



Basic DVOM Operation

Quick Training Guide – QT617A

This Quick Training Guide will explain basic operation and usage of a digital volt-ohm meter, or “Multi-Meter.” Note that a Fluke brand DVOM is used for this QTG, however other DVOM’s have similar functionality and universal symbols. Always practice safety and pay attention to your specific DVOM’s electrical ratings.



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Introduction

 Click the tabs at the top and side to view each section

- DVOM stands for Digital Volt-Ohm Meter and it is used for electrical diagnosis.
- DVOM's can help in automotive diagnosis and repair, and help reduce repair time if used properly.
- Having a DVOM is one thing, knowing how to use it is something else. This QTG will go through the basics on how to set up your meter, and how to test basic electrical circuits.



General Safety

High Voltage Safety

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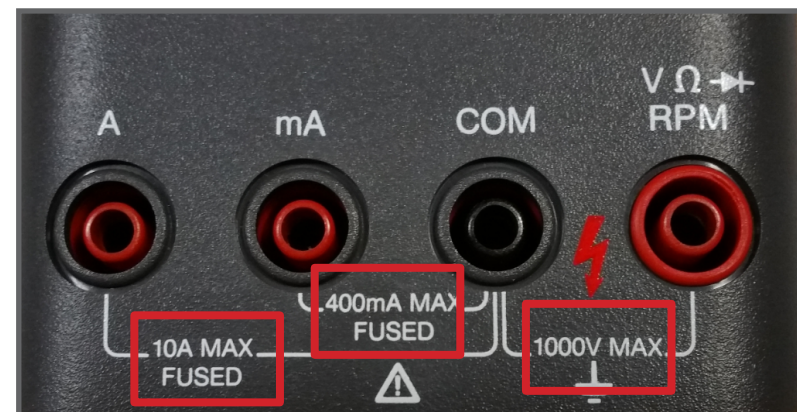
Example Measurements

General Safety

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- Electrical shock can occur in even the most simple circuits, always be safe during electrical diagnostics.
- Know the testing capabilities of your specific meter (see bottom image)
- Inspect leads for damaged insulation, excessive wear, or high resistance (over 1 Ω)
- Check your meter's fuses before testing a circuit.
- Double check meter setting and lead connections (on meter and on circuit) to avoid injury or meter damage.
- When measuring amperage always connect the meter in series, NOT parallel.

| mA | Effect on Human Body |
|-----------|---------------------------------|
| 0.5-3 | Tingling sensations |
| 3 - 10 | Muscle contractions and pain |
| 10 - 40 | "Let-go" threshold |
| 30 - 75 | Respiratory paralysis |
| 100 - 200 | Ventricular fibrillation |
| 200 - 500 | Heart clamps tight |
| 1500 + | Tissue and Organs start to burn |



General Safety

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High Voltage Safety

- Any circuit 50V or more is considered high voltage.
- Toyota Hybrid vehicle circuits can range from 12V to 650V requiring a minimum of CAT III rating. Typically Megohmmeters are used in hybrid diagnosis.
- Test leads should also have a minimum of CAT III rating to match DVOM rating.
- Disable 12V auxiliary and HV systems if applicable (continuity/resistance tests) Always follow repair manual for proper discharging methods if applicable.
- Always use electrical tape to cover any exposed HV terminals when disconnected.
- Verify that no voltage is present after 10 minutes (or time allotted in repair manual) before opening the HV circuit for electrical testing.

 Click the tabs at the top and side to view each section

| Category | Working Voltage | Peak Transient |
|----------|-----------------|----------------|
| Cat I | 600 V | 2500 V |
| Cat I | 1000 V | 4000 V |
| Cat II | 600 V | 4000 V |
| Cat II | 1000 V | 6000 V |
| Cat III | 600 V | 6000 V |
| Cat III | 1000 V | 8000 V |
| Cat IV | 600 V | 8000 V |

Best Practices

- Test the meter by checking a known voltage/resistance source for confirmation (auxiliary battery voltage)
- One hand working rule, reduces possibility of shock.
- Never back probe HV connectors, damage to insulation can cause arcing.
- Do not use cleaning spray around HV circuitry.



CAT III 1000V
CAT IV 600V
10A



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Setup: Ranging

Manual Ranging

- Must select testing range manually by pressing the range button
- Meter may read O.L. if wrong range is selected
- Only use manual range if circuit voltage range is known



Auto Ranging

- Hold range button to select Auto Range Mode
- Automatically selects proper test range
- Safer if circuit voltage range is unknown



Ranging

Units

Mode Sel 1

Mode Sel 2

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Setup: Units

 Click the tabs at the top and side to view each section

Unit Modifiers

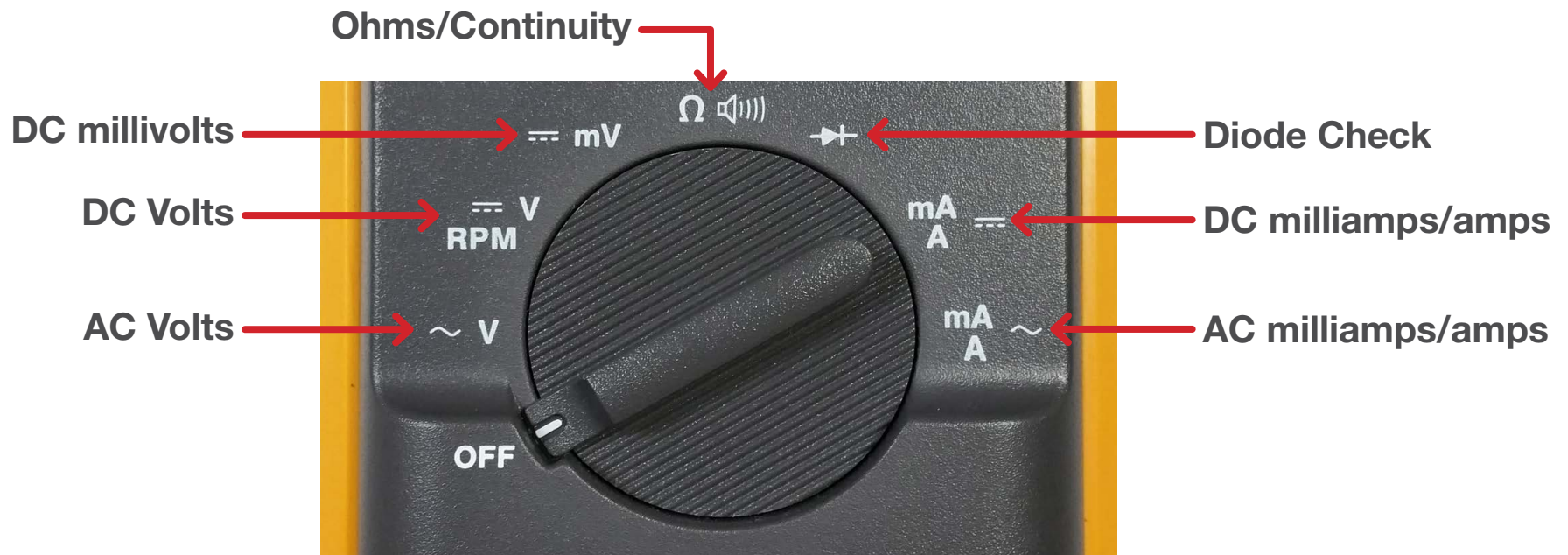
| M | mega (x 1 million) | Decimal point right 6 places | 10.74 MΩ = 1,074,000,000 Ω | Megohmmeter |
|---|----------------------|------------------------------|----------------------------|--------------|
| k | kilo (x 1 thousand) | Decimal point right 3 places | 0.351 kV = 351 V | DVOM |
| m | milli (÷ 1 thousand) | Decimal point left 3 places | 110.6 mΩ = 0.1106 Ω | Milliohmeter |

Ranging

Units

Mode Sel 1

Mode Sel 2



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Setup: Mode Sel 1

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Testing Volts, Ohms, and Diode Checks

- Volts = Amount of potential energy between two points on a circuit, or electrical pressure required to push 1 amp of power through 1 ohm of resistance in either AC (~) or DC (==) circuits.
- Millivolts = Very small voltages measured in AC or DC circuits.
- Ohms = Resistance value (circuit load)
- Diode Check = Meter produces voltage to test diode operation.



Note

Always check the range selection to ensure accurate readings. Especially when verifying no voltage present before HV circuit testing.

Ranging

Units

Mode Sel 1

Mode Sel 2

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Setup: Mode Sel 2

Testing Amperage (AC, DC)

- Milliamps – Current flow within an AC or DC circuit under 400mA (0.4A) – See picture on left
- Amps – current flow within an AC or DC circuit from .4A to 10A – See picture on right
- Notice the dial stays in the same location for milliamps and amps
- The test lead input location must be changed to ensure the correct circuit protection is being used within the meter



Use an Amp Clamp for measurements above the max amperage rating of your meter.

Meter set up
to read DC mA



Meter set up
to read DC A



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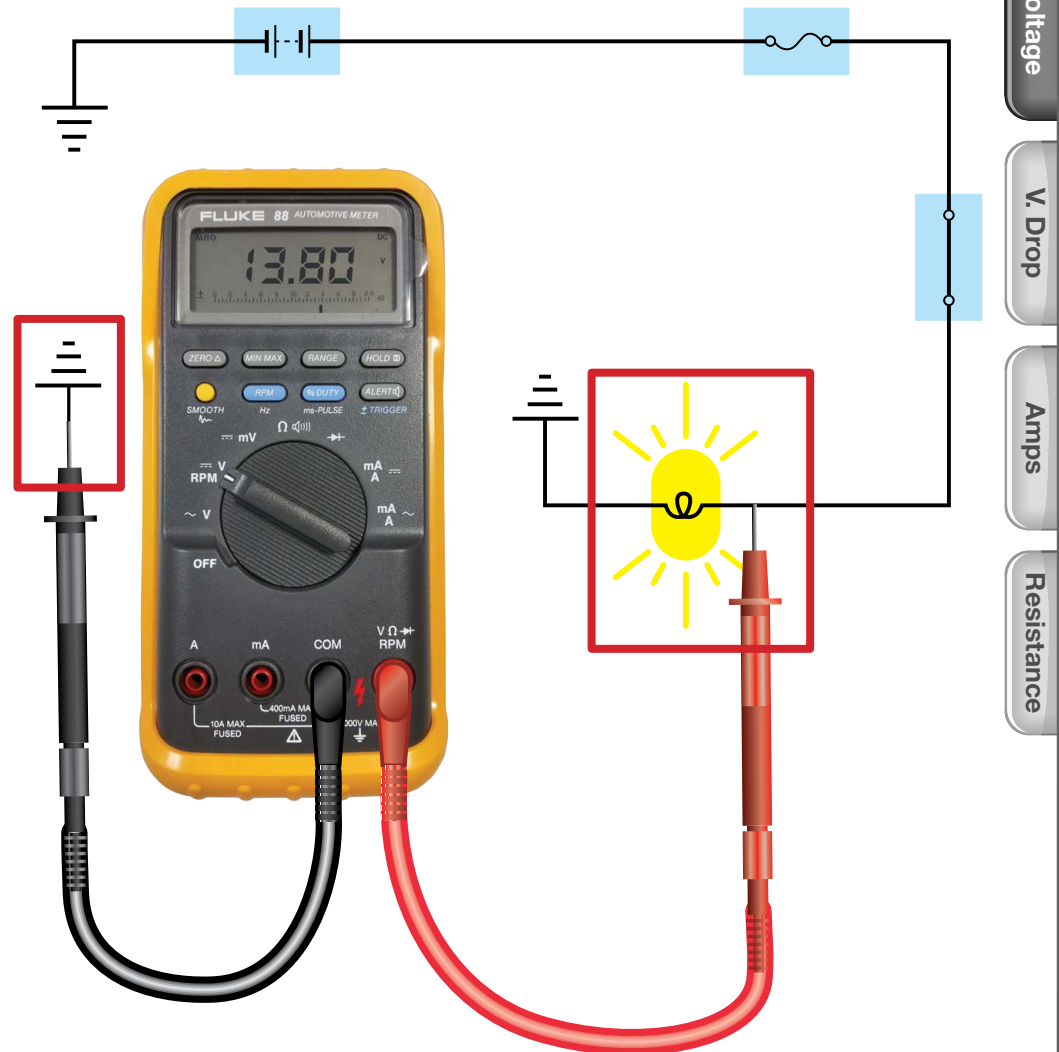
Example Measurements

Example Measurements: Voltage

 Click the tabs at the top and side to view each section

Checking Available Voltage

- Set meter to measure DC Voltage
- Connect Negative test lead to a known good ground
- Switch circuit on to V
- Test in various locations with positive (red) lead to see available voltage on different parts of the circuit
- Testing before the circuit load should be approximately source voltage
- Testing after the circuit load should be approximately zero



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Example Measurements: V. Drop

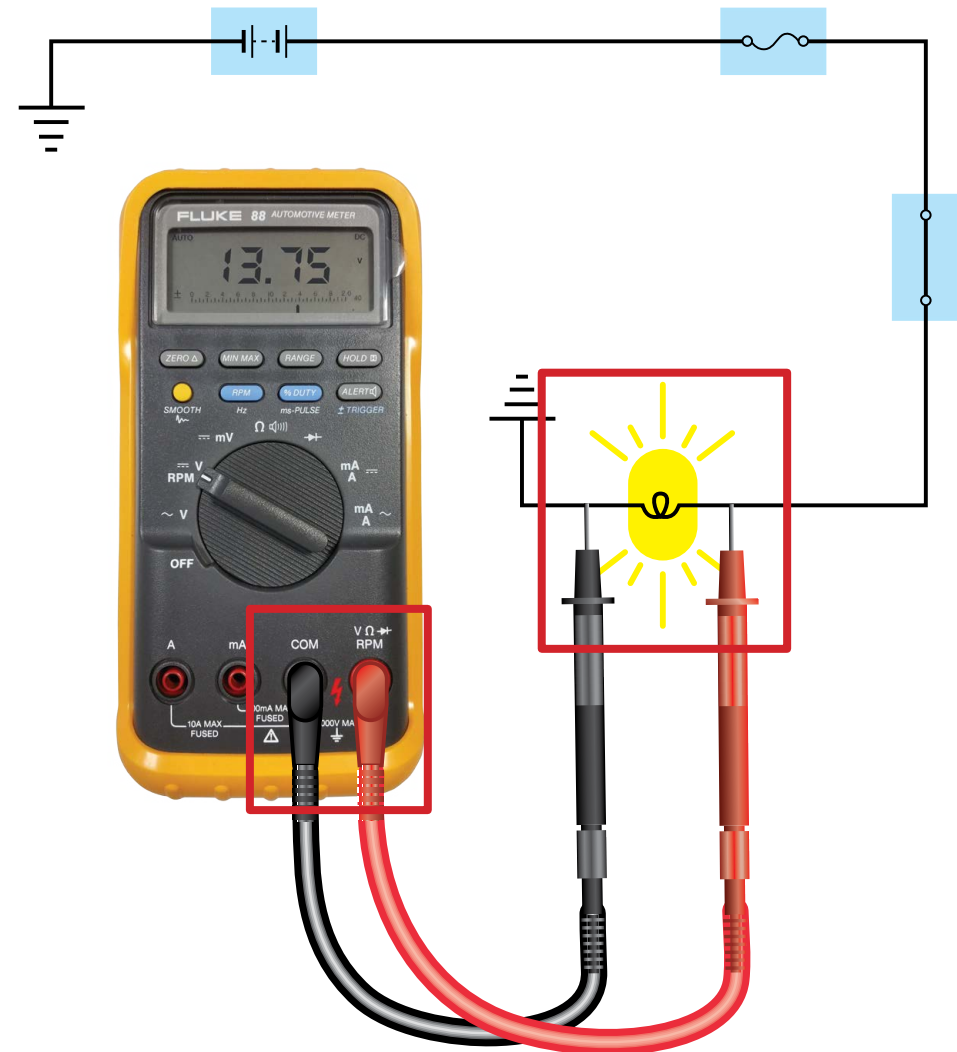
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Voltage Drop

- Set DVOM to measure DC Voltage
- Switch circuit on
- Connect the black test lead to the ground side of the component and the red test lead to the power side
- Voltage drop measurements across a load should be approximately source voltage



Voltage drop through wiring, fuses, or switches should never be higher than 0.1 V.



Voltage

V. Drop

Amps

Resistance

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Example Measurements

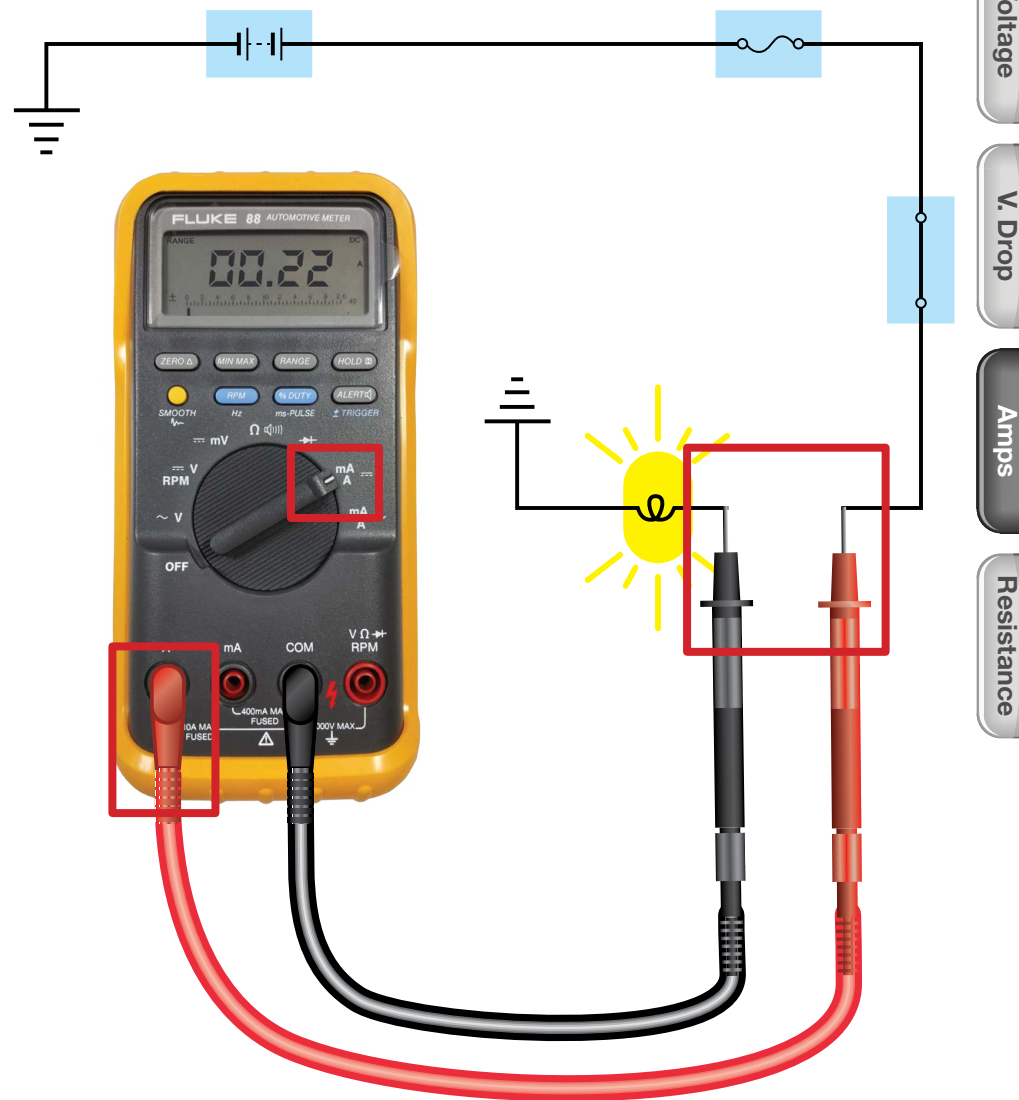
Example Measurements: Amps

 Click the tabs at the top and side to view each section

Amperage Check

- Select DC Amps on the DVOM
- Connect positive (red) test lead to Amperage location (A)
- Open the circuit and place DVOM in series to complete the circuit
- Turn the circuit on
- The meter can now read the amperage flow in the functioning circuit

 **Note** Use an Amp Clamp for measurements above the max rating of your meter.



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Example Measurements: Resistance

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Resistance or Continuity Test

- Disconnect and isolate the component from the circuit
- Select ohms (Ω) on the DVOM
- Make sure the test leads are in their correct location in DVOM
- Probe or clamp the test leads to either side of the component
- If there is no continuity through the component, (in this case a failed bulb) the meter reads O.L (Out of Limits)
- If the bulb or other component does not have a broken connection, you will read a resistance value in ohms.

