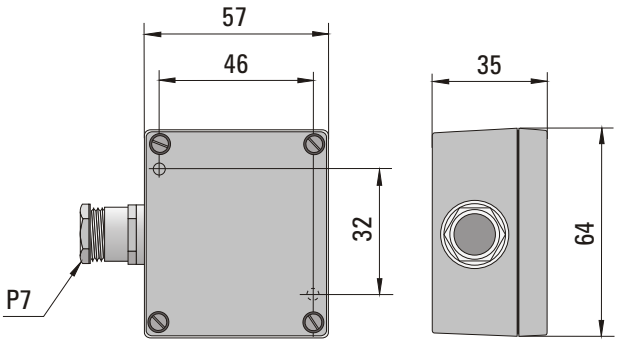
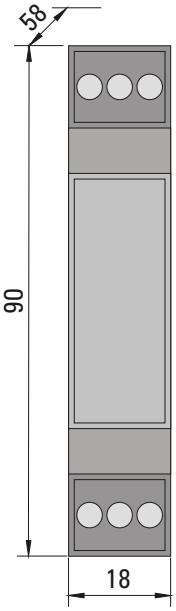
TEMPERATURE SENSOR

type 951



type 952





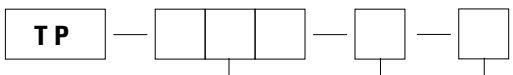
type 953

SPECIFICATION

Application	room temperature sensor	**(TP-951)**
	outdoor temperature sensor	**(TP-952)**
	temperature measurement in control cabinets, rail mounting system according to DIN EN 5022-35	**(TP-953)**
Temperature range	–30°C...+70°C	
Measuring element	platinum resistor	**(Pt100)**[1]
Class of processing element	A	
Maximum measuring current	1 mA	
Maximum relative humidity	up to 80%	**(TP-951)**
	up to 95%	**(TP-952)**
	up to 80%	**(TP-953)**
Case material	ABS	**(TP-951)**
	PC	**(TP-952)**
	PPO	**(TP-953)**
Additional accessories	temperature transmitter: analogue with fixed processing range specified in ordering code or programmable via **IF-2013U** interface (parameters are set as in the case of transmitters **TEH-27** and **TED-27**)	

[1] Pt500, Pt1000, Ni100, Ni1000 on demand

ORDERING CODE



Sensor type **951**, **952**, **953**
Single (**1**) or duble (**2**) measuring element
Option with temperature transmitter: fixed range **T**, programmable range **TE**

Example for order:	TP-952-1	sensor with single Pt100 resistor for outdoor temperature measurement.
	TP-952-1-T; -30°C+70°C/4-20 mA	A sensor as above with analogue 4-20 mA temperature transmitter.
	TP-952-1-TE; 0°C+70°C/4-20 mA	A sensor as above with programmable 4-20 mA temperature transmitter, factory-set range 0...70°C.

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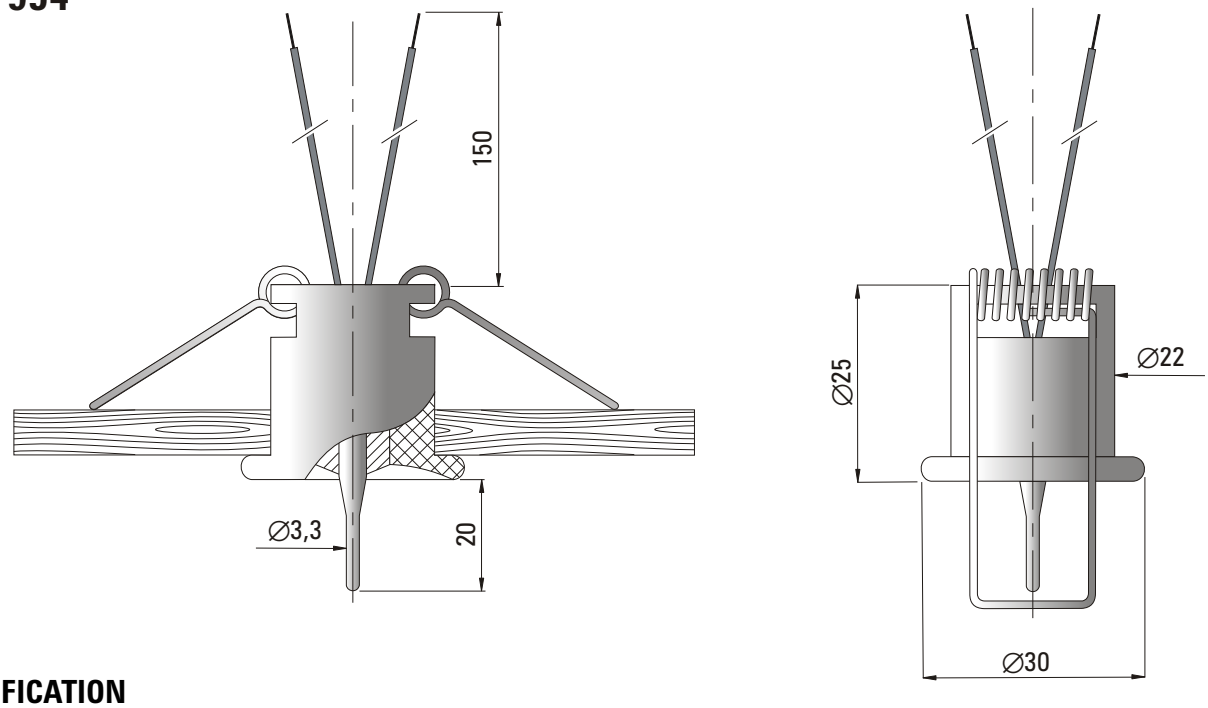
TEMPERATURE SENSOR

type 954



SPECIFICATION

Application	room temperature sensor for mounting on suspended ceiling
Temperature range	–20°C...+70°C
Measuring element	platinum resistor **(Pt100)**[1]
Class of processing element	A
Maximum measuring current	1 mA
Connection cable	2 wires, PTFE insulated[2]
Cable length	150 mm[2]
Response time $T_{0,9}$ (in air 2 m/s)	<15 sek.
Protection class	IP54

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements

ORDERING CODE

TP	—	954	—	

Single (**1**) or double (**2**) processing element

Example for order: TP-954-1 sensor with single Pt100 resistor for room temperature measurement.

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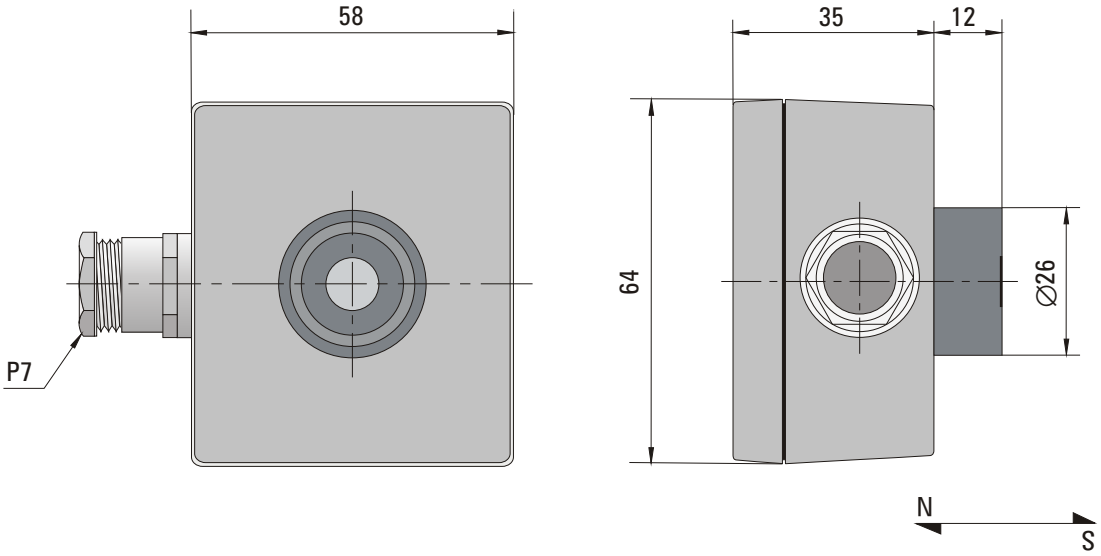
TEMPERATURE SENSOR

type 958



SPECIFICATION

Application	surface temperature measurement of blocks, parts of machinery or construction elements made from magnetic materials
Temperature range	0°C...+70°C[1]
Measuring element	platinum resistor **(Pt100)**[2]
Class of processing element	B
Maximum measuring current	1 mA
Magnetic material	Alnico
Case material	PC
Protection class	IP54
Additional accessories	temperature transmitter: analogue with fixed processing range specified in ordering code or programmable via **IF-2013U** interface (parameters are set as in the case of transmitters **TEH-27** and **TED-27**)

[1] Other parameters according to customer requirements
[2] Pt500, Pt1000, Ni100, Ni1000, thermocouples on demand

ORDERING CODE

T P	—	9 5 8	—	

Option with temperature transmitter: fixed range **T**, programmable range **TE**

Example for order:

TP-958	temperature sensor with handle magnet.
TP-958-T; 0°C+70°C/4-20 mA	A sensor as above with analogue 4-20 mA temperature transmitter for 0...+70°C processing range.
TP-958-TE; 0°C+50°C/4-20 mA	A sensor as above with programmable 4-20 mA temperature transmitter, factory-set range 0...+50°C.

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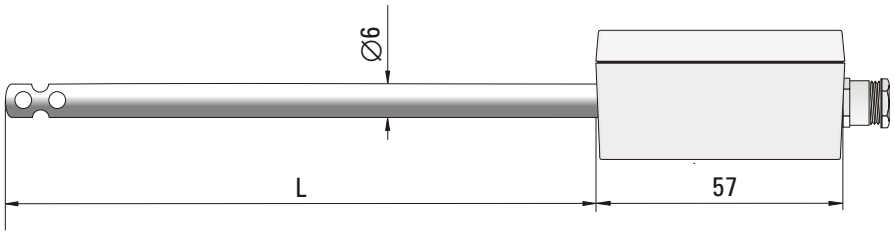
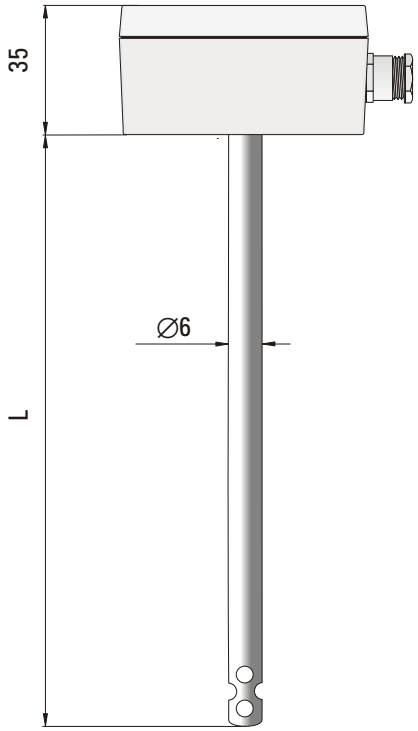
TEMPERATURE SENSOR

type 961, 962

961



962

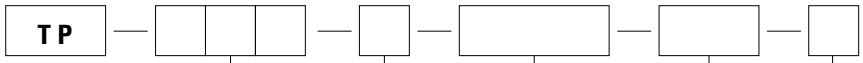


SPECIFICATION

Application	temperature measurement of the air in ventilation ducts and systems
Temperature range	–40°C...+400°C
Measuring element	platinum resistor **(Pt100)**[1]
Class of processing element	A
Conductor material	wire Cu/Ag
Sheath material	steel 1.4541
Case material	PC
Dimensions	57 x 64 x 35 mm
Case operating temperature	–20°C...+80°C
Additional accessories	compression gland type **KP** temperature transmitter: analog with fixed processing range specified in ordering code or programmable via **IF-2013U** interface (parameters are set as in the case of transmitters **TEH-27** and **TED-27**)

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements

ORDERING CODE



Sensor type **961**, **962**
Single (**1**) or double (**2**) measuring element
Sensor length L = **50**, **100**, **150** or **200** mm[2]
Additional accessories: compression gland type **KPM10x1**
temperature transmitter: fixed range **T**, programmable range **TE**

Example for order:

TP-961-1-100 sensor with single Pt100 resistor of outer diameter ∅ = 6 mm and length L = 100 mm.
TP-961-1-100-T; 0°C+100°C/4-20mA sensor as above with analogue 4-20 mA temperature transmitter for 0...+100°C processing range.
TP-961-1-100-TE; 0°C+200°C/4-20mA sensor as above with programmable 4-20 mA temperature transmitter, factory-set range 0...+200°C.

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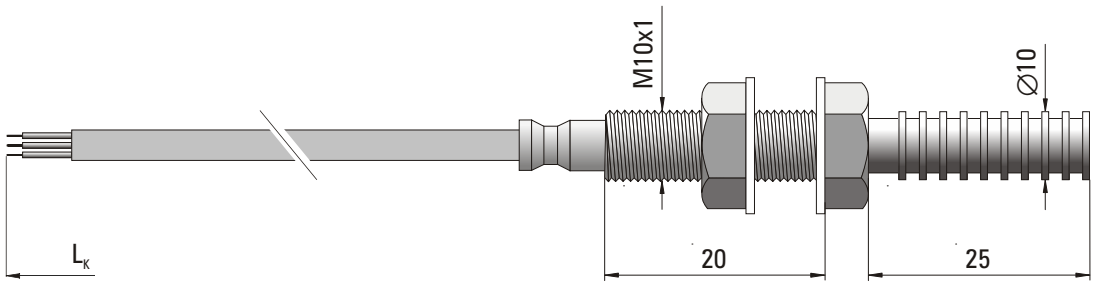
TEMPERATURE SENSOR

type 963

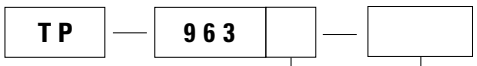


SPECIFICATION

Application	temperature measurement in industrial buildings
Temperature range	–40°C...+150°C
Measuring element	platinum resistor **(Pt100)**, **(Pt500)**, **(Pt1000)**[1]
Class of processing element	B[2]
Connecting cable in PTFE insulation	cord 3 x 0,22 mm^2
Sheath material	nickel plated brass
Response time $T_{0,9}$ (in air 2 m/s)	< 30 s

[1] Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[2] Double measuring element on demand

ORDERING CODE



Measuring element **Pt100**, **Pt500**, **Pt1000**
Length of cable L_K = **0,15** m ... **2,5** m[2]

Example for order: TP-963Pt100-0,5 Pt100 resistance sensor with cable of length L_K = 0,5 m.

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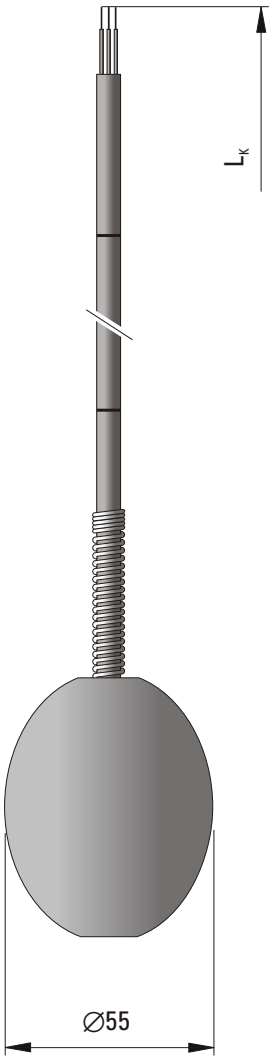
TEMPERATURE SENSOR

type 964

SPECIFICATION

Application	sensor with extender for temperature measurement in bodies of water (ponds, lakes), markers placed on connecting cable at every 1m.
Temperature range	-30°C...+70°C
Measuring element	platinum resistor **(Pt100)**[1]
Class of processing element	B[2]
Connecting cable	reinforced construction 3x0,75 mm^2 [2]
Maximum measuring current	1mA
Extender	cast-iron bullet 1kg[2]
Protection class	IP68

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements



ORDERING CODE

TP	—	964	—	

Cable length L_K = **1**m ... **100**m

Example for order: TP-964-25 Pt100 resistance sensor with cable of length 25 m.

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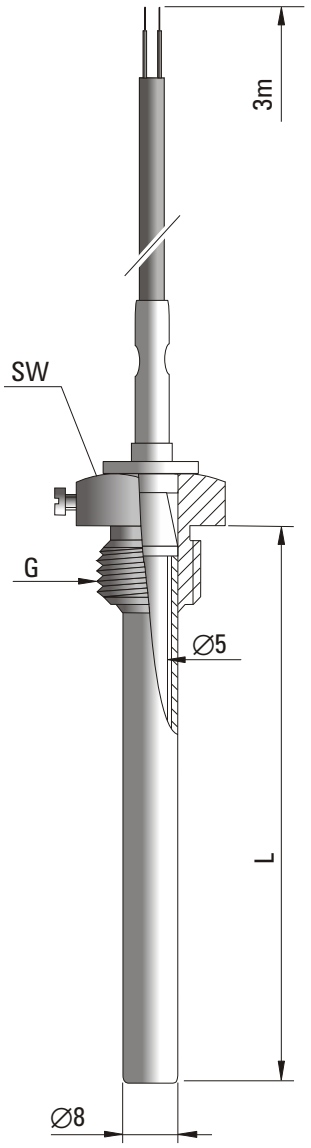
TEMPERATURE SENSOR

type 971, 972, 973, 974

SPECIFICATION

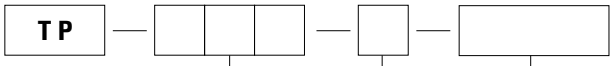
Application	temperature measurement in pipelines and central heating systems
Temperature range	-40°C...+150°C
Measuring element	platinum resistor **(Pt100)**[1]
Class of processing element	B[2]
Sheath material	steel 1.4541
Maximum operating pressure	1,6 MPa
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$[2]
Connecting cable in silicon insulation	cord 2 x 0,35 mm[2]
Length of the cable L_k	3 m[3]
Cable operating temperature	–20°C...+150°C
Additional accessories	thermowell for welding

[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Other sensor and cable lengths on demand
[4] Other threads inch and metric on demand



Sensor type	TP-971	TP-972	TP-973	TP-974
G[4]	G 1/2"	G 3/8"	G 1/4"	for welding ∅22
SW	Hex.24	Hex.19	Hex.17	

ORDERING CODE



Sensor type **971, 972, 973, 974**
Single (**1**) or double (**2**) measuring element
Sensor length L=**50, 85, 100, 150** or **200** mm[2]

Example for order: TP-971-1-85 sensor with single Pt100 resistor, outer housing of length L = 85mm and thread G1/2", cable of length L_k = 3 m.

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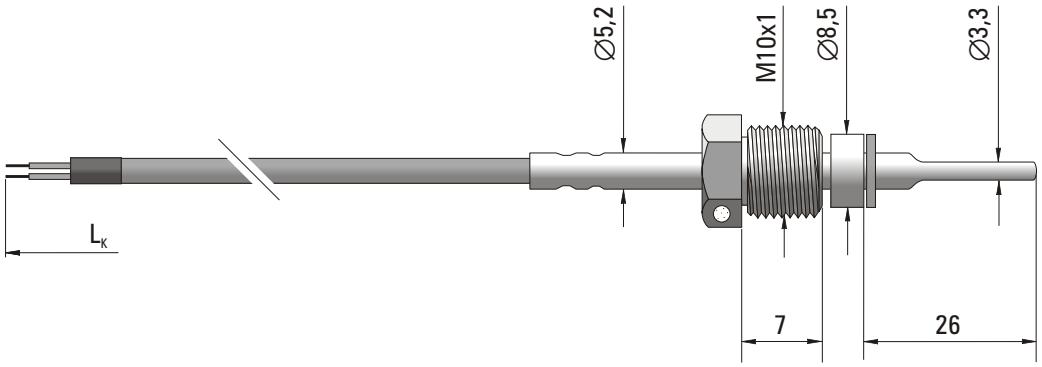
TEMPERATURE SENSOR

type 979

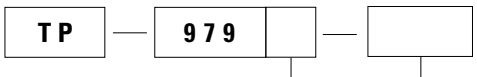


SPECIFICATION

Application	temperature measurement in pipelines and central heating systems
Temperature range	0°C...+180°C
Measuring element	platinum resistor **(Pt100)**, **(Pt500)**, **(Pt1000)**[1]
Class of processing element	B[2]
Sheath material	steel 1.4541
Gland material M10 x 1	brass
Maximum operating pressure	1,6 MPa
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$[2]
Response time $T_{0,9}$	< 5 s (in water 0,1 m/s)
Connecting cable in silicon insulation	cord 2 x 0,25 mm^2

[1] Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements

ORDERING CODE



Measuring element **Pt100**, **Pt500**, **Pt1000**
Length of the cable L_K = **0,5**, **1,5** or **3** m[2]

Example for order: TP-979Pt100-3 sensor with single Pt100 resistor and cable of length L_K = 3 m.

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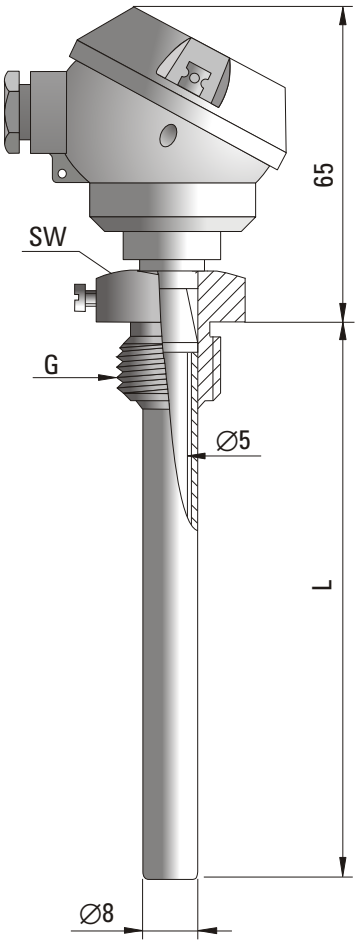
TEMPERATURE SENSOR

type 981, 982, 983, 984

SPECIFICATION

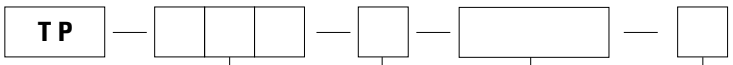
Application	temperature measurement in pipelines and central heating systems
Temperature range	-40°C...+150°C
Measuring element	platinum resistor **(Pt100)**[1]
Assembly	2, 3 or 4 wires
Class of processing element	B[2]
Sheath material	steel 1.4541
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$[2]
Maximum operating pressure	1,6 MPa
Connection head type	MA or B[3]
Head operating temperature	–40°C...+100°C
Additional accessories	temperature transmitter thermowell for welding



[1] Pt500, Pt1000, Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Connection head with protection class IP65 or acid resistant on demand
[4] Other threads inch and metric on demand

Sensor type	TP-981	TP-982	TP-983	TP-984
G[4]	G 1/2"	G 3/8"	G 1/4"	for welding ∅22
SW	Hex.24	Hex.19	Hex.17	

ORDERING CODE



Sensor type **981, 982, 983, 984**
Single (**1**) or double (**2**) measuring element
Sensor length L=**50, 85, 100, 150** or **200** mm[2]
Option with the head-mount transmitter **T**

Example for order: TP-981-1-85 sensor with single Pt100 resistor, connection head type MA, outer housing of length L = 85mm and thread G1/2".
TP-981-1-85-T; TCHF-2120 sensor with connection head type B, option with the head-mount transmitter type TCHF-2120.

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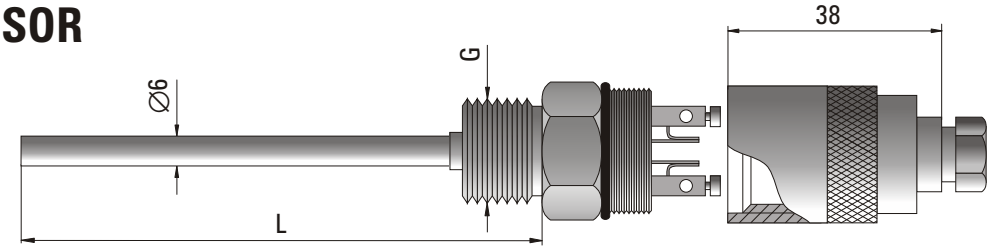
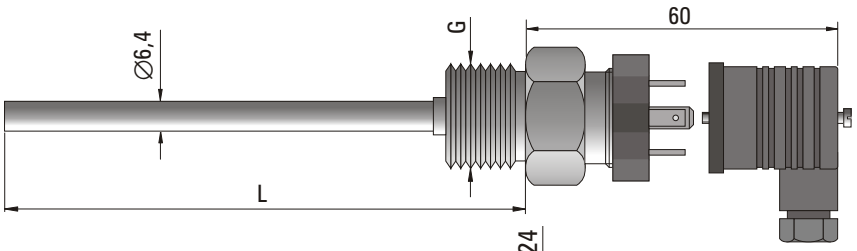
TEMPERATURE SENSOR

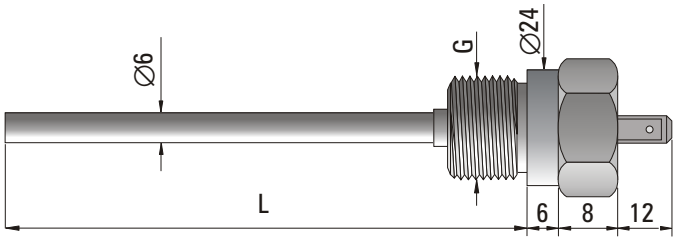
type 991



type 992



type 993

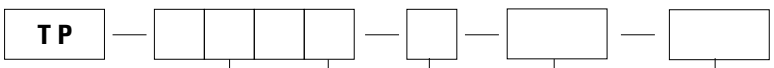


SPECIFICATION

Application	temperature measurement of liquid, gases and solids in receptacles, ducts and pipelines. Sensor type **991** with ceramic terminal block and cap with cable gland P7. Sensor type **992** with industrial connector (socket-plug). Sensor type **993** with two flat quick-connect terminations 6,3x0,8mm acc. to EN 61210:2010.
Temperature range	–40°C...+200°C **(TP-991, TP-992)**, –40°C...+150°C **(TP-993)**
Measuring element	platinum resistor **(Pt100)**, **(Pt500)**, **(Pt1000)**[1]
Class of processing element	B[2]
Assembly	2, 3 or 4 wires
Sheath and body material	steel 1.4541
Roughness of sheath surface	$R_a < 0{,}8\ \mu m$[2]
Maximum operating pressure	1,6 MPa
Connector operating temperature	–40°C...+125°C
Protection class	IP65
Thread G	M12x1,5; M14x1,5; M20x1,5; G3/8"; G1/2" [3] (on demand without thread)
Additional accessories	thermowell for welding

[1] Ni100, Ni1000 on demand
[2] Other parameters according to customer requirements
[3] Other threads inch and metric on demand

ORDERING CODE



Sensor type **991**, **992**, **993**
Measuring element **Pt100**, **Pt500** or **Pt1000**[1]
Single (**1**) or double (**2**) measuring element
Sensor length L = **50**, **85**, **100**, **150** or **200** mm[2]
Thread G = **M14x1,5**; **M20x1,5**; **G3/8"** or **G1/2"**[3]

Example for order: TP-992Pt100-1-100-M20x1,5 sensor with single Pt100 resistor of length L = 100 mm with thread (G) M20x1,5 and with industrial connector.

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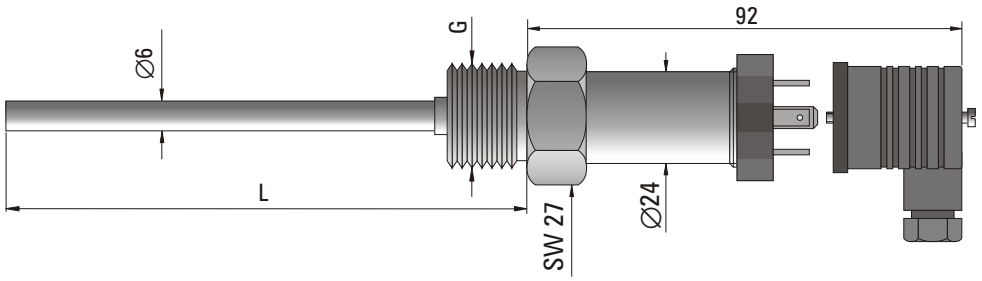
TEMPERATURE SENSOR WITH TRANSMITTER

type 995



Pt100 sensor with industrial connector (available on request M12), is designed for temperature measurement of liquid, gases and solids in receptacles,ducts and pipelines.
The sensor has a built-in programmable transmitter which converts the sensor resistance change to a standard 4-20 mA signal **(TP-995/A)** or voltage 0-10V **(TP-995/V)**. The transmitter is configured using a PC via **IF-2013U** interface. Parameters are set as in the case of transmitters **TEH-27** and **TED-27**, except for the type of processing element and its connection method.

SPECIFICATION

Temperature sensor

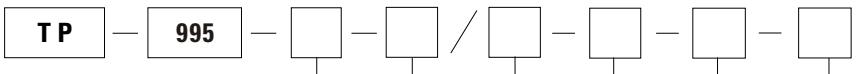
Temperature range	–40°C...+200°C
Measuring element	platinum resistor Pt100, class B *(class A on demand)*
Sheath and body material	steel 1.4541
Roughness of sheath surface	$R_a < 0,8\ \mu m$ *(other on demand)*
Maximum operating pressure	1,6 MPa
Protection class	IP65
Thread G	M14x1,5; M20x1,5; G3/8"; G1/2" *(other threads or no thread on demand)*
Additional accessories	thermowell for welding

Measurement transmitter

Measuring range	programmable, maximum –50°C ...+200°C (URV - LRV ≥ 30°C)	
Accuracy (T_a = 23°C)	0,2°C	
Thermal drift (dependent on T_a)	0,01°C/°C	
	TP-995/A	**TP-995/V**
Output signal, programmable	4-20mA or 20-4mA	0-10Vor 10-0V
Linear region of output signal	3,8 ... 20,5mA	0,0 ... 10,3V
Sensor failure indication, programmable	3,5 or 23mA	0 lub 11,5V
Power supply	8 ... 36VDC / 24mA (from current loop)	14 ... 36VDC / 18mA
Output signal delay after power on	ca. 5s	
Digital filter time constant (1st order filter)	selected: 0,2; 1; 2; 4; 8; 16 lub 32s	
Connector and body operating temperature T_a	-40 ...+80°C	

Default values are underscored. Factory programmed in case of the incomplete ordering code.

ORDERING CODE



Sensor length L = **50 ... 1000** mm
Thread G = **M14x1,5**; **M20x1,5**; **G3/8**; **G1/2**; no thread **0**
Output signal 4-20mA (**A**) or 0-10V (**V**)
Lower range value (LRV) [°C], default -40
Upper range value (URV) [°C], default 200
Additional accessories: thermowell for welding, interface **IF-2013U**

Example for order: TP-995-200-M20x1,5/A-0-150 temperature sensor of length L = 200 mm, with thread M20x1,5 with built-in transmitter for output signal 4-20mA and measuring range 0...150 °C.

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TECHNICAL INFORMATION

EU ATEX Directive 94/9/WE

The EU ATEX Directive sets out the demands which must be met by equipment installed in atmospheres where there is a risk of explosion. It concerns equipment installed in countries of the European Union. It is a document which overrides national standards and which specifies the demands and tests required in the construction of explosion proof equipment.
The ATEX Directive introduces new markings for ATEX equipment.

Types of explosion proofing for temperature sensors

Type	Method	Marking	Standard
fireproofing	explosion proof enclosure	d	EN 60079-1
mechanical	mechanical - no electric arcs, sparks, hot surfaces	e	EN 60079-7
intrinsically safe	electrical design	i	EN 60079-11

Explosion danger zones

Gases, vapors, mists, dusts	Occurrence of explosion risk	Frequency
zone 0	continuous during normal operations	>1000 h/yr
zone 1	possible during normal operations	10÷1000 h/yr
zone 2	small possibility during normal operations	<10 h/yr

Methods of explosion protection for atmospheres – group I, II

I	II	Explosive substance	Protection level Protection characteristics	Zone	Type of housing
Category					
	1G	gases, vapors, mists	- very high level protection - two independent protection methods - assures required protection level in case of 2 independent faults	0	Ex ia or (Ex ib, Ex e, Ex d) + mechanical separation
	1D	dusts		20	- housing min. IP 6X - surface temperature limit - no ignition sparks
M1		methane, coal dust		-	Ex ia or (Ex ib, Ex e, Ex d) + Ex m
	2G	gases, vapors, mists	- high protection level - one protection method - anticipated fault	1	Ex ib lub Ex e lub Ex d
	2D	dusts		21	- housing min. IP 6X - surface temperature limit - no ignition sparks
M2		methane, coal dust		-	Ex ib or Ex e or Ex d
	3G	gases, vapors, mists	- normal protection level - protection sufficient for normal operation	2	Ex ib or Ex e or Ex d
	3D	dusts		22	- housing min. IP 5X - surface temperature limit

Temperature class

Equipment in Group II: 2G should be assigned a temperature class according to the maximum surface temperature achieved during operation.

Temperature class	Maximum surface temperature (Ts)	Ignition temperature of the explosive substance
T1	450°C	>450°C
T2	300°C	>300°C<450°C
T3	200°C	>200°C<300°C
T4	135°C	>135°C<200°C
T5	100°C	>100°C<135°C
T6	85°C	>85°C<100°C

The maximum surface temperature Ts is a result of several factors:
- temperatures resulting from heat emission of electric conductors Te
- ambient temperature Tamb
- process temperature Tp measured by the sensor

Ts = Te + Tamb + Tp

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The manufacturer of a sensor is not in a position to foretell the actual operating conditions of a sensor, and therefore is not able to establish the actual temperature class. In these data sheets the temperature classes given are those which appertain to surface temperatures allowed according to the construction of the sensor. The actual temperature class of the sensor may accordingly be lower depending on the surface temperature Ts arrived at in actual operating conditions of the sensor.

In no case can the maximum temperature of the sensor surface be higher than the ignition temperature of explosive gas mixtures, vapors or mist with air.

Temperature classes for gas groups

	T1	T2	T3	T4	T5	T6
II A	acetone, propylene, toluene, ammonia, carbon monoxide	cyclohexane, ethanol, ethyl alcohol, n-butane, trichlorethylene	cyclohexane, n-dekan, n-hexane, petrol, crude oil	acetaldehyde	-	-
II B	hydrogen cyanide, town gas	ethylene oxide, acrylonitrile, butadiene, propylene oxide	hydrogen sulfide, crotonaldehyde	diethyl ether, dioxin	-	-
II C	hydrogen	acetylene	hydrazine	-	carbon disulfide	-

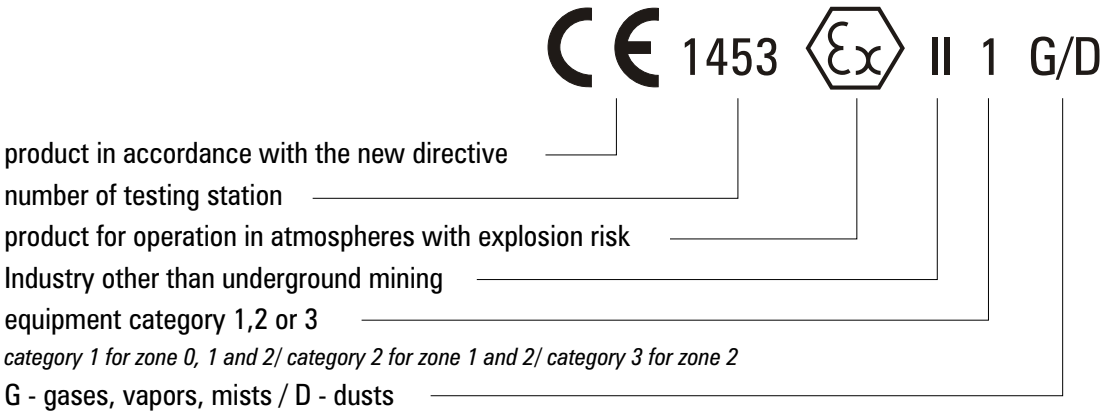
Maximum permitted surface temperature

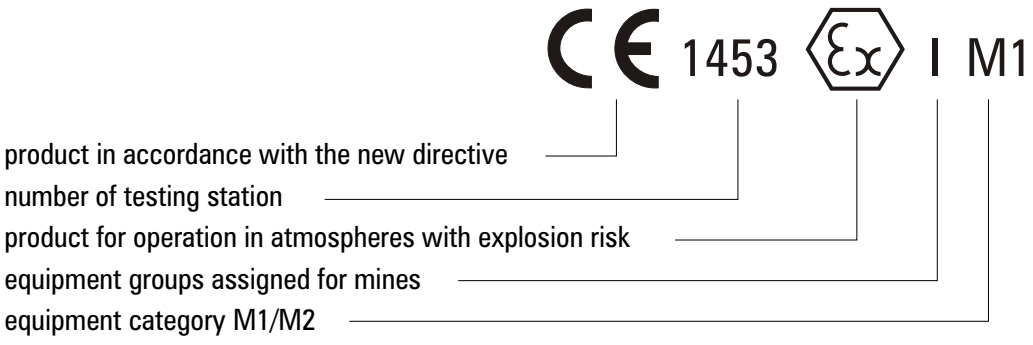
For equipment in group II: 2D the maximum surface temperature achieved during operation should be given.

In no case may the maximum surface temperature of the sensor exceed the maximum permitted surface temperature as defined by:

- **Ts max=2/3Tc where Tc - ignition temperature of the dust cloud**
- **Ts max=T5mm - 75K where T5mm - ignition temperature of a 5mm thick dust layer**
- **for dust layers of thickness 5 to 50mm Ts max is as T5mm but reduced according to standard EN 61241-10**
- **for dust layers of greater thickness, the maximum permitted surface temperature is established by testing**

Marking of products according to ATEX (basic markings)





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TEMPERATURE SENSOR TYPE
TP-Exi-431, TP-Exi-432, TP-Exi-433, TP-Exi-434

☐ Temperature measurement in mines, gas and dust hazardous areas

☐ ATEX designation
CE Ex I M1 Ex ia I Ma
CE Ex II 2G Ex ia IIC T6-T1 Gb
CE Ex II 1D Ex ia IIIC T85÷700°C Da

☐ Temperature range
-40°C...+700°C (J)
-40°C...+1100°C (K)
-40°C...+1250°C (N)

☐ Option - temperature transmitter

Sensor type	Atmosphere type	Temperature range	ATEX designation
TP-Exi-43X-XJ	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷700°C	Ex II 2G Ex ia IIC T6-T1 Gb
	dusts	-40÷700°C	Ex II 1D Ex ia IIIC T85÷700°C Da
TP-Exi-43X-XK	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷1100°C	Ex II 2G Ex ia IIC T6-T1 Gb
	dusts	-40÷1100°C	Ex II 1D Ex ia IIIC T85÷1100°C Da
TP-Exi-43X-XN	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷1250°C	Ex II 2G Ex ia IIC T6-T1 Gb
	dusts	-40÷1250°C	Ex II 1D Ex ia IIIC T85÷1250°C Da

These temperature sensors are recommended for temperature measurements in mines (sensor category M1) in explosive gases (sensor category 2 G) and dusts (sensor category 1 D).
The sensing element of the sensor, thermocouple type J, K and N is sheathed thermocouple in a flexible Inconel 600 casing (J, K) or in the case of type N Nicrobell.
Sheathed thermocouples are made using thermoelectric wires insulated with highly compacted mineral powder (99% MgO) and a metal sheath (casing) providing mechanical and chemical protection of thermocouple wires and measuring junction.
This design allows for high flexibility, high mechanical resistance and short reaction time.
An ATEX certified temperature transmitter which converts the measured values to a 4-20mA, 0-20mA or 0-10V (option) signal can be mounted in the connection head.
For each sensor an Instruction Manual, Warranty Card and Declaration of Conformity are supplied. A free of charge Quality Certificate specifying the class of the sensor or payable Calibration Certificate for the specified temperature values is supplied on request.

TECHNICAL DATA

Process connection	without or compression gland, stainless steel 1.4541 (option)		
Protection sheath	Ø3, Ø4,5, Ø6, Ø8mm, Inconel 600 (J, K), Nicrobell (N)		
Sensing element	J (Fe-CuNi)	insulated	EN 60584 class 1
	K (NiCr-NiAl)	insulated	EN 60584 class 1
	N (NiCrSi-NiSi)	insulated	EN 60584 class 1
Connection head and cable gland	head type XE-DANA, IP65, ATEX II 2GD		
	cable gland ATEX II GD, IP65, for cable of outer diameter Ø6÷Ø8mm		
	head type XE-BE, IP65, ATEX I M2, operating temperature up to 100°C		
	cable gland ATEX I M2, Ip65, for cable of outer diameter Ø6÷Ø12mm		
Ambient temperature (Tamb)	-40°C +75°C		
Response time	t_{09} ca.3s (in water 0,2 m/s for Ø3mm), t_{09} ca.14s (in water 0,2 m./s for Ø8mm)		
Maximum operating pressure	0,1MPa		
Temperature transmitter (option)	ATEX certified		

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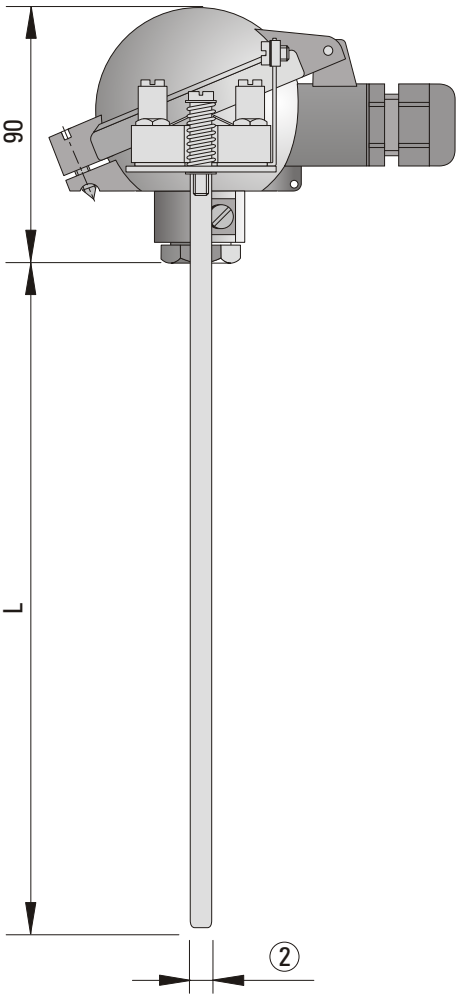
Temperature sensor type TP-Exi-431, TP-Exi-432, TP-Exi-433, TP-Exi-434



(1) Basic version
TP-Exi

(2) Protection sheath

431	Ø3,0mm
432	Ø4,5mm
433	Ø6,0mm
434	Ø8,0mm

(3) Sensing element

1J	1xJ (1 x Fe-CuNi)
1K	1xK (1 x NiCr-NiAl)
1N	1xN (1 x NiCrSi-NiSi)
2J	2xJ (2 x Fe-CuNi)
2K	2xK (2 x NiCr-NiAl)
2N	2xN (2 x NiCrSi-NiSi)

(4) Length in mm (100<L<5000)

100	100 mm
150	150 mm
. . .	other length (by 50 mm)

(5) ATEX designation

mines	I M1 Ex ia I Ma
gases	II 2G Ex ia IIC T6 Gb
dusts	II 1D Ex ia IIIC T85°C Da

(6) Additional accessories (option)

0	without
KP	compression gland (type acc. to catalogue page)
T	ATEX certified temperature transmitter (parameters acc. to catalogue page)

Ordering code:	**(1)**		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**
		—		—		—		—		—	
Example:	**TP-Exi**	—	**431**	—	**1P2**	—	**1200**	—	**IM1ExialMa**	—	**0**

Additional accessories please specify at the end, for example KPM10x1-3

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than the temperature class for a given substance (gas, mist, vapor).

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than 2/3 of the ignition temperature of dust cloud T_{cl} or ignition temperature of a 5-millimeter layer of dust T_{5mm} reduced by 75K.

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TEMPERATURE SENSOR TYPE TP-Exi-461, TP-Exi-462, TP-Exi-463

☐ Temperature measurement in mining plants, gas and dust hazardous areas

☐ ATEX designation CE Ex I M1 Ex ia I Ma
CE Ex II 2G Ex ia IIC T6-T1 Gb
CE Ex II 1D Ex ia IIIC T85°C Da

☐ Temperature range -200°C...+550°C

☐ Option - temperature transmitter

Sensor type	Atmosphere type	Temperature range	ATEX designation
TP-Exi-46X-XPX	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-200÷550°C	Ex II 2G Ex ia IIC T6-T1 Gb
	dusts	-200÷550°C	Ex II 1D Ex ia IIIC T85÷550°C Da

These temperature sensors are recommended for temperature measurements in mines (sensor category M1) in explosive gases (sensor category 2 G) and dusts (sensor category 1 D).
The sensing element of the sensor is a Pt100 resistor placed in a flexible sheathed cable made of stainless steel 1.4541. Sheathed cable is made of copper-zirconium alloy (CuZr) wires insulated with highly compacted mineral powder (99% MgO) and metal sheath (casing) providing mechanical and chemical protection of wires and the Pt100 resistor.
This design allows for high flexibility, high mechanical resistance and short reaction time.
Note: rigid end of the probe is 40 mm in length.
An ATEX certified temperature transmitter which converts the measured values to a 4-20mA, 0-20mA or 0-10V (option) signal can be mounted in the connection head.
For each sensor an Instruction Manual, Warranty Card and Declaration of Conformity are supplied.
A free of charge Quality Certificate specifying the class of the sensor or payable Calibration Certificate for the specified temperature values is supplied on request.

TECHNICAL DATA

Process connection	without or compression gland, stainless steel 1.4541 (option)
Protection sheath	Ø3, Ø5, Ø6mm, stainless steel 1.4541
Sensing element	Pt100, EN 60751 class B
Connection head and cable gland	head type XE-DANA, IP65, ATEX II 2GD cable gland ATEX II 2GD, IP65, for cable of outer diameter Ø6÷Ø8mm head type XE-BE, IP65, ATEX I M2, operating temperature up to 100°C cable gland ATEX I M2, IP65, for cable of outer diameter Ø6÷Ø12mm
Ambient temperature (Tamb)	-40°C +75°C
Response time	t_{09} ca.10s (in water 0,2 m/s for Ø3mm), t_{09} ca.40s (in water 0,2 m/s for Ø6mm)
Maximum operating pressure	0,1MPa
Temperature transmitter (option)	ATEX certified

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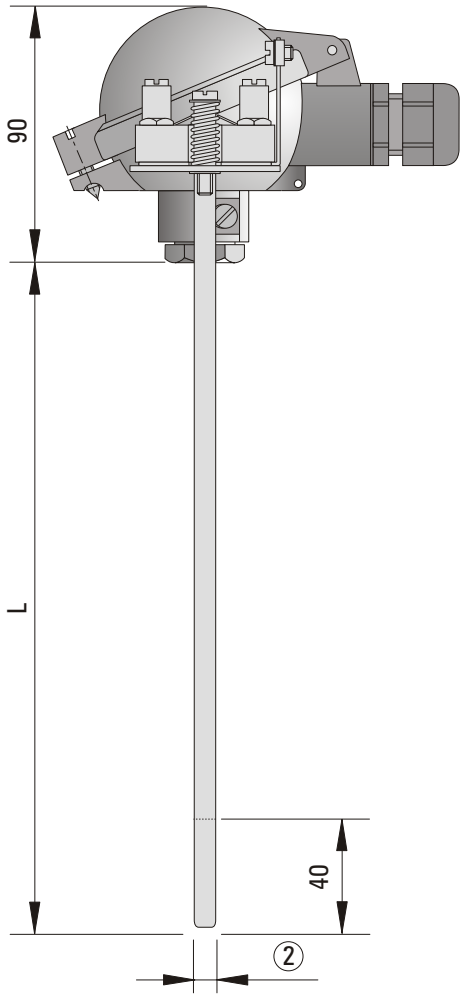
Temperature sensor type TP-Exi-461, TP-Exi-462, TP-Exi-463



(1) Basic version
TP-Exi

(2) Protection sheath

461	Ø3mm
462	Ø5mm
463	Ø6mm

(3) Sensing element

1P2	1xPt100 2-wires
1P3	1xPt100 3-wires
1P4	1xPt100 4-wires
2P2	2xPt100 2-wires
2P3	2xPt100 3-wires

(4) Length in mm (100<L<5000)

100	100 mm
150	150 mm
. . .	other length (by 50 mm)

(5) ATEX designation

mines	I M1 Ex ia I Ma
gases	II 2G Ex ia IIC T6 Gb
dusts	II 1D Ex ia IIIC T85°C Da

(6) Additional accessories (option)

0	without
KP	compression gland (type acc. to catalogue page)
T	ATEX certified temperature transmitter (parameters acc. to catalogue page)
class A	sensor class (other than basic)

Ordering code:	**(1)**		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**
		—		—		—		—		—	
Example:	**TP-Exi**	—	**461**	—	**1P2**	—	**1200**	—	**IM1ExialMa**	—	**0**

Additional accessories please specify at the end, for example KPM10x1-3, class A

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than the temperature class for a given substance (gas, mist, vapor).

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than 2/3 of the ignition temperature of dust cloud T_{cl} or ignition temperature of a 5-millimeter layer of dust T_{5mm} reduced by 75K.

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TEMPERATURE SENSOR TYPE
TP-Exi-601, TP-Exi-602, TP-Exi-603, TP-Exi-604, TP-Exi-605

☐ Temperature measurement in mines, gas and dust hazardous areas

☐ ATEX designation CE Ex I M1 Ex ia I Ma
CE Ex II 2G Ex ia IIC T6-T1 Gb
CE Ex II 1D Ex ia IIIC T85°C Da

☐ Temperature range -200°C...+550°C (Pt100)
-40°C...+700°C (J)
-40°C...+900°C (K)

☐ Option - temperature transmitter

Sensor type	Atmosphere type	Temperature range	ATEX designation
TP-Exi-60X-XPX	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷450°C	Ex II 2G Ex ia IIC T6-T1 Gb
	dusts	-200÷550°C	Ex II 1D Ex ia IIIC T85÷550°C Da
TP-Exi-60X-XJ	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷450°C	Ex II 2G Ex ia IIC T6-T1 Gb
	dusts	-40÷700°C	Ex II 1D Ex ia IIIC T85÷700°C Da
TP-Exi-60X-XK	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷450°C	Ex II 2G Ex ia IIC T6-T1 Gb
	dusts	-40÷900°C	Ex II 1D Ex ia IIIC T85÷900°C Da

These temperature sensors are recommended for temperature measurements in mines (sensor category M1) in explosive gases (sensor category 2 G) and dusts (sensor category 1 D).
These temperature sensors have a protection tube inside of which is located a replaceable measuring insert.
This insert, in standard version, is a single or dual Pt100 resistor or one or two thermocouples J or K, placed in a tube made of stainless steel 1.4541 with a diameter Ø6mm or Ø8mm.
On request measuring inserts are made of sheathed mineral insulated cable.
An ATEX certified temperature transmitter which converts the measured values to a 4-20mA, 0-20mA or 0-10V (option) signal can be mounted in the connection head.
For each sensor an Instruction Manual, Warranty Card and Declaration of Conformity are supplied.
A free of charge Quality Certificate specifying the class of the sensor or payable Calibration Certificate for the specified temperature values is

TECHNICAL DATA

Process connection	without or compression gland, stainless steel 1.4541 (option) or clamping plate, cast steel (option)
Protection sheath	Ø9x1, Ø10x1,5, Ø11x2mm, stainless steel 14541, measuring insert Ø6mm Ø12x1,5, Ø15x3mm, stainless steel 14541, measuring insert Ø8mm
Sensing element	Pt100 EN 60751 class B J (Fe-CuNi) insulated EN 60584 class 2 K (NiCr-NiAl) insulated EN 60584 class 2
Connection head and cable gland	head type XE-DANA, IP65, ATEX II 2GD cable gland ATEX II 2GD, IP65, for cable of outer diameter Ø6÷Ø8mm head type XE-BE, IP65, ATEX I M2, operating temperature up to 100°C cable gland ATEX I M2, IP65, for cable of outer diameter Ø6÷Ø12mm
Ambient temperature (Tamb)	-40°C +75°C
Response time	t_{09} ca.95s (in water 0,2 m/s for Ø9mm)
Maximum operating pressure	0,1MPa
Temperature transmitter (option)	ATEX certified

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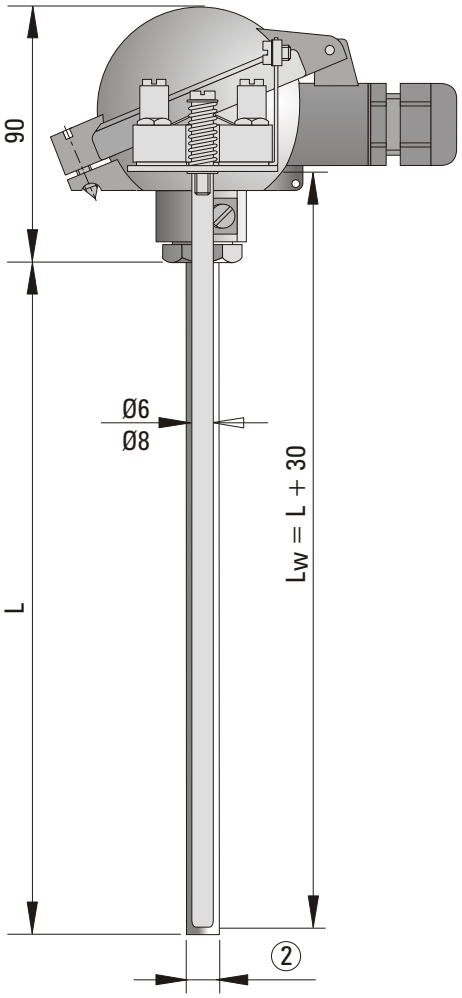
Temperature sensor type TP-Exi-601, TP-Exi-602, TP-Exi-603, TP-Exi-604, TP-Exi-605



(1) Basic version
TP-Exi

(2) Protection sheath

601	Ø9x1mm
602	Ø10x1,5mm
603	Ø11x2mm
604	Ø12x1,5mm
605	Ø15x3mm

(3) Sensing element

1P2	1xPt100 2-wire
1P3	1xPt100 3-wire
1P4	1xPt100 4-wire
2P2	2xPt100 2-wire
2P3	2xPt100 3-wire
1J	1xJ (1 x Fe-CuNi)
1K	1xK (1 x NiCr-NiAl)
2J	2xJ (2 x Fe-CuNi)
2K	2xK (2 x NiCr-NiAl)

(4) Length in mm (100<L<3000)

100	100 mm
150	150 mm
. . .	other length (by 50 mm)

(5) ATEX designation

mines	I M1 Ex ia I Ma
gases	II 2G Ex ia IIC T6 Gb
dusts	II 1D Ex ia IIIC T85°C Da

(6) Additional accessories (option)

0	without
KP, UZ	compression gland, clamping plate (type acc. to catalogue page)
T	ATEX certified temperature transmitter (parameters acc. to catalogue page)
class A (1)	sensor class (other than basic)
WPP	sheathed measuring insert

Ordering code:	**(1)**		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**
		—		—		—		—		—	
Example:	**TP-Exi**	—	**601**	—	**1P2**	—	**1200**	—	**IM1ExialMa**	—	**0**

Additional accessories please specify at the end, for example WPP, class A, UZ-15

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than the temperature class for a given substance (gas, mist, vapor).

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than 2/3 of the ignition temperature of dust cloud T_{cl} or ignition temperature of a 5-millimeter layer of dust T_{5mm} reduced by 75K.

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TEMPERATURE SENSOR TYPE
TP-Exi-611, TP-Exi-612, TP-Exi-613, TP-Exi-614, TP-Exi-615

- ☐ Temperature measurement in mines, gas and dust hazardous areas
- ☐ ATEX designation
  - CE Ex I M1 Ex ia I Ma
  - CE Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb
  - CE Ex II 2G Ex ia IIC T6-T1 Gb
  - CE Ex II 1D Ex ia IIIC T85°C Da
- ☐ Temperature range
  - -200°C...+550°C (Pt100)
  - -40°C...+700°C (J)
  - -40°C...+900°C (K)
- ☐ Option - temperature transmitter

Sensor type	Atmosphere type	Temperature range	ATEX designation
TP-Exi-61X-XPX	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-200÷450°C	Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb lub II 2G Ex ia IIC T6-T1 Gb
	dusts	-200÷550°C	Ex II 1D Ex ia IIIC T85÷550°C Da
TP-Exi-61X-XJ	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷450°C	Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb lub II 2G Ex ia IIC T6-T1 Gb
	dusts	-40÷700°C	Ex II 1D Ex ia IIIC T85÷700°C Da
TP-Exi-61X-XK	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷450°C	Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb lub II 2G Ex ia IIC T6-T1 Gb
	dusts	-40÷900°C	Ex II 1D Ex ia IIIC T85÷900°C Da

These temperature sensors are recommended for temperature measurements in mines (sensor category M1) in explosive gases (sensor category 2 G) and dusts (sensor category 1 D).
These temperature sensors have protection tube inside which is located a replaceable measuring insert.
This insert, in standard version, is a single or dual Pt100 resistor or one or two thermocouples J or K, placed in a tube made of stainless steel 1.4541 with a diameter Ø6mm or Ø8mm.
On request measuring inserts are made of sheated mineral insulated cable.
An ATEX certified temperature transmitter which converts the measured values to a 4-20mA, 0-20mA or 0-10V (option) signal can be mounted in the connection head.
For each sensor an Instruction Manual, Warranty Card and Declaration of Conformity are supplied. A free of charge Quality Certificate specifying the class of the sensor or payable Calibration Certificate for the specified temperature values is supplied on request.

TECHNICAL DATA

Process connection	thread, stainless steel 1.4541 (option)
Protection sheath	Ø9x1, Ø10x1,5, Ø11x2mm, stainless steel 14541, measuring insert Ø6mm Ø12x1,5, Ø15x3mm, stainless steel 14541, measuring insert Ø8mm
Sensing element	Pt100 EN 60751 class B J (Fe-CuNi) insulated EN 60584 class 2 K (NiCr-NiAl) insulated EN 60584 class 2
Connection head and cable gland	head type XE-DANA, IP65, ATEX II 2GD cable gland ATEX II 2GD, IP65, for cable of outer diameter Ø6÷Ø8mm head type XE-BE, IP65, ATEX I M2, operating temperature up to 100°C cable gland ATEX I M2, IP65, for cable of outer diameter Ø6÷Ø12mm
Ambient temperature (Tamb)	-40°C +75°C
Response time	t_{09} ca.95s (in water 0,2 m/s for Ø9mm)
Maksimum operating pressure	according to PN-79/M-53857/03
Temperature transmitter (option)	ATEX certified

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Temperature sensor type TP-Exi-611, TP-Exi-612, TP-Exi-613, TP-Exi-614, TP-Exi-615

(1) Basic version
TP-Exi

(2) Protection sheath

611	Ø9x1mm
612	Ø10x1,5mm
613	Ø11x2mm
614	Ø12x1,5mm
615	Ø15x3mm

(3) Sensing element

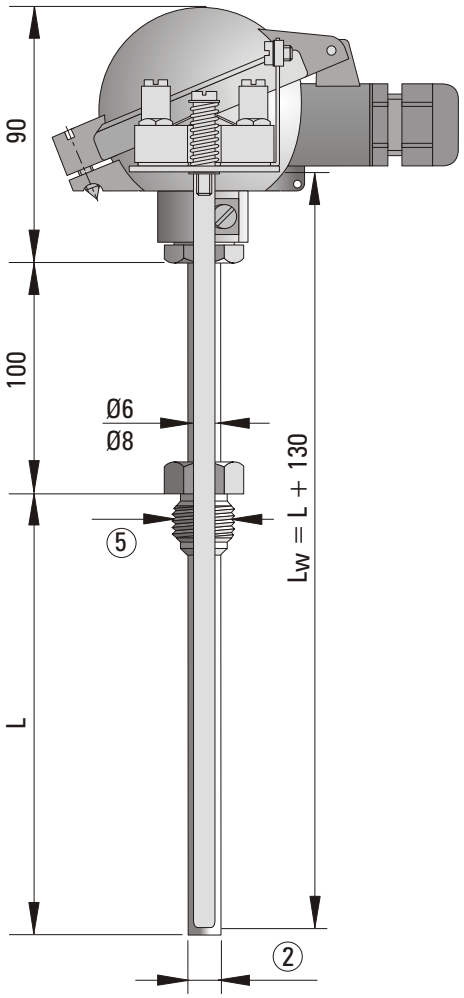
1P2	1xPt100 2-wire
1P3	1xPt100 3-wire
1P4	1xPt100 4-wire
2P2	2xPt100 2-wire
2P3	2xPt100 3-wire
1J	1xJ (1 x Fe-CuNi)
1K	1xK (1 x NiCr-NiAl)
2J	2xJ (2 x Fe-CuNi)
2K	2xK (2 x NiCr-NiAl)

(4) Length in mm (50<L<3000)

50	50 mm
100	100 mm
. . .	other length (by 50 mm)

(5) Process connection

M20x1,5	thread M20x1,5
M24x1,5	thread M24x1,5
M27x2	thread M27x2
G1/2"	thread G1/2"
G3/4"	thread G3/4"
. . .	other thread (needed specification)



(6) ATEX designation

mines	I M1 Ex ia I Ma
gases	II 1/2G Ex ia IIC T6 Ga/Gb
	II 2G Ex ia IIC T6 Gb
dusts	II 1D Ex ia IIIC T85°C Da

(7) Additional accessories (option)

0	without
T	ATEX certified temperature transmitter (parameters acc. to catalogue page)
class A (1)	sensor class (other than basic)
WPP	sheathed measuring insert

Ordering code:	**(1)**		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**		**(7)**
		—		—		—		—		—		—	
Example:	**TP-Exi**	—	**611**	—	**1P2**	—	**1200**	—	**M20x1,5**	—	**IM1ExialMa**	—	**0**

Additional accessories please specify at the end, for example WPP, class A

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than the temperature class for a given substance (gas, mist, vapor).

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than 2/3 of the ignition temperature of dust cloud T_{cl} or ignition temperature of a 5-millimeter layer of dust T_{5mm} reduced by 75K.

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TEMPERATURE SENSOR TYPE
TP-Exi-681

☐ Temperature measurement in mines, gas and dust hazardous areas

☐ ATEX designation
CE Ex I M1 Ex ia I Ma
CE Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb
CE Ex II 2G Ex ia IIC T6-T1 Gb
CE Ex II 1D Ex ia IIIC T85°C Da

☐ Temperature range
-200°C...+150°C (Pt100)
-40°C...+150°C (J)
-40°C...+150°C (K)

☐ Option - temperature transmitter

Sensor type	Atmosphere	Temperature range	ATEX designation
TP-Exi-681-XPX	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-200÷135°C	Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb lub II 2G Ex ia IIC T6-T1 Gb
	dusts	-200÷150°C	Ex II 1D Ex ia IIIC T85÷150°C Da
TP-Exi-681-XJ	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷135°C	Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb lub II 2G Ex ia IIC T6-T1 Gb
	dusts	-40÷150°C	Ex II 1D Ex ia IIIC T85÷150°C Da
TP-Exi-681-XK	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷135°C	Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb lub II 2G Ex ia IIC T6-T1 Gb
	dusts	-40÷150°C	Ex II 1D Ex ia IIIC T85÷150°C Da

These temperature sensors are recommended for measurement in mines (sensor category M1) in explosive gases (sensor category 2 G) and dust (sensor category 1 D).
Temperature sensors have a protection tube inside of which is located a replaceable measuring insert.
This insert, in the standard version, is a single or dual Pt100 resistor or one or two thermocouples J or K, placed in a tube of stainless steel 1.4541 with diameter Ø6mm.
On request measuring inserts can be made of sheathed mineral insulated cable. An ATEX certified temperature transmitter which converts the measured values to a 4-20mA, 0-20mA or 0-10V (option) signal can be mounted in the connection head.
For each sensor an Instruction Manual, Warranty Card and Declaration of Conformity are supplied.
A free of charge Quality Certificate specifying the class of the sensor or payable Calibration Certificate for the specified temperature values is supplied on request.

TECHNICAL DATA

Process connection	thread, stainless steel 1.4541 (option)	
Protection sheath	Ø9x1, stainless steel 14541, measuring insert Ø6mm	
Sensing element	Pt100	EN 60751 class B
	J (Fe-CuNi) insulated	EN 60584 class 2
	K (NiCr-NiAl) insulated	EN 60584 class 2
Connection head and cable gland	head type XE-DANA, IP65, ATEX II 2GD	
	cable gland ATEX II 2GD, IP65, for cable of outer diameter Ø6÷Ø8mm	
	head type XE-BE, IP65, ATEX I M2, operating temperature up to 100°C	
	cable gland ATEX I M2, IP65, for cable of outer diameter Ø6÷Ø12mm	
Ambient temperature (Tamb)	-40°C +75°C	
Response time	t_{09} ca.95s (in water 0,2 m/s)	
Maximum operating pressure	according to PN-79/M-53857/03	
Temperature transmitter (option)	ATEX certified	

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Temperature sensor type TP-Exi-681

(1) Basic version
TP-Exi

(2) Protection sheath

681	Ø9x1mm

(3) Sensing element

1P2	1xPt100 2-wire
1P3	1xPt100 3-wire
1P4	1xPt100 4-wire
2P2	2xPt100 2-wire
2P3	2xPt100 3-wire
1J	1xJ (1 x Fe-CuNi)
1K	1xK (1 x NiCr-NiAl)
2J	2xJ (2 x Fe-CuNi)
2K	2xK (2 x NiCr-NiAl)

(4) Length in mm (50<L<3000)

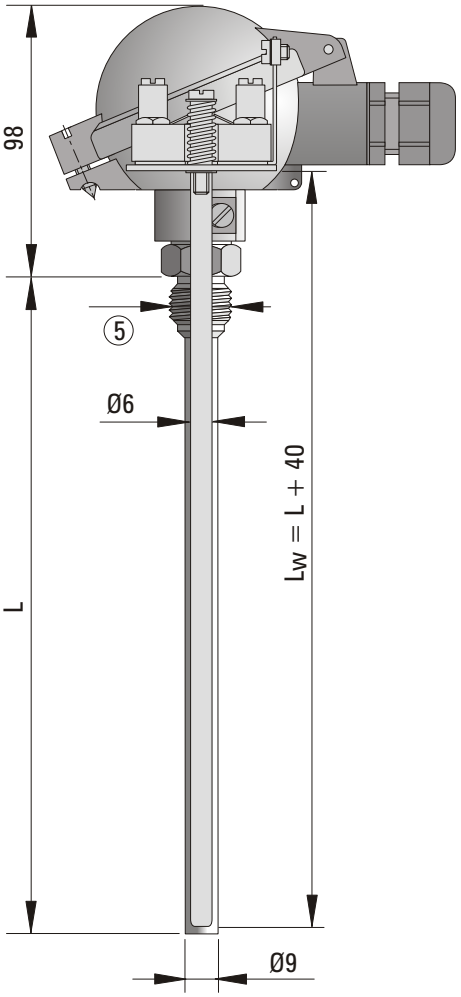
50	50 mm
100	100 mm
. . .	other length (by 50 mm)

(5) Process connection

M20x1,5	thread M20x1,5
M24x1,5	thread M24x1,5
M27x2	thread M27x2
G1/2"	thread G1/2"
G3/4"	thread G3/4"
. . .	other thread (on request)

(6) ATEX designation

mines	I M1 Ex ia I Ma
gases	II 1/2G Ex ia IIC T6 Ga/Gb
	II 2G Ex ia IIC T6 Gb
dusts	II 1D Ex ia IIIC T85°C Da



(7) Additional accessories (option)

0	without
T	ATEX certified temperature transmitter (parameters acc. to catalog page)
class A (1)	sensor class (other than basic)
WPP	sheathed measuring insert

Ordering code:	**(1)**		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**		**(7)**
		—		—		—		—		—		—	
Example:	**TP-Exi**	—	**681**	—	**1P2**	—	**1200**	—	**M20x1,5**	—	**IM1ExialMa**	—	**0**

Additional accessories please specify at the end, for example WPP, class A

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than the temperature class for a given substance (gas, mist, vapor).

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than 2/3 of the ignition temperature of dust cloud T_{cl} or ignition temperature of a 5-millimeter layer of dust T_{5mm} reduced by 75K.

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TEMPERATURE SENSOR TYPE TP-Exi-701, TP-Exi-702

- ☐ measuring insert for temperature sensors used in mines, gas and dust hazardous areas
- ☐ ATEX designation CE Ex II 2G Ex ia IIC T6-T1 Gb
- ☐ Temperature range -200°C...+550°C (Pt100)
  -40°C...+700°C (J)
  -40°C...+900°C (K)
- ☐ Option - temperature transmitter

The replaceable measuring insert is designed for installation in a protective tube of temperature sensor category M1, 1/2 G or 2 G and 1 D.
Measuring insert, in standard version, is a single or dual Pt100 resistor or one or two thermocouples J or K, placed in a tube made of stainless steel 1.4541 with a diameter Ø6mm or Ø8mm.
On request measuring inserts are made of sheathed mineral insulated cable.
Insert can be supplied with ATEX certified temperature transmitter which converts the measured values to a 4-20mA, 0-20mA or 0-10V (option) signal.
For each sensor an Instruction Manual, Warranty Card and Declaration of Conformity are supplied.
A free of charge Quality Certificate specifying the class of the sensor or payable Calibration Certificate for the specified temperature values is supplied on request.

TECHNICAL DATA

Process connection	none	
Protection sheath	Ø6mm, stainless steel 14541	
	Ø8mm, stainless steel 14541	
Sensing element	Pt100	EN 60751 class B
	J (Fe-CuNi) insulated	EN 60584 class 2
	K (NiCr-NiAl) insulated	EN 60584 class 2
Ambient temperature (Tamb)	-40°C +75°C	
Response time	t_{09} ca.95s (in water 0,2 m/s for Ø8mm)	
Maksimum operating pressure	0,1MPa	
Temperature transmitter (option)	ATEX certified	

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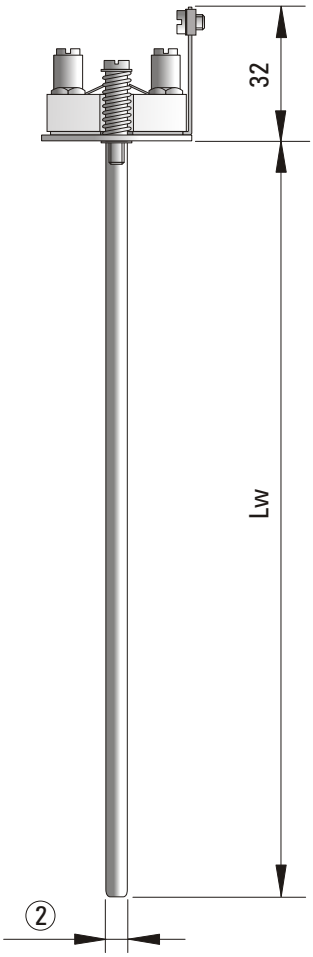

(1) Basic version
TP-Exi

(2) Protection sheath

701	Ø6mm
702	Ø8mm

(3) Sensing element

1P2	1xPt100 2-wire
1P3	1xPt100 3-wire
1P4	1xPt100 4-wire
2P2	2xPt100 2-wire
2P3	2xPt100 3-wire
1J	1xJ (1 x Fe-CuNi)
1K	1xK (1 x NiCr-NiAl)
2J	2xJ (2 x Fe-CuNi)
2K	2xK (2 x NiCr-NiAl)

(4) Length in mm (50<Lw<3000)

50	50 mm
80	80 mm
100	100 mm
. . .	other length in mm

(5) ATEX designation
II 2G Ex ia IIC T6 Gb

(6) Additional accessories (option)

0	none
T	ATEX certified temperature transmitter (parameters acc. to catalogue page)
class A (1)	sensor class (other than basic)
WPP	sheathed measuring insert

Ordering code:	**(1)**		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**
		—		—		—		—		—	
Example:	**TP-Exi**	—	**701**	—	**1P2**	—	**200**	—	**II2GExiaIICT6Gb**	—	**0**

Additional accessories please specify at the end, for example WPP, class A

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than the temperature class for a given substance (gas, mist, vapor).

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than 2/3 of the ignition temperature of dust cloud T_{cl} or ignition temperature of a 5-millimeter layer of dust T_{5mm} reduced by 75K.

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TEMPERATURE SENSOR TYPE
TP-Exi-901, TP-Exi-902, TP-Exi-903

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☐ Temperature measurement in mines, gas and dust hazardous areas

☐ ATEX designation
CE Ex I M1 Ex ia I Ma
CE Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb
CE Ex II 2G Ex ia IIC T6-T1 Gb
CE Ex II 1D Ex ia IIIC T85°C Da

☐ Temperature range -200°C...+550°C (Pt100)
-40°C...+700°C (J)
-40°C...+800°C (K)

☐ Option - temperature transmitter

Sensor type	Atmosphere type	Temperature range	ATEX designation
TP-Exi-90X-XPX	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-200÷450°C	Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb lub II 2G Ex ia IIC T6-T1 Gb
	dusts	-200÷550°C	Ex II 1D Ex ia IIIC T85÷550°C Da
TP-Exi-90X-XJ	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷450°C	Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb lub II 2G Ex ia IIC T6-T1 Gb
	dusts	-40÷700°C	Ex II 1D Ex ia IIIC T85÷700°C Da
TP-Exi-90X-XK	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷450°C	Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb lub II 2G Ex ia IIC T6-T1 Gb
	dusts	-40÷800°C	Ex II 1D Ex ia IIIC T85÷800°C Da

These temperature sensors are recommended for temperature measurements in mines (sensor category M1) in explosive gases (sensor category 2 G) and dusts (sensor category 1 D).
Temperature sensors have a protection tube inside of which is located a replaceable measuring insert.
This insert, in standard version, is a single or dual Pt100 resistor or one or two thermocouples J or K, placed in a tube made of stainless steel 1.4541 with a diameter Ø6mm.
On request measuring inserts are made of sheathed mineral insulated cable. An ATEX certified temperature transmitter that converts the measured values to a 4-20mA, 0-20mA or 0-10V (option) signal can be mounted in the connection head.
For each sensor an Instruction Manual, Warranty Card and Declaration of Conformity are supplied.
A free of charge Quality Certificate specifying the class of the sensor or payable Calibration Certificate for the specified temperature values is supplied on request.

TECHNICAL DATA

Process connection / protection sheath	conical solid drilled thermowell for welding-in, stainless steel 1.4541	
	cylindrical solid drilled thermowell with thread, stainless steel 1.4541	
	cylindrical solid drilled thermowell with flange acc. to ISO 7005-1, stainless steel 1.4541	
Sensing element	Pt100	EN 60751 class B
	J (Fe-CuNi) insulated	EN 60584 class 2
	K (NiCr-NiAl) insulated	EN 60584 class 2
Connection head and cable gland	head type XE-DANA, IP65, ATEX II 2GD	
	cable gland ATEX II 2GD, IP65, for cable of outer diameter Ø6÷Ø8mm	
	head type XE-BE, IP65, ATEX I M2, operating temperature up to 100°C	
	cable gland ATEX I M2, IP65, for cable of outer diameter Ø6÷Ø12mm	
Ambient temperature (Tamb)	-40°C +75°C	
Response time	t_{09} ca. 450s (in water 0,2 m/s)	
Maximum operating pressure	10-40MPa	
Temperature transmitter (option)	ATEX certified	

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Temperature sensor type TP-Exi-901, TP-Exi-902, TP-Exi-903

(1) Basic version
TP-Exi

(2) Protection tube / process connection

901	conical thermowell for welding-in
902	cylinrical thermowell with thread
903	cylinrical thermowell with flange

(3) Sensing element

1P2	1xPt100 2-wire
1P3	1xPt100 3-wire
1P4	1xPt100 4-wire
2P2	2xPt100 2-wire
2P3	2xPt100 3-wire
1J	1xJ (1 x Fe-CuNi)
1K	1xK (1 x NiCr-NiAl)
2J	2xJ (2 x Fe-CuNi)
2K	2xK (2 x NiCr-NiAl)

(4) Length in mm (50<L<1000)

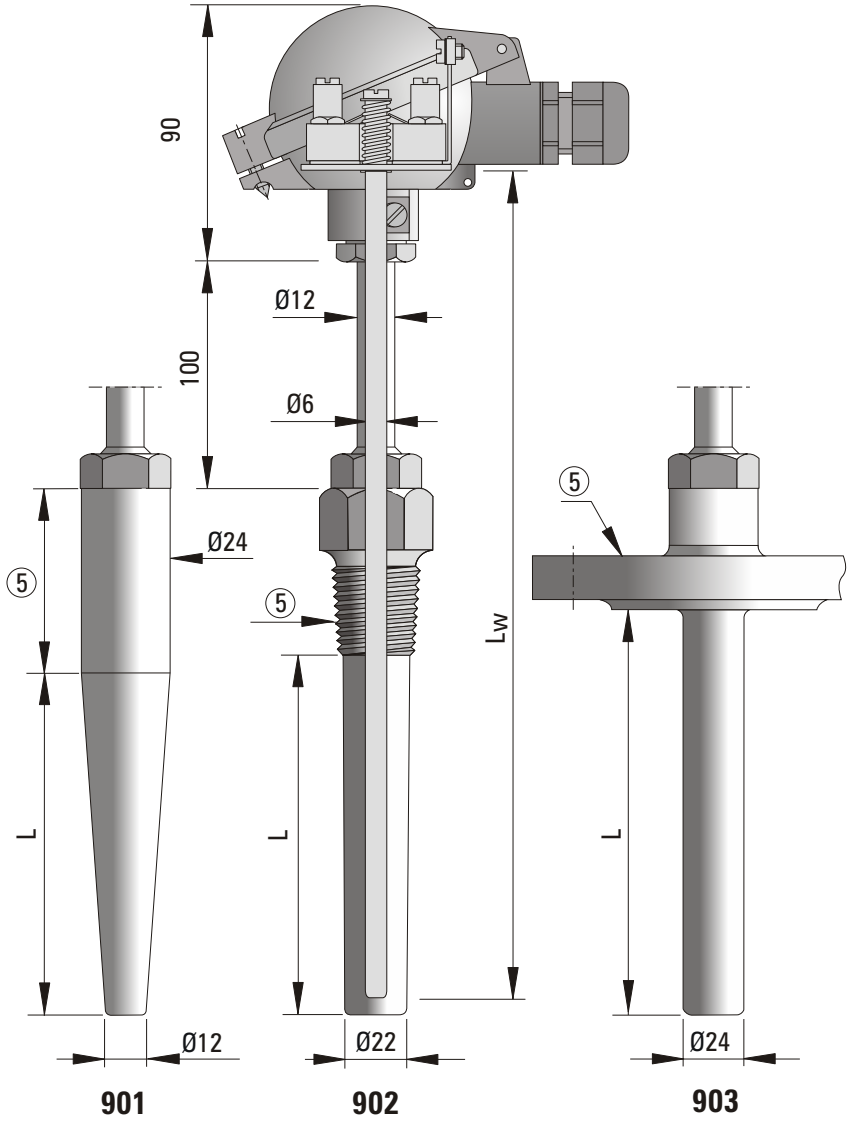
50	50 mm
100	100 mm
. . .	other length (by 50 mm)

(5) Process connection

for 901	specify length in mm
for 902	specify thread type
for 903	flange acc. to ISO 7005-1

(6) ATEX designation

mines	I M1 Ex ia I Ma
gases	II 1/2G Ex ia IIC T6 Ga/Gb
	II 2G Ex ia IIC T6 Gb
dusts	II 1D Ex ia IIIC T85°C Da



(7) Additional accessories (option)

0	none
T	ATEX certified temperature transmitter (parameters acc. to catalogue page)
class A (1)	sensor class (other than basic)
WPP	sheathed measuring insert

Ordering code:	**(1)**		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**		**(7)**
		—		—		—		—		—		—	
Example:	**TP-Exi**	—	**901**	—	**1P2**	—	**300**	—	**100**	—	**IM1ExialMa**	—	**0**

Additional accessories please specify at the end, for example WPP, class A

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than the temperature class for a given substance (gas, mist, vapor).

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than 2/3 of the ignition temperature of dust cloud T_{cl} or ignition temperature of a 5-millimeter layer of dust T_{5mm} reduced by 75K.

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TEMPERATURE SENSOR TYPE
TP-Exi-911, TP-Exi-912

☐ Temperature measurement in mines, gas and dust hazardous areas

☐ ATEX designation
CE Ex I M1 Ex ia I Ma
CE Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb
CE Ex II 2G Ex ia IIC T6-T1 Gb
CE Ex II 1D Ex ia IIIC T85°C Da

☐ Temperature range
-200°C...+550°C (Pt100)
-40°C...+700°C (J)
-40°C...+800°C (K)

☐ Option - temperature transmitter

Sensor type	Atmosphere type	Temperature range	ATEX designation
TP-Exi-91X-XPX	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-200÷450°C	Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb lub II 2G Ex ia IIC T6-T1 Gb
	dusts	-200÷550°C	Ex II 1D Ex ia IIIC T85÷550°C Da
TP-Exi-91X-XJ	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷450°C	Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb lub II 2G Ex ia IIC T6-T1 Gb
	dusts	-40÷700°C	Ex II 1D Ex ia IIIC T85÷700°C Da
TP-Exi-91X-XK	mines	-20÷150°C	Ex I M1 Ex ia I Ma
	gases	-40÷450°C	Ex II 1/2G Ex ia IIC T6-T1 Ga/Gb lub II 2G Ex ia IIC T6-T1 Gb
	dusts	-40÷800°C	Ex II 1D Ex ia IIIC T85÷800°C Da

These temperature sensors are recommended for temperature measurements in mines (sensor category M1) in explosive gases (sensor category 2 G) and dusts (sensor category 1 D).
Temperature sensors have a protection tube inside of which is located a replaceable measuring insert.
This insert, in standard version, is a single or dual Pt100 resistor or one or two thermocouples J or K, placed in a tube made of stainless steel 1.4541 with a diameter Ø6mm.
On request measuring inserts are made of sheathed mineral insulated cable. An ATEX certified temperature transmitter that converts the measured values to a 4-20mA, 0-20mA or 0-10V (option) signal can be mounted in the connection head.
For each sensor an Instruction Manual, Warranty Card and Declaration of Conformity are supplied.
A free of charge Quality Certificate specifying the class of the sensor or payable Calibration Certificate for the specified temperature values is supplied on request.

TECHNICAL DATA

Process connection	thermowell with flange DN20 acc. to ISO 7005-1, stainless steel 1.4541	
	thermowell with flange DN25 acc. to ISO 7005-1, stainless steel 1.4541	
Protection tube	Ø11x2mm, stainless steel 1.4541	
Sensing element	Pt100	EN 60751 class B
	J (Fe-CuNi) insulated	EN 60584 class 2
	K (NiCr-NiAl) insulated	EN 60584 class 2
Connection head and cable gland	head type XE-DANA, IP65, ATEX II 2GD	
	cable gland ATEX II 2GD, IP65, for cable of outer diameter Ø6÷Ø8mm	
	head type XE-BE, IP65, ATEX I M2, operating temperature up to 100°C	
	cable gland ATEX I M2, IP65, for cable of outer diameter Ø6÷Ø12mm	
Ambient temperature (Tamb)	-40°C +75°C	
Response time	t_{09} ca. 150s (in water 0,2 m/s)	
Maximum operating pressure	3-10MPa	
Temperature transmitter (option)	ATEX certified	

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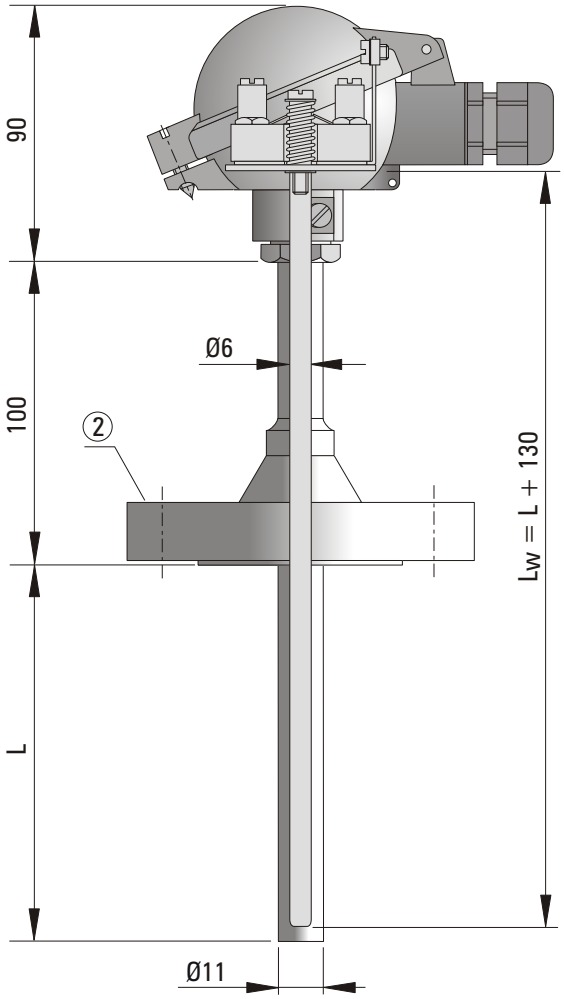

(1) Basic version
TP-Exi

(2) Protection tube / process connection

911	thermowell with flange DN20 ISO 7005-1
912	thermowell with flange DN25 ISO 7005-1

(3) Sensing element

1P2	1xPt100 2-wire
1P3	1xPt100 3-wire
1P4	1xPt100 4-wire
2P2	2xPt100 2-wire
2P3	2xPt100 3-wire
1J	1xJ (1 x Fe-CuNi)
1K	1xK (1 x NiCr-NiAl)
2J	2xJ (2 x Fe-CuNi)
2K	2xK (2 x NiCr-NiAl)

(4) Length in mm (50<L<3000)

50	50 mm
100	100 mm
. . .	other length (by 50 mm)

(5) ATEX designation

mines	I M1 Ex ia I Ma
gases	II 1/2G Ex ia IIC T6 Ga/Gb
	II 2G Ex ia IIC T6 Gb
dusts	II 1D Ex ia IIIC T85°C Da

(6) Additional accessories (option)

0	none
T	ATEX certified temperature transmitter (parameters acc. to catalogue page)
class A (1)	sensor class (other than basic)
WPP	sheahted measuring insert

Ordering code:	**(1)**		**(2)**		**(3)**		**(4)**		**(5)**		**(6)**
		—		—		—		—		—	
Example:	**TP-Exi**	—	**911**	—	**1P2**	—	**1200**	—	**IM1ExialMa**	—	**0**

Additional accessories please specify at the end, for example WPP, class A

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than the temperature class for a given substance (gas, mist, vapor).

The designer of the installation will be responsible for selecting a type of sensor and method of its implementation such that after installation, during extreme operating conditions, the temperature of the sensor's hottest surface is lower than 2/3 of the ignition temperature of dust cloud T_{cl} or ignition temperature of a 5-millimeter layer of dust T_{5mm} reduced by 75K.

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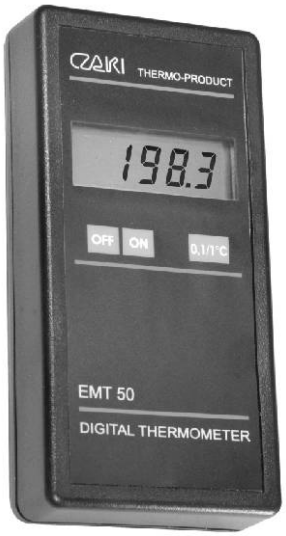
PORTABLE THERMOMETER

type EMT-50
type EMT-55



- ☐ for use with sensors
  - Fe-CuNi (J) (**EMT-50-J**)
  - NiCr-NiAl (K) (**EMT-50-K**)
  - NiCrSi-NiSi (N) (**EMT-50-N**)
  - PtRh10-Pt (S) (**EMT-50-S**)
  - PtRh13-Pt (R) (**EMT-50-R**)
  - PtRh30-PtRh6 (B) (**EMT-50-B**)
  - Pt100 (**EMT-55**)
- ☐ linearization of the sensor characteristics
- ☐ automatic compensation of thermocouple cold junction (**EMT-50-x**)
- ☐ 3-wire input for compensation of sensor lead resistance and temperature change of lead resistance (**EMT-55**)
- ☐ low battery indication

The meter with its sensor, is used for quick and accurate temperature measurements of solids, powders, liquids, vapors and gases. Battery power, small size and weight make it a portable device for measurements in hard to reach places.

TECHNICAL DATA

Measuring range	−100°C ... +700°C	(**EMT-50-J**)	
	−100°C ... +1200°C	(**EMT-50-K**)	
	0°C ... +1300°C	(**EMT-50-N**)	
	+300°C ... +1600°C	(**EMT-50-S**), (**EMT-50-R**)	
	+600°C ... +1600°C	(**EMT-50-B**)	
	−100°C ... +800°C	(**EMT-55**)	
Resolution	1°C or 0,1°C in range -50,0°C...+199,9°C		
Accuracy (T_A = 23°C ± 5°C)	±0,15% of temperature range ±1 digit		
Sensor input	socket type **MT-G**x [1]	(**EMT-50-**x)	(x - type of thermocouple)
	socket type **MP-G** [2]	(**EMT-55**)	
Display	LCD, maximum reading 1999, height of digits 10,4 mm		
Power supply	9 V battery 6F22		
Ambient temperature T_A	+5°C...+40°C		
Dimension / Weight	131 x 58 x 30 mm / 150 g		
Additional accessories	thermocouple sensors with plug type MT-x	(**EMT-50-**x)	
	Pt100 resistance sensors with plug type MP	(**EMT-55**)	

[1] **DIN-545** socket or other on demand
[2] **JACK 3,5 mm** socket or other on demand

ORDERING CODE

	(1)	(2)	(3)	(4)
EMT	—	—	—	/

(1)	Type of sensor measuring element	**50** for thermocouples, **55** for Pt100
(2)	Thermocouple (for EMT-50)	**J**, **K**, **N**, **S**, **R**, **B**
(3)	Sensor input socket, if other then MT or MP	**DIN-545**, **JACK 3,5 mm**
(4)	Additional accessories	ordering code for temperature sensor

Example for order: EMT-55 / TP-112Pt100-200-M portable thermometer equipped with disconnectable (socket and plug type MP) Pt100 resistance sensor of outer diameter 5 mm and length 200 mm, with spiral connecting cable of length 1,5 m.

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PORTABLE THERMOMETER

type EMT-300
type EMT-302

- ☐ for use with: one sensor NiCr-NiAl (K) (**EMT-300**)
  two sensors NiCr-NiAl (K) (**EMT-302**)
- ☐ linearization of the sensor characteristics
- ☐ automatic compensation of thermocouple cold junction
- ☐ large LCD display
- ☐ low battery indication
- ☐ turns off after 30 minutes of inactivity

The meter with its sensor, is used for quick and accurate temperature measurements of solids, powders, liquids, vapors and gases. Battery power, small size and weight make it a portable device for measurements in hard to reach places.

TECHNICAL DATA

	EMT-300	**EMT-302**
Number of inputs	1 (socket MT-GK)	2 (sockets MT-GK)
Measuring range	-73 ... +1370 °C -100 ... +2498 °F	-200 ... +1360 °C -200 ... +1999 °F
Resolution	0,1 °C / 0,1 °F for **T** < 2000 1 °F for **T** ≥ 2000	0,1 °C / 0,1 °F for **T** < 200 1 °C / 1 °F for **T** ≥ 200
Accuracy (T_A = 23 ± 5 °C) (**T** - readed temperature value)	0,1% **T** ± 1 °C 0,1% **T** ± 2 °F	0,3% **T** ± 5 °C for **T** < -93 °C 0,3% **T** ± 1 °C for -93 ≤ **T** ≤ 1000 °C 0,5% **T** ± 1 °C for **T** > 1000 °C 0,3% **T** ± 2 °F for **T** ≤ 1832 °F 0,5% **T** ± 2 °F for **T** > 1832 °F
Frequency of measurments	4,5 per sec.	1 per sec.
Additional functions	MAX, MIN, AVG, HOLD, OFFSET, memory of 150 measurments	MAX, MIN, AVG, HOLD, OFFSET T1 - T2, display backlight
Power supply	9V, 6 batteries AAA	
Ambient temperature T_A	0 ... 50 °C	
Dimensions / weight	150 x 72 x 35 mm / 235 g	
Additional accessories	thermocouple sensors with plug type MT-K	

ORDERING CODE

	(1)		(2)
EMT	—		/

(1) Thermometer type — **300** - with one input, **302** - with two inputs
(2) Additional accessories — ordering code for temperature sensor (sensors)

Example for order: EMT-300 / TP-101-b-630-MT-K portable thermometer equipped with disconnectable (socket and plug type MT-K) sensor of length 630 mm based on sheathed thermocouple NiCr-NiAl (K) with measuring junction galvanically insulated from the sheath and with spiral connecting cable of length 1,5 m.

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PANEL THERMOMETER

Type EMT-102, EMT-112

EMT-102

EMT-112

- ☐ meter for panel mounting 48 x 96 mm
- ☐ large, easy to read display
- ☐ for use with sensors:
  RTD: Pt100, Ni100
  thermocouples: K, J, N, T, B, R, S
  semiconductor: 1-Wire® (DS18B20)
- ☐ linearization of the sensor characteristics
- ☐ wide operating temperature range
- ☐ 230V AC or 10 ... 30 V DC power supply
- ☐ alarm threshold (EMT-112)

EMT-102 and EMT-112 are microprocessor-based temperature meters for installation in a control panel. Depending on the version they operate with RTDs Pt100, Ni100 (in a two- or three-wire connection), with thermocouples or semiconductor temperature sensors with 1-Wire® interface type DS18B20. The design of the electronic circuit allows high accuracy to be achieved. Meters automatically change the resolution of the displayed value. The large display provides excellent visibility from large distances. Meter EMT-112 is equipped with an alarm system. Alarm threshold value setting is done from the keyboard on the front panel. Exceeding the threshold temperature illuminates the LED light on the front panel and activation of the relay.

TECHNICAL DATA

Measuring range

Version	Sensor type	Range
EMT-1x2-Pt100	**Pt100**	-199 ... 850°C
EMT-1x2-Ni100	**Ni100**	-60 ... 180°C
EMT-1x2-B	**B** PtRh30-PtRh6	400 ... 1800°C
EMT-1x2-J	**J** Fe-CuNi	-199 ... 1200°C
EMT-1x2-K	**K** NiCr-NiAl	-199 ... 1370°C
EMT-1x2-N	**N** NiCrSi-NiSi	-199 ... 1300°C
EMT-1x2-R	**R** PtRh13-Pt	0 ... 1700°C
EMT-1x2-S	**S** PtRh10-Pt	0 ... 1700°C
EMT-1x2-T	**T** Cu-CuNi	-199 ... 300°C
EMT-1x2-DS	**DS** DS18B20	-55 ... 125°C

Resolution	0,1°C in range (-100 ... 1000°C); 1°C outside this range
Accuracy (T_a = 23°C)	±0,15% of measuring range ±1digit
Cold junction measurement error	±0,4°C
Display	**4 digits** 20mm high, red
Standard power supply	230 V AC, 3VA
Optional power supply	10 ... 30 V DC, 500 mW (LV version)
Alarm output (EMT-112 only)	SPDT relay contact, 5 A, 250 V AC / 30 V DC
Ambient temperature T_a	-25°C ... + 50°C
Ingress protection (from the front / behind the panel)	IP61 / IP20
Mounting window dimensions (height x width)	45,2 x 92 mm
Dimensions (height x width x depth) / weight	48 x 96 x 80 mm / ca. 260 g

ORDERING CODE

	(1)	(2)	(3)
EMT	—	—	—

(1)	TypE	**102, 112**
(2)	Sensor measuring element	**Pt100, Ni100, K, J, N, T, B, R, S, DS**
(3)	Power supply, if other then 230 V AC	**LV**

Example for order: EMT-112-Pt100 panel thermometer for Pt100 temperature sensor, standard power supply 230V AC with alarm indicator and relay contacts

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PANEL THERMOMETER

type EMT-100, EMT-101

type EMT-110, EMT-111

- ☐ for use with sensors Pt100, Ni100, Cu-CuNi (T), Fe-CuNi (J), NiCr-NiAl (K), NiCrSi-NiSi (N), PtRh10-Pt (S), PtRh13-Pt (R), PtRh30-PtRh6 (B)
- ☐ linearization of the sensor characteristics
- ☐ automatic compensation of thermocouple cold junction
- ☐ 3-wire input for compensation of RTD sensor lead resistance
- ☐ analog signal voltage output
- ☐ adjustable threshold alarm **(EMT-110, EMT-111)**

This thermometer is designed for installation in a control panel. It is used with 2 and 3-wire RTD's as well as a wide assortment of thermoelectric sensors. It contains automatic cold junction compensation for the thermocouple and has an analog output providing a temperature to voltage signal. The clear and bright display is readable even from a long distance. EMT-110 and EMT-111 thermometers are equipped with an adjustable threshold alarm circuit to control an output relay. Precise setting of the alarm point is assured by a multiturn potentiometer. A signal indicates if the set temperature is exceeded. It is widely used for temperature measurements in many industries and laboratories.

TECHNICAL DATA

Measuring range	–100°C ... +230°C **(EMT-100-T, EMT-110-T)** –100°C ... +700°C **(EMT-100-J, EMT-110-J)** –100°C ... +1200°C **(EMT-100-K, EMT-110-K)** 0°C ... +1300°C **(EMT-100-N, EMT-110-N)** +300°C ... +1600°C **(EMT-100-S, EMT-100-R, EMT-110-S, EMT-110-R)** +600°C ... +1600°C **(EMT-100-B, EMT-110-B)** –200°C ... +800°C **(EMT-100-Pt100, EMT-110-Pt100)** –50°C ... +200°C **(EMT-101-Pt100, EMT-101-J, EMT-101-K, EMT-111-Pt100, EMT-111-J, EMT-111-K)** –50°C ... +180°C **(EMT-101-Ni100, EMT-111-Ni100)**
Resolution	1°C **(EMT-100, EMT-110)**,0,1°C**(EMT-101, EMT-111)**
Accuracy (T_A = 23°C ± 5°C)	±0,15% of measuring range ±1 digit
Display	LED, height of digits 13 mm, red (green on demand)
Voltage output (R_{load} > 2 kΩ)	0 V for T=0°C; 10 V for T=T_{MAX}; for T<0°C negative voltage
Alarm output	SPDT relay contacts 5 A, 250 V AC / 24 V DC
Standard power supply	230 V AC +10% –15%, 50 Hz, 3 VA
Optional power supply	24 V AC, 24 V DC, 12 V DC, 110/115 V AC
Ambient temperature T_A	+5°C...+40°C
Mounting window dimensions (height x width)	44 x 91 mm
Dimensions (height x width x depth) / weight	48 x 96 x 128 mm / 250 g

ORDERING CODE

	(1)	(2)	(3)	(4)
EMT	—	—	—	—

(1)	Type	**100, 101, 110,111**
(2)	Sensor measuring element	**Pt100, Ni100, T, J, K, N, S, R, B**
(3)	Display color, if other then red	**green**
(4)	Power supply, if other then 230 V AC	**24VAC, 24VDC, 12VDC, 110/115VAC**

Example for order: EMT-110-Pt100 panel thermometer, measuring range –200°C...+800°C for use with Pt100 sensor, resolution 1°C, voltage 10 V output and relay alarm output.

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PANEL THERMOMETER

type EMT-133, EMT 134

- ☐ miniature thermometer with front panel dimensions **24 x 48 mm**
- ☐ for use with sensors:
  RTD: Pt100, Ni100
  thermocouples: K, J, N, T, B, R, S
  semiconductor: 1-Wire® (DS18B20)
- ☐ linearization of the sensor characteristics
- ☐ wide range of ambient operating temperature
- ☐ power supply **230 V AC** or **10...30 V DC**

EMT-133 and EMT-134 are microprocessor thermometers designed for installation in a control panel. Depending on the version theyoperate with RTDs: Pt100, Ni100 (in a two- or three-wire connection), with thermocouples or semiconductor temperature sensors with 1-Wire® interface type DS18B20. Design of the electronic circuit allows high accuracy to be achieved. Meters automatically change the resolution of the displayed value. Small size and minimal weight make them ideal for use in portable measuring equipment.

TECHNICAL DATA

Sensor type	EMT-133	EMT-134
Measuring range		
Pt100	-199 ... 850°C	-199 ... 850°C
Ni100	-60 ... 180°C	-60 ... 180°C
B PtRh30-PtRh6	400 ... 999°C	400 ... 1800°C
J Fe-CuNi	-199 ... 999°C	-199 ... 1200°C
K NiCr-NiAl	-199 ... 999°C	-199 ... 1370°C
N NiCrSi-NiSi	-199 ... 999°C	-199 ... 1300°C
R PtRh13-Pt	0 ... 999°C	0 ... 1700°C
S PtRh10-Pt	0 ... 999°C	0 ... 1700°C
T Cu-CuNi	-199 ... 300°C	-199 ... 300°C
DS DS18B20	-55 ... 125°C	-55 ... 125°C

Resolution	0,1°C in range (- 10 ... 100°C), 1°C below -10°C and above 100°C	0,1°C in range (-100 ... 1000°C) 1°C below -100°C and above 1000°C
Temperature drift (T_a = 23°C)	±0,15% of measuring range ±1digit	
Cold junction temperature compensation error	±0,4°C	
Display	LED **3 digits** 13 mm, red	LED **4 digits** 10mm, red
Standard power supply	230 V AC, 2VA	
Optional power supply	10 ... 30 V DC, 500 mW (LV version)	
Ambient temperature T_a	-25°C ... + 50°C	
Ingress protection (from the front / behind the panel)	IP61 / IP20	
Mounting window dimensions (height x width)	21,5 x 44,5 mm	
Dimensions (height x width x depth) / weight	24 x 48 x 90 mm / ok. 60 g	

ORDERING CODE

	(1)	(2)	(3)
EMT —	☐	— ☐	— ☐

(1)	Type	**133, 134**
(2)	Sensor element	**Pt100, Ni100, K, J, N, T, B, R, S, DS**
(3)	Supply voltage if other then 230 V AC	**LV**

Example for order: EMT-133-Pt100 miniature panel thermometer for Pt100 temperature sensor, standard power supply 230V AC

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PANEL THERMOMETER

type EMT-200

- ☐ for use with a wide assortment of temperature sensors
- ☐ range overload and sensor fault indication
- ☐ two programmable multifunction alarms with relay outputs
- ☐ RS-232 or RS-485 communication interface galvanically separated from input circuit
- ☐ data logging software for PC: **Logger** and **Logger-9**
- ☐ configuration via front panel keyboard or interface
- ☐ access control function

The EMT-200 type is a microprocessor thermometer designed for installation in a control panel. It is used with a wide assortment of RTD and thermoelectric temperature sensors. It is equipped with two multifunction programmable alarm circuit to control output relays. The EMT-200 thermometer is easy to program. Menu driven operating commands are displayed on a dual 4-digit LED to allow easy setting of process parameters. This thermometer has a built-in serial communication interface which allows reading and programming of the process parameters by a computer. A printer with a serial input can be connected to the EMT-200 type thermometer directly. It has built in non-volatile memory for 300 measurement results. The access control function provides protection from un-authorized operators. Windows® application program **Logger** allows for the visualization of the temperature read out on the screen of the monitor, printing graphs and saving to the file. Program **Logger-9** enables the simultaneous visualization for several (at most 9) EMT-200-RS-485 thermometers connected to a common RS-485 bus. It is possible to order the CD-ROM with both applications for extra charge, or free of charge download from the web page www.czaki.pl.

TECHNICAL DATA

Sensor type, measuring range	according to the table
Resolution	0,1°C up to +400°C 1°C over +400°C
Accuracy (T_A = 23°C ± 5°C)	± (0,002 × |T| +0,3°C +1 digit) T - read temperature value
Pt100, Ni100 bias current	0,2 mA
Display	LED, height of digits 13 mm, red
RS-232 / RS-485 speed transmission	600, 1200, 2400, 4800, 9600 bps
Alarm outputs (2 independent)	SPDT relay contacts 5 A, 250 V AC / 24 V DC
Standard power supply	230 V AC +10% –15%, 50 Hz, 3 VA
Optional power supply	24 V AC, 24 V DC, 12 V DC, 110/115 V AC
Ambient temperature T_A	0°C...+45°C
Mounting window dimensions (height x width)	44 x 91 mm
Dimensions (height x width x depth) / weight	48 x 96 x 128 mm / 400 g

Sensor type	Range [°C]
B PtRh30-PtRh6	400...1800
R PtRh13-Pt	200...1600
S PtRh10-Pt	200...1600
N NiCrSi-NiSi	–100...1300
K NiCr-NiAl	–100...1200
J Fe-CuNi	–100...1000
T Cu-CuNi	–100...230
Pt100(1)	–100...850
Ni100(1)	–60...180

(1) 2 or 3 wire connection

ORDERING CODE

	(1)	(2)	(3)
EMT - 200	—	—	—

(1) Serial interface, if other then RS-232 — **RS-485**
(2) Power supply, if other then 230 V AC — **24VAC**, **24VDC**, **12VDC**, **110/115VAC**
(3) Additional accessories — **LOGGER** - CD-ROM with applications: Logger and Logger-9

Example for order: EMT-200-RS-485 panel thermometer for use with Pt100, Ni100 resistance sensors and thermocouples: T, J, K, N, S, R, B equipped with serial communication interface RS-485.

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PANEL THERMOMETER

type EMT-220

- ☐ for use with temperature sensors
  resistors: Pt100, Ni100
  thermocouples: J, K, N, T, S, R, B
- ☐ linearization of the sensor characteristics
- ☐ range overload and sensor fault indication
- ☐ two programmable multifunction alarms with relay outputs
- ☐ optional extension module: analog output or serial communication interface
- ☐ data logging software for PC: **Logger** and **Logger-9** (for EMT-220-RS-232 and EMT-220-RS-485)

EMT-220 is a programmable thermometer designed for use with a wide assortment of temperature sensors. Sensor type is configured by the user. Two independent relay outputs allow for alarm or simple control functions. This meter can be equipped with optional module galvanically separated from input circuit: analog output or serial communication interface. Windows® application program **Logger** allows for the visualization of the temperature read out on the screen of the monitor, printing graphs and saving to the file (EMT-220-RS-232 and EMT-220-RS-485). Program **Logger-9** enables the simultaneous visualization for a several (at most 9) of EMT-220-RS-485 thermometers connected to a common RS-485 bus. It is possible to download both applications from the web page www.czaki.pl.

TECHNICAL DATA

Sensor type, measuring range		according to the table
Resolution:	thermocouples S, R, B	1°C
	other sensors	0,1°C (T<1000°C) 1°C (T>999,9°C)
Accuracy (T_A=23°C)		according to the table
Ambient temperature drift:	thermocouples	± 0,015% /°C
	thermoresistors	± 0,005% /°C
Accuracy of cold junction compensation		± 1,5°C
Pt100 and Ni100 bias current		0,2 mA
Pt100 and Ni100 connection		2 or 3 wires
Display		LED, height of digits 20 mm, red (green on demand)
Alarm outputs (2 independent)		SPDT relay contacts 5 A, 250 V AC / 24 V DC
Power supply		80÷250 V AC 50..60 Hz, 3 VA
Ambient temperature T_A		0...+50°C
Mounting window dimensions (height x width)		44 x 91 mm
Dimensions (height x width x depth) / weight		48 x 96 x 103 mm / 200 g
Additional accessories (1 of 2 options):		
analog output		0...10V, 0...20mA and 4..20mA
serial interface RS-232 or RS-485		2400 bit/s

Sensor type	Range [°C]	Accuracy *
Pt100	–200...660	±0,2°C / ±0,1%
Ni100	–60...180	±0,1°C / ±0,1%
B PtRh30-PtRh6	400...1800	±3,0°C / ±0,2%
R PtRh13-Pt	200...1600	±2,0°C / ±0,2%
S PtRh10-Pt	200...1600	±2,0°C / ±0,2%
N NiCrSi-NiSi	–100...1300	±0,8°C / ±0,1%
K NiCr-NiAl	–100...1200	±0,5°C / ±0,1%
J Fe-CuNi	–100...1000	±0,5°C / ±0,1%
T Cu-CuNi	–100...250	±1,0°C / ±0,2%

* greater of 2 values

ORDERING CODE

	(1)	(2)
EMT - 220	–	—

(1) Additional accessories(1 of 2 options)
- **A** analog output (0...20 mA, 4...20 mA and 0...10 V)
- **RS-232** or **RS-485** serial communication interface

(2) LED colour, if other then red
- **green**

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PROCESS INDICATOR

type LM-103

type LM-104

- ☐ measurment of standard analog signals in industrial automation systems:
  voltage 0...5 V or 0...10 V
  current 0...20 mA or 4...20mA
- ☐ factory scaled to display in engineering units according to customer requirements
- ☐ additionally equipped with 24 V / 30 mA power supply for the transmitter **(LM-104)**

This process indicator is designed to measure voltage 0...5 V or 0...10 V and current in 0...20 mA and 4... 20 mA current loop systems and in networks and industrial system instalations. The result is indicated in milliamperes, volts or directly in physical units. i.e. Mpa, N, °C. It can be installed in a control panel. The LM-104 type process indicator is equipped with a 24 V/30 mA power supply which may also be used to power the transmitter connected to it. The clear display allows results to be read even from a long distance.

TECHNICAL DATA

Input signal (DC)	0...20 mA, 4...20 mA [1] 0...5 V, 0...10 V [1]
Accuracy (T_A = 23°C ± 5°C)	±0,3% of readed value ±1 digit
Input resistance	< 20 Ω (current input) > 1 MΩ (voltage input)
Maximum readout	± 1999 (3½ digits)
Display	LED, height of digits 13 mm, red (green on demand)
Supply output for transmitter excitation (LM-104)	24 V DC ± 5% / 30 mA
Standard power supply	230 V AC +10% –15%, 50 Hz, 3 VA
Optional power supply	24 V AC, 24 V DC, 12 V DC, 110/115 V AC
Ambient temperature T_A	0°C...+50°C
Mounting window dimensions (height x width)	44 x 91 mm
Dimensions (height x width x depth) / weight	48 x 96 x 128 mm / 250 g

[1] Other input signals on demand

ORDERING CODE

	(1)		(2)		(3)		(4)		(5)
LM	—		/		/		—	—	

(1) Type of indicator **103**, **104**
(2) Input signal **0-5V**, **0-10V**, **0-20mA**, **4-20mA**
(3) Range of indication (with decimal point position) and engineering unit
(4) Display colour, if other then red **green**
(5) Power supply, if other then 230 V AC **24VAC**, **24VDC**, **12VDC**, **110/115VAC**

Example for order: LM-104 / 4-20 mA / 0,00-10,00 MPa process indicator with current input 4...20 mA, indicating pressure in range 0-10 MPa (0,00-10,00 MPa), equipped with 24 V / 30 mA power supply output for transmitter.

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PROGRAMMABLE PROCESS MONITOR

type LM-220

- ☐ measurment of standard analog signals in industrial automation systems: 0 ... 20mA, 4 ... 20mA, 0 ... 10V
- ☐ user programmable indication range
- ☐ user selectable characteristic: linear or square root
- ☐ two programmable multifunction alarms with relay outputs
- ☐ optional extension module (1 of 3 options):
  transmitter power supply 24 V/30 mA
  scalable current and voltage analog output
  serial communication interface: RS-232 or RS-485

LM-220 is a programmable current and voltage meter designed to measure voltage 0...10 V and current 0...20 mA or 4...20 mA. Measured and scaled value of the signal is displayed on a 4-digit LED display. The range of the displayed measured values, decimal point position are programmed by the user. The monitor has two independent relay outputs to enable signaling of alarm or simple implementation of regulatory functions. The threshold values and the operating mode of the alarm relays are configured by the user. LM-220 is characterized by high accuracy over the range of ambient temperatures. Engineering unit or a description of the display are placed under the plastic front of the monitor and can be changed by the user.

TECHNICAL DATA

Input signal, accuracy (T_a = 23°C ± 5°C)	according to the table
Maximum readout	-999...9999 (4 digits)
Display	LED, height of digits 20 mm, red (green on demand)
Alarm outputs (2 independent)	SPDT relay contacts 5 A, 250 V AC / 24 V DC
Power supply	80÷250 V AC 50..60 Hz, 3 VA
Ambient temperature T_a	0°C...+50°C
Mounting window dimensions (height x width)	44 x 91 mm
Dimensions (height x width x depth) / weight	48 x 96 x 103 mm / 200 g
Additional accessories (1 of 3 options):	
transmitter power supply	24 V DC / 30 mA
analog output	0...10V, 0...20mA and 4..20mA
serial interface RS-232 or RS-485	2400 bit/s

Input signal	Input resistance	Accuracy
0...20mA	< 22 Ω	0,1%
4...20mA	< 22 Ω	0,1%
0...10V	> 1M Ω	0,1%

ORDERING CODE

	(1)		(2)		(3)
LM-220	—		—		—

(1) Engineering unit (for example **%**,**°C**, **MPa**, **N**, **mA**)

(2) Additional accessories (1 of 3 options)

A	analog output (0...20 mA, 4...20 mA and 0...10 V)
RS-232 or **RS-485**	serial communication interface
Z	transmitter power supply 24V DC / 30 mA

(3) LED color, if other then red **green**

Example for order: LM - 220 - °C - Z process indicator with universal voltage or current input, indicating temperature in [°C] with 24 V DC supply for transmitter.

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PROGRAMMABLE HEAD-MOUNTING PROCESS MONITOR
type LMH-21, type LMH-22

LMH-21

LMH-22

- ☐ measurement standard signal 4 - 20 mA
- ☐ user-adjustable display range
- ☐ two programmable alarm thresholds with optical indication
- ☐ optical indication of sensor failure
- ☐ current loop supplied
- ☐ ibuilt in the lid to the head type B (LMH-21)
- ☐ installation in the head type DANAWwin (LMH-22)

LMH-21 and LMH-22 were designed as local displays in connection head temperature sensors with transmitter.
Measured and scaled value of the signal 4 - 20 mA is displayed on a 4-digit LED display. Display range and decimal point position are programmed by the user. In addition, you can program two alarm thresholds: the lower and upper, which, if exceeded is signaled by an appropriate message on the display. Configuration is done using a computer equipped with a USB port, through the interface **IF-2013U**.
Monitors operate with the following transducers manufactured by Czaki Thermo-Product: TEH-27, TEH-28, TCH-2xxx, TCHF-2xxx.

Instruments feature high accuracy over the whole range of ambient temperatures and the use of LED display allows readings regardless of the ambient light conditions.

TECHNICAL DATA

Input signal		current, standard 4 - 20 mA
Signal processing characteristics		linear
Measurement error of the input signal (T_a = 23°C)		± 10 μA
Temperature drift (dependent on T_a)		± 1,5 μA / °C
Display type		7 segment LED, red, height of digit 9,2 mm
Display range		programmable: -999...9999 (4 digits), 400...2000 by default
Precision (decimal point position)		programmable: 0, 1, 2 or 3 digits after the decimal point, 2 by default
Physical unit symbol under the display		standard [°C], another on request
Number and value of alarm set points		2, programmable, within display range, turn off by default
Upper and lower alarm signals		AL. L or AL. H displayed alternately with measured reading
Failure indicators		I < 3,6 mA, I > 22,5 mA
Failure signals		Err.L or Err.H
Current loop volltage supply		5 ... 36 V DC
Current limit from voltage source		26 ± 2 mA
Operating temperature T_a		–20°C...+70°C
Dimensions (dia. x height) / weight	(LMH-21)	70 x 27 mm / ca. 70 g
	(LMH-22)	63 x 35 mm / ca. 20 g (without head)

ORDERING CODE

	(1)		(2)		(3)		(4)		(5)
LMH	—	☐	/	☐	/	☐	/	☐	/	☐

(1) Type: **21** - B type head mounting, **22** - DANAWwin type head mounting
(2) Lower range value (LRV) with decimal point position
(3) Upper range value (URV) with decimal point position
(4) Lower alarm threshold (ALL), LRV < ALL < URV
(5) Upper alarm threshold (ALH), ALL < ALH > URV

Example for order: LMH-21 / -50.0 / 150.0 process indicator with 4-20mA current input, loop powered, indicating temperature in [°C], range of indications from -50.0 to 150°C, installation in the head type B.

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TEMPERATURE CONTROLLER

type R-201
type R-202

- ☐ control characteristic:
  - – proportional (**P**) **(R-201)**
  - – threshold with hysteresis for heating **(R-202)**
  - – threshold with hysteresis for cooling **(R-202-Pt100/2)**
- ☐ for use with sensors:
  Pt100, Fe-CuNi (**J**), NiCr-NiAl (**K**), NiCrSi-NiSi (**N**), PtRh30-PtRh6 (**B**), PtRh13-Pt (**R**), PtRh10-Pt (**S**), Cu-CuNi (**T**)
  or current loop 4...20 mA[1]
- ☐ automatic compensation of thermocouple cold junction
- ☐ assembly into the hole on the board or control panel

R-201 and R-202 are easy-to-use microprocessor temperature controller. To control the temperature of the process simply type the temperature set point and two additional parameters: the width of the proportionality zone and the pulse repetition period (R-201) or hysteresis and dead time (R-202).
Ideal for applications not requiring control by PID algorithm. Four-digit display for measured temperature or temperature setpoint and other control parameters.
Application: temperature control in plastics and rubber processing industries as well as in different types of furnaces and driers.

TECHNICAL DATA

Temperature control range	according to table [1],[2]
Accuracy (T_A 23°C ± 5°C)	0,25% of control range
Output	relay contacts or control voltage for SSR
Relay contacts	SPDT, 5 A, 250 V AC / 24 V DC
SSR control voltage	10VDC ± 2V
Thermocouple cold junction compensation	internal, automatic
Ambient temperature T_A	0°C...+45°C
Standard power supply	230 V AC +10% –15%, 50 Hz, 3 VA
Optional power supply	24 V AC, 24 V DC, 12 V DC, 110/115 V AC
Mounting window dimensions (height x width)	45,5 x 45,5 mm
Dimensions (height x width x depth) / weight	48 x 48 x 115 mm / 200 g

[1] When ordering version with input signal 4..20 mA indicate temperature value for 4 mA and 20 mA
[2] Set value limiting and other parameters on demand

Sensor type	Range [°C]
B PtRh30-PtRh6	400...1800
R PtRh13-Pt	200...1600
S PtRh10-Pt	200...1600
N NiCrSi-NiSi	0...1300
K NiCr-NiAl	0...1200
J Fe-CuNi	0...700
T Cu-CuNi	0...200
Pt100[3]	0...800
Pt100[3]	0,0...199,9
Pt100[3],[4] cooling	-50,0...150,0

[3] 2 or 3 wires
[4] type 202 only

ORDERING CODE

	(1)	(2)		(3)	(4)	(5)
R	—	—	/		—	—

(1)	Type (control characteristic)	proportional **201**, threshold with hysteresis **202**
(2)	Input	**PT100**, **B**, **J**, **K**, **N**, **R**, **S**, **T**, **420**
(3)	Reduced measurement range, resolution 0,1°C (PT100)	**1**
	Option for cooling (R-202-PT100)	**2**
	Readout for 4 and 20 mA	(lower range value **...** upper range value)
(4)	Control output, if other then relay contacts	**SSR**
(5)	Power supply, if other then 230 V AC	**24VAC**,**24VDC**,**12VDC**,**110/115VAC**

Example for order: R-201-Pt100/1 temperature controller of range 0,0°C...199,9°C for use with Pt100 sensor.
R-202-420/(0...+400°C) temperature controller of range 0°C...400°C, for use with current loop 4...20 mA.

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TEMPERATURE CONTROLLER

type RD-201
type RD-202

- ☐ control characteristic:
  - – proportional (**P**) **(R-201)**
  - – threshold with hysteresis for heating **(R-202)**
  - – threshold with hysteresis for cooling **(R-202-Pt100/2)**
- ☐ for use with sensors:
  Pt100, Fe-CuNi (**J**), NiCr-NiAl (**K**), NiCrSi-NiSi (**N**), PtRh30-PtRh6 (**B**), PtRh13-Pt (**R**), PtRh10-Pt (**S**), Cu-CuNi (**T**)
  or current loop 4...20 mA[1]
- ☐ automatic compensation of thermocouple cold junction
- ☐ rail mounting system according to DIN EN 50022-35

RD-201 and RD-202 are easy-to-use microprocessor temperature controller. To control the temperature of the process simply type the temperature set point and two additional parameters: the width of the proportionality zone and the pulse repetition period (RD-201) or hysteresis and dead time (RD-202).
Ideal for applications not requiring control by PID algorithm. Four-digit display for measured temperature or temperature setpoint and other control parameters.
Application: temperature control in plastics and rubber processing industries as well as in different types of furnaces and driers.

TECHNICAL DATA

Temperature control range	according to the table [1],[2]
Accuracy (T_A 23°C ± 5°C)	0,25% of control range
Output	relay contacts or control voltage for SSR
Relay contacts	SPDT, 5 A, 250 V AC / 24 V DC
SSR control voltage	10VDC ± 2V
Thermocouple cold junction compensation	internal, automatic
Ambient temperature T_A	0°C...+45°C
Standard power supply	230 V AC +10% –15%, 50 Hz, 3 VA
Optional power supply	24 V AC, 24 V DC, 12 V DC, 110/115 V AC
Dimensions (height x width x depth) / weight	90 x 53 x 58 mm / 200 g

Sensor type	Range [°C]
B PtRh30-PtRh6	400...1800
R PtRh13-Pt	200...1600
S PtRh10-Pt	200...1600
N NiCrSi-NiSi	0...1300
K NiCr-NiAl	0...1200
J Fe-CuNi	0...700
T Cu-CuNi	0...200
Pt100[3]	0...800
Pt100[3]	0,0...199,9
Pt100[3],[4] cooling	-50,0...150,0

[1] When ordering version with input signal 4..20 mA indicate temperature value for 4 mA and 20 mA
[2] Set value limiting and other parameters on demand

[3] 2 or 3 wires
[4] type 202 only

ORDERING CODE

	(1)	(2)	(3)	(4)	(5)
RD —	☐	— ☐	/ ☐	— ☐	— ☐

(1)	Type (control characteristic)	proportional **201**, threshold with hysteresis **202**
(2)	Input	**PT100**, **B**, **J**, **K**, **N**, **R**, **S**, **T**, **420**
(3)	Reduced measurement range, resolution 0,1°C (PT100)	**1**
	Option for cooling (R-202-PT100)	**2**
	Readout for 4 and 20 mA	(lower range value **...** upper range value)
(4)	Control output, if other then relay contacts	**SSR**
(5)	Power supply, if other then 230 V AC	**24VAC**,**24VDC**,**12VDC**,**110/115VAC**

Example for order: RD-201-Pt100/1 temperature controller of range 0,0°C...199,9°C for use with Pt100 sensor.
RD-202-420/(0...+400°C) temperature controller of range 0°C...400°C, for use with current loop 4...20 mA.

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TEMPERATURE CONTROLLER

type R-700, R-701, R-703

R-703

- ☐ control characteristic **P**, **PI**, **PD**, **PID** or threshold with hysteresis
- ☐ for use with wide assortment of sensors: **Pt100**, **Ni100**, Fe-CuNi (**J**), NiCr-NiAl (**K**), NiCrSi-NiSi (**N**), PtRh30-PtRh6 (**B**), PtRh13-Pt (**R**), PtRh10-Pt (**S**), Cu-CuNi (**T**)
- ☐ overload range and open circuit sensor alarm
- ☐ programmable multifunction alarm with relay output
- ☐ access control function
- ☐ RS-232 or RS-485 communication interface and data logging software for PC: **Logger** and **Logger-9** (R-700 and R-701 only)

R-700, R-701 and R-703 are universal one-channel microprocessor based temperature controllers which are used with RTD and thermoelectric temperature sensors. The software enables easy choice of control characteristics P, PI, PD, PID or threshold with hysteresis. Menu driven operating commands are displayed on a dual 4-digit LED to allow easy setting of process parameters.The special access control function gives protection from un-authorised operators. These controllers are equipped with a two SPDT output relays by default: one for control and one for a programmable multifunction alarm. Different voltage outputs for driving SSR are available on request. R-700 and R-701 controllers have a built-in serial communication interface which allows reading and programming of the process parameters by a computer. Windows® application programs: **Logger** and **Logger-9** allow visualization of the temperature read out on the screen of the monitor, printing graphs and saving to the file (see EMT-200 datasheet). Programs can be ordered for an additional fee on CD-ROM or downloaded free of charge from the www.czaki.pl.

TECHNICAL DATA

Sensor type, measuring range	according to the table
Resolution	0,1°C up to +1000°C; 1°C over +1000°C
Accuracy (T_A = 23°C ± 5°C, T - temp. readout)	± (0,002 × |T| +0,3°C +1 digit)
Pt100, Ni100 bias current	0,2 mA
Standard control and alarm outputs	SPDT relay contacts 5 A, 250 V AC / 24 V DC
Optional control and alarm outputs	12 ± 2 V DC for SSR driving
Standard power supply	230 V AC +10% –15%, 50 Hz, 3 VA
Optional power supply	24 V AC, 24 V DC, 12 V DC, 110/115 V AC
Ambient temperature T_A	0°C...+45°C
Mounting window dimensions (height x width)	91 x 44 mm (R-700)
	44 x 91 mm (R-701)
	45,5 x 45,5 mm (R-703)
Dimensions (height x width x depth) / weight	96 x 48 x 140 mm / 400 g (R-700)
	48 x 96 x 128 mm / 400 g (R-701)
	48 x 48 x 115 mm / 260 g (R-703)

Sensor type	Range [°C]
B PtRh30-PtRh6	400...1800
R PtRh13-Pt	200...1600
S PtRh10-Pt	200...1600
N NiCrSi-NiSi	–100...1300
K NiCr-NiAl	–100...1200
J Fe-CuNi	–100...1000
T Cu-CuNi	–100...230
Pt100(1)	–100...850
Ni100(1)	–60...180

(1) 2 or 3 wire connection

ORDERING CODE

(1) ☐ – (2) ☐ – (3) ☐ – (4) ☐ – (5) ☐ – (6) ☐

(1)	Type	**R-700**, **R-701**, **R-703**
(2)	Serial interface, if other then RS-232	**RS-485** (R-700 i R-701 only)
(3)	Control output, if other then relay contact	**SSRRG**
(4)	Alarm output, if other then relay contact	**SSRAL**
(5)	Power supply, if other then 230 V AC	**24VAC**, **24VDC**, **12VDC**, **110/115VAC**
(6)	Additional accessories	**LOGGER** - CD-ROM with applications: Logger and Logger-9

Example for order: R-701 temperature controller with RS232 interface, relay outputs and power supply 230VAC.
R-700-485-SSRRG-24VDC temperature controller with RS-485 interface, voltage control output for SSR driving, power supply 24 V DC.

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TEMPERATURE CONTROLLER

type R-720

- ☐ control characteristic **P**, **PI**, **PD**, **PID** or threshold with hysteresis
- ☐ **auto-tuning** function helps to choose control parameters
- ☐ real time clock enables **temperature profile programming**
- ☐ for use with wide assortment of sensors:
  Pt100, **Ni100**, Fe-CuNi (**J**), NiCr-NiAl (**K**), NiCrSi-NiSi (**N**), PtRh30-PtRh6 (**B**), PtRh13-Pt (**R**), PtRh10-Pt (**S**), Cu-CuNi (**T**)
- ☐ overload range and open circuit sensor alarm
- ☐ programmable multifunction alarm with relay output
- ☐ access control function
- ☐ programming by a computer or by keypad

R-720 is a universal one-channel microprocessor temperature controller designed for use with RTDs and thermoelectric sensors. The software enables easy choice of control characteristics P, PI, PID or threshold with hysteresis. The controller is equipped with a special autotuning function. This allows identification and dynamic estimation of process control parameters. Values of separate parameters are calculated automatically. Temperature profile programming function allows programming the set value as a function of time. The operating commands and process parameters are set from the front keypad or with a serial communication interface by a computer and are also displayed on the dual 4-digit LEDs. This makes it very easy and helpful for the operator. The special acces control function gives protection from un-authorised operators. The controller as a default is equipped with a two SPDT output relays: one for control and one for a programmable multifunction alarm. Voltage outputs for SSR driving are available on demand. The R-720 type temperature controllers are widely used in many industrial process.

TECHNICAL DATA

Sensor type, measuring and set value range	according to the table
Resolution	0,1°C up to +1000°C;1°C over +1000°C
Accuracy (T_A = 23°C ± 5°C, T - temp. readout)	± (0,002 × |T| +0,3°C +1 digit)
Pt100, Ni100 bias current	0,2 mA
Standard control and alarm outputs	SPDT relay contacts 5 A, 250 V AC / 24 V DC
Optional control and alarm outputs	12 ± 2 V DC for SSR driving
Standard power supply	230 V AC +10% –15%, 50 Hz, 3 VA
Optional power supply	24 V AC, 24 V DC, 12 V DC, 110/115 V AC
Ambient temperature T_A	0°C...+45°C
Mounting window dimensions (height x width)	91 x 44 mm
Dimensions (height x width x depth) / weight	96 x 48 x 140 mm / 400 g

Sensor type	Range [°C]
B PtRh30-PtRh6	400...1800
R PtRh13-Pt	200...1600
S PtRh10-Pt	200...1600
N NiCrSi-NiSi	–100...1300
K NiCr-NiAl	–100...1200
J Fe-CuNi	–100...1000
T Cu-CuNi	–100...230
Pt100(1)	–100...850
Ni100(1)	–60...180

(1) 2 or 3 wire connection

ORDERING CODE

	(1)	(2)	(3)	(4)
R-720	—	—	—	—

(1)	Serial interface, if other then RS-232	**RS-485**
(2)	Control output, if other then relay contact	**SSRRG**
(3)	Alarm output, if other then relay contact	**SSRAL**
(4)	Power supply, if other then 230 V AC	**24VAC**, **24VDC**, **12VDC**, **110/115VAC**

Example for order: R-720 temperature controller with RS232 interface, relay outputs and power supply 230VAC.

R-720-485-SSRRG-24VDC temperature controller with RS-485 interface, voltage control output for SSR driving, power supply 24 V DC.

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PROGRAMMABLE RAIL-MOUNT TRANSMITTER
type TMD-10

- ☐ for use with RTD sensors: Pt100 or Ni100
- ☐ 2, 3 or 4-wire sensor connection arrangement
- ☐ high accuracy of temperature measurement
- ☐ **RS485 interface and MODBUS-RTU communication protocol**
- ☐ up to 247 sensors on a common bus
- ☐ LED indication of communication process
- ☐ for mounting on 35 mm wide rail, according to DIN EN 50022-35

The TMD-10 transmitter is designed to measure the temperature using Pt100 or Ni100 RTD sensors. Measurement results and configuration of the transmitter is via RS-485 using a MODBUS-RTU communication protocol. One bus can serve up to 247 transmitters.
The transmitter has a high processing accuracy, low temperature drift and high resistance to interference. It can work with any automation system based on RS-485 and MODBUS-RTU communication protocol, however it is recommended for use with multi-channel temperature logger **WRT-16M** .
To configure the transmitter the **TmdCfg** program running on Windows® is employed.
This can be ordered for an additional fee on CD-ROM or downloaded free of charge from the www.czaki.pl.
TMD-10 can be connected to a computer's USB port using the interface **IF-485U**.

TECHNICAL DATA

Sensor type	Pt100, Ni100	(EN 60751)
Connection arrangement	2, 3 or 4-wire	
Measuring range	-200 ... 850°C	(**Pt100**)
	-60 ... 180°C	(**Ni100**)
Bias current Pt100, Ni100	0,2 mA	
Processing accuracy	±(0,05°C + 0,05% of actual reading)	
Temperature drift	< 0,005% of actual reading / °C	
Response time	< 0,1s	
Averaging time	< 0,3÷60s (factory set 1 s)	
Communication standard	RS-485	
Communication protocol	MODBUS-RTU	
Bus address	1 ... 247	
Transmision speed	9600, 19200 bit/s	
Transmision parameters	8E1, 8O1, 8N1	(8 data bits + parity + stop)
Galvanic isolation	no	
Power supply	12 ... 36 V DC / 0,2 W	
Ambient temperature	0 ... +60°C	
Humidity	< 90% without condensation	
Dimensions (height x width x depth) /weight	98 x 17,5 x 56,4mm / ca. 50 g	

ORDERING CODE

		(1)
TMD-10	—	

(1) Additional equipment — **TmdCfg** program on CD-ROM

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PROGRAMMABLE RAIL-MOUNT TRANSMITTER
type TMD-20

- ☐ for use with temperature sensors:
  RTD: Pt100or Ni100
  thermocouplesi: J, K, N, S, R, T, B
- ☐ standard signal measurement:
  current 0÷20mA, 4÷20mA
  voltage 0÷10V
- ☐ **RS485 interface and MODBUS-RTU communication protocol**
- ☐ up to 247 sensors on a common bus
- ☐ **measuring input galvanically isolated from the power supply and output**
- ☐ LED indication of communication process
- ☐ for mounting on 35 mm wide rail, according to DIN EN 50022-35

TMD-20 is a programmable transmitter designed for operation with temperature sensors and to measure analogue standard signals used in industrial automation systems.
Reading the measurement results and configuration of the transmitter is via RS-485 using a MODBUS-RTU communication protocol. One bus can serve up to 247 transmitters.
The transmitter has a high processing accuracy, low temperature drift and high resistance to interference. It can work with any automation system based on RS-485 and MODBUS-RTU communication protocol, however it is recommended for use with multi-channel temperature logger **WRT-16M** .
To configure the transmitter is used **TmdCfg** program running on Windows®.
This can be ordered for an additional fee on CD-ROM or downloaded free of charge from the www.czaki.pl.
TMD-10 can be connected to a computer's USB port using the interface **IF-485U**.

TECHNICAL DATA

Temperature measurement	given in Tab.1
RTD connection arrangement	2 or 3-wire
Cold junction compensation error	±1,0°C
Standard signals measurement	given in Tab.2
Processing accuracy	given in Tab.1, Tab.2
Temperature drift	< 0,01% of actual reading / °C
Response time	< 0,1s
Averaging time	< 0,3÷60 s (factory set 1 s)
Communication standard	RS-485
Communication protocol	MODBUS-RTU
Bus address	1 ... 247
Transmision speed	9600, 19200 bit/s
Transmision parameters	8E1, 8O1, 8N1 (8 data bits + parity + stop)
Galvanic isolation	500 V AC
Power supply	12 ... 36 V DC / 0,2 W
Ambient temperature	0 ... +60°C
Humidity	< 90% without condensation
Dimensions (height x width x depth) /weight	98 x 17,5 x 56,4mm / ca. 50 g

Sensor type	Range [°C]	Accuracy
Pt100	–100...850	0,05%
Ni100	–60...180	0,05%
B PtRh30-PtRh6	400...1800	0,15%
R PtRh13-Pt	200...1600	0,1%
S PtRh10-Pt	200...1600	0,1%
N NiCrSi-NiSi	–100...1300	0,1%
K NiCr-NiAl	–100...1200	0,1%
J Fe-CuNi	–100...1000	0,1%
T Cu-CuNi	–100...230	0,1%

Tab.1 Sensor input parameters

Input signal	Input resistance	Accuracy
0...20mA	< 22 Ω	0,1%
4...20mA	< 22 Ω	0,1%
0...10V	> 1M Ω	0,1%

Tab.2 Analog signal input parameters

ORDERING CODE

		(1)
TMD-20	—	

(1) Additional equipment **TmdCfg** program on CD-ROM

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PROGRAMMABLE RAIL-MOUNT TRANSMITTER

TED series

- ☐ output signal 4 ... 20 mA (**TED-27**, **TED-28**)
  0 ... 10 V (**TED-37**, **TED-38**)
- ☐ **input - output galvanic insulation** (**TED-28**, **TED-38**)
- ☐ programmable input signal range
- ☐ programmable sensor type: Pt100, Ni100, J, K, N, S, R, B, T
- ☐ RTD sensor can be connected in 2, 3 or 4-wire system
- ☐ internal or external compensation of thermocouple cold junction
- ☐ sensor failure indication by LED
- ☐ for mounting on 35 mm wide rail, according to DIN EN 50022-35

The transmitter TED is designed to converting resistance of temperature sensor or voltage of thermocouple sensor to standard current signal 4...20 mA (TED-27, TED-28) or voltage 0...10V (TED-37, TED-38).
Transmitters TED-28 and TED-38 provide galvanic insulation between input and output terminals.
Most parameters such as: sensor type, input signal range or mode of cold junction compensation, may be adapted by user for specific requirements of his measuring system.
The transmitter is programmed using a personal computer with USB port via **IF-2013U** interface which is also offered.
The housing is designed for mounting on 35 mm wide rail, according to DIN EN 50022-35.

TECHNICAL DATA

Sensor type, measuring range		programmable, see Table 1
Maximum range, accuracy, thermal drift		see Table 1
Pt100 or Ni100 sensor connection		2, 3 or 4-wire, programmable
Pt100 or Ni100 connection resistance (2 and 3-wire)		$<$10 Ω (each wire)
Maximum resistance for 2-wire connection which can be corrected with software		0,00 ...20,00 Ω (sum of both wires)
Bias current of Pt100 or Ni100 sensors		$<$ 0,25mA
Compensation of thermocouple cold junction		internal or external, programmable
Maximum error of thermocouple cold junction internal compensation		±1 °C
Temperature range of thermocouple cold junction external compensation		-50,0 ... 100,0 °C
Range of temperature offset		-10,0 ... 10,0 °C
Galvanic insulation between input and output terminals (TED-28 and TED-38)		500 V AC
Output signal	TED-2x	4 ... 20 mA or 20 ... 4 mA, programmable
	TED-3x	0 ... 10 V or 10 ... 0 V, programmable
Linear region of output signal	TED-2x	3,8 ... 20,5 mA
	TED-3x	0,0 ... 10,3 V
Output signal delay after power on		ca. 5 s
Digital filter time constant (1st order filter))		selected: 0,2; 1; 2; 4; 8; 16; 32 s
Sensor failure indication	TED-2x	3,5 or 23 mA, programmable
	TED-3x	0 or 11,5 V, programmablea
Power supply	TED-2x	8 ... 36 V DC / 24 mA (from current loop)
	TED-3x	14 ... 36 V DC / 18 mA
Ambient temperature		0 ... +60 °C
Dimensions (height x width x depth) / weight		98 x 17,5 x 56,4 mm / ca. 50 g

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Table 1. Summary of sensor types, input signal ranges and accuracy.

Sensor type	Measuring range [°C]	Minimal measuring range [°C] (1)	Accuracy- largest value (2),(3)	Thermal drift / 10°C - largest value (2),(4)
B PtRh30-PtRh6	400 ... 1800	200	0,2% or ±5°C	0,07% or ±1,5°C
J Fe-CuNi	-100 ... 1000	50	0,2% lor ±1°C	0,07% or ±0,7°C
K NiCr-NiAl	-100 ... 1200	50		
N NiCrSi-NiSi	-100 ... 1300	100		
R PtRh13-Pt	0 ... 1600	200	0,2% or ±2°C	0,07% lor ±1,5°C
S PtRh10-Pt	0 ... 1600	200		
T Cu-CuNi	-100 ... 230	50	0,2% or ±1°C	0,07% or ±0,7°C
Pt100	-100 ... 800	30	0,15% or ±0,2°C	0,05% or ±0,1°C
Ni100	-60 ... 180	30		
Voltage [mV]	-10 ... 65 mV	2 mV	0,2% or ±0,05mV	0,07% or ±0,03mV
Resistance [Ω]	60 ... 370 Ω	20 Ω	0,15% or ±0,1 Ω	0,05% or ±0,05 Ω

(1) Minimum difference between upper and lower range value.
(2) Error values in [%] are relative to user-defined range.
(3) The ambient temperature = 23 °C.
(4) Thermal drift means that the error may change with the ambient temperature.

ORDERING CODE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TED	—	—	—	—	—	—	—	—

(1)	Model of transmitter	**27** output 4 ... 20 mA, without insulation **37** output 0 ... 10 V, without insulation **28** output 4 ... 20 mA, with insulation **38** output 0 ... 10 V, with insulation
(2)	Sensor type	**Pt100**, **Ni100**, **J**, **K**, **N**, **S**, **R**, **T**, **mV**, **Ohm**
(3)	Lower range value	value in [°C], [mV] or [Ω] (default lowest value for selected sensor type)
(4)	Upper range value	value in [°C], [mV] or [Ω] (default highest value for selected sensor type)
(5)	Connecting Pt100, Ni100 or thermocouple cold junction compensation	**2**(...)(*), **3**, **4** - wires **I** - internal (automatic), **E**(...)(**) - external (user defined)
(6)	Converting characteristic	**N** - normal (4 ...20 mA, 0 ... 10 V), **R -** reverse (20 ... 4 mA, 10 ... 0 V)
(7)	Time constant of digital filter [s], selected	**0**, **1**, **2**, **4**, **8**, **16**, **32** (0 really means 0,2 s)
(8)	Alarm output signal	**H** - high level (23 mA or 11,5 V), **L** - low level (3,5 mA or 0 V)

(*) Sum of resistances of wires can be given in brackets.
(**) Thermocouple cold junction temperature must be given in brackets.

Default values were marked by under-scoring. Factory programmed in case of incomplete ordering code.
The specification of the model, i.e. point (1) is compulsory.

Example for order: TED-27-Pt100-0-150-2(0,8)-N-2-L denotes Pt100 temperature transmitter for range 0 ... 150°C with 4 ... 20 mA signal output. The sensor is connected with two wires (sum of resistances of wires = 0,8 Ω); time constant = 0.5 s; in the case of sensor failure, output current is 3,5 mA.

TED-38-K-0-600-I-N-1-H denotes thermocouple K temperature transmitter for range 0 ... 600 °C with 0 ...10V signal output galvanically insulated from sensor. Internal cold junction compensation; time constant = 1 s; in the case of sensor failure, output voltage is 11,5 V.

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RAIL-MOUNT TRANSMITTER

TCD series

- ☐ output signal 0 ... 20 mA (**TCD-1**, **TCD-4**)
  4 ... 20 mA (**TCD-2**)
  0 ... 10 V (**TCD-3**)
- ☐ for use with sensors Pt100, J, K, N, S, R, B
- ☐ 2-wire or 3-wire Pt100 sensor connection
- ☐ with or without sensor linearization
- ☐ automatic compensation of thermocouple cold junction
- ☐ out of range / sensor failure indication
- ☐ for mounting on 35 mm wide rail, acoding to DIN EN 50022-35

The TCD type transmitter converts the Pt100 sensor resistance or voltage of thermocouples to a current signal in the range 0...20mA (TCD-1..., TCD-4...), 4...20mA (TCD-2...) or to a voltage signal in the range 0...10V (TCD-3...). TCD-2... transmitter is powered from current loop. The electronic circuit of the transmitter allows high accuracy of conversion with low temperature drift and very good resistance to noise. It is widely used for temperature measurement in many branches of industry.

TECHNICAL DATA

Sensor type, measuring range	according to the table [1], [2]
Output signal	0 ... 20 mA ref. to +24V (**TCD-1**)
	4 ... 20 mA 2-wire arrangement (**TCD-2**)
	0 ... 10 V ref. to GND (**TCD-3**)
	0 ... 20 mA ref. to GND (**TCD-4**)
Bias current of Pt100 sensors	0,5 mA
Accuracy (T_A = 23°C ±5°C)	0,15% of the range value
Temperature drift	0,02% of the range value / °C
Power supply	12 ... 36 V DC / 25 mA
Ambient temperature T_A	0°C...+60°C
Dimensions (height x width x depth)	42 x 29 mm
Weight	ca. 50 g

[1] Other sensor types on demand
[2] Other measuring ranges on demand

Code	Range [°C]	Pt100	J	K	N	S, R, B
10	-50 ... 50	+				
15	0 ... 50	+				
20	0 ... 100	+				
25	0 ... 150	+				
30	0 ... 200	+	+	+		
35	0 ... 300	+	+	+		
40	0 ... 400	+	+	+		
45	0 ... 500	+	+	+	+	
50	0 ... 600	+	+	+	+	
55	0 ... 700	+	+	+	+	
60	0 ... 800	+	+	+	+	
65	0 ... 1000			+	+	
70	0 ... 1200			+	+	
75	300 ... 1400					+
80	300 ... 1600					+

ORDERING CODE

	(1)	(2)	(3)	(4)
TCD	—			—

(1)	Output signal	**1**	0 ... 20 mA, referenced to +24V
		2	4 ... 20 mA, 2-wire system
		3	0 ... 10 V, referenced to GND
		4	0 ... 20 mA, referenced to GND
(2)	Sensor linearisation	**0**	no
		1	yes
(3)	Measuring range	**10** ... **80**	(code according to the table)
(4)	Sensor type	**Pt100**, **J**, **K**, **N**, **S**, **R**, **B**	

Example for order: TCD-2130-Pt100 means transmitter for range 0...200°C, with sensor linearization, for use with Pt100 temperature sensor, output current 4...20 mA, powered from current loop.

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RAIL-MOUNT TRANSMITTER

TBD series

- ☐ output signal 0 ... 20 mA (**TBD-1**, **TBD-4**)
  4 ... 20 mA (**TBD-5**, **TBD-6**)
  0 ... 10 V (**TBD-3**)
- ☐ **input - output galvanic insulation**
- ☐ for use with sensors Pt100, J, K, N, S, R, B
- ☐ 2-wire or 3-wire Pt100 sensor connection
- ☐ with or without sensor linearization
- ☐ automatic compensation of thermocouple cold junction
- ☐ out of range / sensor failure indication
- ☐ for mounting on 35 mm wide rail, according to DIN EN 50022-35

This TBD type transmitter converts resistance of Pt100 sensor or voltage of thermocouple to a standard current signal 0...20 mA, 4...20 mA or to a voltage signal 0...10 V in 3-wire systems. In current versions, output current can be measured between output and ground (TBD-4..., TBD-5...) or output and positive power supply (TBD-1..., TBD-6...). Input circuit is galvanically insulated from output. Thermoelectric versions have built-in cold junction compensation.The electronic circuit of the transmitter allows high accuracy of conversion with low temperature drift and very good resistance to noise. It is widely used for temperature measurement in many branches of industry.

TECHNICAL DATA

Sensor type, measuring range	according to the table [1], [2]	
Output signal	0 ... 20 mA ref. to +24V	(**TBD-1**)
	0 ... 10 V ref. to GND	(**TBD-3**)
	0 ... 20 mA ref. to GND	(**TBD-4**)
	4 ... 20 mA ref. to GND	(**TBD-5**)
	4 ... 20 mA ref. to +24V	(**TBD-6**)
Bias current of Pt100 sensors	0,5 mA	
Accuracy (T_A = 23°C ±5°C)	0,15% of the range value	
Temperature drift	0,02% of the range value / °C	
Power supply	13 ... 30 V DC, 40 mA	
Input - output insulation	750 V AC 50Hz/ 1kV DC	
Ambient temperature T_A	0°C...+60°C	
Dimensions (height x width x depth)	79 x 22,5 x 84 mm	
Weight	ca. 55 g	

[1] Other sensor types on demand
[2] Other measuring ranges on demand

Code	Range [°C]	Pt100	J	K	N	S, R, B
10	-50 ... 50	+				
15	0 ... 50	+				
20	0 ... 100	+				
25	0 ... 150	+				
30	0 ... 200	+	+	+		
35	0 ... 300	+	+	+		
40	0 ... 400	+	+	+		
45	0 ... 500	+	+	+	+	
50	0 ... 600	+	+	+	+	
55	0 ... 700	+	+	+	+	
60	0 ... 800	+	+	+	+	
65	0 ... 1000			+	+	
70	0 ... 1200			+	+	
75	300 ... 1400					+
80	300 ... 1600					+

ORDERING CODE

	(1)	(2)	(3)	(4)
TBD —				—

(1)	Output signal	**1**	0 ... 20 mA, referenced to +24V
		3	0 ... 10 V, referenced to GND
		4	0 ... 20 mA, referenced to GND
		5	4 ... 20 mA, referenced to GND
		6	4 ... 20 mA, referenced to +24V
(2)	Sensor linearisation	**0**	no
		1	yes
(3)	Measuring range	**10** ... **80**	(code according to the table)
(4)	Sensor type	**Pt100**, **J**, **K**, **N**, **S**, **R**, **B**	

Example for order: TCD-5130-Pt100 means transmitter for range 0...200°C, with sensor linearization, for use with Pt100 temperature sensor, output current 4...20 mA referenced to GND (current source).

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PROGRAMMABLE HEAD-MOUNT TRANSMITTER
TEH series

- ☐ output signal 4 ... 20 mA (**TEH-27**, **TEH-28**)
  0 ... 10 V (**TEH-37**, **TEH-38**)
- ☐ **input - output galvanic insulation** (**TEH-28**, **TEH-38**)
- ☐ programmable input signal range
- ☐ programmable sensor type: Pt100, Ni100, J, K, N, S, R, B, T
- ☐ RTD sensor can be connected in 2, 3 or 4-wire system
- ☐ internal or external compensation of thermocouple cold junction
- ☐ for mounting in type B connection heads

The transmitter TEH is designed to convert resistance of temperature sensor or voltage of thermocouple sensor to standard current signal 4...20 mA (TEH-27, TEH-28) or voltage 0...10V (TEH-37, TEH-38).
Transmitters TEH-28 and TEH-38 provide galvanic insulation between input and output terminals.
Most parameters such as: sensor type, input signal range or mode of cold junction compensation, may be adapted by user for specific requirements of his measuring system.
The transmitter is programmed using a personal computer with USB port via **IF-2013U** interface which is also offered.
The housing is dedicated to mounting in type B connection heads.

TECHNICAL DATA

Sensor type, measuring range		programmable, see Table 1
Maxium range, accuracy, thermal drift		see Table 1
Pt100 or Ni100 sensor connection		2, 3 or 4-wire, programmable
Pt100 or Ni100 connection resistance (2 and 3-wire)		$<$10 Ω (each wire)
Maximum resistance for 2-wire connection which can be corrected with software		0,00 ...20,00 Ω (sum of both wires)
Bias current of Pt100 or Ni100 sensors		$<$ 0,25mA
Compensation of thermocouple cold junction		internal or external, programmable
Maximum error of thermocouple cold junction internal compensation		±1 °C
Temperature range of thermocouple cold junction external compensation		-50,0 ... 100,0 °C
Range of temperature offset		-10,0 ... 10,0 °C
Galvanic insulation between input and output terminals (TEH-28 and TEH-38)		500 V AC
Output signal	TEH-2x	4 ... 20 mA or 20 ... 4 mA, programmable
	TEH-3x	0 ... 10 V or 10 ... 0 V, programmable
Linear region of output signal	TEH-2x	3,8 ... 20,5 mA
	TEH-3x	0,0 ... 10,3 V
Output signal delay after power on		ca. 5 s
Digital filter time constant (1st order filter))		selected: 0,2; 1; 2; 4; 8; 16; 32 s
Sensor failure indication	TEH-2x	3,5 or 23 mA, programmable
	TEH-3x	0 or 11,5 V, programmable
Power supply	TEH-2x	8 ... 36 V DC / 24 mA (from current loop)
	TEH-3x	14 ... 36 V DC / 18 mA
Ambient temperature		-20 ... +70 °C
Dimensions (diameter x height) / weight		44 x 21 mm / ca. 50 g

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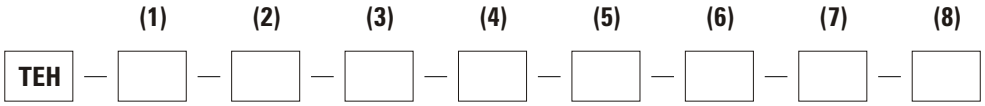
Table 1. Summary of sensor types, input signal ranges and accuracy.

Sensor type	Measuring range [°C]	Minimal measuring range [°C] (1)	Accuracy- largest value (2),(3)	Thermal drift / 10°C - largest value (2),(4)
B PtRh30-PtRh6	400 ... 1800	200	0,2% or ±5°C	0,07% or ±1,5°C
J Fe-CuNi	-100 ... 1000	50	0,2% lor ±1°C	0,07% or ±0,7°C
K NiCr-NiAl	-100 ... 1200	50		
N NiCrSi-NiSi	-100 ... 1300	100		
R PtRh13-Pt	0 ... 1600	200	0,2% or ±2°C	0,07% lor ±1,5°C
S PtRh10-Pt	0 ... 1600	200		
T Cu-CuNi	-100 ... 230	50	0,2% or ±1°C	0,07% or ±0,7°C
Pt100	-100 ... 800	30	0,15% or ±0,2°C	0,05% or ±0,1°C
Ni100	-60 ... 180	30		
Voltage [mV]	-10 ... 65 mV	2 mV	0,2% or ±0,05mV	0,07% or ±0,03mV
Resistance [Ω]	60 ... 370 Ω	20 Ω	0,15% or ±0,1 Ω	0,05% or ±0,05 Ω

(1) Minimum difference between upper and lower range value.
(2) Error values in [%] are relative to user-defined range.
(3) The ambient temperature = 23 °C.
(4) Thermal drift means that the error may change with the ambient temperature.

ORDERING CODE



(1)	Model of transmitter	**27** output 4 ... 20 mA, without insulation **37** output 0 ... 10 V, without insulation **28** output 4 ... 20 mA, with insulation **38** output 0 ... 10 V, with insulation
(2)	Sensor type	**Pt100**, **Ni100**, **J**, **K**, **N**, **S**, **R**, **T**, **mV**, **Ohm**
(3)	Lower range value	value in [°C], [mV] or [Ω] (default lowest value for selected sensor type)
(4)	Upper range value	value in [°C], [mV] or [Ω] (default highest value for selected sensor type)
(5)	Connecting Pt100, Ni100 or thermocouple cold junction compensation	**2**(...)(*), **3**, **4** - wires **I** - internal (automatic), **E**(...)(**) - external (user defined)
(6)	Converting characteristic	**N** - normal (4 ...20 mA, 0 ... 10 V), **R -** reverse (20 ... 4 mA, 10 ... 0 V)
(7)	Time constant of digital filter [s], selected	**0**, **1**, **2**, **4**, **8**, **16**, **32** (0 really means 0,2 s)
(8)	Alarm output signal	**H** - high level (23 mA or 11,5 V), **L** - low level (3,5 mA or 0 V)

(*) Sum of resistances of wires can be given in brackets.
(**) Thermocouple cold junction temperature must be given in brackets.

Default values marked by under-scoring. Factory programmed in case of incomplete ordering code.
The specification of the model, i.e. point (1) is compulsory.

Example for order: TEH-27-Pt100-0-150-2(0,8)-N-2-L denotes Pt100 temperature transmitter for range 0 ... 150°C with 4 ... 20 mA signal output. The sensor is connected with two wires (sum of resistances of wires = 0,8 Ω); time constant = 0.5 s; in the case of sensor failure, output current is 3,5 mA.

TEH-38-K-0-600-I-N-1-H denotes thermocouple K temperature transmitter for range 0 ... 600 °C with 0 ...10V signal output galvanically insulated from sensor. Internal cold junction compensation; time constant = 1 s; in the case of sensor failure, output voltage is 11,5 V.

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HEAD-MOUNT TRANSMITTER
TCH series

- ☐ output signal 4 ... 20 mA (**TCH-2**)
  0 ... 10 V (**TCH-3**)
- ☐ for use with sensors Pt100, J, K, N, S, R, B
- ☐ 2-wire or 3-wire Pt100 sensor connection
- ☐ with or without sensor linearization
- ☐ automatic compensation of thermocouple cold junction
- ☐ for mounting in type B connection heads

The TCH type transmitter converts the Pt100 sensor resistance or voltage of thermocouples to a current signal in the range 4...20mA (TCH-2...) or to a voltage signal in the range 0...10V (TCH-3...). TCH-2... transmitter is powered from current loop. The electronic circuit of the transmitter allows high accuracy of conversion with low temperature drift and very good resistance to noise. It is widely used for temperature measurement in many branches of industry.

TECHNICAL DATA

Sensor type, measuring range	according to the table [1], [2]
Output signal	4 ... 20 mA 2-wire arrangement (**TCH-2**) 0 ... 10 V 3-wire arrangement (**TCH-3**)
Bias current of Pt100 sensors	0,5 mA
Accuracy (T_A = 23°C ±5°C)	0,15% of the range value
Temperature drift	0,02% of the range value / °C
Power supply	12 ... 36 V DC / 25 mA
Ambient temperature T_A	–20°C...+70°C
Dimensions (diameter x height)	42 x 29 mm
Weight	ca. 70 g

[1] Other sensor types on demand
[2] Other measuring ranges on demand

Code	Range [°C]	Pt100	J	K	N	S, R, B
10	-50 ... 50	+				
15	0 ... 50	+				
20	0 ... 100	+				
25	0 ... 150	+				
30	0 ... 200	+	+	+		
35	0 ... 300	+	+	+		
40	0 ... 400	+	+	+		
45	0 ... 500	+	+	+	+	
50	0 ... 600	+	+	+	+	
55	0 ... 700	+	+	+	+	
60	0 ... 800	+	+	+	+	
65	0 ... 1000			+	+	
70	0 ... 1200			+	+	
75	300 ... 1400					+
80	300 ... 1600					+

ORDERING CODE

	(1)	(2)	(3)	(4)
TCH –				–

(1)	Output signal	**2**	4 ... 20 mA
		3	0 ... 10 V
(2)	Sensor linearisation	**0**	no
		1	yes
(3)	Measuring range	**10** ... **80**	(code according to the table)
(4)	Sensor type	**Pt100**, **J**, **K**, **N**, **S**, **R**, **B**	

Example for order: TCH-2130-Pt100 means transmitter for range 0...200°C, with sensor linearization, for use with Pt100 temperature sensor, output current 4...20 mA, powered from current loop.

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HEAD-MOUNT TRANSMITTER
type TCHF

- ☐ output signal: 4 ... 20 mA
- ☐ powered from current loop
- ☐ **for use with Pt100 sensors**
- ☐ 2-wire or 3-wire Pt100 sensor connection
- ☐ with or without sensor linearization
- ☐ for mounting in type B connection heads

TCHF type transmitter converts the Pt100 sensor resistance into a 4...20mA current signal on the 2-wire system (power supply from current loop). It is designed for use with 2-wire or 3-wire Pt100 sensors. The electronic circuit of the transmitter allows high accuracy of conversion with low temperature drift and very good resistance to noise. It is widely used for temperature measurement in many branches of industry.

TECHNICAL DATA

Input sensor type		Pt100
Measuring range		according to the table [1]
Pt100 bias current		0,8 mA
Accuracy (T_A = 23°C ±5°C)		0,15% of the range value
Temperature drift		0,02% of the range value / °C
Output signal		4...20 mA
Sensor failure indication:	resistance too high	27±3 mA
	resistance too low	2,2±0,5 mA
Power supply		12 ... 36 V DC / 30 mA
Ambient temperature T_A		–20°C...+70°C
Dimensions (diameter x height) / weight		42 x 20 mm / ca. 50 g

[1] Other measuring ranges on demand

Code	Range [°C]
10	-50 ... 50
15	0 ... 50
20	0 ... 100
25	0 ... 150
30	0 ... 200
35	0 ... 300
40	0 ... 400
45	0 ... 500
50	0 ... 600
55	0 ... 700
60	0 ... 800

ORDERING CODE

		(1)	(2)	(3)
TCHF	—			

(1)	Output signal	**2**	4 ... 20 mA, 2-wire system
(2)	Sensor linearisation	**0**	no
		1	yes
(3)	Measuring range	**10** ... **60**	(according to the table)

Example for order: TCHF-2130 means transmitter for range 0...200°C, with sensor linearization, for use with Pt100 temperature sensor, output current 4...20 mA, powered from current loop.

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PROGRAMMABLE HEAD-MOUNT TRANSMITTER
type TEHM

- ☐ output signal 4 ... 20 mA
- ☐ powered from current loop
- ☐ programmable measuring range
- ☐ programmable sensor type: Pt100, Ni100, J, K, N, S, R, B, T
- ☐ 2-wire RTD sensor connection arrangement
- ☐ internal or external thermocouple cold junction compensation
- ☐ for mounting in connection heads type MA

The transmitter TEHM is designed to convert resistance of temperature sensor or voltage of thermocouple sensor to standard current signal 4...20 mA.
Some transducer parameters such as sensor type, measuring range and method of thermocouple cold junction compensation, can be user modified to adapt them to the requirements of the measurement system.
The transmitter is programmed using a personal computer with USB port via **IF-2013U** interface which is also offered.
TEHM is dedicated for mounting inside connection heads type MA.

TECHNICAL DATA

Sensor type, measuring range	programmable, see Table 1
Maximum range, accuracy, thermal drift	see Table 1
Pt100 or Ni100 sensor connection arrangement	2-wire
Pt100 or Ni100 connection resistance (2 and 3-wire)	$<$10 Ω (each wire)
Maximum resistance for 2-wire connection which can be corrected with software	0,00 ...20,00 Ω (sum of both wires)
Bias current of Pt100 or Ni100 sensors	$<$ 0,25mA
Compensation of thermocouple cold junction	internal or external, programmable
Maximum error of thermocouple cold junction internal compensation	±1 °C
Temperature range of thermocouple cold junction external compensation	-50,0 ... 100,0 °C
Range of temperature offset	-10,0 ... 10,0 °C
Galvanic insulation between input and output terminals)	no
Output signal	4 ... 20 mA or 20 ... 4 mA, programmable
Linear region of output signal	3,8 ... 20,5 mA
Output signal delay after power on	ca. 5 s
Digital filter time constant (1st order filter))	selected: 0,2; 1; 2; 4; 8; 16; 32 s
Sensor failure indication	3,5 or 23 mA, programmable
Power supply (U_s)	8 ... 36 V DC / 24 mA (from current loop)
Output load resistance	$R_L[\Omega] < (U_s[V] - 8) / 0{,}023$
Ambient temperature	-20 ... +70 °C
Dimensions (diameter x height) / weight	25 x 14 mm / ca. 12 g

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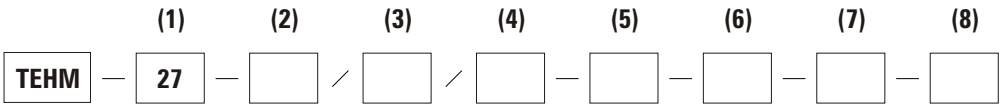
Table 1. Summary of sensor types, input signal ranges and accuracy

Sensor type	Measuring range [°C]	Minimal measuring range [°C] (1)	Accuracy - largest value (2),(3)	Thermal drift / 10°C - largest value (2),(4)
B PtRh30-PtRh6	400 ... 1800	200	0,2% or ±5°C	0,07% or ±1,5°C
J Fe-CuNi	-100 ... 1000	50	0,2% or ±1°C	0,07% or ±0,7°C
K NiCr-NiAl	-100 ... 1200	50		
N NiCrSi-NiSi	-100 ... 1300	100		
R PtRh13-Pt	0 ... 1600	200	0,2% or ±2°C	0,07% or ±1,5°C
S PtRh10-Pt	0 ... 1600	200		
T Cu-CuNi	-100 ... 230	50	0,2% or ±1°C	0,07% or ±0,7°C
Pt100	-100 ... 800	30	0,15% or ±0,2°C	0,05% or ±0,1°C
Ni100	-60 ... 180	30		
Voltage [mV]	-10 ... 65 mV	2 mV	0,2% or ±0,05mV	0,07% or ±0,03mV
Resistance [Ω]	60 ... 370 Ω	20 Ω	0,15% or ±0,1 Ω	0,05% or ±0,05 Ω

(1) Minimum difference between upper and lower range value.
(2) Error values in [%] are relative to user-defined range.
(3) The ambient temperature = 23 °C.
(4) Thermal drift means that the error may change with the ambient temperature.

ORDERING CODE



(1)	Model of transmitter	**27** - 4 ... 20 mA output, without galvanic isolation
(2)	Sensor type	**Pt100**, **Ni100**, **B**, **J**, **K**, **N**, **S**, **R**, **T**, **mV**, **Ohm**
(3)	Lower range value	value in [°C], [mV] or [Ω] (default lowest value for selected sensor type)
(4)	Upper range value	value in [°C], [mV] or [Ω] (default highest value for selected sensor type)
(5)	RTD connection wires resistance (both) or thermocouple cold junction compensation	value in [Ω] (default 0,00) **I** - internal (automatic), **E**(...)(*) - external (user defined)
(6)	Converting characteristic	**N** - normal (4 ...20 mA, 0 ... 10 V), **R -** reverse (20 ... 4 mA, 10 ... 0 V)
(7)	Time constant of digital filter [s], selected	**0**, **1**, **2**, **4**, **8**, **16**, **32** (0 really means 0,2 s)
(8)	Alarm output signal	**H** - high level (23 mA or 11,5 V), **L** - low level (3,5 mA or 0 V)

(*) Thermocouple cold junction temperature must be given in brackets.

Default values marked by under-scoring. Factory programmed in case of incomplete ordering code.

Example for order: TEHM-27-Pt100-0-150-(0,8)-N-2-L denotes Pt100 temperature transmitter for range 0 ... 150°C with 4 ... 20 mA signal output. The sensor is connected by two wires (sum of resistances of wires = 0,8 Ω); time constant = 0.5 s; in the case of sensor failure, output current is 3,5 mA.

TEHM-27-K-0-600-I-N-1-H denotes thermocouple K temperature transmitter for range 0 ... 600 °C with 4 ... 20 mA signal output. Internal cold junction compensation; time constant = 1 s; in the case of sensor failure, output current is 23 mA.

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HEAD-MOUNT TRANSMITTER
type TCHM

- ☐ output signal: 4 ... 20 mA
- ☐ powered from current loop
- ☐ **for use with Pt100 sensors**
- ☐ 2-wire Pt100 sensor connection
- ☐ with or without sensor linearization
- ☐ for mounting in type MA connection heads

The TCHM type transmitter converts the Pt100 sensor resistance into a 4...20mA current signal in the 2-wire system (power supply from current loop). It is designed for use with 2-wire Pt100 sensors. The electronic circuit of the transmitter provides high accuracy of conversion with low temperature drift and very good resistance to noise. It is widely used for temperature measurement in many branches of industry.

TECHNICAL DATA

Input sensor type		Pt100
Measuring range		according to the table [1]
Pt100 bias current		0,8 mA
Accuracy (T_A = 23°C ±5°C)		0,15% of the range value
Temperature drift		0,02% of the range value / °C
Output signal		4...20 mA
Sensor failure indication:	resistance too high	27±3 mA
	resistance too low	2,2±0,5 mA
Power supply		12 ... 36 V DC / 30 mA
Ambient temperature T_A		–20°C...+70°C
Dimensions (diameter x height) / weight		25 x 15 mm / ca. 12 g

[1] Other measuring ranges on demand

Code	Range [°C]
10	-50 ... 50
15	0 ... 50
20	0 ... 100
25	0 ... 150
30	0 ... 200
35	0 ... 300
40	0 ... 400
45	0 ... 500
50	0 ... 600
55	0 ... 700
60	0 ... 800

ORDERING CODE

		(1)	(2)	(3)
TCHM	—			

(1)	Output signal	**2**	4 ... 20 mA, 2-wire arrangement
(2)	Sensor linearization	**0**	no
		1	yes
(3)	Measuring range	**10** ... **60**	(according to table)

Example for order: TCHM-2130 means transmitter for range 0...200°C, with sensor linearization, for use with Pt100 temperature sensor, output current 4...20 mA, powered from current loop.

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MULTI-CHANNEL SWITCH

type PMP-201

- ☐ 10 pole, 3 track electronic switch
- ☐ for use with sensors in 2 or 3-wire configuration
- ☐ automatic switching mode
- ☐ optional RS-232, RS-485 or TTL digital interface

This multi-channel switch is designed to connect up to 10 temperature sensors to one thermometer to enable automatic multiple measurements. It can be installed in a control panel. PMP-201 may be used in manual or automatic operating mode. The number of active channels may be set from 1 to 10 and switching times in the automatic mode may be set from 1 to 90 secs. Optionally PMP-201 has built-in RS-232, RS-485 or TTL digital interface to enable automatic remote control in measurement systems. It is used in many branches of industry.

TECHNICAL DATA

Number of channel inputs (poles)	10	without digital interface
	9	with digital interface
Number of tracks	3	
Switching time (AUTO mode)	1, 3, 5, 10, 20, 30, 40, 50, 60 or 90 sec.	
Relay contacts resistance	$< 100\ m\Omega$	
Maximum voltage / current switching	30 V / 100 mA	
Digital interface (option)	TTL	(PMP-201-TTL)
	RS-232	(PMP-201-232)
	RS-485	(PMP-201-485)
Standard power supply	230 V	AC +10% –15%, 50 Hz, 3 VA
Optional power supply	24 V AC, 24 V DC, 12 V DC, 110/115 V AC	
Ambient temperature	0°C...+50°C	
Mounting window dimensions (height x width)	44 x 91 mm	
Dimensions (height x width x depth) / weight	48 x 96 x 145 mm / ca. 400 g	

ORDERING CODE

		(1)	(2)
PMP-201	—		—

(1)	Interface (option)	**TTL**, RS-**232**, RS-**485**
(2)	Power supply if other then 230 V AC	**24VAC**, **24VDC**, **12VDC**, **110/115VAC**

Example for order: PMP-201 means 10-channel switch without interface.
PMP-201-485 means 9-channel switch with RS-485 serial communication interface.

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MULTI-CHANNEL TEMPERATURE DATA LOGGER

type WRT-9

type WRT-9-BOX

+

WRT-9

WRT-9-BOX
front view

WRT-9-BOX
rear view

WRT-9 is a universal temperature data logger. It can measure temperature at a maximum of 9 points. The logger can be used with a wide assortment of thermocouples and resistance temperature detectors. It is designed for use with 2 or 3-wire RTD sensors.

There are two options when ordering WRT-9:

1) as two separate devices: PMP-201 and EMT-200 designed for installation in a control panel (WRT-9)
2) in common desktop case, with power supply and communication cable (WRT-9-BOX).

The set includes software for PC (Windows® application program). It has the following features:

- each channel can be labeled separately,
- actual temperature of each channel can be shown on-line,
- all the data can be stored in a file and can be browsed off-line,
- graphs of temperature vs. time can be printed out,
- files with the stored data have format that can be easily imported in many PC programs (for example in Excel),
- time interval between sequential measurements can be adjusted,
- alarm thresholds can be set separately for each channel.

The latest version of the software can be downloaded from our website www.czaki.pl.

Collected data is systematically saved on the computer disc. This is saved in text form, making later processing is very simple. Alarm functions allow supervision of many channels simultaneously and the monitoring of out of limits temperature events both up and down.

The software functions also with older PCs. It accepts Windows® operating systems: 98, 2000, XP, VISTA, 7, 8 and 10.

WRT-9 requres serial interface RS-232 or RS-485 for data transmission. Czaki IF-232U or IF-485U serial USB converters can be used.

Typical application of the logger is the temperature monitoring of industrial processes.
It is widely used for temperature measurements in many industries.

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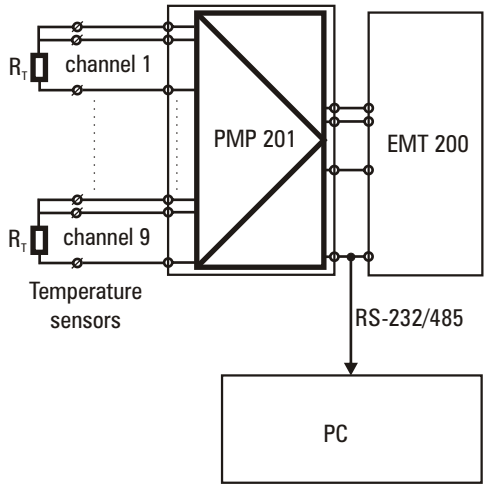
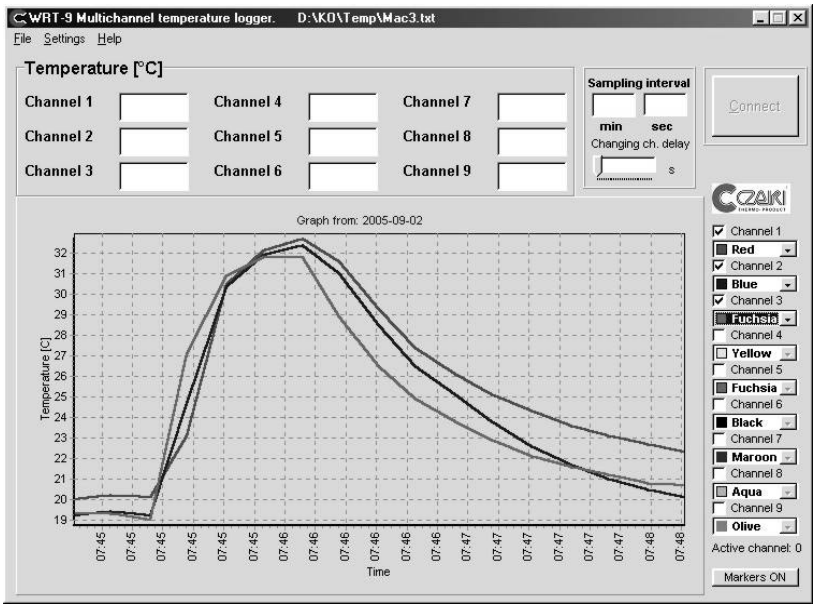
MULTI-CHANNEL TEMPERATURE DATA LOGGER
type WRT-9



Simplified diagram of WRT-9



Program application window

TECHNICAL DATA

Maximum number of channels	9
Minimal time for one measurement	4 sec.
Interface type	RS-232 - standard, RS-485 - on demand
Input sensor type, measuring range	according to the table
Resolution	0,1°C up to 400°C; 1°C over 400°C
Standard power supply	230 V AC +10% –15%, 50 Hz, 6 VA
Optional power supply	24 V AC, 24 V DC, 12 V DC, 110/115 V AC
Ambient temperature	0°C...+45°C
RS-232 / RS-485 speed transmission	2400 bps
Dimensions (height x width x depth) / weight	70 x 260 x 210 mm / ca. 1400 g (WRT-9-BOX) 48 x 96 x 145 mm / ca. 400g (x2) (WRT-9)
Other parameters	like EMT 200 and PMP 201
RS-232 cable length	1,5 m (WRT-9-BOX), other values on demand
Power supply cable length	1,5 m (WRT-9-BOX)
Additional accessories	IF-232U converter, IF-485U converter

Sensor type	Range [°C]
B PtRh30-PtRh6	400...1800
R PtRh13-Pt	200...1600
S PtRh10-Pt	200...1600
N NiCrSi-NiSi	–100...1300
K NiCr-NiAl	–100...1200
J Fe-CuNi	–100...1000
T Cu-CuNi	–100...230
Pt100(1)	–100...850
Ni100(1)	–60...180

(1) 2 or 3-wire connection

ORDERING CODE

	(1)	(2)	(3)	(4)	(5)
WRT-9					

(1) Common case **BOX**
(2) Serial interface, if other then RS-232 RS-**485**
(3) Supply voltage, if other then 230 V AC **24VAC**, **24VDC**, **12VDC**, **110/115VAC**
(4) RS-232 cable length (for WRT-9-BOX) if other then 1,5m)
(5) Additional accessories **IF-232U**, **IF-485**

Example for order: WRT-9-BOX means multi-channel temperature data logger in desktop case.
WRT-9-485 means multi-channel temperature data logger for panel mounting with RS-485 interface.

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16-CHANNEL TEMPERATURE DATA LOGGER

type WRT-16W

type WRT-16M

- ☐ temperature data logging for 16 channels
- ☐ communication with:
  - sensors using 1-Wire® bus protocol (**WRT-16W**)
  - TMD-10 and TMD-20 transmitters (**WRT-16M**)
- ☐ temperature measuring range:
  -55°C ... +125°C (**WRT-16W**)
  -200°C ... +1600°C (**WRT-16M**)
- ☐ up to 3 million records from each channel can be stored on MMC/SD memory card
- ☐ up to 4 alarm thresholds can be set independently for each channel
- ☐ configuration settings can be managed either from front panel or remotely from PC
- ☐ low voltage option for automobile car power supply 12V or 24V
- ☐ two independent temperature controllers stabilizing average temperatures of user-defined groups of sensors

WRT- 16 is a 16 measuring channel measurement system to the measure ,log,regulate and superve temperature.

WRT-16W scans semiconductor temperature sensors using 1-Wire® protocol.
The range of measured temperatures is from -55°C to +125°C.

WRT-16M is designed to communication with TMD-10 and TMD-20 transmitters allowing temperature measurement of sensors depending on range . Simultaneous operation using different types of sensors in different channels is possible.

The measured data is stored on 128 MB MultiMedia Card (MMC) sufficient for 3 million data records. The data is in unreadable binary format which prevents forging. There are two access levels: user and supervisor, these allow the protection of important parameters from non-authorized users.

The logger has autodiagnostic functionality. Due to an advanced alarm feature, the temperature in selected channels can be easily controlled. The alarm thresholds can be set separately for each channel.

The temperature logger WRT-16 has two output relays, these can be configured either as outputs of two independent on/off controllers or as outputs of one triple-state controller. The controllers can stabilize average temperatures of user-defined groups of sensors.

WRT- 16 communication with the computer is carried out with RS- 232 or RS- 485 serial interface using the MODBUS protocol.

There are two software applications attached to the data logger. The Windows® application **WRT-16 Manager** allows remote configuration of the logger parameters and shows measured temperature values as well as presenting their plots. Another application **WRT-16 Viewer** visualizes the data stored on the MMC and makes reports in readable text format.

The latest version of the software is available for downloading from the website www.czaki.pl.

The data logger WRT-16 is used in applications which requre a thorough knowledge of thermal processes and permanent evidence, for instance wood drying, tobacco drying, food processing or pharmaceuticals.

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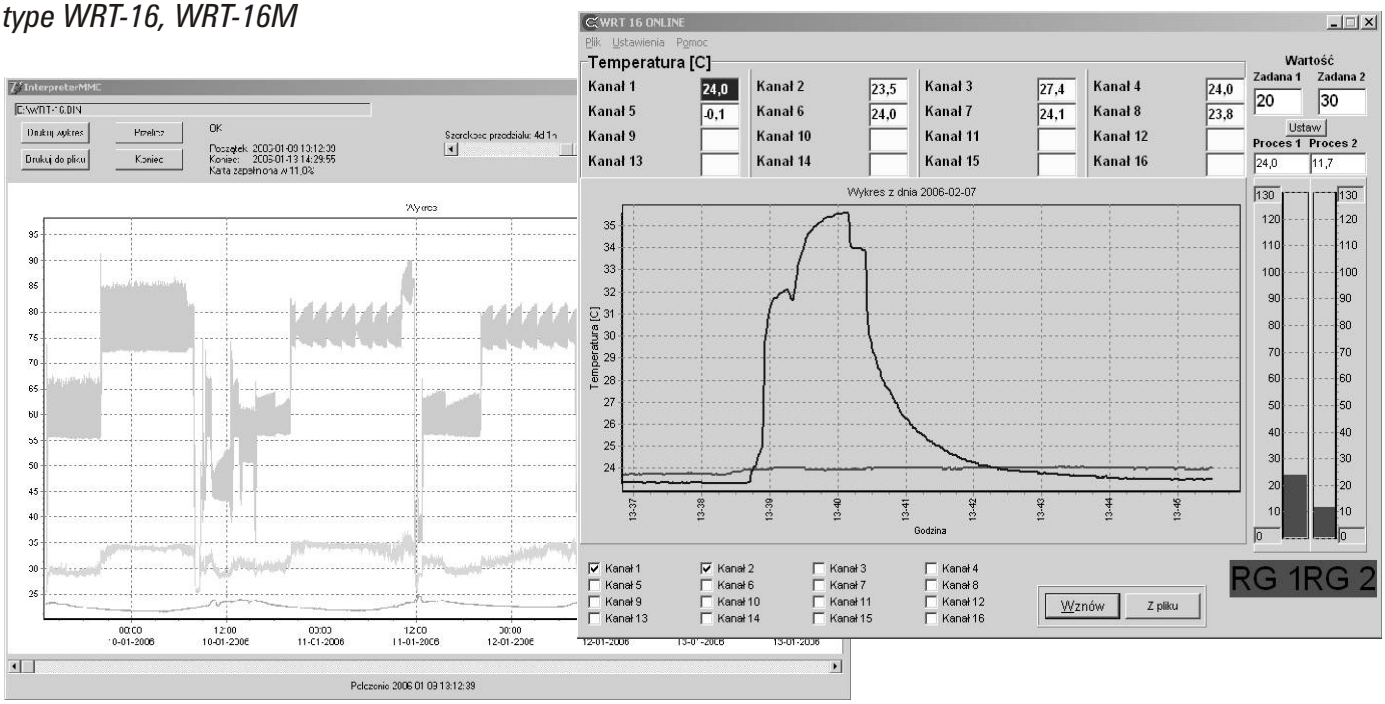

TECHNICAL DATA

	WRT-16W:	**WRT-16M**:
Sensor/transmitter type	any, $\varnothing_{min}$=6mm, with processing element DS18B20 (1-Wire® bus)	transmitter TMD-10, TMD-20
Measuring range	-55...+125°C	-200...+1600°C
Accuracy	± 0,5 °C in range -10 ... 85°C ± 2,0 °C in range -55...-10°C and 85...125°C	acc. to TMD-10, TMD-20 data
Resolution	0,1°C	
Maximum sensor number	16	
Measurement delay	ca. 2,5 s	
Memory card type	MultiMediaCard (MMC) 128MB or Secure Digital (SD)	
Output type	SPDT relay contacts 5 A, 250 V AC / 24 V DC	
Standard power supply	230 V AC +10% –15%, 50 Hz, 4 VA	
Optional power supply	10...30 V DC lub 10...26 V AC / 1,5W (wersja LV)	
Ambient temperature	0.. +45 °C	
Dimensions (heigh x width x depth) / weight	90 x 70 x 58 mm / ca. 290 g	
Communication interface	RS-485 or RS-232	
Type of mounting	on a rail 35 mm, DIN EN 50022-35	

ORDERING CODE

	(1)	(2)	(3)
WRT-16		—	—

(1)	Input	**W -** DS18B20 sensors (1-Wire®), **M** - MODBUS-RTU transmitters
(2)	Power supply, if other than 230 V AC	**LV**
(3)	Communication interface, if other than RS-232	RS-**485**

Example for order: WRT-16M-LV-485 means a temperature logger designed for use with transmitters MODBUS-RTU, low voltage power, communication interface RS-485
WRT-16W means a temperature logger designed for use with 1-Wire® temperature sensors, power supply 230 V AC, communication interface RS-232

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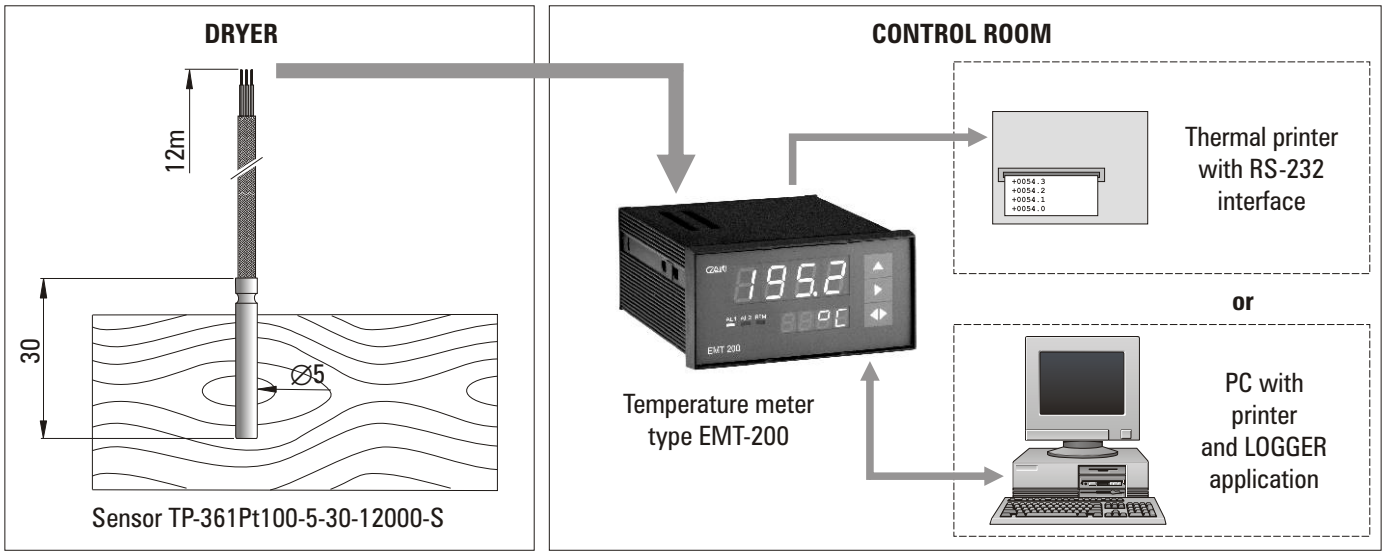
TEMPERATURE MONITORING SYSTEM FOR WOOD

Single-sensor system

The kit is designed for measuring and recording temperature in wood during its treatment according to phytosanitary requirements of the FAO / IPPC / ISPM 15.
The system consists of:

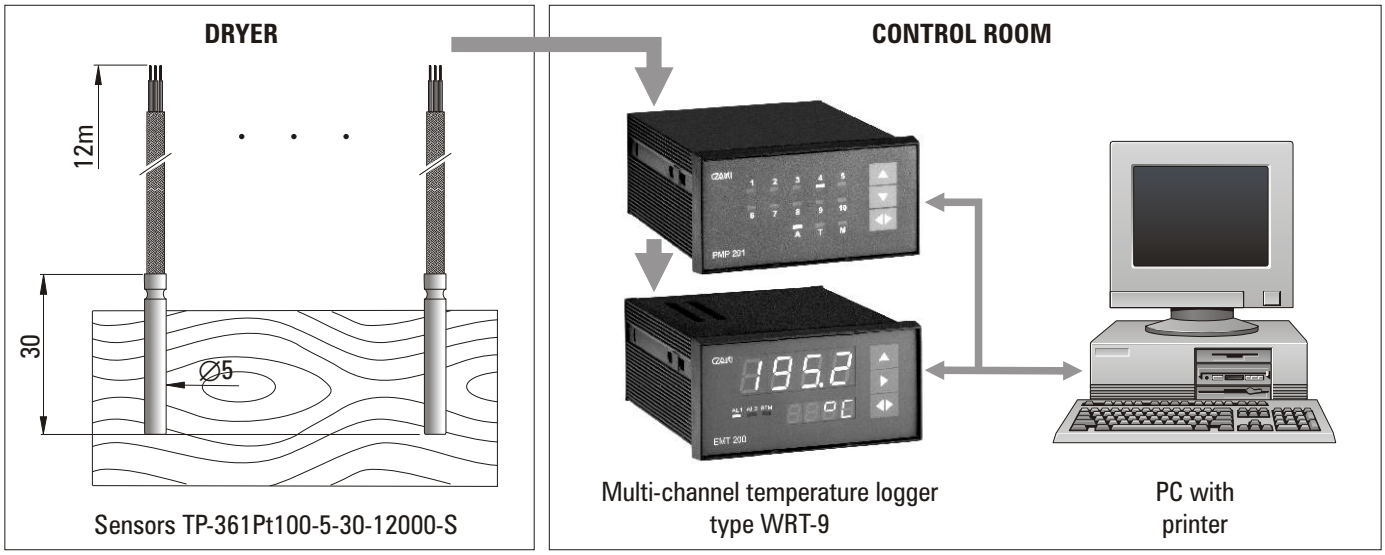
1. Temperature sensor type TP-361Pt100-5-30-12000-S; a sensor with a diameter of 5 mm and a length of 30 mm with a 3-wire silicone cable with length of 12 meters (cable length depends on the individual needs)
2. Temperature meter type EMT-200
3. Thermal printer with RS-232 interface, for example MEFA-Blonie (www.mefa.com.pl) type MEFKA: PDT, PDT-R or SQ PDT or a PC with printer and software LOGGER for EMT-200 meter



Multi-sensor system

The kit is designed for measuring and recording temperature in wood during its treatment according to phytosanitary requirements of the FAO / IPPC / ISPM 15.
The system consists of:

1. Up to 9 temperature sensors type TP-361Pt100-5-30-12000-S; sensors with a diameter of 5 mm and a length of 30 mm with a 3-wire silicone cables with length of 12 meters (cable length depends on the individual needs)
2. Multi-channel temperature logger type WRT-9
3. PC with printer



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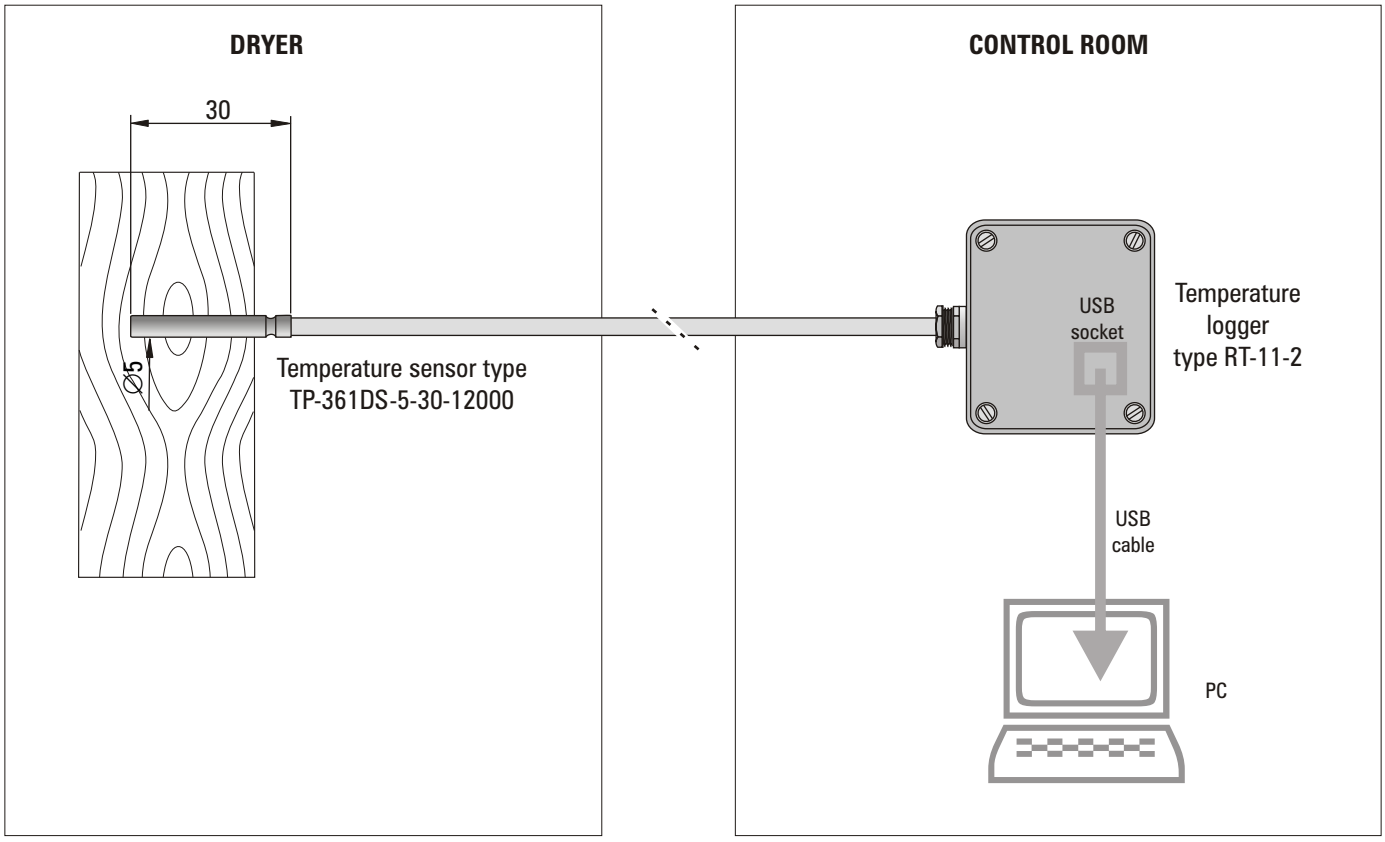
WOOD TEMPERATURE LOGGING SYSTEM

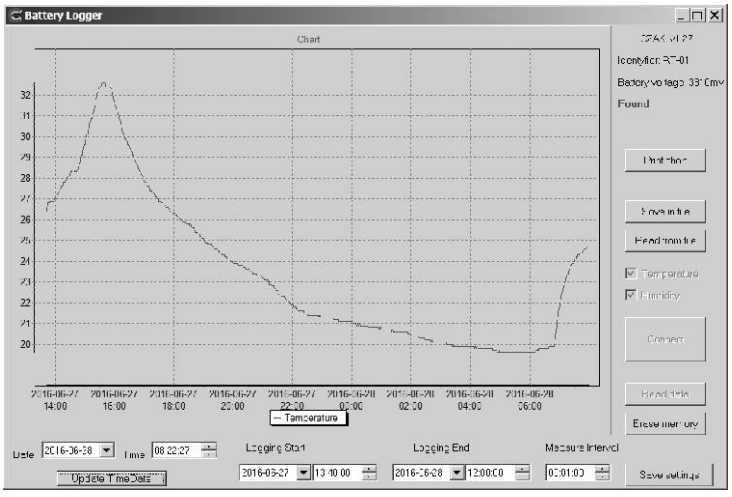
Single-sensor system

The kit is designed for measuring and recording temperature in wood during its treatment according to phytosanitary requirements of the FAO / IPPC / ISPM 15.
The system consists of:

1. Temperature sensor type TP-361DS-5-30-12000; a sensor with a diameter of 5 mm and a length of 30 mm with a 3-wire cable with length of for example 12 meters (cable length depends on the individual needs).
2. Temperature logger type RT-11-2 (see logger data sheet).

Temperature data logger type RT-11-2 has a hermetic casing, has its own power source (lithium battery), its memory lets you save 204800 measurement results, record the temperature with the date and time, works with a PC via USB. Recorder software allows the configuration and visualization of stored data.





Data visualization on computer screen

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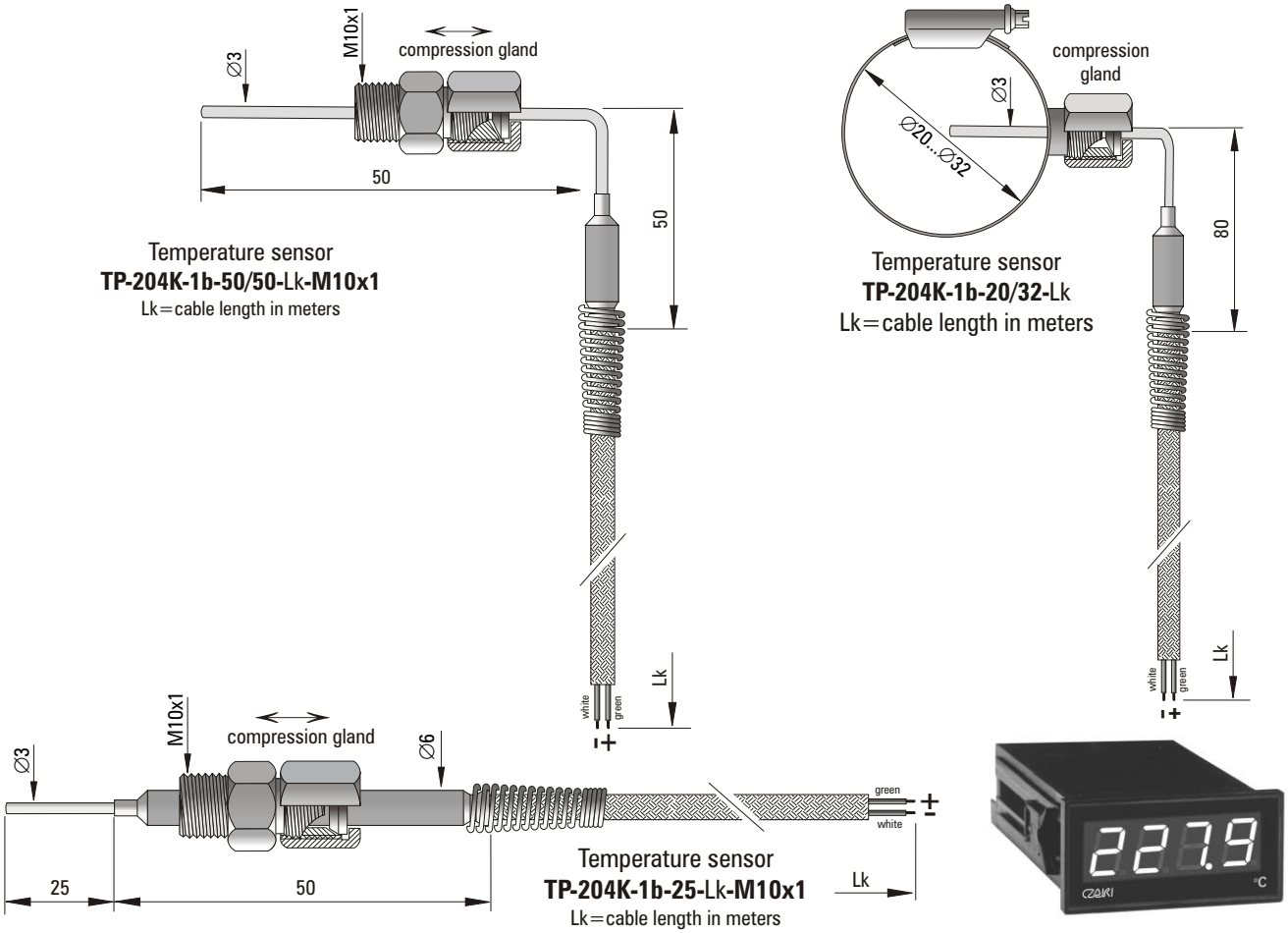
EXHAUST GAS TEMPERATURE MEASUREMENT SYSTEM (EGT)

The kit is designed to measure the temperature of exhaust gases in exhaust systems of internal combustion engines.
The system consists of:
- temperature sensor type TP-204K straight or angular version, mounted in the exhaust manifold
- thermometer type EMT-134-K-LV, powered by 12VDC.

Mounting the sensor with movable compression gland in the exhaust manifold requires drilling a hole diameter of 9 mm and cutting a thread M10x1. The compression gland is screwed into the threaded hole. The sensor is inserted through the gland.
The gland nut clamps the ferrule onto the sheath of the sensor, tightly locating the sensor in the exhaust manifold.

Mounting the sensor with metal hose clamp in the exhaust manifold requires drilling a hole diameter of 3,1 mm. The clamp is installed on the manifold. The sensor extends through the central hole of compression gland into the manifold.
The gland nut clamps the ferrule onto the sheath of the sensor, tightly locating the sensor in the exhaust manifold.

The sensor should be placed as close as possible to the head. Installation depth of the measuring tip should be greater than 10mm.
The power supply system of the meter must contain a two amp fuse.



Technical data temperature sensor

Thermocouple type	K (NiCr-NiAl) class 1, isolated
Measurement range	0°C...+900°C (temporary +1000°C)
Connecting cable Lk	glass fiber insulation with steel braid, maximum operating temperature +400°C
Process connection	compression gland with external thread M10x1

Note: available in other lengths and thermocouple diameters, other inch and metric threads on demand

Technical data temperature meter

Measuring range	-199°C...+1370°C
Power supply	10...30VDC, 500mW
Dimensions / weight	24 x 48 x 90mm / 60g
Mounting window dimensions	21,5 x 44,5 mm

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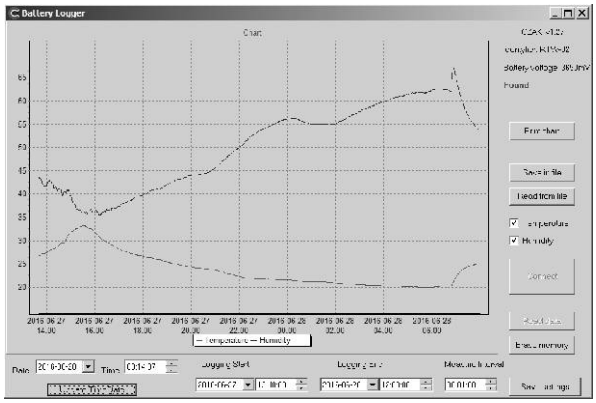
DATA LOGGERS

type RT-01 ambient temperature logger
type RTW-02 ambient temperature and humidity logger



- ☐ internal non-volatile memory for over 200 000 measurements
- ☐ lithium battery for more than **five years** of continuous operation
- ☐ temperature measurement range **-55°C...+85°C**
- ☐ humidity measurement range **0...100% RH**
- ☐ configuration and data read from the memory via USB
- ☐ graphical representation of the temperature and humidity
- ☐ print graph and detailed report
- ☐ check the battery status

Battery loggers type RT-01 and the RTW-02 are microprocessor-based devices enabling the registration of temperature (type RT-01) or the temperature and humidity (type RTW-02). Loggers are fully standalone devices. They are equipped with sensors, their own non-volatile memory with control system and their own power source in the form of a lithium battery. The logger can store over 200,000 measurements. When recording measurements once every quarter of an hour, registered data can be stored for almost 6 years. Stored data is protected from modification or falsification. Temperature or temperature and humidity are recorded with the current date and time. Communication with a PC is via USB. An integral part of the logger is software running on Windows®. It allows full configuration of thedevice and visualization of data stored on a computer monitor or printer. The format of stored data allows importation by popular programs such as MS Excel. Each record contains the temperature or temperature and humidity value, and the date and time of measurement.
The latest version of the software can be downloaded free of charge from www.czaki.pl.
An example of the use of temperature recorders is the transport and preservation of food and drugs, vaccines, blood products and other deep-frozen products, where there is an obligation to document the conditions of production, storage and transport.

TECHNICAL DATA

Temperature measurement range	RT-01	-55°C...+85°C
	RTW-02	-40°C...+85°C
Temperature measurement accuracy	RT-01	± 0,5°C (-10°C...+85°C); ± 2,0°C (-55°C...-10°C)
	RTW-02	± 0,4°C (5°C...40°C); ± 1,5°C (-40°C...+5°C) and (40°C...+85°C)
Humidity measurement range	RTW-02	0...100% RH
Humidity measurement accuracy	RTW-02	± 2%RH (10...90%); ± 4%RH (0...10%) and (90...100%)
Resolution		0,1°C; 0,1%RH
Measurement repetition time		from10 seconds to 24 hours, programmable
Memory type / size		internal, non-volatile / 204800 measurements
Power supply		soldered lithium battery 3,6 V AA size
Dimensions / weight		70 x 71 x 27 mm / ca. 60 g
Interface / connector for communication with PC		USB / USB-B4 socket
Ingress protection		IP20

Example for order: RT-01 means the ambient temperature logger
RTW-02 means the ambient temperature and humidity logger

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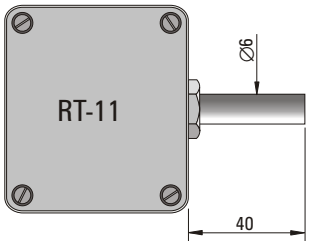
DATA LOGGERS

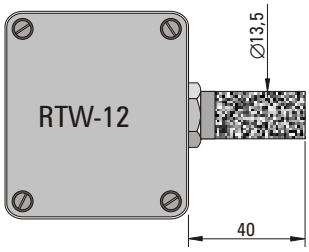
type RT-11 temperature data logger
type RTW-12 temperature and humidity data logger

RT-11 and RTW-12 data loggers have a hermetic housing with IP65 protection.
RT-11-1 is a device that allows measurement of the ambient temperature, and the RT-11-2 sensor enables remote measurement of the temperature of solid, liquid or gas, depending on the design of the sensor.
RTW-12-1 allows recording of temperature and relative humidity of a gas at the installation site, and the RTW-12-2 at the installation site of remote sensor. Special filters enclosing sensors of RTW data loggers are made of a porous sintered stainless steel.

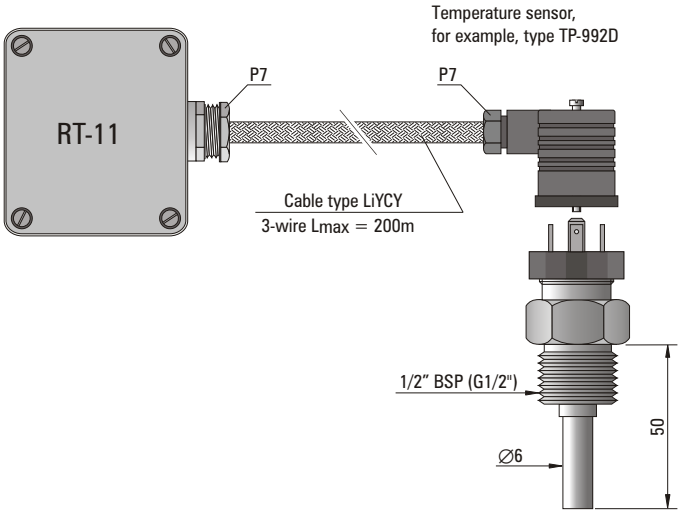
RT-11-1 (with local sensor)



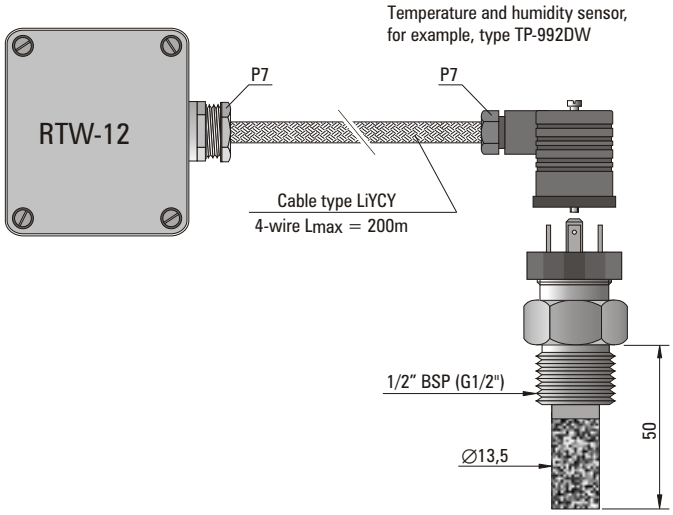
RTW-12-1 (with local sensor)



RT-11-2 (with remote sensor)



RTW-12-2 (with remote sensor)



Battery loggers type RT-11 and RTW-12 are microprocessor-based devices enabling the registration of temperature (type RT-11) or the temperature and humidity (Type RTW-12). The small size and battery power supply allow for their use wherever required to register changes in time of temperature and humidity. Especially when supply power is absent.

Loggers are fully standalone devices. They are equipped with sensors, their own non-volatile memory with the control system and their own power source in the form of a lithium battery. The logger can store over 200,000 measurements. When recording measurements once every quarter of an hour, registered data can be stored for almost 6 years. Stored data is protected from modification or falsification. Temperature or temperature and humidity are recorded with the current date and time. Communication with a PC is via USB. An integral part of the logger is software running on Windows®. It allows full configuration of thedevice and visualization of data stored on a computer monitor or printer. The format of stored data allows importation by popular programs such as MS Excel. Each record contains the temperature or temperature and humidity value, and the date and time of measurement.
The latest version of the software can be downloaded free of charge from www.czaki.pl.
An example of the use of temperature recorders is the transport and preservation of food and drugs, vaccines, blood products and other deep-frozen products, where there is an obligation to document the conditions of production, storage and transport.

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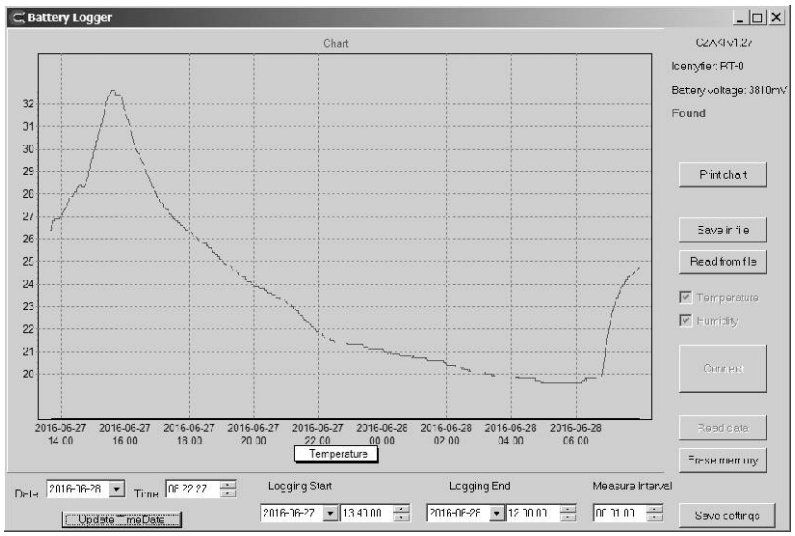
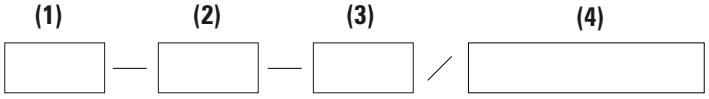


TECHNICAL DATA

Temperature measurement range	RT-11-1	-55°C...+85°C
	RT-11-2	-55°C...+125°C
Temperature measurement accuracy	RT-11	± 0,5°C (-10°C...+85°C); ± 2,0°C (-55°C...-10°C) and (85°C...125°C)
Temperature measurement range	RTW-12-1	-40°C...+85°C
	RTW-12-2	-40°C...+120°C
Temperature measurement accuracy	RTW-12	± 0,4°C (5°C...+40°C); ± 1,5°C (-40°C...+5°C) i (40°C...+85°C) ± 2°C (85°C...+120°C)
Humidity measurement range	RTW-12	0...100% RH
Humidity measurement accuracy	RTW-12	± 2%RH (10...90%); ± 4%RH (0...10%) and (90...100%)
Resolution		0,1°C; 0,1%RH
Measurement repetition time		from10 seconds to 24 hours, programmable
Memory type / capacity		internal, non-volatile / 204800 measurements
Power supply		soldered lithium battery 3,6 V AA size
Dimensions (width x height x depth)/ weight (without sensor)		64 x 58 x 35 mm / ca. 60 g
Interface / connector for communication with PC		USB / USB-B4 socket
Ingress protection		IP65

ORDERING CODE



(1) Device type **RT-11** temperature logger, **RTW-12** temperature and humidity logger
(2) Version **1** - local sensor, **2** - remote sensor
(3) Cable length in meters for remote sensor.
(4) Remote sensor type.

Example for order: RT-11-1 means the ambient temperature logger with local sensor.
RTW-12-2-10 / TP-992D-50-G1/2" means temperature and humidity logger with remote sensor type TP-992D-50-G1/2", cable length 10m.

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DEWPOINT HYGROMETER with chilled mirror

type CMH-10

measuring head

- ☐ **Dewpoint temperature measurement**
- ☐ Accuracy 0,2°Cdp
- ☐ Dewpoint temperature measurement range 50°C under ambient temperature
- ☐ Self-cleaning mirror function
- ☐ Two independent current outputs 4-20 mA or 0-20 mA
- ☐ Two independent alarms
- ☐ Measuring head with **IP65**
- ☐ Wide supply voltage range
- ☐ The measurement result is available in units of absolute humidity: **°Cdp, °Fdp, gm^{-3} ,ppm(v)** or relative: **%Rh**
- ☐ Communication interface RS-232 (optional RS-485), USB
- ☐ Graphical visualization of temperature and humidity changes

CMH-10 is a precision microprocessor-based meter using a chilled mirror to measure the absolute humidity of gases. The measurement is based on the definition of the **dew point**.
Inside the measuring head is a gold plated copper mirror chilled by a two-stage Peltier, precision resistor Pt100 measuring the temperature on the surface of the mirror and an optical detection system.
Condensation of dew on the surface of the mirror is indicated by an the optical system. The temperature at which this phenomenon occurs is called the **dew point temperature**.

CMH-10 consists of a measuring unit for bench mounting, the measuring head equipped with a filter, connecting cable and an additional gas temperature sensor for measuring the temperature of the measured gas, and allowing the automatic calculation of relative humidity (% RH) .
User-friendly interface and a large bright displays makes using CMH-10 very simple to operate.

CMH-10 is addition to humidity, can measure temperature to an accuracy of +/- 0.1°C - witch is necessary for the display of relative humidity

CMH-10 meter has a user-programmable outputs: two analog 4-20 mA or 0-20 mA, and two alarms.

Full configuration of the hygrometer is possible from the front panel or via the serial interface RS-232 (RS-485). Dedicated software for Windows® expands the possibilities for on-line reading and registration, remote configuration and much more.
The device is also equipped with a system for **automatic cleaning** the surface of the mirror.

Unlike devices based on capacitive or semiconductor sensors CMH-10 provides a much more accurate measurement of humidity.

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DEWPOINT HYGROMETER with chilled mirror
type CMH-10

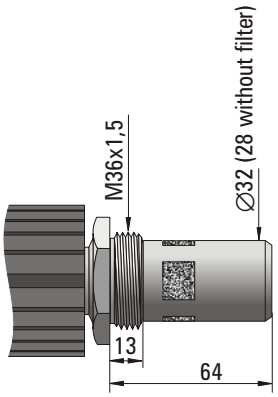
TECHNICAL DATA

Meter

Measuring range	-30°C ...+60°C dew point
Dew point temperature accuracy	±0,2°C
Gas temperature accuracy	±0,1°C
Units of measurement	°Cdp, °Fdp, %Rh, gm^{-3}, ppm(v),°C,°F, T-Tdp
Resolution	0,1 or 0,01 for °Cdp, °Fdp, %Rh,°C,°F, T-Tdp, autoscalling for gm^{-3} and ppm(v)
Analog output	two channels 4-20 mA or 0-20 mA referenced to common ground, programmable
Alarm output	two channels, SPDT relay contacts, 5 A, 250 V AC / 24 V DC, programmable
Interface	RS-232 (RS-485 on request), USB
Standard power supply	85...264 V AC / 47...440 Hz, 15 VA
Low voltage power supply, optional	9...36 V DC, 15 W
Ambient temperature	-10°C ... +40°C
Dimensions (w x h x d) / weight	96 x 96 x 120 mm / 0,77 kg
Mounting hole dimensions	91 x 91 mm
Case material	aluminum
Ingress protection	IP41 from front side, IP20 from rear

Measuring head

Protective filter	stainless steel net, PTFE membrane
Mirror	copper, gold plated
Mirror temperature sensor	Pt100, 1/3 DIN, 4-wire
Maximum gas flow	10 m/s
Maximum working pressure	0,1 MPa
Process connection	M36 x 1,5
Cable length	3, 5, 7 m
Dimensions / weight	60 x 60 x 173 mm / 0,52 kg
Ingress protection	IP65



Gas temperature sensor (standard) PT100, 1/3 DIN, 4-wire, type TP-361 3x60mm, 3 meters long wire

ORDERING CODE

	(1)	(2)	(3)	(4)
CMH-10	—	—	—	—

(1) Length of measuring head cable in meters (3m by default)
(2) Interface, if other than RS-232 RS-**485**
(3) Low voltage power supply (option) **LV**
(4) Gas temperature sensor specification, if other than standard one

Example for order: CMH-10-5-TP-371Pt100-3-100-PCV-Lk=3m means hygrometer with measuring head with cable of length 5m and with temperature sensor (diameter 3mm, 100mm long) , with M10x1 threat, with PVC cable of lenght 3m

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PROGRAMMABLE 2- WIRE DEWPOINT TRANSMITTER

type DPT-21

- ☐ **dewpoint temperature measurement**
- ☐ measurement range **-100 ... +20 °Cdp**, scaleable
- ☐ operating temperature -40 ... +60 °C
- ☐ ceramic capacitive sensor
- ☐ fast response to the changing humidity
- ☐ sensor fault indication
- ☐ 4-20mA current loop powered
- ☐ programming in units: **°Cdp, °Fdp, ppm** (by volume)

DPT-21 is a microprocessor-based electronic device which converts the capacitance of the integrated dewpoint sensor to standard current signal 4-20 mA. Its design allows for quick and easy installation on site makes monitoring dewpoints as easy as measuring temperature or pressure.
Transmitter is factory calibrated and configurated, but some parameters as measurement unit and range may be adapted by user for specific requirements of his measuring system.
DPT-21 is programmed using a personal computer with USB port via **IF-2013U-DPT** interface which is also offered.

TECHNICAL DATA

	Default values are underscored
Dewpoint measurement range:	-100 ... +20 °Cdp or -148 ... +68 °Fdp or 0,01 ... 23000 ppm(v)
Measurement accuracy	± 2 °Cdp
Thermal drift	compensated across operating temperature range
Conversion range	10 % ... 100 % of measurement range - programmable
Response time T95	1 min (dry to wet)
Output signal	4 ... 20 mA or 20 ... 4 mA - programmable
Linear region of output signal	3,8 ... 20,5 mA
Output signal delay after power on	ca. 5 s
Sensor failure indication	23 mA or 3,5 mA - programmable
Power supply Vs	8 ... 36 V DC / 24 mA (from current loop)
Maximal load resistance [Ω]	(Vs[V] - 8) / 0,024
Operating temperature range	-40 ... +60 °C
Maximal operating pressure	40 MPa
Housing material / filter	stainless steel / 5 μm stainless steel sintered guard
Ingress protection	IP65
Process connection	external thread 5/8"-18 UNF
Dimensions with connector (diameter x length) / weight	31 x 129 mm / 150 g
Accessories (ordered separately) - details at www.czaki.pl	interface **IF-2013U-DPT** process connection adapter **G1/2"-DPT** sampling block **SB-DPT**

ORDERING CODE

	(1)	(2)	(3)	(4)	(5)
DPT-21	/ ☐	/ ☐	/ ☐	/ ☐	/ ☐

(1)	Lower range value (for 4 mA output)	value in units declared in (3), default -100
(2)	Upper range value (for 20 mA output)	value in units declared in (3), default +20
(3)	Physical unit	**°Cdp**, **°Fdp**, **ppm** ,default °Cdp
(4)	Measured gas pressure if ppm	value in [hPa], default 1013,25
(5)	Sensor fault indication	**H** - by 23 mA output, **L** - by 3,5 mA output, default H

Example for order: DPT-21 denotes dewpoint transmitter for measurement range from -100 to +20 °Cdp with 4...20 mA signal output.
DPT-21 / 0,01 / 23000 / ppm denotes dewpoint transmitter for measurement range from 0,01 to 23000 ppm (pressure 1013,25 hPa) with 4...20 mA signal output.

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PROGRAMMABLE DEWPOINT MONITOR

DPM-221

- ☐ **signal monitor for dewpoint DPT-21 transmitter**
- ☐ user programmable display units **°Cdp,°Fdp, ppm(v)**
- ☐ measurment of standard analog signals in industrial automation systems: **0 ... 20mA, 4 ... 20mA**
- ☐ user programmable indication range
- ☐ two programmable multifunction alarms with relay outputs
- ☐ build-in transmitter power supply **24 V/30 mA**
- ☐ **RS-485** serial communication interface

DPM-221 is a programmable current meter designed to operate with **DPT-21 dewpoint transmitter**.
It provide power supply for transmitter and has 3 programmable display units. Device measure currents in 0...20mA or 4...20mA range.
Measured and scaled value of the signal is displayed on a 4-digit LED display.
The unit and range of the displayed measured value are programmed by the user: °Cdp, °Fdp, ppm(v).

The monitor has two independent relay outputs to enable signaling of alarm or simple implementation of regulatory functions.
The threshold values and the operating mode of the alarm relays are configured by the user.

DPM-221 has high accuracy over the range of ambient temperatures.

TECHNICAL DATA

Nominal input signal range	0÷20mA
Input signal measurement - accuracy	0.1%
Input resistance	< 22 Ω
Display units	°C dp, °F dp, ppm
Maximum readout	-100.0÷20.0°C dp
	-150.0÷70.0°F dp
	0.014÷9999 ppm
Display	4 digit LED, red,
	height of digits 20 mm
Alarm outputs (2 independent)	SPST relay contacts
	3 A, 250 V AC / 24 V DC
Power supply	80÷250 V AC 50..60 Hz, 3 VAAmbient temperature T_a
Ambient temperature Ta	0°C...+50°C
Mounting window dimensions (height x width)	45 x 91.4 mm
Dimensions (height x width x depth) / weight	48 x 96 x 79 mm / 200 g
Serial interface	RS-485 57600 bit/s, 8N1

ORDERING CODE

DPM-221

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DEWPOINT Portable Hygrometer

type DPH-31

- ☐ Dewpoint measure range **-100°Ccp to +20°Cdp**
- ☐ Calibration traceable to international standards
- ☐ Rapid response
- ☐ Up to 24 working hours on **Li-ion battery**
- ☐ Rugged IP 65 enclosure
- ☐ Line or atmospheric dewpoint measurement
- ☐ 4-20 mA output
- ☐ **Integral sampling system**
- ☐ Charging from DC source (attached) or 12V DC
- ☐ **Atmospheric** or **pressure** (up to 3 MPa) dewpoint

The DPH-31 portable hygrometer is microprocessor-based meter that has been engineered to make moisture measurements in air and process gases on plants or in the field simple and quick. The DPH-31 is economical to buy and easy to operate. The DPH-31 incorporates a sampling system which allows practical connection to any air or gas line, free flow or at up to 3 MPa pressure (choosing by integrated valve).The DPH-31 is fitted with a Lithium-ion battery giving (depending of load) a working time between charges of 16 to 24 hours.The hygrometer is equipped with a 4-20 mA output for connection to a chart recorder.

TECHNICAL DATA

Humidity measurement range	-100°C...+20°Cdp, -148°Fdp...+68°Fdp*, 0.5...23000 ppm(v)*
Humidity measurement accuracy	± 2°Cdp
Flow rate	max 3l/min
Max. pressure	3 MPa
Operating temperature / Charging temperature	0°C to +40°C / 0°C to +40°C
Display / Resolution	LED, 4-digits (20mm high) / 0,1°Cdp; 0,1°Fdp; 1ppm(v)
Output	analog 4-20mA (-100°C...+20°Cdp*)
Power supply	12V DC (accepts 10...20V), max. 14W (when charging)
Battery / Charging time	Lithum-ion (giving 16h up to 24h use) / 2 to 3 hours
Sample connections	6mm quick connect, 1/4 inch Swagelok*
Samle tube	6mm OD PTFE (1,5 meter long*)
Filter	HDPE sintered replaceable disk filter at inlet port
Case material / Ingress protection	polypropylene / IP67 (closed case), IP 50 (open case)
Dimensions / Weight	270 x 248 x 124 mm / ca. 3,0 kgDimensions / Weight
Power supply	100 ... 240V AC power adapter, 12V, 1A

*other paramaters and option on request

ORDERING CODE

	(1)	(2)	(3)	(4)
DPH-31	—	—	—	—

(1)	Value of bottom level output (4mA), if other than -100	value in units descripted at point (3) below
(2)	Value of top level output (20mA), if other than +20	value in units descripted at point (3) below
(3)	Unit, if other than °Cdp	**°Fdp, ppm(v)**
(4)	Lenght of sample tube, if other than 1,5 meter	value in meters

Ordering example: **DPH-31** means °Cdp hygrometer with -100 ... 20°Cdp output
DPH-31-(-60)-0-°Fdp-2 means °Fdp hygrometer with -60 ... 0°Fdp output, with 2 meters long sample tube

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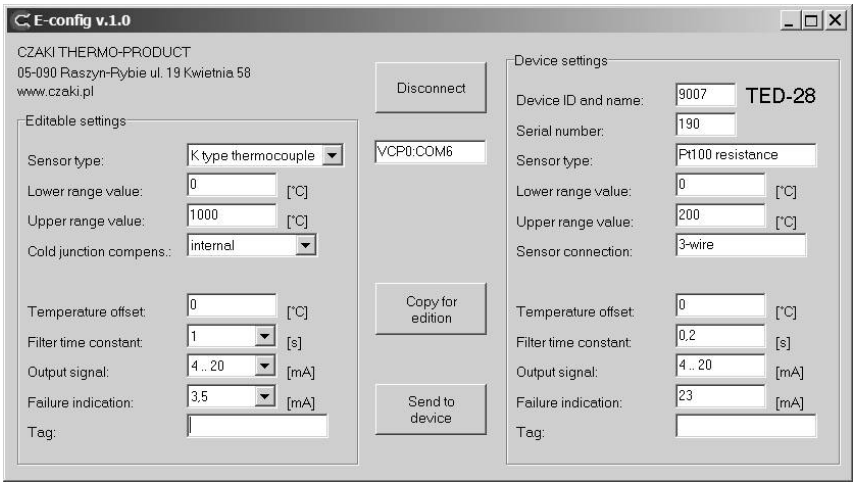
DEVICE PROGRAMMING INTERFACE

type IF-2013U, IF-2013U-DPT

- ☐ supply from the computer USB port
- ☐ visual indication of data transmission
- ☐ galvanic insulation between the computer and the programmed device
- ☐ power supply for the programmed device
- ☐ user-friendly software for PC



The interface is designed for programming transmitters **TEH** and **TED** series and other devices based on the same protocol of transmission, like **DPT-21** transmitter. The interface is connected to the USB port of the computer and after installing the drivers is seen as an additional serial port . It is powered from the USB port and provides power for the programmed device. It also provides galvanic insulation between the computer and the programmed device. Bidirectional data transmission is signalled by flashing LEDs. The plastic casing is fitted on one side with a USB-B socket, and on the other - with a disconnectable terminal for connecting the device. A set of cables for connecting a PC is supplied with the interface. Supplied with the set is software: drivers and Windows® application program **E-config** (for IF-2013U) or **DPT-config** (for IF-2013U-DPT). The latest version of the software is available for downloading from the website www.czaki.pl.

TECHNICAL DATA

Computer side connector	USB-B socket
Computer signal standard	USB1.1, USB2.0
Supply current	ca. 25 mA (programming)
	max. 150 mA (short device terminals)
Galvanic insulation between connectors	500 V AC
Programmed device supply voltage	20 V DC ± 2 V DC
Programmed device supply output resistance	250 Ω
Ambient temperature	0 ... 50 °C
Dimensions / weight	50 x 35 x 20 mm / ca. 20 g
USB A4-B4 cable lenghth in set	2 m
Cable for connecting device length in set	30 cm (IF-2013U) or 1m (IF-2013U-DPT)

Example for order: IF-2013U denotes interface for programming transmitters **TEH** and **TED** series and other devices being based on the same protocol of transmission .

IF-2013U-DPT denotes interface for programming DPT-21 Dewpoint Transmitter.

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COMMUNICATION INTERFACE

type IF-232U interface RS-232 / USB

type IF-485U interface RS-485 / USB

- ☐ power supply from computer's USB port
- ☐ data transmission indication
- ☐ **galvanic isolation between the PC and the RS port**
- ☐ cooperation with all devices with a RS-485 or RS-232 serial port and with a dedicated application software for them

Interfaces: IF-IF-232U and 485U are used to connect devices with a serial port, respectively, RS-232 and RS-485 with a computer having a USB port and Windows® system installed.
The electronic system is placed in a plastic casing fitted on one side with a USB-B4 connector, and on the other - a detachable terminal to connect to the RS port.
The interface is powered from the USB port and provides galvanic isolation PC - RS.
Bidirectional data transmission is indicated by the appropriate LEDs: RxD (green) - computer receives, TxD (yellow) - computer transmits.
The interface is supplied complete with USB cable A4-B4 to connect with your computer and the drivers for Windows®.
After installing the drivers and connecting the interface an additional virtual serial port appears on your computer.
Drivers can also be downloaded free of charge from www.czaki.pl.

TECHNICAL DATA

Connector type for computer link	USB-B4 socket
Standard for signals from the computer	USB1.1, USB2.0
Current consumption from USB port	ca. 25 mA
Galvanic isolation between connectors	500 V AC
RS-232 standard (IF-232U)	TIA/EIA-232-F, TxD and RxD only
RS-485 standard (IF-485U)	TIA/EIA-485-A
Maximum baud rate	230 bps
Ambient temperature	0 ... 50 °C
Dimensions / weight	50 x 35 x 20 mm / ca. 20 g
USB A4-B4 cable length in the set	2 m

ORDERING CODE

	(1)		(2)
IF	—		/	

(1)	Device port standard	**232U** for RS-232, **485U** for RS-485
(2)	Specification of the cable to the device (optional)	device type, cable type and the length, connector type

Example for order: IF-485U means interface for communication between the PC USB and the device with RS-485 port.
IF-232U / WRT-9, LiYY 3x0,25, 15m means interface for communication between the PC USB, and WRT-9 temperature logger with RS-232 port. Additional equipment is a cable type LiYY 3x0,25mm2, 15m length for connecting interface with the logger.

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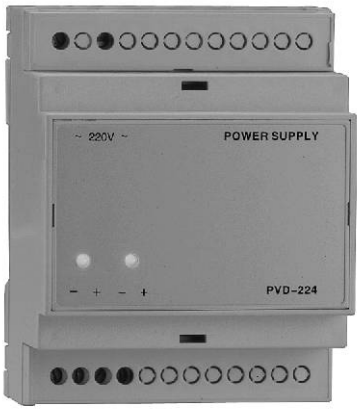
POWER SUPPLY UNIT

type PVD-124, PVD-125, PVD-224



- ☐ **PVD-124** – power supply unit 24 V/50 mA
- ☐ **PVD-125** – power supply unit 24 V/180 mA
- ☐ **PVD-224** – two separate 24 V/50 mA power supply units in one casing
- ☐ for mounting on 35 mm wide rail, accoding to DIN EN 50022-35

These power supply units are designed for industrial control and instrumentation and other applications requiring fixed stabilized 24V. Outputs are fully protected against short-circuit. Designed for mounting on 35 mm wide rail, accoding to DIN EN 50022-35.

TECHNICAL DATA

Output voltage		24V DC ± 2%
Maximum load current		
	PVD-124	50 mA
	PVD-125	180 mA
	PVD-224	2 x 50 mA
Current limit		
	PVD-124	100 mA
	PVD-125	300 mA
	PVD-224	100 mA
Power supply		230V +10% –15%, 50Hz
Ambient temperature		0°C...+50°C
Dimensions (height x width x depth) /weight		
	PVD-124	90 x 35 x 58 mm / ca. 150 g
	PVD-125, PVD-224	90 x 70 x 58 / ca. 350 g

ORDERING CODE

			(1)
PVD	—		

(1)	Type	**124**	power supply unit 24 V/50 mA
		125	power supply unit 24 V/180 mA
		224	two separate power supply units 24 V/50 mA in one case

Example for order: **PVD - 125** means power supply unit 24 V/180 mA

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SWITCHMODE POWER SUPPLY

typ PS-025

- ☐ output voltage 24 V DC, 1 A load
- ☐ high output power with compact dimensions and high efficiency
- ☐ output voltage alarm relay
- ☐ parallel operation possible
- ☐ for mounting on 35 mm wide rail, according to DIN EN 50022-35

The PS-025 type power supply unit is designed for industrial control and instrumentation and other applications requiring fixed stabilized 24V at a maximum load of 1A. This unit is equipped with overload and short-circuit protection. Two or more units may be connected in parallel for higher output current or redundancy. This is made possible when internal jumper MODE is connected in PARALLEL. Another internal jumper RELAY connects N/O or N/C alarm relay contacts to external terminal. A green LED on front panel indicates active output.

TECHNICAL DATA

Output voltage (no load)	24 V DC ± 0,5%
Output current	1 A
Current limit (max.)	1,5 A
Output voltage drop (1A load)	0,03 V (MODE=SNGLE) or 0,65 V (MODE=PARALLEL)
Output ripple (max.)	60 mVpp
Power supply	230 V AC +10%,-20%, 50 Hz
Efficiency (1A load)	85%
Output voltage alarm level	ca. 19 V
Alarm relay contacts	1 A, 250 V AC / 125 V DC
Isolation test (input - output - alarm)	1500 V DC
Ambient temperature	0°C ... +50°C
Dimensions (height x width x depth) /weight	99 x 22,5 x 114 mm / ca. 150 g

ORDERING CODE

	(1)	(2)
PS-025	—	—

(1) MODE jumper position, if other then PARALLEL
(2) RELAY jumper position, if other then NC

SINGLE - power supply units not connected in parallel
NO - alarm relay contacs closed if 24V at output

Example for order: PS-025 means 24 VDC / 1 A power supply unit for mounting on 35 mm wide rail, with parallel output connecting option and with output voltage failure alarm (relay contacts closed).

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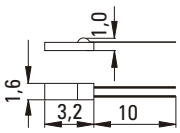
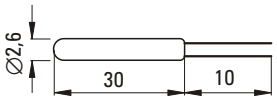
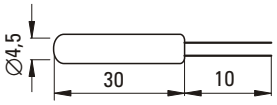
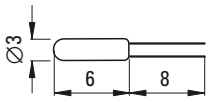
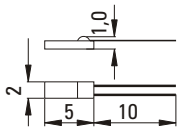
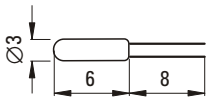
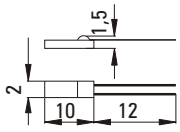
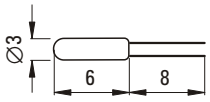
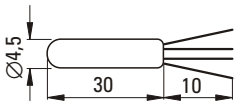
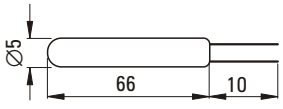
RTD TEMPERATURE SENSOR ELEMENTS

EN 60751, PN-83/M-53852

Type	Dimensions	Nominal resistance (Ω)	Measuring range (°C)	Maximum bias current (mA)	Self-heating factor (in air) (°C/mW)	Response time $T_{0,9}$ (s)	
						in water V = 0,4 m/s	in air V = 1 m/s
P101		Pt100 1x100	–50 ... +500	1	0,5	0,5	11
P112		Pt100 1x100	–200 ... +700	1	0,06	0,7	50
P113		Pt100 1x100	–200 ... +700	1	0,06	1,4	125
P114		Pt100 1x100	–50 ... +500	1	0,2	3	40
P501		Pt500 1x500	–50 ... +500	0,3	0,5	0,5	11
P510		Pt500 1x500	–50 ... +500	1	0,2	3	40
P901		Pt1000 1x1000	–50 ... +500	0,3	0,5	0,5	11
P910		Pt1000 1x1000	–50 ... +500	1	0,2	3	40
P122		2Pt100 2x100	–200 ... +600	1	0,06	1,4	125
N112		Ni100 1x100	–50 ... +150	5	0,1	5	150

* Parameters of platinum resistors class B

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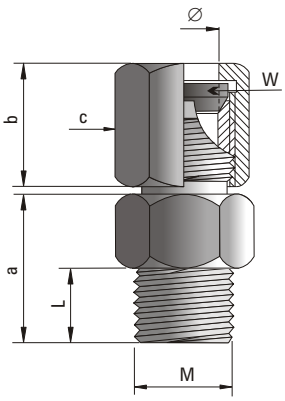
COMPRESSION GLAND type KP

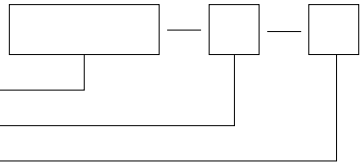
Compression glands KP are used to mount temperature sensors.
They are provided to seal at pressures up to 0,1 MPa.
Body material: stainless steel 1.4541.
Fixing element material (W): brass (Mo), *PTFE (PTFE) or steel (St) on demand*



Typ	M	L	a	b	c
KPM8x1	M8x1	8	13	10	SW10
KPM10x1	M10x1	10	17	15	SW14
KPM12x1,5	M12x1,5	12	20	15	SW17
KPM20x1,5	M20x1,5	18	28	23	SW24
KPG1/2"	G1/2"	18	28	23	SW24

(1) Other inch and metric threads on demand

ORDERING CODE

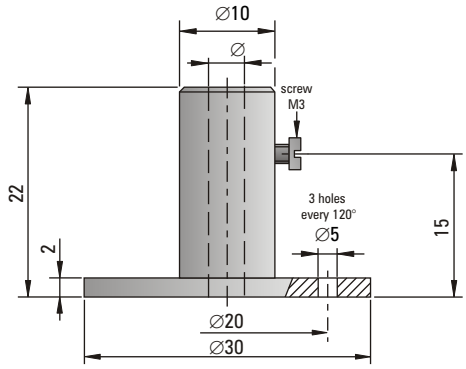


Gland type **KPM8x1**, **KPM10x1**, **KPM12x1,5**, **KPM20x1,5**, **KPG1/2"** (1)
Sensor sheath diameter ∅
*Option: fixing element material **PTFE** or **St***

Example for order: KPM12x1,5-8 means compression gland with thread M12x1,5 for sensor sheath with diameter ∅= 8 mm.

FLANGE type UK

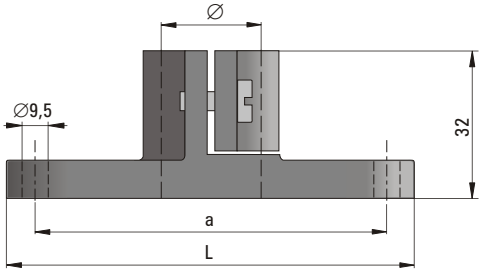
Flanges type UK are used to mount temperature sensors.
Material: stainless steel 1.4541.



Type	∅
UK-4	∅4,2
UK-5	∅5,2
UK-6	∅6,2

CLAMPING PLATE type UZ

Clamping plates UZ are used to mount temperature sensors.
Materiał: cast steel.



Type	∅	a	L
UZ-15	∅16	55	75
UZ-22	∅23	70	90
UZ-32	∅33	70	90

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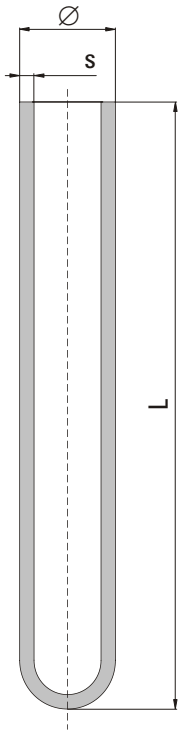
SENSOR SHEATHS

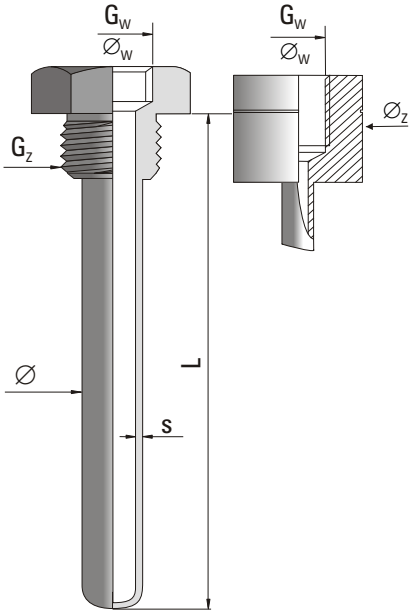
type OC



	Material	Maximum temperature (°C) (in air)	∅ x s (mm)	L (mm)
STEEL	**1.4541** (1H18N9T)	900	2,5x0,3 3x0,3 4x0,4 5x0,4 6x0,5 6x1,0 8x0,6 8x1,0 9x1,0 10x1,5 11x2,0 12x1,5 14x2,0 15x1,5 15x3,0 16x2,0 30x5,0	50 ... 3000
	1.4762 (H24JS)	1200	22x2,0	300 ... 3000
	1.4749 (H25T)	1100	22x2,0	300 ... 3000
CERAMICS	**C610** Al_2O_3(60%)	1400	6x1,0 10x1,5	300, 500, 700
			15x2,0	500, 700, 1000, 1400
	C799 Al_2O_3(99,7%)	1800	6x1,0 10x2,0	300, 500, 700
			15x2,5	500, 700, 1000, 1400

Example for order: OC-1H18N9T-10x1,5-250 sheath with diameter of 10x1,5 mm and length of 250 mm.

type PC



Material	∅ x s (mm)	$\varnothing_z$ G_z	$\varnothing_w$ G_w	L (mm)
1.4541 (1H18N9T)	6x0,5 6x1,0 8x0,6 9x1,0 10x1,5 11x2,0 12x1,5 15x3,0	M10x1 M12x1,5 M20x1,5 G1/2" $\varnothing_z$	M10x1 M12x1,5 M20x1,5 G1/2" $\varnothing_w$	50 ... 1000

Other diameters and threads on demand

Example for order: PC-1H18N9T-10x1,5-250-M20x1,5/M10x1 sheath with diameter of 10 mm and length of 250 mm with external thread G_z M20x1,5 and internal thread G_w M10x1.
PC-1H18N9T-9x1-150-∅20/M10x1 sheath with diameter of 9mm and length of 150mm with the part to weld diameter of $\varnothing_z$ 20mm and internal thread G_w M10x1.

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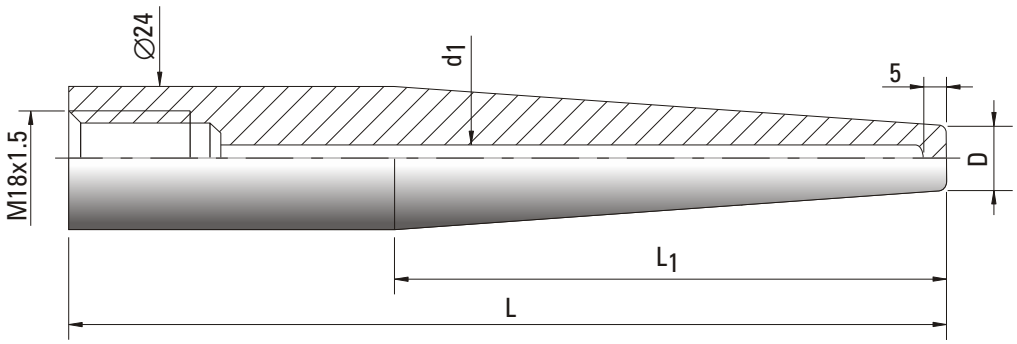
DRILLED THERMOWELLS

Drilled thermowell for welding

Designed for temperature sensors for liquids and gases under high pressure.
Pressure tested: 500 bar, 20 ° C.



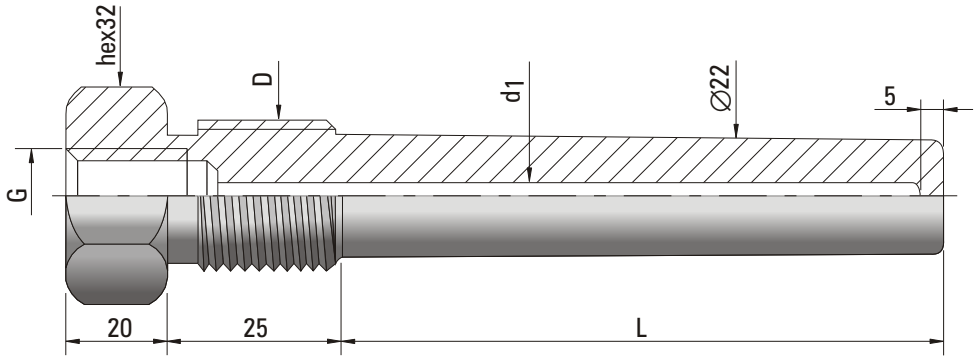
Type	L (mm)(1)	L_1 (mm)(1)	d_1 (mm) / D (mm)(1)	Material(1)
D1	100	50	∅7,0 / ∅12,5 or ∅9,0 / ∅14,5	1.4305 or 1.4571 or 1.4541
D2	200	150		
D3	300	200		
D4	400	250		
D5	500			
D6	600			

(1) Other parameters on demand

Example for order: D1-7/12,5-1.4305; D5-9/14,5-1.4541

Drilled thermowell with external thread

Designed for temperature sensors for liquids and gases under high pressure.
Pressure tested: 500 bar, 20 ° C.



Type	L (mm)(1)	d_1 (mm)(1)	D(1)	G(1)	Material(1)
E0	50	∅7,0 lub ∅9,0	M27x2 lub G3/4"	M20x1,5 lub G1/2"	1.4305 lub 1.4571 lub 1.4541
E1	100				
E2	200				
E3	300				
E4	400				
E5	500				
E6	600				

(1) Other parameters on demand

Example for order: E2-7-M27x2-G1/2"-1.4305; E6-9-G3/4"-G1/2"-1.4305

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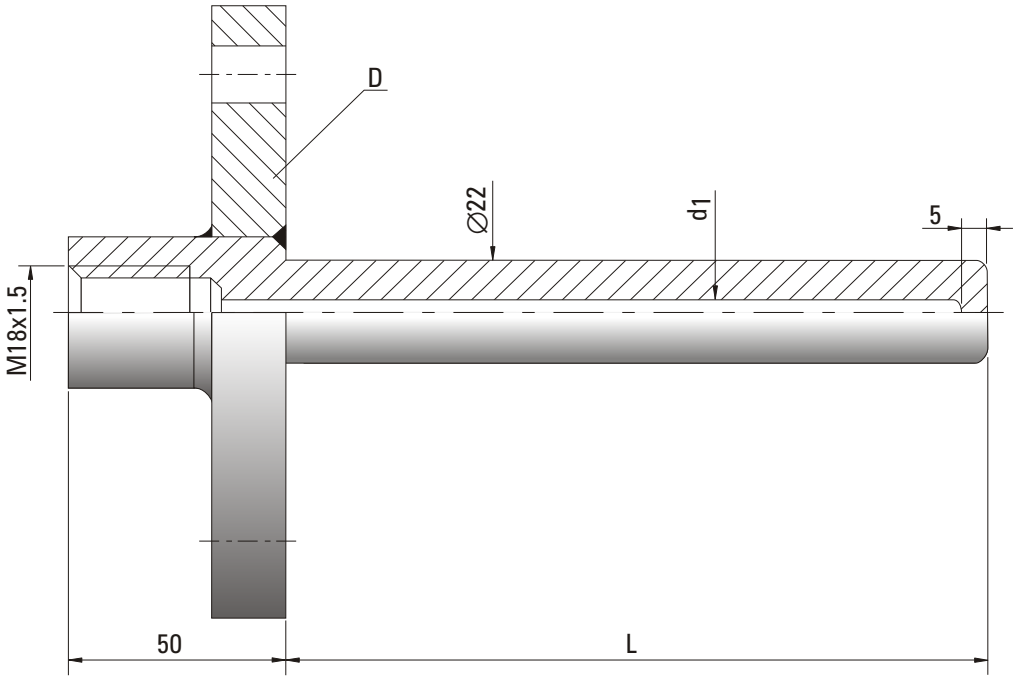
Drilled thermowell with flange

Designed for temperature sensors for liquids and gases under high pressure.
Pressure tested: 500 bar, 20 ° C.



Type	L (mm)[1]	d_1 (mm)	D	Material[1]
F1	100	Ø7,0 or Ø9,0	acc. to ISO 7005-1	1.4305 or 1.4571 or 1.4541
F2	200			
F3	300			
F4	400			
F5	500			
F6	600			

[1] Other parameters on demand

Example for order: F2-7-DN100PN40-1.4305

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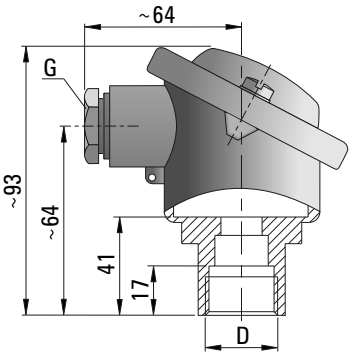
SENSOR HEADS

Type AA

Material: aluminum RAL9006

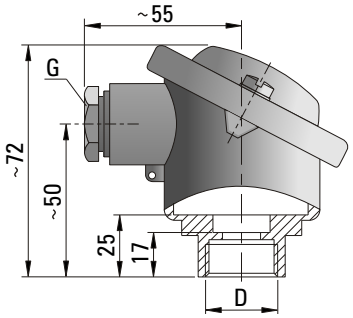
Connection D	Gland G	IP class	Designation
∅32,5	P16	IP 54	AA-32



Type BA

Material: aluminum RAL9006

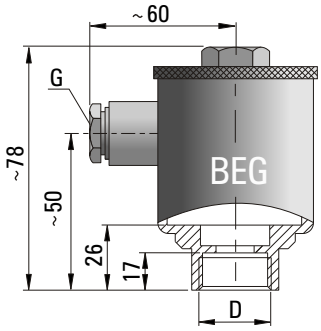
Connection D	Gland G	IP class	Designation
M24x1,5	P16	IP 54	BA-M24

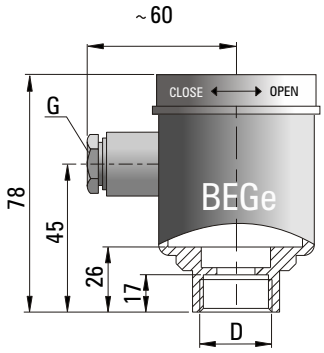


Type BEG; BEGe

Material: stainless steel SS316

Connection D	Gland G	IP class	Designation
M24x1,5	M20x1,5	IP 65	BEG
M24x1,5	M20x1,5	IP 54	BEGe

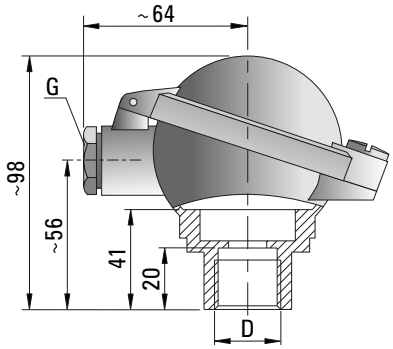




Type DAA

Material: aluminum RAL9006

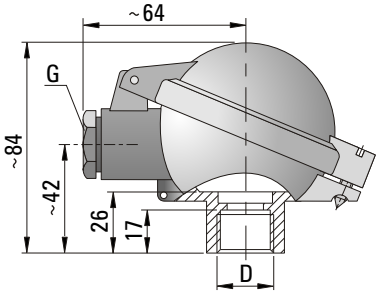
Connection D	Gland G	IP class	Designation
∅32,5	P16	IP 54	DAA-32



Type DANA

Material: aluminum RAL9006

Connection D	Gland G	IP class	Designation
M24x1,5	M20x1.5	IP 54	DANA-M24



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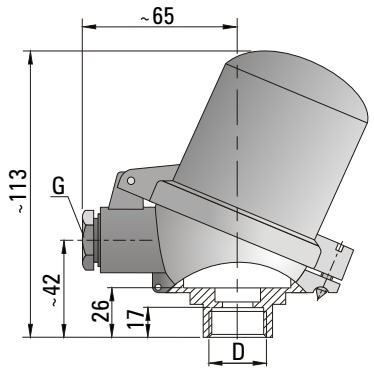
SENSOR HEADS

Type DANAW

Material: aluminum RAL9006

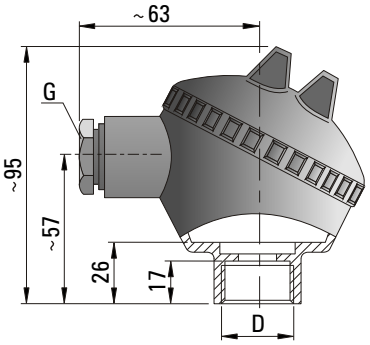
Connection D	Gland G	IP class	Designation
M24x1,5	M20x1,5	IP 54	DANAW-M24



Type DNAG

Material: aluminum RAL9006

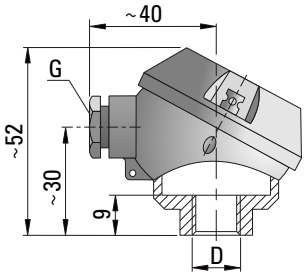
Connection D	Gland G	IP class	Designation
G1/2"	M20x1,5	IP 65	DNAG-G



Type MAA

Material: aluminum RAL9006

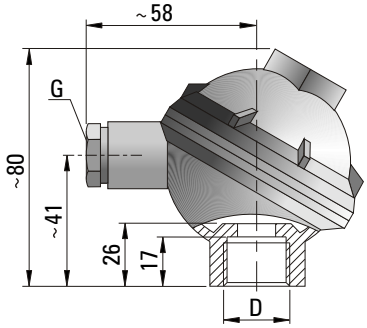
Connection D	Gland G	IP class	Designation
M10x1	P9	IP 54	MAA-M10
M12x1	P9	IP 54	MAA-M12



Type NS

Material: polyphenylene oxide black

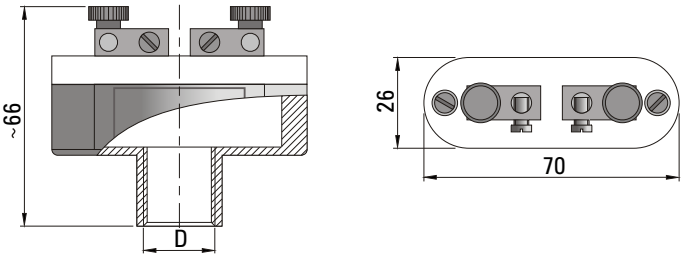
Connection D	Gland G	IP class	Designation
M20x1,5	P16	IP 54	NS-M20
M24x1,5	P16	IP 54	NS-M24



Type TL

Material: aluminum RAL9006

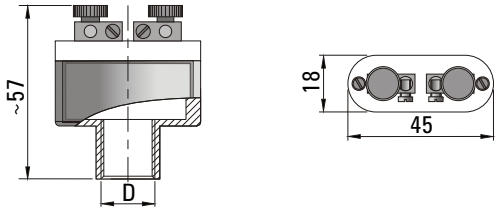
Connection D	IP class	Designation
G1/2"	IP 00	TL



Type TS

Material: aluminum RAL9006

Connection D	IP class	Designation
G1/4"	IP 00	TS



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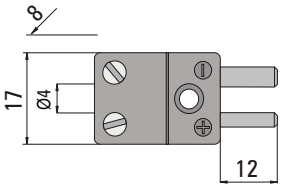
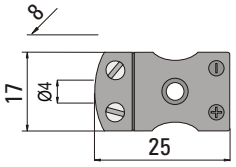
PLUG type MT–x

Miniature compensation plug for thermocouples
Plug operating temperature: –20°C...+120°C
Where x = T, J, K, N, S or B (thermocouple type)



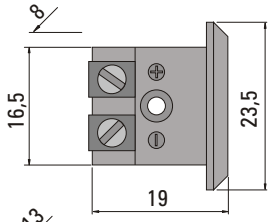
SOCKET type MT–Gx

Miniature compensation socket for thermocouples
Socket operating temperature: –20°C...+120°C
Where x = T, J, K, N, S or B (thermocouple type)



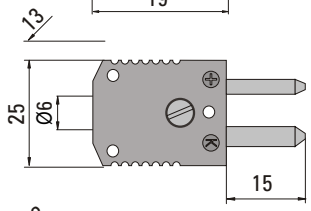
PANEL SOCKET type MT–Gpx

Miniature compensation socket for thermocouples
Socket operating temperature: –20°C...+120°C
Gdzie x = T, J, K, N, S lub B (typ termopary)



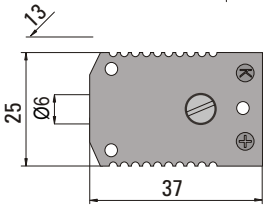
PLUG type ST–x

Standard compensation plug for thermocouples
Plug operating temperature: –20°C...+120°C
Where x = T, J, K, N, S or B (thermocouple type)



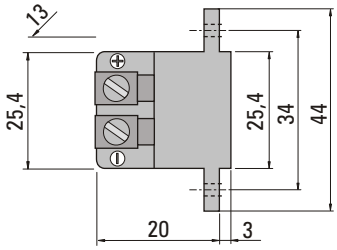
SOCKET type ST–Gx

Standard compensation socket for thermocouples
Socket operating temperature: –20°C...+120°C
Where x = T, J, K, N, S or B (thermocouple type)



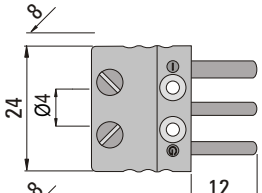
PANEL SOCKET type ST–Gpx

Standard compensation socket for thermocouples
Socket operating temperature: –20°C...+120°C
Where x = T, J, K, N, S or B (thermocouple type)



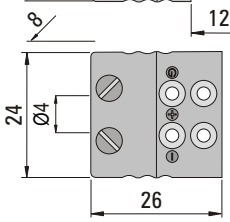
PLUG type MP

Miniature 3-pin plug for resistance sensors
Plug operating temperature: –20°C...+120°C



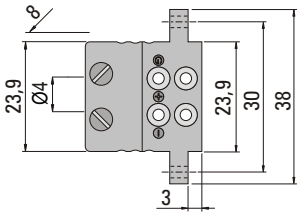
SOCKET type MP–G

Miniature 3-pin socket for resistance sensors
Socket operating temperature: –20°C...+120°C



PANEL SOCKET type MP–Gp

Miniature 3-pin panel socket for resistance sensors
Socket operating temperature: –20°C...+120°C



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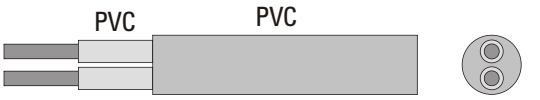
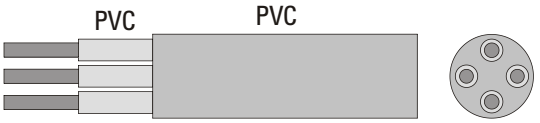
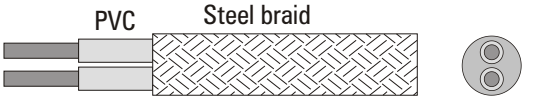
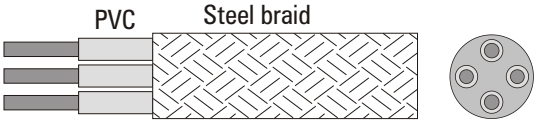
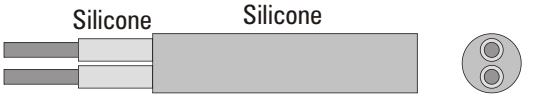
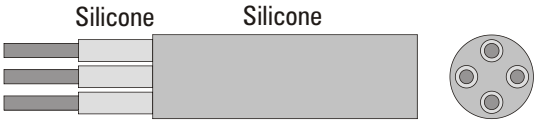
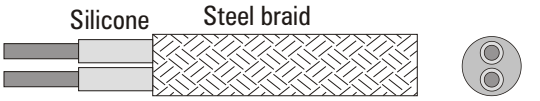
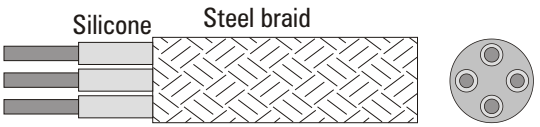
COMPENSATING CABLES

(class 1 according to EN 60584-3)

Compensating cable is required to connect the thermocouple sensor with a measuring device.

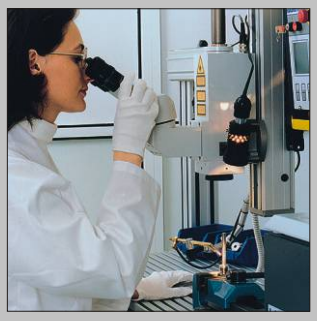
Type		Wire cross section (mm^2)	Cable outer dimensions (mm)	Operating temperature (°C)
L2*		0,25	∅4	–20 ...+80
L3*		1,5	7x5	
L4*		0,25	∅6	–20 ...+80
L5*		1,5	∅8	
L2P*		0,25	∅4,6	–20 ...+80
L3P*		1,5	8x6	
L4P*		0,25	∅6,5	–20 ...+80
L5P*		1,5	∅8,5	
S3*		1,5	∅8	–50 ...+180
S5*		1,5	∅9	–50 ...+180
S3P*		1,5	∅8,5	–50 ...+180
S5P*		1,5	∅10	–50 ...+180

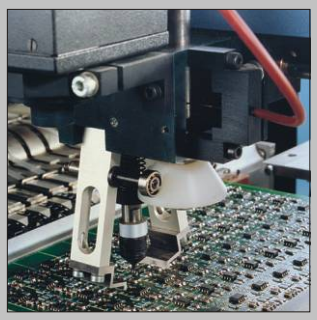
In place of * specify the type of thermocouple (T, J, K, N or S)

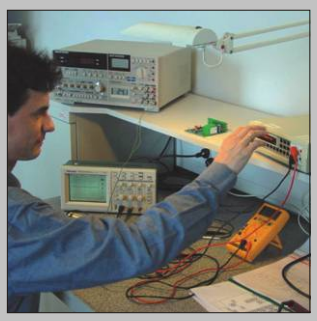
thermocouple		cable colour	wire ⊕	colour	wire ⊖	colour
T	Cu-CuNi	brown	Cu	brown	CuNi	white
J	Fe-CuNi	black	Fe	black	CuNi	white
K	NiCr-NiAl	green	NiCr	green	NiAl	white
N	NiCrSi-NiSi	pink	NiCrSi	pink	NiSi	white
S	PtRh-Pt	orange	PtRh	orange	Pt	white

Example for order: L2PK means compensating cable for thermocouple NiCr-NiAl (K) 2x0,25 mm^2, PVC insulated, with steel braid.

NOTES







CZAKI THERMO-PRODUCT started business in 1978 beginning with the production of portable temperature measurement instruments and industrial temperature sensors. The company grew by concentrating on in-house development and manufacture of its products.

In 1988 CZAKI THERMO-PRODUCT transferred to a new plant in Raszyn, which in 1992 was extended with additional production, stores and staff facilities. Several state of the art technical installations and production machines were installed, among these laser and plasma micro-welding and an automatic SMT assembly line. The mechanical workshop was equipped with numerically controlled metal working machines and measurements laboratory with high class measurement, control and calibration equipment was established.

In January 2000 the firm achieved ISO9001 accreditation.

CZAKI THERMO-PRODUCT produces a wide range of industrial and laboratory temperature sensors, portable and panel thermometers, head-mount and rail-mount temperature transmitters, temperature controllers, process monitors for current and voltage signals, temperature and humidity data loggers and dew point temperature meters with chilled mirror.

CZAKI THERMO-PRODUCT also manufactures ATEX certified temperature sensors for hazardous areas and sensors for special order according to individual requirements customers.

CZAKI THERMO-PRODUCT for many years, presenting its products at the world's largest industrial fair HANNOVER MESSE and industrial automation fair AUTOMATICON in Warsaw.

The main directions of our exports are the United Kingdom, France, Germany, Norway, Sweden, Lithuania, Latvia, Slovakia and Ukraine.

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