

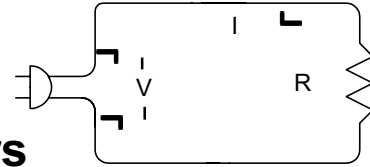
# Fieldpiece MULTIMETER BASICS

## Parameters

| Parameter             | Unit of measure | Symbols  |
|-----------------------|-----------------|--|
| Voltage               | Volts           | $V\sim$ = VAC = AC Volts<br>$V\equiv$ = VDC = DC Volts |
| Current<br>(Amperage) | Amps            | $A\sim$ = AAC = AC Amps<br>$A\equiv$ = ADC = DC Amps   |
| Resistance            | Ohms            | $\Omega$   |
| Capacitance           | Farads          | F  |
| Continuity            | Yes/no          | $\text{)))}$   |

## Ohm's law: $V=IR$

Three versions:  $V=I \times R$ ,  $I=V \div R$ , or  $R=V \div I$   
where V=voltage, R=resistance, & I=current in amps.



## Unit of measure multipliers

| Symbol | Verbal | Descr.     | Multiplier       | Example                     |
|--------|--------|------------|------------------|-----------------------------|
| M      | mega   | million    | X1,000,000       | 1M $\Omega$ =1,000,000 ohms |
| K      | kilo   | thousand   | X1,000           | 1KV=1,000 volts             |
| m      | milli  | thousandth | $\div$ 1,000     | 1mA=.001 amps               |
| $\mu$  | micro  | millionth  | $\div$ 1,000,000 | 1 $\mu$ F=.000001 farads    |

## Display limitations and ranging

Digital multimeters can display any number from 0 to 1999, some higher. The user (or the meter) places the decimal point by selecting the maximum value the meter will display. In the 2 range, the meter can display as high as 1.999. In the 20 range, it can display 19.99, in the 200 range, 199.9.

and so on. The unit of measure could be ohms, kilohms, or megohms (or millivolts, volts, or kilovolts, etc.). For example, a 1.5V battery would read 1.500 on the 2V scale, 1.50 on the 20V scale, 1.5 on the 200V scale, or 1500 on the 2000mV scale.

## Overloads

### Volts

**The problem:** overvoltage. As the voltage goes up, the meter's ability to keep current from flowing may be exceeded. When the meter begins to draw current something fails.

**The solution:** designed-in high steady state voltage withstand capability along with transient voltage protectors. The maximum steady state voltage is determined by component selection and mechanical design. Heavy duty meters use expensive MOVs for transient voltage protection to absorb most of the destructive energy above safe voltage levels.

### Amps

**The problem:** overcurrent. As the current goes up, eventually enough heat will be generated in the meter and something will fail.

**The solution:** fuses. When currents reach a dangerous level, the fuse opens and the meter stops conducting. Heavy duty meters use high energy 600V fuses.

**The problem with fuses:** small voltages can drive enough current to blow a fuse. Users blow most fuses when they accidentally touch a voltage while the meter is set up to read current. Without fuses, this mistake could spell disaster.

### Ohms and capacitance

**The problem:** voltage. The meter sends a test current through the device and then measures the resulting voltage. Externally supplied voltage will affect the reading. If the voltage is too high, it can damage the circuit supplying the test current.

**The solution:** current limiting PTCs (positive temperature coefficient resistors) that squeeze off the current supplied by external voltage sources.

### Mechanical and environmental

**The problem:** drops and contamination.

**The solution:** heavy duty meters are made of valox and have "O" rings to keep out contamination, including water.

## Checking For Blown Fuses

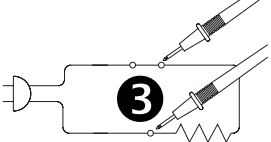
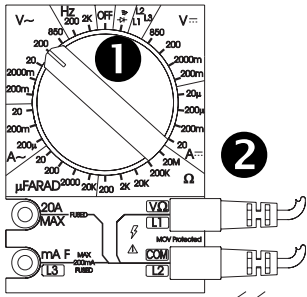
### Use the continuity range

**The problem:** Do not apply voltage to the capacitance or current jacks. Even low voltages can cause a current overload and blow a fuse. Amp, mA, and capacitance ranges are fuse protected in most Fieldpiece meters. Testing beyond the limits of the specified ranges will also blow a fuse.

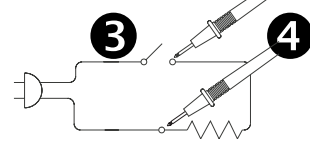
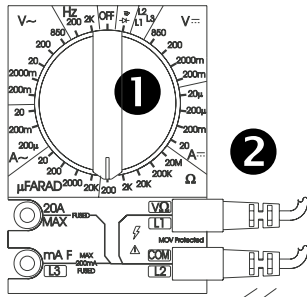
**The solution:** Test for blown fuses. This can be done by removing the fuse from the meter and selecting the continuity/diode range (first position to right of off). Check the continuity across the fuse. If a fuse is good, a continuous beep will be heard from the meter. If a fuse is open/bad, there will be no beeping sound at all. Ranges not protected by a fuse (i.e VAC/DC, continuity) will remain functional without a fuse present in the meter.



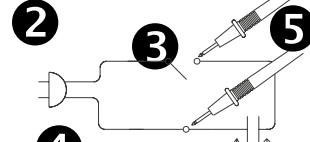
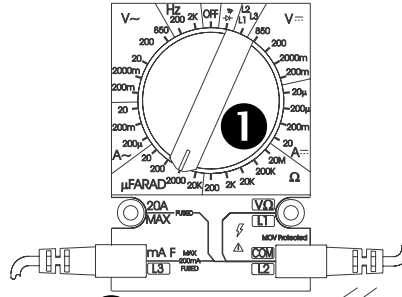
# DIGITAL MULTIMETER SETUP



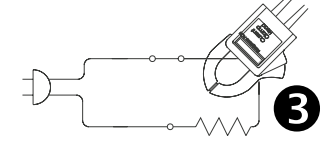
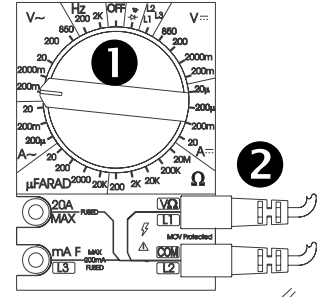
**VOLTS**



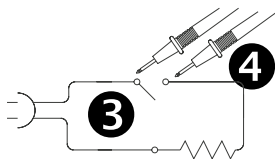
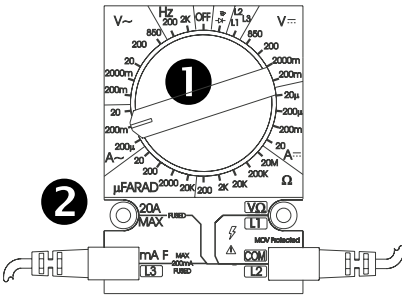
**OHMS**



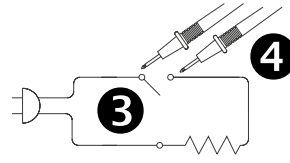
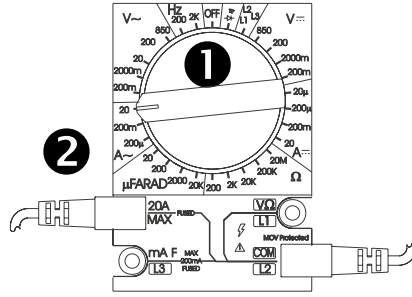
**FARADS**



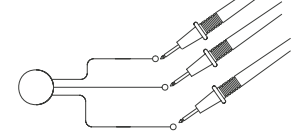
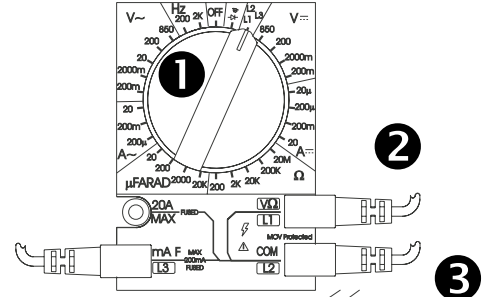
**AMPS WITH CURRENT CLAMP**



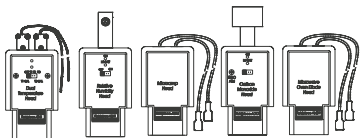
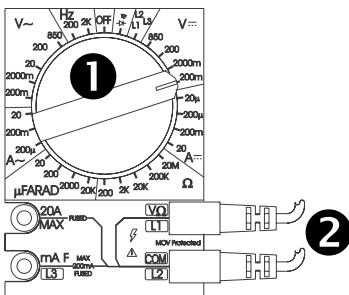
**AMPS <.2A**



**AMPS <20A**



**PHASE ROTATION**



**ACCESSORIES**

*For DC, set the meter to the DC parameter instead of AC. Choose range just above value you expect. If display reads "1" or "OL" (overload), select a higher range. If display shows less than three numbers, select a lower range for better accuracy.*

