



PIE 311+Plus

Diagnostic RTD & Milliamp Calibrator

- **Easy to use**

With the PIE 311Plus you can check & calibrate all your RTD instruments, measure RTD 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 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 decade box and RTD resistance tables. The PIE 311Plus works with the RTDs you use including Platinum 100 (alpha = 3850, 3902, 3926) & 1000 (alpha = 3850, 3750) Ohm, Copper 10 & 50 Ohm, and Nickel 120 Ohm. Easily set any value quickly to within 0.1° with the adjustable digital potentiometer "EZ-DIAL" plus store any three temperatures for instant recall with the EZ-CHECK™ switch. Or use like a decade box from 0.00 to 410.00 and from 0.0 to 4001.0 Ohms.

- **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 311Plus 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.

- **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. Works with older instruments with fixed excitation currents and newer multichannel instruments that switch the excitation current between input channels.

- **Measure RTD sensors**

Trouble shoot 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 and measures the RTD in degrees C or F. Secondary display shows the resistance value corresponding to the RTD 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 311Plus 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 311Plus 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 311Plus display.

The PIE 311Plus 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

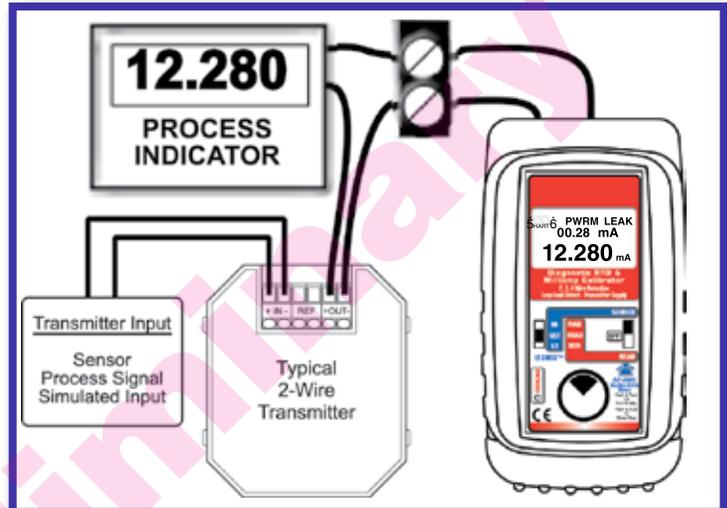
mA OUT, % OUT (Percent of 4 to 20 mA)

Find current leaks in loops caused by ground faults, moisture or corrosion. The 311Plus 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.

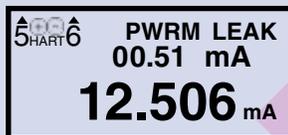
Disconnect one or both input wires from the device to be calibrated and connect the red source lead of the PIE 311Plus to the plus (+) input of the device and the black source lead to the minus (-).

The PIE 311Plus 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 311Plus 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 311Plus 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 311Plus 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 311Plus 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.

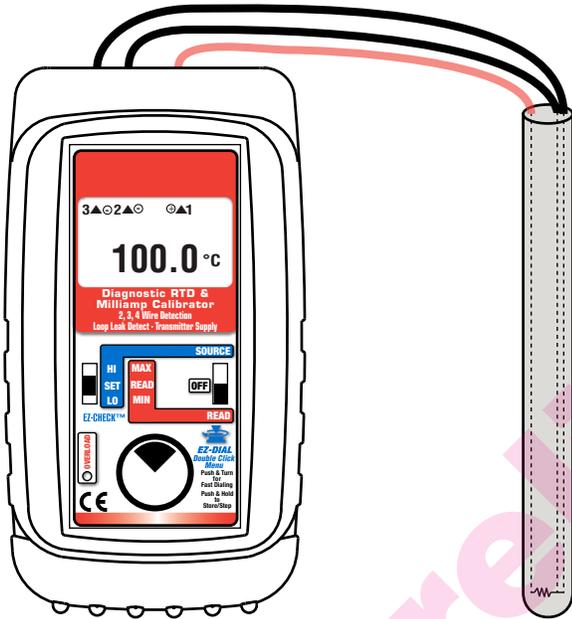
With LEAK DETECT enabled the 311Plus indicates when there is a ground fault in the loop or an internal problem with the transmitter allowing unregulated current to pass through causing offsets in the loop current.



Reading RTD Sensors

READ

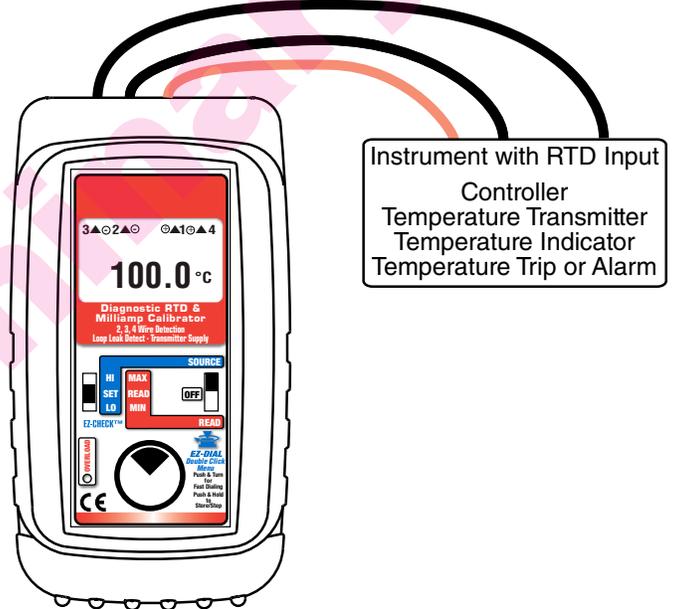
Choose this function to measure temperatures with an RTD probe or sensor.



Calibrating RTD Instruments

SOURCE

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

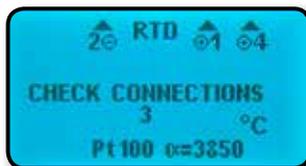


Troubleshooting RTD Sensors

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.



This is much simpler and quicker 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 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.

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:

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. 020-0208
2 Red & 2 Black Leads with Banana Plugs & Spade Lugs	
Evolution mA/V Wire Kit	Part No. 020-0207
1 Red & 1 Black Lead with Banana Plugs & Alligator Clips	

Optional:

Ni-MH 1 Hour Charger with 4 Ni-MH AA Batteries	Part No. 020-0103
Magnetic Hanging Strap	Part No. 020-0236

PIE 31 I Plus 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 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 60V 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	
Accuracy	±(0.015% of Reading + 0.05 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	±(0.015% of R _{dg} + $\frac{0.025 \text{ mV}}{\text{mA Excitation Current}}$ + 0.05 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

RTD Type	Alpha	Degrees C Range	°C	Degrees F Range	°F
Pt 100 Ohm DIN/IEC/JIS 1989 Based on ITS-90	1.3850 (0.00385)	-200.0 to -150.0	±0.1°	-328.0 to -238.0	±0.2°
		-150.0 to 360.0	±0.2°	-238.0 to 660.0	±0.4°
		360.0 to 740.0	±0.3°	660.0 to 1364.0	±0.6°
		740.0 to 850.0	±0.4°	1364.0 to 1562.0	±0.7°
Pt 100 Ohm (Burns)	1.3902 (0.003902)	-195.6 to -100.0	±0.1°	-320.1 to -148.0	±0.3°
		-100.0 to 370.0	±0.2°	-148.0 to 698.0	±0.4°
		370.0 to 648.9	±0.3°	698.0 to 1200.0	±0.6°
Pt 100 Ohm (Old JIS 1981)	1.3916 (0.003916)	-200.0 to -140.0	±0.1°	-328.0 to -220.0	±0.2°
		-140.0 to 130.0	±0.2°	-220.0 to 266.0	±0.3°
		130.0 to 370.0	±0.2°	266.0 to 698.0	±0.4°
		370.0 to 648.9	±0.3°	698.0 to 1200.0	±0.5°
Pt 100 Ohm (US Lab)	1.3926 (0.003926)	-200.0 to -140.0	±0.1°	-328.0 to -220.0	±0.2°
		-140.0 to 130.0	±0.2°	-220.0 to 266.0	±0.3°
		130.0 to 380.0	±0.2°	266.0 to 716.0	±0.4°
		380.0 to 610.0	±0.3°	716.0 to 1130.0	±0.5°
Pt 1000 Ohm DIN/IEC/JIS 1989	1.3850 (0.00385)	-200.0 to 170.0	±0.1°	-328.0 to 338.0	±0.2°
		170.0 to 470.0	±0.2°	338.0 to 878.0	±0.4°
		470.0 to 730.0	±0.2°	878.0 to 1346.0	±0.4°
		730.0 to 850.0	±0.3°	1346.0 to 1562.0	±0.5°
Pt 1000 Ohm Hy-Cal HVAC	1.3750 (0.00375)	-200.0 to 200.0	±0.2°	-328.0 to 392.0	±0.4°
		200.0 to 600.0	±0.3°	392.0 to 1112.0	±0.6°
		600.0 to 850.0	±0.4°	1112.0 to 1562.0	±0.7°
Copper 10 Ohm (Minco)	1.4274 (0.004274)	-200.0 to -150.0	±1.2°	-328.0 to -238.0	±2.2°
		-150.0 to 260.0	±1.4°	-238.0 to 500.0	±2.4°
Copper 50 Ohm	1.4280 (0.00428)	-50.0 to 150.0	±0.3°	-58.0 to 302.0	±0.5°
Ni 120 Ohm (Pure)	1.6720 (0.00672)	-80.0 to 260.0	±0.1°	-112.0 to 500.0	±0.2°

Available From:



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