

# PIECAL 520B & 521B Thermocouple Source Operating Instructions



(Shown without optional boot)

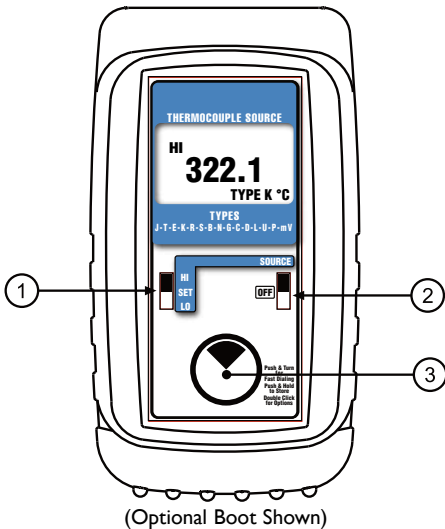


(Shown with optional boot)

## Product Description

- Easy to use**  
 With the PIECAL 520B/521B you can check & calibrate all your thermocouple instruments.
- Take it into the shop, plant or field**  
 Carry it without worry - protect it with an optional rubber boot and rugged, low profile switches. Easy to operate even in the dark areas of the plant with the backlit display.
- Calibrate directly in temperature (°C & °F)**  
 Stop carrying around a millivolt source and thermocouple tables. The PIECAL 520B/521B works with the thermocouples you use including types J, T, E, K, R, S, B, N, G, C, D, L (J-DIN), U (T-DIN) and Platinel II. Easily set any value quickly to within 0.1° with the adjustable digital potentiometer "DIAL" plus store any three temperatures for instant recall with the EZ-CHECK™ switch.
- Compatible with all process instruments**  
 Connect directly to the thermocouple inputs of smart transmitters, PLCs, DCS and multichannel recorders and verify their outputs or displays.

## Basic Operation



### ① EZ-CHECK™ SWITCH

**SOURCE:** Instantly output two preset thermocouple temperatures by moving the EZ-CHECK™ switch to the “LO” position or “HI” position. For fast three point checks select the “DIAL” position. The PIECAL 520B/521B will remember the last “DIAL” value, even with the power off.

These values can easily be changed to suit the calibration requirements. The temperatures stored in the HI and LO positions are also used for Auto Stepping.

### ② SOURCE/OFF/READ Switch

Select “SOURCE” to output in °C, °F, or millivolts. Select “READ” to read a thermocouple sensor or millivolts.

### ③ EZ-DIAL™ KNOB

**SOURCE:** Turn the knob to adjust the output level. Turn clockwise to increase the output, counter clockwise to decrease the output in 0.1° steps at a time. Push down and turn the EZ-DIAL knob for faster dialing.

Press and hold the knob for two seconds to store desired EZ-Check™ HI/LO points in SOURCE mode.

Double click the knob to get into the PIECAL 520B/521B Configuration Mode. Use configuration to select °C or °F, T/C Type (521 Only) and Auto Off On/Off.

### CHANGING BATTERIES

Low battery is indicated by “BAT” on the display. Approximately one to four hours of typical operation remain before the PIECAL 520B/521B will automatically turn off. To change the batteries; remove the optional rubber boot, remove the battery door from the back of the unit by sliding the door downward. This allows access to the battery compartment. Replace with four (4) “AA” 1.5V batteries being careful to check the polarity. Replace the battery door and replace the boot. All stored configuration options (T/C Type, EZ-CHECK Memories, etc., are reset to factory settings when the batteries are removed.

**Note:** Alkaline batteries are supplied and recommended for maximum battery life and performance.

# Configuration

## Configure the Calibrator

Move ② POWER SWITCH to “SOURCE” or “READ”.

**MODEL 51#B V#.#  
DOUBLE CLICK  
EZ-DIAL KNOB  
FOR CONFIGURATION**

### Setup

Double click the ③ DIAL KNOB at any time the unit is on and the following displays will appear for 15 seconds:

> EXIT	15
TEMP UNITS	°C
T/C	K
AUTO OFF	ON

Turn the ③ DIAL KNOB to move through the menu. Press the ③ DIAL KNOB to toggle between OFF and ON or to scroll through the settings.

**EXIT MENU** - exits this menu immediately and saves any changes. Menu will automatically exit after 15 seconds of inactivity (countdown timer is displayed).

**TEMP UNITS** - pressing the knob will toggle between °C and °F.

**T/C** -

520: pressing the knob will toggle between the factory configured T/C Type and mV.

521: pressing the knob will cycle through T/C types J, T, E, K, R, S, B, N, G, C, D, L (J-DIN), U (T-DIN), Platinel II and mV.

**AUTO OFF** - If AUTO OFF is ON, the unit will turn off after 30 minutes of inactivity to save battery life. If AUTO OFF is OFF the unit will stay on until the POWER SWITCH is moved to the off position.

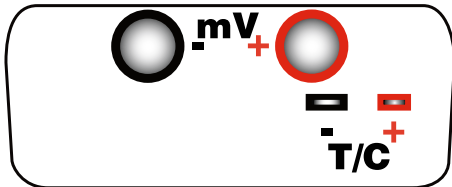
**Note:** All settings are remembered even with the power off. Removing the batteries resets the values to factory defaults.

# Connections

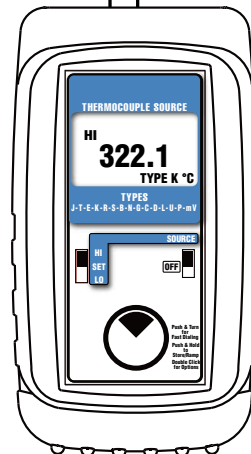
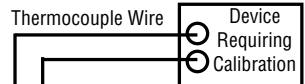
Simulating thermocouples requires the use of thermocouple or extension grade thermocouple wire.

Plug thermocouple wires into the female miniature thermocouple connector mounted in the top end of the housing.

The PIECAL 520B/521B has two banana jacks mounted in the top end of the housing. These are not temperature compensated and are to be used only for millivolt signals.



Banana jacks and female thermocouple connector on the top of the calibrator



(Optional Boot Shown)

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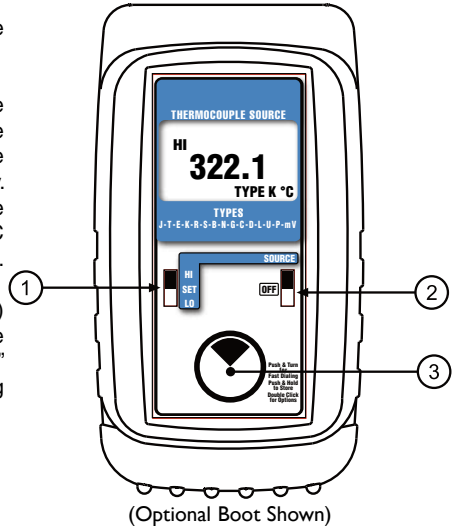
# Sourcing Thermocouple

## SOURCE

Choose this function to provide a simulated thermocouple signal into controllers, temperature transmitters, indicators or any input devices that measure thermocouple sensors..

- 1) Disconnect the thermocouple sensor from the device to be calibrated.
- 2) Select “SOURCE” with slide switch ②.
- 3) Connect a thermocouple wire (matching the type of wire to sensor being simulated) with miniature male T/C connector to the inputs of the device being calibrated, making sure to check polarity. Millivolt outputs (without cold junction) may be connected with a copper (white) miniature T/C connector or the banana jacks with copper wire.

The output is adjusted in 0.1° (or 0.001 mV) increments by turning the knob ③ while the EZ-CHECK™ switch ① is in the “HI” “LO” or “SET” position. Press and turn the knob for faster dialing with 10° (or 0.100) increments.



# Storing EZ-CHECK Outputs

## STORING HI and LO EZ-CHECK Outputs

Choose this function to provide a simulated thermocouple signal into controllers, temperature transmitters, indicators or any other input device that measure thermocouple sensors..

- 1) Store your high (SPAN) output temperature by moving the EZ-CHECK switch to the **HI** position and turn the ③ EZ-Dial knob until the desired temperature is on the display. Press and hold the EZ-Dial knob until **STORED** appears to store the value. Release the EZ-Dial knob.
- 2) Store your low (ZERO) output temperature by moving the EZ-CHECK switch to the **LO** position and turn the ③ EZ-Dial knob until the desired temperature is on the display. Press and hold the EZ-Dial knob until **STORED** appears to store the value. Release the EZ-Dial knob.
- 3) Instantly output your SPAN and ZERO temperature outputs by moving the EZ-CHECK switch between HI and LO. You may also select any third temperature output (such as mid-range) using the SET position on the EZ-CHECK switch.

## Specifications

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

General	
Accuracy	$\pm(0.015\% \text{ of Reading} + 0.009 \text{ mV})$
Cold Junction Compensation	$\pm 0.45^\circ\text{F} (\pm 0.25^\circ\text{C})$
Millivolt Range	-13.000 to 80.000 mV
Operating Temperature Range	-25 to 60 °C (-10 to 140 °F)
Temperature Drift	$\leq 50 \text{ ppm of range (includes mV and Cold Junction)}$
Relative Humidity Range	10 % $\leq$ RH $\leq$ 90 % (0 to 35 °C), Non-condensing
	10 % $\leq$ RH $\leq$ 70 % (35 to 60 °C), Non-condensing
Size With Boot	4.96 x 2.73 x 1.79 inches, 126 x 69 x 45 mm (L x W x H)
	5.67 x 3.06 x 2.05 inches, 144 x 78 x 52 mm (L x W x H)
Weight With Boot	8.4 ounces, 0.24 kg (including batteries)
	11 ounces, 0.32 kg (including batteries)
Batteries	Four "AA" Alkaline 1.5V (LR6)
Battery Life	50 Hours
Optional NiMh Rechargeable battery kit	120 VAC for North America Only; charger, four NiMh batteries, AC & DC cords [Part # 020-0103]
Low Battery	Low battery indication with nominal 1 hour of life left
Protection against misconnection	Over-voltage protection to 60V dc (rated for 30 seconds)
Display	High contrast graphic liquid crystal display. LED backlighting for use in low lit areas.

### Source

Output Impedance	< 0.3 Ohms
Source Current	> 20 mA (drives 80 mV into 10 Ohms)
Noise	$\leq 4 \text{ microvolts p-p}$ for frequencies of 10 Hz or below

## 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

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.

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## Ranges & Accuracies

T/C Type	Degrees C Range	Accuracy	Degrees F Range	Accuracy	T/C Material	ISA/ANSI Color
J	-200.0 to -180.0	±0.5°	-346.0 to -292.0	±0.9°	+Iron -Constantan Jacket	White Red Black
	-180.0 to -50.0	±0.4°	-292.0 to -58.0	±0.7°		
	-50.0 to 500.0	±0.3°	-58.0 to 932.0	±0.5°		
	500.0 to 1200.0	±0.4°	932.0 to 2192.0	±0.7°		
K	-230.0 to -100.0	±0.8°	-382.0 to -148.0	±1.4°	+Chromel® -Alumel® Jacket	Yellow Red Yellow
	-100.0 to 1050.0	±0.4°	-148.0 to 1922.0	±0.7°		
	1050.0 to 1371.1	±0.5°	1922.0 to 2500.0	±0.9°		
T	-260.0 to -200.0	±1.2°	-436.0 to -328.0	±2.2°	+Copper -Constantan Jacket	Blue Red Blue
	-200.0 to -50.0	±0.7°	-328.0 to -58.0	±1.3°		
	-50.0 to 0.0	±0.4°	-58.0 to 32.0	±0.7°		
	0.0 to 400.0	±0.3°	32.0 to 752.0	±0.5°		
E	-240.0 to -200.0	±0.6°	-400.0 to -328.0	±1.1°	+Chromel -Constantan Jacket	Purple Red Purple
	-200.0 to -100.0	±0.4°	-328.0 to -148.0	±0.7°		
	-100.0 to 850.0	±0.3°	-148.0 to 1562.0	±0.5°		
	850.0 to 1000.0	±0.4°	1562.0 to 1832.0	±0.7°		
R	-13.3 to 250.0	±1.4°	-1.0 to 482.0	±2.5°	+Pt/13Rh -Platinum Jacket	Black Red Green
	250.0 to 750.0	±0.8°	482.0 to 1382.0	±1.4°		
	750.0 to 1600.0	±0.7°	1382.0 to 2192.0	±1.3°		
	1600.0 to 1767.8	±0.8°	2192.0 to 3214.0	±1.4°		
S	-18.3 to 100.0	±1.4°	-1.0 to 212.0	±2.5°	+Pt/10Rh -Platinum Jacket	Black Red Green
	100.0 to 400.0	±1.0°	212.0 to 752.0	±1.8°		
	400.0 to 1700.0	±0.8°	752.0 to 3092.0	±1.4°		
	1700.0 to 1767.8	±0.9°	3092.0 to 3214.0	±1.6°		
B	315.6 to 550.0	±2.0°	600 to 1022.0	±3.6°	+Pt/30Rh -Pt/6Rh Jacket	Grey Red Grey
	550.0 to 900.0	±1.3°	1022.0 to 1652.0	±2.3°		
	900.0 to 1150.0	±0.9°	1652.0 to 2102.0	±1.6°		
	1150.0 to 1820.0	±0.8°	2102.0 to 3308.0	±1.5°		

(Cold Junction Accuracy not included)

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## Ranges & Accuracies

T/C Type	Degrees C Range	Accuracy	Degrees F Range	Accuracy	T/C Material	ISA/ANSI Color
N	-230.0 to -180.0	±1.2°	-382.0 to -292.0	±2.2°	+Nicrosil -Nisil Jacket	Orange Red Orange
	-180.0 to -50.0	±0.7°	-292.0 to -58.0	±1.3°		
	-50.0 to 1100.0	±0.4°	-58.0 to 2012.0	±0.7°		
	1100.0 to 1300.0	±0.5°	2012.0 to 2372.0	±0.9°		
G (W)	100.0 to 150.0	±1.4°	212.0 to 302.0	±2.5°	+Tungsten -W26/Re Jacket	White Red White/Blue
	150.0 to 400.0	±1.0°	302.0 to 752.0	±1.8°		
	400.0 to 1700.0	±0.6°	752.0 to 3092.0	±1.1°		
	1700.0 to 2320.0	±0.9°	3092.0 to 4208.0	±1.6°		
C (W5)	-1.1 to 1500	±0.7°	30.0 to 2372.0	±1.3°	+W5/Re -W26/Re Jacket	White Red White/Red
	1500 to 1900	±0.8°	2372.0 to 3452.0	±1.4°		
	1900.0 to 2100.0	±0.9°	3452.0 to 3812.0	±1.6°		
	2100.0 to 2320.0	±1.1°	3812.0 to 4208.0	±2.0°		
D	-1.0 to 50.0	±0.8°	30.0 to 122.0	±1.4°	+W3/Re -W25/Re Jacket	White Red White/Yellow
	50.0 to 1400.0	±0.6°	122.0 to 2552.0	±1.3°		
	1400.0 to 1800.0	±0.7°	2552.0 to 3272.0	±1.3°		
	1800.0 to 2320.0	±1.1°	3272.0 to 4208.0	±2.0°		
P Platinel®	-217.8 to -150.0	±0.8°	-360.0 to -238.0	±1.4°	+Pd55/Pt31/Au14 -Au65/Pd35 Jacket	Yellow Red Black
	-150.0 to -50.0	±0.6°	-238.0 to -58.0	±1.1°		
	-50.0 to 1000.0	±0.4°	-58.0 to 1832.0	±0.7°		
	1000.0 to 1395.0	±0.5°	1832.0 to 2543.0	±0.9°		
<b>DIN Colors</b>						
L J-DIN	-200.0 to -50.0	±0.4°	-328.0 to -58.0	±0.7°	+Iron -Constantan Jacket	Red Blue Blue
	-50.0 to 500.0	±0.3°	-58.0 to 932.0	±0.5°		
	500.0 to 750.0	±0.4°	932.0 to 1382.0	±0.7°		
U T-DIN	-200.0 to -75.0	±0.5°	-328.0 to -103.0	±0.9°	+Copper -Constantan Jacket	Red Brown Brown
	-75.0 to 100.0	±0.4°	-103.0 to 212.0	±0.7°		
	100.0 to 600.0	±0.3°	212.0 to 1112.0	±0.5°		

(Cold Junction Accuracy not included)

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## Ordering Information

**PIECAL 520B** (Choose one of the ordering codes below):

PIECAL 520B-J	PIECAL 520B-G
PIECAL 520B-K	PIECAL 520B-C
PIECAL 520B-T	PIECAL 520B-D
PIECAL 520B-E	PIECAL 520B-N
PIECAL 520B-R	PIECAL 520B-L
PIECAL 520B-S	PIECAL 520B-U
PIECAL 520B-B	PIECAL 520B-P

**PIECAL 521B:**

Includes all fourteen T/C Types listed above

## Accessories

### Included:

	<b>Part Number</b>
Four "AA" Alkaline batteries, Certificate of Calibration	
Evolution mV Wire Kit	020-0207
1 Red & 1 Black Lead with Retractable Shield Banana Plugs & Alligator Clips	

### Optional:

	<b>Part Number</b>
T/C Wire Kit 1 for Types J, K, T & E (for PIECAL 521)	020-0202
T/C Wire Kit 2 for Types B, R/S & N (for PIECAL 521)	020-0203
Individual T/C wire (for PIECAL 520B)	020-0210-*
*Insert T/C Type J, K, T, E, N, R/S or B	
Three feet (1 meter) of T/C extension wire, stripped on one end with a miniature T/C male connector on the other end	
Rubber Boot	020-0209
Small Carrying Case with PIE Logo (fits unit with or without boot)	020-0205
Ni-MH 1 Hour Charger with 4 Ni-MH AA Batteries (100-120 V AC input for North America Only)	020-0103



### More Than a Simple Boot

The optional boot provides more than just protection. Flip out the tilt stand and free up both hands for calibration adjustments.

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