



Multimeter Basics and Application

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A Few Safety Notes



- Never work on high voltage DC or any AC systems unless qualified
- This class doesn't qualify you
- Don't work on live systems if possible
- Don't work alone
- Unsure? Stop
- Did I mention this course doesn't make you an electrician?

Manual Range



Analog



Auto Range



The DMM is your best friend and a good one can be had for about \$50



Roll over image to zoom in



VIDEO



Extech EX330 Autoranging Mini Multimeter with NCV and Type K Temperature, orange and green

Brand: Extech

★★★★★ 824 ratings

-8% \$54⁹⁹

List Price: \$59.99

✓prime

& FREE Returns

or 3 monthly payments of \$18.33

Get 5% back (\$2.74 in rewards) on the amount charged to your Amazon Prime Rewards Visa Signature Card.

May be available at a lower price from other sellers, potentially without free Prime shipping.

Size: **Autorange Multimeter with Thermometer**

Autorange Multimeter with Thermometer

\$54.99

✓prime

Electrical TRMS Multimeter

\$109.99

✓prime

Manual Range Multimeter

\$34.22

✓prime

Standard Autorange Multimeter

1 option from \$182.80

You can go as crazy as you want depending upon the features you need



Roll over image to zoom in

Fluke 117 Digital Multimeter, Non-Contact AC Voltage Detection, Measures Resistance/Continuity/Frequency/Capacitance/Min Max Average, Automatic AC/DC Voltage Selection, Low Impedance Mode

Visit the Fluke Store
 ★★★★★ 3,299 ratings
 Amazon's Choice for "fluke meter"

-10% \$239⁹⁹
 List Price: \$265.99

prime & FREE Returns
 You can get up to 4% off on Amazon Business — and this past year, you would have saved \$116⁵³. Sign up, it's free. More details
 Get 5% back (\$11.99 in rewards) on the amount charged to your Amazon Prime Rewards Visa Signature Card.
 May be available at a lower price from other sellers, potentially without free Prime shipping.

Enhance your purchase

Payment plans
 From \$40.00/mo (6 mo) with 0% APR



Roll over image to zoom in

Fluke 87V Digital Multimeter with a NIST-Traceable Calibration Certificate with Data

Visit the Fluke Store
 ★★★★★ 42 ratings | 19 answered questions
 Amazon's Choice for "fluke 87v"

\$552⁰⁰

prime & FREE Returns

Pay \$552.00 \$412.43 after using available Amazon Rewards Visa Card Points.

May be available at a lower price from other sellers, potentially without free Prime shipping.

Enhance your purchase

Payment plans
 From \$30.67/mo (18 mo) with 0% APR

Brand Fluke
 Style Fluke 87-V Multimeter w/ NIST Certificate
 Measurement Type Multimeter



Roll over image to zoom in

Fluke 289 True-RMS Stand Alone Logging Multimeter

Visit the Fluke Store
 ★★★★★ 127 ratings | 19 answered questions
 Amazon's Choice for "fluke 289"

-12% \$715⁵⁷

List Price: \$809.99

prime

& FREE Returns

or 12 monthly payments of \$59.64

You can get up to 12% off on Amazon Business — and this past year, you would have saved \$ it's free. More details

May be available at a lower price from other sellers, potentially without free Prime shipping.

Style:









Fluke 289 True-RMS Logging Multimeter

Brand	Fluke
Power Source	Corded Electric
Style	Fluke 289 True-RMS Logging Multimeter
Item Weight	1.92 Pounds
Item Dimensions LxWxH	0.24 x 0.4 x 0.87 inches

Never use these cheap meters or connect to AC unless you know what you are doing - and even then avoid cheap meters!



Meter functions are marked with symbols on a dial or in a menu

Symbol	Meaning	Symbol	Meaning
* V 	V DC	* 	Capacitance (uF: Microfarads) (nF: Nanofarads)
V 	V AC		Diode test
mV	millivolts (.001V or 1/1,000V)	Hz	Hertz (cycles/sec)
* A	Amps	REL 	Relative or offset reading
mA	milliamps (.001A or 1/1000A)	Range	Manual override of autorange
μA	microA (.000001A or 1/1,000,000A)	Hold 	Touch Hold-last stable reading
* Ω	Resistance (Ohms)	MIN MAX	Highest, lowest recorded readings
kΩ , MΩ	kilo-Ohms, Megohms		Dangerous voltage levels
*)))	Continuity beeper		Caution: see manual

Resistance Measurement

- Select the resistance function
- Plug black probe into COM jack and red into Ohms jack
- Touch probes across resistance to be measured, watch the units!
- OL is open circuit
- Testing a resistor in circuit works but it will always be better to measure the resistance in isolation.

**DO NOT MEASURE RESISTANCE
ON A LIVE CIRCUIT!**

Capacitance can be measured in a very similar way, however probing a capacitor that is in a circuit will have inaccurate results.



Image: electrical-engineering-portal.com

Voltage measurement is the most common task

- Select correct voltage function (AC/DC)
 - Plug black probe into COM jack and red into V jack
 - Select highest range if the meter is not autoranging
 - Touch probes across DUT in parallel to the voltage to be measured
 - Use a Ground references
- Troubleshooting circuits:
- Test power rails
 - Test analog signals
 - Test reference voltages

DO NOT:

Measure Battery voltage without a load



Image: electrical-engineering-portal.com

Current measurements require a different hookup structure

- Select the current function (AC or DC), use mA for small currents
- Ensure the circuit is powered off and break the circuit
- Insert the probes in series at the circuit break
- Plug black probe into COM jack and red into correct current jack
- Power the circuit

DO NOT:

- Try to measure voltage while in current mode
- Measure current without a load (Probe a Battery)



Image: electrical-engineering-portal.com

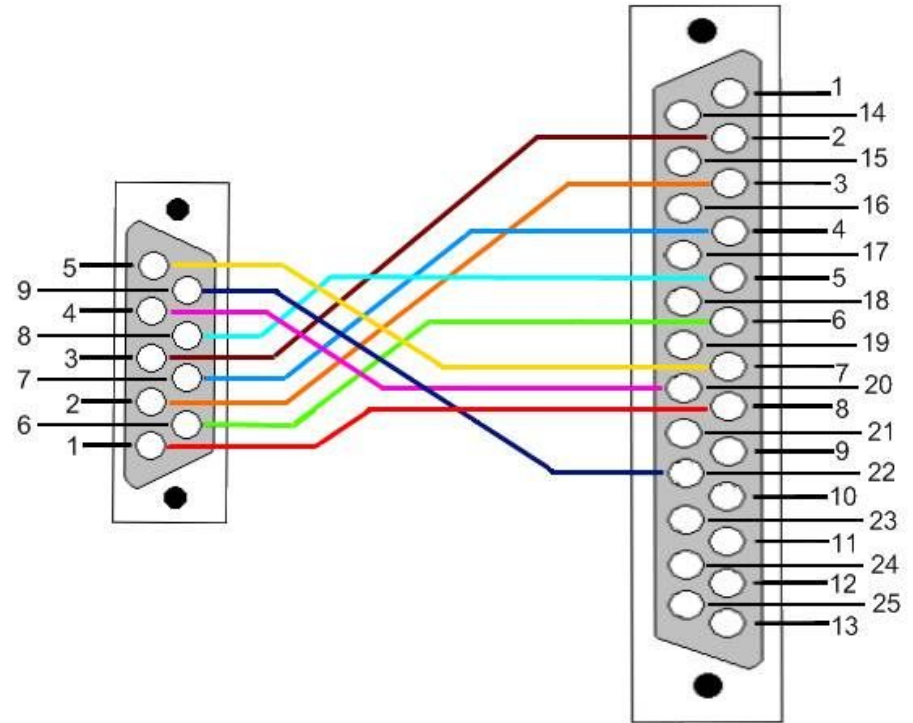
Pay attention to the mA/A connector - you may even need a current clamp device for higher current measurements



Continuity Beeper can be an incredibly useful tool!)))

- Identify pinouts of a cable
- Locate flakey connections
- Find shorts

In the event of a mishap in the lab, where a board sparks, shuts off, or pulls too much power, try buzzing out the board to identify if there are any shorts before powering on the device and testing voltages.



DO NOT CONTINUITY TEST
A LIVE CIRCUIT!