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University of Nizwa

College of Arts & Sciences
Department of Mathematics & Physical Sciences
Physics Section

Digital Multimeter

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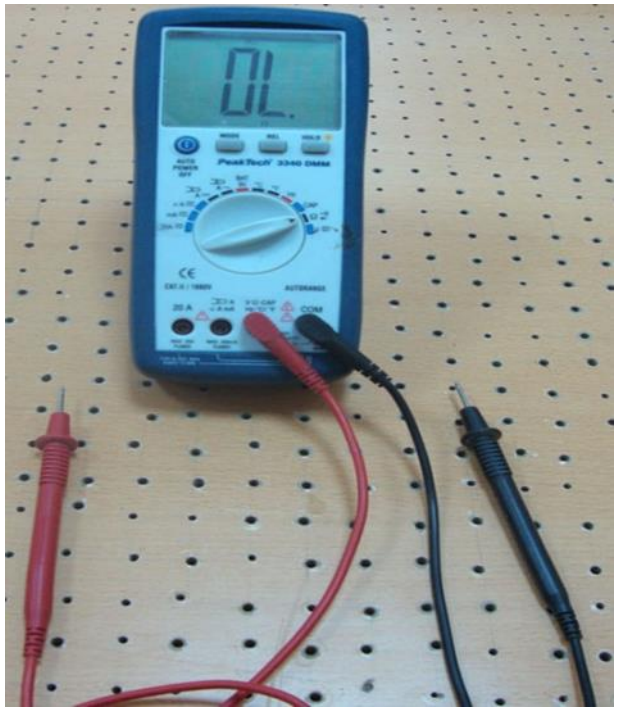
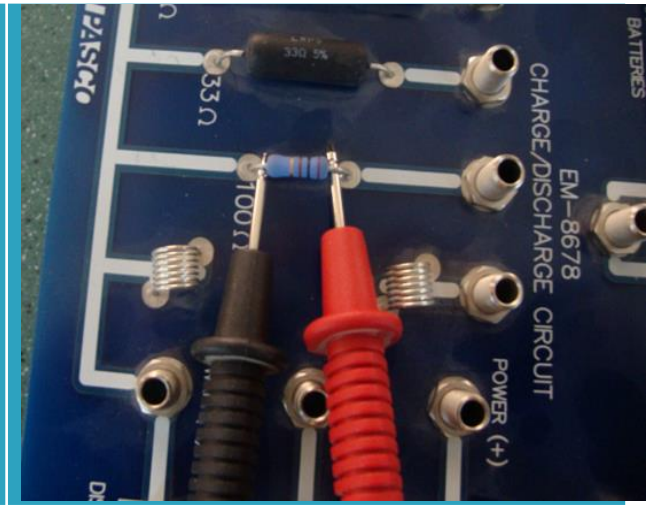
What is a Digital Multimeter?

- A digital multimeter measures AC / DC voltage, resistance, and current in an electric circuit It is highly accurate and displays an LCD number readout.



Test Leads

- Test leads are used to connect the multimeter to the circuit to be tested.



Objectives

1. To know how to use the Ammeter and how to read the measure.
2. To learn how to operate the Voltmeter and read the recorded voltage.
3. Have knowledge about measuring resistance using the Ohmmeter.

Voltmeter use

- The voltmeter is used to measure the voltage potential across a component in an active circuit.

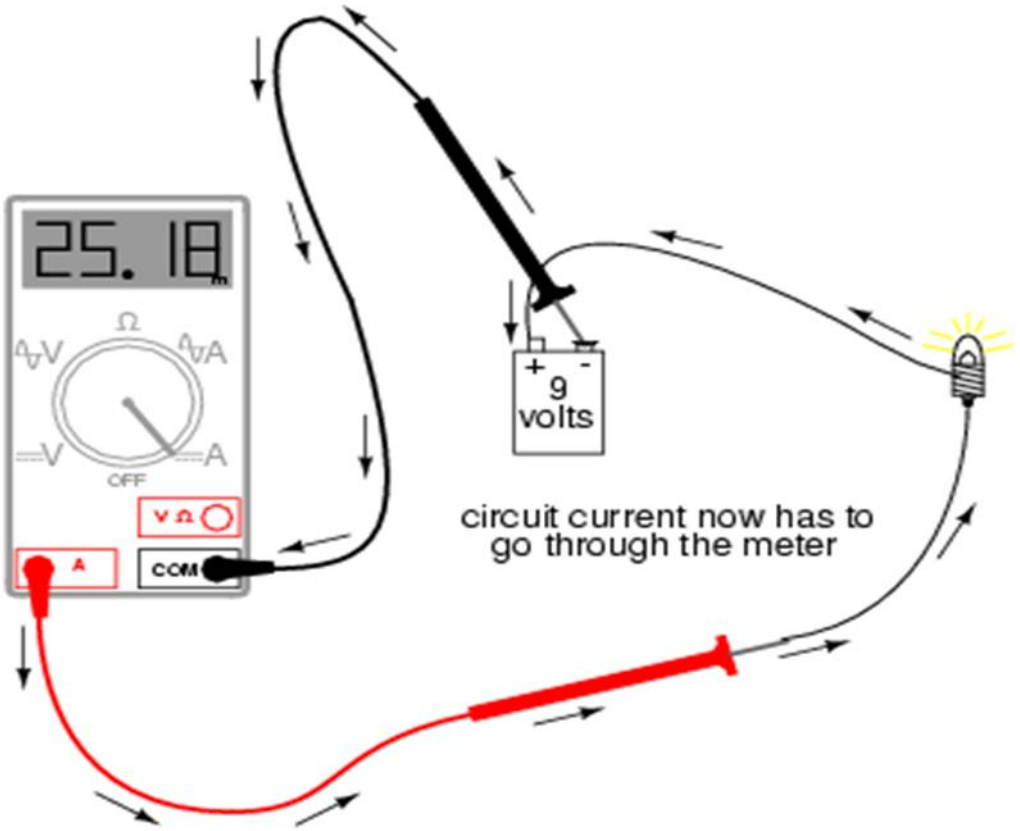
- It can be used to measure either DC or AC voltages, resistance, and current in an electric circuit.

How to measure voltage

Ammeter use A digital multimeter measures AC / DC voltage, resistance, and current in an electric circuit.

How to measure current

Current is the measure of the rate of electron "flow" in a circuit. It is measured in the unit of the Ampere, simply called "Amp," (A).


25.18
Ω
V
A
V
A
OFF
V Ω
A
COM
+ 9 -
volts
circuit current now has to
go through the meter

Ohmmeter use

- How to measure resistance
- Use of Ohm's Law

Using Ohm's Law

- Take and the measure the voltage and resistance of a circuit, use the Ohm's Law equation to calculate circuit current. Compare this calculated figure with the measured figure for circuit current:

Ohm's Law
(solving for current)

$$I = \frac{E}{R}$$

Where,

E = Voltage in volts

I = Current in amps

R = Resistance in ohms

- Taking the measured figures for voltage and current, use the Ohm's Law equation to calculate circuit resistance.
- Compare this calculated figure with the measured figure for circuit resistance:

Ohm's Law
(solving for resistance)

$$R = \frac{E}{I}$$

- Taking the measured figures for resistance and current, use the Ohm's Law equation to calculate circuit voltage. Compare this calculated figure with the measured figure for circuit voltage:

Ohm's Law
(solving for voltage)

$$E = IR$$

PeakTech 3340 DMM (digital) Function Switch Dial

1. Digit LCD – display with backlight
2. Rotary selector
3. COM – input jack
4. V/W/CAP/Hz/Temp. – input jack
5. µA, mA and A-clamp adaptor input jack
6. 20 A-input jack
7. Pushbutton for DATA-HOLD and backlight
8. Pushbutton for relative mode
9. Pushbutton MODE
10. Power pushbutton

Components :

1. LCD - Display

Screen to show the measurements

2. Function / Range Selector Rotary Switch

This rotary switch selects function and range needed. Each time the rotary switch is moved from OFF to a function setting, all LCD segments will turn on for one second.

3. COM - Terminal

This is the negative (ground) input terminal for all measurement modes. Connection is made to it using the black test lead.

4. V/Ω/CAP/Hz/Temp. - Input Terminal

This is the positive input terminal for all functions except current/capacitance measurements. Connection is made to it using the red test lead.

6. 20 A - Input Terminal

This is the positive input terminal for current measurement (AC or DC) up to 20 A. Connection is made to it using the red test lead.

7. HOLD - Button

Press HOLD-button to toggle in and out of the DATA-Hold mode. In the DATA-Hold mode, the "HOLD" annunciator is displayed and the last reading is frozen on the display. Press the HOLD-button again to exit and resume readings.

To switch on or off the backlight, press HOLD-button for 2 sec.

8. REL - Δ - button

When the REL- **Δ** button is pressed the present reading becomes the zero reading and all subsequent readings are displayed relative to this value. This function is cleared by pressing the REL- **Δ** button > 1 sec. which returns the meter to normal operation.

9. MODE - button

For switching from AC/DC voltage ranges to current ranges and from resistance, diode test and continuity test.

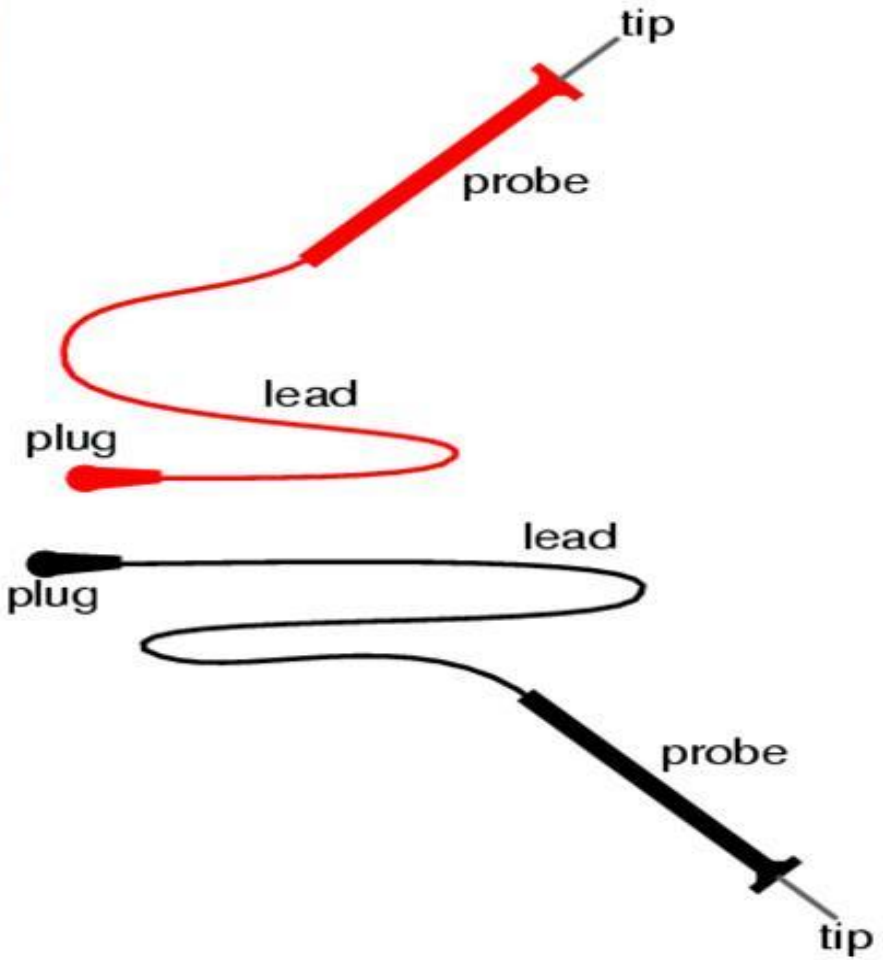
10. ON/OFF button

For switching the instrument on and off.

Steps before using

- Connection of test leads
- The supplied test leads can be used for measurements up to 1000 V.
- High-voltage measurements should be done with care and in presence of a person, who is educated in first-aid.
- The maximum input voltage for this instrument is 1000 V DC or 700 V AC and to be on the safe side, these values mustn´t be passed. The maximum voltage - difference between COM-input and earth is 500 V DC/AC_{eff}. Higher voltage-differences may cause personal injury or damage of the unit.


AUTO
HOLD
33.40
mV
PeakTech
3340 DMM
20A
COM

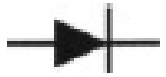

tip
probe
lead
plug
lead
plug
probe
tip

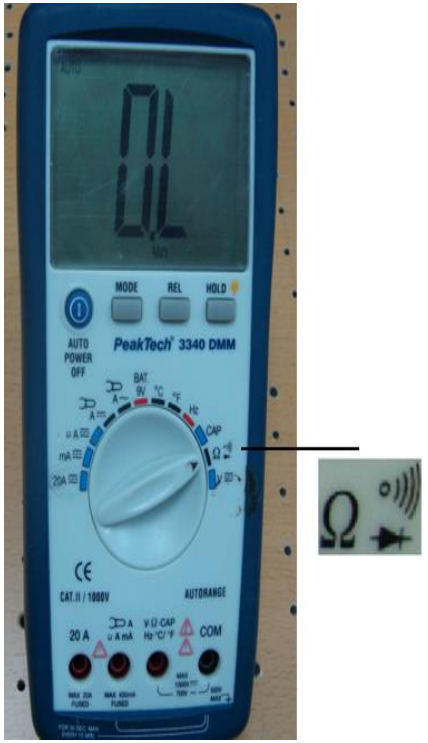
Function Switch Positions

- There are many different functions to choose from on the function switch.
- The first is off. The meter should always be returned to this position when not in use.
- The V markings are for measuring DC and AC voltage
- The Ω marking is for measuring resistance.
- The A marking is for measuring current.

Diode testing

Measurements must only be made with the circuit power OFF.

1. Insert the black and red test lead into the COM and V/Ω/CAP/Hz/Temp. - Input terminal respectively.
2. Set the Rotary Selector Switch to the Ω - position.
3. Select the  function by pressing the Mode - button.
4. Follow steps 1 and 3 as for resistance measurements.



Continuity testing

1. Insert the black and red test lead into the COM and V/Ω/CAP/Hz/Temp.- input terminal respectively.

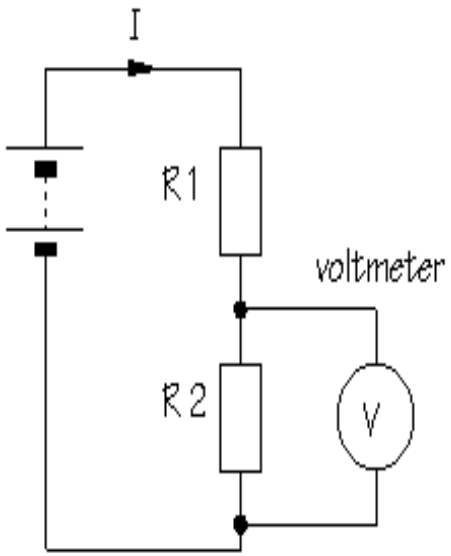
2. Set the Rotary Selector Switch to the Ω - position.

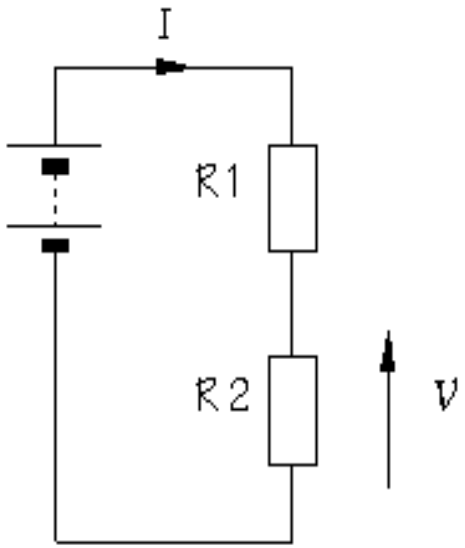
3. Select the *))) function by pressing the MODE - button.

4. Follow steps 1 and 3 as for resistance measurements. An audible tone will sound for resistance less than approx. 50 W. After all measurements are completed, disconnect the test leads from the circuit and from the multimeter input terminals.

5. The red lead should be connected to the anode and the black lead to the cathode. For a silicon diode, the typical forward voltage should be about 0,6 V.

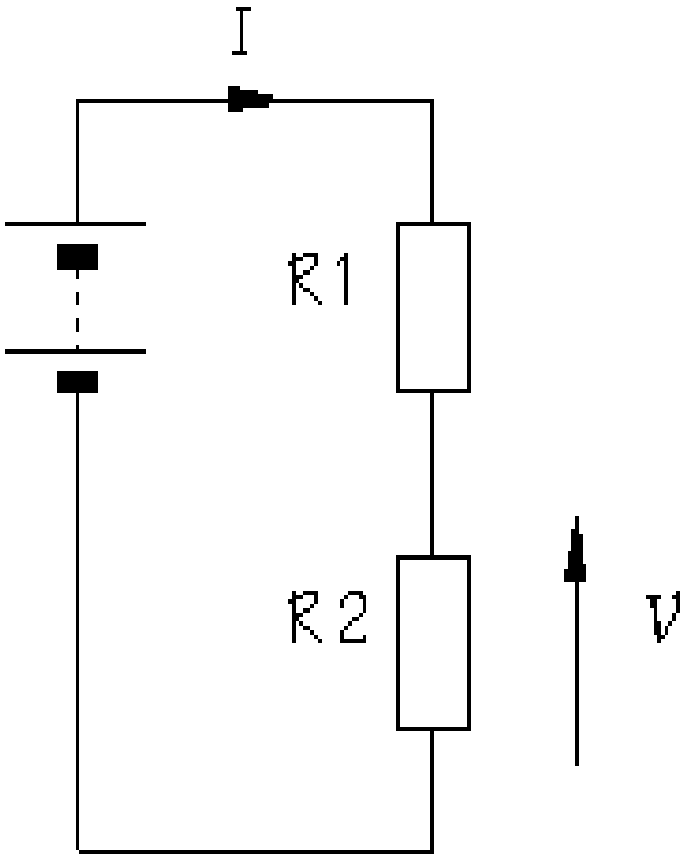
Multimeter as a Voltmeter

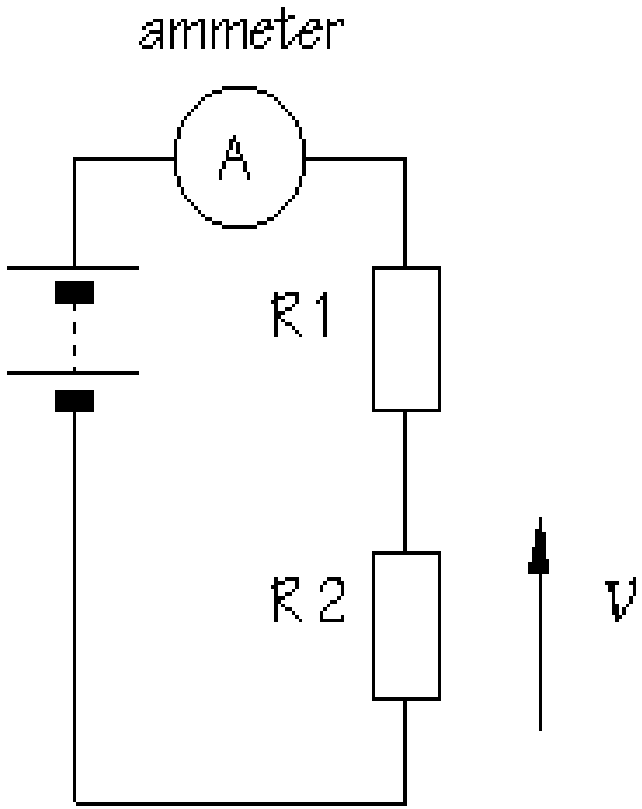




Multimeter as an Ammeter

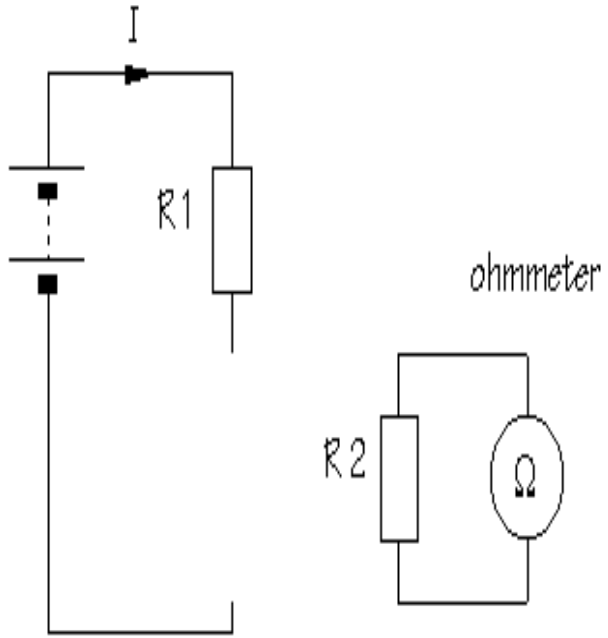
- Turn Power Off before connecting multimeter
- Break Circuit
- Place multimeter in series with circuit
- Select highest current setting, turn power on, and work your way down.
- Turn power off
- Disconnect multimeter.
- Reconnect Circuit

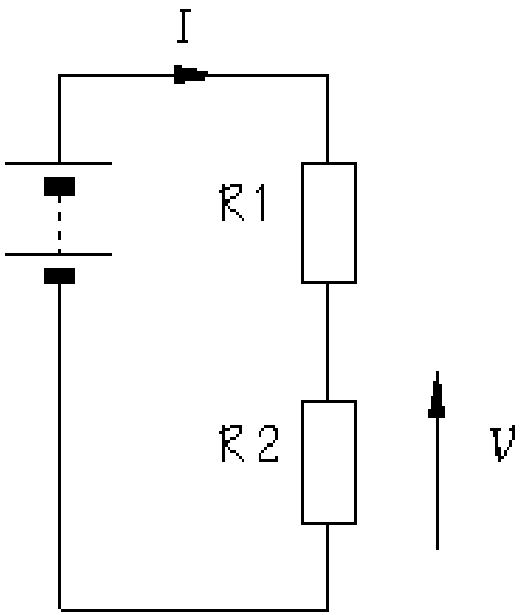

I
R1
R2
V


ammeter
A
R1
R2
V

Multimeter as an Ohmmeter

- Power always has to be off.
- Component has to be removed from circuit.
- Start at lowest Ohm setting.





Function Switch Positions

Capacitance measurements

Turn off power and discharge the capacitor before attempting a capacitance measurement. Use the DCV function to confirm that the capacitor is discharged.

1. Set the Function / Range switch to CAP (capacitance).
2. Connect the test leads to the capacitor. Observe polarity when measuring polarized capacitors.
3. Read the capacitance directly from the display. A shorted capacitor will indicate an over range. An open capacitor will indicate near zero on all ranges.

Function Switch Positions

Frequency measurements

1. Set the Function / Range switch to Hz for frequency measurement.

2. Connect the red test lead to the V/Ω/CAP/Hz/Temp. - Input jack and the black test lead to the COM - jack.

3. Connect test leads to the point of measurement and read the frequency from the display.

Function Switch Positions

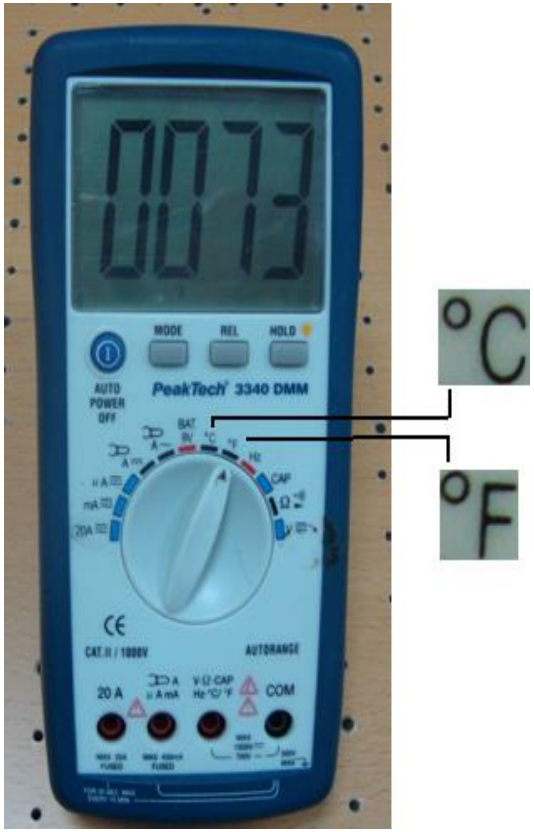
Temperature measurements

1. Select the required temperature range, by turning the rotary selector switch either to °C or °F position. Connect the thermocouple adaptor to the V/Ω/CAP/Hz/Temp.- and COM input terminal.

2. Connect a type K thermocouple to the thermocouple input terminal on the thermocouple adaptor.

3. Place the thermocouple junction tip at the point where the temperature is to be measured.

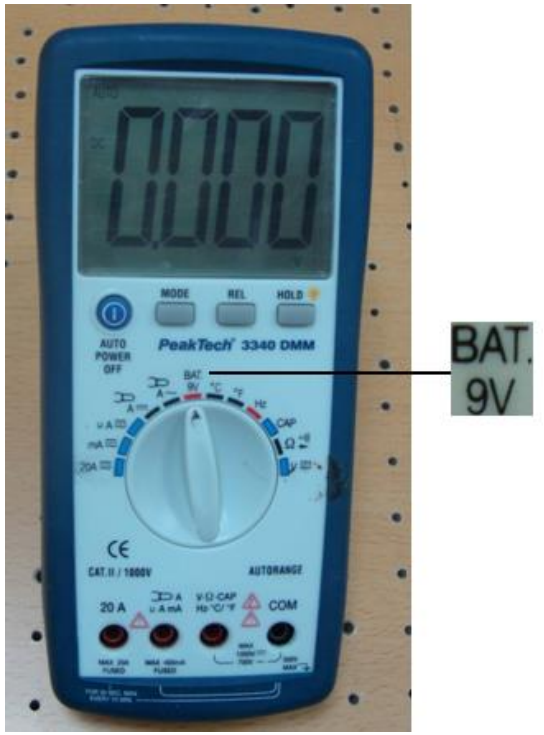
4. For very high temperatures the multimeter must be kept far enough away from the source of temperature to avoid heat damage. At high temperatures, the life of the temperature probe will be reduced.



Function Switch Positions

Battery Test

1. Insert the black test lead plug into the negative COM jack and the red test lead plug into the positive V jack.
2. Select the BAT 9V position using the function select switch.
3. Connect the red test lead to the positive side of the 9V battery and the black test lead to the negative side of the 9V battery.
4. Read the voltage in the display



Function Switch Positions

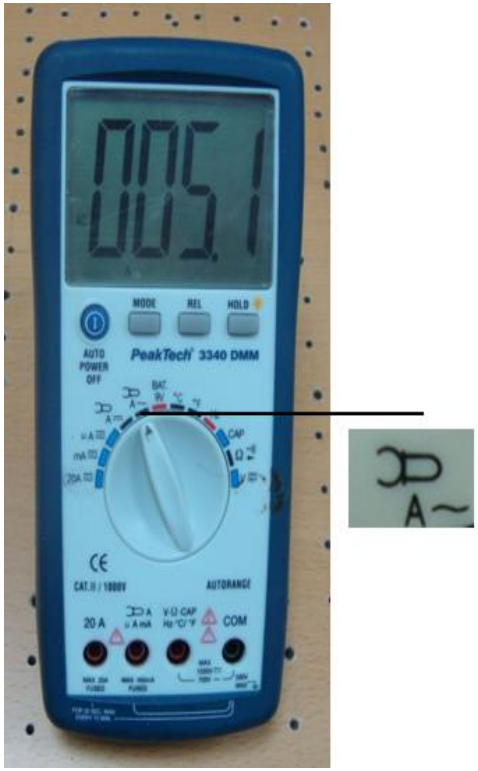
How to make measurements?

- When you connect the test probes to an AC outlet, do not turn the rotary selector switch to another range. It could damage the meter´s internal components or injure you.

- Understanding Phantom readings in some DC and AC voltage ranges, when the test leads are not connected

  to any circuit, the display might show a phantom reading. This is normal. When you connect the test leads to a circuit, accurate reading appears.

- Before making any measurements always examine the instrument and accessories used with the instrument for damage, contamination (excessive dirt, grease, etc.) and defects. Examine the test leads for cracked or frayed insulation and make sure the lead plugs fit snugly into the instrument jacks. In any abnormal conditions exist do not attempt to make any measurements.



Function Switch Positions

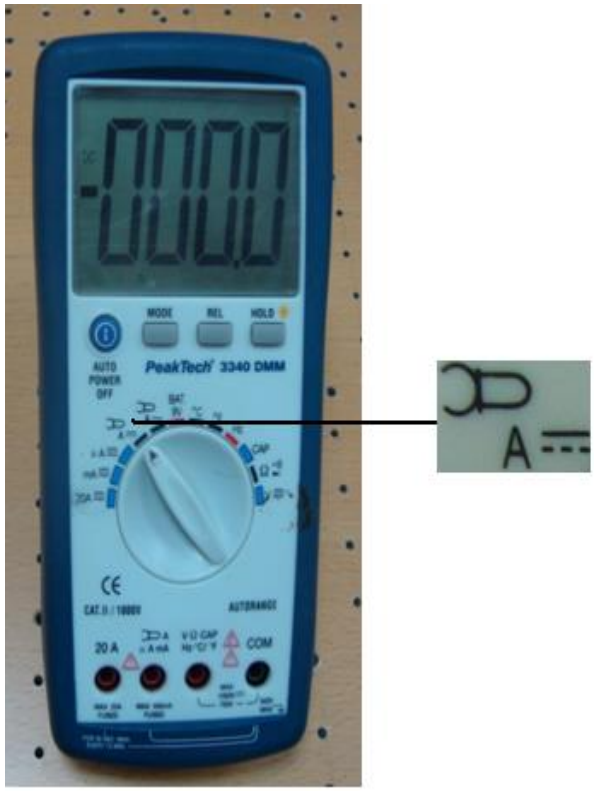
Voltage measurements

- Insert the black and red test leads into the COM and V/Ω/ CAP/Hz/Temp.- input terminals respectively.
- Select the desired AC voltage range (V ~) or DC voltage range (V⎓).
- To avoid possible electric shock, instrument damage, do not take any voltage measurements if the voltage is above 1000 V DC / 700 V AC.
- 1000 V DC and 700 V AC are the maximum voltages, that this instrument is designed to measure. The "COM" terminal potential should not exceed 500 V measured to ground

- Connect the test lead tips in parallel with the circuit to be measured (e.g. across a load or power supply). Be careful not to touch any energized conductors. Note the reading.

- When all measurements are complete, disconnect the test leads from the circuit under test. Remove the leads from the multimeter. For DC voltage readings, the RED lead tip.

- Should be connected to the positive side of the circuit, the BLACK lead to the negative side. A minus (negative) sign on the left hand of the LCD will appear if the leads are connected the other way round.

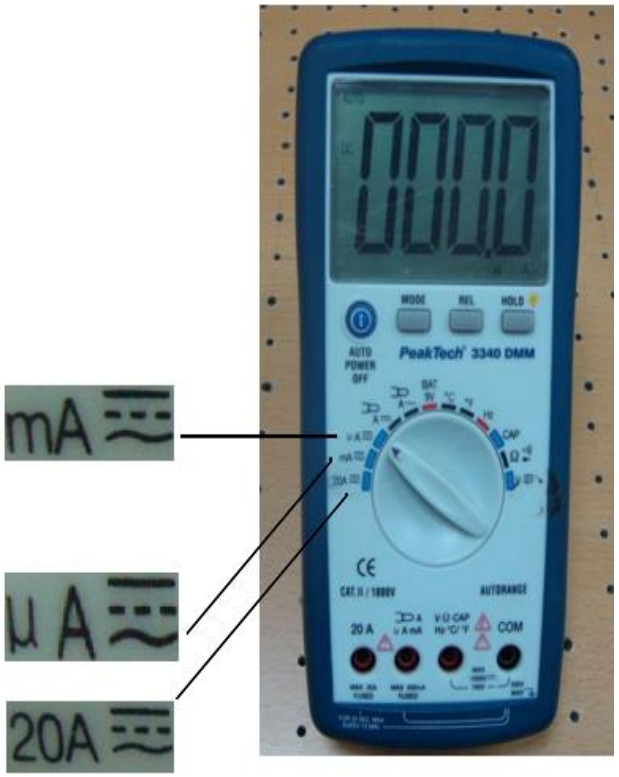


Function Switch Positions

Current measurements

- **These are made in series with the test circuit. All the current to be measured flows through the multimeter.**

1. Insert the BLACK test lead in the COM input terminal.
2. For measuring currents less than 400 mA, connect the red test lead to the µA/mA input terminal.
   For measuring currents between 400 mA and 20 A connect RED test lead to the 20 A terminal.
3. Select the desired current range and select AC/DC by pressing MODE-button.
4. If the (20 A) range is selected then the (20 A) input terminal must be selected in step2. If the (µA, mA) ranges is selected the (mA) input terminal must be selected in step 2.



Note:

a. Do not attempt to measure currents in high energy circuits capable of delivering greater than 500 V. Since the fuse is rated at 250 V damage or injury could occur. The mA input terminal is protected by a 500 mA/250 V fast blow fuse.

b. If a current greater than 20 A on the 20 A ranges or greater ranges flow, the fuse will blow causing an open circuit between the current measuring terminals.

Replacing the fuse

- To avoid electric shock, disconnect all the test probes before removing the fuse.
- Replace only with the same type of fuse.
- Not note remove the top cover. Service should be performed only by qualified personnel.
- For continued protection against fire or other hazard, replace only with fuse of the specified voltage and current ratings.

Follow these steps to replace the fuse:

- Press ON/OFF button to turn the meter off and disconnect the test probes.
- Remove the back cover by unscrewing the five screws and pulling off the meter’s cover.
- Remove the blown fuse.
- Install the new fuse in the fuse compartment.
- Replace the cover and secure it with the screws.
- Do not operate your meter until the back cover is in place and fully closed.