

PIE 830

Process Calibrator

Loop Diagnostics • Transmitter Supply
mA • V • pH • TC • Ω • RTD • Freq • Pressure

Operating Instructions



CE



Practical Instrument Electronics

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Contents

General Operations

Accessories.....	3
Carrying Case, Boot & Changing Batteries	4
Storing EZ-CHECK Outputs & Connections	5

Basic Operation

Switches & Knobs.....	6, 7
MAIN Menu - Functions, Units & Ranges	8, 9
FEATURE Menu - Stepping & Ramping / Auto Off	10
FEATURE Menu - Stepping & Ramping / Backlight	11

Functions and Hookup Diagrams

2-Wire Transmitter Calibration

Simulate sensor while powering 2-Wire Transmitters.....	12, 13
---	--------

Universal Isolated Transmitter

Use the 830 to replace a 2-Wire Transmitter	14-17
---	-------

Milliamp

Simulate 2 Wire Transmitters.....	18, 19
Source mA, Read mA	20, 21
Power/Measure Transmitters	22
Using Ground Leak Detection.....	23, 24

Voltage & Millivolt

Source V & mV; Read V & mV	25, 26
----------------------------------	--------

pH

Source pH	27, 28
-----------------	--------

Thermocouple

Source T/C & Read T/C Sensors	29, 30
-------------------------------------	--------

Resistance

Source Resistance, Read Resistance & Continuity	31, 32
---	--------

RTD

Source RTD & Read RTD Sensors.....	33, 34
------------------------------------	--------

Frequency

Source KHz, Hz & CPM; Read KHz, Hz & CPM	35, 36
--	--------

Pressure

Read Pressure	37
Pressure Accessories.....	38
Pressure Module Ranges & Specifications.....	39

Specifications

General	40-44
Thermocouple Ranges & Accuracies.....	45-47
RTD Ranges & Accuracies	48

Warranty

Warranty & Additional Information	49
---	----

Get more tools in a smaller calibrator

Carry eight single function calibrators

plus a milliamp calibrator with loop supply

plus a loop troubleshooter in the palm of your hand!

*Milliamp • Voltage • Frequency • pH • Ohms
Thermocouples • RTDs • Pressure
Loop Diagnostics • Transmitter Supply*

1 Detect 'hidden' loop problems

Quickly diagnose troublesome ground faults & current leakage with patented Loop Diagnostic technology. These problems are undetectable with other instruments!

2 Check all loop parameters at once with LoopScope™

Simultaneously displays current, voltage and resistance to let you know the condition of a live loop. Finds problems with power supplies & loops with too many loads. Patented by PIE!

3 Automatically detect 2, 3, or 4 wire RTDs

Trouble shoot sensor connections and find broken wires with patented technology. LCD indicates which of the four wires are connected to an RTD sensor.

4 Swap out faulty transmitters to diagnose control issues

Easily setup the 830 as a universal isolated transmitter for Thermocouple, RTD, frequency, millivolt, resistance or pressure. If the loop is back under control you know the transmitter was faulty. Turn on the LoopScope to simultaneously see the loop current, loop voltage and loop loads for troubleshooting.

5 Troubleshoot wiring problems without a multimeter

Built in continuity checker with 'beeper' quickly finds broken wires or shorts in instrumentation wiring. Also handy for checking operation of relays and controller outputs.

The PIE Model 830 is more than a multifunction calibrator. It is also a loop detective that is able to diagnose common problems that other test equipment just can't find. Have a flooded junction box or unknown ground faults? Our Loop Diagnostic technology will detect it. Or use the *LoopScope* to see at a glance all the parameters - milliamps, voltage and resistance - in the loop.

Stop throwing away perfectly good transmitters only to find the problem is somewhere else in the loop. Setup the PIE Model 830 as an isolated universal transmitter and turn on the Loop Diagnostics. The display will tell you EXACTLY the sensor input, the current output and if there is any uncontrolled current in the loop due to a ground fault, corrosion bridge or moisture. If the control system sees no problem when the 830 is acting as a transmitter THEN you can replace the faulty transmitter. With RTDs the 830 automatically detects which of the 2, 3 or 4 wires are connected and unbroken quickly alerting you to a sensor problem. Diagnostic features are covered by US Patent #7,248,058.

Become a troubleshooting technician with Patented Diagnostic Technology - *Available only with PIE Calibrators!*

Accessories

INCLUDED:

Four "AA" Alkaline batteries, Certificate of Calibration	
Evolution Hands Free Carrying Case	Part No. 020-0211
Blue Rubber Boot	Part No. 020-0213
Test Leads - one pair with banana plug & alligator clips	Part No. 020-0207
Evolution RTD Wire Kit 2 Red & 2 Black Leads with Banana Plugs & Spade Lugs	Part No. 020-0208

OPTIONAL:

Ni-MH 1 Hour Charger with 4 Ni-MH AA Batteries (100-120 V AC input for North America Only)	Part No. 020-0103
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.

Operating Instructions

FIELD & BENCH USE

PIE 830 comes with a carrying case designed for hands-free operation and a rubber boot with a built-in tilt stand. The PIE 830 is held in the case by elastic straps for use with the carrying case open. The tilt stand is easily raised by pulling the stand until it locks into place.



CHANGING BATTERIES

Low battery is indicated by a battery symbol on the display. Approximately one to four hours of typical operation remain before the PIE 830 will automatically turn off. To change the batteries remove the rubber boot and 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 typical battery life and performance. Optional rechargeable batteries (charged externally) are available.

Operating Instructions

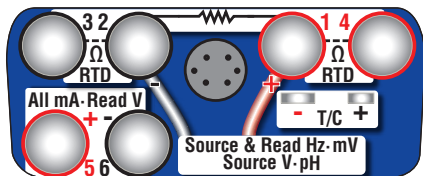
STORING HI and LO EZ-CHECK Source Outputs

Speed up your calibration by storing Span & Zero output setting for instant recall with the EZ-CHECK switch.

- 1) Store your high (SPAN) output temperature by moving the EZ-CHECK switch to the **HI** position and turning the EZ-Dial knob until the desired output value 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 value by moving the EZ-CHECK switch to the **LO** position and turning the EZ-Dial knob until the desired output value 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 output settings by moving the EZ-CHECK switch between HI and LO. You may also select any third output setting (such as mid-range) using the SET position on the EZ-CHECK switch.

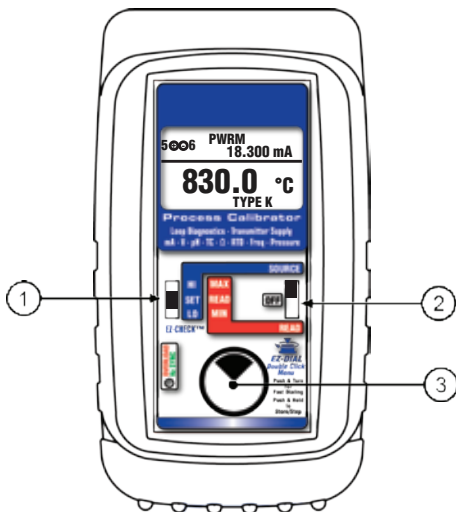
Connections

PIE 830 has banana jacks compatible with unshielded or retractable banana plugs. Included with your calibrator are a pair of test leads with alligator clips for mA, V, pH & Hz connections. Four test leads with spade lugs are also included for 2, 3 and 4 Wire RTD connections. Thermocouple connections are made through a miniature thermocouple socket.



Operating Instructions

Basic Operation



① EZ-CHECK™ SWITCH

SOURCE: Instantly output two preset settings by moving the EZ-CHECK™ switch to the “LO” position or “HI” position. For fast three point checks select the “SET” position. The PIE 830 will remember the last “SET” value, even with the power off.

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

READ: Slide the switch to the SET position. The PIE 830 will display the current reading from the sensor or device being measured. Slide the switch to MAX and the highest value measured since turn-on or reset will be displayed; slide the switch to MIN and the lowest value measured since turn-on or reset will be displayed.

Operating Instructions

Basic Operation

② SOURCE/OFF/READ Switch

Select "**SOURCE**" to output mA, V, pH, T/C, Ω , RTD or frequency.
Select "**READ**" to read mA, V, T/C, Ω , RTD, pressure or frequency.
Select "**OFF**" to turn off the 830.

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 one least significant digit step 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. Continue to press and hold the knob for two more seconds to start the automatic ramping.

READ: Press and hold to transfer the current temperature into the EZ-Check™ MIN/MAX points. This clears the MIN/MAX readings which will update as the input value changes.

SELECTING FUNCTIONS

The EZ-DIAL knob is used to setup the PIE 830 to match the instrument to be calibrated or signal to be measured. Each time you turn on the PIE 830 the LCD displays the following screen for about 1 second followed by operating in the function used the last time it was operated.

**PIE 830
DOUBLE CLICK
EZ-DIAL KNOB
FOR CONFIGURATION**

Double Click the EZ-DIAL knob to change the function of the calibrator and to select ranges, units and other user settings. Each function (mA, V, T/C, Ohms, RTD, Frequency) has up to four pages of menus. The first menu page has settings for the function and the last menu page has settings for STEPPING, AUTO OFF and BACKLIGHT. Settings are remembered even with the power off but are reset when the batteries are changed.

Operating Instructions

Double Click Menus - MAIN Page

Double click the EZ-DIAL knob to access the Double Click Menus. Shown are the **MAIN** menus for each function. Turn the knob to scroll thru the menus and press the knob to select. Available choices are shown in grey.

Source mA & Simulate 2 Wire Transmitters

MAIN

> EXIT
FUNCTION mA
MODE SOURCE 2W SIM
UNITS mA %
HART 250Ω ON OFF

Read mA, Power/Measure Transmitters & Leak Detect

> EXIT
FUNCTION mA
MODE READ PWR MEAS
UNITS mA %
HART 250Ω ON OFF

Source V & mV

>EXIT
FUNCTION V
RANGE 10V 100mV 1V

Read V & mV

>EXIT
FUNCTION V
RANGE 10V 1V 60V 100mV

Source pH

> EXIT
FUNCTION pH

Source & Read Frequency

> EXIT
FUNCTION FREQ
RANGE 20KHZ 10000HZ 1000HZ 2000CPM

Operating Instructions

Double Click Menus - MAIN Page

Source & Read Thermocouples

> EXIT
FUNCTION T/C
UNITS °C °F
T/C TYPE J K E T R S B N L U G D D P
COLD JUNC ON OFF

Source RTD

> EXIT
FUNCTION RTD
UNITS °C °F
RTD Pt 100 $\alpha=3850$ [*RTD Types - See Read RTD]

Read RTD

> EXIT
FUNCTION RTD
UNITS °C °F
RTD Pt 100 $\alpha=3850$, $\alpha=3902$, $\alpha=3916$, $\alpha=3926$
Pt 1000 $\alpha=3850$; Cu 10 $\alpha=4274$, Cu 50 $\alpha=4280$
Ni 120 $\alpha=6720$, Ni 110 $\alpha=5801$

Source Ohms

>EXIT
FUNCTION OHMS
RANGE 400 Ω 4000 Ω

Read Ohms

>EXIT
FUNCTION OHMS
RANGE 400 Ω 4000 Ω CONT

Read Pressure

>EXIT
FUNCTION PRESSURE
UNITS psi inH₂O* ftH₂O* mmH₂O* cmH₂O* mH₂O* inHg mHg
cmHg mmHg torr kg/cm² kg/m² hPa kPa MPa bar mbar atm oz/in²
lb/ft² *Engineering unit available at 4°C, 20°C and 60°F.

Operating Instructions

Double Click Menu - FEATURES

To change the Automatic Stepping settings

Double click the ③ DIAL KNOB at any time the unit is on and the following typical display (will be different for each FUNCTION) will appear for 15 seconds:

MAIN		
>	EXIT	(1/2)
	FUNCTION	mA
	MODE	SOURCE
	UNITS	mA
	HART	250Ω ON

Turn the ③ DIAL KNOB to move to the second, third or fourth menu page so the word **FEATURES** appears at the top of the menu.

FEATURES		
>	EXIT	(2/2)
	AUTO OFF	ON
	BACKLIGHT	ON
	STEPS/RAMP	3
	STEP/RAMP TIME	5

Turn the ③ DIAL KNOB to move through the menu. Press the ③ DIAL KNOB to toggle between OFF and ON or to change the STEPS/RAMP and the STEP/RAMP TIME settings. These settings are remembered even with the power off.

EXIT MENU - exits this menu immediately and saves any changes. Menu will automatically exit after 15 seconds of inactivity.

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.

Operating Instructions

Double Click Menu - FEATURES

STEPS/RAMP - pressing the knob will cycle through 2, 3, 5, 11 and RAMP. The endpoints of the steps or ramp are based on the values stored in the **HI** and **LO** EZ-CHECK outputs.

2 steps will automatically switch between the values stored in the HI & LO EZ-CHECK (0 & 100%).

3 steps between the HI, Midpoint and LO EZ-CHECK (0, 50 & 100%).

5 steps between the HI and LO EZ-CHECK in 25% increments (0, 25, 50, 75 & 100%).

11 steps between the HI and LO EZ-CHECK in 10% increments (0, 10, 20...80, 90 & 100%).

RAMP continuously ramps up and down between the HI and LO EZ-CHECK outputs.

STEP/RAMP TIME - pressing the knob will cycle through 5, 6, 7, 8, 9, 10, 15, 20, 25, 30 and 60 seconds.

To start the Automatic Stepping

Start automatic stepping or ramping by placing the EZ-CHECK Switch into the HI or LO position then press and hold the ③ DIAL KNOB for 6 seconds (the word STORE will appear on the display after 3 seconds and continue to press the EZ-DIAL KNOB) until the word STEPPING appears on the display. The word STEPPING will appear on the display anytime the selected automatic function is running. Stop the stepping by again pressing and holding the ③ DIAL KNOB for 3 seconds.

BACKLIGHT - If BACKLIGHT is ON the backlight will light all the time the unit is powered up. For maximum battery life turn the backlight off when using the calibrator in areas with enough ambient light to read the display.

Operating Instructions

Calibrate a 2-Wire Transmitter by sourcing the input while monitoring the output.

Works with SOURCE pH, T/C, DC V, OHMS, RTD, FREQ and READ PRESSURE.

Move the power switch ② to READ and Double click the ③ DIAL KNOB and the MAIN menu for the function in use will appear for 15 seconds:

MAIN	
> EXIT	
FUNCTION	T/C
UNITS	°C
T/C TYPE	K
COLD JUNC	ON

Turn the ③ DIAL KNOB to move to the second (or third) menu page so the word **mA DISPLAY** appears at the top of the menu.

mA DISPLAY	
> EXIT	
MODE	OFF READ PWRM READ% PWRM%
HART 250Ω	OFF ON
LEAK DETECT	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 change the MODE setting.

HART 250Ω - turn on the 250Ω resistor if you are powering up a HART transmitter. This provides the loop load required for HART communication.

EXIT MENU - exits this menu immediately and saves any changes. Menu will automatically exit after 15 seconds of inactivity.

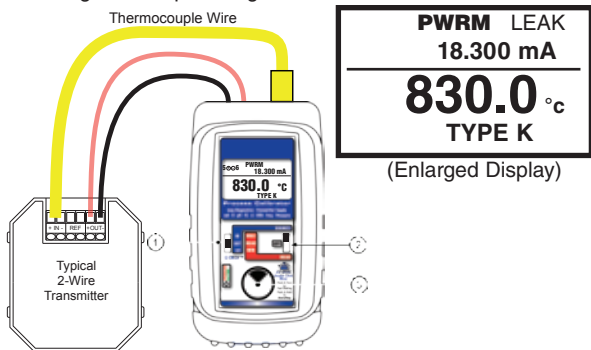
Operating Instructions

MODE - pressing the knob will cycle through READ, PWRM, READ% ,PWRM% and OFF.

READ turns on the mA display and indicates current passing through the loop proportional to the input of the transmitter which is controlled by the output of the the 830. Choose **READ%** if you would like the mA display in percent of 4-20 milliamps.

PWRM is POWER MEASURE which uses the internal loop supply of the 830 to power up the transmitter while indicating the current passing through the loop proportional to the input of transmitter which is controlled by the output of the 830. Choose **PWRM%** if you would like the mA display in percent of 4-20 milliamps.

If **PWRM** or **PWRM%** is selected an additional menu selection of **LEAK DETECT** will appear. When **LEAK DETECT** is turned on the 830 will display **LEAK** on the display if there is more than 0.015 mA of uncontrolled current in the loop. This may be due to a faulty transmitter, corrosion causing a bridge to ground or moisture present at some connection point. When LEAK DETECT tests a loop with leakage the loop mA signal will be affected.



Universal Isolated Transmitter

Swap out a transmitter to diagnose control issues.

The 830 acts as an isolated universal T/C, mV, OHMS, RTD, FREQ and PRESSURE transmitter. Choose this function to temporarily replace a transmitter when you suspect the transmitter is faulty or to diagnose the parameters of the loop.

Move the power switch ② to READ and Double click the ③ DIAL KNOB and the MAIN menu for the function in use will appear. Turn the ③ DIAL KNOB until the pointer is at FUNCTION and press the ③ KNOB until the desired FUNCTION appears. Turn the ③ DIAL KNOB to move through the menu. Press the ③ DIAL KNOB to toggle the units, range, T/C Type or RTD curve.

MAIN		
> EXIT		
FUNCTION	T/C	
UNITS	°C	
T/C TYPE	K	
COLD JUNC	ON	

MAIN		
> EXIT		
FUNCTION	RTD	
UNITS	°C	
RTD	Pt 100	$\alpha=3850$

MAIN		
>EXIT		
FUNCTION	V	
RANGE	100mV	

MAIN		
>EXIT		
FUNCTION	OHMS	
RANGE	400 Ω	

MAIN		
> EXIT		
FUNCTION	FREQ	
RANGE	20KHZ	

MAIN		
>EXIT		
FUNCTION	PRESSURE	
UNITS	psi	

Turn the ③ DIAL KNOB to move to the second (or third) menu page so the word **XXX XMTR** appears at the top of the menu.

Turn the ③ DIAL KNOB to move through the menu. Press the ③ DIAL KNOB to toggle between DOWN and UP, OFF and ON, or to change the MODE setting.

XXX XMTR

> EXIT

MODE OFF LINEAR NONLINEAR SQ ROOT

BURNOUT DOWN UP

LOOPSCOPE OFF ON

MODE - pressing the knob will cycle through OFF, LINEAR, NONLINEAR. When setup to read pressure SQ ROOT replaces NONLINEAR.

LINEAR turns on the mA display and regulates the loop current linear with the input signal. For thermocouples & RTDs this is linear relative to the temperature between zero and span of the sensor input. This mimics the operation of a digital temperature transmitter or other linearizing transmitters.

NONLINEAR (applies only to thermocouples and RTDs) turns on the mA display and regulates the loop current linear with base units (millivolts or ohms) of zero and span of the sensor input. This mimics the operation of an analog temperature transmitter without linearizing.

SQ ROOT turns on the mA display and regulates the loop current with square root extraction of zero and span of the pressure module input. This mimics the operation of a differential pressure transmitter setup for square root extraction.

BURNOUT selects the failure mode of the calibrator when the input signal is lost or beyond the input scale. **Down** sets the output to 1.0 mA and **UP** to 21.5 mA when sensor failure is detected.

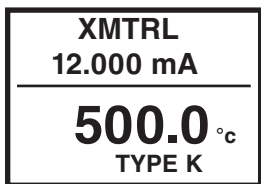
LOOPSCOPE turns on the Loop Diagnostic display which simultaneously indicates the current, voltage and resistance of the loop. When enabled the **LOOPSCOPE** also indicates errors by flashing the LED and writing diagnostic messages on the display. Messages include **LOW LOOP VOLT**, **HIGH LOOP VOLT** and **HIGH LOOP IMPED**. With LOOPSCOPE on the 830 occasionally performs a test on the loop. During this short test the loop mA signal will be affected.

Setting up the 830 in as a transmitter

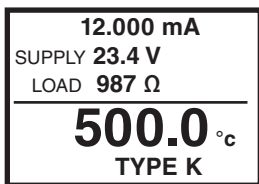
Configure your 830 to the same Span (URV) and Zero (LRV) by storing Span & Zero setting with the ① EZ-CHECK switch.

- 1) Store your SPAN input by moving the ① EZ-CHECK switch to the **MAX** position and turning the ③ EZ-Dial knob until the desired output value 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 ZERO input by moving the EZ-CHECK switch to the **MIN** position and turning the EZ-Dial knob until the desired output value is on the display. Press and hold the EZ-Dial knob until **STORED** appears to store the value. Release the EZ-Dial knob.
- 3) Move the EZ-CHECK switch to the **READ** position. The 830 constantly measures the input from the process sensor and regulates the current in the 4-20 mA loop.

Once the PIE 830 is setup and connected to the process sensor and the 4-20 mA loop it acts just like a calibrated isolated transmitter and will display the input signal from the sensor and the regulated 4-20 mA output signal. XMTR is shown on the display along with L, N or S for Linear, Nonlinear or Square Root respectively.



830 as Transmitter

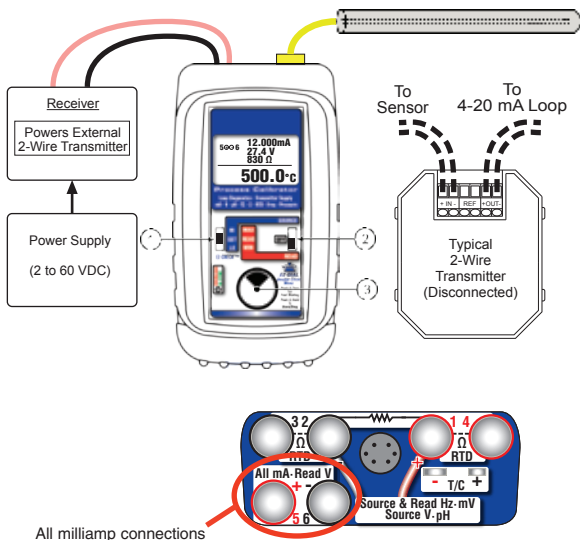


830 with LOOPSCOPE

For full loop diagnostics turn on LOOPSCOPE which indicates the current, SUPPLY (voltage) and LOAD (resistance) of the loop. It also indicates errors by flashing the LED and writing diagnostic messages including **LOW LOOP VOLT**, **HIGH LOOP VOLT** and **HIGH LOOP IMPED.**

Connecting the 830 in place of a transmitter

Connect the PIE 830 in place of the transmitter. The 4-20 mA loop connects to the mA jacks of the 830 and the sensor (or pressure module) connects to the other jacks of the 830.



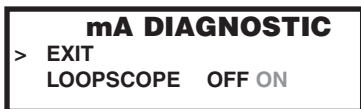
Note: With LOOPSCOPE on the 830 occasionally performs a test on the loop. During this short test the loop mA signal will be affected.

2 Wire SIM mA, 2 Wire SIM % (Percent of 4 to 20 mA)

Choose this function to simulate a 2 Wire Transmitter output from 0.000 to 24.000 milliamps. Operates in loops with power supply voltages from 2 to 60 VDC.

Move the power switch ② to SOURCE then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob to scroll through the settings and press the knob to make your selection. Select mA for the FUNCTION and 2W SIM for the MODE. Choose either mA or % and whether you need the 250 Ω HART resistor active in the loop.

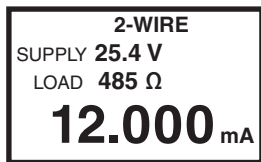
If you would also like to see the condition of the loop turn the ③ DIAL KNOB to move to the second (or third) menu page so the word **mA DIAGNOSTIC** appears at the top of the menu.



LOOPSCOPE turns on the Loop Diagnostic display which simultaneously indicates the current, voltage and resistance of the loop. When enabled the **LOOPSCOPE** also indicates errors by flashing the LED and writing diagnostic messages on the display. Messages include **LOW LOOP VOLT**, **HIGH LOOP VOLT** and **HIGH LOOP IMPED**. With **LOOPSCOPE** on the 830 occasionally performs a test on the loop. During this short test the loop mA signal will be affected.



830 Simulating a Transmitter

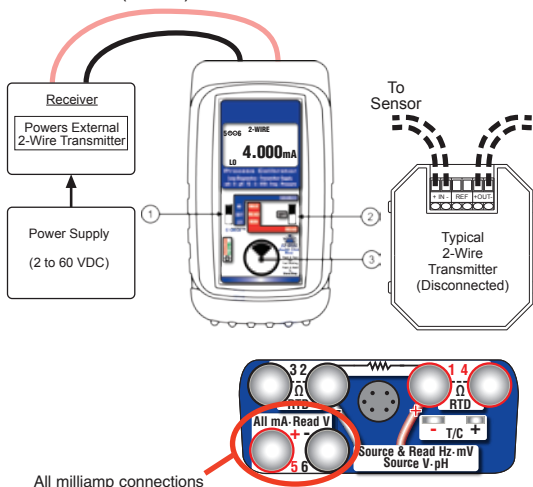


830 with LOOPSCOPE

2 Wire SIM mA, 2 Wire SIM % (Percent of 4 to 20 mA)

Connect the output leads of the PIE 830 to the inputs of the device being calibrated, making sure to check polarity. Red lead to the plus (+) input and black lead to the minus (-) input.

Instantly output your SPAN and ZERO output settings by moving the EZ-CHECK switch between HI and LO (defaults to 20 & 4 mA). You may also select any third output setting (such as mid-range) using the SET position on the EZ-CHECK switch. The output is adjusted in 0.001 mA (0.01%) increments by turning the knob ③. Press and turn the knob for faster dialing with 0.100 mA (1.00%) increments.



Note: With LOOPSCOPE on the 830 occasionally performs a test on the loop. During this short test the loop mA signal will be affected.

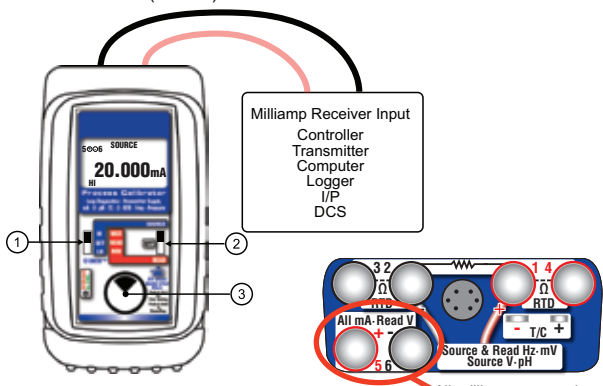
mA SOURCE/ % SOURCE (Percent of 4 to 20 mA)

Choose this function to provide an output from 0.000 to 24.000 milliamps. The compliance voltage is a nominal 24 VDC to provide the driving power to your milliamp receivers.

Move the power switch ② to SOURCE then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob to scroll through the settings and press the knob to make your selection. Select mA for the FUNCTION and SOURCE for the MODE. Choose either mA or % and whether you need the 250 Ω HART resistor active in the loop.

Connect the output leads of the PIE 830 to the inputs of the device being calibrated, making sure to check polarity. Red lead to the plus (+) input and black lead to the minus (-) input.

Instantly output your SPAN and ZERO output settings by moving the EZ-CHECK switch between HI and LO (defaults to 20 & 4 mA). You may also select any third output setting (such as mid-range) using the SET position on the EZ-CHECK switch. The output is adjusted in 0.001 mA (0.01%) increments by turning the knob ③. Press and turn the knob for faster dialing with 0.100 mA (1.00%) increments.



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

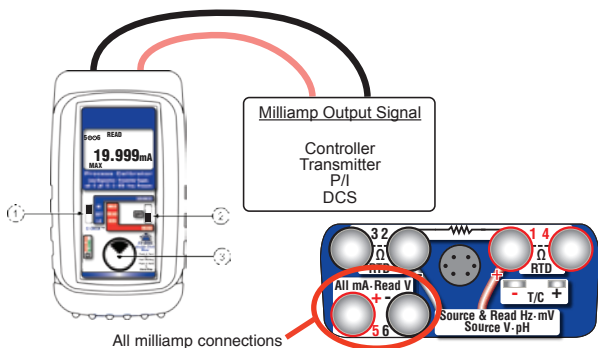
Choose this function to measure from 0.000 to 24.000 milliamps or -25.00 to 125.00%.

Move the power switch ② to READ then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob ③ to scroll through the settings and press the knob to make your selection. Select mA for the FUNCTION and READ for the MODE. Choose either mA or % and whether you need the 250 Ω HART resistor active in the loop.

Connect the red input lead (+) of the PIE 830 to the more positive point of the break and the black input to the more negative point.

Signals below 0 mA or open circuits are indicated by 0.000 mA (-25.00%) on the display. Signals above 24 mA are current limited by protection circuitry with "OVERRANGE" flashed on the display and the red OVERLOAD LED lit.

The PIE 830 measures the input signal and constantly updates the display with the current reading. Move the EZ-CHECK switch ① to MAX to see the highest reading and to MIN to see the lowest reading. Press and hold the knob ③ to clear the MAX and MIN readings.



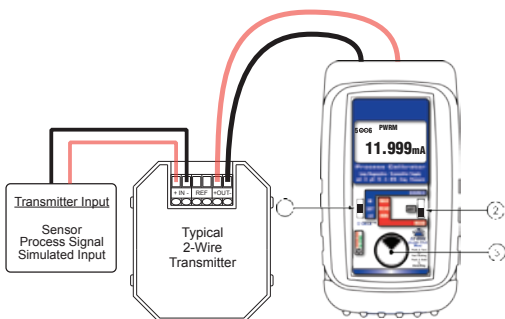
Power/Measure mA, Power/Measure % (Percent of 4 to 20 mA)

Choose this function to simultaneously supply power to a 2 Wire Transmitter while displaying the 4.000 to 20.000 mA output of the transmitter.

Move the power switch ② to READ then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob ③ to scroll through the settings and press the knob to make your selection. Select mA for the FUNCTION and PWR MEAS for the MODE. Choose either mA or % and whether you need the 250 Ω HART resistor active in the loop.

Disconnect one or both input wires from the device to be calibrated. Connect the red source lead of the PIE 830 to the plus (+) input of the device and the black source lead to the minus (-).

The PIE 830 supplies a nominal 24 volts DC at 24 mA to the 2 Wire Transmitter. The current passed by the transmitter will be accurately displayed by the PIE 830. Calibrate the transmitter in the usual manner and disconnect the PIE 830. Signals above 24 mA are current limited by protection circuitry with "OVERRANGE" flashed on the display and the red OVERLOAD LED lit.



Using Ground Leak Detection

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

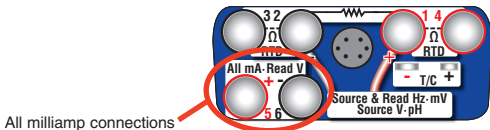
Find current leaks in loops caused by ground faults, moisture or corrosion. The 830 simultaneously supplies power to a 2 Wire Transmitter (or loop with a transmitter) while displaying the 4 to 20 mA output and the amount of current leaking in the loop.

- 1) Move the power switch ② to READ then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob ③ to scroll through the settings and press the knob to make your selection. Select mA for the FUNCTION and PWR MEAS for the MODE. Choose either mA or %.
- 2) Turn the knob ③ until the following menu appears.

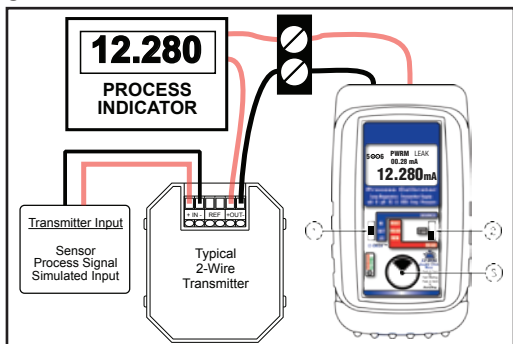


- 3) Turn the knob ③ to scroll through the settings and press the knob to make your selection. Turn on the LEAK DETECT.
- 4) Connect the red source lead from the mA (+) jack of the 830 to the plus (+) input of the device and the black source lead from the mA (-) to the minus (-).

The PIE 830 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 830 along with an indication of leakage current at the top of the display. If there is an uncontrolled loop, a transmitter with upscale burnout and bad or missing sensor or a short the display shows "OVER RANGE"



Using Ground Leak Detection



Typical Error Conditions

PWRM LEAK
00.28 mA

12.280 mA

The PIE 830 is supplying the loop voltage. A calibrated transmitter is limiting the loop current to 12.00 mA. An additional 0.28 mA is not controlled by the transmitter and is leaking somewhere in the loop.

PWRM LEAK
mA

OVER RANGE mA

The PIE 830 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.

Note: Many installed transmitters will normally indicate 0.01 to 0.02 mA leakage without significant control problem. Unstable readings may indicate loose connections or the presence of moisture.

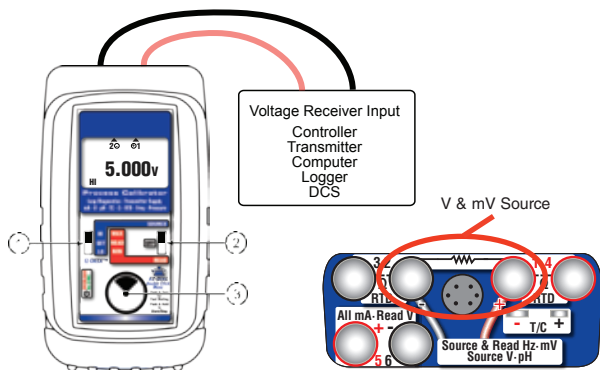
mV/V SOURCE

Choose this function to provide an output from -20.000 to 99.999 mV, -500.00 TO 999.99 mV or from 0.000 to 10.250 V. The source current is a nominal 20 mA to provide the driving power to your voltage receivers.

Move the power switch ② to SOURCE then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob to scroll through the settings and press the knob to make your selection. Select V for the FUNCTION and 1 V, 10V or 100 mV for the RANGE.

Connect the output leads of the PIE 830 to the inputs of the device being calibrated, making sure to check polarity. Red lead to the plus (+) input and black lead to the minus (-) input.

Instantly output your SPAN and ZERO output settings by moving the EZ-CHECK switch between HI and LO. You may also select any third output setting (such as mid-range) using the SET position on the EZ-CHECK switch. The output is adjusted in 0.001 mV, 0.01 mV or 0.001 V increments by turning the knob ③. Press and turn the knob for faster dialing with 0.100 mV, 1.00 mV or 0.100 V increments.



Read mV/V

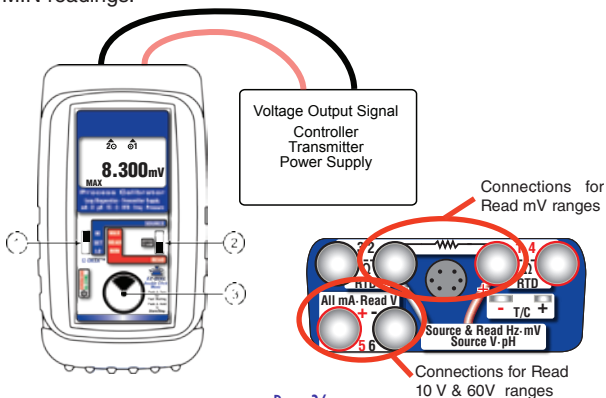
Choose this function to measure from -99.999 to 99.999 millivolts, -999.99 to +999.99 mV, 0.000 to 10.250 V dc or 0.00 to 60.00 V dc.

Move the power switch ② to READ then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob to scroll through the settings and press the knob to make your selection. Select V for the FUNCTION and 1V, 10V, 60V or 100 mV for the RANGE.

Connect the red input lead (+) of the PIE 830 to the more positive point of the break and the black input to the more negative point.

Signals above the maximum scale are limited by protection circuitry with "OVER RANGE" flashed on the display and the red OVERLOAD LED lit.

The PIE 830 measures the input signal and constantly updates the display with the current reading. Move the EZ-CHECK switch ① to MAX to see the highest reading and to MIN to see the lowest reading. Press and hold the knob ③ to clear the MAX and MIN readings.



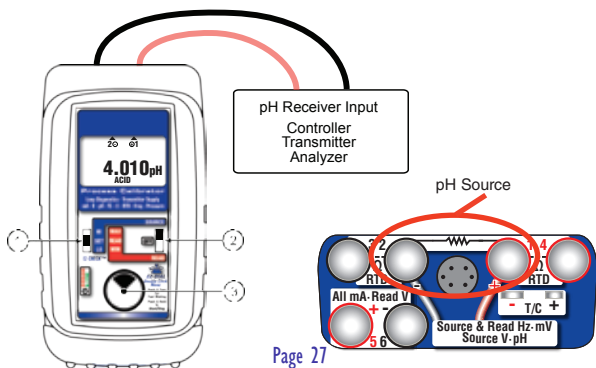
pH SOURCE

Choose this function to provide an output from 0.000 to 14.000 pH @ 25°C (77°F) which corresponds to 414.12 to -414.12 mV. The source current is a nominal 20 mA to provide the driving power to your pH receivers.

Move the power switch ② to SOURCE then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob to scroll through the settings and press the knob to make your selection. Select pH for the FUNCTION.

Connect the output leads of the PIE 830 to the inputs of the device being calibrated, making sure to check polarity. Red lead from the mV (+) jack of the 830 to the plus (+) input and black lead from the mV (-) jack to the minus (-) input.

Instantly output your SPAN and ZERO output settings by moving the EZ-CHECK switch between HI and LO. You may also select any third output setting (such as mid-range) using the DIAL position on the EZ-CHECK switch. The output is adjusted in 0.001 pH increments by turning the knob ③. Press and turn the knob for faster dialing with 0.100 pH increments.



Simulate pH probes into transmitters & analyzers

Use the pH simulator to verify proper operation of pH devices before you place a probe into a calibrated buffer. Adjusting the pH transmitter or analyzer without a probe allows you to make sure the device is calibrated and operating correctly. The 830 simulates 0.000 to 14.000 pH @ 25°C corresponding to 414.12 to -414.12 mV.

Once the pH instrument has been adjusted against the PIE 830 reconnect the pH probe and check it against the proper buffer (typically 7 pH). If the instrument zero point requires more than the manufacturer's recommendations (typically within 0.5 pH) it is time to clean or replace the probe.



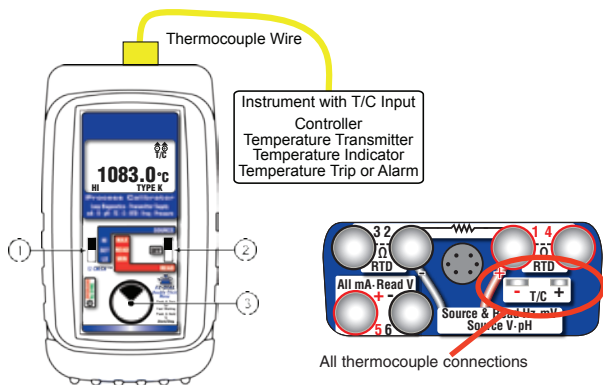
Thermocouple Source

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

Move the power switch ② to SOURCE then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob to scroll through the settings and press the knob to make your selection. Select T/C for the FUNCTION, °F or °C for the UNITS, T/C Type (J, K, E, T, R, S, B, N, L (J-DIN), U (T-DIN), G, C, D or P (Platinel II)) and internal COLD JUNC ON or OFF (ON is the default).

Connect the PIE 830 to the inputs of the device being calibrated using the proper type of thermocouple wire via the miniature thermocouple socket.

Instantly output your SPAN and ZERO output settings by moving the EZ-CHECK switch between HI and LO. You may also select any third output setting (such as mid-range) using the SET position on the EZ-CHECK switch. The output is adjusted in 0.1° increments by turning the knob ③. Press and turn the knob for faster dialing with 10.0° increments.



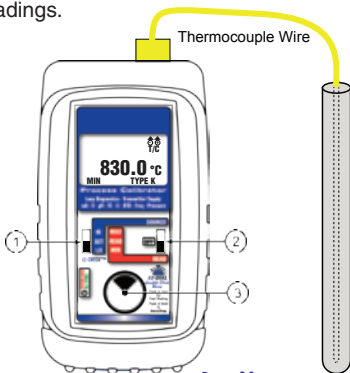
Read Thermocouple Sensors

Choose this function to measure temperatures with a thermocouple probe, sensor or any device that output a thermocouple signal.

Move the power switch ② to READ then Double Click the EZ-DIAL knob to get into the Double Click Menu. Turn the knob to scroll through the settings and press the knob to make your selection. Select T/C for the FUNCTION, °F or °C for the UNITS, T/C Type (J, K, E, T, R, S, B, N, L (J-DIN), U (T-DIN), G, C, D or P (Platinel II)) and COLD JUNC ON or OFF (ON is the default).

Connect the PIE 830 to the inputs of the device being calibrated using the proper type of thermocouple wire via the miniature thermocouple socket. If no sensor is connected, a wire is broken or the sensor is burned out, OPEN TC will appear on the display. Signals above the maximum scale are limited by protection circuitry with "OVER RANGE" on the display and the OVERLOAD LED blinks red.

The PIE 830 measures the input signal and constantly updates the display with the current reading. Move the EZ-CHECK switch ① to MAX to see the highest reading and to MIN to see the lowest reading. Press and hold the knob ③ to clear the MAX and MIN readings.



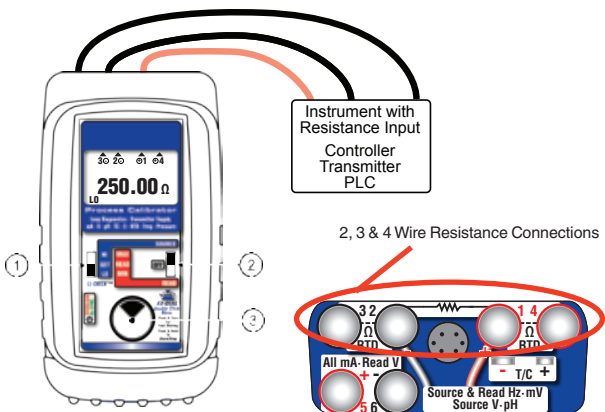
Resistance Source

Choose this function to provide a simulated resistance into any device that measures resistance.

Move the power switch ② to SOURCE then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob to scroll through the settings and press the knob to make your selection. Select OHMS for the FUNCTION, 400 Ω or 4000 Ω for the RANGE.

Disconnect all sensor wires from the devices to be calibrated and connect the PIE 830 to the inputs of the device using 2, 3 or 4 wires.

Instantly output your SPAN and ZERO output settings by moving the EZ-CHECK switch between HI and LO. You may also select any third output setting (such as mid-range) using the SET position on the EZ-CHECK switch. The output is adjusted in 0.01 Ω /0.1 Ω increments by turning the knob ③. Press and turn the knob for faster dialing with 1.00 Ω /10.0 Ω increments.



Read Resistance & Check Continuity

Choose this function to measure resistance or check continuity.

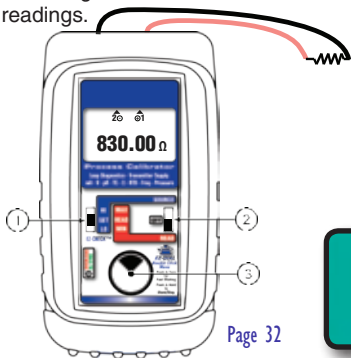
Move the power switch ② to READ then Double Click the EZ-DIAL knob to get into the Double Click Menu. Turn the knob to scroll through the settings and press the knob to make your selection. Select OHMS for the FUNCTION, 400Ω, 4000Ω or Continuity for the RANGE.

Connect the PIE 830 to the resistor or sensor using 2, 3 or 4 wires. The PIE 830 automatically detects how many wires are connected using a patented circuit and indicates each wire that is connected. Any wires that are not connected or broken are indicated by the 830. This is useful for troubleshooting the sensor.

If continuity is selected, resistance is measured up to 400.0Ω. The beeper will sound and))) appears on the display when resistance below 100.0Ω is measured.

Signals above the maximum scale are limited by protection circuitry with "OVER RANGE" flashed on the display and the OVERLOAD LED blinks red.

The PIE 830 measures the input signal and constantly updates the display with the current reading. Move the EZ-CHECK switch ① to MAX to see the highest reading and to MIN to see the lowest reading. Press and hold the knob ③ to clear the MAX and MIN readings.



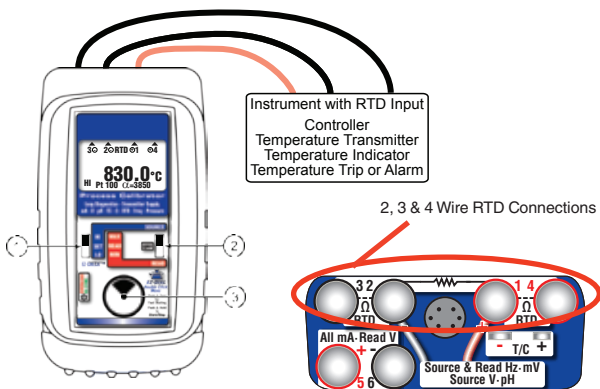
RTD Source

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

Move the power switch ② to SOURCE then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob to scroll through the settings and press the knob to make your selection. Select RTD for the FUNCTION, °F or °C for the UNITS and RTD (Choose from one of Platinum 100Ω, or 1000Ω, Copper 10Ω or 50Ω, Nickel 120Ω or 110Ω curves). *Note: Pt 100Ω 3850 is the most common RTD type.*

Disconnect all sensor wires from the devices to be calibrated and connect the PIE 830 to the inputs of the device using 2, 3 or 4 wires.

Instantly output your SPAN and ZERO output settings by moving the EZ-CHECK switch between HI and LO. You may also select any third output setting (such as mid-range) using the SET position on the EZ-CHECK switch. The output is adjusted in 0.1° increments by turning the knob ③. Press and turn the knob for faster dialing with 10.0° increments.



Read RTD Sensors

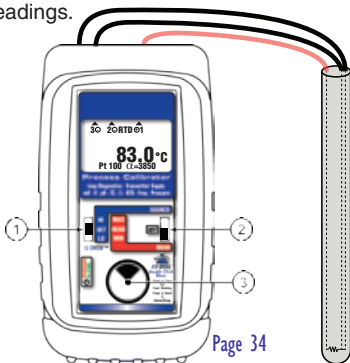
Choose this function to measure temperatures with an RTD probe, sensor or any device that output an RTD signal.

Move the power switch ② to READ then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob to scroll through the settings and press the knob to make your selection. Select RTD for the FUNCTION, °F or °C for the UNITS and RTD (Choose from one of Platinum 100Ω, or 1000Ω, Copper 10Ω or 50Ω, Nickel 120Ω or 110Ω curves). *Note: Pt 100Ω 3850 is the most common RTD type.*

Connect the PIE 830 to the RTD sensor using 2, 3 or 4 wires. The PIE 830 automatically detects how many wires are connected using a patented circuit and indicates each wire that is connected. Any wires that are not connected or broken are indicated by the 830. This information is useful for troubleshooting the sensor.

Signals above the maximum scale are limited by protection circuitry with "OVER RANGE" flashed on the display and the red OVERLOAD LED lit.

The PIE 830 measures the input signal and constantly updates the display with the current reading. Move the EZ-CHECK switch ① to MAX to see the highest reading and to MIN to see the lowest reading. Press and hold the knob ③ to clear the MAX and MIN readings.



Read Frequency

Choose this function to count frequency.

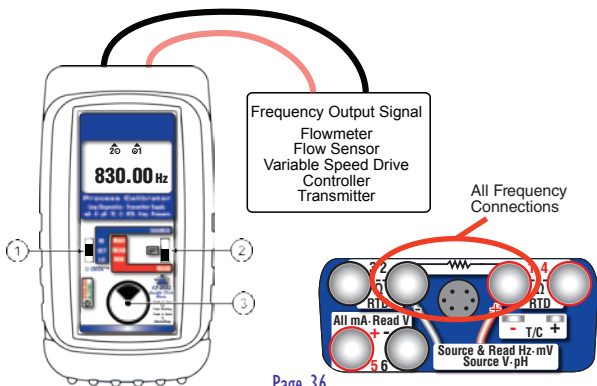
Move the power switch ② to READ then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob to scroll through the settings and press the knob to make your selection. Select FREQ for the FUNCTION and 20KHZ, 10000HZ, 1000HZ or 2000CPM for the RANGE.

Disconnect all input wires from the devices to be calibrated and connect the PIE 830 to the output of the device matching polarity.

The green HZ SYNC LED pulses in synch with the input frequency.

Signals above the maximum scale are limited by protection circuitry with "OVER RANGE" flashed on the display and the red OVERLOAD LED lit.

The PIE 830 measures the input signal and constantly updates the display with the current reading. Move the EZ-CHECK switch ① to MAX to see the highest reading and to MIN to see the lowest reading. Press and hold the knob ③ to clear the MAX and MIN readings.



Read Pressure

Choose this function to measure pressure in one of 32 different engineering units using a PIE Pressure Module.

1) Move the power switch ② to READ then Double Click the EZ-DIAL knob to get into the Menu. Turn the knob to scroll through the settings and press the knob to make your selection. Select PRESSURE for the FUNCTION and make your choice of UNITS to match the pressure instrument to be checked.

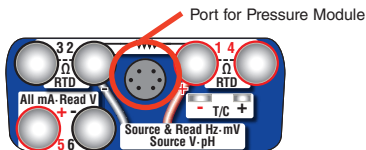
2) Remove the covers from the ends of the connector on the pressure module cable and the pressure connector of the 830. Align the white arrows and plug the cable into the 830.

3) Connect pressure hoses, fittings & pumps (if required) to the pressure instrument to be checked.

4) Press and hold the ③ E-Z DIAL KNOB for 2 seconds (after MAX/MIN RESET appears) to 'Zero' or 'Tare' the pressure. The display will briefly display 'TARE ON' then a '0' appears on the display indicating that all measurements are relative to the pressure measured when the calibrator was zeroed. Press and hold the ③ E-Z DIAL KNOB for 2 seconds (after MAX/MIN RESET appears) when you want to turn the 'Tare' off.

The PIE 830 measures the pressure and constantly updates the display with the current reading. Move the EZ-CHECK switch ① to MAX to see the highest reading and to MIN to see the lowest reading. Press and hold the knob ③ for 1 second to clear the MAX and MIN readings.

To disconnect the pressure module gently pull up on the grooved area just above the white arrow.





PIE 830 with Pressure Module,
Pressure/Vacuum Pump & Hose



Hands free carrying case with pockets for the PIE 830 and the pressure module. Back of the case has a zippered pocket for the manual, test leads, hoses and pressure fittings.

Optional Pressure Modules

Sensor Code	Application
DNxxxx	Differential, Non-isolated
0 to 0010*, 0028, 0200, 0415, 2000" H2O	
DIxxxx	Differential, Isolated
0 to 0001, 0005, 0015, 0030, 0100, 0300, 0500 PSID	
GIxxxx	Gauge, Isolated
0 to 0015, 0030, 0050, 0100, 0300, 0500, 1000, 3000 PSIG	
CIxxxx	Compound, Isolated
-14.7 to +0015, 0030, 0050, 0100, 0300, 0500, 1000, 3000 PSIG	
AIxxxx	Absolute, Isolated
0 to 0017, 0038, 0100, 1000 PSIA	

Media Compatibility

Non-isolated DN sensors: clean, dry, non-corrosive, non-condensing gases only

Isolated DI sensors: any media compatible with 316L SS & Viton®

Isolated GI, CI & AI sensors: any media compatible with 316L SS

Pressure Module Accuracy

±0.025% of full scale including all effects of linearity, repeatability and hysteresis from -20° to +50°C (-4° to +122°F)

* The DN0010 sensor accuracy is ±0.050% of full scale

32 Engineering Units:

PSI • inches, feet, mm, cm and meter of H2O @ 4°C, 20°C & 60°F
inches, meter, cm and mm of Hg @ 0°C

torr • kg/cm² • kg/m² • Pa • hPa • kPa • MPa • Bar • mBar

ATM • oz/in² • lb/ft²

Specifications

General	
Operating Temp Range	-20 to 60 °C (-5 to 140 °F)
Storage Temp Range	-30 to 60 °C (-22 to 140 °F)
Temperature effect	$\leq \pm 0.01\ \%/^{\circ}\text{C}$ of Full Scale
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
Isolation: Voltage	60V rms between all mA functions/Read V DC and Source V DC/thermocouple/RTD/Ohms//Frequency/Pressure
Common Mode	50/60 Hz, 100 dB
Normal Mode Rejection	50/60 Hz, 50 dB
Noise	$\leq \pm \frac{1}{2}$ Least Significant Digit from 0.1 to 10 Hz
Size	5.63x3.00x1.60" 143x76x41mm (LxWxH)
Weight	12.1 ounces, 0.34 kg with boot & batteries
Batteries	Four "AA" Alkaline 1.5V (LR6)
Battery life	Read Functions: ≥ 20 hrs; Pressure ≥ 7 hrs Source mA: ≥ 14 hours @ 12 mA into 250 Ω Pwr/Meas mA: ≥ 12 hours at 20 mA Source V, Ω , T/C, RTD & Hz: ≥ 20 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, 0.315" (8.0 mm) high digits, backlighting

Specifications

Read mA

Ranges and Resolution	0.000 to 24.000 mA or -25.00 to 125.00% of 4-20 mA
Accuracy	$\leq \pm (0.02 \% \text{ of Reading} + 0.003 \text{ mA})$
Voltage burden	$\leq 2\text{V}$ at 24 mA
Overload/Current limit protection	25 mA nominal

Source mA / Power & Measure Two Wire Transmitters

Ranges and Resolution	Same as Read mA
Accuracy	$\leq \pm (0.02 \% \text{ of Reading} + 0.003 \text{ mA})$
Loop compliance voltage	$\geq 24 \text{ DCV @ } 20.00\text{mA}$
Loop drive capability	1200 Ω at 20 mA for 15 hours nominal; 950 Ω with Hart Resistor enabled

mA 2-Wire Transmitter Simulation

Accuracy	Same as Source/Power & Measure
Voltage burden	$\leq 2\text{V}$ at 20 mA
Overload/Current limit	24 mA nominal
Loop voltage limits	2 to 60 VDC (fuse-less protected)

DC Voltage Read

Range and Resolution	$\pm 99.999 \text{ mV}$, $\pm 999.99\text{mV}$, 0 to 10.250 V, 0.00 to 60.00 V DC
Accuracy	$\leq \pm (0.02 \% \text{ of Reading} + 0.01\% \text{ Full Scale})$
Input resistance	$\geq 1 \text{ M}\Omega$

Specifications

Source V dc

Ranges and Resolution	-20.000 to 99.999 mV, -500.00 to 999.99 mV, 0.000 to 10.250V
Accuracy	$\leq \pm (0.02 \% \text{ of Reading} + 0.01\% \text{ Full Scale})$
Source Current	$\geq 20 \text{ mA}$
Sink Current	$> 16 \text{ mA}$
Output Impedance	$< 1 \text{ Ohm}$
Short Circuit Duration	Infinite

pH Source

Range and Resolution	-414.00 to +414.00 pH
Accuracy in mV	$\leq \pm (0.02 \% \text{ of Reading in mV} + 0.1 \text{ mV})$
Accuracy in pH	$\leq \pm 0.003 \text{ pH @ } 25^{\circ}\text{C}$

Thermocouple Source

Accuracy	$\leq \pm (0.02 \% \text{ of Reading} + 0.01 \text{ mV})$
Cold Junction Compensation	$\pm (0.05^{\circ}\text{C} + 0.01\%/^{\circ}\text{C})$
Output Impedance	$< 1 \text{ Ohm}$
Source Current	$> 20 \text{ mA}$ (drives 80 mV into 10 Ohms)

Thermocouple Read

Accuracy & Cold Junction Compensation	Same as Thermocouple Source
Input Impedance	$> 1 \text{ Megohms}$
Open TC Threshold; Pulse	10K Ohms; $< 5 \mu\text{amp}$ pulse for 300 milliseconds (nominal)

Specifications

RTD, OHMS and Continuity Read

Resistance Ranges	0.00 to 401.00, 0.0 to 4010.0 Ohms
Accuracy	$\pm(0.025\% \text{ of Reading} + 0.075 \text{ Ohms})$
Excitation Current	1.0 mA to 401 Ohms, 0.5 mA to 4010 Ohms (nominal)
Continuity	0.0 to 401.0 Ohms; Beeps from 0.0 to 100.0 Ohms

RTD and OHMS Source

3 Wire & 4 Wire Accuracy From 1 to 10.2 mA External Excitation Current Below 1 mA of External Excitation Current	$\pm(0.025\% \text{ of Full Scale} + 0.075 \text{ Ohms})$ $\pm(0.025\% \text{ of Full Scale} + 0.075 \text{ Ohms} + \frac{0.025 \text{ mV}}{\text{mA Excitation Current}})$
2 Wire Accuracy	Add 0.1 Ohm to specifications listed above
Resistance Ranges	0.0 to 401.00 to 4010.0 Ohms
Allowable Excitation Current Range	<401 Ohms: 10.2 mA max; steady or pulsed/intermittent 401 to 4010 Ohms: 1 mA max; steady or pulsed/intermittent
Pulsed Excitation Current Compatibility	DC to 0.01 second pulse width

Specifications

Frequency Source	
Ranges	1 to 2000 CPM, 0.01 to 999.99 Hz, 0.1 to 9999.9 Hz, 0.001 to 20.000 kHz
Accuracy	$\pm (0.02 \% \text{ of Reading} + 0.01\% \text{ Full Scale})$
Output Waveform	Square Wave, Zero Crossing -1.0 to +5 V peak-to-peak $\pm 10\%$
Risetime (10 to 90% of amplitude)	< 10 microseconds
Output Impedance	< 1 Ohm
Source Current	> 1 mA rms at 20 kHz
Short Circuit Duration	Infinite
Optical Coupling	Green LED (HZ SYNC) flashes at output frequency

Frequency Read	
Ranges & Accuracy	Same as Frequency Source
Accuracy	$\pm (0.02 \% \text{ of Reading} + 0.01\% \text{ Full Scale})$
Trigger Level	1 V rms, dc coupled
Input Impedance	> 1 Meg Ohm + 60 pF

Thermocouple Ranges & Accuracies

Based on $\leq \pm (0.02 \% \text{ of Reading} + 0.01 \text{ mV})$

T/C	Degrees C Range	°C	Degrees F Range	°F
J	-200.0 to -50.0	$\pm 0.5^\circ$	-328.0 to -58.0	$\pm 1.0^\circ$
	-50.0 to 300.0	$\pm 0.2^\circ$	-58.0 to 572.0	$\pm 0.4^\circ$
	300.0 to 900.0	$\pm 0.3^\circ$	572.0 to 1652.0	$\pm 0.6^\circ$
	900.0 to 1200.0	$\pm 0.4^\circ$	1652.0 to 2192.0	$\pm 0.8^\circ$
K	-230.0 to -50.0	$\pm 1.2^\circ$	-382.0 to -58.0	$\pm 2.2^\circ$
	-50.0 to 550.0	$\pm 0.3^\circ$	-58.0 to 1022.0	$\pm 0.6^\circ$
	550.0 to 1000.0	$\pm 0.5^\circ$	1022.0 to 1832.0	$\pm 0.8^\circ$
	1000.0 to 1371.1	$\pm 0.6^\circ$	1832.0 to 2500.0	$\pm 1.1^\circ$
T	-260.0 to -230.0	$\pm 2.9^\circ$	-436.0 to -382.0	$\pm 5.2^\circ$
	-230.0 to -210.0	$\pm 1.0^\circ$	-382.0 to -346.0	$\pm 1.9^\circ$
	-210.0 to -50.0	$\pm 0.8^\circ$	-346.0 to -58.0	$\pm 1.4^\circ$
	-58.0 to 50.0	$\pm 0.3^\circ$	-58.0 to 122.0	$\pm 0.6^\circ$
	50.0 to 400.0	$\pm 0.2^\circ$	122.0 to 752.0	$\pm 0.4^\circ$
E	-240.0 to -200.0	$\pm 0.9^\circ$	-400.0 to -328.0	$\pm 1.7^\circ$
	-200.0 to 0.0	$\pm 0.5^\circ$	-328.0 to 32.0	$\pm 0.8^\circ$
	0.0 to 350.0	$\pm 0.2^\circ$	32.0 to 662.0	$\pm 0.3^\circ$
	350.0 to 1000.0	$\pm 0.3^\circ$	662.0 to 1832.0	$\pm 0.6^\circ$
R	-18.3 to 100.0	$\pm 2.1^\circ$	-1.0 to 212.0	$\pm 3.8^\circ$
	100.0 to 500.0	$\pm 1.3^\circ$	212.0 to 932.0	$\pm 2.4^\circ$
	500.0 to 1400.0	$\pm 1.0^\circ$	932.0 to 2552.0	$\pm 1.8^\circ$
	1400.0 to 1767.8	$\pm 1.2^\circ$	2552.0 to 3214.0	$\pm 2.0^\circ$

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

Thermocouple Ranges & Accuracies

Based on $\leq \pm (0.02 \% \text{ of Reading} + 0.01 \text{ mV})$

T/C	Degrees C Range	°C	Degrees F Range	°F
S	-18.3 to 100.0	$\pm 2.0^\circ$	-1.0 to 212.0	$\pm 3.7^\circ$
	100.0 to 350.0	$\pm 1.4^\circ$	212.0 to 662.0	$\pm 2.5^\circ$
	350.0 to 1600.0	$\pm 1.1^\circ$	662.0 to 2912.0	$\pm 2.0^\circ$
	1600.0 to 1767.8	$\pm 1.3^\circ$	2912.0 to 3214.0	$\pm 2.4^\circ$
B	315.6 to 600.0	$\pm 3.2^\circ$	600.0 to 1122.0	$\pm 5.7^\circ$
	600.0 to 850.0	$\pm 1.7^\circ$	1122.0 to 1562.0	$\pm 3.1^\circ$
	850.0 to 1100.0	$\pm 1.3^\circ$	1562.0 to 2012.0	$\pm 2.4^\circ$
	1100.0 to 1820.0	$\pm 1.1^\circ$	2012.0 to 3308.0	$\pm 2.0^\circ$
N	-230.0 to -150.0	$\pm 1.9^\circ$	-382.0 to -238.0	$\pm 3.4^\circ$
	-150.0 to -50.0	$\pm 0.7^\circ$	-238.0 to -58.0	$\pm 1.2^\circ$
	-50.0 to 950.0	$\pm 0.4^\circ$	-58.0 to 1742.0	$\pm 0.8^\circ$
	950.0 to 1300.0	$\pm 0.5^\circ$	1742.0 to 2372.0	$\pm 1.0^\circ$
G (W)	100.0 to 350.0	$\pm 1.7^\circ$	212.0 to 662.0	$\pm 3.0^\circ$
	350.0 to 1700.0	$\pm 0.8^\circ$	662.0 to 3092.0	$\pm 1.5^\circ$
	1700.0 to 2000.0	$\pm 1.0^\circ$	3092.0 to 3632.0	$\pm 1.8^\circ$
	2000.0 to 2320.0	$\pm 1.1^\circ$	3632.0 to 4208.0	$\pm 2.1^\circ$
C (W5)	-1.1 to 100.0	$\pm 0.8^\circ$	30.1 to 212.0	$\pm 1.4^\circ$
	100.0 to 1000.0	$\pm 0.7^\circ$	212.0 to 1832.0	$\pm 1.3^\circ$
	1000.0 to 1750.0	$\pm 1.2^\circ$	1832.0 to 3182.0	$\pm 2.1^\circ$
	1750.0 to 2320.0	$\pm 2.0^\circ$	3182.0 to 4208.0	$\pm 3.5^\circ$

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

Thermocouple Ranges & Accuracies

Based on $\leq \pm (0.02 \% \text{ of Reading} + 0.01 \text{ mV})$

T/C	Degrees C Range	°C	Degrees F Range	°F
D	-1.1 to 150.0	$\pm 1.0^\circ$	30.1 to 302.0	$\pm 1.8^\circ$
	150.0 to 1100.0	$\pm 0.7^\circ$	302.0 to 2012.0	$\pm 1.3^\circ$
	1100.0 to 1750.0	$\pm 1.0^\circ$	2012.0 to 3182.0	$\pm 1.8^\circ$
	1750.0 to 2320.0	$\pm 2.0^\circ$	3182.0 to 4208.0	$\pm 3.6^\circ$
P	0.0 to 600.0	$\pm 0.3^\circ$	32.0 to 1112.0	$\pm 0.6^\circ$
	600.0 to 900.0	$\pm 0.4^\circ$	1112.0 to 1652.0	$\pm 0.8^\circ$
	900.0 to 1200.0	$\pm 0.6^\circ$	1652.0 to 2192.0	$\pm 1.1^\circ$
	1200.0 to 1395.0	$\pm 0.7^\circ$	2192.0 to 2543.0	$\pm 1.2^\circ$
L J-DIN	-200.0 to -50.0	$\pm 0.4^\circ$	-328.0 to -58.0	$\pm 0.7^\circ$
	-50.0 to 300.0	$\pm 0.2^\circ$	-58.0 to 572.0	$\pm 0.4^\circ$
	300.0 to 900.0	$\pm 0.3^\circ$	572.0 to 1652.0	$\pm 0.5^\circ$
U T-DIN	-200.0 to -50.0	$\pm 0.6^\circ$	-328.0 to -58.0	$\pm 1.1^\circ$
	-50.0 to 50.0	$\pm 0.3^\circ$	-58.0 to 122.0	$\pm 0.5^\circ$
	50.0 to 550.0	$\pm 0.2^\circ$	122.0 to 1022.0	$\pm 0.4^\circ$
	550.0 to 600.0	$\pm 0.3^\circ$	1022.0 to 1112.0	$\pm 0.5^\circ$

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

RTD Ranges & Accuracies

RTD Accuracy Based on $\pm(0.025\%$ of Reading in Ohms + 0.075 Ohms)

RTD Type	Degrees C Range	°C	Degrees F Range	°F
Pt 100 Ohm DIN/IEC/JIS 1989 1.3850 (ITS-90)	-200.0 to 0.0 0.0 to 340.0 340.0 to 640.0 640.0 to 850.0	$\pm 0.2^\circ$ $\pm 0.3^\circ$ $\pm 0.4^\circ$ $\pm 0.5^\circ$	-328.0 to 32.0 248.0 to 644.0 644.0 to 1184.0 1184.0 to 1562.0	$\pm 0.4^\circ$ $\pm 0.6^\circ$ $\pm 0.8^\circ$ $\pm 1.0^\circ$
Pt 100 Ohm (Burns) 1.3902	-200.0 to 10.0 10.0 to 350.0 350.0 to 650.0 650.0 to 850.0	$\pm 0.2^\circ$ $\pm 0.3^\circ$ $\pm 0.4^\circ$ $\pm 0.5^\circ$	-328.0 to 50.0 50.0 to 662.0 662.0 to 1202.0 1202.0 to 1562.0	$\pm 0.4^\circ$ $\pm 0.6^\circ$ $\pm 0.8^\circ$ $\pm 0.9^\circ$
Pt 100 Ohm (Old JIS 1981) 1.3916	-200.0 to 20.0 20.0 to 360.0 360.0 to 650.0 650.0 to 850.0	$\pm 0.2^\circ$ $\pm 0.3^\circ$ $\pm 0.4^\circ$ $\pm 0.5^\circ$	-328.0 to 68.0 68.0 to 680.0 680.0 to 1202.0 1202.0 to 1562.0	$\pm 0.4^\circ$ $\pm 0.6^\circ$ $\pm 0.8^\circ$ $\pm 0.9^\circ$
Pt 100 Ohm (US Lab) 1.3926	-200.0 to 20.0 20.0 to 360.0 360.0 to 660.0 660.0 to 850.0	$\pm 0.2^\circ$ $\pm 0.3^\circ$ $\pm 0.4^\circ$ $\pm 0.5^\circ$	-328.0 to 68.0 68.0 to 680.0 680.0 to 1220.0 1220.0 to 1562.0	$\pm 0.4^\circ$ $\pm 0.6^\circ$ $\pm 0.8^\circ$ $\pm 0.9^\circ$
Pt 1000 Ohm DIN/IEC/JIS 1989 1.3850	-200.0 to 0.0 0.0 to 340.0 340.0 to 640.0 640.0 to 850.0	$\pm 0.2^\circ$ $\pm 0.3^\circ$ $\pm 0.4^\circ$ $\pm 0.5^\circ$	-328.0 to 32.0 248.0 to 644.0 644.0 to 1184.0 1184.0 to 1562.0	$\pm 0.4^\circ$ $\pm 0.6^\circ$ $\pm 0.8^\circ$ $\pm 1.0^\circ$
Copper 10 Ohm 1.4274 (Minco)	-200.0 to 260.0	$\pm 2.0^\circ$	-328.0 to 500.0	$\pm 3.6^\circ$
Copper 50 1.4280	-50.0 to 150.0	$\pm 0.4^\circ$	-58.0 to 302.0	$\pm 0.8^\circ$
Ni 120 Ohm 1.6720 (Pure)	-80.0 to 260.0	$\pm 0.1^\circ$	-112.0 to 500.0	$\pm 0.3^\circ$
Ni 110 Ohm Bristol 7 NA 1.5801	-100.0 to 260.0	$\pm 0.2^\circ$	-148.0 to 500.0	$\pm 0.4^\circ$

Standard 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.

Pressure sensors that have been damaged by over pressurization or contaminated by process chemicals are not covered by our warranty. Pneumatic pumps that are contaminated with process chemicals are also not covered by our warranty.

Optional Repair/Replacement Warranty

Under our Repair/Replacement Warranty (RP-WAR-B), our equipment is warranted against ANY damage or malfunction that may cause the unit to fail for a period of three (3) years from the date of shipment.

This warranty is limited to one complete replacement against any damage or malfunction during the warranty period. If replaced, the new calibrator will carry our Standard Warranty for the remainder of the three (3) years or a minimum of one (1) year from the date of shipment.

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.

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