

# DMM Ohmmeter constant current and full scale voltage values

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For bench DMM instruments, it turns out that one way to investigate the ohms scales of a DMM is to use the 4 Wire ohms function of the DMM under test, as shown in the accompanying schematic diagram.<sup>1</sup> The advantage of the 4 Wire ohms function is that a series ammeter will not adversely affect the ohms measurement, since the sense leads of the DMM under test can be directly connected to the resistor under test.

The DMM under test (left side of drawing) is wired according to the diagram, and set to auto range or to a manual range scale appropriate for the resistor under test (RUT). The RUT can be a decade box or a hand full of test resistors having values from about 100 ohms to 1 Mega ohm.

The tables below show some exemplary sample measurements for the hp 3456A DMM and the hp 34410A DMM. A Fluke 77 hand held DMM was used to measure the series test current  $i$  and the DMMs alternated, with the DMM not under test used to measure the voltage  $V$  across the RUT.<sup>2</sup> We rounded values, since we are not so much interested in DMM calibration to several digits, but rather just to see what currents and voltages the DMM uses in over its range of ohms scales.

While hp and Agilent use combinations which yield the ohms value (i.e.  $V/i$ ), it might not have been so obvious to know ahead of time that they used 5  $\mu\text{A}$  or 50  $\mu\text{A}$  constant currents for the higher ohms scales. Also, note that the Agilent 34410A DMM has three higher scales (10M, 100M, and 1Gig) which we did not measure here.

Example Test Data:

## hp 3456A DMM Four Wire Ohms Scales

Ohms Scale	Resistor Under Test	Constant Current	Voltage across RUT
100 ohms	0 ohms	1 mA	0 V
100 ohms	100 ohms	1 mA	0.1 V
1 k ohms	1 k ohms	1 mA	1 V
10 k ohms	10 k ohms	0.1 mA	1 V
100 k ohms	100 k ohms	50 $\mu\text{A}$	5 V
1 M ohms	1 M ohms	5 $\mu\text{A}$	5 V

## Agilent 34410A DMM Four Wire Ohms Scales

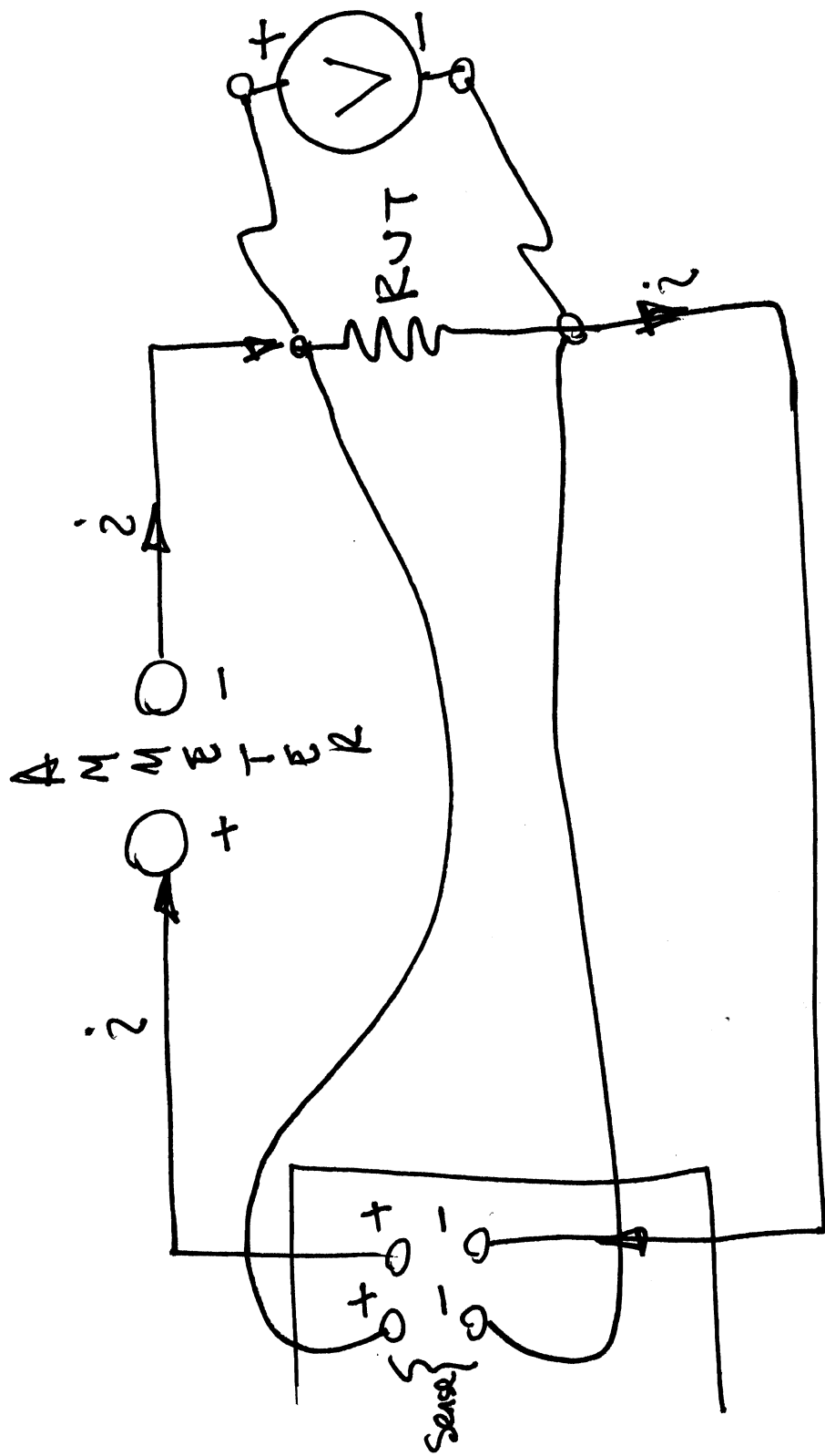
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100 k ohms	100 k ohms	10 $\mu$ A	1V
1 M ohms	1 M ohms	5 $\mu$ A	5 V

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<sup>1</sup> This information can usually be found in the operator's and/or service manual. However, time and instruments allowing, it is an interesting measurement to make.

<sup>2</sup> We used an older model Shallcross 827 decade resistance box with recently cleaned contacts from 0 and 100 ohms to 1 Mega ohm.



MEASURING CURRENT & VOLTAGE

FOR AMMETER

USING 4 WIRE OHMS SCALAS, A DECANE BOX,

AN EXTERNAL AMMETER & AN EXTERNAL VOLTMETER

11/19/11

Bob