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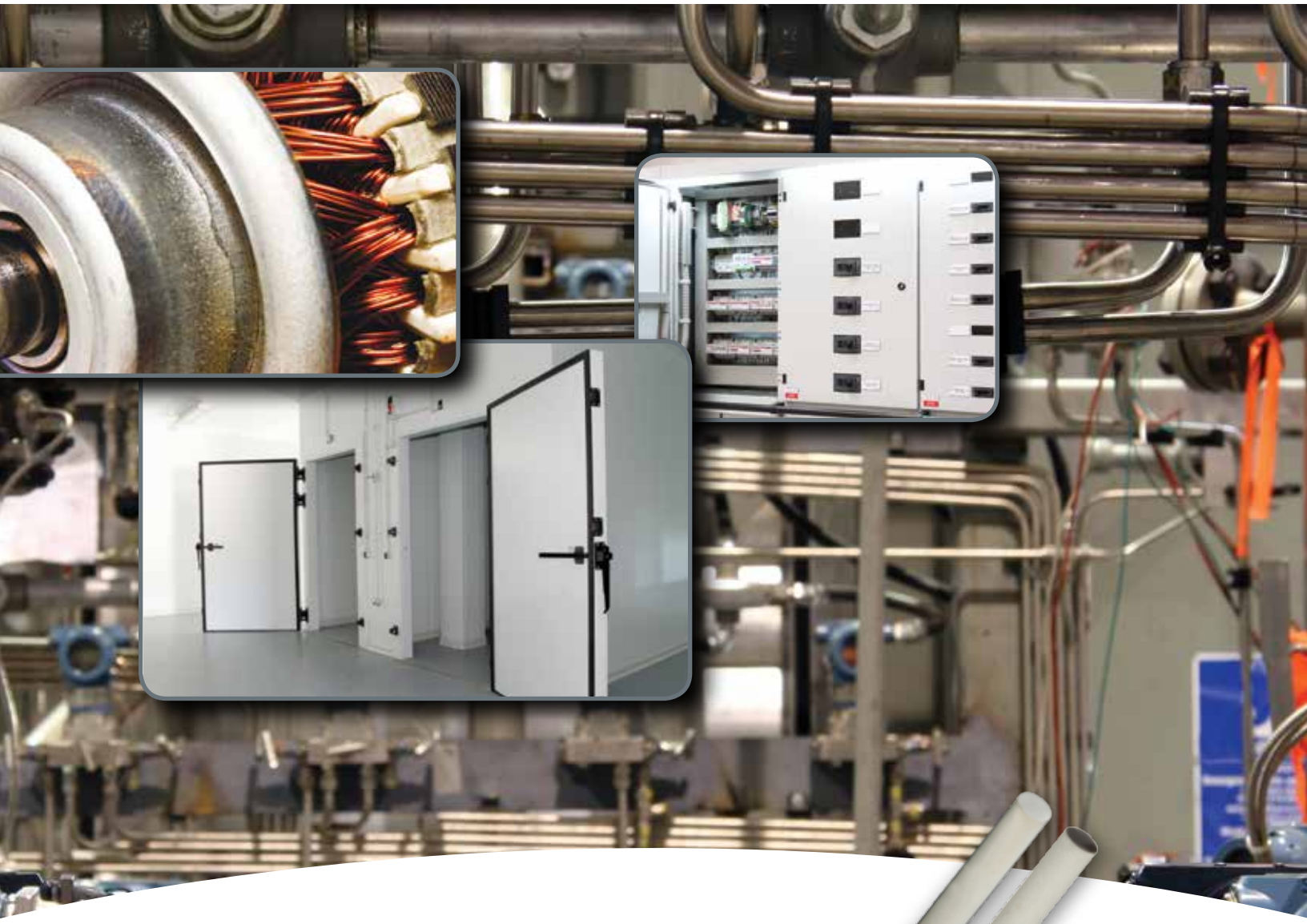


Thin Film Platinum RTDs

HEL-700 Series

Datasheet

Thin Film Platinum RTDs

The HEL-700 Series Thin Film Platinum RTDs (Resistance Temperature Detectors) are designed to monitor or control critical temperatures in industrial applications. They provide a linear change in resistance versus temperature, combining high linearity, stability, accuracy, and wide temperature range in a small, fast-response package.

The HEL-700 Series is designed to measure temperatures from -75 °C to 540 °C [-100 °F to 1000 °F] with high accuracy. These fully-assembled elements are ready-to-use in probe assemblies, without the need for fragile splices to extension leads.

These products are manufactured using a thin layer of platinum deposited on an alumina substrate and are laser trimmed to a resistance interchangeability of a standard ±0.2% (±0.5 °C accuracy) or optional ±0.1% (±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 TFE Teflon®- or fiberglass-insulated lead wires.

Key Features

- Wide temperature range
- Interchangeable
- Accurate
- Linear resistance vs temperature
- Fast response
- Laser trimmed
- Ceramic case material
- TFE Teflon® or fiberglass leadwires
- Multiple small sizes
- Ready-to-use, fully assembled elements

Potential Applications

Temperature sensing for monitoring, compensation and regulation in:

INDUSTRIAL

- HVAC equipment
- Instrument and probe assemblies
- Process control
- Motor windings and bearings
- Battery packs
- Environmental chambers
- Ovens and kilns
- Drill holes in large objects

MEDICAL

- Autoclaves

AEROSPACE/DEFENSE

- Aircraft
- Space vehicles

WIDE TEMPERATURE RANGE • INTERCHANGEABLE • ACCURATE

Thin Film Platinum RTDs, HEL-700 Series

Table 1. Specifications

Characteristic	Condition	Parameter
Alpha: R_0 = 1000 Ω R_0 = 100 Ω	0 °C	 0.00375 Ω/Ω/°C 0.00385 Ω/Ω/°C
Temperature range: TFE Teflon fiberglass	—	 -70 °C to 260 °C [-94 °F to 500 °F] -75 °C to 540 °C [-100 °F to 1000 °F]
Temperature accuracy: R_0 ±0.2% trim (standard) R_0 ±0.1% trim (optional)	—	 ±0.5°C or 0.8% of temperature, whichever is greater ±0.3°C or 0.6% of temperature, whichever is greater
Base resistance and interchangeability, R_0 ±ΔR_0: R_0 ±0.2% trim (standard) R_0 ±0.1% trim (optional)	0 °C	 1000 Ω ±2 Ω 1000 Ω ±1 Ω
Linearity: -40 °C to 125 °C -75 °C to 540 °C	—	 ±0.1% of full scale ±2.0% of full scale
Time constant	water at 3 ft/s still water	<0.5 s for 0.086 in O.D. <1.0 s for 0.086 in O.D.
Operating current	—	2 mA max. minimal self heating errors of 1 °C; 1 mA recommended
Stability	occupied environments	<0.25 °C /year; 0.05 °C /5 years
Self heating	—	<15 mW/°C typ. for 0.086 in O.D.
Insulation resistance	50 Vdc at 25 °C	>50 MΩ
Construction/material: case Teflon®-insulated leads fiberglass-insulated leads	—	 high purity alumina nickel-coated stranded copper, epoxy potting nickel-coated stranded copper, ceramic potting

Table 2. Constant Values (β = 0 and C = 0 for T > 0 °C)

Constant	1000 Ω	100 Ω
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 x 10^{-3}	3.908 x 10^{-3}
B (°C^{-2})	-6.02 x 10^{-7}	-5.775 x 10^{-7}
C (°C^{-4})	-6.0 x 10^{-12}	-4.183 x 10^{-12}

Functional Behavior

$R_T = R_0(1 + AT + BT^2 - 100CT^3 + CT^4)$

Where:
R_T = Resistance (Ω) at temperature T (°C)
R_0 = Resistance (Ω) at 0 °C
T = Temperature (°C)

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

CAUTION

PRODUCT DAMAGE

- Ensure proper ESD (Electrostatic Discharge) precautions are followed when handling this product.

Failure to comply with these instructions may result in product damage.

Thin Film Platinum RTDs, HEL-700 Series

Table 3. Accuracy vs Temperature

Temperature (°C)	Tolerance			
	Standard Trim (±0.2%)		Optional Trim (±0.1%)	
	±ΔR[1] (Ω)	±ΔT (°C)	±ΔR[1] (Ω)	±ΔT (°C)
-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

[1]1000 Ω RTD. Divide Δ by 10 for 100 Ω RTD.

Table 4. NIST Calibration

Temperature (°C)	Standard Temperature Point (±ΔT (°C))		
	1	2	3
-100	0.5	0.27	0.15
0	0.03	0.03	0.03
100	0.4	0.11	0.07
200	0.8	0.02	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

[1]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.

Figure 1. Resistance vs Temperature

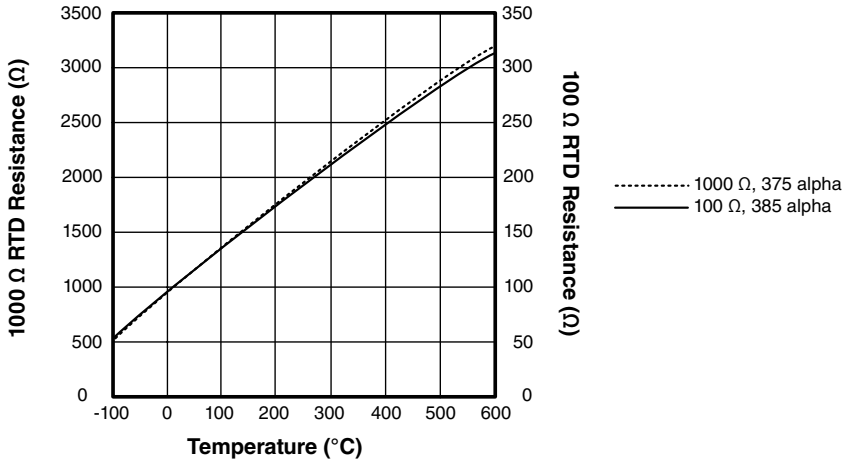


Figure 2. Nomenclature and Ordering Guide

For example, a **HEL-705-U-0-12-C1** part number defines an HEL-700 Series Thin Film RTD with two, 28 gauge TFE Teflon® insulted leadwires, an alpha of 1000 Ω: 0.00375 Ω/Ω/°C, a standard ±0.2% trim resistance, 12 inch leadwires, and a NIST calibration report at 0 °C.

HEL- Product Series

HEL-700 Series Thin Film Platinum RTDs

705- Leadwire Insulation Material, Gauge and Number

705	TFE Teflon®, 28 gauge; 1000 Ω: 2-wire, 100 Ω: 2-wire
707	fiberglass, 28 gauge; 1000 Ω: 2-wire, 100 Ω: 2-wire
711	TFE Teflon®, 28 gauge; 1000 Ω: 2-wire, 100 Ω: 3-wire
712	fiberglass, 28 gauge; 1000 Ω: 2-wire, 100 Ω: 3-wire
716	TFE Teflon®, 24 gauge; 1000 Ω: 2-wire, 100 Ω: 3-wire
717	fiberglass, 24 gauge; 1000 Ω: 2-wire, 100 Ω: 3-wire

U- Resistance and Alpha

U	1000 Ω: 0.00375 Ω/Ω/°C
T	100 Ω: 0.00385 Ω/Ω/°C (DIN Standard)

0- Resistance Trim

0	Standard: ±0.2%
1	Optional: ±0.1%

12- Leadwire Length

12	12 inches

C1 NIST Calibration Report

00	none
C1	at 0 °C
C2	at 0 °C and 100 °C
C3	at 0 °C, 100 °C and 260 °C

Thin Film Platinum RTDs, HEL-700 Series

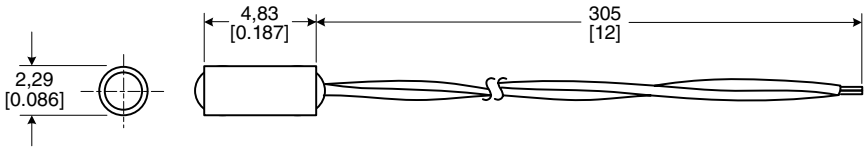
Figure 3. All Available Standard Configurations

Teflon®-Insulated Leadwires	Fiberglass-Insulated Leadwires
HEL-705	**HEL-707**
2-wire only	2-wire only
HEL-711	**HEL-712**
2-wire	2-wire
3-wire	3-wire
HEL-716	**HEL-717**
2-wire	2-wire
3-wire	3-wire

Figure 4. Dimensional Drawings (For reference only: mm [in].)

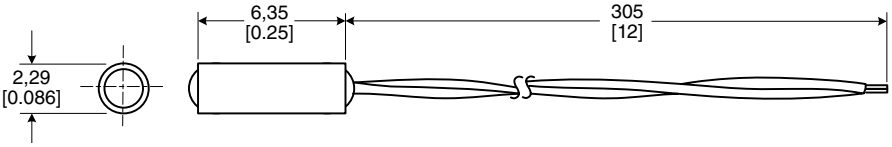
HEL-705

2-wire only



HEL-707

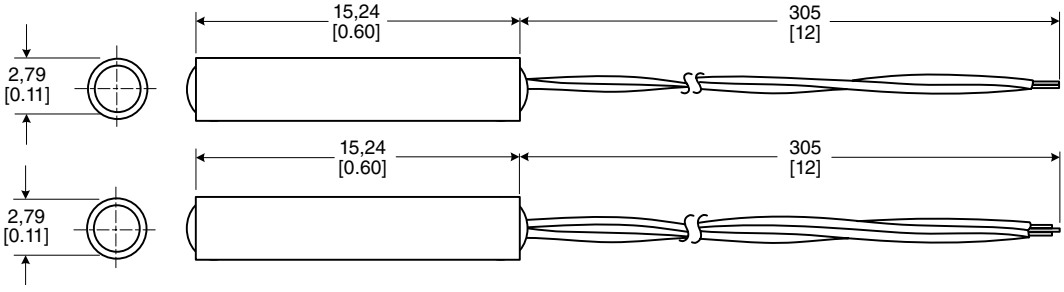
2-wire only



HEL-711, HEL-712

2-wire

3-wire



HEL-716, HEL-717

2-wire

3-wire

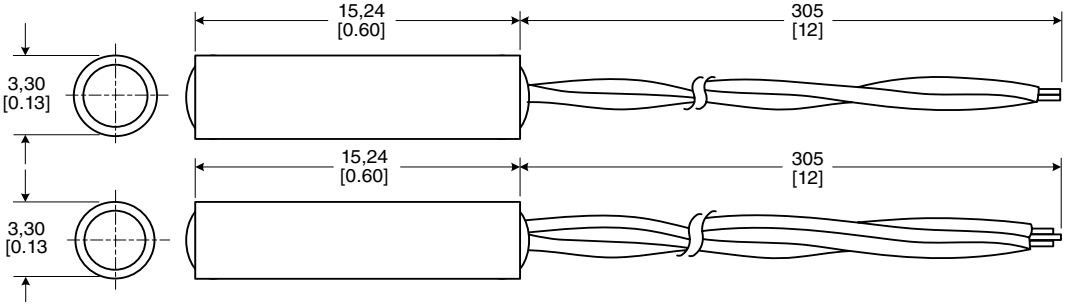
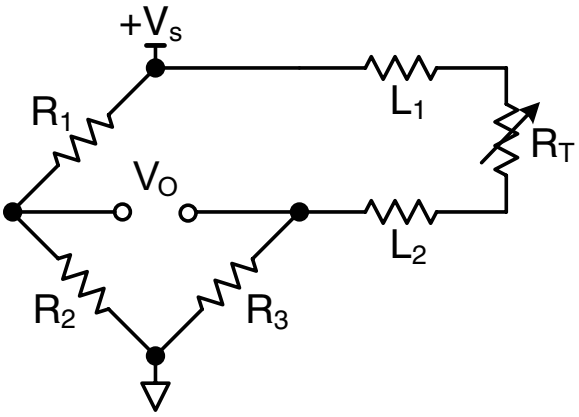
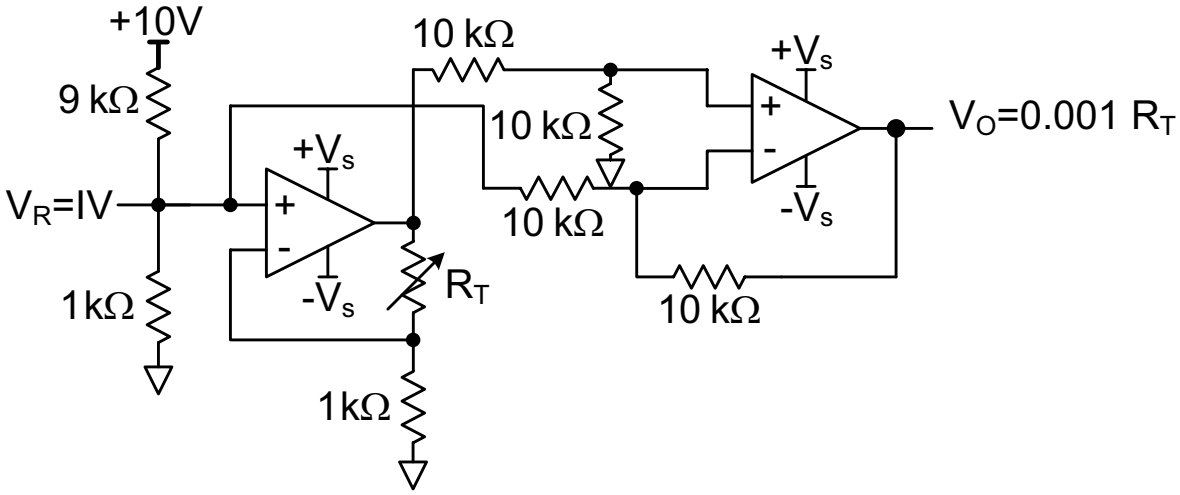


Figure 5. Circuits

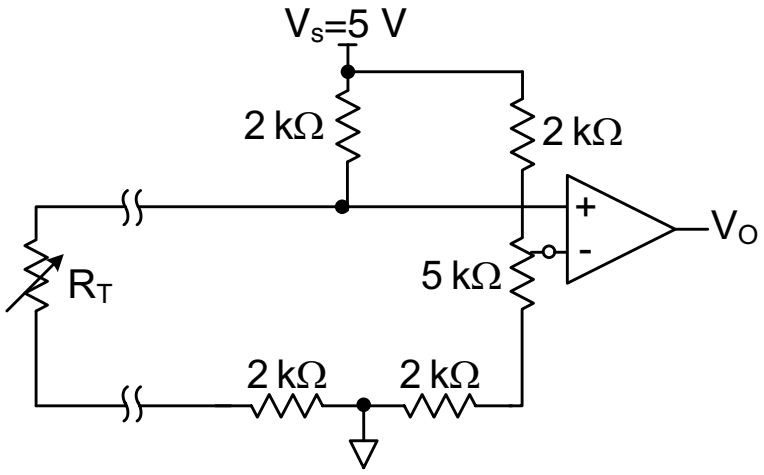
Wheatstone Bridge 2-Wire Interface



Linear Output Voltage



Adjustable Point (Comparator) Interface



ADDITIONAL INFORMATION

The following associated literature is available at sensing.honeywell.com:

- Temperature Sensors Line Guide
- Thermal Sensors Range Guide

⚠ WARNING

PERSONAL INJURY

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

Failure to comply with these instructions could result in death or serious injury.

⚠ WARNING

MISUSE OF DOCUMENTATION

- The information presented in this product sheet is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

Failure to comply with these instructions could result in death or serious injury.

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Phone and Fax:

Asia Pacific	+65 6355-2828
	+65 6445-3033 Fax
Europe	+44 (0) 1698 481481
	+44 (0) 1698 481676 Fax
Latin America	+1-305-805-8188
	+1-305-883-8257 Fax
USA/Canada	+1-800-537-6945
	+1-815-235-6847
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Sensing and Control
Honeywell
1985 Douglas Drive North
Golden Valley, MN 55422
honeywell.com

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