Part Four – The Agilent 34401A Digital Multimeter

1. Measuring DC and AC Voltage
2. Measuring Resistance
3. Measuring Current

The DMM (digital multimeter) is a very important laboratory instrument. This section will show you how to make three of the basic measurements: voltage, resistance and current. The 34401A has many capabilities beyond measuring V, R and I; consult the Agilent User's Guide for information on measuring frequency, period, continuity & diodes, and using the many features and functions of this DMM.

When you turn the DMM on, it will be in the "Power-On and Reset State":
Function = DC volts
Input resistance = 10M Ω (may be changed to 10G Ω for 100 mV, 1 V, & 10 V DC ranges)
Range = Autorange
Resolution = 5½ digits

**To Measure Voltage**

Ranges: 100 mV, 1 V, 10 V, 100 V, 1000 V (750 Vac)
Maximum resolution: 100 nV (on 100 mV range)
AC technique: true RMS, ac-coupled

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**Measuring DC and AC Voltage**

Key points:
- You **must insert the voltmeter leads across** the two points in a circuit for which you want to measure the voltage. Use the red and black input jacks as shown below.
- You can use the rear panel red and black input jacks also (be sure to select front or rear).
- If you use front and rear, you can easily and quickly select one of two voltages.
- The DMM will **Autorange**, unless you override it by selecting a range.
- You can choose the number of digits displayed, using the **DIGITS** buttons.
- Be sure to select **DC V** or **AC V**, as needed.
- AC voltage displayed is the true RMS value of the waveform.
- AC voltage is accurate to less than 1% up to 100 kHz.
- Input impedance for AC V is 1MΩ in parallel with 100 pF (not including test leads).
- Input resistance for DC V is 10MΩ, unless changed to 10GΩ! for 100 mV, 1 V, & 10 V DC ranges.
To Measure Resistance

Ranges: 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ, 10 MΩ, 100 MΩ
Maximum resolution: 100 μΩ (on 100 ohm range)

Measuring Resistance
Key points:
- **NEVER** measure resistance in a "live" circuit. Turn off all power to the circuit.
- If an ohmmeter is used in a "live" circuit, at best you will get incorrect readings; at worst you can seriously damage the DMM.
- You **must insert the ohmmeter leads across** the two points in a circuit for which you want to measure the resistance. Use the red and black input jacks as shown below.
- Use the red and black input jacks (on the right) as shown below.
- You can use the rear panel red and black input jacks also (be sure to select front or rear).
- If you use front and rear, you can easily and quickly select one of two voltages.
- The DMM will **Autorange**, unless you override it by selecting a range.
- You can choose the number of digits displayed, using the **DIGITS** buttons.
- Be sure to select **Ω 2W** (ohms, two-wire).
- **Ω 4W** (ohms, four-wire) is a more complex measurement that gives greater accuracy by eliminating the contact resistance (of the leads to the device under test).
- Make sure your hands don't contact both test leads; if they do, then you're measuring the device under test in parallel with you.
To Measure Current

Ranges: 10 mA (dc only), 100 mA (dc only), 1 A, 3 A
Maximum resolution: 10 nA (on 10 mA range)
AC technique: true RMS, ac-coupled

Measuring Current

Key points:
- You must insert the ammeter leads in series to measure current in a circuit.
- Use the red and black input jacks (on the right) as shown below.
- You can use the rear panel red and black input jacks also (be sure to select front or rear).
- If you use front and rear, you can easily and quickly select one of two currents.
- The DMM will Autorange, unless you override it by selecting a range.
- You can choose the number of digits displayed, using the DIGITS buttons.
- Be sure to select DC I or AC I to measure DC and AC current.
- See User's Guide page 216 for the "Burden Voltage" for each current range.