

# Temperature Sensors

Product Information and  
Application Notes





# Contents

- 10J Series..... 4
- 11J Series..... 5
- 12J Series..... 6
- 13J Series..... 7
- 20J Series..... 8
- 22J Series..... 11
- 36J Series..... 12
- 40J Series..... 14
- 73J Series..... 15
- 74J and 75J Series ..... 16
- 76J Series..... 17
- 80J Series..... 19
- 93J Series..... 20
- 95J Series..... 21
- Technical Data ..... 22
- Product Nomenclature ..... 23

Together with our customers, Therm-O-Disc continuously works on new designs to meet the high demands of today’s and future applications. We offer a wide range of NTC sensor packages, known for their long term stability and accurate measurements.

NTC thermistors are a semiconductor ceramic made with various metal oxides. Their electrical resistance decreases with increasing temperature. This resistance is processed by an electronic circuit to provide temperature measurement. While a bimetallic thermostat provides both temperature sensing and electrical circuit control, an NTC thermistor itself does not provide any control over heating elements, relays, etc. A thermistor is strictly a sensor and an electrical control would need to be implemented by the circuit utilizing the sensor.

Therm-O-Disc NTC Sensors offer economical, reliable and accurate solutions to those applications requiring more extensive sensing than the one or two temperature points typically offered by a bimetallic thermostat. NTC sensors provide a change in resistance with temperature that when combined with an electronic circuit provide a means of continuity measuring temperature over a wide range.



# 10J Series



The 10J series is a lead-wired temperature measurement sensor with a cost effective plastic shell. Custom designs can be developed if needed to meet complex application requirements. Complete or partial plastic designs can be developed with customized mounting features to fit various applications. Alternate materials and UL recognized models available upon request.

## Specifications

- Typical thermal time constant 10 sec. (measured: 25°C air to 85°C stirred water, 63.2%  $\Delta T$ )
- Typical operating temperature range -40°C to 80°C or -20° to 105°C (dependant on wire rating)
- Insulation strength 500VAC/0.5mA/2sec. (inquire for others)
- Stable performance with high degree of accuracy

## Applications

- Heat Pumps
- HVAC
- Furnace





# 11J Series



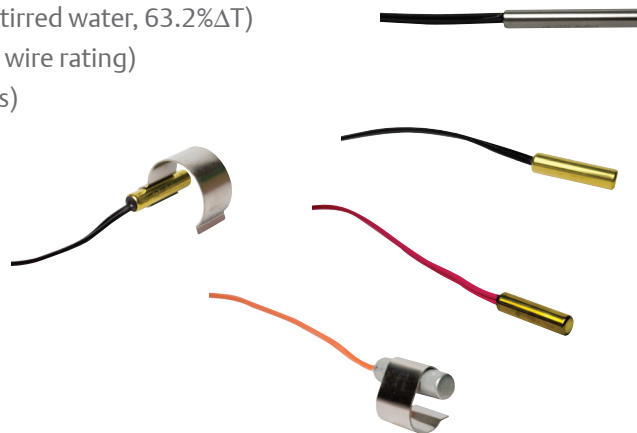
The 11J series is a lead-wired temperature measurement sensor with a brass/metal shell for use in HVAC systems. Custom designs can be developed if needed to meet complex application requirements. Brass or Stainless Steel designs can be developed with customized mounting features or one of several snap-on clips to fit various applications. UL recognized models available upon request.

## Specifications

- Thermal time constant 10 sec. (measured: 25°C air to 85°C stirred water, 63.2%ΔT)
- Operating temperature range -40°C to 150°C (dependant on wire rating)
- Insulation strength 1500VAC/0.5mA/2sec. (inquire for others)
- Moisture resistance

## Applications

- Floor Heating
- Heat Pumps
- Boilers
- HVAC
- Solar Water Heaters
- Ambient Air Temperature Sensing



Therm-O-Disc

# 12J Series



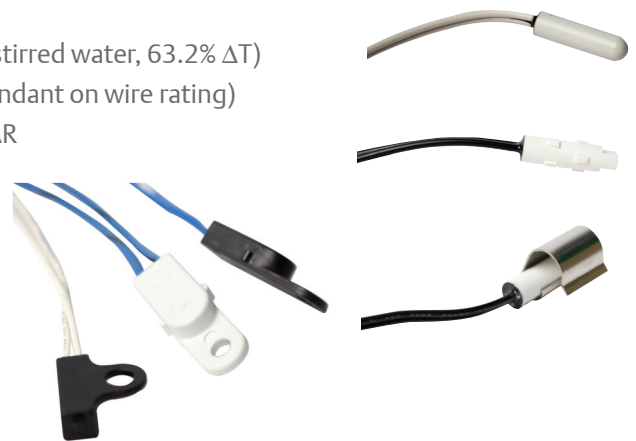
The 12J series is a lead-wired temperature measurement sensor with epoxy-filled plastic shell. Designed for use in refrigeration and other high humidity environments, it can also be used successfully in general purpose applications. UL recognized models available upon request.

## Specifications

- Typical thermal time constant 11 sec. (measured: 25°C air to 85°C stirred water, 63.2%  $\Delta T$ )
- Operating temperature range -40°C to 80°C or -40°C to 105°C (dependant on wire rating)
- Temperature exposure 1000 hours at -20°C & at 80°C, typical < 1%  $\Delta R$
- Insulation strength 3750VAC/0.5mA/2sec.
- Stable performance with high degree of accuracy
- Moisture resistance

## Applications

- Refrigeration systems
- Freezer compartments
- Floor Heating
- Heat pumps
- Boilers
- Ambient temperature sensing





## 13J Series



The 13J series is a lead-wired temperature measurement sensor for applications where small size and fast response time is required. Its design is focused on the heater requirements and widely used in dry and high temperature environments. UL recognized models available upon request.

### Specifications

- Thermal time constant 0.9 to 5sec (dependant on configuration) (measured: 25°C air to 85°C stirred water, 63.2%  $\Delta T$ )
- Operating temperature range -40°C to 175°C (dependant on shrink tube and wire rating)
- Insulation strength 600VAC/0.5mA/2sec (dependant on shrink tube rating)
- Stable performance and high degree of accuracy

### Applications

- Heater
- Humidifier
- Gas Boiler
- HVAC Systems
- Clothes Washer
- Ambient temperature sensing in dry environment





# 20J Series



20J sensors are used to measure air or fluid temperature in automotive applications such as HVAC or Charge-Air temperature sensing. Therm-O-Disc is proud to offer different connection and mounting options to fit your needs. Custom designs can also be developed if needed to meet complex application requirements.

## Specifications

- Operating Temperature Range: -40°C - 320°C
- Accuracy: 1°C typical
- Response Time: <13sec
- Specifications vary based on the wires, sensors, and materials used. For specifications for specific materials please contact us for more information.

## Applications

### Internal Combustion Engines




- Ambient Air Temperature
- Intake Air Temperature
- HVAC Temperature
- Engine Coolant Temperature

### Electric Vehicles

- Battery Temperature
- Coolant Temperature
- Charge Port
- Motor/Busbar
- HVAC Temperature



# 20J Series

	Ambient Air Temp Sensors	HVAC Air Temp Sensors	Engine Coolant and Exhaust Temp Sensors	Intake Air Temp Sensors
				
Description	All-plastic designs for measuring ambient air temperature	Measure temperature of air flow in interior air ducts and evaporator fins.	Measure temperature of fluid in engine coolant or exhaust gas applications.	Measures average temperature of air intake to the engine.
Operating temp	-40° to 105°C	-40° to 85°C	-40° to 150°C; 320°C for exhaust gas sensor	-40°C to 125°C
Fast thermal response	✓	✓	✓	✓
Stable performance with high degree of accuracy	✓	✓	✓	✓
Various mounting and interface configurations	✓	✓	✓	✓
Moisture resistant	✓	✓	✓	

# 20J Series

	Coolant Temp Sensors	Battery Temp Sensors	Charge Port Temp Sensors	Motor/Busbar Temp Sensors	HVAC Temp Sensors
					
Description	Measures coolant for temp sensing and battery system.	Measure temperature of battery cells in electric vehicles.	Measures temperatures at the charge port inlet and outlet.	Measures motor coil and busbar temperature.	Measures temperature at various points in the HVAC system.
Operating temp	-40°C-150°C	-40°C-150°C	-40°C-150°C	-40°C-200°C	-40°C-85°C
Fast thermal response	✓	✓	✓	✓	✓
Stable performance with high degree of accuracy	✓	✓	✓	✓	✓
Various mounting and interface configurations	✓	✓	✓	✓	✓
Moisture resistant	✓	✓	✓	✓	



## 22J Series



The 22J sensor is a high temperature sensor designed to monitor exhaust temperature. This helps determine the efficiency and emission levels of applications to make sure they are meeting emission requirements. This sensor is designed with long term durability and stability in mind, while delivering optimized results.

### Specifications

- Temperature Tolerance:
  - ▶  $-40^{\circ}\text{C} < \pm 10^{\circ}\text{C} < 0^{\circ}\text{C}$
  - ▶  $0^{\circ}\text{C} < \pm 5^{\circ}\text{C} < 650^{\circ}\text{C}$
  - ▶  $650^{\circ}\text{C} < \pm 10^{\circ}\text{C} < 1000^{\circ}\text{C}$
- Response Time: <13sec
- N Type Thermocouple: 3.2mm (Other diameter and thermocouple types available)
- Electronic Module Working Temperature:  $-40^{\circ}\text{C}$  to  $140^{\circ}\text{C}$
- Digital output: CAN 2.0B Bus, SENT protocol



### Applications

- Emissions Control
- Exhaust Gas Recirculation
- Diesel Oxidation Catalyst

## 36J Series



The 36J series is a temperature measurement sensor based on the ½” thermostat design. It’s available with bead thermistor inside and comes in several well known designs as well as a fast response version. Designs can be developed with various mounting features including clips to fit various applications. UL recognized models and product customization available upon request.

### Specifications

- Thermal time constant: 3-4 sec. (measured: 25°C air to 85°C application medium brass tube or hot plate, 63.2%  $\Delta T$ )
- Operating temperature range -20°C to 130°C
- Insulation strength 500VAC/0.5mA/1sec. (inquire for others)
- Moisture resistance

### Applications

- Boiler Heating Systems
- Instant Hot Water Heater– Washer
- Dishwashers





## 36J Series



### Specifications

- Thermal time constant: 2-3 sec. (measured: 25°C air to 85°C, application medium [brass pipe, flatness, screw thread, or stirred water], 63.2%  $\Delta T$ )
- Operating temperature range -40°C to 200°C (dependent on plastic material rating)
- Insulation strength 500VAC/0.5mA/2sec. (inquire for others)
- Moisture resistance

### Applications

- Boiler Heating Systems
- Storage Water Heaters
- General fast response applications
- Small Appliances



### Specifications

- Thermal time constant: 11 sec. (measured: 25°C air to 85°C application medium brass tube or hot plate, 63.2%  $\Delta T$ )
- Operating temperature range -40°C to 200°C
- Insulation strength 1500VAC/0.5mA/2sec. (inquire for others)
- Moisture resistance

### Applications

- Boiler Heating Systems
- AC Units
- Dishwashers
- Laundry
  - Clothes Dryer
  - Washer



# 40J Series



40J is our Thermocouple product line. Thermocouple sensors are used to measure temperature. Thermocouple legs are made up of two different metals welded together at one end to create a junction wherein in this junction, the temperature is measured – otherwise known as the Seebeck effect. Thermocouples have a wide measurement range. There are several types of thermocouples (Types J, K, N, etc) with each having their own different temperature range.

## Specifications

Can offer temp range as high as 1000°C

- Thermal time constant of 8 seconds
- Type K, N and others available
- Contact a Therm-O-Disc representative for mounting specifications as we can customize them according to customer application.

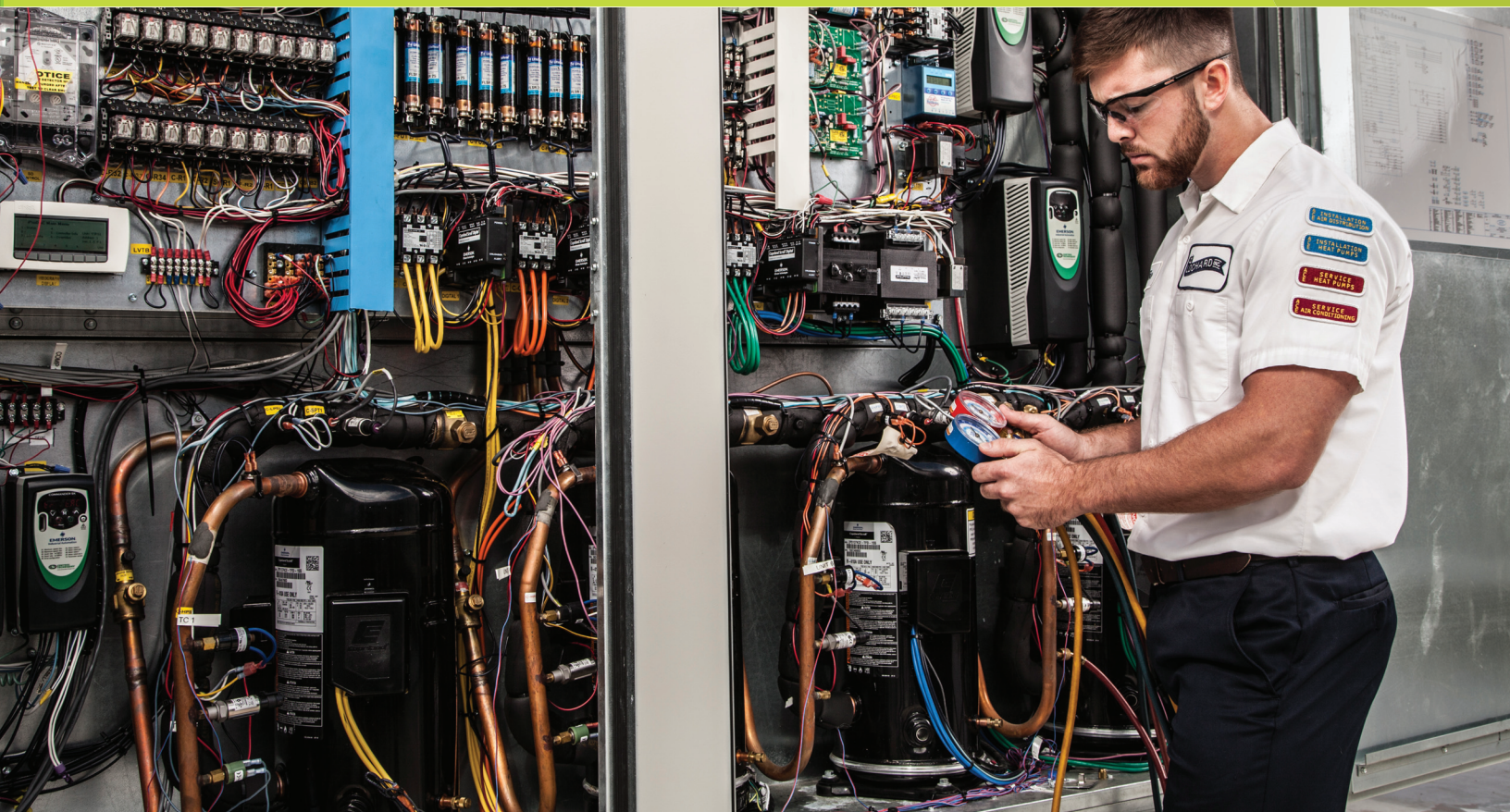
## Applications

- Furnaces
- Ovens
- Hot plates
- Stoves
- Power generation
- Other high temp applications that requires temperature measurement





# 73J Series



The 73J sensor is used to monitor temperatures in industrial HVAC compressors. The sensor helps to monitor running efficiency, temperature monitor, and prevents compressors from overheating.

## Specifications

- Specifications vary based on the wires, sensors, and materials used. For specifications for specific materials please contact us for more information.

## Applications

- Refrigeration compressors
- Miscellaneous





## 74J and 75J Series



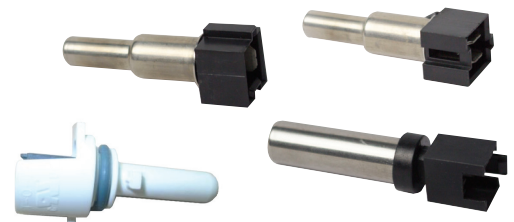
The 74J and 75J series temperature sensors are developed for major appliances like clothes washers and dishwashers. The 74J is available in an all-plastic design as well as stainless steel versions. Metal or plastic designs can be developed with customized features and connector options to fit various applications. The 75J is an all-plastic design. UL recognized models available upon request.

### Specifications

- Typical thermal time constant 10-22 sec. dependant on material (measured: 25°C air to 85°C stirred water, 63.2%  $\Delta T$ )
- Typical operating temperature range -40°C to 130°C
- Insulation strength 3750VAC/0.5mA/1sec. (inquire for alternative values)
- Stable performance with high degree of accuracy

### Applications

- Laundry
  - Washer
- Dishwasher
- Water Heaters





## 76J Series



These series are developed for air-stream temperature measurement with a plastic or metal shell, customized as needed to interface with application requirements. UL recognized models available upon request.

### Applications

- Laundry
  - Clothes Dryer
  - Washer
- HVAC Air Duct Sensing



# 76J Series

Complete or partial plastic designs typically developed with flange-style mounting features to fit various applications.

## Specifications

- Typical thermal time constant (dependant on wire rating): (measured: 25°C air to 85°C stirred water, 63.2%  $\Delta T$ )  
**Metal** – 1 sec.      **Plastic** – dependent on plastic thickness
- Typical operating temperature range -40°C to 125°C
- Insulation strength 1500VAC/0.5mA/2sec. (inquire for others)
- Stable performance with high degree of accuracy
- Moisture resistant



Plastic and metal designs with flange-style mounting feature. Some plastic designs are Class II insulation compliant.

## Specifications

- Thermal time constant (measured: 25°C air to 85°C stirred water, 63.2%  $\Delta T$ )  
**Metal** – 1 sec.      **Plastic** – dependent on plastic thickness.
- Operating temperature range -40°C to 200°C (dependant on wire rating)
- Insulation strength 3750VAC/0.5mA/2sec. (inquire for others)
- Plastic sealed shell is moisture resistant





# 80J Series



The 80J series is a design solution with plastic cover and box, focused on the measurement of outdoor ambient temperature. Plastic designs can be developed with customized appearance and mounting features. Molded from UV resistant materials.

## Specifications

- Typical operating temperature range -30°C to 60°C
- Temperature exposure 1000 hours at -20°C & at 80°C, typical < 1%  $\Delta R$
- Stable performance with high degree of accuracy

## Applications

- Outdoor temperature sensing





# 93J Series



The 93J is a precise temperature measurement sensor with an ultra fast response time to be used in numerous applications. Both the immersion style and the flat-tipped version are available in various rugged designs. UL recognized models are available upon request.

## Specifications

- Typical thermal time constant 0.5-2 sec. (dependent on tip configuration)  
(measured: 25°C air to 85°C stirred water, 63.2%  $\Delta T$ )
- Typical operating temperature range -40°C to 200°C (dependent on wire rating, epoxy rating and plastic)
- Insulation strength 500VAC/0.5mA/2sec. (inquire for others)
- Stable performance with high degree of accuracy
- Moisture resistant

## Applications

- Boiler Heating Systems
- Bath/Spa (Shower units)
- Laundry
  - Dryer
  - Steamer
- Small Appliances
  - Coffee Makers
  - Single Brewers, Multi-Brewers
  - Kettles
  - Dishwasher
- Refrigeration



# 95J Series



The 95J series is a temperature measurement sensor intended to be immersed in direct contact with liquids like water or flue gases. It has a small tip with a fast response and comes in several designs with different molded connector types and thread options. Metal or plastic designs can be developed with customized mounting features to fit various applications. UL recognized models and product customization available upon request.

## Specifications

- Typical thermal time constant 1-1.8 sec. (dependent on tip configuration)  
(measured: 25°C air to 85°C stirred water, 63.2%  $\Delta T$ )
- Typical operating temperature range -40°C to 140°C (dependant on wire rating)
- Insulation strength 500VAC/0.5mA/2sec. (inquire for others)
- Stable performance with high degree of accuracy
- Moisture resistant

## Applications

- Boiler Heating Systems
- Storage water heaters
- Other fast response in liquid applications



## APPLICATION NOTES

### Technical Data

#### Typical Resistance/Temperature

T (°C)	Grade 1	Grade 5	Grade 9	Grade 15	Grade 18	Grade 19	Grade 25
	B25/85=3977K	B25/85=4107K	B25/85=3435K	B25/85=3740K	B25/85=4269K	B25/85=3468K	B25/85=3680K
	Multiplier						
-40	33.73	37.25	19.58	25.79	43.67	21.65	24.87
-35	24.32	26.63	14.83	19.12	30.73	16.23	18.34
-30	17.74	19.26	11.34	14.31	21.89	12.30	13.69
-25	13.08	14.07	8.76	10.81	15.77	9.41	10.33
-20	9.74	10.38	6.83	8.23	11.48	7.27	7.88
-15	7.321	7.74	5.37	6.33	8.45	5.66	6.07
-10	5.55	5.83	4.25	4.90	6.28	4.45	4.72
-5	4.25	4.42	3.39	3.83	4.71	3.52	3.71
0	3.27	3.38	2.72	3.01	3.56	2.81	2.93
5	2.54	2.61	2.20	2.38	2.72	2.26	2.34
10	1.99	2.03	1.79	1.90	2.09	1.82	1.87
15	1.57	1.59	1.47	1.52	1.62	1.48	1.51
20	1.25	1.26	1.21	1.23	1.27	1.21	1.23
25	1	1	1	1	1	1	1
30	0.81	0.80	0.83	0.82	0.79	0.83	0.82
35	0.65	0.84	0.69	0.67	0.63	0.69	0.68
40	0.53	0.52	0.58	0.55	0.51	0.58	0.56
45	0.44	0.43	0.49	0.46	0.41	0.49	0.47
50	0.36	0.35	0.41	0.38	0.33	0.41	0.39
55	0.30	0.29	0.35	0.32	0.27	0.35	0.33
60	0.25	0.24	0.30	0.27	0.22	0.30	0.28
65	0.21	0.20	0.26	0.23	0.19	0.25	0.23
70	0.18	0.17	0.22	0.19	0.15	0.22	0.20
75	0.15	0.14	0.13	0.17	0.13	0.19	0.17
80	0.13	0.12	0.17	0.14	0.11	0.16	0.14
85	0.11	0.10	0.15	0.12	0.09	0.14	0.12
90	0.09	0.08	0.13	0.11	0.08	0.12	0.11
95	0.08	0.07	0.11	0.09	0.07	0.11	0.09
100	0.07	0.06	0.10	0.08	0.06	0.10	0.08
105	0.06	0.05	0.09	0.07	0.05	0.08	0.07
110	0.05	0.05	0.08	0.06	0.04	0.07	0.06
115	0.04	0.04	0.07	0.05	0.04	0.07	0.05
120	0.04	0.03	0.06	0.05	0.03	0.06	0.05
125	0.03	0.03	0.05	0.04	0.03	0.05	0.04
130	0.03	0.03	0.05	0.04	0.02	0.05	0.04
135	0.03	0.02	0.04	0.03	0.02	0.04	0.03
140	0.02	0.02	0.04	0.03	0.02	0.04	0.03
145	0.02	0.02	0.03	0.03	0.02	0.03	0.02
150	0.02	0.02	0.03	0.02	0.01	0.03	0.02

Other values are available upon request. For higher temp values, contact a Therm-O-Disc Sales Engineer.



## APPLICATION NOTES

### Product Nomenclature Thermistors

#### Model Designation System

XXJ	1B	XXXXX
I	II	III

I – Series designator, where X is any numeral between 0-9

II – Grade and NTC type (Ex: 1B, 1E, 1G, 1H, 1M, 1R, 1S, etc.)

III – Customer specific numbers (4 or 5 digits)

### Product Nomenclature Thermistors – UL Recognized

#### Model Designation System

XXJ	1B	A	M	Z	XXXXX
I	II	III	IV	V	VI

I – Series designator, where X is any change to numeral between 0-9

II – Grade and NTC type (Ex: 1B, 1E, 1G, 1H, 1M, 1R, etc.)

III – Temperature rating – A, B, C etc. – See table below for details

III	Max Op Temp	III	Max Op Temp
A	80	F	130
B	90	G	150
C	105	H	180
D	120	K	200
E	125		

IV – Construction

E - Plastic shell with epoxy fill

M - Metal shell

R - Molded in plastic

X - Not insulated with or without shell

V – Investigation Standard Code

Z - NTC elements tested to UL60730-1

Without Z - NTC elements tested to UL1434

VI – Customer specific numbers (4 or 5 digits)

### Part # - J Probes Not UL Recognized Using RTD Sensors

#### Model Designation System

XXJ	PT	102	XXXXX
I	II	III	VI

I – Product Series Designator

II – Material of RTD: PT = Platinum RTD, NI = Nickel RTD

III – Resistance: 201 = 200 ohms, 501 = 500 ohms, 102 = 1,000 ohms

VI – Customer specific numbers (4 or 5 digits)

### Product Nomenclature RTD Sensors

#### Model Designation System

XXJ	PT	103	XX	X	XXXXX
I	II	III	IV	V	VI

I – Series designator

II – Material of RTD: PT = Platinum RTD, NI = Nickel RTD

III – Resistance: 201 = 200 ohms, 501 = 500 ohms, 102 = 1,000 ohms

IV – Max Temperature Rating Designator – A, B, C etc. - See table below for details (1 or 2 letters)

III	Max Op Temp	III	Max Op Temp
A	80	M	300
B	90	N	350
C	105	P	400
D	120	Q	450
E	125	R	500
F	130	S	520
G	150	T	540
H	180	U	560
K	200	V	580
L	250	W	600

V- Construction Designator:

E- Plastic shell with epoxy fill (shrink tube does not need to be UL recognized if plastic is the insulator)

M- Dead metal shell

R- Molded in plastic

X- Not insulated with or without shell

VI – Customer specific numbers (4 or 5 digits)

### Important Notice

The scope of the technical and application information included in this article is necessarily limited. Operating environments and conditions can materially affect the operating results of Therm-O-Disc™ products. **Users must determine the suitability of any Therm-O-Disc component for their specific application, including the level of reliability required, and are solely responsible for the function of the end-use product. It is important to review the Application Notes which can be found at [www.tod.com](http://www.tod.com).**

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