



PIE 422Plus

Diagnostic Thermocouple & Milliamp Calibrator

- **Easy to use**

With the PIE 422Plus you can check & calibrate all your thermocouple instruments, measure thermocouple Sensors, and calibrate 4 to 20 milliamp instruments. Automatic indication of connections on the display for simple hookups. Calibrate all your 4 to 20 milliamp instruments with the built-in milliamp calibrator.

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

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

- **Calibrate directly in temperature (°C & °F)**

Stop carrying around a millivolt source and thermocouple tables. The PIECAL 422Plus 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). 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. Or calibrate from -13.000 to +80.000 mV.

- **Checkout all your 4 to 20 mA loops & instruments**

With the built-in milliamp calibrator you can check, calibrate and measure all your current signal instruments in a 4 to 20 milliamp DC loop. It can be used at any access point in your loop. Source & Read 0.000 to 24.000 mA, Simulate a 2 Wire Transmitter or use the PIE 422Plus to simultaneously power your 2 Wire RTD Transmitter and measure its output while simulating the RTD sensor input. Powers HART™ transmitters with built-in 250 ohm resistor simplifying hookups with HART communicators.

- **Troubleshoot loop problems**

Quickly diagnose ground fault and current leakage with the patented loop diagnostic technology (US Patent# 7,248,058).

- **Fast calibration with automatic output stepping**

Choose between 2, 3, 5, 11 and 21 steps to automatically increment the output in 100%, 50%, 25%, 10% or 5% of span. Select the step time to match your system from 5, 6, 7, 8, 9, 10, 15, 20, 25, 30 and 60 seconds.

- **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. It has an extremely stable voltage reference and low drift components which make it more accurate than most other handheld & benchtop thermocouple calibrators.

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

The PIECAL 422 meets or exceeds the requirement of AMS 2750 as a Field Test Instrument.

- **Measure thermocouple sensors**

Connect your thermocouple and the PIE 422Plus measures the probe in degrees C or F. Secondary display shows the millivolt value corresponding to the thermocouple temperature.

- **Evolutionary design**

PIE 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 422Plus improves upon other brands by including a rubber boot, tilt stand, backlit display with larger digits, rugged switches and a battery compartment for fast battery changes.

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



Actual Size



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Ground Leak Detection

Have you ever replaced a “faulty” transmitter only to find the problem was somewhere else in the loop? And did you end up throwing the transmitter away after you fixed the other problem “just in case” the transmitter was faulty?

If you find a loop where the transmitter is calibrated correctly but all the readings elsewhere in the loop have a fixed offset this is due to a *Zero Shift*. This zero shift is typically caused by some current in the loop bypassing the transmitter. This might be caused by ground faults, moisture or corrosion.

If you have some loops that are erratic after it rains there may be moisture present in a junction box or where insulation has broken down. Turn on Ground Leak Detection and use the PIE 422Plus to power up the loop. Any current that isn't controlled by the transmitter or other current control element will be indicated as leakage on the PIE 422Plus display.

The PIE 422Plus powers up the 2-Wire transmitter or loop and indicates the total current and the uncontrolled current. This provides information useful in troubleshooting loop errors.

Using Ground Leak Detection

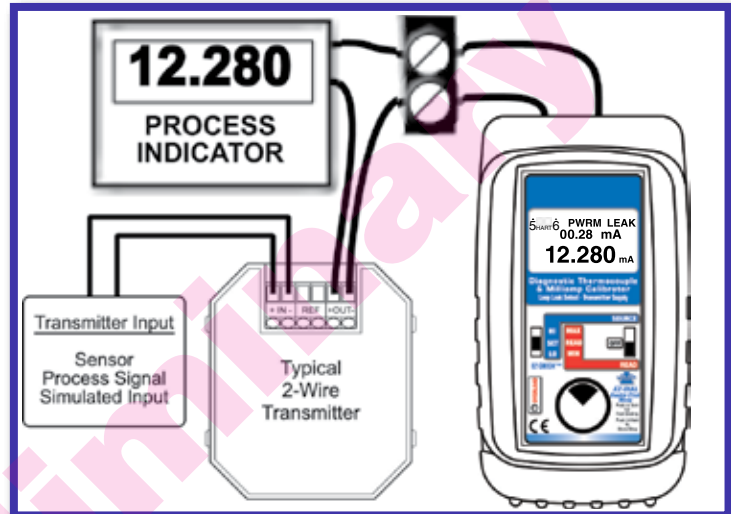
mA OUT, % OUT (Percent of 4 to 20 mA)

Find current leaks in loops caused by ground faults, moisture or corrosion. The 422Plus simultaneously supplies power to a 2 Wire Transmitter (or loop with a transmitter) while displaying the 4 to 20 mA output and the amount of current leaking in the loop.

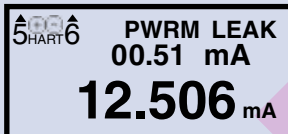
Disconnect one or both input wires from the device to be calibrated and connect the red source lead of the PIE 422Plus to the plus (+) input of the device and the black source lead to the minus (-).

The PIE 422Plus supplies a nominal 24 volts DC at 24 mA to the 2 Wire Transmitter or loop. The current passed by the transmitter will be accurately displayed by the PIE 422Plus along with an indication of leakage current on the display. If there is an uncontrolled loop, a transmitter with upscale burnout, bad or missing sensor or a short the display shows “OVER RANGE” and the red OVERLOAD LED will flash.

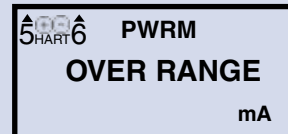
Note: Many installed transmitters will normally indicate 0.01 to 0.10 mA leakage without significant control problem. Unstable readings may indicate loose connections or the presence of moisture.



Typical Error Conditions



The PIE 422Plus is supplying the loop voltage. A calibrated transmitter is limiting the loop current to 12.00 mA. An additional 0.51 mA is not controlled by the transmitter and is leaking somewhere in the loop.



The PIE 422Plus is supplying the loop voltage. There is a control loop error. This may be a transmitter (set for upscale burnout) with a bad or missing sensor, or a short in the loop. The red ERROR LED will also flash.

Calibrate 2 Wire Transmitters

• Power & measure 2 wire transmitters

The 422Plus can simultaneously simulate the temperature, frequency, pH or pressure input to a transmitter while outputting 24V DC to power the transmitter using the internal batteries and internal switching power supply while displaying the output of the 2 Wire Transmitter. Powers HART™ transmitters with built-in 250 ohm resistor simplifying hookups with HART communicators.

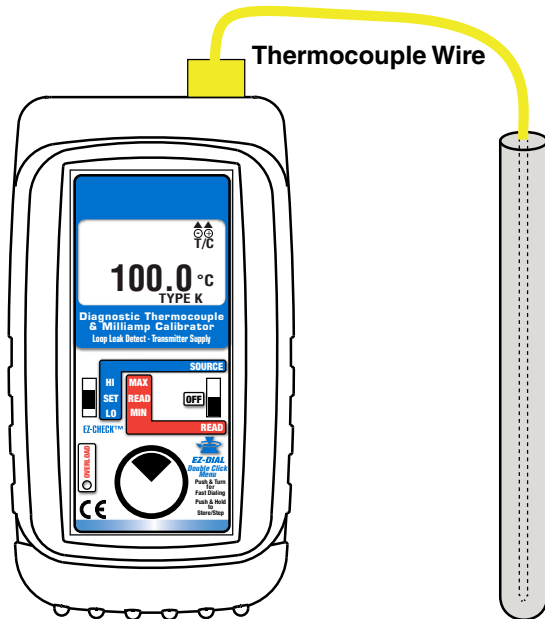
With LEAK DETECT enabled the 422Plus indicates when there is a ground fault in the loop or an internal problem with the transmitter allowing unregulated current to pass through causing offsets in the loop current.



Reading Thermocouple Sensors

READ

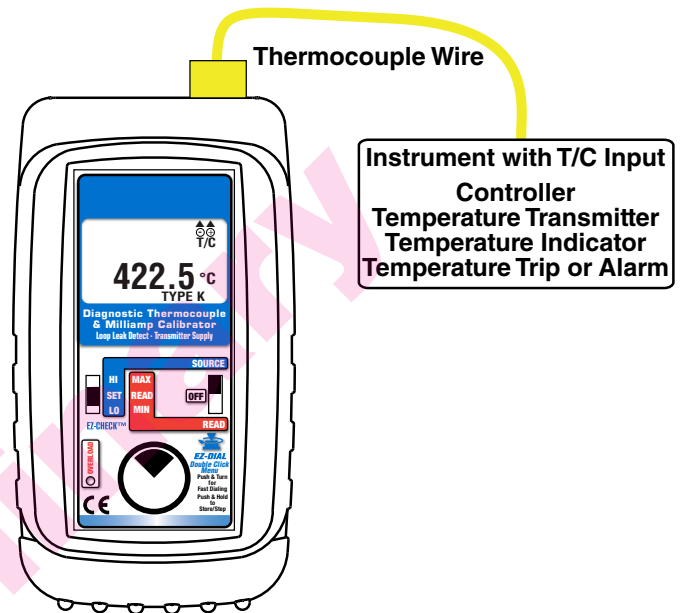
Choose this function to measure temperatures with a thermocouple probe or sensor.



Calibrating Thermocouple Instruments

SOURCE

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



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 422Plus 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.



PIE 422Plus Specifications

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

General	
Operating Temperature Range	-25 to 60 °C (-10 to 140 °F)
Relative Humidity Range	10 % ≤RH ≤90 % (0 to 35 °C), Non-condensing 10 % ≤RH ≤ 70 % (35 to 60 °C), Non-condensing
Temperature Drift	± 0.01% of span outside of 23°C ±10 °C (73°C ±18 °F)
Size	5.63 x 3.00 x 1.60 in, 143 x 76 x 41 mm (L x W x H)
Weight	12.1 ounces, 0.34 kg (including boot & batteries)
Batteries	Four "AA" Alkaline 1.5V (LR6)
Battery Life	50 Hours thermocouple, XX Hours milliamp
Isolation: Voltage	60V rms between all milliamp functions/Read V DC and Source V DC/Thermocouple
Normal Mode Rejection	50/60 Hz, 50 dB
Common Mode Rejection	50/60 Hz, 120 dB
Optional NiMh Rechargeable battery kit	Charger, four NiMh batteries [Part # 020-0103]
Low Battery	Low battery indication with nominal 1 hour of operation left
Protection against misconnection	Over-voltage protection to 60 V dc (rated for 30 seconds)
Display	High contrast graphic liquid crystal display. LED backlighting for use in low lit areas.

Source Thermocouple	
Accuracy	±(0.008% of Reading + 0.006 mV)
Cold Junction Compensation	± 0.09°F (±0.05 °C) - Thermistor traceable to NIST for 11 years
Millivolt Range	-13.000 to 80.000 mV
Output Impedance	< 0.3 Ohms
Source Current	> 20 mA (drives 80 mV into 10 Ohms)
Noise	≤ 4 microvolts p-p for frequencies of 10 Hz or below

Read Thermocouple	
Accuracy	±(0.008% of Reading + 0.006 mV)
Cold Junction Compensation	± 0.09°F (±0.05 °C) - Thermistor traceable to NIST for 11 years
Millivolt Range	-13.000 to 80.000 mV
Input Impedance	> 10 Megohms
Open Thermocouple Threshold Pulse	10,000 Ohms nominal < 10 microamp pulse for 400 milliseconds
Normal Mode Rejection	50/60 Hz, 50 dB
Common Mode Rejection	50/60 Hz, 120 dB

Read mA	
Ranges and Resolution	0.000 to 24.000 mA or -25.00 to 125.00% of 4-20 mA
Accuracy	≤ ± (0.02 % of Reading + 0.003 mA)
Voltage burden	≤ 2V at 24 mA
Overload/Current limit protection	25 mA nominal

Source mA / Power & Measure Two Wire Transmitters & PWRM LEAK	
Ranges and Resolution	0.000 to 24.000 mA or -25.00 to 125.00% of 4-20 mA
Accuracy	≤ ± (0.02 % of Reading + 0.003 mA)
Loop compliance voltage	≥ 24 DCV @ 20.00mA
Loop drive capability	1200 Ω at 20 mA for 15 hours nominal; 950 Ω with Hart Resistor or leak detection running

mA 2-Wire Transmitter Simulation	
Accuracy	Same as Source/Power & Measure
Voltage burden	≤ 2V at 20 mA
Overload/Current limit protection	24 mA nominal
Loop voltage limits	2 to 60 VDC (fuse-less protected from reverse polarity connections)

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.

Accessories

Included:

Rubber Boot, Four "AA" Alkaline batteries, Certificate of Calibration
 Deluxe Hands Free Carrying Case Part No. 020-0211
 Standard Test Leads (Included with calibrator) Part No. 020-0207
 Three feet (1 meter) of wire with an alligator clip on one end and a banana plug on the other end.

Optional:

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.
 Magnetic Hanging Strap Part No. 020-0236
 Ni-MH Charger with 4 Ni-MH AA Batteries Part No. 020-0103

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.

Thermocouple Ranges & Accuracies

Based on \pm (0.008 % of Reading + 0.006 mV)

T/C	Degrees C Range	°C	Degrees F Range	°F	T/C Material
J	-200.0 to -180.0	$\pm 0.3^\circ$	-328.0 to -292.0	$\pm 0.5^\circ$	+Iron -Constantan
	-180.0 to -50.0	$\pm 0.2^\circ$	-292.0 to -58.0	$\pm 0.4^\circ$	
	-50.0 to 500.0	$\pm 0.1^\circ$	-58.0 to 932.0	$\pm 0.2^\circ$	
	500.0 to 1200.0	$\pm 0.2^\circ$	932.0 to 2192.0	$\pm 0.4^\circ$	
K	-230.0 to -100.0	$\pm 0.6^\circ$	-382.0 to -148.0	$\pm 1.1^\circ$	+Chromel® -Alumel®
	-100.0 to 1050.0	$\pm 0.2^\circ$	-148.0 to 1922.0	$\pm 0.4^\circ$	
	1050.0 to 1371.1	$\pm 0.3^\circ$	1922.0 to 2500.0	$\pm 0.5^\circ$	
T	-260.0 to -200.0	$\pm 1.0^\circ$	-436.0 to -328.0	$\pm 1.8^\circ$	+Copper -Constantan
	-200.0 to -50.0	$\pm 0.5^\circ$	-328.0 to -58.0	$\pm 0.9^\circ$	
	-50.0 to 0.0	$\pm 0.2^\circ$	-58.0 to 32.0	$\pm 0.4^\circ$	
	0.0 to 400.0	$\pm 0.1^\circ$	32.0 to 752.0	$\pm 0.2^\circ$	
E	-240.0 to -200.0	$\pm 0.4^\circ$	-400.0 to -328.0	$\pm 0.7^\circ$	+Chromel -Constantan
	-200.0 to -100.0	$\pm 0.2^\circ$	-328.0 to -148.0	$\pm 0.4^\circ$	
	-100.0 to 850.0	$\pm 0.1^\circ$	-148.0 to 1562.0	$\pm 0.2^\circ$	
	850.0 to 1000.0	$\pm 0.2^\circ$	1562.0 to 1832.0	$\pm 0.4^\circ$	
R	-18.3 to 250.0	$\pm 1.2^\circ$	-1.0 to 482.0	$\pm 2.2^\circ$	+Pt/13Rh -Platinum
	250.0 to 750.0	$\pm 0.6^\circ$	482.0 to 1382.0	$\pm 1.1^\circ$	
	750.0 to 1600.0	$\pm 0.5^\circ$	1382.0 to 2192.0	$\pm 0.9^\circ$	
	1600.0 to 1767.8	$\pm 0.6^\circ$	2192.0 to 3214.0	$\pm 1.1^\circ$	
S	-18.3 to 100.0	$\pm 1.2^\circ$	-1.0 to 212.0	$\pm 2.1^\circ$	+Pt/10Rh -Platinum
	100.0 to 400.0	$\pm 0.8^\circ$	212.0 to 752.0	$\pm 1.4^\circ$	
	400.0 to 1700.0	$\pm 0.6^\circ$	752.0 to 3092.0	$\pm 1.1^\circ$	
	1700.0 to 1767.8	$\pm 0.7^\circ$	3092.0 to 3214.0	$\pm 1.3^\circ$	
B	315.6 to 550.0	$\pm 1.8^\circ$	600 to 1022.0	$\pm 3.2^\circ$	+Pt/30Rh -Pt/6Rh
	550.0 to 900.0	$\pm 1.1^\circ$	1022.0 to 1652.0	$\pm 2.0^\circ$	
	900.0 to 1150.0	$\pm 0.7^\circ$	1652.0 to 2102.0	$\pm 1.3^\circ$	
	1150.0 to 1820.0	$\pm 0.6^\circ$	2102.0 to 3308.0	$\pm 1.1^\circ$	

T/C	Degrees C Range	°C	Degrees F Range	°F	T/C Material
N	-230.0 to -180.0	$\pm 1.0^\circ$	-382.0 to -292.0	$\pm 1.8^\circ$	+Nicrosil -Nisil
	-180.0 to -50.0	$\pm 0.5^\circ$	-292.0 to -58.0	$\pm 0.9^\circ$	
	-50.0 to 1100.0	$\pm 0.2^\circ$	-58.0 to 2012.0	$\pm 0.4^\circ$	
	1100.0 to 1300.0	$\pm 0.3^\circ$	2012.0 to 2372.0	$\pm 0.5^\circ$	
G (W)	100.0 to 150.0	$\pm 1.2^\circ$	212.0 to 302.0	$\pm 2.2^\circ$	+Tungsten -W26/Re
	150.0 to 400.0	$\pm 0.8^\circ$	302.0 to 752.0	$\pm 1.4^\circ$	
	400.0 to 1700.0	$\pm 0.4^\circ$	752.0 to 3092.0	$\pm 0.7^\circ$	
	1700.0 to 2320.0	$\pm 0.7^\circ$	3092.0 to 4208.0	$\pm 1.3^\circ$	
C (W5)	-1.1 to 1500	$\pm 0.5^\circ$	30.0 to 2372.0	$\pm 0.9^\circ$	+W5/Re -W26/Re
	1500 to 1900	$\pm 0.6^\circ$	2372.0 to 3452.0	$\pm 101^\circ$	
	1900.0 to 2100.0	$\pm 0.7^\circ$	3452.0 to 3812.0	$\pm 1.3^\circ$	
	2100.0 to 2320.0	$\pm 0.9^\circ$	3812.0 to 4208.0	$\pm 1.6^\circ$	
D (W3)	-1.1 to 50.0	$\pm 0.6^\circ$	30.0 to 122.0	$\pm 1.1^\circ$	+W3/Re -W25/Re
	50.0 to 1400.0	$\pm 0.4^\circ$	122.0 to 2552.0	$\pm 0.7^\circ$	
	1400.0 to 1800.0	$\pm 0.5^\circ$	2552.0 to 3272.0	$\pm 0.9^\circ$	
	1800.0 to 2320.0	$\pm 0.9^\circ$	3272.0 to 4208.0	$\pm 1.6^\circ$	
P <small>Platinel®</small>	0.0 to 1000.0	$\pm 0.2^\circ$	32.0 to 1832.0	$\pm 0.4^\circ$	+Pd55/Pt31/Au14 -Au65/Pd35
	1000.0 to 1395.0	$\pm 0.3^\circ$	1832.0 to 2543.0	$\pm 0.5^\circ$	
DIN Colors					
L J-DIN	-200.0 to -50.0	$\pm 0.2^\circ$	-328.0 to -58.0	$\pm 0.4^\circ$	+Iron -Constantan
	-50.0 to 500.0	$\pm 0.1^\circ$	-58.0 to 932.0	$\pm 0.2^\circ$	
	500.0 to 900.0	$\pm 0.2^\circ$	932.0 to 1652.0	$\pm 0.4^\circ$	
U T-DIN	-200.0 to -75.0	$\pm 0.3^\circ$	-328.0 to -103.0	$\pm 0.5^\circ$	+Copper -Constantan
	-75.0 to 100.0	$\pm 0.2^\circ$	-103.0 to 212.0	$\pm 0.4^\circ$	
	100.0 to 600.0	$\pm 0.1^\circ$	212.0 to 1112.0	$\pm 0.2^\circ$	

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



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