PIE 311 Plus
Diagnostic RTD & Milliamp Calibrator

Best RTD & Milliamp Calibrator on the market!

- **The only 2-in-1 *full function* RTD & Milliamp calibrator on the market**
  Only calibrator that combines ALL the functions of a diagnostic milliamp calibrator with the accuracy of a laboratory RTD calibrator.

- **Protect instruments & technicians from potentially dangerous catastrophic failures due to hidden loop problems**
  Quickly diagnose ground fault and current leakage often caused by water in conduits and junction boxes with patented loop diagnostic technology (US Patent# 7,248,058).

- **Compatible with ALL process instruments**
  No competitor's calibrator is compatible with as many process instruments! Connect directly to the RTD inputs of smart transmitters, PLCs, DCS and multichannel recorders and verify their outputs or displays.

- **Troubleshoot RTD sensors**
  Troubleshoot sensor connections and find broken wires with patented technology. Connect your two, three or four wire RTDs and the PIE 311Plus automatically detects the connections. Secondary display shows the resistance value corresponding to the RTD temperature.

- **Half the size of the closest competitor & easiest to use**
  Fits the palm of your hand like a cell phone and weighs less than a pound. Automatic indication of connections on the display for simple hookups. Carry it without worry - it comes protected with a rubber boot and rugged, low profile switches. Easy to operate even in dark areas of the plant with the backlit display.

Actual Size

Practical Instrument Electronics
Tel: 585.872.9350 • Fax: 585.872.2638 • sales@piecal.com • www.piecal.com

More functions and better accuracy in one calibrator

- **Two complete calibrators**

  Unlike any other combination RTD/milliamp calibrator on the market the PIE 311Plus includes a FULL function diagnostic milliamp calibrator that sources and reads 0.000 to 24.000 mA, simulates two wire transmitters, powers and measures transmitters with its internal 24V supply, has a built-in 250 ohm resistor for HART compatibility, and PIE's patented Ground Leak detection. Competitive calibrators allow you to calibrate temperature transmitters but don't have the ability to test other instruments in a 4 to 20 milliamp loop.

  The other half of the calibrator sources and reads 12 RTD Sensors for Platinum 10, 50, 100, 200, 500 & 1000 (alpha = 3850); Platinum 100 Ohm (alpha=3902, 3916, 3926); Copper 10 & 50 Ohm, and Nickel 120 Ohm.

- **Protect instruments & technicians from potentially dangerous catastrophic failures due to hidden loop problems**

  It's important to find hidden loop problems BEFORE they become cause product problems or catastrophic failures. Only PIE Calibrators have Ground Leak Detection that can detect these problems.

  Some technicians routinely check their critical loops for ground faults and current leaks using PIE's Ground Leak detection as part of their preventative maintenance programs. When a significant leak or fault is detected it is located and fixed before catastrophic failures occur.

  Sometimes the control room detects a problem that isn't fixed with routine calibration of the instruments. The technician then reaches for a calibrator with Ground Leak Detection to power up the loop and confirm that the issue is hiding somewhere in the loop wiring.

- **Compatible with ALL process instruments**

  Calibrating smart transmitters and PLCs is a problem for many electronic RTD calibrators. These instruments measure RTD sensors with a pulsed excitation current that is too fast for many calibrators to lock onto which causes errors in calibration. The PIE 311Plus has unique circuitry designed to accurately calibrate smart and multivariable transmitters, PLC inputs, and multichannel recorders. PIE guarantees compatibility with all RTD instruments.

- **Troubleshoot RTD sensors**

  When you have an RTD input problem that is difficult to diagnose the PIE 311Plus makes it easy. When the PIE 311Plus is connected directly to the RTD sensor it will indicate on the display which wires are connected. This quickly points out if there is problem with the wiring or with the sensor itself. If no problem is found with the sensor connect the 311Plus to the sensor input connections on the instrument to see if it is working properly. Secondary displays show you the resistance value of the RTD plus the magnitude and direction of the excitation current used by the instrument to measure an RTD sensor. If no excitation current is detected there is a problem with the instrument.

- **Half the size of the closest competitor & easiest to use**

  Don't get tired by lugging around heavy oversized test equipment when you can carry the palm sized PIE 311Plus that weighs less than a pound. It comes with a deluxe carrying case for simple, hands free operation. The simple and intuitive double click menu and EZ-Check switch are faster and easier to use than a calibrator with lots of confusing buttons or with confusing menus. And with the optional magnet strap you can attach it to a panel or loop the strap around a conduit or pipe.

  Many calibrators don't have automatic stepping and ramping while others limit you to selecting either slow or fast fixed 25% steps. The PIE 311Plus lets you 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.

Prevent Small Problems from Becoming Major Plant Failures

The PIE 311Plus offers powerful troubleshooting tools that offer visibility to the health of your loop that is not possible with any calibrator brand on the market. Ground Leak Detection allows technicians to find and fix undetected problems before they cause quality issues or become catastrophic failures - ending in poor product, injury, loss of life, or equipment damage. Common loop problems caused by moisture, corrosion and contamination left unchecked can lead to dangerous conditions that are easily avoided with the innovation technology in the PIE 311Plus.

Even the most common small errors caused by loop wiring issues can lead to inferior product, lost production time and risk to personnel. Intrinsically safe loops are protected by barriers only against extreme overvoltage and over current conditions but allowing small but significant ground faults to go undetected. PIE's unique and powerful Ground Leak Detection technology quickly and easily finds a fault that would otherwise go undetected. These undetected faults could lead to potentially disastrous outcomes.

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 of the current in the loop bypassing the transmitter. 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.

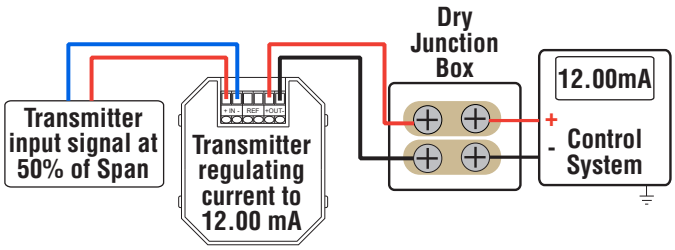
Only a PIE Calibrator with patented Ground Leak Detection can find all these hidden problems. Turn on Ground Leak Detection and use the PIE 422Plus to power up the loop. Any current that isn't controlled by the transmitter or other current control element will be clearly indicated as leakage on the PIE 311Plus display.

Ground Leak detection allows technicians to troubleshoot loop problems with ease and confidence - minimizing risk and maximizing process uptime.

Hidden Problem Found with Ground Leak Detection

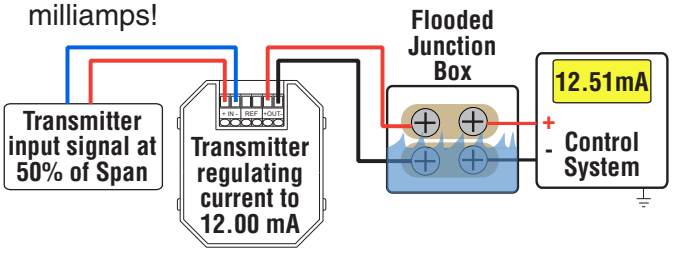
Safe loop

Sealed junction box is dry and the control system is operating within parameters.



Dangerous loop

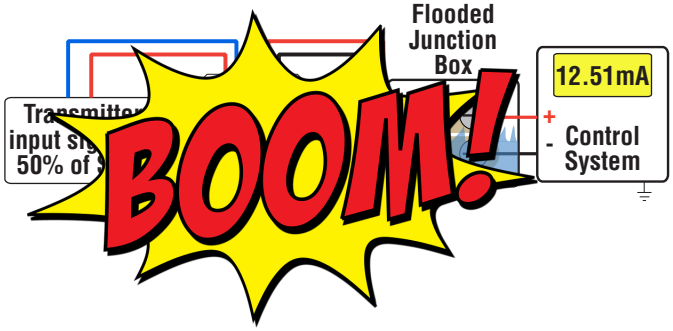
Sealed junction box is wet* and the control system is operating with a fixed offset of 0.51 milliamps!



* The value of the current leak increases when the water in the junction box is contaminated with rust, salt or process chemicals.

Dangerous loop left undetected

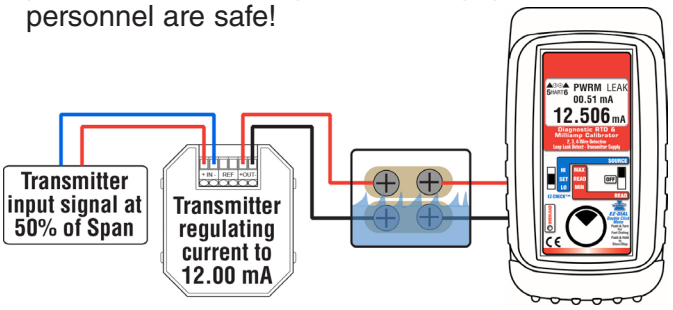
The flooded junction box goes undetected and the control system potentially goes further out of control until...



OR

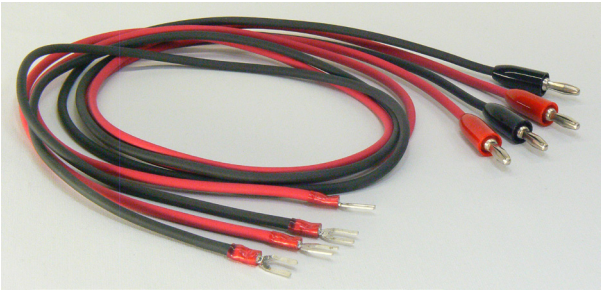
Disaster averted

Hidden problem is detected by the PIE 311Plus. The flooded sealed junction box is emptied and the control system is once again operating within parameters. The product, equipment, and personnel are safe!



Accessories

Deluxe Hands Free Carrying Case (Included)



Evolution RTD Test Leads (Included)

Magnetic Hanging Strap (Optional)

Included:
Red Rubber Boot, Four "AA" Alkaline batteries, Certificate of Calibration

Deluxe Hands Free Carrying Case	Part No. 020-0211
Evolution RTD Wire Kit	Part No. 020-0206
2 Red & 2 Black Leads with Banana Plugs & Spade Lugs	

Optional:

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

PIE 311Plus 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	25 Hours RTD, 8 Hours milliamp
Isolation: Voltage	60V rms between all milliamp functions and Source/ Read RTD/Ohms
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.

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)

Read Ohms & RTD	
3 Wire & 4 Wire Accuracy 2 Wire Accuracy	±(0.015% of Reading + 0.05 Ohms) ±(0.015% of Reading + 0.15 Ohms)
Resistance Ranges	0.00 to 401.00, 0.0 to 4010.0 Ohms
Excitation Current	0.9 mA to 401 Ohms, 0.4 mA to 4010 Ohms (nominal)

Source Ohms & RTD	
3 & 4 Wire Accuracy From 1 to 10.2 mA External Excitation Current	±(0.015% of Reading + 0.05 Ohms)
Below 1 mA of External Excitation Current	$\pm(0.015\% \text{ of Rdg} + \frac{0.025 \text{ mV}}{\text{mA Excitation Current}} + 0.05 \text{ Ohms})$
2 Wire Accuracy	Add 0.1 Ohms to 3 Wire & 4 Wire Accuracy
Resistance Ranges	0.00 to 401.00, 0.0 to 4010.0 Ohms
Allowable Excitation Current Range	0 to 400 Ohm: 10.2 mA max; steady or pulsed/intermittent 401 to 4000 Ohms: 1 mA max; steady or pulsed/intermittent
Pulsed Excitation Current Compatibility	DC to 0.01 second pulse width

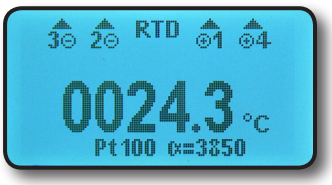
RTD Ranges & Accuracies

Table based on 3 & 4 Wire RTD Accuracy:
≤ ± (0.015 % of Reading +0.05 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 -150.00 to 360.00 360.00 to 740.00 740.00 to 850.00	±0.1° ±0.2° ±0.3° ±0.4°	-328.0 to -238.00 -238.00 to 660.00 660.00 to 1364.00 1364.00 to 1562.00	±0.2° ±0.4° ±0.6° ±0.7°
Pt 10 Ohm DIN/IEC/JIS 1989 Based on ITS-90	1.3850 (0.00385)	-200.00 to -120.00 -120.0 to 210.00 210.00 to 370.00 370.00 to 650.00 650.00 to 850.00	±1.2° ±1.4° ±1.5° ±1.7° ±1.9°	-328.00 to -184.00 -184.00 to 410.00 410.00 to 698.00 698.00 to 1202.00 1202.00 to 1562.00	±2.2° ±2.6° ±2.8° ±3.1° ±3.4°
Pt 50 Ohm DIN/IEC/JIS 1989 ITS-90	1.3850 (0.00385)	-200.00 to 200.00 200.00 to 550.00 550.00 to 850.00	±0.3° ±0.4° ±0.5°	-328.00 to 392.00 392.00 to 1022.00 1022.00 to 1562.00	±0.6° ±0.8° ±1.0°
Pt 200 Ohm DIN/IEC/JIS 1989 ITS-90	1.3850 (0.00385)	-200.00 to -120.00 -120.00 to 180.00 180.00 to 450.00 450.00 to 680.00 680.00 to 850.00	±0.1° ±0.1° ±0.2° ±0.2° ±0.3°	-328.00 to -184.00 -184.00 to 356.00 356.00 to 842.00 842.00 to 1256.00 1256.00 to 1562.00	±0.1° ±0.2° ±0.3° ±0.4° ±0.5°
Pt 500 Ohm DIN/IEC/JIS 1989 ITS-90	1.3850 (0.00385)	-200.00 to 90.00 90.00 to 390.00 390.00 to 660.00 660.00 to 850.00	±0.1° ±0.1° ±0.2° ±0.2°	-328.00 to 194.00 194.00 to 734.00 734.00 to 1220.00 1220.00 to 1562.00	±0.1° ±0.2° ±0.3° ±0.4°
Pt 1000 Ohm DIN/IEC/JIS 1989 ITS-90	1.3850 (0.00385)	-200.00 to 170.00 170.00 to 470.00 470.00 to 730.00 730.00 to 850.00	±0.1° ±0.1° ±0.2° ±0.2°	-328.00 to 338.00 338.00 to 878.00 878.00 to 1346.00 1346.00 to 1562.00	±0.1° ±0.2° ±0.3° ±0.4°
Pt 100 Ohm (Burns)	1.3902 (0.003902)	-195.61 to -100.00 -100.00 to 370.00 370.00 to 648.90	±0.1° ±0.2° ±0.3°	-320.10 to -148.00 -148.00 to 698.00 698.00 to 1200.00	±0.3° ±0.4° ±0.6°
Pt 100 Ohm (Old JIS 1981)	1.3916 (0.003916)	-200.00 to -140.00 -140.00 to 130.00 130.00 to 370.00 370.00 to 648.90	±0.1° ±0.2° ±0.2° ±0.3°	-328.00 to -220.00 -220.00 to 266.00 266.00 to 698.00 698.00 to 1200.00	±0.2° ±0.3° ±0.4° ±0.6°
Pt 100 Ohm (US Lab)	1.3926 (0.003926)	-200.00 to -140.00 -140.00 to 130.00 130.00 to 380.00 380.00 to 610.00 610.00 to 850.00	±0.1° ±0.2° ±0.2° ±0.3° ±0.4°	-328.00 to -220.00 -220.00 to 266.00 266.00 to 716.00 716.00 to 1130.00 1130.00 to 1562.00	±0.2° ±0.3° ±0.4° ±0.5° ±0.7°
Copper 10 Ohm (Minco)	1.4274 (0.004274)	-200.00 to -150.00 -150.00 to 90.00 90.00 to 260.00	±1.2° ±1.3° ±1.4°	-328.00 to -238.00 -238.00 to 194.00 194.00 to 500.00	±2.2° ±2.4° ±2.4°
Copper 50 Ohm	1.4280 (0.00428)	-50.00 to 150.00	±0.3°	-58.00 to 302.00	±0.5°
Ni 120 Ohm (Pure)	1.6720 (0.00672)	-80.00 to 260.00	±0.1°	-112.00 to 500.00	±0.2°

Problem found with RTD Sensor Wiring

Here is an example of the PIE 311Plus reading a sensor with all 4 wires connected.



Here is an example where connections are made to a 4 wire sensor and the 311Plus 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 311Plus.

Only a calibrator with PIE's patented 2, 3 & 4 wire detection makes troubleshooting sensor wiring quick, easy and automatic. This is much simpler and faster than going through the process of testing each pair of wires to figure out which, if any, connection is loose or which wire is broken.

Additional Information

PIE Calibrators are designed, assembled, and calibrated 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.

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.

Practical Instrument Electronics

Tel: 585.872.9350 • Fax: 585.872.2638
sales@piecal.com • www.piecal.com

Copyright © 2019 All rights reserved 311Plus-9001 - Rev C 10 October 2019

Available From: