

ELT 101: Basic Electricity: AC/DC

LAB 3-1: Digital Multimeter (DMM) Basics

A multimeter or a multitester, also known as a volt/ohm meter or VOM, is an electronic measuring instrument that combines several measurement functions in one unit. A typical multimeter may include features such as the ability to measure voltage, current and resistance. There are two categories of multimeters: analog multimeters and digital multimeters (often abbreviated DMM or DVOM.)



Most DMM's are hand-held and are used for basic fault finding and field service work. Bench-style DMM's can measure to a very high degree of accuracy and are most often found in laboratories and high-end manufacturing. DMM's can be used to troubleshoot electrical problems in a wide array of industrial and household devices such as batteries, motor controls, appliances, power supplies, and wiring systems.

Objectives

- 1) Become familiar with the operation controls of the Fluke 179 DMM
- 2) Perform pre-use meter safety tests

Equipment and materials

- 1) Fluke 179 DMM and manual
- 2) Test leads (located inside the DMM carrying case)

Safety issues

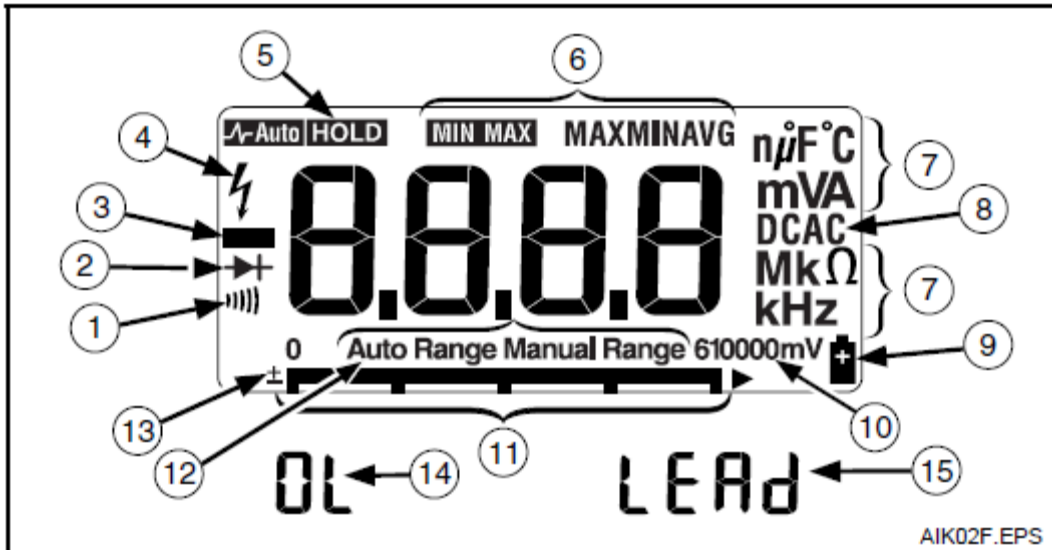
- Follow all lab safety rules: wearing safety glasses at all times in the lab.
- Always turn OFF power before hooking up a meter for measurement.
- Check your meter fuses (as shown below) and check your meter leads.
- Check with your instructor if you're unsure about how to do something

Procedure 1: Becoming familiar with the Fluke 179 DMM

- 1) Open up the meter case and remove the meter.
- 2) Turn on the meter by rotating the main function switch to any function.
- 3) The meter display should turn on; if it doesn't, contact your instructor


4) Note the illustration below to locate each of the numbers shown on your meter.

Display



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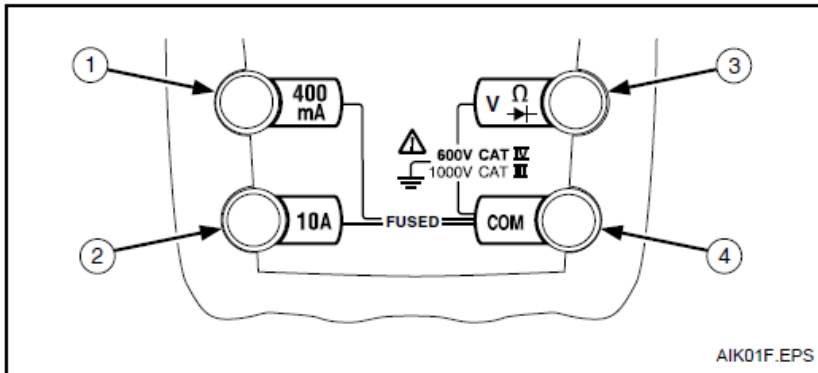
No.	Symbol	Meaning
1)	Continuity test.
2	→	Diode test.
3	—	Negative readings.
4	⚡	Unsafe voltage. Voltage ≥ 30 V, or voltage overload (OL)
5	HOLD Auto HOLD	Display HOLD is enabled. Display freezes present reading. In MIN MAX AVG mode, MIN MAX AVG recording is interrupted. AutoHOLD is enabled. Display holds present reading until it detects new stable input. Then the Meter beeps and displays new reading.
6	MIN MAX MAX, MIN, AVG	MIN MAX AVG enabled. Maximum, minimum, average or present reading.

No.	Symbol	Meaning
7	μ F, °F, °C mVA, M Ω , kHz	Measurement units.
8	DC, AC	Direct current, alternating current.
9		Low battery. Replace battery.
10	610000mV	All possible ranges.
11	Bar graph	Analog display.
12	Auto Range Manual Range	The Meter selects the range with the best resolution. The user selects the range.
13	\pm	Bar graph polarity.
14	OL	The input out of range.
15	LEAD	Δ Test lead alert. Displayed when the rotary switch is moved <u>to</u> or <u>from</u> the mA or A position.

Error Messages	
bAtt	Replace the battery immediately.
diSC	In the capacitance function, too much electrical charge is present on the capacitor being tested.
EEPr Err	Invalid EEPROM data. Have Meter serviced.
CAL Err	Invalid calibration data. Calibrate Meter.
OPEn	Open thermocouple is detected.

5) Next, note the terminals as shown below.

Terminals



Item	Description
1	Input terminal for AC and DC milliamp measurements to 400 mA and frequency measurements.
2	Input terminal for AC and DC current measurements to 10 A and frequency measurements.
3	Input terminal for voltage, continuity, resistance, diode, capacitance, frequency, and temperature (Model 179 only) measurements.
4	Common (return) terminal for all measurements.

6) Finally, note the rotary switch position functions as shown below.

Rotary Switch Positions

Switch Position	Measurement Function
\tilde{V} Hz	AC voltage from 30.0 mV to 1000 V. Frequency from 2 Hz to 99.99 kHz.
\bar{V} Hz	DC voltage 1 mV to 1000 V. Frequency from 2 Hz to 99.99 kHz.
$m\bar{V}$ 	DC mV 0.1 mV to 600 mV. Temperature - 40 °C to + 400 °C - 40 °F to + 752 °F
Ω $\text{--}\text{+}$	Ohms from 0.1 Ω to 50 M Ω . Farads from 1 nF to 9999 μ F.
 $\text{--}\text{+}$	Beeper turns on at <25 Ω and turns off at >250 Ω . Diode test. Displays OL above 2.4 V.
$\text{---}\tilde{m}A$ Hz	AC mA from 3.00 mA to 400 mA DC mA from 0.01 mA to 400 mA Frequency of AC mA 2 Hz to 30 kHz.
$\text{---}A$ $\sim A$ Hz	AC A from 0.300 A to 10 A DC A from 0.001 A to 10 A >10.00 display flashes. >20 A, OL is displayed. Frequency of AC A 2 Hz to 30 kHz.

Note: AC voltage and current AC-coupled, true RMS, up to 1 kHz.

Procedure 2: Checking your DMM

1) Check your fuses. The Fluke 179 uses two fast-blow fuses to prevent an overcurrent situation from both harming the meter and you. These fuses can't protect you if they're blown. That's why it's imperative that you check your fuses before each use – particularly in high voltage situations. Checking fuses requires a meter lead and a just a few seconds of your time. If you do this every time you use a meter, it will become habit – *a habit that may save your life!*

- A. Set the meter to the ohms scale as shown in the illustration below.
- B. Plug one end of a meter lead into the V/ohms jack (see below).
- C. Plug the remaining lead end into the 440mA jack and then the 11A jack (both of these are located at the bottom left corner of the meter)
- D. Record the resistance for each current jack and compare them with the readings shown in the illustration below.

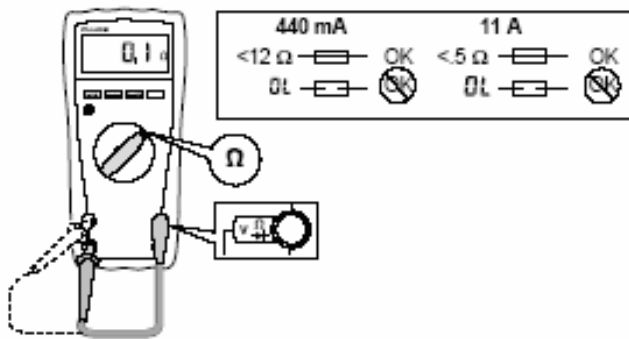
400mA _____ ohms 11A _____ ohms

- E. If the display shows **OL**, it means the resistance is out of range. In this case it means the fuse is open (blown) and needs replacing. **WARNING:** always replace a meter fuse with a **direct replacement** from the manufacturer. Substituting a different fuse could lead to meter damage, or worse, personal injury.

Testing the Fuses**Warning**

To avoid electrical shock or injury, remove the test leads and any input signals before replacing the fuse.

Test fuses as shown below.



2) Check your test leads. Verify that your test leads are in good shape. Inspect them carefully and look for hairline cracks or any obvious signs of damage. Have them replaced if you find any defects (notify your instructor).

3) When you're done, stow the meter in the case and coil the leads into a neat loop and stow these inside the case.

****** end of lab 3-1 ******