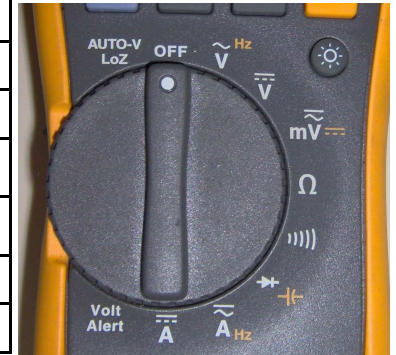


# Digital Multi-Meter Primer

By Jason Prather 01/2009



Legend		
Voltage AC	VAC	$\tilde{V}$
Voltage DC	VDC	$\overline{V}$
Ohms/ Resistance	Ohms	$\Omega$
Continuity	Cont	$\gg$
Amperage AC	A AC	$\tilde{A}$
Amperage DC	DCA	$\overline{A}$

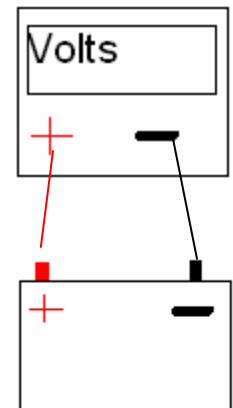


Some meters come with extra features such as this Fluke 117. It also has Frequency, Diode and capacitance. The Features in the legend are the more commonly used by the automotive/home hobbyist. Some meters also have a range setting, this one is Auto Ranging, it picks the scale to show the reading. **Manual Range Adjustment, unless you know the scale you are working in, use the highest range and work down.**

**Voltage.** There are very few times you will check for AC voltage in the automotive environment. Of these would be coil, injector and analog VSS signals. Most of the time we will be using Volts DC. Voltage is the pressure current is under, car/truck batteries are 12.6v nominal and around 13.6v while the engine is running.

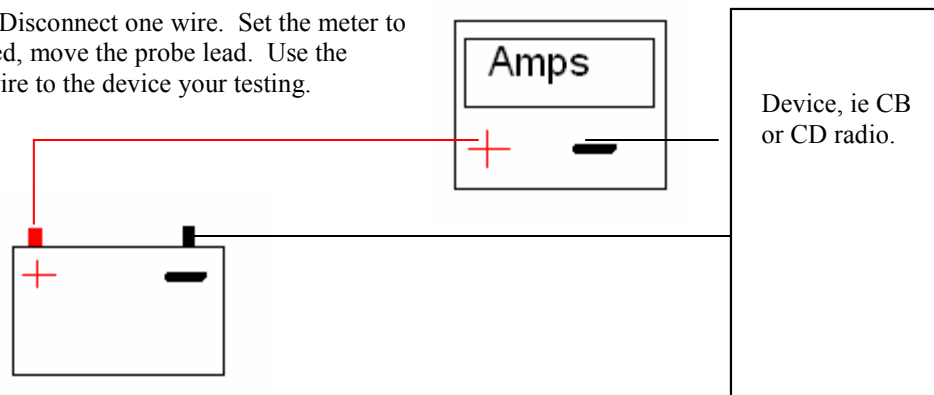
**Testing Battery.** Turn the dial to VDC (set the range to 20v on manual range). The red lead goes to the positive and the black lead goes to the negative. The meter will show 12 volts or there about. If you reverse the leads the meter will read -12.

**Testing wires.** Same as the battery, but there will probably not be a convenient negative wire. Automotive chassis (in the US) are negative ground, any bare metal connected to the body will serve as the negative source. If the wire you are testing does not show the same voltage as the battery, you have resistance somewhere in the circuit.



**Amperage.** Amperage is the volume of electricity flowing through a circuit. **Connecting a battery as above while in amperage mode will blow the fuse in the meter.** The Fluke meter shown has a separate port use for testing amperage. This connection is fuse to 10A, check your fuse rating before continuing.

**Testing a component.** Disconnect one wire. Set the meter to Amperage and if required, move the probe lead. Use the probes to connect this wire to the device your testing.



**Continuity.** Continuity is used to check for connection. Ohms/resistance can be used as well if you need to find the resistance in the circuit, however continuity adds a buzzer to the function to alert you when there is a good connection. The use is very basic, touch your probes to any two surfaces or wires, if it beeps and shows a low number you have a connection. If there is no beep, a number may still be displayed, however your test points have a weak connection.

**Resistance.** Resistance is a nice figure to have when you can apply Ohms law. **Do not meter circuits with power or across the battery.** To determine the resistance of a device, one probe goes to the constant power wire and the other to the ground wire or metal chassis of the device.

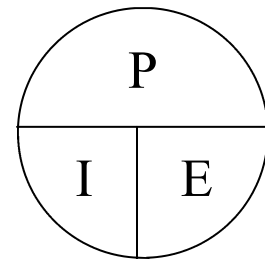
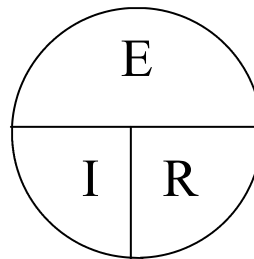
**Useful information.**

**Cool trick.** If you need to find a voltage drop, for instance a ground loop. Switch the meter back to VDC and use the two probes on the wire/chassis component your are checking on. For ground loops, use one probe on bare metal near the fire wall and use the other probe at the location you would like to use as a ground. If the meter shows voltage, then the location is not an ideal ground.

**Metering a resistor.** Place one probe on one lead and the other lead on the other end, read Ohms on meter.

Pneumonic	Color	First #	2nd #	Multiplier
Bad	Black	0	0	1
Boys	Brown	1	1	10
ravish	red	2	2	100
often	orange	3	3	1,000
young	yellow	4	4	10k
girls	green	5	5	100k
but	blue	6	6	1,000k
violet	violet	7	7	10m
gives	grey	8	8	
willingly	White	9	9	

**Ohm's Law**



P= Watts  
 I= Current/Amperage  
 E= Voltage  
 R= Resistance

Cover the variable you need and the formula is the rest.

Ex.  $P=I \cdot E$ ,  $I=P/E$ ,  $E=P/R$

You can use substitution as well for  $P=(E \cdot E)/R$

Power Wire (insulated) Table.

Total Amperage Draw	Up to 4 Ft	4 to 7 Ft	7 to 10 Ft	10 to 13 Ft	13 to 16 Ft	16 to 19 Ft	19 to 22 Ft	22 to 28 Ft
0-20 A	14	12	12	10	10	8	8	8
20-35 A	12	10	8	8	6	6	6	4
35-50 A	8	8	6	4	4	4	4	2
65-85 A	6	6	4	4	2	2	2	0
85-105 A	6	6	4	2	2	2	2	0
125-150 A	2	2	2	0	0	0	0	00

Based on IASCA's Recommended Minimum Wire Gauge Sizes. Adjust up for aluminum or tinned wire. Takes into account terminal connection resistance.