FEATURES
- Interchangeable without sensor-to-sensor recalibration
- Very small thermal mass for fast response
- Air or liquid temperature sensing
- Linear temperature sensitivity
- Proven thin film processing reliability
- Low cost
- Long term stability
- 2000 ohms nominal resistance at 20°C

TYPICAL APPLICATIONS
- HVAC – room, duct and refrigerant temperature
- Motors – overload protection
- Electronic circuits – semiconductor protection
- Process control – temperature regulation
- Automotive – air or oil temperature
- Appliances – cooking temperature

GENERAL INFORMATION
TD Series temperature sensors from MICRO SWITCH respond rapidly to temperature changes, and are accurate to ±0.7°C at 20°C—completely interchangeable without recalibration. They are RTD (resistance temperature detector) sensors, and provide 8 Ω/°C sensitivity, with inherently near linear outputs.

The sensing element is a silicon chip, 0.040 × 0.050″ with a thin film resistive network pattern. The chips are individually laser trimmed to provide 2000 ohms nominal resistance at room temperature (20°C), accurate to ±0.7°C. Maximum error over the entire operating range of −40 to +150°C (−40 to +302°F) is ±2.5°C. This extremely accurate trimming provides true sensor-to-sensor interchangeability without recalibration of the user circuit.

TD4A Liquid temperature sensor
TD4A liquid temperature sensor is a two-terminal threaded anodized aluminum housing. The environmentally sealed liquid temperature sensors are designed for simplicity of installation, such as in the side of a truck. TD4A sensors are not designed for total immersion. Typical response time (for one time constant) is 4 minutes in still air and 15 seconds in still water (unmounted position). The temperature rise is 0.12° C/milliwatt suspended by leads in still air, and 0.08° C/milliwatt when mounted on 1 square foot 0.25″ thick aluminum foil.

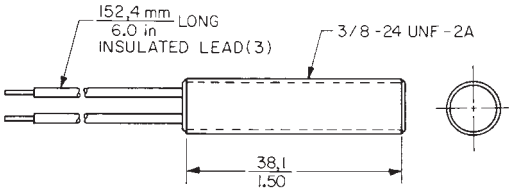
TD5A Miniature temperature sensor
The TD5A is a subminiature temperature sensor with three leads (center not connected). It has response times of 11.0 seconds and a temperature rise of .23°C per milliwatt in still air.

TD ORDER GUIDE

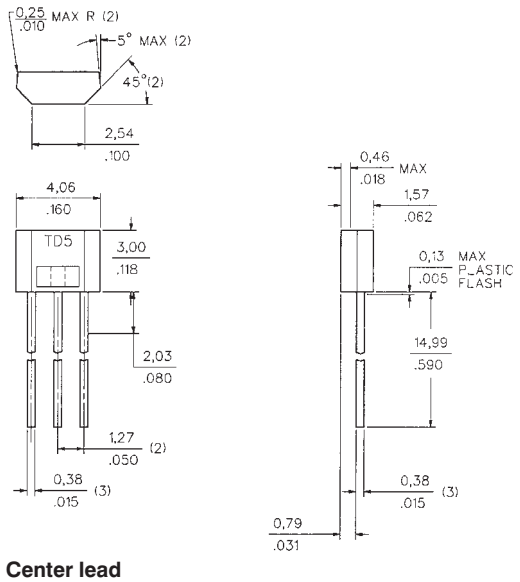
Catalog Listing	Description
TD4A	Liquid temperature sensor, 1.5° threaded (3/8-24 UNF-2A) anodized aluminum housing, two six inch black insulated leads
TD5A	Subminiature package, low cost, fast response time (TO-92)

MOUNTING DIMENSIONS (for reference only)

TD4A



TD5A



Center lead not connected

Temperature

ABSOLUTE MAXIMUM RATINGS

Operating temperature range	−40 to +150°C (−40 to +302°F)
Storage temperature range	−55 to 165°C (−67 to +338°F)
Voltage	10 VDC Continuous (24 hours)

INTERCHANGEABILITY (with 100 μA maximum current)

Temperature	Resistance (Ohms)	Temperature	Resistance (Ohms)
−40°C (−40°F)	1584 ± 12 (1.9°C)	+60°C (140°F)	2314 ± 9 (1.1°C)
−30°C (−22°F)	1649 ± 11 (1.7°C)	+70°C (158°F)	2397 ± 10 (1.2°C)
−20°C (−4°F)	1715 ± 10 (1.5°C)	+80°C (176°F)	2482 ± 12 (1.4°C)
−10°C (14°F)	1784 ± 9 (1.3°C)	+90°C (194°F)	2569 ± 14 (1.6°C)
0°C (32°F)	1854 ± 8 (1.1°C)	+100°C (212°F)	2658 ± 16 (1.8°C)
+10°C (50°F)	1926 ± 6 (0.8°C)	+110°C (230°F)	2748 ± 18 (2.0°C)
+20°C (68°F)	2000 ± 5 (0.7°C)	+120°C (248°F)	2840 ± 19 (2.0°C)
+30°C (86°F)	2076 ± 5 (0.7°C)	+130°C (266°F)	2934 ± 21 (2.2°C)
+40°C (104°F)	2153 ± 6 (0.8°C)	+140°C (284°F)	3030 ± 23 (2.4°C)
+50°C (122°F)	2233 ± 7 (0.9°C)	+150°C (302°F)	3128 ± 25 (2.5°C)

It is recommended that resistance measurements be made at 100 μA or less to minimize internal heating of the sensor. Measurements at currents up to 1mA will not damage the sensor, but the resistance characteristics should be adjusted for internal heating.

Equation for computing resistance:

$R_T = R_O + (3.84 \times 10^{-3} \times R_O \times T) + (4.94 \times 10^{-6} \times R_O \times T^2)$

R_T = Resistance at temperature T

R_O = Resistance at 0°C

T = Temperature in °C

Figure 2
Linear Output Voltage Circuit

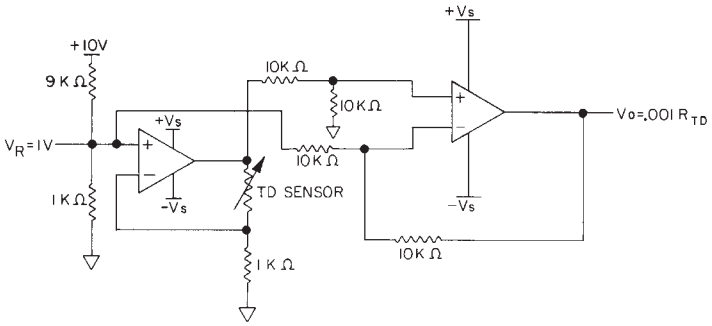
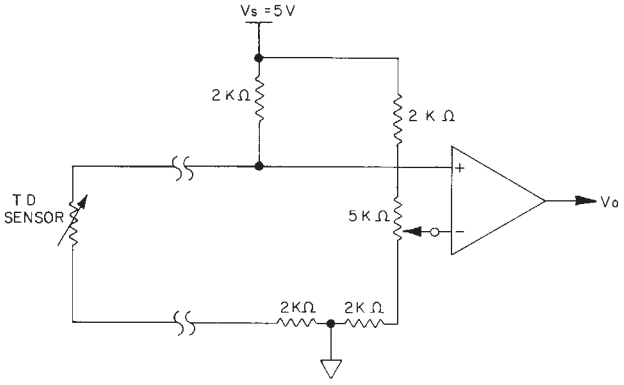


Figure 3
Adjustable Point (Comparator) Interface



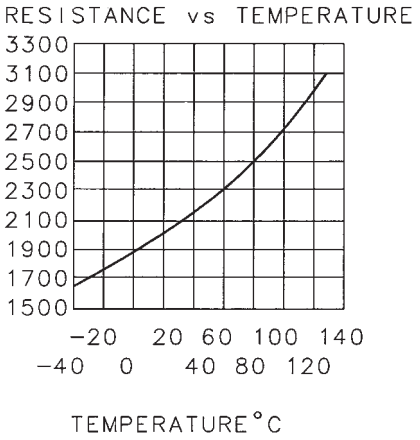
Linearity

±2% (−25 to 85°C)
±3% (−40 to 150°C)
TD sensors can be linearized to within ±0.2%.

Repeatability

±1 Ω

Figure 1
TD Series Resistance vs Temperature



ELECTRICAL INTERFACING

The high nominal resistance, positive temperature coefficient and linear sensitivity characteristics of the TD Series temperature sensors simplifies the task of designing the electrical interface. Figure 2 is a simple circuit that can be used to linearize the voltage output to within 0.2% or a ±0.4°C error over a range of −40° to +150°C (−40° to +302°F).

In some applications, it may be desirable to detect one particular temperature. Figure 3 illustrates one way this can be accomplished. In the comparator circuit shown, the potentiometer can be adjusted to correspond to the desired temperature.

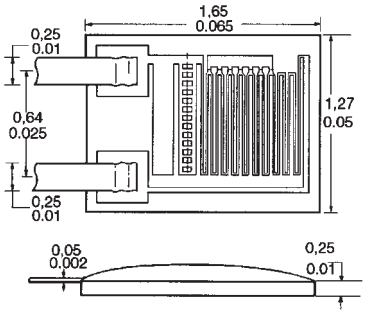
FEATURES
- Linear resistance vs temperature
- Accurate and Interchangeable
- Excellent stability
- Small for fast response
- Wide temperature range
- 3-packaging options

TYPICAL APPLICATIONS
- HVAC - room, duct and refrigerant equipment
- Electronic assemblies - thermal management, temperature compensation
- Process control - temperature regulation

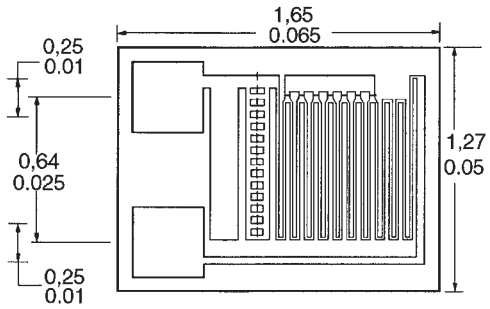
HEL-700 Thin Film Platinum RTDs (Resistance Temperature Detectors) provide excellent linearity, accuracy, stability and interchangeability. Resistance changes linearly with temperature. Laser trimming provides ±0.3°C interchangeability at 25°C.

1000Ω, 375 alpha provides 10X greater sensitivity and signal-to-noise. Both 1000Ω and 100Ω provide interchangeabilities of ±0.6°C or better from -100°C to 100C, and ±3.0°C at 500°C.

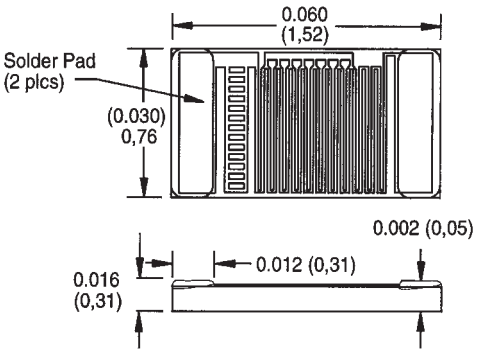
MOUNTING DIMENSIONS (for reference only)
HEL-700 Ribbon Lead



HEL-700 Radial Chip



HEL-700 SMT (Axial) Flip Chip



ORDER GUIDE

HEL-700	Thin Film Platinum RTD		
	-U	1000Ω, 0.00375 Ω/Ω/°C	
	-T	100Ω, 0.00385 Ω/Ω/°C DIN Standard	
		-0	±0.2% Resistance Trim (Standard)
		-1	±0.1% Resistance Trim (Optional)
			-A Radial Ribbon Lead
			-B Radial Chip
			-C SMT Axial Flip Chip (1000Ω **ONLY)**

Fig. 1: Linear Output Voltage

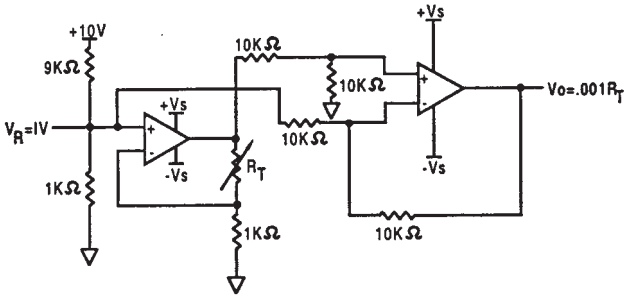
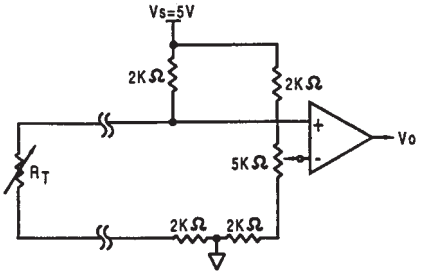


Fig. 2: Adjustable Point (Comparator) Interface



Temperature

Temperature Sensors
Platinum RTDs

FUNCTIONAL BEHAVIOR

$R_T = R_0(1+AT+BT^2-100CT^3+CT^4)$
RT = Resistance (Ω) at temperature T (°C)
R_0 = Resistance (Ω) at 0°C
T = Temperature in °C

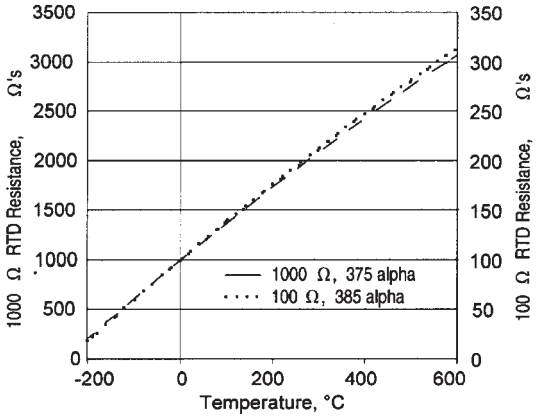
$A = \alpha + \frac{\alpha\,\delta}{100}$ $B = \frac{-\alpha\,\delta}{100^2}$ $C_{T<0} = \frac{-\alpha\,\beta}{100^4}$

CONSTANTS

Alpha, α (°C^{-1})	0.00375 ±0.000029	0.003850 ±0.000010
Delta, δ (°C)	1.605 ± 0.009	1.4999 ± 0.007
Beta, β (°C)	0.16	0.10863
A (°C^{-1})	3.81×10^{-3}	3.908×10^{-3}
B (°C^{-2})	-6.02×10^{-7}	-5.775×10^{-7}
C (°C^{-4})	-6.0×10^{-12}	-4.183×10^{-12}

Both β = 0 and C = 0 for T>0°C

RESISTANCE VS TEMPERATURE CURVE



ACCURACY VS TEMPERATURE

HEL-700 platinum RTDs are available in two base resistance trim tolerances: ±0.2% or ±0.1%. The corresponding resistance interchangeability and temperature accuracy for these tolerances are:

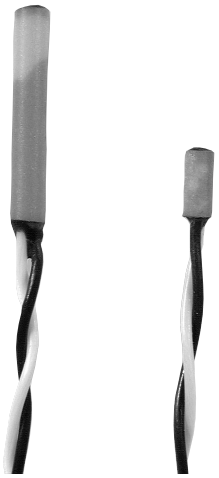
Tolerance	**Standard ±0.2%**		**Optional ±0.1%**	
Temperature (°C)	±ΔR* (Ω)	±ΔT (°C)	±ΔR* (Ω)	±ΔT (°C)
−200	6.8	1.6	5.1	1.2
−100	2.9	0.8	2.4	0.6
0	2.0	0.5	1.0	0.3
100	2.9	0.8	2.2	0.6
200	5.6	1.6	4.3	1.2
300	8.2	2.4	6.2	1.8
400	11.0	3.2	8.3	2.5
500	12.5	4.0	9.6	3.0
600	15.1	4.8	10.4	3.3

*1000Ω RTD. Divide ΔR by 10 for 100Ω RTD.

CAUTION
PRODUCT DAMAGE
The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take normal ESD precautions when handling this product.

SPECIFICATIONS

Sensor Type	Thin film platinum RTD; R_0 = 1000 Ω @ 0°C; alpha = 0.00375 Ω/Ω/°C R_0 = 100 Ω @ 0°C; alpha = 0.00385 Ω/Ω/°C
Temperature Range	−200 to +540°C (−300 to +1000°F)
Temperature Accuracy	±0.5°C or 0.8% of temperature, °C (R_0 ±0.2% trim), whichever is greater ±0.3°C or 0.6% of temperature, °C (R_0 ±0.1% trim), whichever is greater (optional)
Base Resistance and Interchangeability, $R_0 \pm \Delta R_0$	1000 ± 2 Ω (±0.2%) @ 0°C 1000 ± 1 Ω (±0.1%) @ 0°C (optional)
Linearity	±0.1% of full scale for temperatures spanning −40° to +125°C ±2.0% of full scale for temperatures spanning −200° to +540°C
Time Constant	<0.15 seconds in water @ 3 ft./sec. <1 second on metal surfaces: <4 seconds in air @ 10 ft./sec.
Operating Current	2 mA max. For self-heating errors of 1°C 1 mA recommended
Stability	Better than 0.25°C/year: 0.05°C/5 years for occupied environments
Self-Heating	0.3 mW/°C
Insulation Resistance	>50 MΩ @ 50 VDC @ 25°C
Case Material	99% alumina support, vapor deposited alumina passified resistance portion, refractory glass passified overall
Lead Material – Ribbon	Platinum ribbon, 0.002 × 0.010 × 0.16 in. long nominal
Lead Pull Strength – Ribbon	200 grams nominal pulling up from surface



FEATURES
- Linear resistance vs temperature
- Accurate and Interchangeable
- Excellent stability
- Teflon or fiberglass lead wires
- Wide temperature range
- Ceramic case material

TYPICAL APPLICATIONS
- HVAC – room, duct and refrigerant equipment
- Instrument and probe assemblies – temperature compensation
- Process control – temperature regulation

HEL-700 Series elements are fully assembled, ready to use directly or in probe assemblies without the need for fragile splices to extension leads.

The 1000Ω, 375 alpha version, provides 10X greater sensitivity and signal-to-noise. Optional NIST calibrations improve accuracy to ±0.03°C at 0°C.

ORDER GUIDE

HEL-705	28 ga. TFE Teflon, 2-wire only				
HEL-707	28 ga. Fiberglass, 2-wire only				
HEL-711	28 ga. TFE Teflon (2-wire 1000Ω, 3-wire 100Ω)				
HEL-712	28 ga. Fiberglass (2-wire 1000Ω, 3-wire 100Ω)				
HEL-716	24 ga. TFE Teflon (2-wire 1000Ω, 3-wire 100Ω)				
HEL-717	24 ga. Fiberglass (2-wire 1000Ω, 3-wire 100Ω)				
	-U	1000Ω, 0.00375 Ω/Ω/°C			
	-T	100Ω, 0.00385 Ω/Ω/°C DIN Standard			
		-0	±0.2% Resistance Trim (Standard)		
		-1	±0.1% Resistance Trim (Optional)		
			-12	Lead wire length, 12 inches	
				-00	No NIST calibration
				-C1	NIST @ 0°C
				-C2	NIST @ 0 & 100°C
				-C3	NIST @ 0, 100 & 260°C

MOUNTING DIMENSIONS (for reference only)

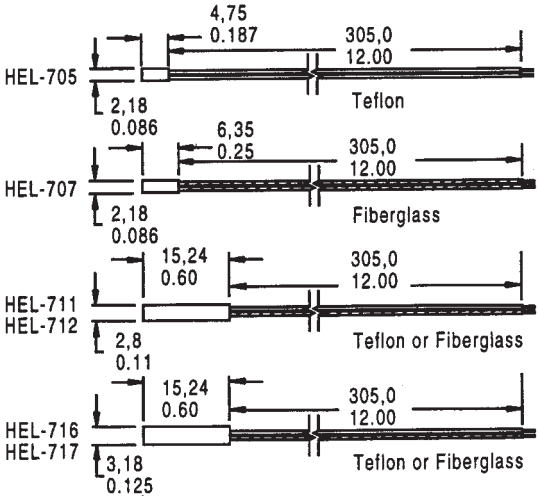


Fig. 1: Wheatstone Bridge 2-Wire Interface

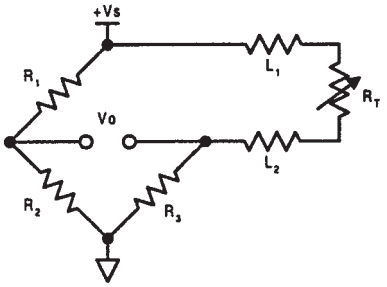


Fig. 2: Linear Output Voltage

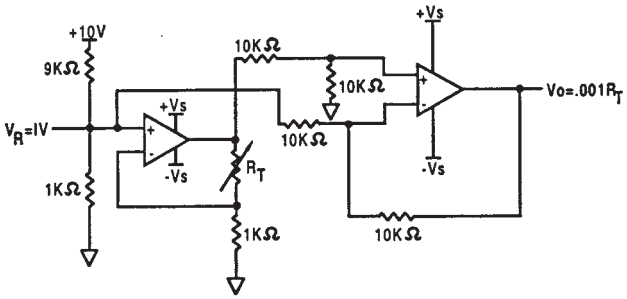
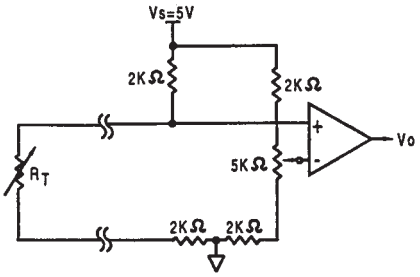


Fig. 3: Adjustable Point (Comparator) Interface



CAUTION
PRODUCT DAMAGE
The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take normal ESD precautions when handling this product.

Temperature

Platinum RTDs

FUNCTIONAL BEHAVIOR

$R_T = R_0(1+AT+BT^2-100CT^3+CT^4)$
RT = Resistance (Ω) at temperature T (°C)
R_0 = Resistance (Ω) at 0°C
T = Temperature in °C

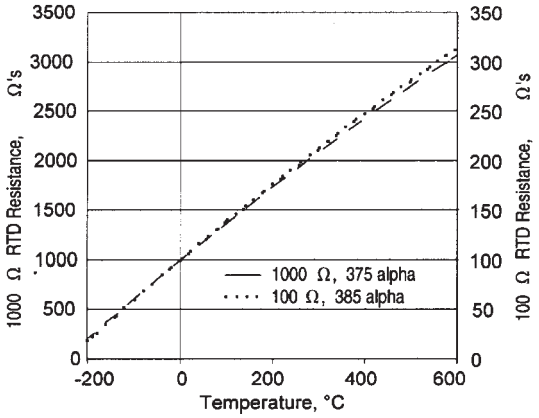
$A = \alpha + \frac{\alpha\,\delta}{100}$ $B = \frac{-\alpha\,\delta}{100^2}$ $C_{T<0} = \frac{-\alpha\,\beta}{100^4}$

CONSTANTS

Alpha, α (°C^{-1})	0.00375 ±0.000029	0.003850 ±0.000010
Delta, δ (°C)	1.605 ± 0.009	1.4999 ± 0.007
Beta, β (°C)	0.16	0.10863
A (°C^{-1})	3.81×10^{-3}	3.908×10^{-3}
B (°C^{-2})	-6.02×10^{-7}	-5.775×10^{-7}
C (°C^{-4})	-6.0×10^{-12}	-4.183×10^{-12}

Both β = 0 and C = 0 for T>0°C

RESISTANCE VS TEMPERATURE CURVE



ACCURACY VS TEMPERATURE

Tolerance	Standard ±0.2%		Optional ±0.1%	
Temperature (°C)	±ΔR* (Ω)	±ΔT (°C)	±ΔR* (Ω)	±ΔT (°C)
−200	6.8	1.6	5.1	1.2
−100	2.9	0.8	2.4	0.6
0	2.0	0.5	1.0	0.3
100	2.9	0.8	2.2	0.6
200	5.6	1.6	4.3	1.2
300	8.2	2.4	6.2	1.8
400	11.0	3.2	8.3	2.5
500	12.5	4.0	9.6	3.0
600	15.1	4.8	10.4	3.3

*1000Ω RTD. Divide Δ by 10 for 100Ω RTD.

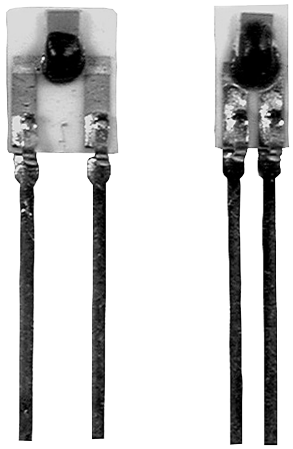
NIST CALIBRATION

NIST traceable calibration provides resistance readings at 1, 2 or 3 standard temperature points to yield a resistance versus temperature curve with 10x better accuracy.

Calibration	1 Point	2 Point	3 Point
T (°C)	±ΔT (°C)	±ΔT (°C)	±ΔT (°C)
-200	0.9	—	—
-100	0.5	0.27	0.15
0	0.03	0.03	0.03
100	0.4	0.11	0.07
200	0.8	0.2	0.08
300	1.2	0.33	6.2
400	1.6	0.5	8.3
500	2.0	0.8	9.6
600	2.6	1.2	10.4

SPECIFICATIONS

Sensor Type	Thin film platinum RTD; R_0 = 1000 Ω @ 0°C; alpha = 0.00375 Ω/Ω/°C R_0 = 100 Ω @ 0°C; alpha = 0.00385 Ω/Ω/°C
Temperature Range	TFE Teflon: −200° to +260°C (−320° to +500°F) Fiberglass: −75° to +540°C (−100° to +1000°F)
Temperature Accuracy	±0.5°C or 0.8% of temperature, °C (R_0 ±0.2% trim), whichever is greater ±0.3°C or 0.6% of temperature, °C (R_0 ±0.1% trim), whichever is greater (optional)
Base Resistance and Interchangeability, $R_0 \pm \Delta R_0$	1000 ± 2 Ω (±0.2%) @ 0°C 1000 ± 1 Ω (±0.1%) @ 0°C (optional)
Linearity	±0.1% of full scale for temperatures spanning −40° to +125°C ±2.0% of full scale for temperatures spanning −75° to +540°C
Time Constant	<0.5 sec. 0.85 inch O.D. in water at 3 ft/sec; <1.0 sec, 0.85 inch O.D. in still water
Operating Current	2 mA maximum for self heating errors of <1°C; 1 mA recommended
Stability	<0.25°C/year; 0.05°C per 5 years in occupied environments
Self Heating	<15 mW/°C for 0.85 O.D. typical
Insulation Resistance	>50 MΩ at 50 VDC at 25°C
Construction	Alumina case; Epoxy potting (Teflon leads); Ceramic potting (fiberglass leads)
Lead Material	Nickel coated stranded copper, Teflon or Fiberglass insulated



FEATURES
- Linear resistance vs temperature
- Accurate and Interchangeable
- Excellent stability
- Small size
- Printed circuit mountable
- Ceramic SIP package

TYPICAL APPLICATIONS
- HVAC – room, duct and refrigerant equipment
- Instrument and probe assemblies
- Electronic assemblies – temperature compensation
- Process control – temperature regulation

HEL-775 platinum RTDs are designed to measure temperatures from −55° to +150°C (−67° to 302°F) in printed circuit boards, temperature probes, or other lower temperature applications. Solderable leads in 0.050″ or 0.100″ spacing provide strong connections for wires or printed circuits.

The 1000Ω, 375 alpha version, provides 10x greater sensitivity and signal-to-noise. The 0.050″ lead space models are ideal for probes.

ORDER GUIDE

HEL-775-A	Ceramic SIP pkg. 0.100″ lead spacing		
HEL-775-B	Ceramic SIP pkg. 0.050″ lead spacing		
	-U	1000Ω, 0.00375 Ω/Ω/°C	
	-T	100Ω, 0.00385 Ω/Ω/°C, DIN specification	
		-0	±0.2% Resistance Trim (Standard)
		-1	±0.1% Resistance Trim (Optional)

MOUNTING DIMENSIONS (for reference only) mm/in.

HEL-775-A **HEL-775-B**

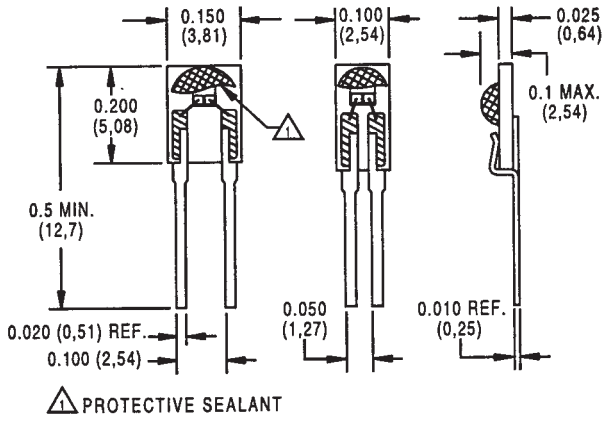


Fig. 1: Wheatstone Bridge 2-Wire Interface

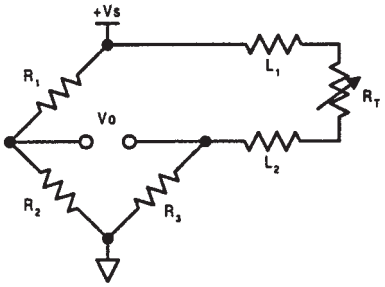


Fig. 2: Linear Output Voltage

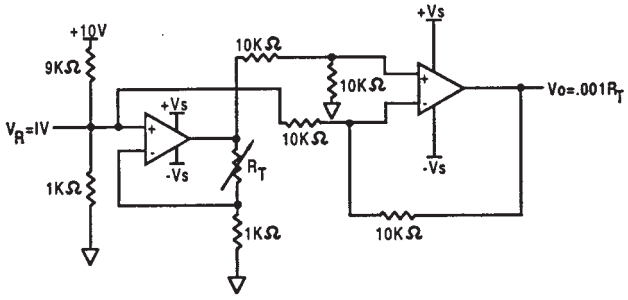
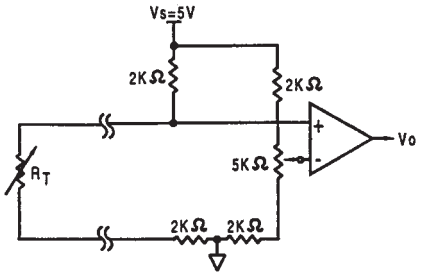


Fig. 3: Adjustable Point (Comparator) Interface



CAUTION
PRODUCT DAMAGE
The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take normal ESD precautions when handling this product.

Temperature

Temperature Sensors
Platinum RTDs

HEL-775 Series

FUNCTIONAL BEHAVIOR

$R_T = R_0(1+AT+BT^2-100CT^3+CT^4)$
RT = Resistance (Ω) at temperature T (°C)
R_0 = Resistance (Ω) at 0°C
T = Temperature in °C

$A = \alpha + \frac{\alpha\,\delta}{100}$ $B = \frac{-\alpha\,\delta}{100^2}$ $C_{T<0} = \frac{-\alpha\,\beta}{100^4}$

Alpha, α (°C^{-1})	0.00375 ±0.000029	0.003850 ±0.000010
Delta, δ (°C)	1.605 ± 0.009	1.4999 ± 0.007
Beta, β (°C)	0.16	0.10863
A (°C^{-1})	3.81×10^{-3}	3.908×10^{-3}
B (°C^{-2})	-6.02×10^{-7}	-5.775×10^{-7}
C (°C^{-4})	-6.0×10^{-12}	-4.183×10^{-12}

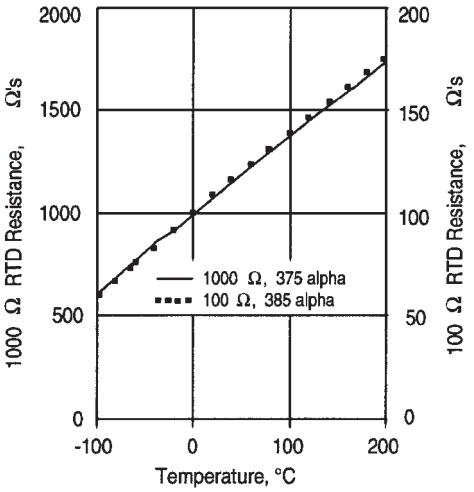
Both β = 0 and C = 0 for T>0°C

ACCURACY VS TEMPERATURE

Tolerance	Standard ±0.2%		Optional ±0.1%	
Temperature (°C)	±ΔR* (Ω)	±ΔT (°C)	±ΔR* (Ω)	±ΔT (°C)
−200	6.8	1.6	5.1	1.2
−100	2.9	0.8	2.4	0.6
0	2.0	0.5	1.0	0.3
100	2.9	0.8	2.2	0.6
200	5.6	1.6	4.3	1.2
300	8.2	2.4	6.2	1.8
400	11.0	3.2	8.3	2.5
500	12.5	4.0	9.6	3.0
600	15.1	4.8	10.4	3.3

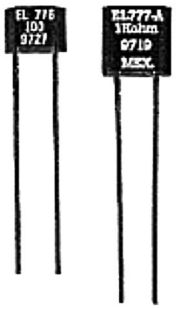
* 1000Ω RTD. Divide ΔR by 10 for 100Ω RTD.

RESISTANCE VS TEMPERATURE CURVE



SPECIFICATIONS

Sensor Type	Thin film platinum RTD: R_0 = 1000 Ω @ 0°C; alpha = 0.00375 Ω/Ω/°C R_0 = 100 Ω @ 0°C; alpha = 0.00385 Ω/Ω/°C
Temperature Range	−55° to +150°C (−67° to +302°F)
Temperature Accuracy	±0.5°C or 0.8% of temperature, °C (R_0 ±0.2% trim), whichever is greater ±0.3°C or 0.6% of temperature, °C (R_0 ±0.1% trim), whichever is greater (optional)
Base Resistance and Interchangeability, $R_0 \pm \Delta R_0$	1000 ± 2 Ω (±0.2%) @ 0°C or 100 ± 0.2 Ω (±0.2%) @ 0°C 1000 ± 1 Ω (±0.1%) @ 0°C or 100 + 0.2 Ω (+0.2%) @ 0°C (optional)
Linearity	±0.15% of full scale for temperatures spanning −55° to 150°C
Time Constant	<10 sec. in air at 10 ft./sec.
Operating Current	1 mA maximum in still air for <0.3°C (0.5°F) self heating
Stability	<0.05°C per 5 years in occupied environments
Self Heating HEL-775-A HEL-775-B	 9.7mW/°C nominal in air at 10ft/sec, 4.3mW/°C nominal in enclosed still air 6.8mW/°C nominal in air at 10ft/sec, 3.0mW/°C nominal in enclosed still air
Insulation Resistance	>50 MΩ @ 50 VDC @ 25°C
Construction	Alumina substrate with epoxy protection
Lead Material	Phosphor bronze with bright tin lead 60/40 plating
Lead Configuration	2-wire



FEATURES
- Linear resistance vs temperature
- Accurate and Interchangeable
- Excellent stability
- Small size
- Printed circuit mountable
- Ceramic SIP package

TYPICAL APPLICATIONS
- HVAC – room, duct and refrigerant equipment
- Instrument and probe assemblies
- Electronic assemblies – temperature compensation
- Process control – temperature regulation

HEL-776 and HEL-777 platinum RTDs are designed to measure temperatures from −55° to +150°C (−67° to 302°F) in printed circuit boards, temperature probes, or other lower temperature applications. Solderable leads in 0.050″ or 0.100″ spacing provide strong connections for wires or printed circuits.

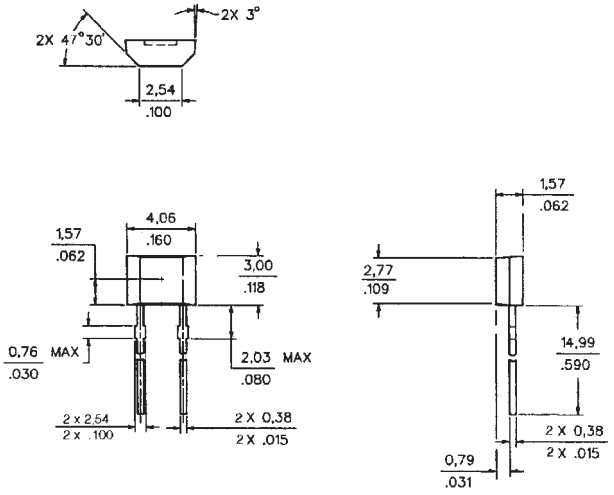
The 1000Ω, 375 alpha version, provides 10x greater sensitivity and signal-to-noise. Both are ideal for air temperature sensing.

ORDER GUIDE

HEL-776-A	Molded SIP pkg. 0.100″ lead spacing		
HEL-777-A	Molded SIP pkg. 0.100″ lead spacing		
	-U	1000Ω, 0.00375 Ω/Ω/°C	
	-T	100Ω, 0.00385 Ω/Ω/°C	
		-0	±0.2% Resistance Trim (Standard)
		-1	±0.1% Resistance Trim (Optional)

MOUNTING DIMENSIONS (for reference only) mm/in.

HEL-776-A



HEL-777-A

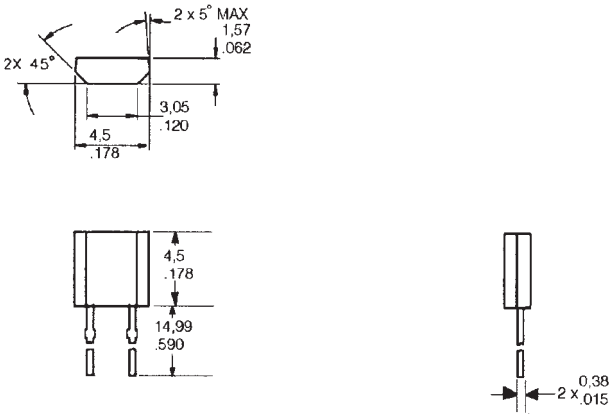


Fig. 1: Wheatstone Bridge 2-Wire Interface

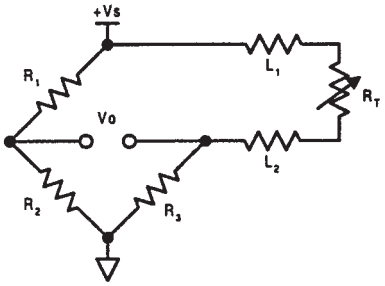


Fig. 2: Linear Output Voltage

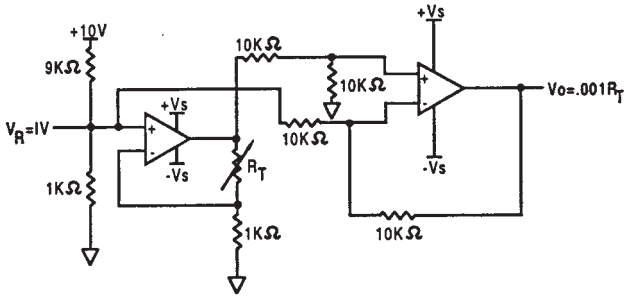
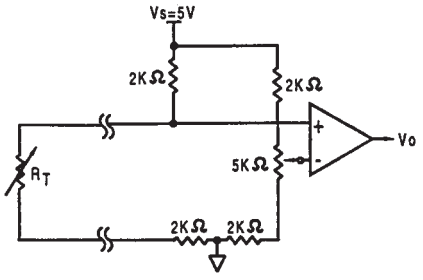


Fig. 3: Adjustable Point (Comparator) Interface



CAUTION
PRODUCT DAMAGE
The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take normal ESD precautions when handling this product.

Temperature

Platinum RTDs

FUNCTIONAL BEHAVIOR

$R_T = R_0(1+AT+BT^2-100CT^3+CT^4)$
RT = Resistance (Ω) at temperature T (°C)
R_0 = Resistance (Ω) at 0°C
T = Temperature in °C

$$A = \alpha + \frac{\alpha\,\delta}{100} \qquad B = \frac{-\alpha\,\delta}{100^2} \qquad C_{T<0} = \frac{-\alpha\,\beta}{100^4}$$

CONSTANTS

Alpha, α (°C^{-1})	0.00375 ±0.000029	0.003850 ±0.000010
Delta, δ (°C)	1.605 ± 0.009	1.4999 ± 0.007
Beta, β (°C)	0.16	0.10863
A (°C^{-1})	3.81×10^{-3}	3.908×10^{-3}
B (°C^{-2})	-6.02×10^{-7}	-5.775×10^{-7}
C (°C^{-4})	-6.0×10^{-12}	-4.183×10^{-12}

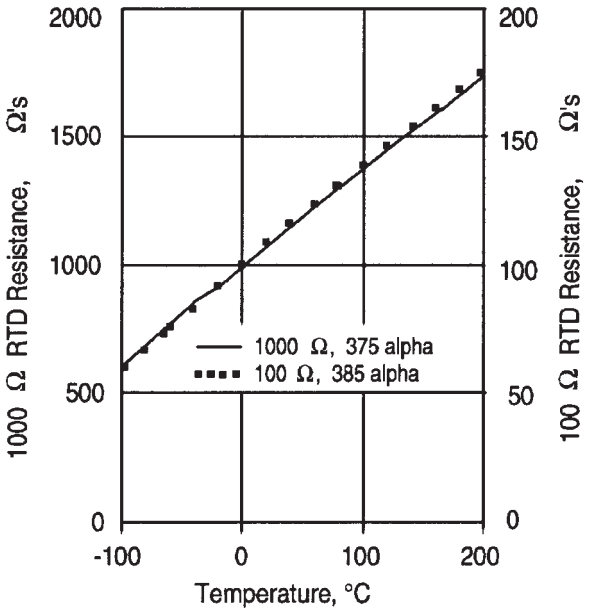
Both β = 0 and C = 0 for T>0°C

ACCURACY VS TEMPERATURE

Tolerance	Standard ±0.2%		Optional ±0.1%	
Temperature (°C)	±ΔR* (Ω)	±ΔT (°C)	±ΔR* (Ω)	±ΔT (°C)
−200	6.8	1.6	5.1	1.2
−100	2.9	0.8	2.4	0.6
0	2.0	0.5	1.0	0.3
100	2.9	0.8	2.2	0.6
200	5.6	1.6	4.3	1.2
300	8.2	2.4	6.2	1.8
400	11.0	3.2	8.3	2.5
500	12.5	4.0	9.6	3.0
600	15.1	4.8	10.4	3.3

* 1000Ω RTD. Divide ΔR by 10 for 100Ω RTD.

RESISTANCE VS TEMPERATURE CURVE



SPECIFICATIONS

Sensor Type	Thin film platinum RTD: R_0 = 1000 Ω @ 0°C; alpha = 0.00375 Ω/Ω/°C R_0 = 100 Ω @ 0°C; alpha = 0.00385 Ω/Ω/°C
Temperature Range	TFE Teflon: −200° to +260°C (−320° to +500°F) Fiberglass: −75° to +540°C (−100° to +1000°F)
Temperature Accuracy	±0.5°C or 0.8% of temperature °C (R_0 ±0.2% trim), whichever is greater ±0.3°C or 0.6% of temperature °C (R_0 ±0.1% trim), whichever is greater (optional)
Base Resistance and Interchangeability, $R_0 \pm \Delta R_0$	1000 ± 2 Ω (±0.2%) @ 0°C or 100 ± 0.2 Ω (±0.2%) @ 0°C 1000 ± 1 Ω (±0.1%) @ 0°C or 100 ± 0.2 Ω (±0.2%) @ 0°C (optional)
Linearity	±0.1% of full scale for temperatures spanning −40° to 125°C ±2.0% of full scale for temperatures spanning −75° to 540°C
Time Constant	<0.5 sec, 0.85 inch O.D. in water at 3 ft/sec; <1.0 sec, 0.85 inch O.D. in still water
Operating Current	2 mA maximum for self heating errors of <1°C; 1 mA recommended
Stability	<0.25°C/year; 0.05°C per 5 years in occupied environments
Self Heating	<15mW/°C for 0.85 O.D. typical
Insulation Resistance	>50 MΩ @ 50 VDC @ 25°C
Construction	Alumina case; Epoxy potting (Teflon leads); Ceramic potting (fiberglass leads)
Lead Material	Nickel coated stranded copper, Teflon or Fiberglass insulated

FEATURES
- Resistance interchangeable
- Accurate
- Linear
- Fast
- Laser trimmed
- Bolt, cement-on or strap-on models

TYPICAL APPLICATIONS
- HVAC – room, duct and refrigerant equipment
- OEM assemblies
- Electronic assemblies – semiconductor protection, temperature compensation
- Process control – temperature regulation

The HRTS is designed to measure surface temperatures from −200° to +480°C (−320° to +900°F) in printed circuit, temperature probe, or other applications.

HRTS surface temperature sensors are fully assembled elements, ready to use, without the need for fragile splices to extension leads.

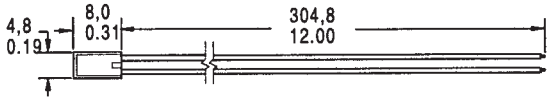
A thin layer of platinum is deposited on an alumina substrate and laser trimmed to a resistance interchangeability of ±0.2% with ±0.5°C accuracy or ±0.1% with ±0.3°C accuracy. The sensor chip is then glassed, wired and potted or ceramic fired to result in a cylindrical alumina package with either Teflon or fiber glass insulated lead wires.

ORDER GUIDE

HRTS-5760-B	Miniature, ceramic body, 28 ga TFE Teflon insulated leads (2-wire only)			
HRTS-61	Bolt-on, nickel plated copper alloy body, 24 ga fiberglass insulated leads, SST braid, TFE overwrap, spiral armor			
	-T	100Ω, 0.00385 Ω/Ω/°C, 3-wire leads, DIN specification		
	-U	1000Ω, 0.00375 Ω/Ω/°C, 2-wire leads		
		-0	±0.2% Resistance Trim (Standard)	
		-1	±0.1% Resistance Trim (Optional)	
			-12	Standard length, HRTS-5760-B
			-24	Standard length, HRTS-61

MOUNTING DIMENSIONS (for reference only)

HRTS-5760-B



HRTS-61

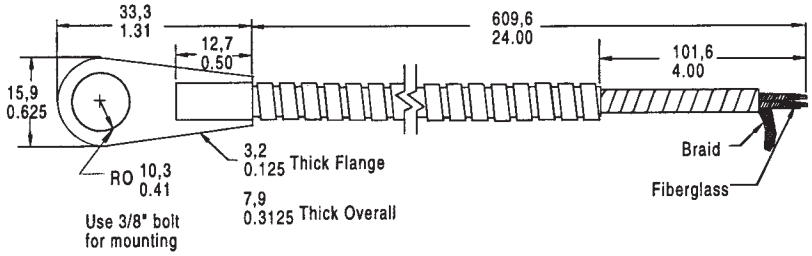


Fig. 1: Wheatstone Bridge 2-Wire Interface

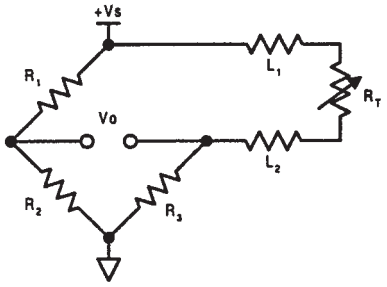


Fig. 2: Linear Output Voltage

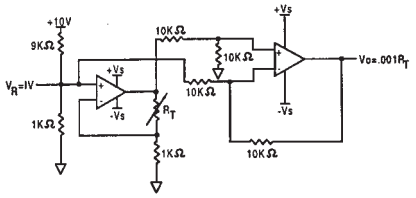
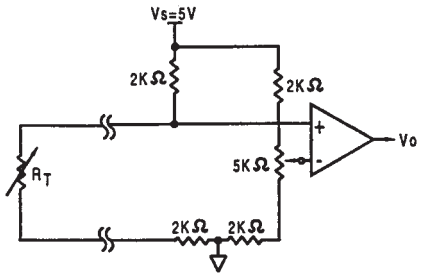


Fig. 3: Adjustable Point (Comparator) Interface



Temperature

Platinum RTDs

FUNCTIONAL BEHAVIOR

$R_T = R_0(1+AT+BT^2-100CT^3+CT^4)$
RT = Resistance (Ω) at temperature T (°C)
R_0 = Resistance (Ω) at 0°C
T = Temperature in °C

$$A = \alpha + \frac{\alpha\,\delta}{100} \qquad B = \frac{-\alpha\,\delta}{100^2} \qquad C_{T<0} = \frac{-\alpha\,\beta}{100^4}$$

CONSTANTS

Alpha, α (°C^{-1})	0.00375 ±0.000029	0.003850 ±0.000010
Delta, δ (°C)	1.605 ± 0.009	1.4999 ± 0.007
Beta, β (°C)	0.16	0.10863
A (°C^{-1})	3.81×10^{-3}	3.908×10^{-3}
B (°C^{-2})	-6.02×10^{-7}	-5.775×10^{-7}
C (°C^{-4})	-6.0×10^{-12}	-4.183×10^{-12}

Both β = 0 and C = 0 for T>0°C

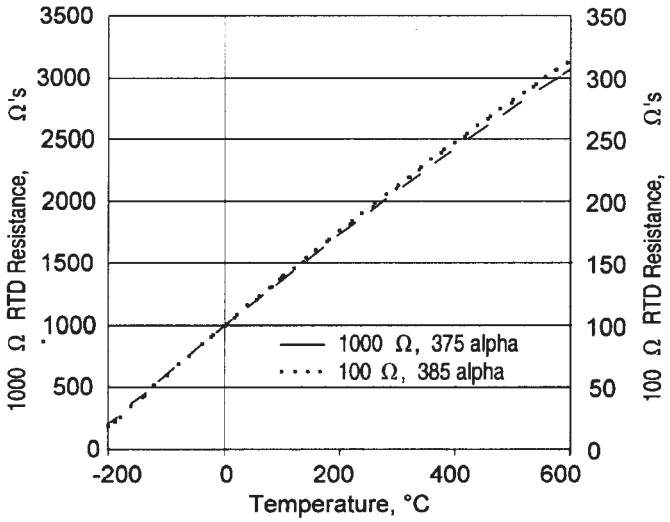
ACCURACY VS TEMPERATURE

HRTS platinum RTDs are available in two base resistance trim tolerances: ±0.2% or ±0.1%. The corresponding resistance interchangeability and temperature accuracy for these tolerances are:

Tolerance	**Standard ±0.2%**		**Optional ±0.1%**	
Temperature (°C)	±ΔR* (Ω)	±ΔT (°C)	±ΔR* (Ω)	±ΔT (°C)
−200	6.8	1.6	5.1	1.2
−100	2.9	0.8	2.4	0.6
0	2.0	0.5	1.0	0.3
100	2.9	0.8	2.2	0.6
200	5.6	1.6	4.3	1.2
300	8.2	2.4	6.2	1.8
400	11.0	3.2	8.3	2.5
500	12.5	4.0	9.6	3.0
600	15.1	4.8	10.4	3.3

*1000Ω RTD. Divide ΔR by 10 for 100Ω RTD.

RESISTANCE VS TEMPERATURE CURVE



CAUTION
PRODUCT DAMAGE
The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take normal ESD precautions when handling this product.

SPECIFICATIONS

Sensor Type	Thin film platinum RTD: R_o = 1000 Ω @ 0°C; alpha = 0.00375 Ω/Ω/°C R_o = 100 Ω @ 0°C; alpha = 0.00385 Ω/Ω/°C
Temperature Range	HRTS-5760-B: −200° to +260°C (−320° to +500°F) HRTS-61: −75° to +425°C (−100° to +800°F)
Temperature Accuracy	±0.5°C or 0.8% of temperature @ 0.2% R_o Trim ±0.3°C or 0.6% of temperature @ 0.1% R_o Trim Optional
Time Constant, 1/e	HRTS-5760-B: Typically 0.6 sec. on metal surfaces HRTS-61: Typically 20 sec. On metal surfaces
Operating Current	2 mA max. for self-heating errors of 1°C 1 mA recommended
Self-Heating	0.3 mW/°C
Lead Material	Nickel coated stranded copper, Teflon or Fiberglass insulated