

Part No. 8894

LASER[®]

Milliohm Meter

Instructions

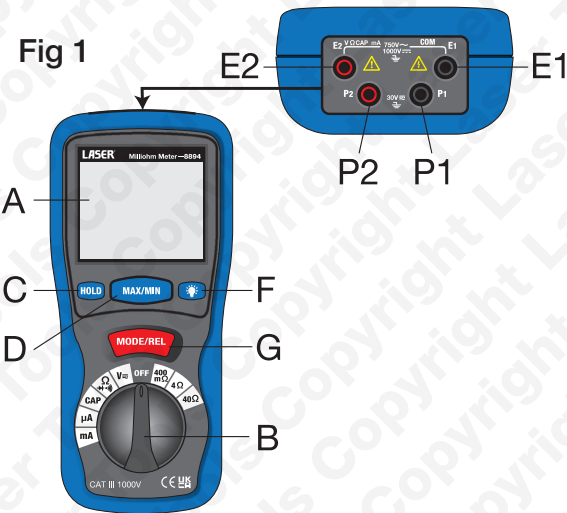


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Introduction

The Laser Tools 8894 is a digital low-resistance tester designed specifically to measure very low resistances. Designed for technicians and engineers, this tool is indispensable for diagnosing resistance issues in high-voltage circuits, where even minute deviations can trigger fault codes and lead to critical component failures. Essential for technicians working to diagnose motor winding and cabling resistance issues where the resistance measured are much lower than a standard multimeter can show. Uses well-established, industry-standard 4-wire Kelvin leads combined with volts and amps measurement to give a very accurate reading of the resistance. Using the additionally supplied standard probe leads, this instrument also offers voltage measurement up to 1000v DC or 750v AC, amperage up to 400mA and capacitance to 40mF. Overload protected with recording modes and auto shut off. Ideal for working with hybrid and battery electric vehicles. CE and RoHS compliant. CAT III.

Controls



Ref.	Description
A	Display screen
B	OFF/ON Rotary Function Switch
C	Data hold button
D	MAX/MIN button
E1	COM E1 jack
E2	VΩ Cap mA E2 jack
F	Backlight button
G	Mode/REL button
H	Standard probe leads
I	Low-resistance Kelvin clip leads
P1	P1 jack
P2	P2 jack

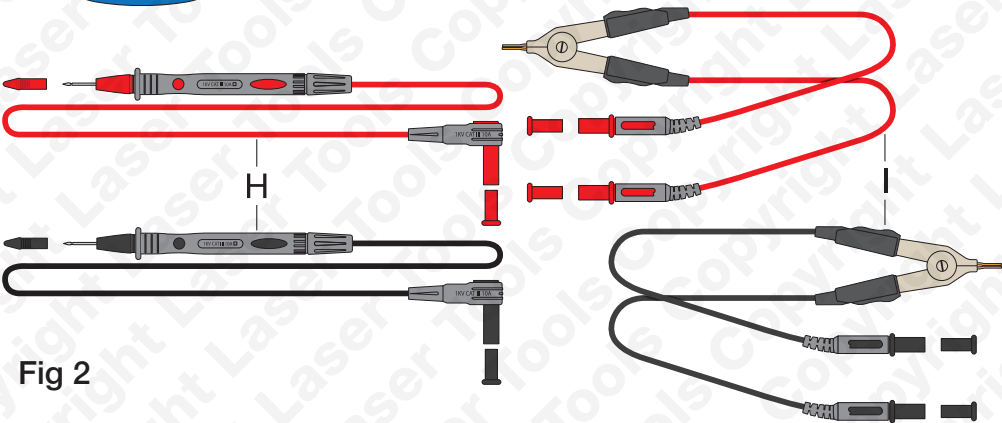


Fig 2

Battery Replacement

Ref.	Description
J	Tilt stand
K	Screws: battery compartment
L	Battery compartment cover
M	Fuses (X 2) 500mA / 250V
N	Hook mount


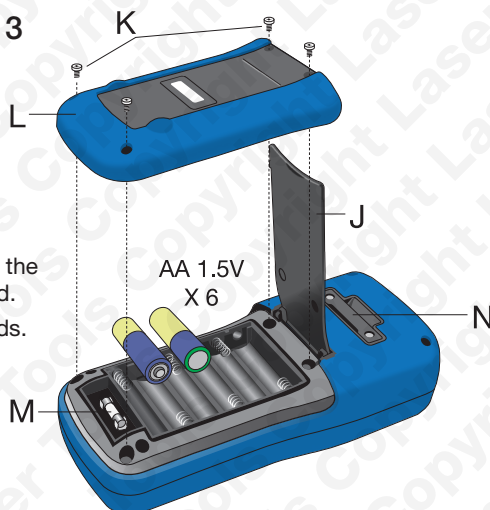
1. When the low battery symbol  appears on the LCD, the six 1.5V AA batteries must be replaced.
2. Turn the instrument off and remove the test leads.
3. Refer to Figure 3: Unclip the tilt stand (J) from the rear of the instrument.
4. Remove the four Phillips head screws (K), that secure the battery cover.
5. Remove the battery compartment cover (L).
6. Replace the batteries (6 X 1.55 AA) observing polarity.
7. Refit the rear cover and secure the screws.

Fig 3



Operating Principle of Measuring Low Resistance:

Refer to Figure 4: You need to measure the resistance of a component located a significant distance away from your ohmmeter. Such a scenario would be problematic, because an ohmmeter measures all resistance in the circuit loop, which includes the resistance of the wires (R_{wire}) connecting the ohmmeter to the component being measured (R_{subject}):

Usually, wire resistance is very small (only a few ohms per hundreds of feet, depending primarily on the gauge of the wire), but if the connecting wires are very long, and/or the component to be measured has a very low resistance anyway, the measurement error introduced by wire resistance will be substantial.

To measure the subject resistance in a situation like this involves the use of an instrument that acts as both an ammeter and a voltmeter. We know from Ohm's Law that resistance is equal to voltage divided by current ($R = E/I$). Thus, we should be able to determine the resistance of the subject component if we measure the current going through it and the voltage dropped across it (Figure 5):

Current is the same at all points in the circuit, because it is a series loop. Because we're only measuring voltage dropped across the subject resistance (and not the wires' resistances) though, the calculated resistance is indicative of the subject component's resistance (R_{subject}) alone.

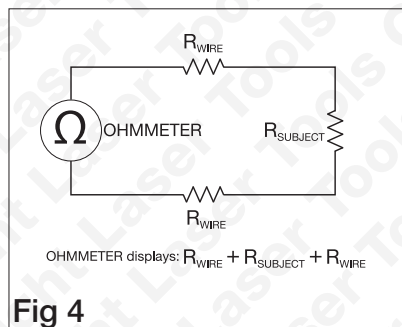


Fig 4

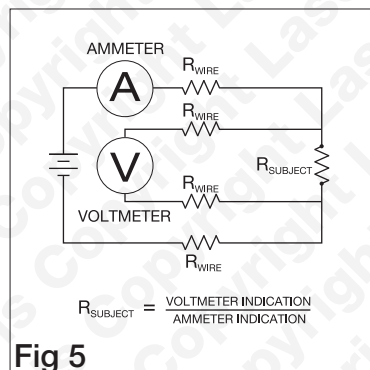


Fig 5

Operation

(Refer to **Controls** and **Precautions** sections before using this instrument.)

Refer to Figure 1:

HOLD button (C)

The HOLD function allows the meter to “freeze” a measurement for later reference.

1. Press the HOLD button to “freeze” the reading on the indicator. The “HOLD” message will appear in the display.
2. Press the HOLD button again to return to normal operation.

MAX/MIN button (D)

The MAX/MIN function allows the meter to capture the highest or lowest measurement for later reference.

1. Press the MAX/MIN button to begin measurement. The indicator “MAX” or “MIN” will appear in the display.
2. If the “MAX MIN” messages are flashing, the instrument is in MAX/MIN mode but not recording, press the MAX/MIN button to select a mode.
3. To return to normal AUTO measurement mode, hold down the MAX/MIN button for 2 seconds.

Backlight button (F)

Press the backlight button (F) to turn on the display backlight function. The backlight will automatically turn off after 15 seconds.

MODE/REL button (G)

MODE: Use this button (G) to select AC or DC measurement when in settings: V, mA, uA, Ω , \rightarrow , \bullet)).

RELATIVE ZERO BUTTON: For convenient readings comparison and offset during a low resistance test.

DC/AC VOLTAGE MEASUREMENT

1. Refer to Figures 1 and 2: Insert the black standard probe (H) test lead into the negative **COM** jack and the red standard probe test lead into the V Ω Cap mA **E2** jack.
2. Set the function switch to the **V** position.
3. Use the **MODE (G)** button to select AC or DC voltage.
4. Connect the test leads in parallel to the circuit under test.
5. Read the voltage measurement on the LCD display.

DC/AC CURRENT MEASUREMENT

1. Insert the black standard probe (H) test lead into the negative **COM** jack and the red standard probe test lead into the V Ω Cap mA **E2** jack.
2. For current measurements up to 4000uA, set the function switch to the uA position.
3. For current measurements up to 400mA, set the function switch to the mA range.
4. Press the **MODE (G)** button until DC or AC appears in the display.
5. **Remove power from the circuit under test**, then open up the circuit at the point where you wish to measure current.
6. Touch the black test probe tip to the negative side of the circuit. Touch the red test probe tip to the positive side of the circuit.

7. Apply power to the circuit.
8. Read the current in the display. The display will indicate the proper decimal point, value and symbol.

RESISTANCE [Ω] MEASUREMENT

WARNING: To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any resistance measurements. If applicable, remove the batteries and unplug the line cords.

1. Set the function switch to the Ω position.
2. Insert the black standard probe (**H**) test lead into the negative **COM** jack and the red standard probe test lead into the V Ω Cap mA **E2** jack.
3. Press the MODE (G) button until “M Ω ” appears in the display.
4. Touch the test probe tips across the circuit or part under test. It is best to disconnect one side of the part under test so the rest of the circuit will not interfere with the resistance reading.
5. Read the resistance in the display. The display will indicate the proper decimal point, value and symbol.

CONTINUITY CHECK

WARNING: To avoid electric shock, never measure continuity on circuits or wires that have voltage on them.

1. Set the range switch to the \bullet position.
2. Insert the black standard probe (**H**) test lead into the negative **COM** jack and the red standard probe test lead into the V Ω Cap mA **E2** jack.
3. Press the MODE (G) button until \bullet appears in the display.
4. Touch the test probe tips to the circuit or wire you wish to check.
5. If the resistance is less than 35 Ω , the audible signal will sound. The display will also show the actual resistance in ohms.

DIODE TEST

WARNING: To avoid electric shock, do not test any diode that has voltage on it.

1. Set the function switch to the $\rightarrow|+$ position.
2. Insert the black standard probe (**H**) test lead into the negative **COM** jack and the red standard probe test lead into the V Ω Cap mA **E2** jack.
3. Press the MODE (G) button until “ $\rightarrow|+$ ” appears in the display.
4. Touch the test probe tips to the diode or semiconductor junction you wish to test. Note the meter reading.
5. Reverse the probe polarity by switching probe position. Note this reading.
6. The diode or junction can be evaluated as follows:
 - A: If one reading shows a value and the other reading shows OL, the diode is good.
 - B: If both readings show OL, the device is open.
 - C: If both readings are very small or zero, the device is shorted.

NOTE: The value indicated in the display during the diode check is the forward voltage.

CAPACITANCE MEASUREMENT

WARNING: To avoid electric shock, discharge the capacitor under test before measuring.

1. Set the function switch to the CAP capacitance position.
2. Insert the black standard probe (**H**) test lead into the negative **COM** jack and the red standard probe test lead into the V Ω Cap mA **E2** jack.
3. Touch the test probe tips across the part under test.
4. Read the capacitance value in the display.
5. The display will indicate the proper decimal point and value.


NOTE: For very large values of capacitance measurement time can be several minutes before the final reading stabilises. The LCD displays DSC when discharging. Discharging through the chip is quite slow. We recommend the user to discharge the capacitor with some other apparatus.

LOW RESISTANCE MEASUREMENT

WARNING: To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any resistance measurements.

1. Insert the red Kelvin clip leads (**I**) into the red E2 and P2 jacks. Insert the black Kelvin clip leads (**I**) into the black E1 COM and P1 jacks.
2. At the range of 40 Ω , connect the clips to the low resistance's terminals; if the reading is too low then switch the range to 4 Ω or 400m Ω .
3. Remove the clips from the low resistance terminals, connect them to each other, then press the MODE/REL (**G**) button.
4. Re-connect the clips to the low resistance's terminals.
5. Read the resistance in the display. The display will indicate the proper decimal point, value and symbol.

Specifications

Low resistance range:	0~40 Ω
Display:	LCD with bar graph display.
Maximum output current:	200mA (400m Ω)
Sampling Rate:	2 times per second relative measurement.
Over Range Indicator:	OL of highest digit is displayed.
Low Battery Indication:	Low battery symbol  is displayed when the battery voltage drops below the specified operating voltage.
Auto Power-Off:	
To conserve battery life, the meter will automatically turn off after approximately 30 minutes of non-use. When this happens, the state of the meter is saved. In order to disable auto power-off function, power on the meter when any of the push function, except for HOLD, is pressed down. The "APO" sign on the LCD panel indicates whether the auto power-off function is enabled or not.	
Operating Temperature:	0°C to 40°C (32°F to 104°F) and humidity below 80% RH.
Storage Temperature:	-10°C to 60°C (14°F to 140°F) and humidity below 70% RH.
Power source:	6 X 1.5V Size AA batteries.
Dimensions:	200(L) x 92(W) x 50(H) mm
Weight:	Approximately 700g include batteries.

Electrical Specifications:

Accuracies are specified in this manner:

\pm (___ % of reading ___ digits) at 23°C \pm 5°C, below 80% RH.

Low resistance:

Range	Resolution	Accuracy	Current
400m Ω	0.1m Ω	\pm (1%+10d)	200mA
4 Ω	1m Ω	\pm (1%+5d)	20mA
40 Ω	0.01 Ω	\pm (1%+5d)	2mA

OHMS:

Range	Resolution	Accuracy
400 Ω	0.1 Ω	\pm (1.0% + 4d)
4K Ω	1 Ω	\pm (1.5% + 2d)
40K Ω	10 Ω	
400K Ω	100 Ω	\pm (2.5% + 3d)
4M Ω	1K	
40M Ω	10k Ω	\pm (3.5% + 5d)

DC Current:

Range	Resolution	Accuracy
400 μ A	0.1 μ A	\pm (1.5%+5d)
4000 μ A	1 μ A	
40mA	0.01mA	
400mA	0.1mA	

AC Current:

Range	Resolution	Accuracy/50~60Hz	Accuracy/400Hz
400 μ A	0.1 μ A	\pm (1.5%+5d)	\pm (1.5%+5d)
4000 μ A	1 μ A	\pm (1.5%+5d)	\pm (1.5%+5d)
40mA	0.01mA	\pm (1.5%+5d)	\pm (1.5%+5d)
400mA	0.1mA	\pm (1.5%+5d)	\pm (1.5%+5d)

DC Voltage:

Range	Resolution	Accuracy
400mV	0.1mV	\pm (1%+5d)
4V	1mV	
40V	0.01V	
400V	0.1V	
4000V	1V	\pm (1.2%+5d)

AC Voltage:

Range	Resolution	Accuracy/50~60Hz	Accuracy/400Hz
400mV	0.1mV	\pm (1.2%+10d)	\pm (2.5%+10d)
4V	1mV	\pm (1.0%+10d)	\pm (1.2%+10d)
40V	0.01V	\pm (1.0%+10d)	\pm (1.2%+10d)
400V	0.1V	\pm (1.0%+10d)	\pm (1.2%+10d)
750V	1V	\pm (1.0%+10d)	\pm (1.2%+10d)

Capacitance:

Range	Resolution	Accuracy
4nF	1pF	unspecified
40nF	10PF	\pm (5.0% + 20d)
400nF	0.1nF	\pm (3%+10d)
4 μ F	1nF	
40 μ F	10nF	
400 μ F	0.1 μ F	\pm (4%+10d)
4mF	1 μ F	\pm (10%+10d)
40mF	10 μ F	unspecified

Safety Warnings - please read



Precautions:

Improper use of this instrument can cause damage, shock, injury or death. It should only be used by properly qualified and experienced users. Read and understand this instruction leaflet and precautions (and in the case of hybrid or electric vehicles, all manufacturer's technical documentation) before operating the instrument.

- Do not work alone.
- Do not exceed the maximum allowable input range of any function (refer to tables above).
- **Use great care** when making measurements if the voltages are greater than 25V AC rms or 35V DC; these voltages are considered a shock hazard. Use **extreme caution** when working with high voltages.
- **Do not** measure voltage if the voltage on the COM input jack exceeds 1000V.
- With hybrid and electric vehicles, the high voltage (HV) systems **must be disconnected and isolated** from the batteries before performing any test with the instrument.
- Set functions to the appropriate position before measuring.
- **Never** connect the meter leads across a voltage source while the function switch is in the current, resistance, or diode mode. Doing so can damage the instrument.
- When measuring volts do not switch to current or resistance modes.
- Do not measure DC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

- **Always discharge** capacitors and remove power from the device under test before carrying out resistance or continuity tests.
- When changing ranges using the rotary function switch, always disconnect the test leads from the circuit under test.
- When using the test leads, keep fingers away from the lead contacts. Keep fingers behind the test lead finger guards.
- Set the rotary function switch **(B)** to **OFF** when the meter is not in use and remove the test leads from the instrument.
- Inspect the condition of the test leads and the meter itself for any wear or damage before operating the meter. Repair or replace any wear or damage before use.
- Remove the batteries if the meter is to be stored for long periods.
- Ensure that the meter is switched off when opening the battery compartment.
- Always remove the test leads before replacing the batteries.
- Never operate the meter unless the back cover and the battery and fuse covers are in place and fastened securely.
- **Note:** *Dispose of this product at the end of its working life in compliance with the EU Directive on Waste Electrical and Electronic Equipment (WEEE). When the product is no longer required, it must be disposed of in an environmentally protective way. Contact your local solid waste authority for recycling information.*



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