



## Pt100/500/1000 Elements, Temperature Sensor

Pt100/500/1000 elements to IEC751 Class A/B

For use from  $-200^{\circ}\text{C}$  to  $+650^{\circ}\text{C}$

Thin film construction

Suitable for surface & immersion applications where protected

Vibration resistant

## Specifications

Sensor type:	Pt100/500/1000 (100/500/1000 Ohms @ $0^{\circ}\text{C}$ )
Insulation resistance:	Exceed 100M ohm at 500V DC (@Room Temp.)
Operation Temperature range:	$-200^{\circ}\text{C}$ to $+650^{\circ}\text{C}$
Resistance <b>Tolerance</b> (at $0^{\circ}\text{C}$ ):	Class A / Class B = $0.06\Omega$ / $0.12\Omega$
Temperature coefficient:	TCR ppm/ $^{\circ}\text{C}$ 3850
Insulation resistance :	> 100 M at $20^{\circ}\text{C}$ ; > 2 M at $500^{\circ}\text{C}$
Self-heating:	< $0.4\text{C}/\text{mW}$ at $0^{\circ}\text{C}$ (in Air, 1m/Sec)
Thermal response time (90%):	10 Sec. Max. (in Air, 1m/Sec)
Measuring current 100 :	0.5 to 2.0 mA (self-heating has to be considered)
Response time	water current ( $v = 0.4 \text{ m/s}$ ): $t_{0.5} = 0.06 \text{ s}$ $t_{0.9} = 0.20 \text{ s}$ air stream ( $v = 2 \text{ m/s}$ ): $t_{0.5} = 3.0 \text{ s}$ $t_{0.9} = 13.0 \text{ s}$

## Reliability test

- ◆ High temperature test  
Keep the Pt sensors in  $+650^{\circ}\text{C}$  for 1000 hours.
- ◆ Low temperature test  
Keep the Pt sensors in  $-200^{\circ}\text{C}$  for 1000 hours.
- ◆ Humidity test  
Keep the Pt sensors in  $60^{\circ}\text{C}$  and  $90^{\circ}\text{C}$  to 95% HR for 1000 hours.
- ◆ Thermal shock test  
Keep the Pt sensors in  $0^{\circ}\text{C}$  ice water for at least to 15sec ., then within 10sec.  
Directly put into  $100^{\circ}\text{C}$  hot water for least to 15sec, the above process should be proceeded for least 10 cycles.  
After each item test, valuation of item 1-1 should be within 0.12% and item 1-3  
Should exceed 100M at 500V DC.

## Characteristics

### 1-1 Electrical

#### 1-1-1 Insulation Resistance 1000M ohm or more

The Pt-SMD shall be cramped in the metallic block and tested, as shown below.

Test Voltage: 100V DC for 1 minute at room temperature.

The resistance of a platinum wire with temperature to measure the change in temperature.

The equation for such a change is:

$$R_{\theta} = R_0(1 + \alpha\theta + \beta\theta^2)$$

where  $\theta$  is the temperature change and  $\alpha$  and  $\beta$  are constants,  $\beta$  being much smaller than  $\alpha$ .

We therefore ignore the term  $\beta^2$  and assume that the resistance of the wire varies uniformly with temperature:  $\alpha$  is the temperature coefficient of resistance of the material.

For platinum  $\alpha = 3.8 \times 10^{-4} \text{ } ^\circ\text{C}^{-1}$ .

A simple form of the platinum resistance thermometer is shown in Figure 1. It consists of a platinum wire wound non-inductively on a mica former and held in a glass tube by silica spacers.

The resistance of the wire is measured with a Wheatstone bridge network and to allow for the change in resistance of the leads a set of dummy leads are included in the opposite arm of the bridge (see Figure 2).

This type of thermometer has a large range, from  $-200 \text{ } ^\circ\text{C}$  to  $+1100 \text{ } ^\circ\text{C}$  and this can be extended by the use of different wires. Bronze has a range starting at  $-260 \text{ } ^\circ\text{C}$  and using carbon temperatures as low as  $-270 \text{ } ^\circ\text{C}$  can be measured.

The advantages of the resistance thermometer are its convenient size, wide range and high sensitivity ( $0.00005 \text{ } ^\circ\text{C}$ ). It can only be used for steady readings, however, and is not direct-reading.

## Relationship of temperature with Resistance

When  $t \geq 0^\circ\text{C}$

$$R_t = R_0(1 + At + Bt^2)$$

$$A = 3.9083 \times 10^{-3}$$

$$B = -5.7750 \times 10^{-7}$$

When  $t < 0^\circ\text{C}$

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

$$B = 3.9083 \times 10^{-3}$$

$$B = -5.7750 \times 10^{-7}$$

$$C = -4.1830 \times 10^{-12} \quad R_0 = 1.000 \times 10^2$$

## Ordering Information

Order Map	UHX	100	□	-	□□□□	-	□□□□
	Series Code	Resistance	Res. Class		Leads Gauge AWG Number		Wire Lengths Exp : 400: 400 mm