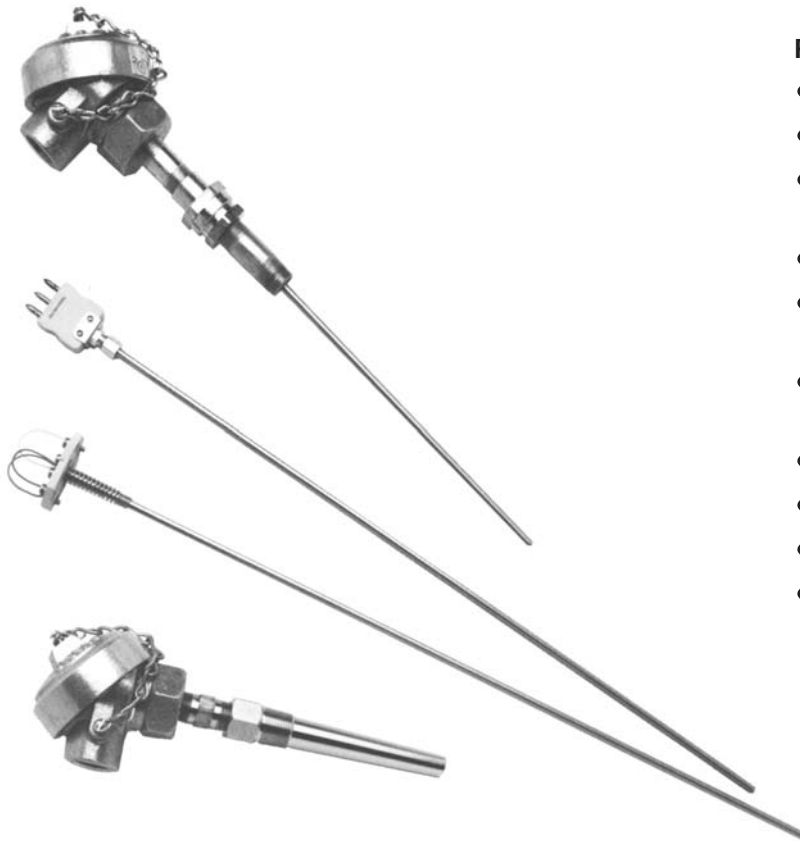




# Resistance Temperature Detectors Probes & Assemblies



## PRODUCT FEATURES

- ☛ Rugged Construction
- ☛ Accurate and Stable Probes
- ☛ General Purpose, Tip Sensitive, High Temperature and High Vibration Probes and Assemblies
- ☛ 2, 3 and 4 Wire Configurations
- ☛ General Purpose or Spring Loaded Mounting, with or without Thermowells
- ☛ Nipple, Nipple-Union-Nipple or Bushing Extension Hardware
- ☛ CSA Approved Assemblies for Hazardous Locations
- ☛ Averaging RTDs
- ☛ Custom Configurations
- ☛ Head Mounted Transmitter Options

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## GENERAL

Resistance Temperature Detectors (RTDs) are used for industrial temperature measurements where high accuracy and long-term stability are required. The 100 ohm platinum element is the most common for industrial applications. The 3-wire lead configuration is used for industrial temperature measurements and provides adequate compensation for leadwire resistance. The 4-wire arrangement fully eliminates all leadwire effects and is used in applications where high accuracy is required.

## TOLERANCE & ACCURACY

**Tolerance** of an RTD is a measure of its conformity to the ITS-90 Temperature-Resistance curve, and is normally expressed as an allowable deviation from the normal resistance at 0 °C. It consists of a manufacturing tolerance on the reference point (eg: how close is the resistance to 100 Ω at 0 °C) and a materials tolerance on the Temperature Coefficient of Resistance (eg: how close does the wire conform to an alpha of .00385).

At the reference temperature, only the manufacturing tolerance applies (since this is where the RTD element is “adjusted” to 100 Ω). At other temperatures, the materials tolerance must be added. As the temperature increases or decreases, the tolerance becomes wider. At higher temperatures, the material tolerance has the larger influence.

**DIN/IEC 60751 (replaces DIN 43760) defines Class B and Class A tolerances.**

Temp °C	Resistance Ω	Class B		Class A	
		Ω	°C	Ω	°C
-200	18.52	±0.56	±1.3	±0.24	±0.55
-100	60.26	±0.32	±0.8	±0.14	±0.35
0	100.00	±0.12	±0.3	±0.06	±0.15
100	138.51	±0.30	±0.8	±0.13	±0.35
200	176.86	±0.48	±1.3	±0.20	±0.55
300	212.05	±0.64	±1.8	±0.27	±0.75
400	247.09	±0.79	±2.3	±0.33	±0.95
500	280.98	±0.93	±2.8	±0.38	±1.15
600	313.71	±1.06	±3.3	±0.43	±1.35
650	329.64	±1.13	±3.6	±0.46	±1.45
700	345.28	±1.17	±3.8	--	--
800	375.70	±1.28	±4.3	--	--
850	390.48	±1.34	±4.6	--	--

**Class B:**  $\pm (0.30 + .005 \times |t|)$  °C

**Class A:**  $\pm (0.15 + .002 \times |t|)$  °C

|t| = absolute value of temperature in °C

NOTE: Tolerances apply to the element, not to final probe.

Elements with narrower tolerances are available (eg: 1/3 B, 1/5 B, etc). No standard exists for these fractional tolerance elements; it depends on the manufacturer of the element. For example, a 1/10 B element would normally have a manufacturing tolerance of 0.03 °C, but the material tolerance would depend on the manufacturer’s choice of wire (class B, class A or other).

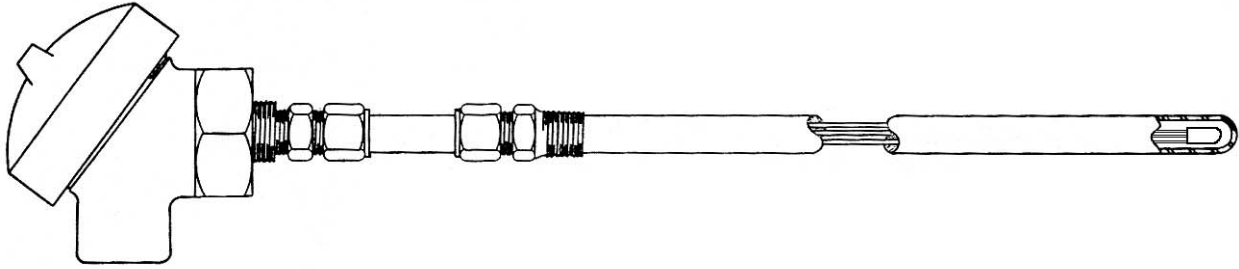
**Accuracy** is dependent on the tolerance of the RTD, the measurement temperature, the accuracy of the readout device, the effects of the interconnecting leadwire and the installation.

For highest accuracy use a calibrated Class B element with a precision transmitter (or meter) that can be characterized to match the RTD calibration.

Platinum elements with other temperature-resistance curves are available (eg: JIS). Copper and Nickel elements are also available as replacements to match existing instrumentation.

## SPECIFICATIONS

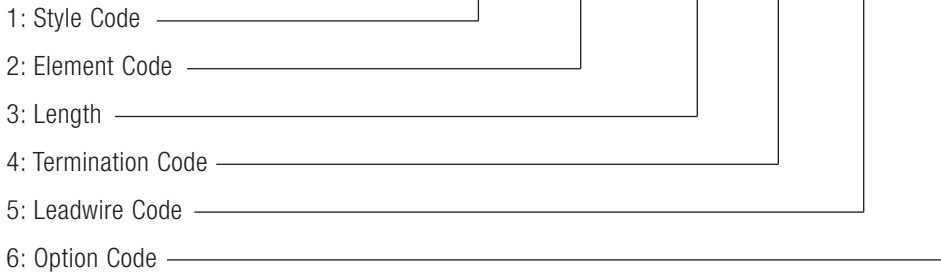
ELEMENT MATERIAL:	Platinum, DIN/IEC 60751
ELEMENT RESISTANCE:	10, 100, 500, 1000 $\Omega$
TOLERANCE:	$\pm 0.12\%$ of resistance at 0 $^{\circ}\text{C}$ (Class B) $\pm 0.06\%$ of resistance at 0 $^{\circ}\text{C}$ (Class A)
STABILITY:	0.05% of resistance/year at 0 $^{\circ}\text{C}$
TEMPERATURE COEFFICIENT:	.00385 $\Omega/\Omega/^{\circ}\text{C}$
TEMPERATURE RANGE:	-50 $^{\circ}\text{C}$ to 250 $^{\circ}\text{C}$ (R1,R2) -200 $^{\circ}\text{C}$ to 500 $^{\circ}\text{C}$ (R3,R5) -200 $^{\circ}\text{C}$ to 550 $^{\circ}\text{C}$ (R4)
LEAD CONFIGURATION:	2, 3 or 4 wire
LEAD MATERIAL:	Stranded copper for 260 $^{\circ}\text{C}$ Stranded ni-clad copper for 500 $^{\circ}\text{C}$ Solid nickel for 550 $^{\circ}\text{C}$
LEAD INSULATION:	Teflon for 260 $^{\circ}\text{C}$ probes Fiberglass for 500 $^{\circ}\text{C}$ probes MgO for 550 $^{\circ}\text{C}$ probes
PROBE MATERIAL:	316 stainless steel
PROBE TIP:	Stainless steel Copper alloy for tip sensitive probe
PROBE SIZE:	0.25" OD
VIBRATION:	20g over 10 to 1K Hz
RESPONSE TIME:	30 sec nominal for SS tip 15 sec nominal for copper tip
SELF HEATING:	20 mW/ $^{\circ}\text{C}$ for SS tip 40 mW/ $^{\circ}\text{C}$ for copper tip
PRESSURE RATING:	500 psig over temperature range
INSULATION RESISTANCE:	1000 M $\Omega$ at 500 VDC



**ORDERING INFORMATION**

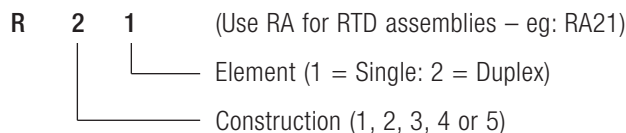
A 6-part catalog number is used to specify a complete RTD probe.

R21 - D100A3 - 012.0 - 68 - A024 - 03



**Example:** The above catalog number identifies a general purpose RTD probe with a .250" OD stainless steel sheath 12" long, a 100 ohm platinum (DIN) element with 3-lead configuration, a heavy duty cast iron head and a stainless steel compression fitting with 1/4" NPT.

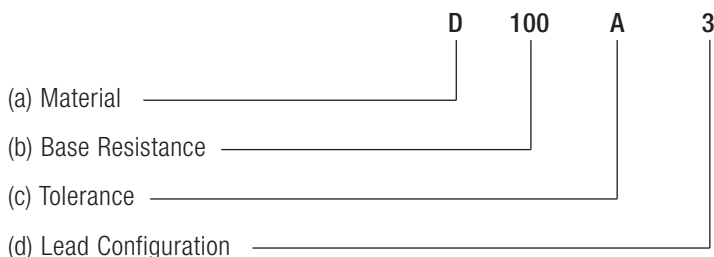
**1: STYLE CODE**



- R1x: General Purpose probe, 0.250" OD, 316 SS sheath and tip, internal leads are teflon insulated, stranded copper (22 ga for simplex, 24 ga for duplex), 260°C maximum temperature.
- R2x: Tip Sensitive probe, 0.250" OD, 316 SS sheath, copper alloy tip, internal leads are teflon insulated, stranded copper (22 ga simplex, 24 ga for duplex), 260°C maximum temperature
- R3x: Medium Temperature probe, 0.250" OD, 316 SS sheath & tip, internal leads are fiberglass insulated, stranded ni-clad copper (22 ga for simplex, 24 ga for duplex), 500°C maximum temperature.
- R4x: High Temperature probe, 0.250" OD, 316 SS sheath & tip, internal leads are solid nickel, MgO insulated, 600°C maximum temperature. This construction can be supplied in long lengths and coiled.
- R5x: High Vibration probe, 0.250" OD, 316 SS sheath & tip, internal leads are solid nickel, MgO insulated, 500°C maximum temperature.

Other constructions, diameters, materials, etc, are available on special order. Contact factory for details.

**2: ELEMENT CODE**



(a) MATERIAL:                    D: Platinum (IEC) · = 0.003850 Ω/Ω/°C  
    S: Platinum (JIS) · = 0.003916 Ω/Ω/°C

(b) BASE RESISTANCE:    10, 100, 500, 1000 for D  
    100 for S

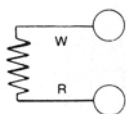
(c) TOLERANCE:            A: ±0.12% of resistance at 0 °C (Standard)  
    E: ±0.06% of resistance at 0 °C (Optional)  
    F: ±0.04% of resistance at 0 °C (Optional)\*  
    H: ±0.012% of resistance at 0 °C (Optional)(range of 0-100 °C only)\*

\* available in 4-wire lead configuration only.

## 2: ELEMENT CODE (cont'd)

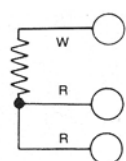
(d) LEADWIRE CONFIGURATION:

### 2-Wire (Code 2)



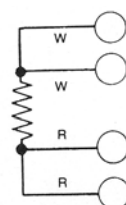
The 2-wire connection provides no lead wire compensation. Reasonable accuracy can only be obtained if leadwire resistance is negligible compared to the ohms/degree change of the RTD.

### 3-Wire (Code 3)



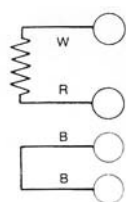
The 3-wire connection allows for leadwire compensation in Wheatstone bridge and constant current circuits. These compensating circuits assume that all leads are of equal resistance. This arrangement is most common for industrial temperature measurements.

### 4-Wire (Code 4)



The 4-wire, type A connection enables complete compensation for the effect of leadwire resistance in potentiometric or compensated bridge measurements. This arrangement is normally used in metrology applications for measurements of the highest precision.

### 4-Wire Type B (Code 5)



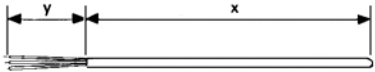

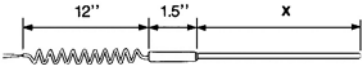
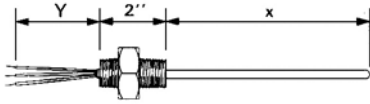
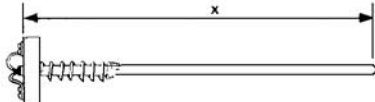
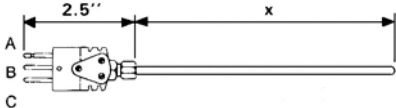
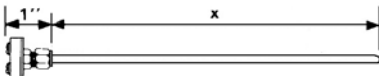
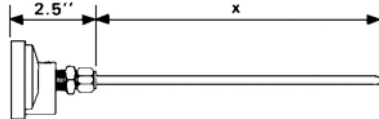
The 4-wire, type B connection is essentially a 2-lead RTD with a compensating loop, and is used in bridge-type differential temperature measurements on equal-ratio bridge networks.

## 3. LENGTH

Specify probe length ("X") in inches (eg: 012.0 = 12")

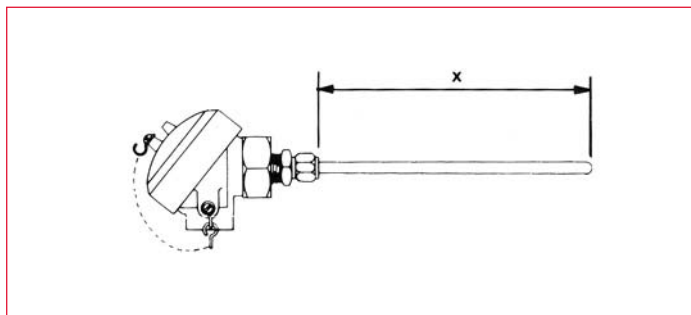
Minimum recommended length: 3"

4: TERMINATION CODE

TERMINATION	CODE	DESCRIPTION
	10	22 ga insulated, stranded copper leads. (Teflon for R1x & R2x; Fiberglass for R3x & R4x.) Specify length Y in inches under "LEADWIRE" 'Construction Type' O (standard length = 6")
	11	Potting adaptor with flexible leadwire. Specify 'Construction Type' and length (Y) under "LEAD WIRE" Use "OPTIONS" to specify fittings, connectors, etc.
	12	Retractable cable, 100°C PVC jacket, 1' coiled, extends to 5.' Specify Y (coiled length) under "LEADWIRE" (Pg 8). Use 'Construction Type' O. (standard length = 1')
	15 16 17 18 19	1/2 x 1/2 MOUNTING ADAPTER 1/2" x 1/2" NPT, S/S      Specify "Y" length (Std = 6") 15 Welded to Probe 16 Spring Loaded 17 Spring Loaded, O-Ring 18 Compression Bolt, Metal Ferrule 19 Compression Bolt, Teflon Seal
	20 21 22 23 24	20 For 14-0008/14-0022 Heads      (X = A + N + 2.25"). 21 For 14-0304/7, 14-0804/7 Heads      (X = A + N + 2.00"). 22 For 14-1080A/1080S/1086S, 14-0018 Heads      (X = A + N + 1.75"). 23 For 14-0007 Head      (X = A + N + 2.25"). 24 For 14-1304/7 Heads      (X = A + N + 2.25").
	25 27	25 3-Pole Plug (200°C) 27 High-Temp 3-Pole plug (425°C)
	30 31	30 Open type, micro terminal block (200°C) 31 High-Temp open type micro terminal block (425°C)
	35 36 37 38	35 Miniature weatherproof plastic terminal head Brass Comp Fitting (200°C) 36 High-Temp miniature W/P plastic terminal head Brass Comp Fitting(425°C) 37 Miniature weatherproof plastic terminal head S/S Comp Fitting (200°C) 38 High-Temp miniature W/P plastic terminal head S/S Comp Fitting(425°C)

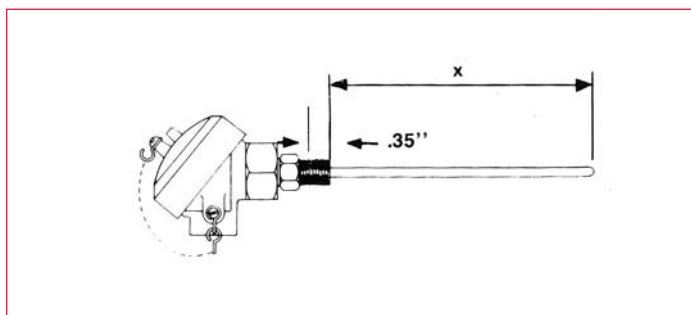
4: TERMINATION CODE (cont'd)

Screw Cover Terminal Head  
Mounted to probe with compression fitting



HEAD					Compression Fitting	
Style	Material	Type*	Haz Loc*	Fig	Brass	Stainless
General Purpose	Aluminum	4	--	1	65	67
	Cast Iron	4	--	1	66	68
	Stainless	4X	--	3	--	64
Heavy Duty	Aluminum	4	B C D	4	42	43
	Cast Iron	--	--	2	46	48
	Stainless	4X	B C D	4	--	44

Screw Cover Terminal Head  
1/2" X 1/2" NPT SS Mounting Adapter  
Fixed probe



HEAD					Welded	Compression Adapter
Style	Material	Type*	Haz Loc*	Fig		
General Purpose	Aluminum	4	--	1	70	91
	Cast Iron	4	--	1	75	93
	Stainless	4X	--	3	C1	C6
Heavy Duty	Aluminum	4	B C D	4	A1	A6
	Cast Iron	--	--	2	55	83
	Stainless	4X	B C D	4	B1	B6

Thread engagement:  
.35" for 1" NPT

If used with a thermowell  
X = TW bore length 1/2"

\*1 Cast Iron body, Aluminum cap

\*2 CSA or Nema type

\*3 Heads meet requirements for Class 1 Div 1 & 2 (Class I Zone 1 & 2).

For Explosion Proof assemblies, refer to RTD Assemblies starting on page 11.

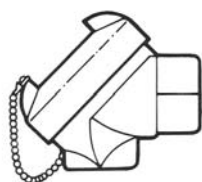


Fig. 1

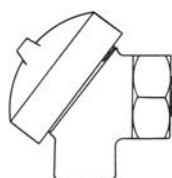


Fig. 2

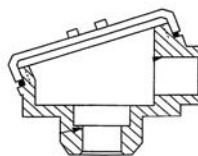


Fig. 3

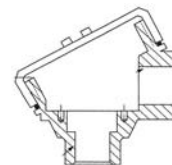


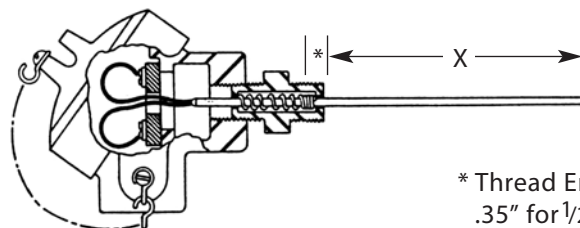
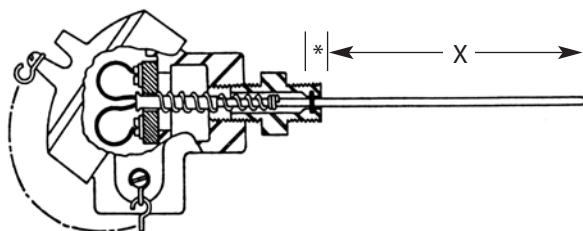
Fig. 4



4: TERMINATION CODE (cont'd)

Screw Cover Terminal Head  
1/2" X 1/2" NPT SS Mounting Adapter  
Spring-Loaded Probe

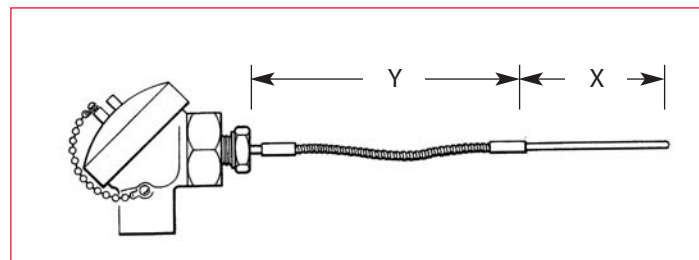
Note: If used with a thermowell,  
X = A (bore length of thermowell)



\* Thread Engagement  
.35" for 1/2" NPT

Style	Material	HEAD			CAPTIVE T/B		SPRG-LOADED ADAPTER	
		Type* <sup>1</sup>	Haz Loc* <sup>2</sup>	Fig	Std	O-Ring	Std	O-Ring
General Purpose	Aluminum	4	--	1	71	72	73	74
	Cast Iron	4	--	1	76	77	78	79
	Stainless	4X	--	3	C2	C3	C4	C5
Heavy Duty	Aluminum	4	B C D	4	A2	A3	A4	A5
	Cast Iron	--	--	2	56	57	58	59
	Stainless	4X	B C D	4	B2	B3	B4	B

Division 2 (Zone 2) Assemblies  
Remote Mounted Head  
Flexible Armour \*\*



Style	HEAD			Transmitter	Class I* <sup>2</sup>	Class II* <sup>3</sup>
	Material	Type* <sup>1</sup>	Fig			
Heavy Duty	Aluminum	4	4	None	9K	8K
			4	TK 381	9T	8T
			4	IPAQ-H	9E	8E
	Stainless	4X	4	None	9L	8L
			4	TK 381	9U	8U
			4	IPAQ-H	9F	8F

\*1 CSA or Nema type

\*2 Head meets requirements for Class 1 Div 1 & 2 (Class I Zone 1 & 2).

For Explosion Proof assemblies, refer to RTD Assemblies starting on page 11.

\*3 Armour is PVC jacketed for Class II applications.

## 5: LEADWIRE CODE

Leadwire extension can be accomplished by extending the internal leads or by attaching a jacketed cable (via a potting adaptor).

### CONSTRUCTION TYPE

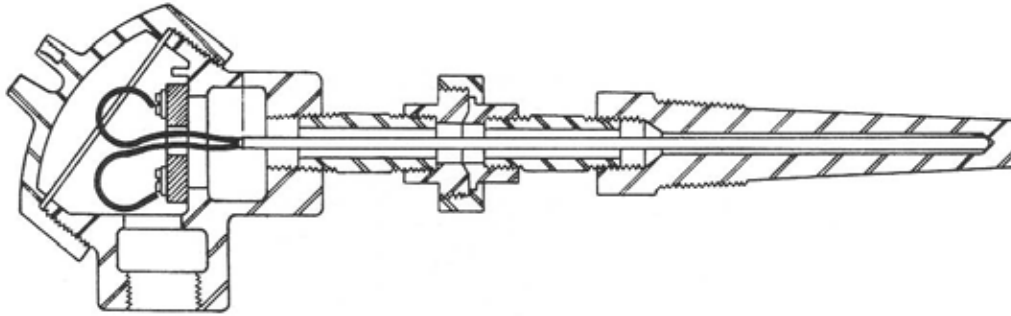
CONSTR. CODE	LEADWIRE EXTENSION	FOR STYLE CODE	REQUIRED TERM CODE
O	Teflon Insulated Leadwire, No Jacket	R1, R2	10
	Teflon Insulated Leadwire, No Jacket	R3, R4, R5	11
Q	F/G Insulated Leadwire, No Jacket	R1, R2, R3	10
	F/G Insulated Leadwire, No Jacket	R4, R5	11
P	PVC Jacketed Cable, Unshielded	All	11
R	PVC Jacketed Cable, Shielded	All	11
T	Teflon Jacketed Cable, Shielded	All	11
W	Teflon Jacketed Cable, Shielded, SS Overbraid	All	11
A	Flex Armour (3/16" ID), Teflon Insulated Leads	All	11
B	Flex Armour (3/16" ID), PVC Jacketed, Teflon Insulated Leads	All	11
C	Flex Armour (3/16" ID), F.G Insulated Leads	R3, R4, R5	11
D	Flex Armour (3/16" ID), PVC Jacketed, F/G Insulated Leads	R3, R4, R5	11

Use O000 when leadwire not applicable (for Term Codes other than 10 & 11).

## 6: OPTION CODE

CODE	DESCRIPTION
000	None
2	Brass Compression Fitting (Metal Ferrule) – 1/4" NPT*
3	Brass Compression Fitting (Teflon Seal) – 1/4" NPT*
4	Brass Compression Fitting (Metal Ferrule) – 1/2" NPT
5	Brass Compression Fitting (Teflon Seal) – 1/2" NPT
6	S.S. Compression Fitting (Metal Ferrule) – 1/4" NPT*
7	S.S. Compression Fitting (Teflon Seal) – 1/4" NPT*
8	S.S. Compression Fitting (Metal Ferrule) – 1/2" NPT
9	S.S. Compression Fitting (Teflon Seal) – 1/2" NPT
C	Transmitter (or Indicator) Configuration
D	3-Pole Plug (at end of leadwire)
E	3-Pole Plug & Mating Jack (at end of leadwire)
F	Brazed Transition
G	Self Grip Spring
H	Spade Lugs (at end of leadwire)
J	1/2" x 1/2" NPT Adapter, Welded to Probe
K	1/2" x 1/2" NPT Spring-Loaded Adapter
L	1/2" x 1/2" NPT Spring-Loaded Adapter with O-Ring Seal
M	1/2" x 1/2" NPT Compression Adaptor, Fixed (Metal Ferrule)
N	1/2" x 1/2" NPT Compression Adaptor, Adjustable (Teflon Seal)
P	Paper Tag
S	Stainless Steel Tag
X	Special

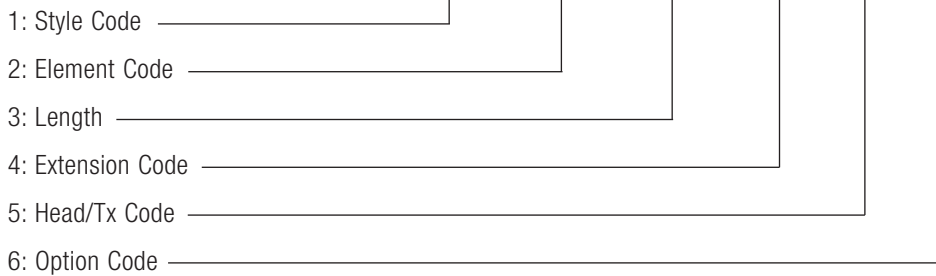
\* For other NPT sizes, use Option X & specify size.



### ORDERING INFORMATION

A 6-part catalog number is used to specify a complete RTD assembly:

RA21 - D100A3 - 012.0 - WX3.0 - BH - TW



**Example:** The above catalog number identifies a tip sensitive RTD assembly with a .250" OD stainless steel sheath 12" long, a 100 ohm platinum (DIN) element with 3-lead configuration, a spring-loaded mounting with captive terminal block, a NUN 1/2" galvanized extension, aluminum general purpose head, a TK381 close-coupled transmitter and mounted to a thermowell.

**1: STYLE CODE**

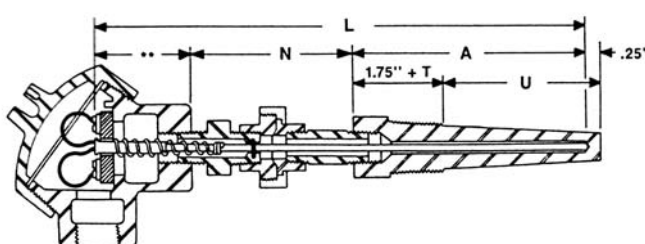
RA1x, 2x, 3x, 4x, 5x, - Refer to page 5

**2: ELEMENT CODE**

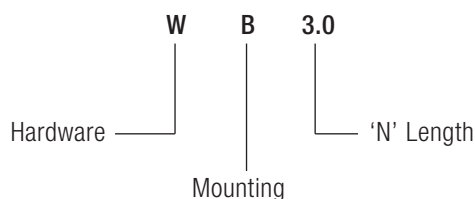
Refer to page 5

**3: "A" LENGTH**

Specify "A" length to 0.1"



**4: EXTENSION CODE**



**"N" LENGTH** Specify "N" length to 0.1"

**HARDWARE**

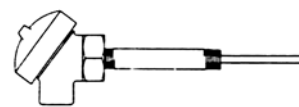
TYPE	MATERIAL/SIZE CODE	
	1/2" Galv	1/2" S.S
N	W	K
NUN	X	L
B	*	Y
BUN	Z	N

\* Type B in S.S only

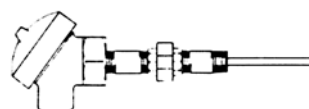
**MOUNTING**

TYPE	CODE
General Purpose (B, BUN only )*	A
Spring-Loaded, Captive T/B	B
Sprg-Ld, Capt T/B, O-Ring Seal	C
Spring-Loaded Bushing	D
Sprg-Ld Bushing, O-Ring Seal	E

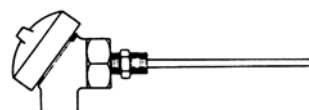
\*Probe welded to bushing



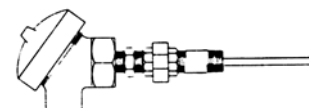
Type N



Type NUN



Type B



Type BUN

Type A, C & D mounting requires type B or BUN hardware.

Spring loading is recommended for applications using thermowells to ensure contact with bottom of well and to allow for differential expansion between element and well.

**5A: HEAD CODE**

TYPE	MATERIAL	HAZ LOC*	RATING	PART NO.	FIG.	TX*	CODE
General	Aluminum		N4	14-1304	1	Y	B
	Cast Iron		N4	14-1307	1	N	D
	Stainless		N4X	14-1076S	3	Y	W
Heavy Duty	Cast Iron			14-0018	2	H	C
	Aluminum	B C D	XP, N4	14-1080A	4	Y	U
	Stainless	B C D	XP, N4X	14-1080S	4	Y	V
DIN	Nylon		IP65	14-0067	5	Y	4
	Aluminum		IP67	14-0094	5	Y	5

\* Heads meet requirements for Class 1 Div 1 & 2 (Class I Zone 1 & 2)

\*\* Transmitter compatible



Fig. 1

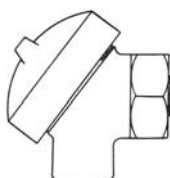


Fig. 2

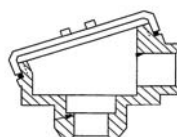


Fig. 3

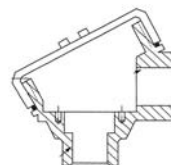


Fig. 4

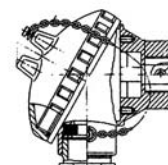


Fig. 5

**5B: TRANSMITTER CODE**

TRANSMITTER	CODE
None	O
IPAQ-H	A
STT173	M
TK381	H

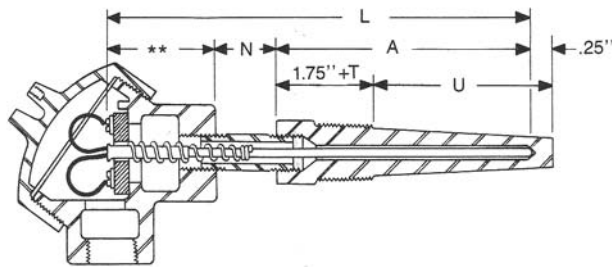


TK model 381 shown.

**6: OPTION CODE**

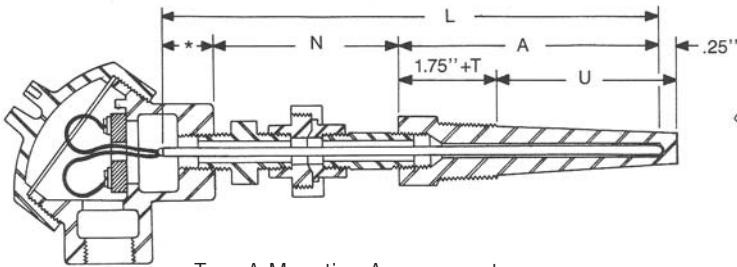
DESCRIPTION	CODE
None	O
Paper Tag	P
Stainless Tag	S
Assembled to Thermowell (Order separately)	T
Hazardous Location (Class 1, Div 1, Group CD)	C
Hazardous Location (Class 1, Div 1, Group BCD)	B
CCA Approval (for Custodial Transfer)	X
1/2" Conduit Bushing	R

**N or N-U-N Extension**

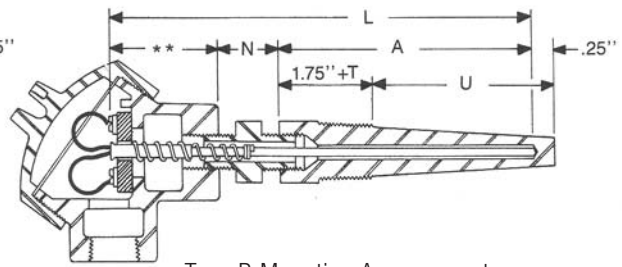


Type B Mounting Arrangement

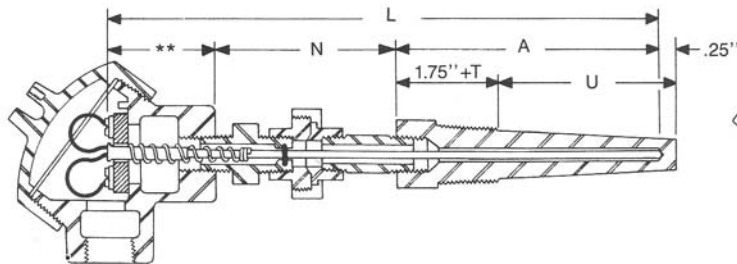
**B or B-U-N Extension**



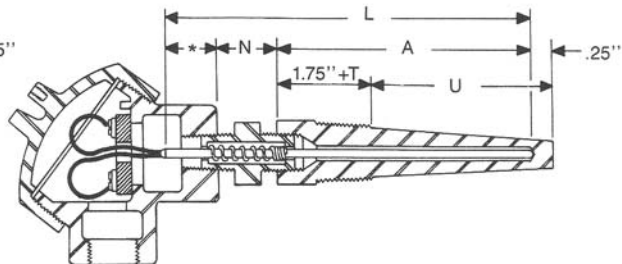
Type A Mounting Arrangement



Type B Mounting Arrangement



Type C Mounting Arrangement



Type D&E Mounting Arrangement

\*\*2.0" for HD Head  
1.75" for GP Head

Thread Engagement  
.35" for 1/2" NPT

\*1.0" for HD Head  
0.5" for GP Head

**"N" DIMENSION**

The "N" dimension is the overall hardware length between the head and the thermowell.

**"A" DIMENSION**

The "A" dimension is the probe immersion length into the cavity of the thermowell.

**"U" DIMENSION**

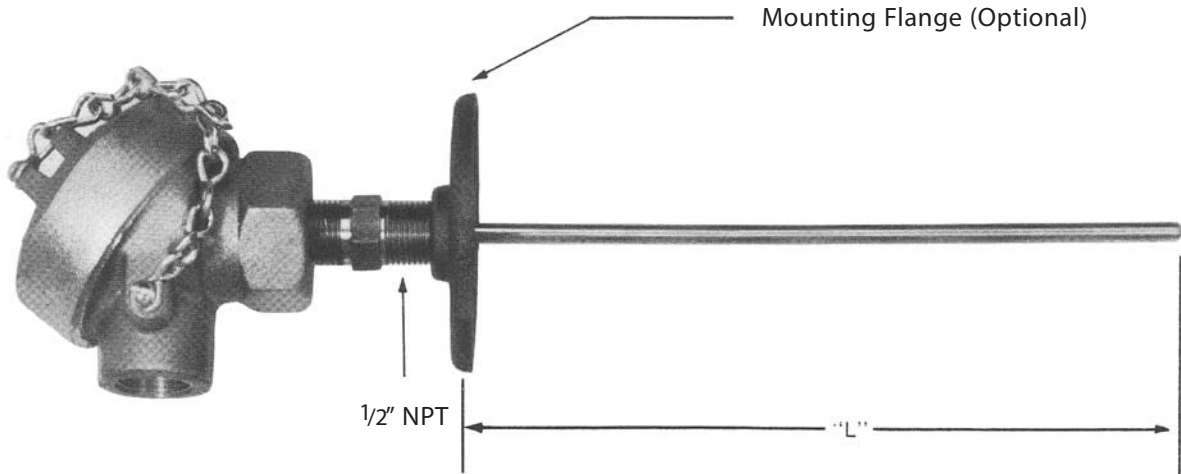
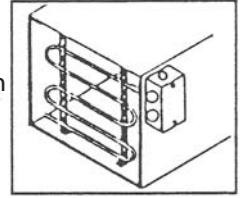
The "U" dimension is the thermowell insertion length below the thread which is exposed to the process.

**"L" LENGTH**

The "L" length is the overall length of the probe. For spring loaded assemblies, an extra .25" is added to ensure contact with the bottom of the thermowell.

**CONTINUOUS AVERAGING RTD**

Application  
Illustration



The continuous averaging RTD probe measures the temperature over its entire length to provide a true average temperature measurement of the cross sectional area of large air ducts or other low temperature air averaging applications. The sensing element is contained within a bendable 3/16" O.D tube and its resistance output conforms to a 100 ohm platinum element with a 0.00385 temperature coefficient. Lengths up to 50 feet in copper and 20 feet in stainless steel can be supplied. Units can be provided with integrally mounted 4-20 mA transmitters. Maximum temperature rating is 100°C

**ORDERING INFORMATION**

Specify: R81 - D100C3 - XXX - 70 - O - F - (0-100°C)

MODEL CODE:

- R81 – Copper tubing, .188" OD
- R82 – Stainless tubing, .250" OD

LENGTH CODE:

Specify length "L" in inches  
Standard lengths are:

CODE	LENGTH
096	96" (8')
144	144" (12')
192	192" (16')
240	240" (20')
288	288" (24')

Max Length:  
R81: 300"  
R82: 780"

\*\*

OPTION CODE:

- O – None
- F – Mounting Flange
- B – Brass compression fitting

TRANSMITTER\*\*

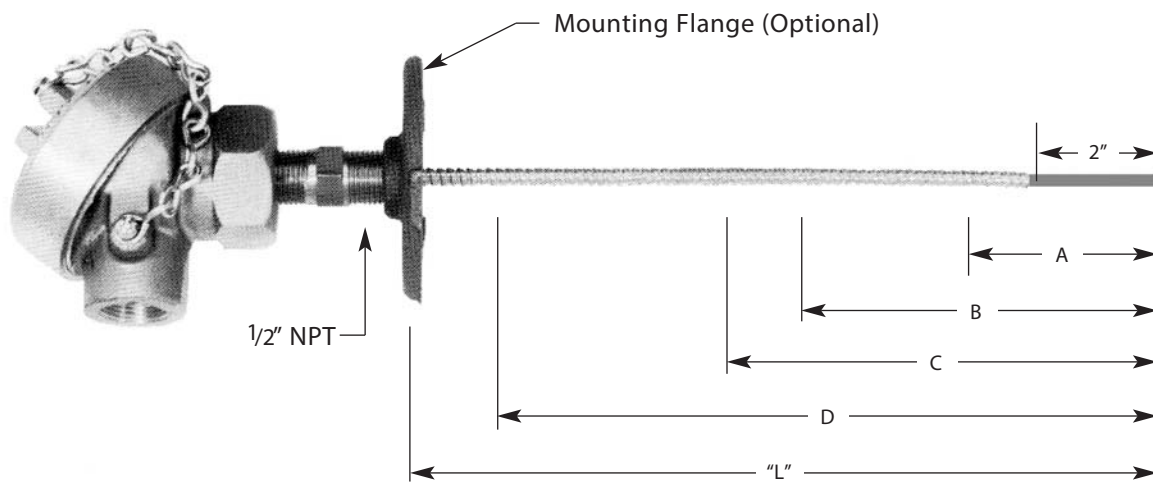
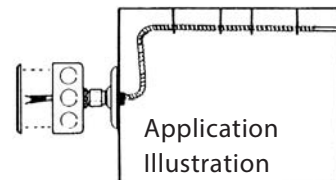
- 0 – None
- 2 – IPAQ - H
- 3 – STT 173
- 4 – TK381 Transmitter

TERMINATION CODE:

- 15 – 1/2" x 1/2" NPT Adapter
- 70 – 1/2" x 1/2" NPT Adapter, GP Aluminum Head
- C1 – 1/2" x 1/2" NPT Adapter, GP Stainless Head
- A1 – 1/2" x 1/2" NPT Adapter, HD Aluminum Head
- B1 – 1/2" x 1/2" NPT Adapter, HD Stainless Head

\*\* Specify range (min span: 30°C, 50°F)  
Element tolerance: 0.5%

**FLEXIBLE 5 & 10-PT AVERAGING RTD**



The point averaging probe is used to measure the average cross-sectional temperature of large air ducts or low temperature ovens and drying kilns. The unit measures at 10 points specified along its length and averages these temperatures for a single output. The sensing elements are inside a 0.27" O.D flexible stainless steel armoured cable. An optional PVC covered cable is available for moisture protection. Resistance output conforms to a 100 ohm platinum element with a 0.00385 temperature coefficient. Units can be provided with integrally mounted 4-20 mA transmitters. Maximum temperature is 200°C (100°C with PVC Jacket)

**ORDERING INFORMATION**

Specify: R84 - D100C3 - XXX - 50 - O - F - A/B/C/D - (0-100°C)

MODEL CODE:

- R84 – 5 pt. averaging, SS Armour, .25OD
- R85 – 10 pt averaging, SS Armour .25OD

LENGTH CODE:

Specify length "L" in inches  
Standard lengths are:

CODE	LENGTH
060	60" (5')
072	72" (6')
096	96" (8')
120	120" (10')
144	144" (12')

Max Length:  
R84: 300"  
R85: 300"

\*\*  
Specify distance from hot end in inches.

OPTION CODE:

- O – None
- F – Mounting Flange
- P – PVC Covered (100°C max)

TRANSMITTER\*\*

- 0 – None
- 2 – IPAQ - H
- 3 – STT 173
- 4 – TK381 Transmitter

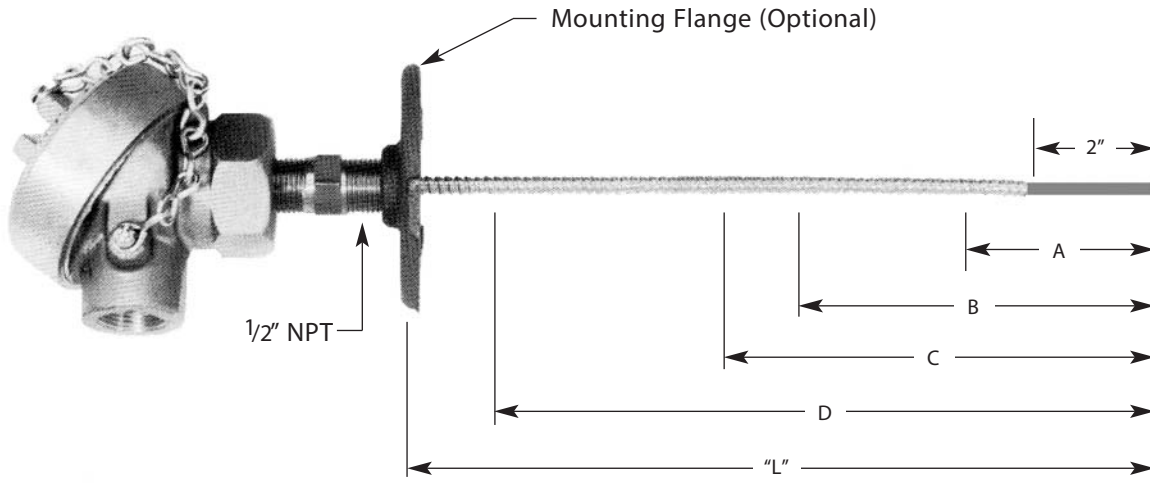
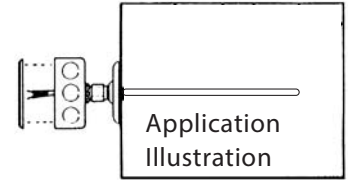
TERMINATION CODE:

- 15 – 1/2" x 1/2" NPT Adapter
- 70 – 1/2" x 1/2" NPT Adapter, GP Aluminum Head
- C1 – 1/2" x 1/2" NPT Adapter, GP Stainless Head
- A1 – 1/2" x 1/2" NPT Adapter, HD Aluminum Head
- B1 – 1/2" x 1/2" NPT Adapter, HD Stainless Head

\*\* Specify range (min span: 30°C, 50°F)  
Element tolerance: 0.5%



**RIGID 5 & 10-PT AVERAGING RTD**



The point averaging probe is used to measure the average cross-sectional temperature of large air ducts or low temperature ovens and drying kilns. The unit measures at 5 or 10 points specified along its length and averages these temperatures for a single output. The sensing elements are inside a 0.25" O.D. stainless steel tube. Resistance output conforms to a 100 ohm platinum element with a 0.00385 temperature coefficient. Units can be provided with integrally mounted 4-20 mA transmitters. Maximum temperature is 200°C

**ORDERING INFORMATION**

Specify: R87 - D100C3 - XXX - 50 - O - F - A/B/C/D - (0-100°C)

MODEL CODE:

- R87 – 5 pt. averaging, SS tubing, .250" OD
- R88 – 10 pt. averaging, SS tubing .250" OD

LENGTH CODE:

Specify length "L" in inches  
Standard lengths are:

CODE	LENGTH
060	60" (5')
072	72" (6')
096	96" (8')
120	120" (10')

Max Length:  
R87: 120"  
R88: 120"

\*\* Specify distance from hot end in inches.

OPTION CODE:

- O – None
- F – Mounting Flange
- B – Brass compression fitting

TRANSMITTER\*\*

- 0 – None
- 2 – IPAQ - H
- 3 – STT 173
- 4 – TK381 Transmitter

TERMINATION CODE:

- 15 – 1/2" x 1/2" NPT Adapter
- 70 – 1/2" x 1/2" NPT Adapter, GP Aluminum Head
- C1 – 1/2" x 1/2" NPT Adapter, GP Stainless Head
- A1 – 1/2" x 1/2" NPT Adapter, HD Aluminum Head
- B1 – 1/2" x 1/2" NPT Adapter, HD Stainless Head

\*\* Specify range (min span: 30°C, 50°F)  
Element tolerance: 0.5%

**RESISTANCE VS TEMPERATURE TABLE – DIN/IEC 60751,  $R_0 = 100\Omega$   $TCR = .00385\Omega/\Omega/^\circ C$**

Temp (°C)	0	1	2	3	4	5	6	7	8	9
0	100.000	100.391	100.781	101.172	101.562	101.953	102.343	102.733	103.123	103.513
10	103.903	104.292	104.682	105.071	105.460	105.849	106.238	106.627	107.016	107.405
20	107.794	108.182	108.570	108.959	109.347	109.735	110.123	110.510	110.898	111.286
30	111.673	112.060	112.447	112.835	113.221	113.608	113.995	114.382	114.768	115.155
40	115.541	115.927	116.313	116.699	117.085	117.470	117.856	118.241	118.627	119.012
50	119.397	119.782	120.167	120.552	120.936	121.321	121.705	122.090	122.474	122.858
60	123.242	123.626	124.009	124.393	124.777	125.160	125.543	125.926	126.309	126.692
70	127.075	127.458	127.840	128.223	128.605	128.987	129.370	129.752	130.133	130.515
80	130.897	131.278	131.660	132.041	132.422	132.803	133.184	133.565	133.946	134.326
90	134.707	135.087	135.468	135.848	136.228	136.608	136.987	137.367	137.747	138.126
100	138.505	138.885	139.264	139.643	140.022	140.400	140.779	141.158	141.536	141.914
110	142.293	142.671	143.049	143.426	143.804	144.182	144.559	144.937	145.314	145.691
120	146.068	146.445	146.822	147.198	147.575	147.951	148.328	148.704	149.080	149.456
130	149.832	150.208	150.583	150.959	151.334	151.710	152.085	152.460	152.835	153.210
140	153.584	153.959	154.333	154.708	155.082	155.456	155.830	156.204	156.578	156.952
150	157.325	157.699	158.072	158.445	158.818	159.191	159.564	159.937	160.309	160.682
160	161.054	161.427	161.799	162.171	162.543	162.915	163.286	163.658	164.030	164.401
170	164.772	165.143	165.514	165.885	166.256	166.627	166.997	167.368	167.738	168.108
180	168.478	168.848	169.218	169.588	169.958	170.327	170.696	171.066	171.435	171.804
190	172.173	172.542	172.910	173.279	173.648	174.016	174.384	174.752	175.120	175.488
200	175.856	176.224	176.591	176.959	177.326	177.693	178.060	178.427	178.794	179.161
210	179.528	179.894	180.260	180.627	180.993	181.359	181.725	182.091	182.456	182.822
220	183.188	183.553	183.918	184.283	184.648	185.013	185.378	185.743	186.107	186.472
230	186.836	187.200	187.564	187.928	188.292	188.656	189.019	189.383	189.746	190.110
240	190.473	190.836	191.199	191.562	191.924	192.287	192.649	193.012	193.374	193.736
250	194.098	194.460	194.822	195.183	195.545	195.906	196.268	196.629	196.990	197.351
260	197.712	198.073	198.433	198.794	199.154	199.514	199.875	200.235	200.595	200.954
270	201.314	201.674	202.033	202.393	202.752	203.111	203.470	203.829	204.188	204.546
280	204.905	205.263	205.622	205.980	206.338	206.696	207.054	207.411	207.769	208.127
290	208.484	208.841	209.198	209.555	209.912	210.269	210.626	210.982	211.339	211.695
300	212.052	212.408	212.764	213.120	213.475	213.831	214.187	214.542	214.897	215.252
310	215.608	215.962	216.317	216.672	217.027	217.381	217.736	218.090	218.444	218.798
320	219.152	219.506	219.860	220.213	220.567	220.920	221.273	221.626	221.979	222.332
330	222.685	223.038	223.390	223.743	224.095	224.447	224.799	225.151	225.503	225.855
340	226.206	226.558	226.909	227.260	227.612	227.963	228.314	228.664	229.015	229.366
350	229.716	230.066	230.417	230.767	231.117	231.467	231.816	232.166	232.516	232.865
360	233.214	233.564	233.913	234.262	234.610	234.959	235.308	235.656	236.005	236.353
370	236.701	237.049	237.397	237.745	238.093	238.440	238.788	239.135	239.482	239.829
380	240.176	240.523	240.870	241.217	241.563	241.910	242.256	242.602	242.948	243.294
390	243.640	243.986	244.331	244.677	245.022	245.367	245.713	246.058	246.403	246.747
400	247.092	247.437	247.781	248.125	248.470	248.814	249.158	249.502	249.845	250.189
410	250.533	250.876	251.219	251.562	251.906	252.248	252.591	252.934	253.277	253.619
420	253.962	254.304	254.646	254.988	255.330	255.672	256.013	256.355	256.696	257.038
430	257.379	257.720	258.061	258.402	258.743	259.083	259.424	259.764	260.105	260.445
440	260.785	261.125	261.465	261.804	262.144	262.483	262.823	263.162	263.501	263.840
450	264.179	264.518	264.857	265.195	265.534	265.872	266.210	266.548	266.886	267.224
460	267.562	267.900	268.237	268.574	268.912	269.249	269.586	269.923	270.260	270.597
470	270.933	271.270	271.606	271.942	272.278	272.614	272.950	273.286	273.622	273.957
480	274.293	274.628	274.963	275.298	275.633	275.968	276.303	276.638	276.972	277.307
490	277.641	277.975	278.309	278.643	278.977	279.311	279.644	279.978	280.311	280.644
500	280.978	281.311	281.643	281.976	282.309	282.641	282.974	283.306	283.638	283.971
510	284.303	284.634	284.966	285.298	285.629	285.961	286.292	286.623	286.954	287.285
520	287.616	287.947	288.277	288.608	288.938	289.268	289.599	289.929	290.258	290.588
530	290.918	291.247	291.577	291.906	292.235	292.565	292.894	293.222	293.551	293.880
540	294.208	294.537	294.865	295.193	295.521	295.849	296.177	296.505	296.832	297.160
550	297.487	297.814	298.142	298.469	298.795	299.122	299.449	299.775	300.102	300.428
560	300.754	301.080	301.406	301.732	302.058	302.384	302.709	303.035	303.360	303.685
570	304.010	304.335	304.660	304.985	305.309	305.634	305.958	306.282	306.606	306.930
580	307.254	307.578	307.902	308.225	308.549	308.872	309.195	309.518	309.841	310.164
590	310.487	310.810	311.132	311.454	311.777	312.099	312.421	312.743	313.065	313.386
600	313.708	314.029	314.351	314.672	314.993	315.314	315.635	315.956	316.277	316.597
610	316.918	317.238	317.558	317.878	318.198	318.518	318.838	319.157	319.477	319.796
620	320.115	320.435	320.754	321.073	321.391	321.710	322.029	322.347	322.666	322.984
630	323.302	323.620	323.938	324.256	324.573	324.891	325.208	325.526	325.843	326.160
640	326.477	326.794	327.110	327.427	327.744	328.060	328.376	328.692	329.008	329.324
650	329.640									

**RESISTANCE VS TEMPERATURE TABLE – DIN/IEC 60751, R<sub>0</sub> = 100Ω TCR = .00385Ω/Ω/°C**

Temp (°C)	0	-1	-2	-3	-4	-5	-6	-7	-8	-9
-200	18.5201									
-190	22.8255	22.3965	21.9672	21.5376	21.1076	20.6772	20.2465	19.8154	19.3840	18.9522
-180	27.0964	26.6708	26.2449	25.8186	25.3920	24.9651	24.5379	24.1103	23.6824	23.2541
-170	31.3350	30.9126	30.4898	30.0667	29.6434	29.2197	28.7956	28.3713	27.9467	27.5217
-160	35.5433	35.1238	34.7040	34.2839	33.8635	33.4429	33.0219	32.6006	32.1791	31.7572
-150	39.7232	39.3064	38.8894	38.4721	38.0545	37.6367	37.2186	36.8002	36.3815	35.9626
-140	43.8764	43.4622	43.0478	42.6331	42.2182	41.8030	41.3876	40.9719	40.5559	40.1397
-130	48.0048	47.5930	47.1810	46.7688	46.3563	45.9436	45.5307	45.1175	44.7040	44.2904
-120	52.1098	51.7003	51.2906	50.8806	50.4705	50.0601	49.6495	49.2386	48.8276	48.4163
-110	56.1930	55.7856	55.3780	54.9702	54.5622	54.1540	53.7456	53.3370	52.9281	52.5191
-100	60.2558	59.8504	59.4448	59.0391	58.6331	58.2269	57.8205	57.4139	57.0072	56.6002
-90	64.2996	63.8960	63.4923	63.0884	62.6843	62.2800	61.8756	61.4709	61.0661	60.6611
-80	68.3254	67.9236	67.5217	67.1195	66.7172	66.3147	65.9120	65.5092	65.1062	64.7030
-70	72.3345	71.9344	71.5340	71.1335	70.7328	70.3320	69.9310	69.5299	69.1286	68.7271
-60	76.3278	75.9292	75.5304	75.1315	74.7324	74.3331	73.9337	73.5341	73.1344	72.7346
-50	80.3063	79.9091	79.5117	79.1143	78.7166	78.3189	77.9210	77.5229	77.1247	76.7263
-40	84.2707	83.8748	83.4789	83.0828	82.6865	82.2902	81.8937	81.4970	81.1003	80.7033
-30	88.2217	87.8271	87.4325	87.0377	86.6428	86.2478	85.8526	85.4573	85.0619	84.6663
-20	92.1599	91.7666	91.3732	90.9797	90.5861	90.1923	89.7985	89.4044	89.0103	88.6160
-10	96.0859	95.6938	95.3016	94.9093	94.5169	94.1244	93.7317	93.3390	92.9461	92.5530
0	100.0000	99.6091	99.2181	98.8270	98.4358	98.0444	97.6529	97.2613	96.8696	96.4778

**RESISTANCE – TEMPERATURE EQUATIONS**

For industrial measurements, the relationship between resistance and temperature can be approximated by the Callendar–Van Dusen equation:

$$R_t = R_0 \cdot [1 + At + Bt^2 + C(t-100)t^3]$$

$$A = \alpha(1+\delta/100)$$

$$B = -\alpha \times \delta \times 10^{-4}$$

$$C = -\alpha \times \beta \times 10^{-8}$$

(= 0 if t > 0)

Calibration Coefficients	
(100 Ω Pt, DIN/IEC 60751)	
A	3.9083 x 10 <sup>-3</sup>
B	-5.775 x 10 <sup>-7</sup>
C	-4.183 X 10 <sup>-12</sup>
α	0.003850
δ	1.49990
β	0.10863

R<sub>0</sub> = resistance at t = 0°C

R<sub>100</sub> = resistance at t = 100°C

R<sub>h</sub> = resistance at t = t<sub>h</sub> (a high temperature – eg: freezing point of tin or zinc)

R<sub>l</sub> = resistance at t = t<sub>l</sub> (a low temperature – eg: boiling point of oxygen)

(alpha) α = (R<sub>100</sub>-R<sub>0</sub>) ÷ 100xR<sub>0</sub> (Temperature coefficient of resistance)

(delta) δ = [t<sub>h</sub>-(R<sub>h</sub>-R<sub>0</sub>)÷(R<sub>0</sub>xα)] ÷ [(t<sub>h</sub>÷100-1)x(t<sub>h</sub>÷100)] (Callendar constant)

(beta) β = [t<sub>l</sub>-{(R<sub>l</sub>-R<sub>0</sub>)÷αxR<sub>0</sub>+δx(t<sub>l</sub>÷100-1)x(t<sub>l</sub>÷100)}] ÷ [(t<sub>l</sub>÷100-1)x(t<sub>l</sub>÷100)<sup>3</sup>] (Van Dusen constant)  
= 0 (if t > 0)

CONNECTION DIAGRAMS

