



# Model 535 Operating Instructions

## Read Voltage Specifications:

Range:	0.00 to 30.00 VDC (with 4X over range)
Resolutions	0.01 VDC
Temperature Effect	≤ ± 200 ppm/°C of range
Input Resistance	≥ 1 MΩ
Accuracy	0.00 to 30.00 VDC ≤ ± (0.1 % of reading ±0.1 V)

## Source Voltage Specifications:

Source Range:	0.000 to 24.000 VDC
Output Resistance	≤0.3 Ω
Source Current	≥20.000 mA
Accuracy	≤±(0.025%RDG + 0.004 V) ±50ppm/°C of range

## Ordering Information:

4-20/10-50 Milliamp mA/V Loop Calibrator	Model 535
Includes:	
Calibration Test Data	
NIST Traceable Certificate	
Carrying Case	020-0200 (included)
60 Hz AC adapter	020-0102 (included)
Option:	
50 Hz AC adapter	020-0101
Option:	
External banana jack access to internal 10 Ω current sense.	Model 535A

## Warranty

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from the date of shipment. Claims under guarantee 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 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.



# Model 535

## 4-20/10-50 mA/V Loop Calibrator

### Operating Instructions

## Basic Keypad Operations

### ① EZ-Check™ Switch/EZ-Step™ Pushbutton

Slide the switch to select the user stored values for calibration points. Press the button to adjust the output by the user defined step size. Press and hold the button to activate the auto step/ramp mode.

### ④ UNITS/STEP TIME Button

Press and release **UNITS/STEP TIME** to change how current is displayed: either in milliamperes or % of 4-20/10-50 mA. Voltage is only displayed in volts.

Press and hold **UNITS/STEP TIME** to change step size.

### ⑤ READ/SOAK TIME Button

Press and release **READ/SOAK TIME** to change read modes. These are:

- Read Milliamps
- Power and Measure 2-Wire Transmitter
- Read Volts

Press and hold **READ/SOAK TIME** to change soak time.

### ⑥ STORE/CLEAR Button

**In any source mode:**

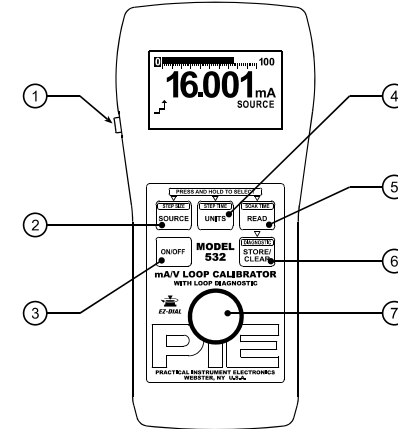
Press **STORE/CLEAR** to save the current reading in the EZ-Check™ HI or LO position. The EZ-Check™ switch must be set to HI or LO. The display will flash "STORED" to confirm.

**In any read mode:**

Press **STORE/CLEAR** to clear the values saved in the EZ-Check™ HI and LO positions. The display will flash "CLEARED" to confirm.

### ⑦ EZ-Dial™ Knob

Turn the EZ-Dial™ knob to adjust the output level. Press and turn to adjust 100X faster.



### ② SOURCE/STEP SIZE Button

Press and release **SOURCE/STEP SIZE** to change source modes. These are:

- Source Milliamps
- 2-Wire Transmitter Simulate
- Source Volts

Press and hold **SOURCE/STEP SIZE** to change step size.

### ③ ON/OFF Button

Press **ON/OFF** to turn the Model 535 on or off.



# Model 535 Operating Instructions

## Model 535 Configuration

Press the EZ-Dial™ Knob while turning the Model 535 on to access the configuration mode. Turn the EZ-Dial™ Knob to select configuration items. Press the EZ-Dial™ Knob to change configuration items. Turn the unit off or just wait approximately 8 seconds to exit the configuration mode.

→ AUTO OFF	ON
EZ-STEP	OFF
EZ-CHECK	OFF
10-50 mA RANGE	ON
FACTORY RESET	OFF

### Auto Off - ON (default)/OFF

Auto Off is ON, by default, to save battery life by turning the unit off after 30 minutes of inactivity. Turn Auto Off to OFF to prevent automatic shutdown. This is typically useful for manual loading or continuous use.

### EZ-Step™ - ON/OFF (default)

If EZ-Step™ is ON manual and automatic stepping/ramping is available. If EZ-Step™ is OFF the EZ-Step™ pushbutton will be disabled and the step direction indicator will not be displayed.

### EZ-Check™ HI/LO Readings ON/OFF (default)

If the EZ-Check™ HI/LO Readings option is ON, the highest and lowest readings will automatically be saved in the HI and LO EZ-Check™ positions.

If this option is OFF the HI and LO positions will show the current reading.

### 4-20/10-50 Range (default) ON

Select either 4-20 or 10-50 milliamp range. The Model 535 scales % mode display and the bar graph accordingly.

### Factory Reset ON/OFF (default)

If Factory Reset is ON, the unit will restore all factory defaults when the Model 535 is turned OFF and back ON. This will reset any changes made in the Model 535 Configuration options, returning the unit to its simplest factory configuration.

## EZ-Dial™ Knob

Adjust the output up and down with the EZ-Dial™ knob. The increment is 0.001 mA (or 0.01 % if display units are % of 4-20/10-50 mA.) Press while turning to adjust 100X faster – 0.100 mA (or 1.00 %.)

## EZ-Check™ Switch

The EZ-Check™ switch has three positions -- high, set, and low. Its position is shown at the left edge of the display with "HI" and "LO" indicators. Use of the EZ-Check™ switch depends on mode:

### Source Modes:

Slide the EZ-Check™ switch to the HI and LO positions to recall the settings stored in those positions. While in the HI and LO positions, dial the EZ-Dial™ knob to change the display. Press **STORE/CLEAR** to save new settings in the HI and LO positions. The display will flash "STORED" to confirm.

*Hint: For faster calibrations, the position of the switch can be felt. This feature allows continuous monitoring of the device being calibrated without looking back at the Model 535 display. This is also useful in poor lighting or under difficult operating conditions.*



### Read Modes:

In read modes, the Model 535 calibrator records the maximum and minimum readings observed in each mode. Slide the EZ-Check™ switch to the HI and LO positions to display the readings. Press **STORE/CLEAR** to clear the readings. The display will flash "CLEARED" to confirm. By default, the Model 535 has EZ-Check™ HI/LO Readings OFF.

## EZ-Step™ Pushbutton/ Manual Step

The EZ-Step™ pushbutton is a feature only in source modes.

Press and hold the EZ-Step™ pushbutton for less than one second to cause the output to step up or down by the EZ-Step™ size.

The EZ-Step™ direction is indicated on the display (  or  ). Press the EZ-Dial™ knob to change the step direction.

Stepping and auto step/ramp limits are defined by the EZ-Check™ HI and LO settings. The step direction changes when a limit is reached.

The step size is computed as the difference between the EZ-Check™ HI and the EZ-Check™ LO divided by the number of steps. See figure 1. By default, the Model 535 has EZ-Step™ OFF.



# Model 535 Operating Instructions

## Common Specifications for all Current Modes:

Ranges	0.000 to 24.000 mA, -25.00 to 125.00% of 4-20 mA
	0.000 to 52.000 mA, -25.00 to 105.00% of 10-50 mA
Accuracy	≤ ± (0.025 % of reading + 0.004 mA)
Temperature Effect	≤ ± 50 ppm/°C of range
Resolution	0.001 mA and 0.01 %
Step/Ramp Timebase Accuracy	0.01% of 4.9152 MHz

## Source/Power and Measure 2-Wire Transmitter Specifications:

Loop Compliance Voltage	≥ 43 Volts
Loop Drive Capability	1200 Ω at 20 mA/800 Ω at 50 mA for entire battery life
Miscellaneous	Open loop or out of compliance conditions are indicated by appropriate error display
	Battery life in:
	Source mode ≥ 18 hrs at 12 mA/≥ 9 hrs at 30 mA typical
	Power measure ≥ 10 hrs at 12 mA/≥ 5 hrs at 30 mA typical
	Selectable EZ-Step(s) for Source Mode/2-Wire Transmitter Simulation:
	2 to 16 selectable step settings
	Step size is determined by the selected high & low ranges
	Selectable time settings for stepping and soak:
	STEP: 5 to 900 seconds    SOAK: 0 to 900 seconds

## Read mA Specifications:

Voltage Burden	≤ 2V
Overload/Current Limit Protection	≤ 24 mA (4-20 range)/ ≤ 52.5 mA (10-50 range) nominal
Battery Life	≥ 40 hours typical

## 2-Wire Transmitter Simulation Specifications:

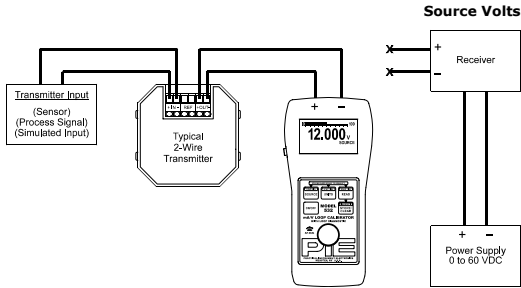
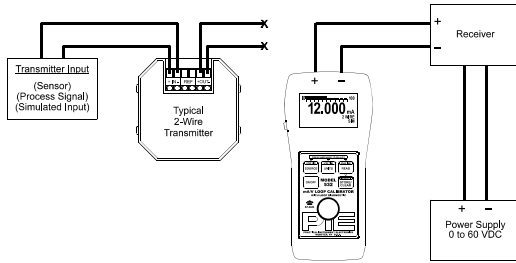
Overload/Current Limit Protection	≤ 24 mA (4-20 range)/ ≤ 52.5 mA (10-50 range) nominal
Loop Voltage Limits	2-90 VDC
Miscellaneous	Open loop or out of compliance conditions are indicated by appropriate error display
	Battery life ≥ 40 hour typical
	Selectable EZ-Step(s) for Source Mode/2-Wire Transmitter Simulation:
	2 to 16 selectable step settings
	<b>Step size is determined by the selected high &amp; low ranges</b>
	Selectable time settings for stepping and soak:
	STEP: 5 to 900 seconds    SOAK: 0 to 900 seconds



# Model 535 Operating Instructions

## 2 Wire Transmitter Simulate

Substitute the Model535 for a 2 wire transmitter. Use the EZ-Dial™ Knob and EZ-Check™ Switch to adjust loop current. At least 2 volts of loop power is required, else the display flashes "CHECK LOOP SUPPLY."



The Model 532 sources 0.000-24.000 volts. This is useful for powering transmitters and receiver equipment. Use the EZ-Dial™ Knob and EZ-Check™ Switch to adjust output voltage. The display flashes "LOW Ω" when the output is overloaded.

## Specifications

### General Specifications:

Unless otherwise indicated all specifications are rated from a nominal 23 °C, 70 % RH for 1 year from calibration with >1 MΩ load on external banana jack access to 10 Ω current sense (Model 535A).

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	7.00 X 3.30 X 2.21 inches (177.8 x 83.8 x 56.1mm)
Weight	14.0 oz (397 grams)
Battery	4 - AA Alkaline Optional 120 VAC 50/60 Hz AC adaptor included
Miscellaneous	Low battery indication with nominal 1 hour of operation left Over-voltage protection to 120 Vrms (rated for 30 seconds) or 240 Vrms (rated for 15 seconds) Bar graph display with 1% resolution of 4-20/10-50 mA signal scale High contrast graphic liquid crystal display with 0.45" (11.4 mm) high digits



# Model 535 Operating Instructions

## Auto Step/Ramp

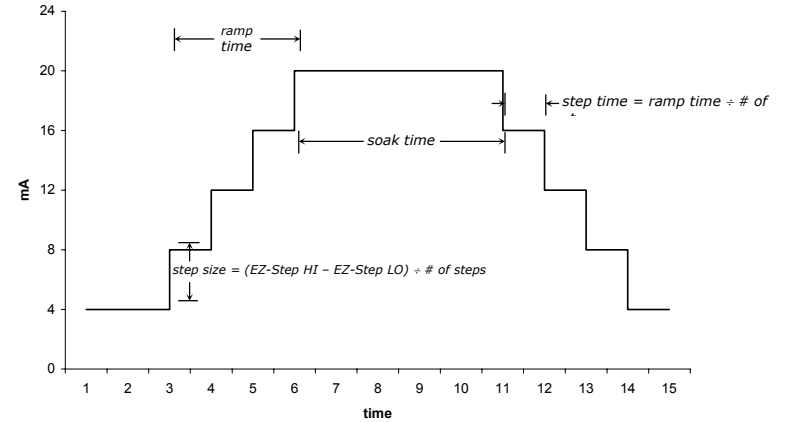
Press the EZ-Step™ pushbutton for more than one second to activate auto step/ramp mode. The Model 535 will automatically step by the selected EZ-Step™ size and time. Press the EZ-Step™ pushbutton again to deactivate auto step/ramp mode.

The EZ-Step™ direction is indicated on the display ( ↓ or ↑ ). Press the EZ-Dial™ knob to change the step direction. The step direction can be changed while automatically stepping/ramping.

Stepping and auto step/ramp limits are defined by the EZ-Check™ HI and LO settings. The step direction changes when a limit is reached.

Figure 1 will show how the Step/Ramp Parameters are used to configure automatic stepping/ramping.

Figure 1



Note: The Model 535's ability to detect overload/undervoltage conditions may be limited by the rate of change in the output when using automatic stepping/ramping. Turn auto step/ramp off while connecting or disconnecting the Model 535.

## Quick Reference Bar Graph

The Quick Reference Bar Graph indicates the input and output level on the Model 535 in % of 4-20/10-50 mA with 1% resolution.



## Manual Step and Auto Step/Ramp Parameter

### To Change the EZ-Step™ Size:

1. Press and hold the SOURCE/STEP SIZE button for more than ¾ of a second.
2. The display will flash "EZ-STEP SIZE".
3. Turn the EZ-Dial™ knob to select from 2 to 16 steps between the EZ-Check™ limits.
4. Turn the EZ-Dial™ clockwise past 16 steps to select continuous ramp mode.
5. Press the SOURCE/STEP SIZE button again to return to the normal display.

**EZ-STEP SIZE**  
04.000mA to 20.000mA  
04 steps  
04.000mA per step

Note: If the EZ-Step™ option is turned off, the display will flash "EZ-STEP OFF".

### To Change the EZ-Step™ Time:

1. Press and hold the UNITS/STEP TIME button for more than ¾ of a second.
2. The display will flash "EZ-STEP TIME".
3. Turn the EZ-Dial™ knob to select from 5 to 900 second ramp time. The time per step is calculated based on the selected EZ-Step™ size.
4. Press the SOURCE/STEP SIZE button to return to the normal display.

**EZ-STEP TIME**  
04.000mA to 20.000mA  
005s ramp  
001.250s per step

### To Change the Soak Time:

1. Press and hold the READ/SOAK TIME button for more than ¾ of a second.
2. The display will flash "SOAK TIME".
3. Turn the EZ-Dial™ knob to select from 0 to 900 second soak time.
4. Press the READ/SOAK TIME button again to return to the normal display.

Note: A soak time of 0 defeats the soak period. The step time will be used instead.

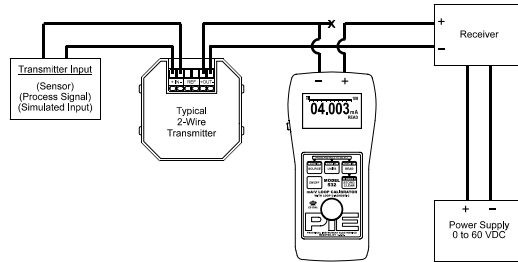
**EZ-STEP SOAK TIME**  
04.000mA to 20.000mA  
005s soak  
001.250s per step

### To Change the EZ-Step™ Direction:

1. Press and release the EZ-Dial™ knob without turning.
2. The display will change to show the EZ-Step™ direction selected ( or ).

## Modes of Operation

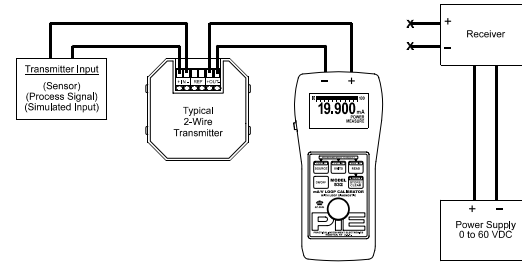
### Read Milliamp



Connect the Model 535 in series with the process loop to monitor current. Observe correct polarity. Current limiting above 24 mA (52 mA if 10-50 range is selected) is indicated by a flashing "CURRENT LIMITED" display.

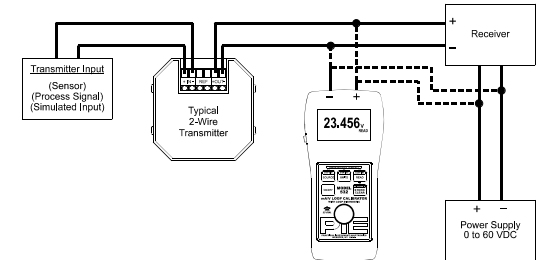


## Power and Measure 2 Wire Transmitter



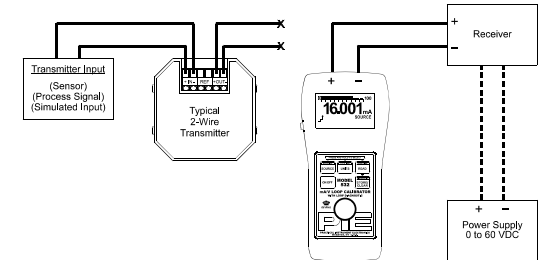
The Model 535 provides power to the process loop while displaying output current. Use this mode to test a transmitter's ability to control loop current. Current limiting above 24 mA (52 mA if 10-50 range is selected) is indicated by a flashing "CURRENT LIMITED" display.

### Read Volts



The Model 535 measures +/- 30 VDC with 4X overrange ability. The display flashes "OVERRANGE" when the 30 volt limit is exceeded.

### Source Milliamp



Connect the Model 535 directly to 4-20/10-50 mA receiver equipment, alarms, panel meters, etc. Use the EZ-Dial™ Knob and EZ-Check™ Switch to adjust loop current. The display flashes "HIGH Ω" when the loop resistance is too high or the leads are open.