

PIECAL Model 334

4-20 mA Loop Calibrator Operating Instructions

Product Description

• EASY TO USE

With the PIECAL Model 334 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 0.00 to 24.00 mA, Simulate a 2 Wire Transmitter or use the PIECAL Model 334 to simultaneously power your 2 Wire Transmitter and measure its output. When desired the PIECAL Model 334 can display current in milliamps or percent of 4 to 20.

• SOURCE MILLIAMPS

Calibrate recorders, digital indicators, stroke valves or any instruments that get their input from a 4 to 20 mA loop. Easily set any value quickly to within 0.01 mA with the adjustable digital potentiometer "DIAL" or use preset **4.00 mA (0.0%)** and **20.00 mA (100.0%)** EZ-CHECK™ settings.

• RECALL OUTPUT SETTINGS

The EZ CHECK™ switch provides rapid checking of 4.00, 20.00 and any convenient third point between 0.00 to 24.00 mA.

• CALIBRATE USING LOOP POWER

Check loop wiring and receivers by using the PIECAL Model 334 in place of a 2 Wire transmitter. Simulate a changing process input to check loop response and control settings. The PIECAL Model 334 uses any loop power from 2 to 100V DC.

• READ LOOP CURRENT

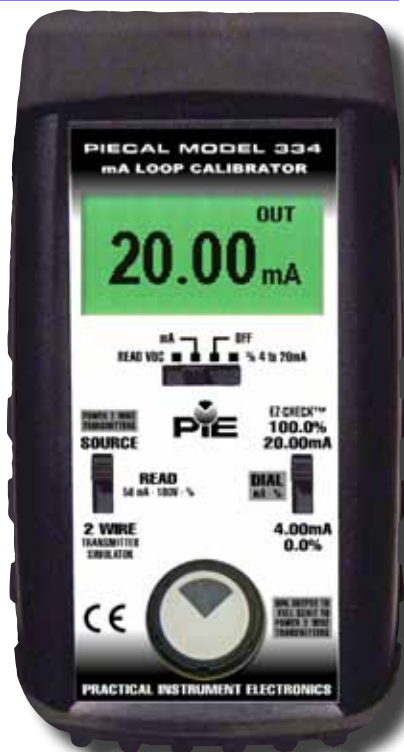
Check controller outputs or measure the milliamp signal anywhere in the loop. The PIECAL Model 334 measures 0.00 to 52.00 mA signals with greater accuracy than a typical multimeter. The PIECAL Model 334 can be easily switched to display milliamps or percent of 4 to 20.

• POWER & MEASURE 2 WIRE TRANSMITTERS

The PIECAL Model 334 can simultaneously output 24V DC to power any and all devices in a process loop using the internal batteries and the internal switching power supply, while measuring the output of a 2 Wire Transmitter and any other loop devices. This is handy for checking the functionality of transmitters in the field or on the bench.

• READ DC VOLTS

The PIECAL Model 334 can measure from -99.99 to +99.99 VDC with 10mV resolution. Use it to check loop power supplies, I/V converters, chart recorders, 1 to 5 Volt signals, and any other voltages within this range making it unnecessary to carry an additional multimeter.

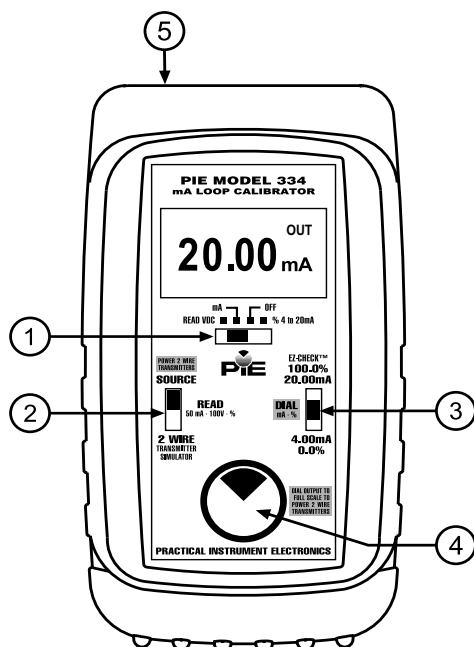


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Basic Operation



① POWER SWITCH

Select “mA” to display and calibrate in milliamps. Select “% 4 to 20 mA” to display and calibrate in percent. Select “READ VDC” to read volts DC. Return the slide switch to the “OFF” position when not in use.

Note:

Percent mode can also be used with chart recorders, valves or current trips that display in percent.

100.0% =	20.00 mA
75.0% =	16.00 mA
50.0% =	12.00 mA
25.0% =	8.00 mA
0.0% =	4.00 mA

To convert from Milliamps to Percent:
 $\text{Percent} = (\text{Milliamps} - 4) / 0.16$

To convert from Percent to Milliamps:
 $\text{Milliamps} = \text{Percent} / 6.25 + 4$

② SOURCE / READ / 2 WIRE SWITCH

Select “SOURCE” to output in milliamps or percent.

Select “READ” for reading in milliamps or percent.

Select “2 WIRE” to simulate a 2 Wire Transmitter.

③ EZ-CHECK™ SWITCH

Instantly output 4.00 mA or 20.00 mA by moving the EZ-CHECK™ switch to the “4.00mA” / “0.0%” position or “20.00mA” / “100.0%” position. For fast three point checks select the “DIAL” position. The PIECAL Model 334 will remember the last “DIAL” value, even with the power off.

Note: The same “DIAL” value is stored for both mA and %. The recalled value will be displayed in the units selected.

④ DIAL KNOB

Turn the knob to adjust output level. Turn clockwise to increase the output, counter clockwise to decrease the output.

⑤ EXTERNAL POWER JACK (Not Shown)

When used in conjunction with the optional AC Adaptor, the external power jack will eliminate the drain on your batteries. This is very handy for applications that require extended use of the PIECAL Model 334. Please see the section on Accessories for ordering information.

Note: This feature does not charge the batteries, it only supplies power to the PIECAL Model 334.

CHANGING BATTERIES

Low battery is indicated by “BAT” on the display. Approximately one to four hours of typical operation remain before the 334 will automatically turn off. To change the batteries; remove the rubber boot, remove the battery door from the back of the unit by sliding the door downward. This will allow access to the battery compartment. Replace with four (4) “AA” 1.5V batteries being careful to check the polarity. Place the battery door back on the unit and replace the rubber boot.

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

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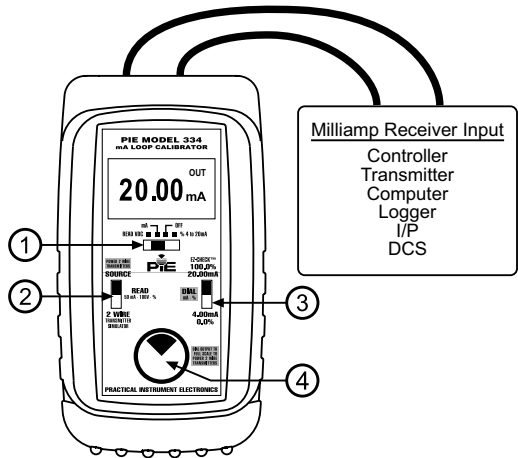
Sourcing Milliamps

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

Choose this function to provide an output from 0.00 to 24.00 milliamps. The compliance voltage is a nominal 24 VDC to provide the driving power to your milliamp receivers.

- 1) Disconnect one or both input wires from the device to be calibrated.
- 2) Select "mA" or "% 4 to 20mA" with slide switch ①.
- 3) Select "SOURCE" using slide switch ②.
- 4) Connect the output leads of the PIECAL Model 334 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.

The output is adjusted by turning knob ④ while the EZ-CHECK™ switch ③ is in the "DIAL" position, or the current can be set at the fixed points of 4.00mA (0.0%) or 20.00mA (100.0%) with switch ③.



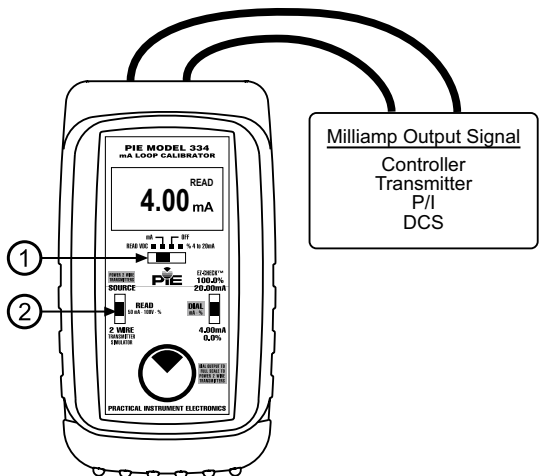
Reading Milliamp Outputs

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

Choose this function to measure from 0.00 to +52.00 milliamps or -25.0 to 300.0%.

- 1) Open the current loop at any convenient point along the signal path.
- 2) Select "mA" or "% 4 to 20mA" with slide switch ①.
- 3) Select "Read" using slide switch ②.
- 4) Connect the red input lead (+) of the PIECAL Model 334 to the more positive point of the break and the black input.

Signals below 0 mA or open circuits are indicated by 0.00 mA (-25.0%) on the display. Signals above 52 mA are current limited by protection circuitry.



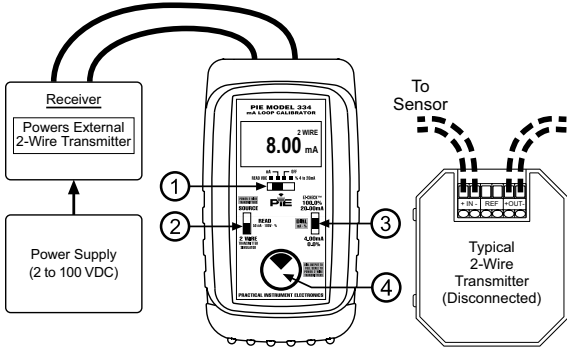
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Simulate 2-Wire Transmitters

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

Choose this function to simulate a 2 Wire Transmitter output from 0.00 to 24.00 milliamps. Operates in loops with power supply voltages from 2 to 100 VDC



- 1) Disconnect one or both input wires from the device to be calibrated.
- 2) Select “mA” or “% 4 to 20mA” with slide switch ①.
- 3) Select “2 WIRE” using slide switch ②.
- 4) Connect the red input lead of the PIECAL Model 334 to the plus (+) input of the field connections and the black lead to the minus (-).

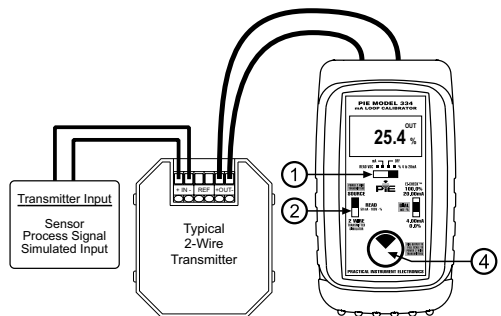
Loop current is adjusted by turning knob ④ while the EZ-CHECK™ switch ③ is in the “DIAL” position, or the current can be set at the fixed points of 4.00mA (0.0%) or 20.00mA (100.0%) with switch ③.

Power & Measure 2-Wire Transmitters

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

Choose this function to simultaneously supply power to a 2 Wire Transmitter while displaying the 4 to 20 mA output of the transmitter.

- 1) Disconnect one or both input wires from the device to be calibrated.
- 2) Select “mA” or “% 4 to 20mA” with slide switch ①.
- 3) Select “SOURCE” using slide switch ②.
- 4) Turn the knob ④ clockwise several times until full scale output (24.00 mA/125.0%) is obtained (this can be verified by clipping the output leads together and checking that the display indicates “FULL SCALE”).
- 5) Connect the red source lead of the PIECAL Model 334 to the plus (+) input of the device and the black source lead to the minus (-).



The PIECAL Model 334 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 PIECAL Model 334. Calibrate the transmitter in the usual manner and disconnect the PIECAL Model 334.

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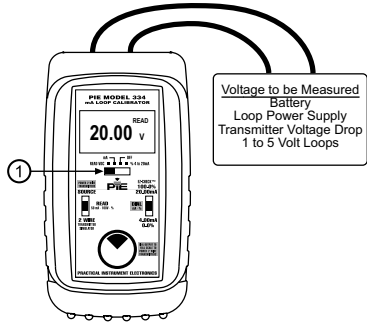
Read DC Volts

READ V

Choose this function to measure from -99.99 to +99.99V DC.

- 1) Select “**READ VDC**” with slide switch ①.
- 2) Connect the red (+) and black (-) leads of the PIECAL Model 334 across the voltage source to be measured.

Any DC voltage from -99.99 to +99.99 volts may be measured. Loop power supplies, signal voltages at receivers, batteries and transmitter voltage drops may be measured. Signals exceeding ± 99.99 VDC will be indicated by OVRLD on the display.



Application Notes

OUT OF RANGE SIGNALS

Signals below 0 mA or open circuits are indicated by 0.00 mA (-25.0%) on the display. Signals above 52 mA are current limited by protection circuitry to approximately 54 mA.

KEEPING THE PROCESS GOING

When an instrument in a critical control loop develops a problem it is important to maintain control of the process. The PIECAL Model 334 can be substituted for a faulty controller or transmitter to provide temporary manual control of the process. One technician takes manual control of the process while a second technician retrieves, installs and configures a replacement instrument.

OPEN LOOPS

The display will indicate 0.00 mA or -25.0% if there is an open loop or if the polarity is reversed. Check all the connections in the loop or try reversing the leads.

POWER TRANSMITTER

Adjusting the SOURCE output to full scale supplies a nominal 24V DC to power a 2 Wire Transmitter while simultaneously displaying the 4 to 20 mA output of the transmitter.

READ MILLIAMPS

Select READ milliamps by moving slide switch ① to “mA” or “% 4 to 20mA” and moving slide switch ② to “READ”. Place the PIECAL Model 334 in the loop in series with the current to be measured.

SOURCE MILLIAMPS or 2-WIRE SIMULATOR

Select “SOURCE” using slide switch ② to output from 0.00 to 24.00 milliamps using the PIECAL Model 334’s internal power source. This will provide 24V DC. Select “2-WIRE” to control the current in loop that is using an existing power supply. To change the output current adjust the dial knob ④. Turning clockwise will increase the output value, turning counter-clockwise will decrease the output value. The output is adjustable in all EZ-CHECK™ positions. When returning to the “4.00mA”/“0.0%” and “20.00mA”/“100%” positions they will always return to 4.00 (0.0%) and 20.00 (100.0%) mA. This method is superior to keypad units. The zero and full scale positions can be adjusted smoothly making easy valve end stop testing, trip point testing, alarm testing, etc. There is virtually no overshoot/undershoot and no automated modes that need to be learned.

READ DC VOLTS

Select “READ VDC” using slide switch ① to read volts DC. Clip the leads across the voltage to be measured.

Application Notes

SETTING UP VALVES

When setting up a valve it is important to correctly set the end stops. Use the PIECAL Model 334 to supply the 4 to 20 mA control signal to stroke the valve. Select "SOURCE" and the PIECAL Model 334 will use the internal power source for outputting current or switch to 2-WIRE SIMULATOR to stroke a valve using any pre-existing installed loop power supply as the power source.

Example:

- 1) Disconnect the 4-20 mA control wires from the Current-to Pressure (I/P) converter or the actuator.
- 2) Connect the PIECAL Model 334 following the connection diagrams on the previous pages for Simulate 2-Wire Transmitters
- 3) Move the EZ-CHECK™ switch ③ to **"4.00 mA"/"0.0%"** and adjust the fully closed stop on the actuator.
- 4) Turn the PIECAL Model 334's knob ④ slowly counterclockwise and verify that the actuator and valve don't move. Repeat steps 3 & 4 until no movement is detected.
- 5) Move the EZ-CHECK™ switch ③ to **DIAL** and quickly back to **"4.00 mA"/"0.0%"** then turn the PIECAL Model 334's knob ④ clockwise. The actuator and valve should begin to move.
- 6) Move the EZ-CHECK™ switch ③ to **"20.00 mA"/"100.0%"** and adjust the fully open stop on the actuator.
- 7) Turn the PIECAL Model 334's knob ④ slowly clockwise and verify that the actuator and valve don't move. Repeat steps 6 & 7 until no movement is detected.
- 8) Move the EZ-CHECK™ switch ③ to **DIAL** and quickly back to **"20.00 mA"/"100.0%"** then turn the PIECAL Model 334's knob counterclockwise. The actuator and valve should begin to move.

Accessories

AC ADAPTOR (200 to 240 VAC)

Part No. 020-0100

AC ADAPTOR (100 to 120 VAC)

Part No. 020-0101

Ni-MH 1 Hour Charger w/4 Ni-MH AA Batteries

Part No. 020-0103

Guarantee

The Practical Instrument Electronics PIECAL Model 334 is guaranteed to be a functional replacement for the Altek Model 334 or Altek Model 334A as described in the product comparison. Claims under this guarantee can be made by returning the equipment prepaid to our factory. The equipment will be repaired, replaced, adjusted or money back at our option. The liability of Practical Instrument Electronics (PIE) is restricted to that given under our guarantee. 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.

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 warrantee 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 warrantee. 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.

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PIECAL 334 Specifications

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

General	
Operating Temperature Range	-20 to 60 °C (-5 to 140 °F)
Storage Temperature Range	-30 to 60 °C (-22 to 140 °F)
Relative Humidity Range	10 % ≤RH ≤90 % (0 to 35 °C), Non-condensing
	10 % ≤RH ≤ 70 % (35 to 60 °C), Non-condensing
Size	L=5.63 x W=3.00 x H=1.60 inches
Weight	12.1 ounces (including boot & batteries)
Batteries	Four "AA" Alkaline 1.5V (LR6)
Optional AC Adaptors	120 VAC 50/60 Hz [Part # 020-0100]
	240 VAC 50/60 Hz [Part # 020-0101]
Optional NiMh Rechargeable battery kit	120 VAC for North America Only; charger, four NiMh batteries, AC & DC cords [Part # 020-0103]
Low Battery	Low battery indication with nominal 1 hour of operation left
Protection against misconnection	Over-voltage protection to 135 vrms (rated for 30 seconds) or 240 vrms (rated for 15 seconds)
Display	High contrast backlit graphic liquid crystal display with 0.413" (10.5 mm) high digits

Read mA	
334 Ranges and Resolution	0.00 to 52.00 mA Full Span OR -25.0 to 300.0% of 4-20 mA
Accuracy	
	Below 24.01mA ≤ ± (0.05 % of 24.00mA) (± 0.01mA)
Above 24.00mA	≤ ± (0.05 % of 52.00mA) (± 0.03mA)
Voltage burden	≤ 2V at 50 mA
Overload/Current limit protection	54 mA nominal
Battery life	≥ 125 Hours nominal

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PIECAL 334 Specifications (continued)

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

Source/Power & Measure Two Wire Transmitters	
334 Ranges and Resolution	0.00 to 24.00 mA Full Span or -25.0 to 125.0% of 4-20 mA
Accuracy	
EZ Check(s) at 4 & 20mA ¹ 0.0 to 24.00 mA	$\leq \pm (0.025\% \text{ of Span at 4 mA \& 20 mA}) \quad (\pm 0.005\text{mA})$ $\leq \pm (0.05\% \text{ of 24.00mA Span}) \quad (\pm 0.012\text{mA})$
Noise	$\leq \pm \frac{1}{2}$ Least Significant Digit
Temperature effect	$\leq \pm 0.005 \text{ } ^\circ\text{C of FS}$
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 (334Plus)
Battery life	Source and Power measure mode ≥ 30 hrs at 12 mA nominal; ≥ 25 hrs with backlight on (334Plus)

¹These are internal calibrated cardinal reference points and accuracy is not defined or limited by display resolution

2-Wire Transmitter Simulation	
Accuracy	Same as Source/Power & Measure
Voltage burden	$\leq 2\text{V at } 20 \text{ mA}$
Overload/Current limit protection	24 mA nominal
Loop voltage limits	2 to 100VDC (fuse-less protected from reverse polarity connections)
Battery life	≥ 125 hours nominal

Voltage Read	
Range and Resolution	-99.99 to +99.99 VDC Full Span (FS)
Accuracy	$\leq \pm 0.05 \text{ \% of FS}$
Temperature effect	$\leq \pm 100 \text{ ppm/}^\circ\text{C of FS}$
Input resistance	$\geq 2 \text{ M}\Omega$
Battery life	≥ 125 hours nominal

Additional Information

This product is calibrated on equipment traceable to NIST and includes a Certificate of Calibration. Test Data is available for an additional charge.

Practical Instrument Electronics recommends a calibration interval of one year. Contact your local representative for recalibration and repair services.

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