Introduction to the
Agilent 34401A Digital Multimeter

Introduction

The Agilent 34401A is a digital multimeter, or DMM, which means that it displays measurements in a digital form rather than a needle moving across a dial. It’s called a multimeter because it can make a variety of measurements and replace a collection of different single-function meters. The measurements that will be most important are voltage, current, and resistance. The voltage and current measurements can be for either a.c. or d.c. signals.

Using the 34401A

1. The first step in using the DMM is to select the desired measurement function. This is done by pressing the appropriate function select button, as shown in Figure 1. Note that the current measurements are printed in blue above the button that performs the similar voltage measurement. To measure current instead of voltage you must first press the blue Shift button, then press the button under the desired function. Note that the units shown on the right side of the display will change to indicate the selected function.

2. The test leads must be connected to the front panel jacks that correspond to the selected function. When measuring current you must use the bottom two jacks on the right side, and for everything else use the top two jacks on the right side. If your meter has a small board with a fuse plugged into the bottom red jack then plug your red test lead into the jack on that board instead of the red jack on the DMM when making current measurements. The remaining two jacks (the ones on the left, marked HI and LO) are for a special method of making precise resistance measurements.

3. It’s always a good idea to match the color of the test lead to the color of the jack. Mixing up the red and black leads is a good way to blow a circuit breaker... not that I know anyone who has done that.

4. The test leads must also be connected to your circuit differently for different kinds of measurements, as shown in Figure 2. Suppose you want to measure the voltage across some part of a circuit (indicated in the figure below).

Figure 1: Agilent 34401A Digital Multimeter

Figure 2: Proper Connections for Measuring Voltage, Current, and Resistance
as the *device under test* (DUT). The DMM, acting as a voltmeter, must be connected in *parallel* with the DUT. In order to measure the current flowing through the DUT the DMM, acting as an ammeter, must be connected in *series* with the DUT. Note that the red jack is assumed to be connected to the higher voltage for voltage measurements, and current is assumed to enter the red jack for current measurements...if you get them reversed your measured values will be negative. To measure the resistance of something you must connect the DMM, acting as an ohmmeter, to that thing alone. A resistance measurement is made by injecting a precise current and measuring the resulting voltage, so you generally can’t measure the resistance of something that is connected to any other source of current. For resistance measurements you can interchange the red and black test leads...it doesn’t make any difference.

5. Note that the DMM has *autoranging*, which means that it automatically changes the measurement units to provide the largest number of usable digits. For example, if you are measuring a very small d.c. voltage then the displayed units will change from VDC to mVDC to indicate that the displayed value is in millivolts instead of volts.

6. **Be very careful** when measuring current. If you connect test leads to the current measurement jacks and then connect the other ends directly to a high current source (such as the output jacks of the bench power supply) you will probably blow a fuse.

**Troubleshooting**

1. **The display always reads something close to zero.**
   
   (a) Make sure you have the test leads plugged into the correct jacks for the type of measurement you are making (voltage, current, or resistance).
   
   (b) Make sure *both* test leads are connected to the circuit you want to measure.
   
   (c) If the **Rear** indicator is lit (just under the characters that display the measurement units) then the banana jacks on the front panel are disabled. Press the **Front/Rear** button once to extinguish the indicator and enable the front panel jacks.
   
   (d) If the problem occurs with resistance measurements, look for a short in the test lead connections.
   
   (e) If voltage and resistance measurements work but current measurements always read near zero, you may have a blown fuse. Ask the lab instructor to check it for you.

2. **The display reads OVLD (overload).**
   
   (a) The quantity (voltage, current, or resistance) that you are trying to measure exceeds the range of the meter. If autoranging has been disabled (you will see the **Man** indicator lighted under the measurement display) press the **Auto/Man** button to enable autoranging. If the OVLD indication persists you will need to use a different meter.
   
   (b) If you are measuring resistance, you may have forgotten to connect both test leads or the connections may be poor.