EQUIPMENT

DIGITAL   MULTI-METER

A Digital Multi-Meter, **DMM**, will measure several different quantities. You must determine which function the DMM will perform by selecting the following four items:

- ***POWER SOURCE:***   Set the switch to DC (Direct Current) or AC (Alternating Current). We use DC for all experiments except Exp. 15, The Oscilloscope.

- ***LEADS:***   The black lead should always plug into the "COM" jack. Although the color of the wire covering is irrelevant, it is standard to define the black wire as the common (ground). The red lead will be plugged into the "VΩ" jack when measuring voltage or resistance. Plug the red lead into the "mA" jack when measuring current (the "10A" jack is used only for *Exp. 22* and *Exp. 23*).

- ***DIAL:*** You must select the function the DMM will perform by turning the dial to the appropriate setting, as well as the appropriate scale. Select the lowest value that will accommodate your circuit, e.g., the '20V' setting will measure voltage *up to* 20 volts.

- ***CONNECTION:***   You must connect the leads to your circuit properly, or the DMM could be damaged.

  A voltmeter is always connected in parallel;   the leads connect to each end of the same element.

  An ammeter is always connected in series;   a jumper *must be removed* from the circuit in order to place the ammeter *into* the circuit.

Fig. 4-A: Digital Multi-Meter   (DMM)

Note the multipliers *μ, m, K,* and *M* on the different scales. This means you would

multiply the digital reading of the DMM by the appropriate multiplier. For example, the

200K scale for the ohmmeter means you should multiply the digital readout by 10^3.

Note also that the DMM will only read values up to the scale value. For example, the

$\dfrac{20m}{10A}$ scale for the ammeter means the DMM will measure current up to *20mA* if using

the *mA* jack, but will measure up to *10A* if using the *10A* jack.
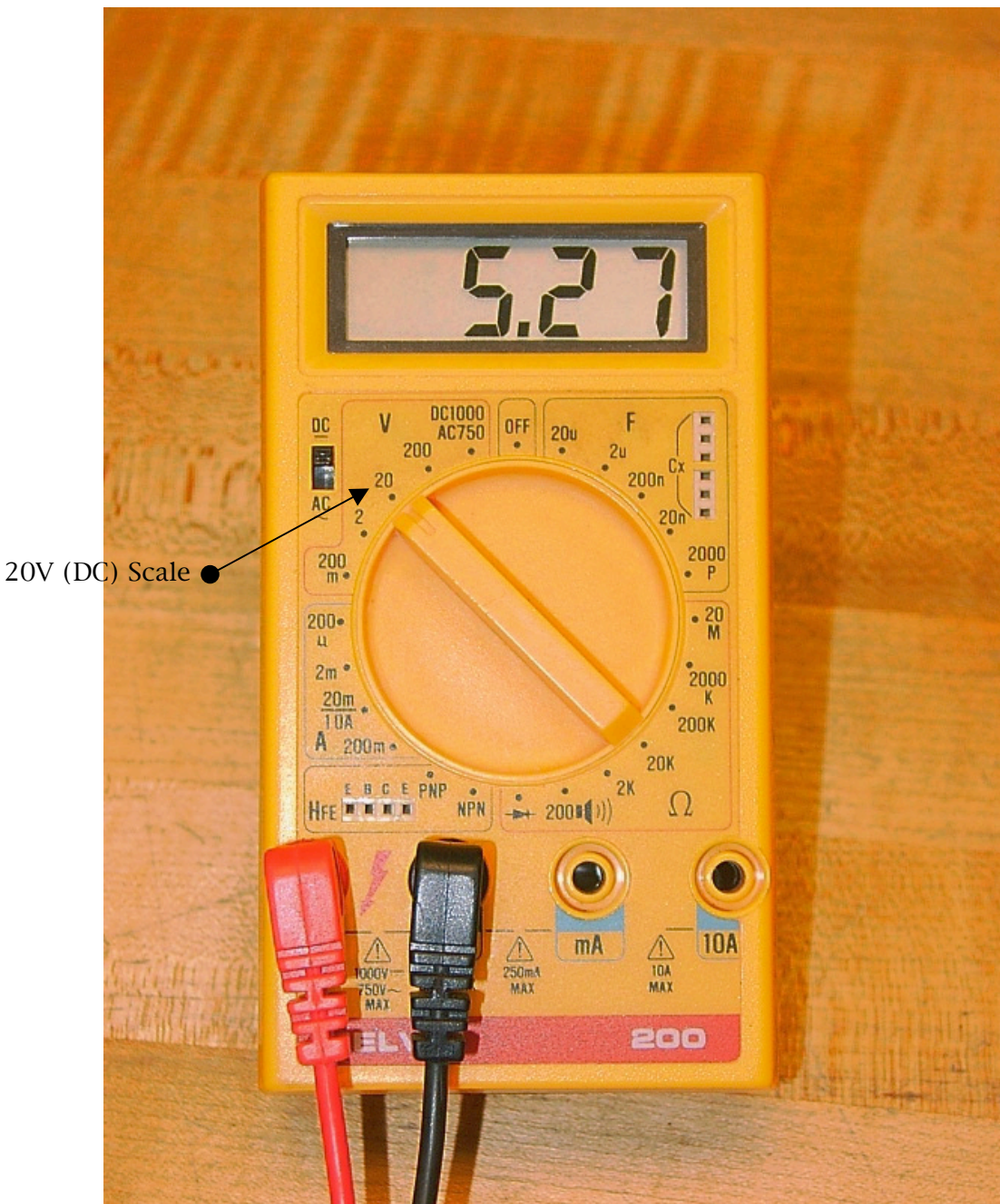
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20V (DC) Scale ●⟶

Fig. 5-A: Voltmeter   (See also Fig. 8-A.) Voltmeter Reading: 5.27 V.

To use the DMM as a voltmeter, make these selections:

- POWER: Select DC or AC.

- LEADS: Plug the black lead into "COM" and the red lead into "VΩ".

- DIAL: Turn to the appropriate scale on "V".

- CONNECTION: Place leads on each end of *the same element.*
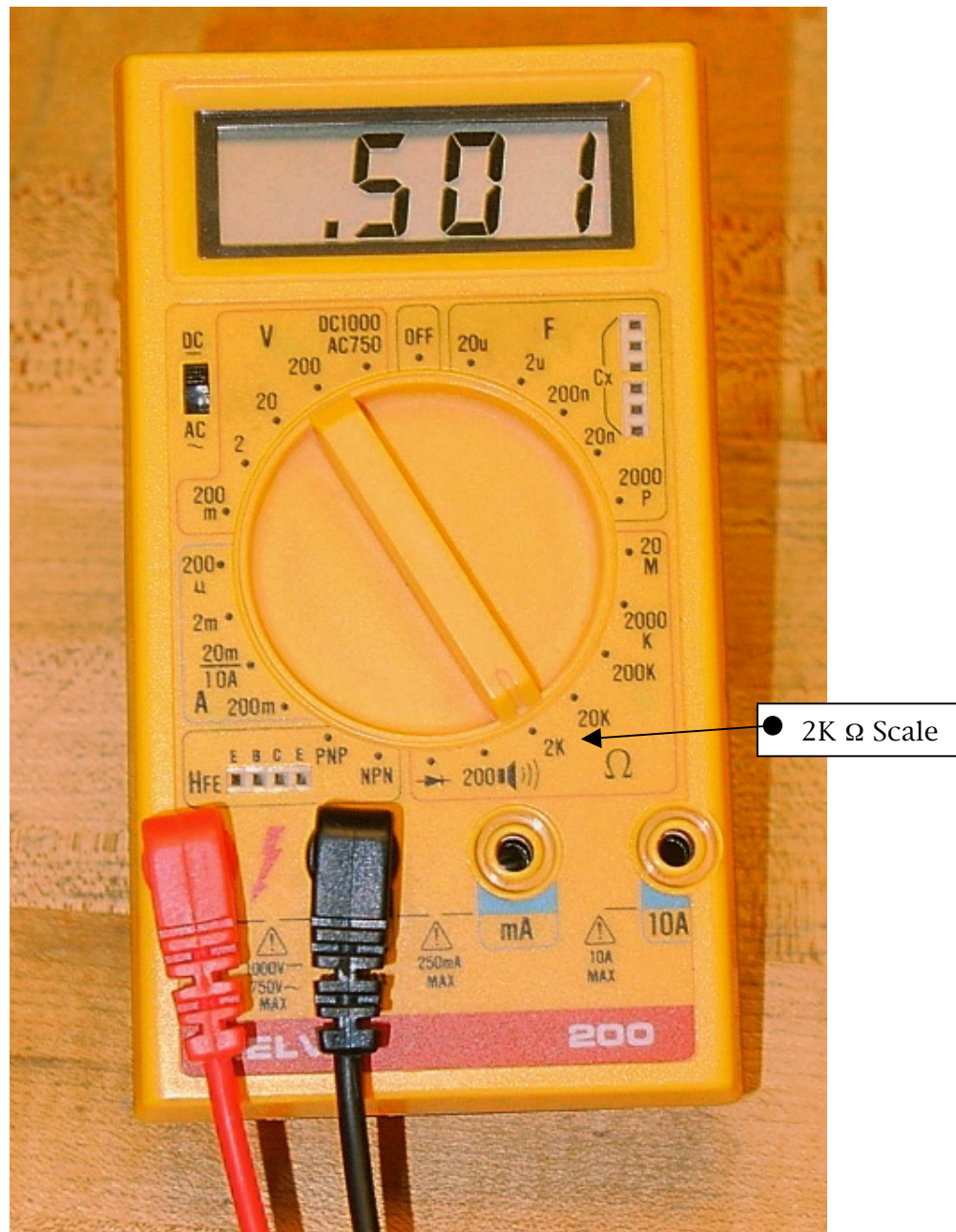
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Fig. 6-A: Ohmmeter   (See also Fig. 9-A and 10-A.)

Ohmmeter Reading: $0.501 \times 10^3 \ \Omega = 501 \ \Omega$.

To use the DMM as an ohmmeter, make these selections:

- POWER: Select DC or AC.

- LEADS: Plug the black lead into "COM" and the red lead into "VΩ".

- DIAL: Turn to the appropriate scale on "Ω".

- CONNECTION: Place leads on each end of *the same element*.
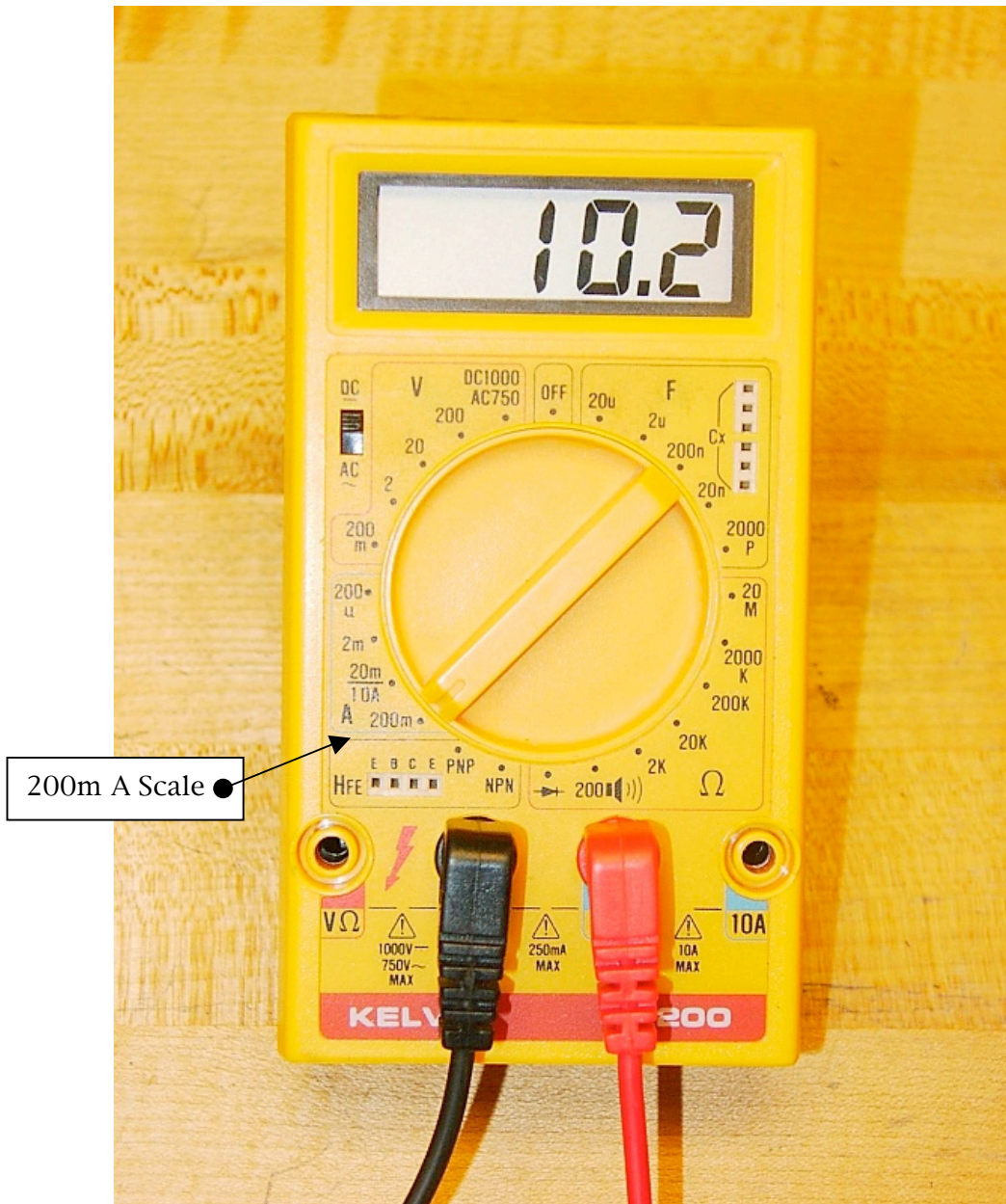
EQUIPMENT

Fig. 7-A: Ammeter   (See also Fig. 11-A.)   Ammeter Reading: 10.2×10^{-3} A = 0.0102 A.

To use the DMM as an ammeter, make these selections:

- POWER: Select DC or AC.

- LEADS: Plug the black lead into "COM" and the red lead into "mA".

- DIAL: Turn to the appropriate scale on "A".

- CONNECTION: Remove a jumper, place leads into circuit (current travels from one element, through the ammeter, into *a different element*).
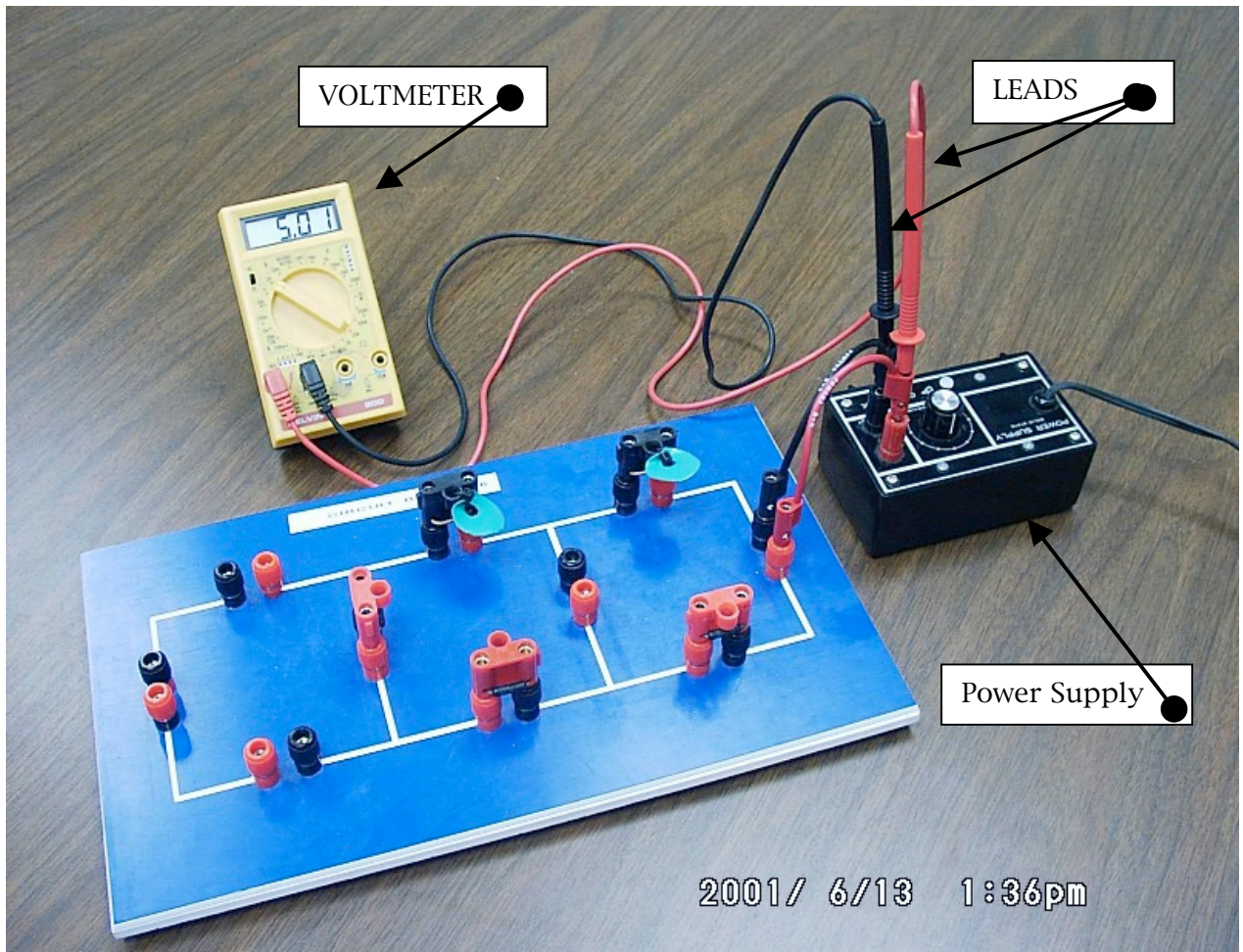
EQUIPMENT

Fig. 8-A: Voltmeter and Circuit   Voltmeter Reading: 5.01 V.

Note that the circuit is complete, power supply plugged in and set to desired voltage.
The voltmeter is connected in parallel, as it measures voltage *across* an element in a
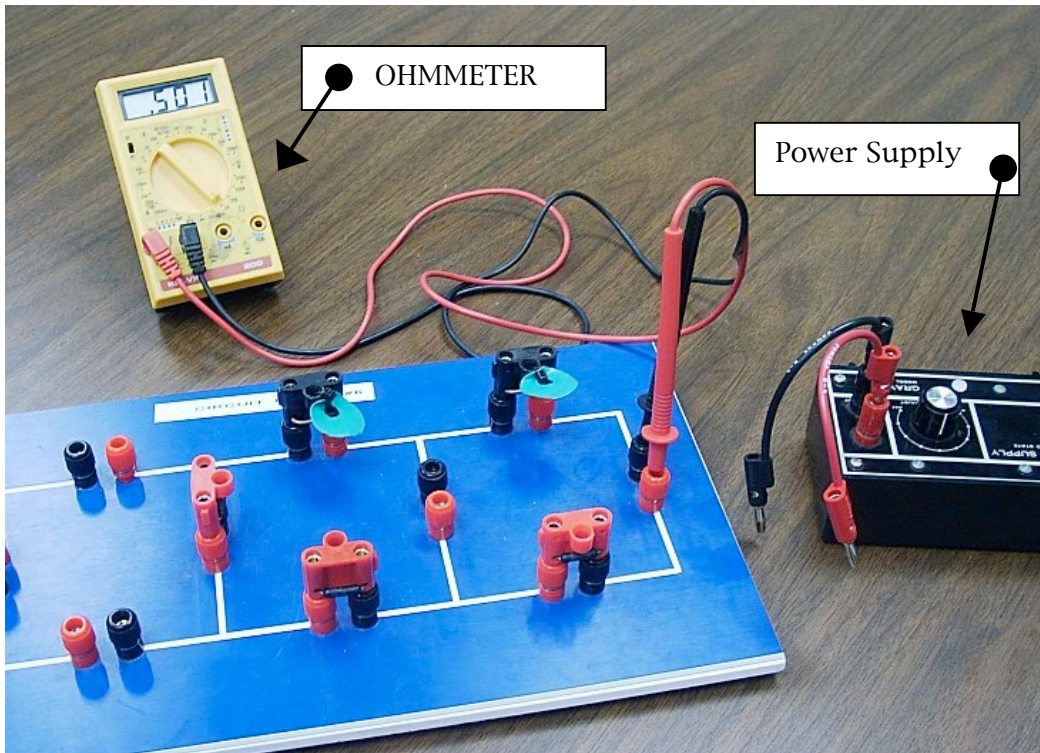circuit.

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Fig. 9-A: Ohmmeter and Circuit   Ohmmeter Reading: 0.501 kΩ=501 Ω.

Note that the power supply has been disconnected in order to measure the resistance, R_{eq}, of the circuit.

Fig. 10-A: Ohmmeter and Resistor   Ohmmeter Reading: 0.200 kΩ=200 Ω.

Connect ohmmeter to resistor for resistance measurement of an individual element.

EQUIPMENT

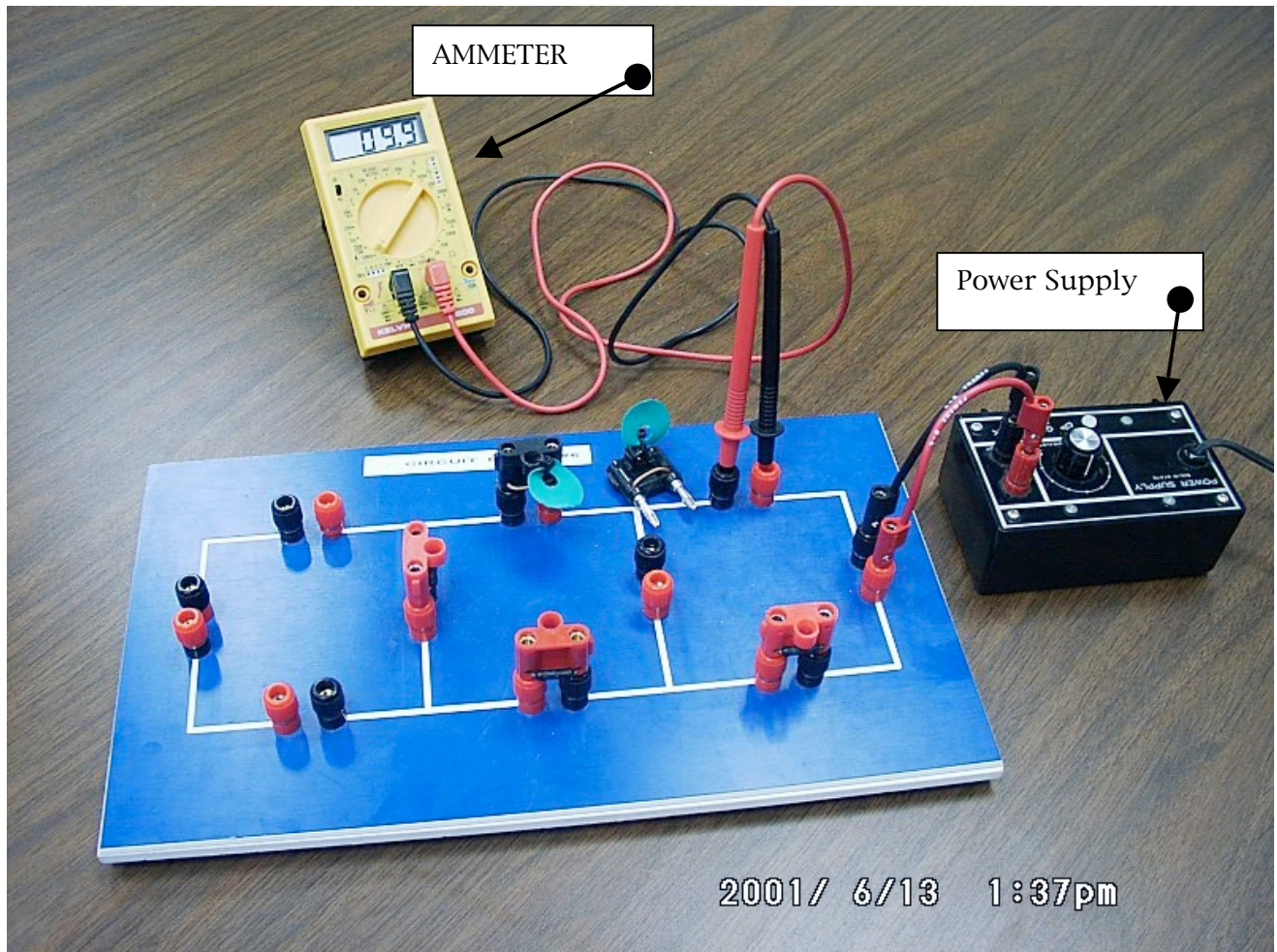**Fig. 11-A: Ammeter and Circuit**   Ammeter Reading: 9.9 mA = 0.0099 A.
Note that the ammeter is connected in series. A jumper has been removed from the circuit so that the ammeter can be inserted, in series, to measure the current. Power supply is connected and active.