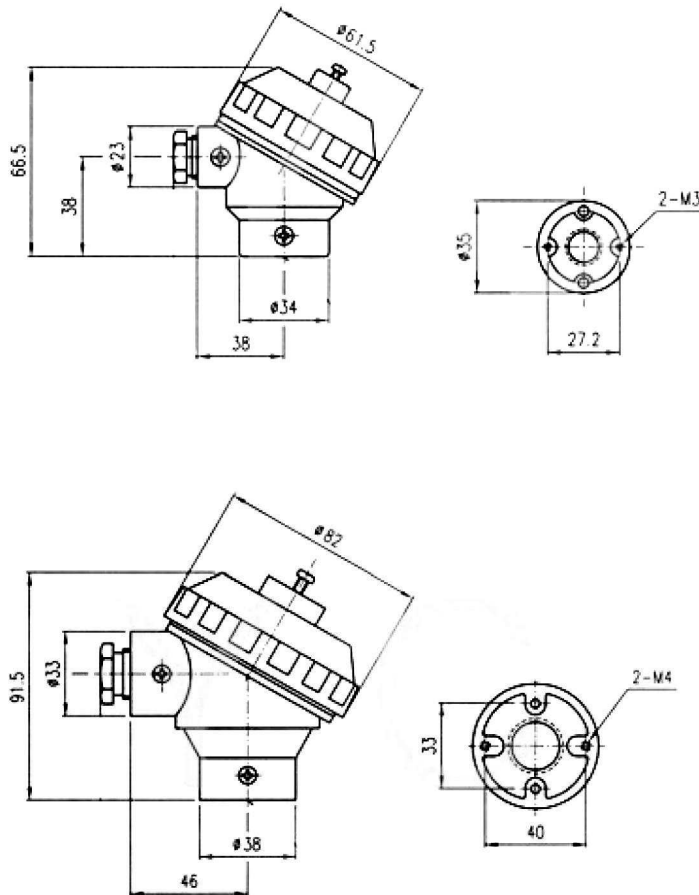




TEMPERATURE SENSOR

to be worked with an indicator or recorder to show temperature of air, liquid or soil.



TERMINAL HEADED TYPE

Size : 61.5mm O.D. or 82mm O.D.

Element : PT100 / D / C / B / R / S / K / N / E / J / T

Temperature range : -200 ~ 2300 deg.C

Terminal box : alloy aluminum

Stem : sus304, sus316, teflon, ceramic, titanium

Stem O.D. : 6mm, 6.35mm, 8mm, 9.5mm, 12.7mm or per request

Connection : 1/4", 3/8", 1/2" PT, BSP, NPT thread or per request

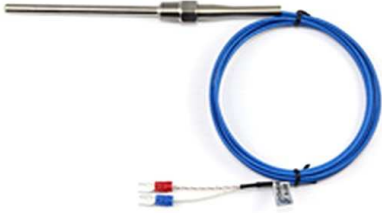
Mounting : bottom or angle or with flange

Junction : grounded, ungrounded, exposed

Thermowell : optional, sus304, sus316 or per request



TEMPERATURE SENSOR



INSERT TYPE

Length : 1M or customized

Wire material : sus304, glass fiber, pvc, teflon

Element : PT100 / D / C / B / R / S / K / N / E / J / T

Temperature range : -200 ~ 2300 deg.C

Connection type : thread type, screw type, bayonet type, sleeve type, sheath type



TEMPERATURE SENSOR

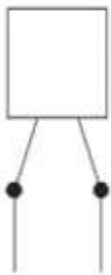
TWO MEASURING WAYS

1) THERMOCOUPLE

A thermocouple is an electrical device consisting of two dissimilar conductors forming electrical junctions at differing temperatures. A thermocouple produces a temperature-dependent voltage as a result of the thermoelectric effect, and this voltage can be interpreted to measure temperature.

2) RESISTANCE BULBS

Resistor changes resistance value when temperature changes. This predictable change is used to determine temperature. Platinum is common used for RTD while the sensor is usually made to have a resistance of $100\ \Omega$ at $0\ ^\circ\text{C}$ called PT100. Wiring configuration could be two-wire, three-wire or four-wire. Four-wire configuration achieved the highest accuracy.



TWO-WIRE



THREE-WIRE



FOUR-WIRE

Factors to be determined the using of thermocouple or RTD:

a) Working temperature

Temperature over $500\ ^\circ\text{C}$ should use thermocouples while RTDs normally process temperatures between -200 and $500\ ^\circ\text{C}$.

b) Response time

Thermocouple can meet the demand of fast response to temperature changes (fractions of a second as opposed to seconds). Time response is measured by immersing the sensor in water moving at $1\ \text{m/s}$ ($3\ \text{ft/s}$) with a 63.2% step change.

c) Accuracy and stability

If a tolerance of $2\ ^\circ\text{C}$ is acceptable and the highest level of repeatability is not required, a thermocouple will serve. RTDs are capable of higher accuracy and can maintain stability for many years.



TEMPERATURE SENSOR

THERMOCOUPLE

Working temperature of different element

Type	Material (+ve wire)	Material (-ve wire)	Continuous working temp. (°C)	Temperature limit (°C)	Sensitivity
D-TYPE (W3)	97% Tungsten 3% Rhenium	75% Tungsten 25% Rhenium	2000	2300	--
C-TYPE (W5)	95% Tungsten 5% Rhenium	74% Tungsten 26% Rhenium	2000	2300	--
B-TYPE (PR30%)	70% Platinum 30% Rhodium	94% Platinum 6% Rhodium	1500	1700	--
R-TYPE (PR13%)	87% Platinum 13% Rhodium	100% Platinum	1400	1600	--
S-TYPE (PR10%)	90% Platinum 10% Rhodium	100% Platinum	1400	1600	--
K-TYPE (CA)	90% Ni 10% Cr	96% Ni - 2% Mn - 2% Al	1000	1200	41 μ V/°C
N-TYPE	Ni-Cr-Si	Ni-Si	1000	1200	39 μ V/°C
E-TYPE (CRC)	90% Ni 10% Cr	55% Cu 45% Ni	700	800	68 μ V/°C
J-TYPE (IC)	100% Fe	55% Cu 45% Ni	600	750	50 μ V/°C
T-TYPE (CC)	100% Cu	55% Cu 45% Ni	300	350	43 μ V/°C



TEMPERATURE SENSOR

THERMOCOUPLE

Class of Tolerance

(t represents the temperature of the hot junction)

Type	Class 1		Class 2		Class 3	
	Measuring range	Tolerance	Measuring range	Tolerance	Measuring range	Tolerance
B-TYPE (PR30%)	--	--			600°C ~ 800°C	+/-4°C
	--	--	600°C ~ 1700°C	+/-0.0025t	800°C ~ 1700°C	+/-0.005t
R-TYPE (PR13%)	0°C ~ 1100°C	+/-1°C	0°C ~ 600°C	+/-1.5°C	--	--
/ S-TYPE (PR10%)	--	--	600°C ~ 1600°C	+/-0.0025t	--	--
K-TYPE (CA) / N-TYPE	-40°C ~ +375°C	+/-1.5°C	-40°C ~ +333°C	+/-2.5°C	-167°C ~ +40°C	+/-2.5°C
	375°C ~ 1000°C	+/-0.004t	333°C ~ 1200°C	+/-0.0075t	-200°C ~ -167°C	+/-0.015t
E-TYPE (CRC)	40°C ~ +375°C	+/-1.5°C	-40°C ~ +333°C	+/-2.5°C	-167°C ~ +40°C	+/-2.5°C
	375°C ~ 800°C	+/-0.004t	333°C ~ 900°C	+/-0.0075t	-200°C ~ -167°C	+/-0.015t
J-TYPE (IC)	-40°C ~ +375°C	+/-1.5°C	-40°C ~ +333°C	+/-2.5°C	--	--
	375°C ~ 750°C	+/-0.004t	333°C ~ 750°C	+/-0.0075t	--	--
T-TYPE (CC)	-40°C ~ +125°C	+/-0.5°C	-40°C ~ +133°C	+/-1°C	-67°C ~ +40°C	+/-1°C
	125°C ~ 350°C	+/-0.004t	133°C ~ 350°C	+/-0.0075t	-200°C ~ -67°C	+/-0.0015t



TEMPERATURE SENSOR

RESISTANCE TEMPERATURE DETECTORS (RTDs)

Tolerance vs Temperature

DIN43760 IEC751 BS1904

°C	1/10 DIN		1/5 DIN		1/3 DIN		CLASS A		CLASS B		CLASS C	
	±°C	±Ω	±°C	±Ω	±°C	±Ω	±°C	±Ω	±°C	±Ω	±°C	±Ω
-200	0.13	0.06	0.26	0.11	0.44	0.19	0.55	0.24	1.3	0.56	2.27	1.15
-100	0.08	0.03	0.16	0.06	0.27	0.11	0.35	0.14	0.8	0.32	1.17	0.71
0	0.03	0.01	0.06	0.02	0.1	0.04	0.15	0.06	0.3	0.12	1.27	0.5
100	0.08	0.03	0.16	0.05	0.27	0.1	0.35	0.13	0.8	0.3	1.77	0.67
200	0.13	0.05	0.26	0.1	0.44	0.16	0.55	0.2	1.3	0.48	2.27	0.83
300	0.18	0.06	0.36	0.13	0.6	0.21	0.75	0.27	1.8	0.64	2.77	0.98
400	0.23	0.08	0.46	0.16	0.77	0.26	0.95	0.33	2.3	0.79	2.77	1.1
500	0.28	0.09	0.56	0.19	0.94	0.31	1.15	0.38	2.8	0.93	3.27	1.22
600	0.33	0.1	0.66	0.21	1.1	0.35	1.35	0.43	3.3	1.06	3.77	1.32
650	0.36	0.11	0.72	0.23	1.2	0.38	1.45	0.46	3.6	1.13	4.27	1.36
700	~	~	~	~	~	~	~	~	3.8	1.17	4.52	1.41
800	~	~	~	~	~	~	~	~	4.3	1.28	5.27	1.49
850	~	~	~	~	~	~	~	~	4.6	1.34	5.52	1.56