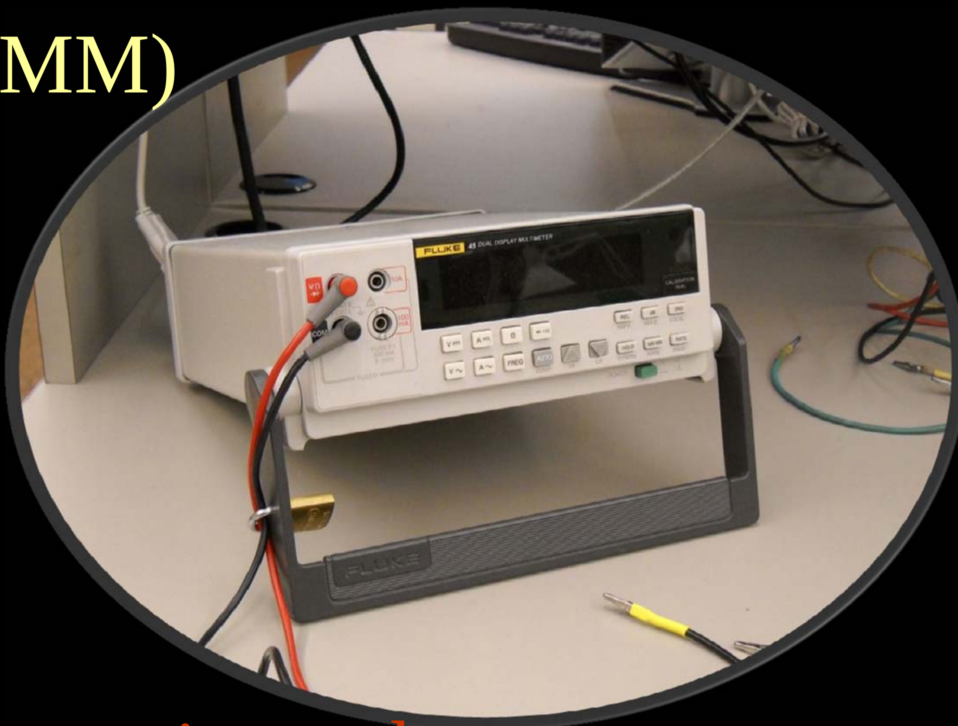
Digital Multi Meter (DMM)



DC & AC Voltage

Ohms (Resistance)

DC & AC Current
100mA & 10A
Range
(Move the red-terminal)

For measuring unknown current, always use 10A socket first

If the measured current is less than 100mA then move the red terminal to the 100mA range

100mA Fuse


FLUKE
45 DUAL DISPLAY MULTIMETER
AUTO
0.000
10A
100 mA
FREQ
AUTO

All modern digital meters are basically
a voltage measurement device

Accuracy of DMM

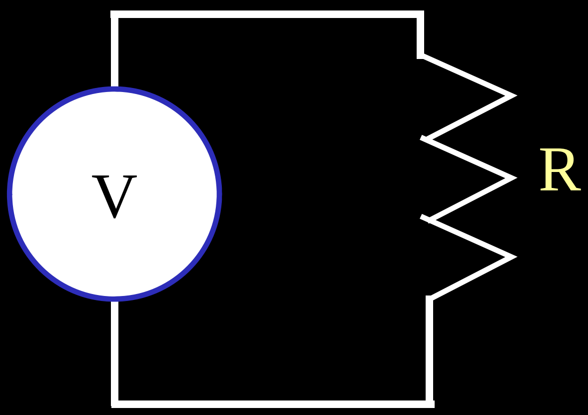
Voltage $\pm$ (0.02% + 2 Digit)

Current $\pm$ (0.05% + 3 Digit)

Resistance $\pm$ (0.05% + 2 Digit)

When you make any measurement notice how many decimal places the display show

A measurement exercise



Verify Ohm's law experimentally

Show your measurement and calculation reconciles within the instrument accuracy

Picked a 470 Ω resistor from the bin

Measured the value using DMM

Measured the voltage applied using DMM

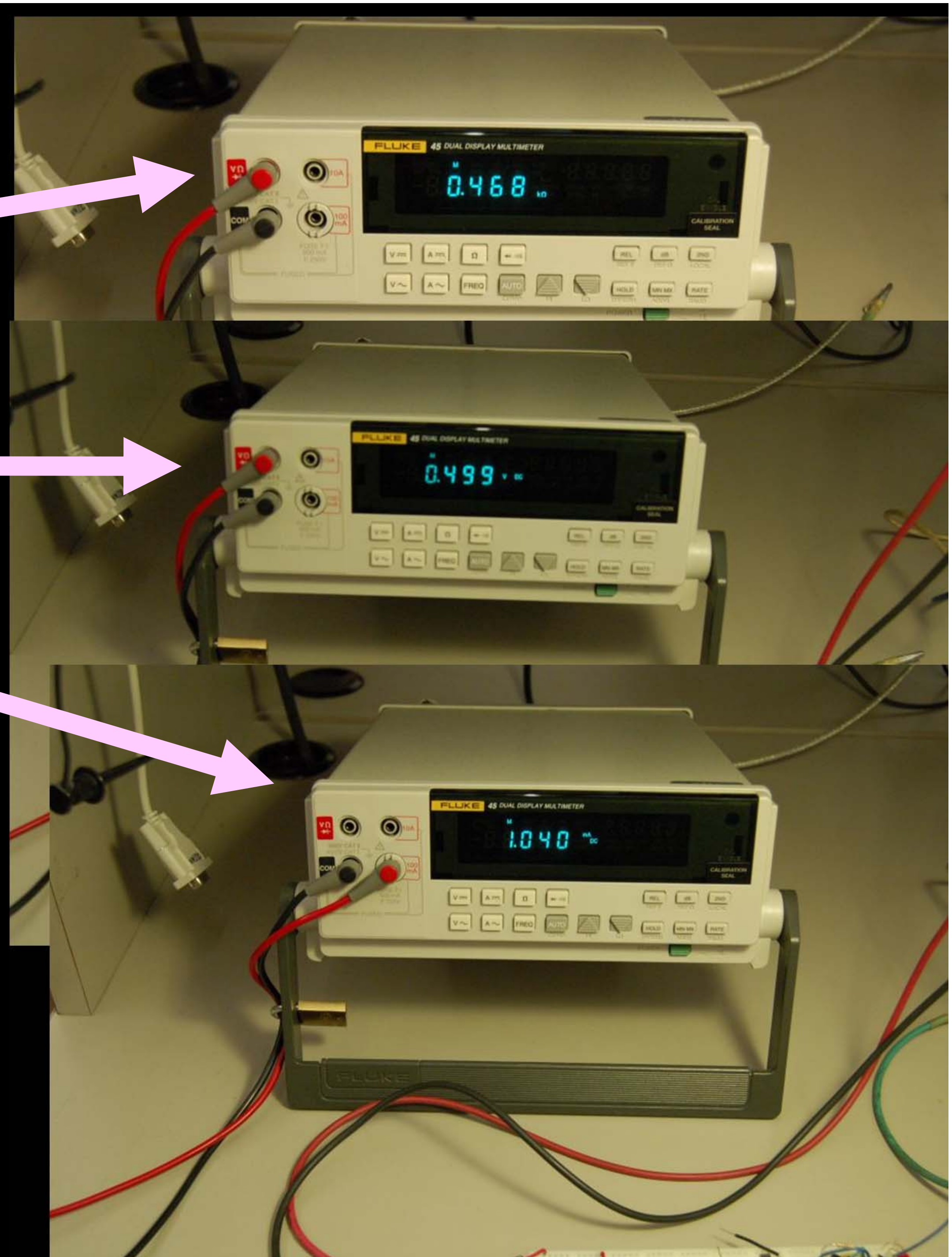
Measured the current using DMM

$$0.499\text{V} \div 468\Omega = 1.066\text{mA}$$

Then why does the meter read 1.04mA?

2% error!

Meter specification:
0.05% + 2 Digit



During current measurement a resistor is introduced in series

(Shunt Resistor or meter burden)

We have to include this in our calculation

100mA range: 11.5Ω 10A range: 0.5Ω

Lets take into account the accuracy of our measurements

Resistance measurement:

0.468 ± (0.05% + 2 Digit)

$$0.468 \pm \left[0.468 \times \left(\frac{0.05}{100} \right) + (2 \times 0.001) \right]$$

470.234Ω

465.766Ω

Voltage measurement:

0.499 ± (0.02% + 2 Digit)

$$0.499 \pm \left[0.499 \times \left(\frac{0.02}{100} \right) + (2 \times 0.001) \right]$$

0.5011V

0.4969V

Current measurement:

1.04 ± (0.05% + 3 Digit)

$$1.04 \pm \left[1.04 \times \left(\frac{0.05}{100} \right) + (3 \times 0.001) \right]$$

1.04352mA

1.03648mA

Re-Calculate the current including the shunt resistance

470.234Ω

465.766Ω

0.5011V

0.4969V

Max possible current

$$\frac{0.5011}{465.766+11.5}=1.0499mA$$

Min possible current

$$\frac{0.4969}{470.234+11.5}=1.0314mA$$

Measured		Calculated	
1.04352mA		1.0499mA	
	1.040mA	1.04065mA	0.06%
1.03648mA		1.0314mA	