

Techtrol Thermocouple Sensor – 'TC'



It is a robust, durable and cost effective temperature sensor used to measure broad range of temperature including high temperature.



Thermocouple with Head



Thermocouple with Cable



'L' Shaped Thermocouple with Head

SALIENT FEATURES

- Available in J, K, T, E, N, R, S, B elements with accuracy Class 1 or Class 2
- Rugged construction and easy to install with various process connection
- Wide choice of protection sheath material and diameter
- Head Exd Gr. IIB / IIC, ATEX protection for hazardous area application
- Customized design/construction available to suit mounting and applications
- Option of temperature transmitter
- Option of thermowell for sensor protection



High Temp Thermocouple with Head



MI Thermocouple with Connector

CONSTRUCTION

A thermocouple is a temperature sensor made of two different metal wires joined at one end forming a sensing junction. Thermocouple wires, covered with insulated beads are inserted inside the protection sheath.



It generates proportional voltage when it experiences a temperature difference between junction and other ends allowing the thermocouple to measure temperature accurately.

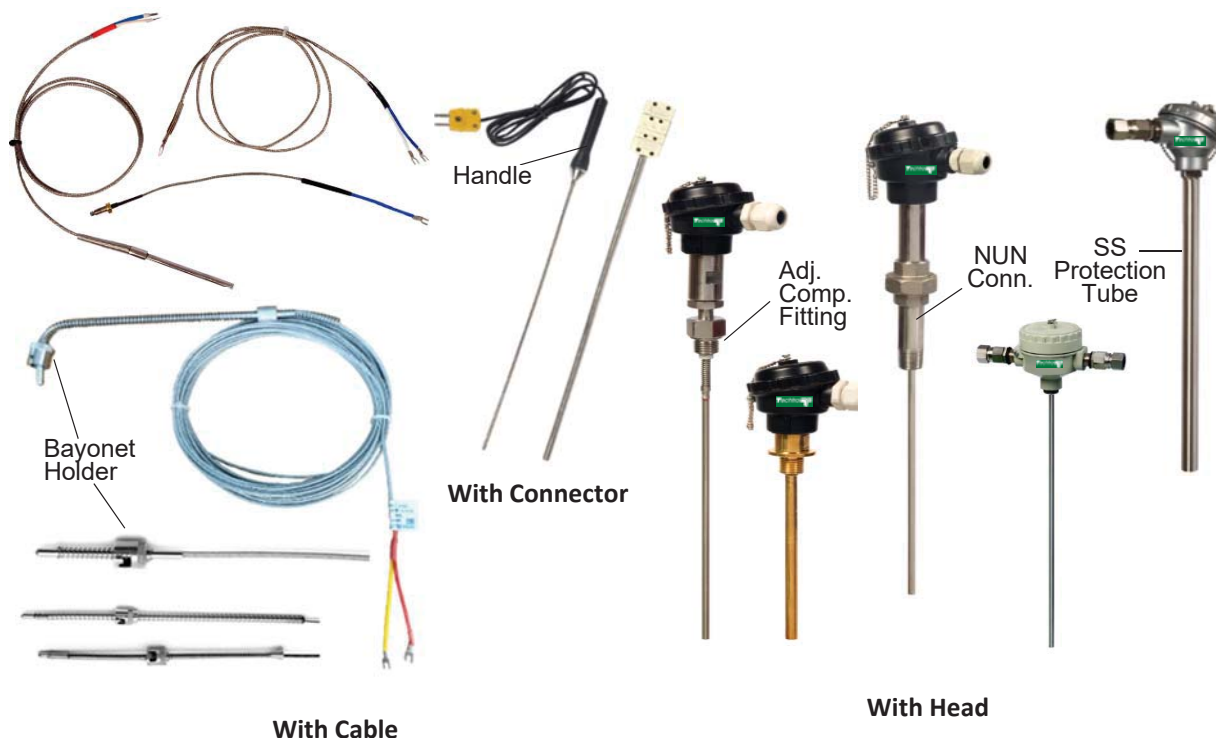
Measuring junctions are offered in three types as-

- 1. Ungrounded Type Junction** : It is electrically and physically isolated from the outer sheath material. Response time is usually slower than grounded thermocouple. It has long life characteristics under maximum corrosion, thermal shock and vibrations. They are used in applications where fluids/ gases are corrosive.
- 2. Grounded Type Junction** : It is welded to protection sheath forming integral part at its tip, hence heat transfer is faster, which improves response time of thermocouple. Thermocouple element wires are protected from chemical environment and moisture. It has fast response time, longer life span and suitable for high pressure applications.
- 3. Exposed Junction:** Thermocouple element wire junction extends beyond the protective sheath. It responds to temperature changes much faster than a grounded junction. It is generally used to measure temperature of non- corrosive gases. It is not recommended in corrosive, contaminating environment.

Thermocouples are classified into two main categories based on metal wire used in its construction i.e. base metal and noble metal.

A) BASE METAL THERMOCOUPLE

Thermocouples J, K, T, E & N are most common type base metal thermocouple used in industry. They comprise less expensive and commonly available metal wires like nickel, copper and iron. They are suitable for wide range of temperature and commonly used in various industries.



Applications

- Metal processing such as aluminum, zinc, brass (with appropriate protection tube)
- Chemicals & Fertilizers
- Petrochemicals
- Thermal Power Plants
- Metal & Steel Industries
- Forging
- Industrial storage tanks

Type J : Most commonly used thermocouple, cost effective as one of its wire is made of iron. It is good choice for general purpose applications, temperature -210 °C to 760°C. It is used in vacuum, in reducing, oxidizing atmosphere or inert gas atmosphere and in environment where moisture is not present.

Type K : It is commonly used in industry as it has better accuracy and has very good oxidation resistance, it has wide temperature range -200 °C to 1260 °C. Suitable for continuous use in oxidizing or inert gas atmosphere. These thermocouples need to be protected from sulphurous atmosphere.

Type T : It is cost effective and mostly used for temperature below zero 0 °C and upper temperature limit upto 350 °C. It has good accuracy and can be used in oxidizing, reducing or inert gas atmospheres. It does not get corrode in moist atmosphere.

Type E : It is suitable for use in oxidizing or inert gas atmosphere from -200 °C to 900 °C. It has high sensitivity, good stability and measures small temperature changes. It can be used in environments with high humidity, oxidizing and inert atmospheres.

Type N : It is used primarily for temperature -200 °C to 1260 °C but not as a replacement of K type. It has better resistance to oxidation at high temperatures hence, they are suitable for use in oxidizing and or inert gas atmosphere. It is more stable over the time and has longer life and accurate at high temperature. They are used in applications, where a longer service life and greater stability are required. They must be protected from sulfurous atmosphere.

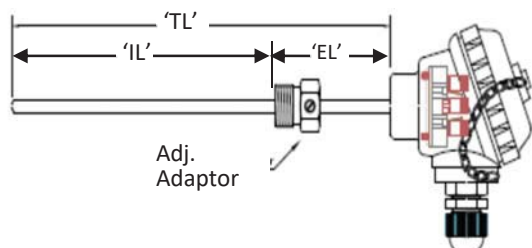
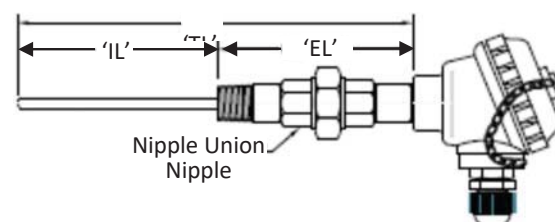
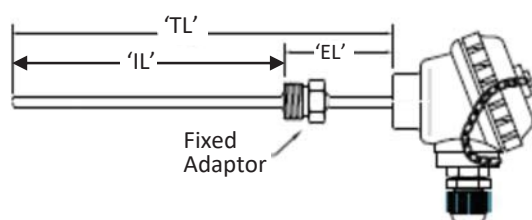
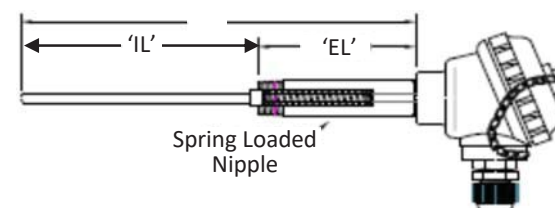
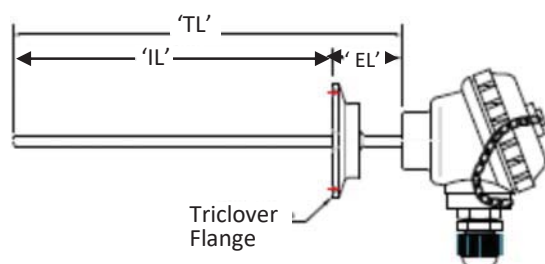
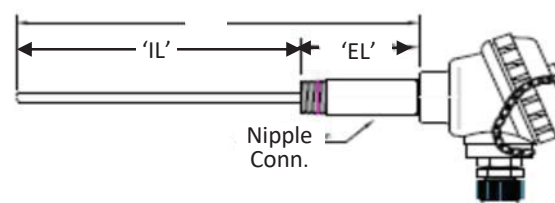
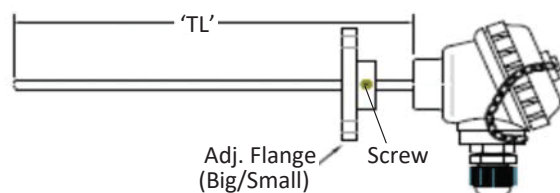
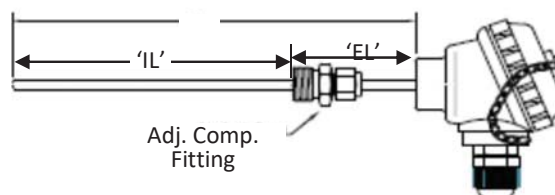
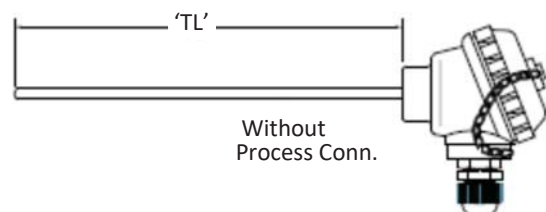
SPECIFICATIONS

Type	Base Metal
Element Type	J (iron- Constantan); K (Chromel – Alumel); T (Copper – Constantan) E (Chromel – Constantan); N (Nicrosil – Nisil)
No. of Element	Simplex, Duplex, Triplex, Multipoint on request
Accuracy	Class 2 (Std.), Class 1 (Optional)
Junction	Grounded, ungrounded, exposed
Insulation	Ceramic, Mineral insulation

Protection Sheath MOC x Size (Ø)	1) SS304/304L/310/316/316L/321/Inconel 600/601/625, Inconel 800 and Titanium/ Hastalloy C x Ø 3, 4, 4.5, 5, 6, 8, 9, 10, 12, 12.7, 15, 16, 19, 20 mm 2) MI Insulation in SS316,SS310, Inconel 600, Inconel 800 x Ø 1, 1.5, 3, 4.5, 6, 8, 12 mm
Total Sheath Length below head	0.02 to 3 mtrs. (Rigid); upto 100 mtrs (Flexible with MI insulation)
Termination 1) Head	Al. WP IP65 x single cable entry Al. WP IP67 x dual cable entry Al. KNE WP IP67 or 68 x single cable entry Al. Exd Gr. IIA, IIB, x single or double cable entry Al. Exd Gr. IIC x single or double cable entry Al. ATEX Exd Gr. IIC x single or double cable entry SS304 or SS316 WP IP65 x single cable entry
2) Cable	7/36 SWG PVC/PVC (80°C max), Teflon/Teflon, Teflon/shield/Teflon Teflon/Teflon/SS braided (200°C max), Teflon/fiber/SS braided (250°C) 14/36 SWG Teflon/Teflon, Teflon/Teflon/SS braided (200°C max).
3) Connector	Plug & Jack
Cable Gland	PG 11, PG 13.5, Nylon or Brass, ½" NPT SC/ DC, Brass, ¾" ET SC/DC Brass Nickel Plated
Terminals	For Head - Ceramic block with nickel pltd brass terminals, option of spring loaded terminals. For Cable - Tinned wire or with pin lug / 'O' lugs / 'U' lugs
Process Connection	Al. x Adj. Flange Big/ Small (Oval shape), (size: 70 PCD, Ø 7 x 2 holes; 62 PCD, Ø 4.5 x 2 holes), SS304 x Fixed /Adj. Flange (size- ½", ¾" 1" NB) SS304 x Adj. or fixed adaptor (size-¼", 3/8", ½", ¾" 1" BSP/ NPT (M)) SS304 x Adj. compression fitting (Size- ¼", 3/8", ½", ¾" 1" BSP/ NPT (M)) SS304 x Nipple, Spring Loaded Nipple, Nipple-Union-Nipple (size-½", ¾") SS316 x Triclover Ferrule (Size ½", 1", 1½") Brass Ni Plated. x Bayonet Holder single or double slot
Protection Tube	SS304/316/310, Inconel 600/601, Inconel 800, Recrystallized Alumina 99.7 % /KER 710 (Ceramic) or Recrystallized Alumina 60%/KER 610 (Ceramic), Silicon Carbide, Silicon Nitride
Accessories	Compensated/extension cable as per standard ANSI MC96.1 1982 or IEC 60584-3. It is used to extend thermocouple signal from a sensor to instrument for reading (size: 7/36, 14/36, 0.5 mm ² , 1mm ² , 1.5 mm ² , other sizes available on request)
Options	
Temperature Transmitter	Isolated or non-isolated x head or DIN rail mounted transmitter with 4-20 mA O/P (4-20mA + HART o/p on request); Supply- 24 VDC
Thermowell	To protect sensor from excess pressure, corrosion and material velocity Available with screwed and flanged connection

SCHEMATIC DIAGRAM

Base Metal Thermocouple with Head



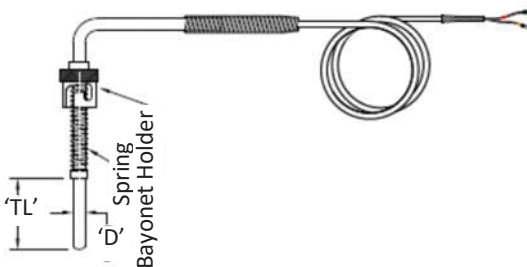
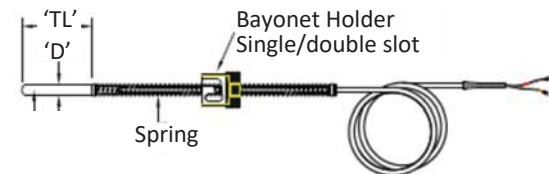
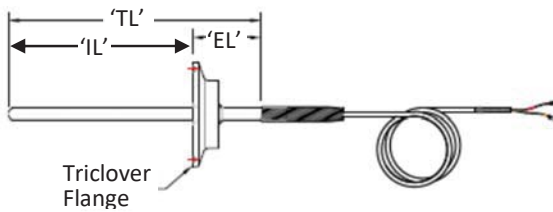
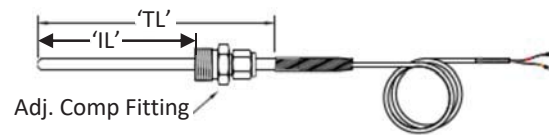
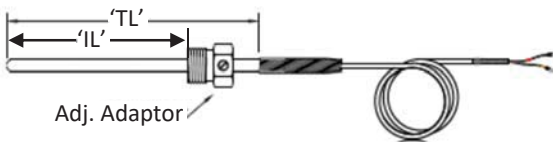
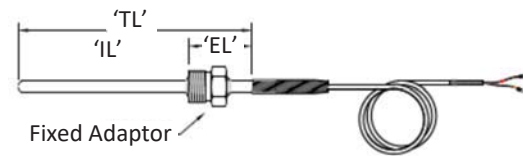
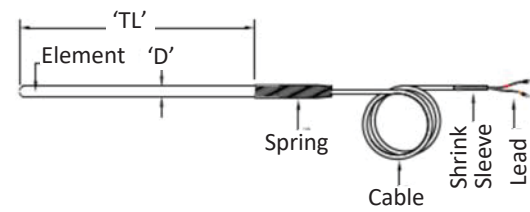
Note:

TL = Total Length

IL = Insertion Length

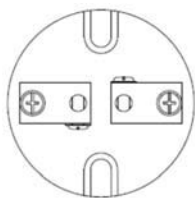
EL = Extension Length

Base Metal Thermocouple with Cable

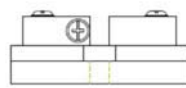
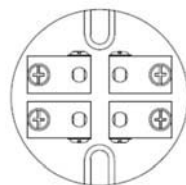


Note:
TL = Total Length
IL = Insertion Length
EL = Extension Length

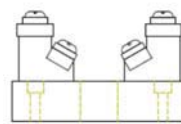
TERMINATIONS (for Thermocouple with enclosure)



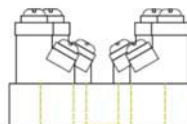
Simplex,
Base/Noble Metal



Duplex,
Base/Noble Metal



Simplex,
For Mineral Insulated



Duplex,
For Mineral Insulated

B) NOBLE METAL THERMOCOUPLE

These are made from more expensive metals like platinum /rhodium alloy R, S & B. It offers better accuracy & stability at high temperature. They must be used with protection tube surrounding the thermocouple element. They are commonly installed in a pure ceramic closed-ended protection tube.



Applications

- Heat treatment, annealing process and furnaces
- Glass, ceramic manufacturing and cement industry
- Power, steel & forging industry
- High temperature application

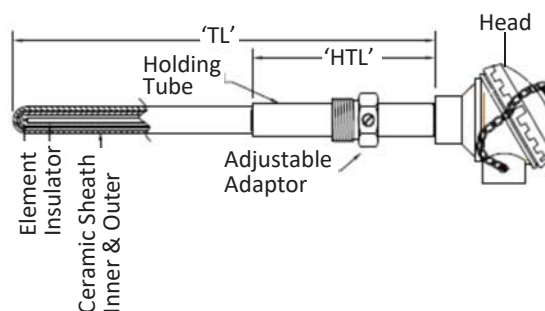
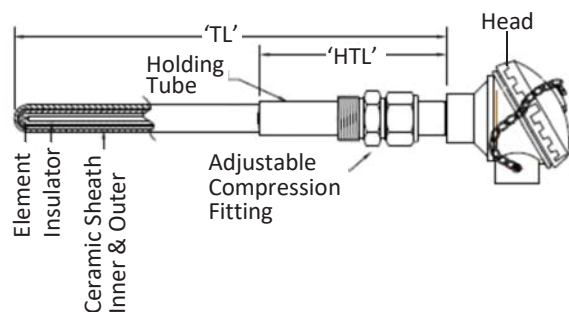
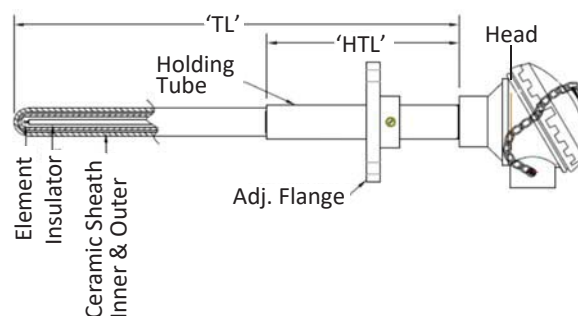
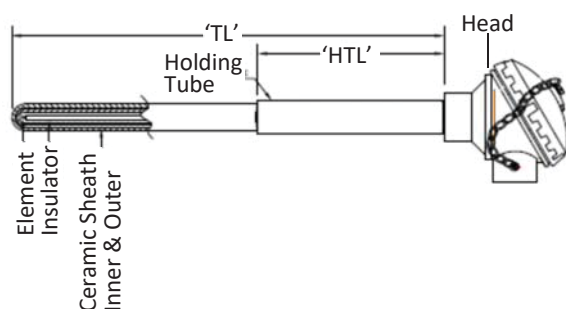
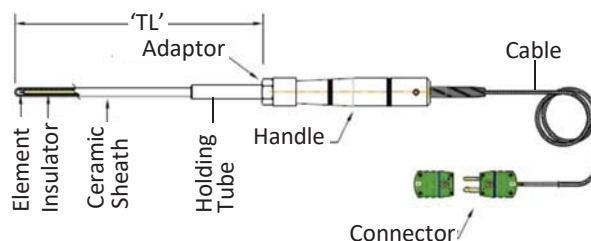
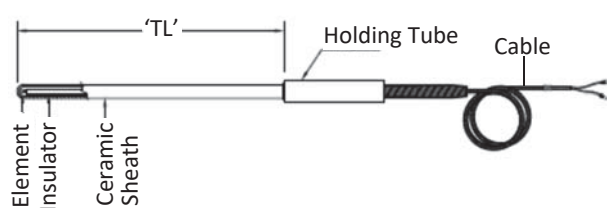
SPECIFICATIONS

Type	Nobel Metal
Element Type	S (PT 10% - RH) R (PT 13 % - RH) B (PT 30 % RH – PT 6 % RH)
No. of Element	Simplex, Duplex, Triplex, Multipoint on request
Accuracy	Class 2 (Std.), Class 1 (Option)
Junction	Grounded, ungrounded or exposed
Insulation	Ceramic
Inner Protection Sheath and Size	SS310, Inconel 600 or 800, Recrystallized Alumina 99.7 % /KER 710 (Ceramic) or Recrystallized Alumina 60%/KER 610 (Ceramic) (Size: 6, 8, 10, 12, 15, 17, 20, 24 mm OD)
Outer Protection Sheath and Size	• SS310, Inconel 600 or 800, Size- 22, 24, 28 mm OD (<1200 °C) • Recrystallized Alumina 99.7 % (Ceramic), Size -15, 20, 24, 28 mm OD • Silicon Carbide, Size -29 mm OD

Holding Tube	SS304/316/310/ Inconel 600 or 800 (size suitable for outer tube)
Process Connection	$\frac{3}{4}$ " , 1" , 1 $\frac{1}{2}$ " x Fixed / Adj. Flange (SS304 MOC) $\frac{3}{4}$ " , 1" , 1 $\frac{1}{2}$ " x BSP(M)/ NPT(M) x Adj. Comp. Fitting (SS304 MOC) $\frac{1}{2}$ " , $\frac{3}{4}$ " x Nipple-Union-Nipple (SS304 MOC)
Total Sheath Length (TL)	0.02 to 4 mtr
Termination 1) Head	Al. WP IP65 x single cable entry Al. WP IP67 x dual cable entry Al. KNE WP IP67 or 68 x single cable entry Al. Exd Gr. IIA, IIB x single or double cable entry Al. Exd Gr. IIC x single or double cable entry Al. ATEX Exd Gr. IIC x single or double cable entry SS304 or SS316 WP IP65 x single cable entry
2) Cable	7/36 SWG x Teflon/ Teflon, Teflon/shield/ Teflon, Teflon/Teflon/SS Braided, Teflon/Fiber/SS Braided (200°C max). 14/36 x SWG Teflon/Teflon, Teflon/Teflon/SS braided (250°C max).
Cable Gland for Head	$\frac{1}{2}$ " , $\frac{3}{4}$ " x NPT or BSP, SC/ DC, Brass, $\frac{3}{4}$ " ET SC/DC Brass Nickel Pltd.
Terminals	For Head- Ceramic block with nickel pltd brass terminals, option- spring loaded terminals. For Cable - Tinned wire or with pin lug / 'O' lugs / 'U' lugs
Accessories	Compensated/Extension Cable: as per standard ANSI MC96.1 1982 or IEC 60584-3. It is used to extend thermocouple signal from a sensor to instrument for indication.
Options	
Temperature Transmitter	Isolated or non-isolated x head or DIN rail mounted transmitter with 4-20 mA O/P (4-20mA + HART o/p on request); Supply- 24 VDC
Thermowell	Used to protect sensor from excess pressure, corrosion and material velocity Available with screwed and flanged connection

SCHEMATIC DIAGRAM

Noble Thermocouple with Cable and Head



Note :

TL = Total Length

HTL= Holding Tube Length

Thermocouple Element x Temperature in deg. Celsius & Fahrenheit

Element	Metal	Temperature		Application
		°C	°F	
J	Iron (+) / Copper-Nickel (Constantan) (-)	210 to 760	-346 to 1,400	Vacuum, Oxidizing, Reducing Atmosphere & Inert Gas Atmosphere
K	Chromel (+) / Alumel (-)	-270 to 1260	-454 to 2,300	Oxidizing & Inert Gas Atmosphere
T	Copper (+)/ Constantan (-)	-270 to 370	-454 to 700	Vacuum, Oxidizing, Reducing Atmosphere & Inert Gas Atmosphere
E	Chromel (+) / Constantan (-)	-270 to 870	-454 to 1600	Oxidizing & Inert Gas Atmosphere
N	Nicrosil (+) / Nisil (-)	-270 to 1260	-454 to 2300	Vacuum, Oxidizing & Inert Gas Atmosphere
R	Platinum-Rhodium 13% (+) / Platinum (-)	-50 to 1480	-58 to 2700	
S	Platinum-Rhodium 10% (+) / Platinum (-)	-50 to 1480	-58 to 2700	
B	Platinum-Rhodium 30% (+) / Platinum (-)	0 to 1700	-32 to 3100	

PROTECTION TUBE

It is used for protection of thermocouple sensor against direct heat, contaminating/ corrosive atmospheres or mechanical damage and extend service life of sensor. It is closed at one end and its material selection is based on the environment in which the sensor will be used. They are available in Ceramic, Silicon Carbide, Silicon Nitride and SS304/316/310, Inconel 600/601 /800 metals



Ceramic



Silicon Carbide



Graphite

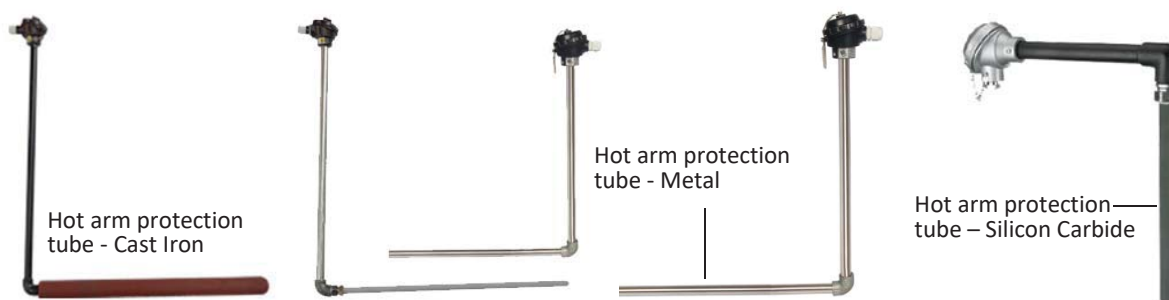


Silicon Nitride

CUSTOMISED MODELS

Angular Type:

Available in K & N Calibration. It is provided with cold arm and hot arm protection tube with elbow. It is used to protect the thermocouple head from the temperature and corrosive environment in metal melts and salt baths, maximum temperature upto 1700 °C. Protection tube is available in SS 304/316/310, Inconel 600/601/800, PTFE Coated SS Cast Iron/ Silicon Carbide/Silicon Nitride, Recrystallized Alumina (ceramic). Hot arm lengths are available as per required length.



MI Insulated Thermocouple:

It is also referred as MgO thermocouples. These are fast responding, durable, bendable and capable of handling temperatures up to 1260°C (2300°F). It enables temperature measurement in poor accessible area. Available in J, K, T, E or N element with MI insulation in SS316/310/321 and Inconel 600.



Handle Type:

Available in J, K, T, E, N, R, S or B element. Used to measure temperature in hot molten metals or solid, semi solid food or liquids. Thermocouple probe sheath is fitted with handle in Nylon/Bakelite/SS /Aluminum and its connections are taken out in the form of cable connections or with miniature connector. Bow Curved Surface probe/roller are used to measure temperature of moving or static convex surfaces.



Skin Type:

Used to measure surface temperature. Available with weld pad, washer, hose clamp and pipe mounting probe. It is used in industry for high temperature measurement and/or in corrosive environment, where fast and accurate temperature is required. Applications – Furnaces, Foundries, Metal & Steel/ Cement Industries and Heat Treatment.



TEMPERATURE TRANSMITTER



DIN Rail Mounted



Head Mounted

TC -		B	J	B	S	U	C	N	A	C	A	A	1	A	W	W	W	W
1. Type																		
Base metal (General Purpose)		B																
2. Element																		
Iron - Constantan			J															
Chromel - Alumel			K															
Copper - Constantan			T															
Chromel - Constantan			E															
Microsil - Nisil			N															
Others			O															
3. Accuracy																		
Standard Tolerance, Class 2				B														
Special Tolerance, Class 1				A														
4. Element Form																		
Simplex					S													
Duplex					D													
Triplex					T													
Others (Multipoint)					O													
5. Junction																		
Grounded						G												
Ungrounded						U												
Exposed						E												
6. Insulation																		
Ceramic							C											
Mineral Insulated (protection sheath 3,5 6,8 mm others on request in SS316/310, Inconel 600)							M											
Others							O											
7. Protection Sheath (MOC x Size)																		
MOC		Size (mm)																
Without	W	Without				W		X	X									
SS304	N	Ø 3				C												
SS304L	D	Ø 4				D												
SS310	C	Ø 4.5				E												
SS316	S	Ø 5				F												
SS316L	L	Ø 6				G												
SS321	E	Ø 8				H												
Hastalloy B	H	Ø 9				I												
Inconel 600 (for K & N)	F	Ø 10				J												
Titanium	U	Ø 12				K												
Others	O	Ø 12.7				L												
Note: (protection sheath SS316, SS310, Inconel 600 with MI insulation 3, 5, 6, 8 mm, others on request)		Ø 15				M												
		Ø 16				N												
		Ø 19				Q												
		Ø 20				R												
		Others				O												

8. Process Connection (Size x Type)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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Others		O							
10. Cable Gland									
No. of Cable Gland		Cable Gland Type							
Without (<i>cable termination</i>)	W	Without (<i>cable termination</i>)	W	X	X				
1 cable gland	1	PG 11 Nylon	A						
2 cable glands	2	PG 13.5 Nylon	B						
1 plug + 1 cable gland	3	PG 13.5 Brass	C						
Others	O	½" BSP SC, Brass	D						
		½" BSP DC, Brass	E						
		½" NPT SC, Brass	F						
		½" NPT DC, Brass	G						
		¾" ET SC, Brass	H						
		¾" ET DC, Brass	I						
		Others	O						
11. Protection Tube									
Not Provided								W	
SS304								N	
SS316								S	
SS310								C	
Inconel 600								F	
Recrystallized Alumina 60 % (Ceramic)								X	
Recrystallized Alumina 99.7 % (Ceramic)								Y	
Silicon Nitride								Q	
Silicon Carbide								R	
Others								O	
<i>Note : Pl. mention cold arm and hot arm length</i>									
12. Customized Options									
Without								W	
Skin Type								S	
Handle Type								H	
Angular Type								A	
Others								O	
13. Transmitter									
Without								W	
Non-isolated 4-20 mA, head mounted type								1	
Non-isolated 4-20 mA, DIN rail mounted								2	
Isolated 4-20 mA, head mounted type								3	
Isolated 4-20 mA, DIN rail mounted								4	
Isolated 4-20 mA + HART, head mounted								5	
Isolated 4-20 mA + HART, DIN rail mounted								6	
Others								O	

Non-isolated 4-20 mA, DIN rail mounted	2
Isolated 4-20 mA, head mounted type	3
Isolated 4-20 mA, DIN rail mounted	4
Isolated 4-20 mA + HART, head mounted	5
Isolated 4-20 mA + HART, DIN rail mounted	6
Others	0

ORDERING INFORMATION

Model number x total length and insertion length (cable length in case of cable termination) and operating temperature.

- Note: 1. Thermocouples are available with thermowell. Refer Thermowell catalog to order it separately.
2. Temperature Controller available. To be ordered separately

All dimensions in mm except specified

Pune Techtrol Pvt. Ltd. [CIN: U31909PN1991PTC063403]

S-18, MIDC, Bhosari, Pune - 411026. India. **Ph:** +91-20-66342900,
ho@punetechtrol.com, www.punetechtrol.com

Works: J-52/7, MIDC, Bhosari, Pune - 411026. India +91-20-67313600

