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# Ω OMEGA® User's Guide



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## CL309A 4-20 Milliamp Loop Calibrator



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# CL309A 4-20 Milliamp Loop Calibrator Operating Instructions

## Product Description

### ● EASY TO USE

With the OMEGA CL309A 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 Model CL309A to simultaneously power your 2 Wire Transmitter and measure its output. When desired the Model CL309A 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 Model CL309A in place of a 2 Wire transmitter. Simulate a changing process input to check loop response and control settings. The Model CL309A uses any loop power from 2 to 100V DC.

### ● READ LOOP CURRENT

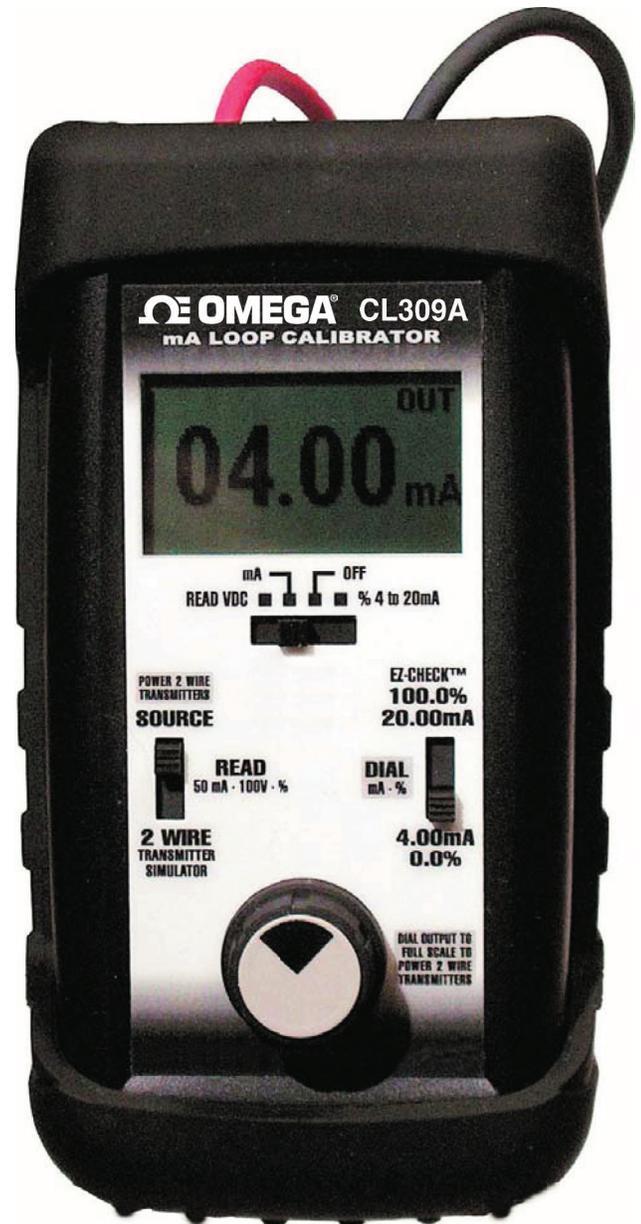
Check controller outputs or measure the milliamp signal anywhere in the loop. The Model CL309A measures 0.00 to 52.00 mA signals with greater accuracy than a typical multimeter. The Model CL309A can be easily switched to display milliamps or percent of 4 to 20.

### ● POWER & MEASURE 2 WIRE TRANSMITTERS

The Model CL309A 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

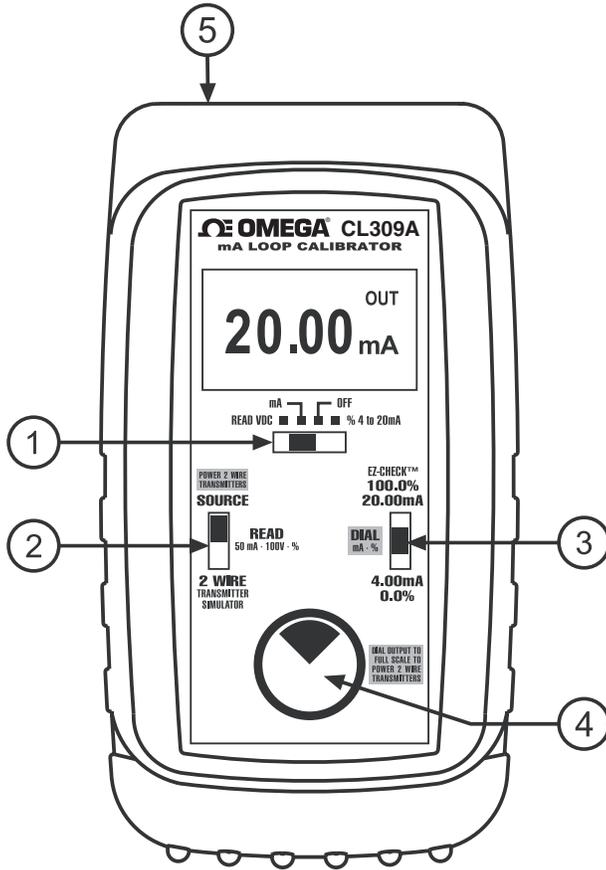
The Model CL309A can measure from -99.99 to +99.99 VDC with 10mV resolution. Use it to check loop power supplies, I/V converters, chart recorders, 1 to 5 Volt signals, and any other voltages within this range making it unnecessary to carry an additional multimeter.





# OMEGA Model CL309A Operating Instructions

## 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.

#### Tech 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  
 Percent = (Milliamps - 4) / 0.16  
 To convert from Percent to Milliamps  
 Milliamps = 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 Model CL309A 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 Model CL309A. Please see the section on Accessories for ordering information.

**Note:** This feature does not charge the batteries, it only supplies power to the Model CL309A.

## CHANGING BATTERIES

Low battery is indicated by “BAT” on the display. Approximately one to four hours of typical operation remain before the CL309A 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.



# OMEGA Model CL309A Operating Instructions

## Specifications

### General Specifications:

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

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
Noise	≤ ± 0.005mA of Reading
Temperature Effect	≤ ± 0.005 %/°C of FS (Voltage Read Mode: ± 100ppm/°C of FS)
Size With Rubber Boot	L=5.63 x W=3.00 x H=1.60 inches L=14.30 x W=7.62 x H=4.06 centimeters
Weight	12.1 ounces (including boot & batteries)
Batteries	Four (4) "AA" Alkaline 1.5V (Duracell MN1500 or equivalent) <b>Optional (100 to 120) VAC Adaptor available</b> <b>Optional (200 to 240) VAC Adaptor available</b> <b>Optional NiMH Rechargeable battery kit available</b>
Miscellaneous	Low battery indication with nominal 1 hour of operation left Over-voltage protection to 135 vrms (rated for 30 second) or 240 vrms (rated for 15 seconds) High contrast graphic liquid crystal display with 0.413" (10.5 mm) high digits

0.3522

### Specifications Common To Source, Power Measure & Simulate 2 Wire Transmitters:

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) ≤ ±0.025% at 4.00mA and 20.00mA (±0.005mA) 0.00 to 24.00 mA ≤ ± 0.05% of 24.00mA (±0.01mA)

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

### Source, Power Measure Specifications:

Loop Compliance Voltage	≥ 24 DCV @ 20.00mA
Loop Drive Capability	1200 Ω at 20 mA for 15 hours nominal
Battery Life	Source and Power measure mode ≥ 30 hrs at 12 mA nominal

### Simulate 2 Wire Transmitter Specifications:

Voltage Burden	≤ 1.2V at 20 mA
Overload/Current Limit Protection	54 mA nominal
Loop Voltage Limits	2 to 100 VDC (fuse-less protected from reverse polarity connections)
Battery Life	≥ 125 hours nominal

### Read mA Specifications:

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 24.00 mA ≤ ± 0.05% of 52.00mA (±0.02mA)
Voltage Burden	≤ 2V at 50 mA
Overload/Current Limit Protection	≤ 54 mA nominal
Battery Life	≥ 125 hours nominal

### Voltage Read Specifications:

Range and Resolution	-99.99 to +99.99 VDC
Accuracy	≤ ± 0.05 % of Full Scale
Temperature Effect	≤ ± 100ppm/°C of Full Scale
Input Resistance	≥ 2 MΩ
Battery Life	> 125 hours nominal



## Application Notes Continued

### SETTING UP VALVES

When setting up a valve it is important to correctly set the end stops. Use the CL309A to supply the 4 to 20 mA control signal to stroke the valve. Select **"SOURCE"** and the CL309A 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 CL309A following the connection diagrams on the previous page for Simulate 2 Wire Transmitters.
- 3) Move the EZ-CHECK™ switch ③ to **"4.00mA"** / **"0.0%"** and adjust the fully closed stop on the actuator.
- 4) Turn the CL309A'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 **"4.00mA"** / **"0.0%"** then turn the CL309A's knob ④ clockwise. The actuator and valve should begin to move.
- 6) Move the EZ-CHECK™ switch ③ to **"20.00mA"** / **"100.0%"** and adjust the fully open stop on the actuator.
- 7) Turn the CL309A's knob ④ slowly clockwise and verify that the actuator and valve do not move. Repeat steps 6 & 7 until no movement is detected.
- 8) Move the EZ-CHECK™ switch ③ to **DIAL** and quickly back to **"20.00mA"** / **"100.0%"** then turn the CL309A's knob ④ counterclockwise. The actuator and valve should begin to move.

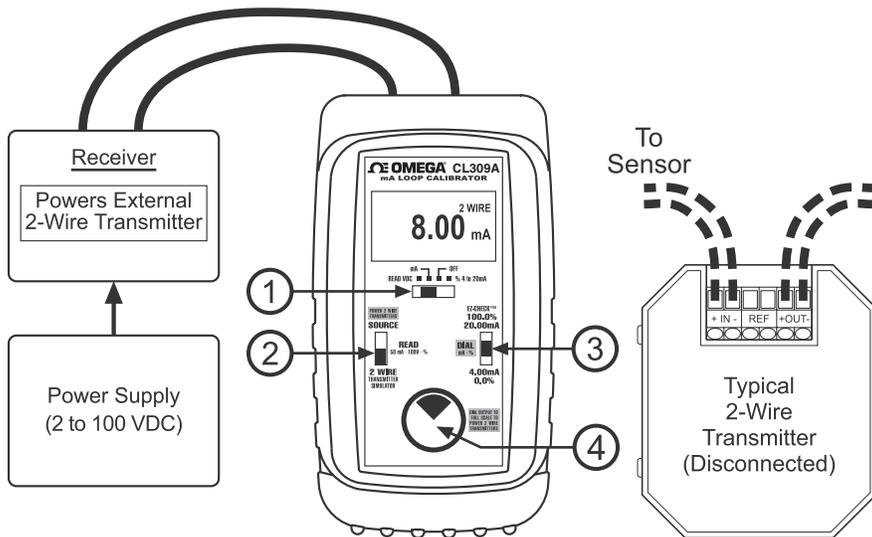


# OMEGA Model CL309A Operating Instructions

## 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 PIE 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).

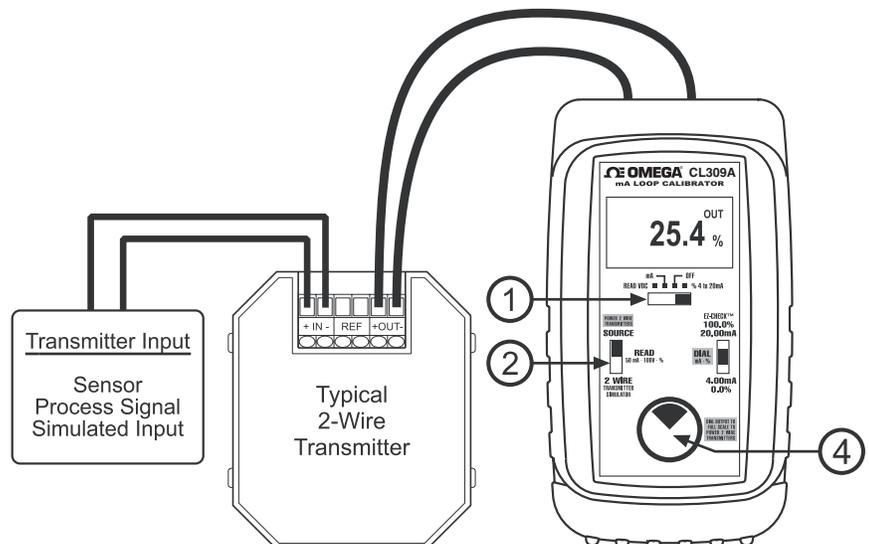
## Power & Measure 2 Wire Transmitters

### 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 OMEGA CL309A to the plus (+) input of the device and the black source lead to the minus (-).

The Model CL309A 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 Model CL309A. Calibrate the transmitter in the usual manner and disconnect the Model CL309A.





# OMEGA Model CL309A Operating Instructions

## Sourcing Milliamps

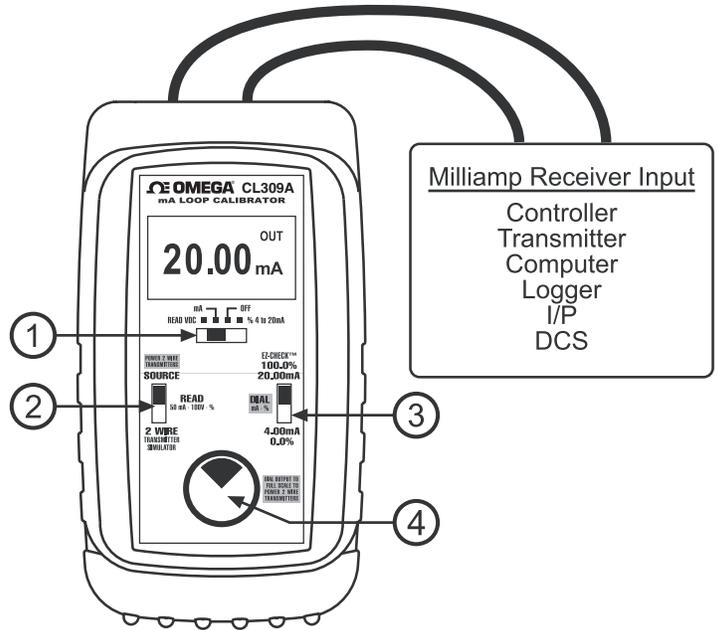
### mA OUT, % OUT (Percent of 4 to 20 mA)

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.

Disconnect one or both input wires from the device to 1) 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 Model CL309A 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.



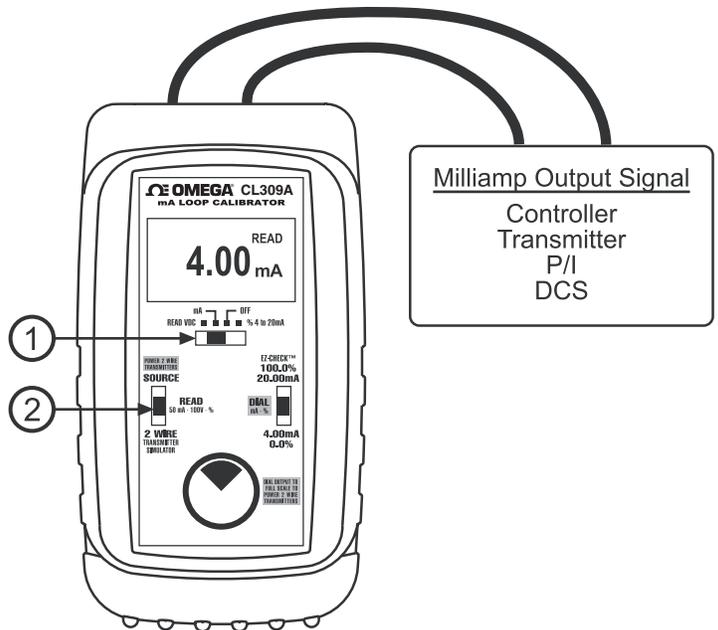
## Reading Milliamp Outputs

### 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 Model CL309A to the more positive point of the break and the black input lead (-) to the more negative point of the break.

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.





# OMEGA Model CL309A Operating Instructions

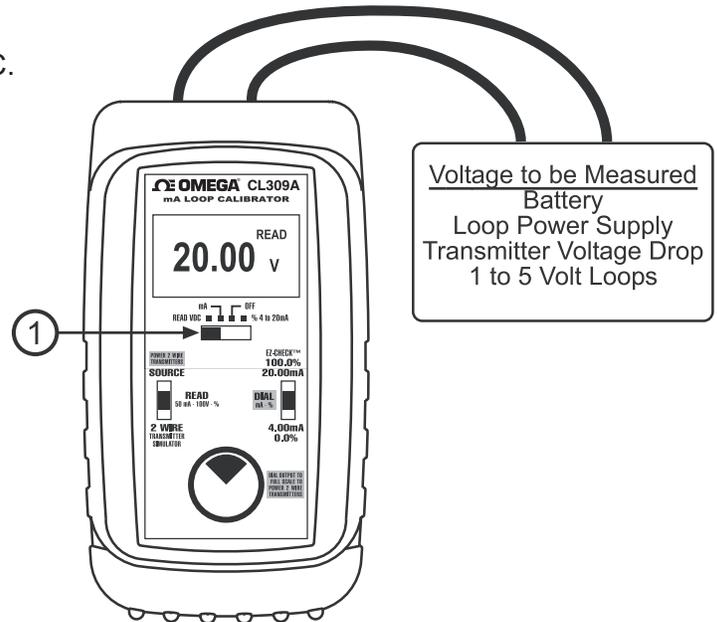
## Read DC Volts

### 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 Model CL309A 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  $\pm 99.99$  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 CL309A 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 Model CL309A 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 Model CL309A’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.

## NOTES:

## WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **37 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **three (3) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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