



# PIE 525B Automated Thermocouple & RTD Calibrator

- **Easy to use**

With the PIE 525B you can check and calibrate all your thermocouple and RTD instruments and measure temperature sensors.

- **Take it into the shop, plant or field**

Carry it without worry - it comes protected with a rubber boot and rugged, low profile switches. Easy to operate even in the dark areas of the plant with the backlit display.

- **Calibrate thermocouple instruments to 0.1 & 0.01 °F & °C**

The PIE 525B works with the thermocouples you use including types J, K, T, E, R, S, B, N, G, C, D, L (J-DIN), U (T-DIN) and P (Platinel II). Or calibrate from -13.0000 to +80.0000 mV.

- **Calibrate RTD instruments to 0.1 & 0.01 °F & °C**

Stop carrying around a decade box and RTD resistance tables. The 525B works with the RTDs you use including Platinum 10, 50, 100, 200, 500 & 1000 Ohm (alpha = 3850), Platinum 100 Ohm (alpha = 3902, 3916, 3926), Copper 10 & 50 Ohm, and Nickel 120 Ohm. Or calibrate from 0.000 to 400.000 and 0.00 to 4000.00 Ohms. For RTDs the fixed or pulsed sensor current is measured by the calibrator.

- **Fast calibration with automatic output stepping**

Easily set any value quickly to within 0.1° or 0.01° with the adjustable digital potentiometer "DIAL" plus store any three temperatures for instant recall with the EZ-CHECK™ switch. Choose between 2, 3, 5, 11 steps and ramp to automatically increment the output in 100%, 50%, 25%, 10% or 5% of span. Select step time from 5, 6, 7, 8, 9, 10, 15, 20, 25, 30 & 60 seconds.

- **Compatible with ALL process instruments**

No competitor's calibrator is compatible with as many process instruments! Connect directly to the temperature inputs of transmitters, PLCs, DCS & multichannel recorders to verify their outputs or displays. RTD simulation works with older instruments with fixed excitation currents and newer multichannel instruments that switch the excitation current between input channels.

- **Measure thermocouple & RTD sensors**

Trouble shoot sensor connections and find broken wires or corroded connections. The PIE 525B measures probes to 0.1 or 0.01 °C or °F. Secondary display shows the millivolt or resistance value corresponding to the sensor temperature as well as the junction temperature measured by the calibrator. Trouble shoot sensor connections and find broken wires with patented technology. Connect your two, three or four wire RTDs and the PIE 525B automatically detects the connections.

- **Calibration Lab Accurate & Stable**

The internal cold junction thermistor is accurate to  $\pm 0.05^{\circ}\text{C}$  and is traceable to NIST. The sensor is thermally bonded to an isothermal mass which includes brass blocks with screw terminals for connection of bare thermocouple wires along with a miniature thermocouple connector for fast connections. The circuitry uses an extremely stable voltage reference and low drift components which make the PIE 525B more accurate than most other handheld and benchtop thermocouple calibrators.

- **Perform Heat Treating Uniformity Surveys and System Accuracy Tests**

The PIE 525B meets or exceeds the requirement of AMS 2750 as a Field Test Instrument.

- **Evolutionary design**

PIECAL Calibrators are designed and built by members of the same team that designed and built the calibrators manufactured by Fluke\* under the Altek\* label. The PIE 525B improves upon other brands by including a rubber boot, tilt stand, backlit display with larger digits, rugged switches & a battery compartment for fast battery changes.

\* PIECAL Calibrators are not manufactured or distributed by Fluke Corp or Altek Industries Inc, manufacturers of Altek Calibrators.



Actual Size



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## Thermocouple Connections

Simulating or reading thermocouples requires the use of thermocouple or extension grade thermocouple wire.

Plug thermocouple wires into the miniature thermocouple jack or place bare thermocouple wires onto the brass block under the screws.

The PIE 525B has two banana jacks (1+ & 2-) mounted in the top end of the housing. These are not temperature compensated and are to be used only for millivolt signals.



## RTD Connections

Simulating or reading RTDs uses copper wire.

Plug 2, 3 or 4 wires into the corresponding jacks on the calibrator. For RTD source the PIE 525B simulates the (+) RTD from jacks 1 & 4 and the (-) RTD from jacks 2 & 3.

When reading an RTD sensor the PIE 525B uses patented circuitry to automatically detects if 2, 3 or 4 wires are connected. This is helpful to troubleshoot sensor connections.



**Flip out stand for bench use**

## PIE 525B Specifications

Unless otherwise indicated all specifications (except Cold Junction) are rated from a nominal 23 °C, 70 % RH for 1 year from calibration

General	
Operating Temperature Range	-20 to 60 °C (-5 to 140 °F)
Storage Temperature Range	-30 to 60 °C (-22 to 140 °F)
Temperature effect	≤ ±25 ppm/°C of Range; Cold Junction Sensor: ≤ ±0.01% °/° from ambient temperature (°C or °F)
Relative Humidity Range	10 % ≤RH ≤90 % (0 to 35 °C), Non-condensing 10 % ≤RH ≤ 70 % (35 to 60 °C), Non-condensing
Normal Mode Rejection	50/60 Hz, 50 dB
Common Mode Rejection	50/60 Hz, 120 dB
Size	5.63 x 3.00 x 1.60 in, 143 x 76 x 41mm (L x W x H)
Weight	12.1 ounces, 0.34 kg with boot & batteries
Batteries	Four "AA" Alkaline 1.5V (LR6)
Optional NiMh Rechargeable battery kit	120 VAC for North America Only; charger, four NiMh batteries, AC & DC cords [Part # 020-0103]
Battery Life	50 Hours
Low Battery	Low battery indication with nominal 1 hour of operation left
Protection against misconnection	Over-voltage protection to 60 vrms (rated for 30 seconds) Red LED indicates OVERLOAD or out of range conditions
Display	High contrast graphic liquid crystal display. LED backlighting for use in low lit areas.

Voltage Source	
Ranges and Resolution	-13.000 to 80.000 mV & -13.0000 to 80.0000 mV
Accuracy	±(0.008% of Setting + 0.006 mV)
Source Current	≥ 10 mA
Output Impedance	< 0.3 Ohm
RMS Noise	≤ ± 0.0005 mV from 0.1 to 10 Hz
Short Circuit Duration	Infinite

Voltage Read	
Range and Resolution	Same as Voltage Source
Accuracy	±(0.008% of Reading + 0.006 mV)
Input resistance	≥ 10 MΩ

Thermocouple Source	
Accuracy	±(0.008% of Setting + 0.006 mV)
Cold Junction Compensation	± 0.09°F (±0.05 °C) - Thermistor traceable to NIST for 11 years
Output Impedance	< 0.3 Ohms
Source Current	> 10 mA (drives 80 mV into 10 Ohms)
RMS Noise	≤ ± 0.0005 mV from 0.1 to 10 Hz

Thermocouple Read	
Accuracy	±(0.008% of Reading + 0.006 mV)
Cold Junction Compensation	± 0.09°F (±0.05 °C) - Thermistor traceable to NIST for 11 years
Input Impedance	> 10 Megohms
Open Thermocouple	Threshold: 10,000 Ohms nominal Pulse: < 10 microamp pulse for 300 milliseconds

RTD and Ohms Source	
<b>3 Wire &amp; 4 Wire Accuracy</b> From 1 to 10.2 mA External Excitation Current	±(0.015% of Setting + 0.05 Ohms)
Below 1 mA of External Excitation Current	Add ( $\frac{0.025 \text{ mV}}{\text{mA Excitation Current}}$ ) Accuracy
<b>2 Wire Accuracy</b>	Add 0.1 Ohms to 3 Wire & 4 Wire Accuracy
Resistance Ranges	400 Ohm Range: 0.00 to 401.00 & 0.000 to 401.000 4000 Ohm Range: 0.0 to 4010.0 & 0.00 to 4010.00
RMS Noise	400 Ohm Range: ≤ ± 0.005 Ohms from 0.1 to 10 Hz 4000 Ohm Range: ≤ ± 0.05 Ohms from 0.1 to 10 Hz
Allowable Excitation Current Range	400 Ohm Range: 10.2 mA max; steady or pulsed/intermittent 4000 Ohms Range: 1 mA max; steady or pulsed/intermittent
Pulsed Excitation Current Compatibility	DC to 0.01 second pulse width

RTD and Ohms Read	
Resistance Ranges	Same as RTD and Ohms Source
Accuracy	±(0.015% of Reading + 0.05 Ohms)
Excitation Current	0.9 mA to 401 Ohms, 0.4 mA to 4010 Ohms (nominal)

## Thermocouple Ranges & Accuracies

**Table based on Accuracy:**

$\leq \pm (0.008 \% \text{ of Reading} + 0.006 \text{ mV})$

*Note: Doesn't include cold junction error of  $\pm 0.05^\circ\text{C}$*

T/C	Degrees C Range	°C	Degrees F Range	°F	T/C Material
<b>J</b>	-200.00 to -150.00	$\pm 0.25^\circ$	-328.00 to -238.00	$\pm 0.55^\circ$	+Iron -Constantan
	-150.00 to -50.00	$\pm 0.17^\circ$	-238.00 to -58.00	$\pm 0.35^\circ$	
	-50.00 to 300.00	$\pm 0.13^\circ$	-58.00 to 572.00	$\pm 0.24^\circ$	
	300.00 to 850.00	$\pm 0.15^\circ$	572.00 to 1562.00	$\pm 0.28^\circ$	
	850.00 to 1200.00	$\pm 0.20^\circ$	1562.00 to 2192.00	$\pm 0.36^\circ$	
<b>K</b>	-230.00 to -100.00	$\pm 0.70^\circ$	-382.00 to -148.00	$\pm 1.26^\circ$	+Chromel® -Alumel®
	-100.00 to 600.00	$\pm 0.19^\circ$	-148.00 to 1112.00	$\pm 0.34^\circ$	
	600.00 to 1000.00	$\pm 0.24^\circ$	1112.00 to 1832.00	$\pm 0.43^\circ$	
	1000.00 to 1371.1	$\pm 0.31^\circ$	1832.00 to 2500.00	$\pm 0.55^\circ$	
<b>T</b>	-260.00 to -240.00	$\pm 1.66^\circ$	-436.00 to -400.00	$\pm 2.98^\circ$	+Copper -Constantan
	-240.00 to -210.00	$\pm 0.60^\circ$	-400.00 to -346.00	$\pm 1.07^\circ$	
	-210.00 to -100.00	$\pm 0.41^\circ$	-346.00 to -148.00	$\pm 0.74^\circ$	
	-100.00 to 50.00	$\pm 0.18^\circ$	-148.00 to 122.00	$\pm 0.33^\circ$	
	50.00 to 400.00	$\pm 0.14^\circ$	122.00 to 752.00	$\pm 0.24^\circ$	
<b>E</b>	-240.00 to -225.00	$\pm 0.51^\circ$	-400.00 to -373.00	$\pm 0.92^\circ$	+Chromel -Constantan
	-225.00 to -100.00	$\pm 0.27^\circ$	-373.00 to -148.00	$\pm 0.48^\circ$	
	-100.00 to 750.00	$\pm 0.13^\circ$	-148.00 to 1382.00	$\pm 0.24^\circ$	
	750.00 to 1000.00	$\pm 0.16^\circ$	1382.00 to 1832.00	$\pm 0.29^\circ$	
<b>R</b>	-18.30 to 250.00	$\pm 1.26^\circ$	-1.00 to 482.00	$\pm 2.27^\circ$	+Pt/13Rh -Platinum
	250.00 to 750.00	$\pm 0.64^\circ$	482.00 to 1382.00	$\pm 1.14^\circ$	
	750.00 to 1600.00	$\pm 0.54^\circ$	1382.00 to 2192.00	$\pm 0.97^\circ$	
	1600.00 to 1767.80	$\pm 0.63^\circ$	2192.00 to 3214.00	$\pm 1.13^\circ$	
<b>S</b>	-18.30 to 150.00	$\pm 1.22^\circ$	-1.00 to 302.00	$\pm 2.20^\circ$	+Pt/10Rh -Platinum
	150.00 to 500.00	$\pm 0.72^\circ$	302.00 to 932.00	$\pm 1.30^\circ$	
	500.00 to 1650.00	$\pm 0.63^\circ$	932.00 to 3002.00	$\pm 1.14^\circ$	
	1650.00 to 1767.80	$\pm 0.73^\circ$	3002.00 to 3214.00	$\pm 1.31^\circ$	
<b>B</b>	315.60 to 550.00	$\pm 1.88^\circ$	600.00 to 1022.00	$\pm 3.39^\circ$	+Pt/30Rh -Pt/6Rh
	550.00 to 900.00	$\pm 1.03^\circ$	1022.00 to 1652.00	$\pm 1.86^\circ$	
	900.00 to 1150.00	$\pm 0.72^\circ$	1652.00 to 2102.00	$\pm 1.30^\circ$	
	1150.00 to 1820.00	$\pm 0.63^\circ$	2102.00 to 3308.00	$\pm 1.14^\circ$	

T/C	Degrees C Range	°C	Degrees F Range	°F	T/C Material
<b>N</b>	-230.00 to -100.00	$\pm 1.10^\circ$	-382.00 to -148.00	$\pm 1.98^\circ$	+Nicrosil -Nisil
	-100.00 to 0.00	$\pm 0.30^\circ$	-148.00 to 32.00	$\pm 0.53^\circ$	
	0.00 to 1100.00	$\pm 0.24^\circ$	32.00 to 2012.00	$\pm 0.44^\circ$	
	1100.00 to 1300.00	$\pm 0.27^\circ$	2012.00 to 2372.00	$\pm 0.49^\circ$	
<b>G (W)</b>	100.00 to 450.00	$\pm 1.14^\circ$	212.00 to 842.00	$\pm 2.05^\circ$	+Tungsten -W26/Re
	440.00 to 1700.00	$\pm 0.44^\circ$	842.00 to 3092.00	$\pm 0.79^\circ$	
	1700.00 to 2000.00	$\pm 0.54^\circ$	3092.00 to 3632.00	$\pm 0.97^\circ$	
	2000.00 to 2320.00	$\pm 0.73^\circ$	3632.00 to 4208.00	$\pm 1.32^\circ$	
<b>C (W5)</b>	-1.10 to 1150.00	$\pm 0.44^\circ$	30.00 to 2102.00	$\pm 0.80^\circ$	+W5/Re -W26/Re
	1150.00 to 1750.00	$\pm 0.61^\circ$	2102.00 to 3182.00	$\pm 1.09^\circ$	
	1750.00 to 2050.00	$\pm 0.74^\circ$	3182.00 to 3722.00	$\pm 1.33^\circ$	
	2050.00 to 2320.00	$\pm 0.99^\circ$	3722.00 to 4208.00	$\pm 1.79^\circ$	
<b>D (W3)</b>	-1.00 to 150.00	$\pm 0.63^\circ$	30.00 to 302.00	$\pm 1.13^\circ$	+W3/Re -W25/Re
	150.00 to 1200.00	$\pm 0.41^\circ$	302.00 to 2192.00	$\pm 0.73^\circ$	
	1200.00 to 1700.00	$\pm 0.51^\circ$	2192.00 to 3092.00	$\pm 0.92^\circ$	
	1700.00 to 2320.00	$\pm 0.97^\circ$	3092.00 to 4208.00	$\pm 1.75^\circ$	
<b>P</b>	0.00 to 950.00	$\pm 0.23^\circ$	32.00 to 1742.00	$\pm 0.41^\circ$	+Pd55/Pt31/ Au14 -Au65/Pd35
	950.00 to 1395.00	$\pm 0.34^\circ$	1742.00 to 2543.00	$\pm 0.61^\circ$	
<b>DIN Wire</b>					
<b>L J-DIN</b>	-200.00 to -100.00	$\pm 0.21^\circ$	-328.00 to -148.00	$\pm 0.38^\circ$	+Iron -Constantan
	-100.00 to 350.00	$\pm 0.13^\circ$	-148.00 to 662.00	$\pm 0.24^\circ$	
	350.00 to 900.00	$\pm 0.15^\circ$	662.00 to 1652.00	$\pm 0.27^\circ$	
<b>U T-DIN</b>	-200.00 to -150.00	$\pm 0.37^\circ$	-328.00 to -238.00	$\pm 0.66^\circ$	+Copper -Constantan
	-150.00 to 100.00	$\pm 0.22^\circ$	-238.00 to 212.00	$\pm 0.40^\circ$	
	100.00 to 600.00	$\pm 0.15^\circ$	212.00 to 1112.00	$\pm 0.28^\circ$	

## RTD Ranges & Accuracies

Table based on 3 & 4 Wire RTD Accuracy:  
 $\leq \pm (0.015 \% \text{ of Reading} + 0.05 \text{ Ohms})$   
 [Read based on 1.0 mA of fixed excitation current]

RTD Type	Alpha	Degrees C Range	°C	Degrees F Range	°F
Pt 100 Ohm DIN/IEC/JIS 1989 ITS-90	1.3850 (0.00385)	-200.00 to -150.00	±0.13°	-328.0 to -238.00	±0.24°
		-150.00 to 360.00	±0.24°	-238.00 to 660.00	±0.44°
		360.00 to 740.00	±0.34°	660.00 to 1364.00	±0.61°
		740.00 to 850.00	±0.37°	1364.00 to 1562.00	±0.67°
Pt 10 Ohm DIN/IEC/JIS 1989 Based on ITS-90	1.3850 (0.00385)	-200.00 to -120.00	±1.24°	-328.00 to -184.00	±2.24°
		-120.0 to 210.00	±1.44°	-184.00 to 410.00	±2.59°
		210.00 to 370.00	±1.54°	410.00 to 698.00	±2.77°
		370.00 to 650.00	±1.74°	698.00 to 1202.00	±3.14°
Pt 50 Ohm DIN/IEC/JIS 1989 ITS-90	1.3850 (0.00385)	-200.00 to 200.00	±0.34°	-328.00 to 392.00	±0.62°
		200.00 to 550.00	±0.44°	392.00 to 1022.00	±0.80°
		550.00 to 850.00	±0.54°	1022.00 to 1562.00	±0.98°
Pt 200 Ohm DIN/IEC/JIS 1989 ITS-90	1.3850 (0.00385)	-200.00 to -120.00	±0.08°	-328.00 to -184.00	±0.14°
		-120.00 to 180.00	±0.14°	-184.00 to 356.00	±0.24°
		180.00 to 450.00	±0.19°	356.00 to 842.00	±0.34°
		450.00 to 680.00	±0.24°	842.00 to 1256.00	±0.44°
Pt 500 Ohm DIN/IEC/JIS 1989 ITS-90	1.3850 (0.00385)	-200.00 to -90.00	±0.08°	-328.00 to -194.00	±0.14°
		-120.00 to 180.00	±0.14°	-184.00 to 356.00	±0.24°
		180.00 to 450.00	±0.19°	356.00 to 842.00	±0.34°
		450.00 to 680.00	±0.24°	842.00 to 1256.00	±0.44°
Pt 1000 Ohm DIN/IEC/JIS 1989 ITS-90	1.3850 (0.00385)	-200.00 to 170.00	±0.08°	-328.00 to 338.00	±0.14°
		170.00 to 470.00	±0.14°	338.00 to 878.00	±0.24°
		470.00 to 730.00	±0.19°	878.00 to 1346.00	±0.34°
		730.00 to 850.00	±0.22°	1346.00 to 1562.00	±0.39°

RTD Type	Alpha	Degrees C Range	°C	Degrees F Range	°F
Pt 100 Ohm (Burns)	1.3902 (0.003902)	-195.61 to -100.00	±0.14°	-320.10 to -148.00	±0.26°
		-100.00 to 370.00	±0.24°	-148.00 to 698.00	±0.44°
		370.00 to 648.90	±0.31°	698.00 to 1200.00	±0.56°
Pt 100 Ohm (Old JIS 1981)	1.3916 (0.003916)	-200.00 to -140.00	±0.13°	-328.00 to -220.00	±0.24°
		-140.00 to 130.00	±0.19°	-220.00 to 266.00	±0.34°
		130.00 to 370.00	±0.24°	266.00 to 698.00	±0.44°
		370.00 to 648.90	±0.31°	698.00 to 1200.00	±0.56°
Pt 100 Ohm (US Lab)	1.3926 (0.003926)	-200.00 to -140.00	±0.13°	-328.00 to -220.00	±0.24°
		-140.00 to 130.00	±0.19°	-220.00 to 266.00	±0.34°
		130.00 to 380.00	±0.24°	266.00 to 716.00	±0.44°
		380.00 to 610.00	±0.30°	716.00 to 1130.00	±0.54°
Copper 10 Ohm (Minco)	1.4274 (0.004274)	-200.00 to -150.00	±1.24°	-328.00 to -238.00	±2.24°
		-150.00 to 90.00	±1.34°	-238.00 to 194.00	±2.42°
		90.00 to 260.00	±1.36°	194.00 to 500.00	±2.44°
Copper 50 Ohm	1.4280 (0.00428)	-50.00 to 150.00	±0.29°	-58.00 to 302.00	±0.52°
Ni 120 Ohm (Pure)	1.6720 (0.00672)	-80.00 to 260.00	±0.10°	-112.00 to 500.00	±0.17°

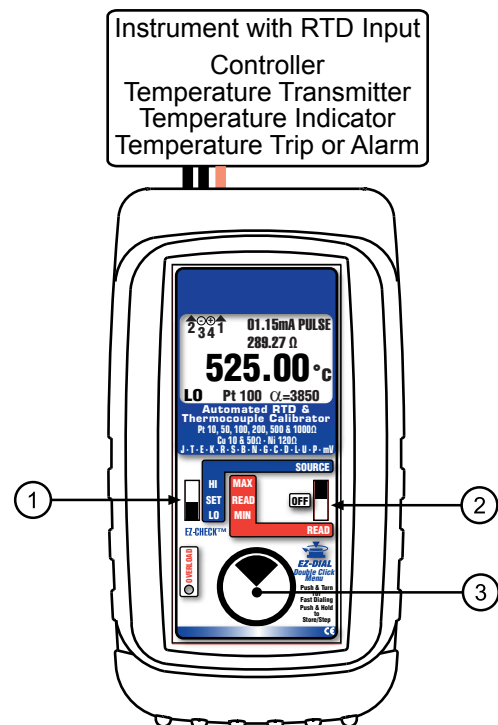
## Troubleshooting RTD Instruments

When you are having an issue where an instrument won't read an RTD sensor or you don't know if the calibrator is connected properly the PIE 525B has a function to measure and display the fixed or pulsed sensor (excitation) current that the instrument uses to measure the resistance of the RTD sensor.

Disconnect all sensor wires from the devices to be calibrated and connect the PIE 525B to the inputs of the device using 2, 3 or 4 wires. The sensor current generated by the instrument will be indicated on the display followed by the word FIXED or PULSE. Older single channel RTD instruments used a constant (fixed) current source to measure an RTD sensor. Smart transmitters, multichannel recorders and PLC or DCS input cards switch the current source sequentially through the channels which is seen as an intermittent (pulsed) current.

**00.21mA FIXED**  
**289.27 Ω**  
**525.00 °C**

**01.15mA PULSE**  
**289.27 Ω**  
**525.00 °C**





## Measure and troubleshoot RTD sensors

### Troubleshooting an RTD Sensor

When measuring an RTD sensor the PIE 525B uses patented circuitry to automatically detect 2, 3 & 4 wire connections. This may also be used as a troubleshooting tool to determine if any wires from the sensor are broken. Here is an example of the 525B reading a sensor with all 4 wire connected.



Here is an example where connections are made to a 4 wire sensor and the PIE 525B indicates that only Wires 1, 2 & 4 are connected. There may be a loose connection or a break in wire 3 somewhere between the sensor and the 525B.





**Guaranteed compatible with smart transmitters, multichannel recorders as well as PLC and DCS input cards.**



**PIE 525B in Deluxe Carrying Case.  
Hangs from your neck freeing up both hands for calibration work.**

## Accessories

### Included:

Four "AA" Alkaline batteries, Certificate of Calibration Card  
Rubber Boot Part No. 020-0213  
Deluxe Hands Free Carrying Case Part No. 020-0211  
Evolution mA/V Test Leads Part No. 020-0207  
    1 Red & 1 Black Lead with Banana Plugs & Alligator Clips  
Evolution RTD Wire Kit Part No. 020-0208  
    2 Red & 2 Black Leads with Banana Plugs & Spade Lugs

### Optional:

Certificate of Calibration with Test Data Part No. Certified Test Data 2  
Ni-MH 1 Hour Charger with 4 Ni-MH AA Batteries Part No. 020-0103  
    (100-120 V AC input for North America Only)  
T/C Wire Kit 1 for Types J, K, T & E Part No. 020-0202  
T/C Wire Kit 2 for Types B, R/S & N Part No. 020-0203  
    Three feet (1 meter) of T/C extension wire, stripped on one end with  
    a miniature T/C male connector on the other end.

## Warranty

Our equipment is warranted against defective material and workmanship (excluding batteries) for a period of three years from the date of shipment. Claims under warranty can be made by returning the equipment prepaid to our factory. The equipment will be repaired, replaced or adjusted at our option. The liability of Practical Instrument Electronics (PIE) is restricted to that given under our warranty. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Practical Instrument Electronics, Inc. be liable for any special, incidental or consequential damage.

## Additional Information

PIE Calibrators are manufactured in the USA. This product is calibrated on equipment traceable to NIST and includes a Certificate of Calibration. Test Data is available for an additional charge.

Practical Instrument Electronics recommends a calibration interval of one year. Contact your local representative for recalibration and repair services.



Available From:

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