

# HP34401A Digital Multimeter

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# Table of Contents

Introduction	1
Features	1
Specifications	1
SECTION 1	
Setting Up the HP34401A	2
Overview of the Controls	2
SECTION 2	
How To Measure DC/AC Voltage	3
How To Measure DC/AC Current	4
How To Measure Resistance	5
How To Measure Frequency	5
SECTION 3	
Trouble Shooting	6
Where to Find More Help	6
References	6

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# Introduction to the HP34401A Digital Multimeter

*The following is a brief overview of the DMM.*

**T**his manual was written to instruct ECE 3041 students on the operation and uses of the HP34401A Digital Multimeter. The HP34401A is a very versatile instrument capable of measuring numerous circuit characteristics. It is capable of measuring electric characteristics such as: voltage, current, frequency and resistance with very high accuracy. These functions will be the focus of this manual. The following guide is for course-specific applications and not intended to be used as a complete user's manual. To find more information beyond the scope of this manual, check the "Where to Find More Help" section.

## Features

**T**he HP34401A is setup for bench-top use with AC power supply. It performs at 1000 readings/sec and has a 6½-digit display. The HP34401A will automatically adjust the range to the characteristic being measured. It is also extremely accurate: 0.0015% error for DC, 0.06% for AC.

## Specifications

<u>Function</u>	<u>Range</u> (For accuracy specifications, consult the full manual)
DC Characteristics:	DC Voltage Range and input Resistances: 0.1V, 1V, 10V: input resistance selectable 10MW or > 10GW 100mV to 1000V: Rin = 10MW DC Current range and shunt resistance: 10mA, 100mA: Rshunt= 5 W 1A and 3A: 0.1 W
AC Characteristics: true RMS:	AC Voltage: from 3 Hz to 300 kHz AC Current from 3 Hz to 5 kHz
Resistance range: 2-wire and 4-wire method:	100 W, 1 kW, 10 kW, 100 kW, 1 MW and 100 MW Input protection: 1000V
Frequency and Period measurement:	Frequency range: 3 Hz - 300 kHz Input voltage range: 100 mV to 750 V

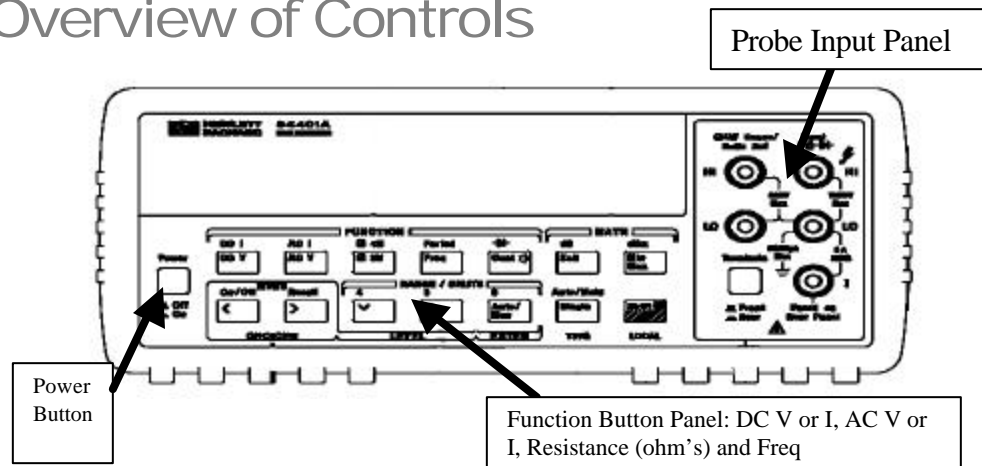
**Table 1.** Table of Function Ranges [1]

## Setting Up the HP34401A

1. Get all lab supplies ready for use.
  - HP34401A Digital Multimeter
  - Probes Leads (found hanging in wall racks)
  - Alligator Clips for Lead ends
  - Breadboard and circuit components (if needed)
2. Turn on the Multimeter.

The front panel display will light up while the meter performs the power-on self-test. After this is complete, the HP34401A is ready to perform measurements.

### Overview of Controls

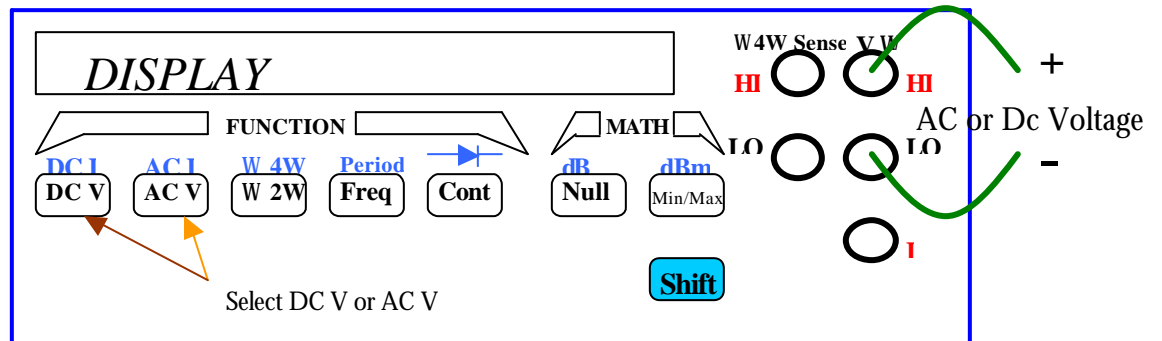


**Figure 1.** Overview of front panel [1]

The front panel has two rows of keys for selecting the functions. The right side of the panel contains various probe input locations of which the selection is dependent upon the characteristic being measure (Figure 1). The selection keys are annotated in black and blue. To select a function in blue, first select the blue **SHIFT** key.

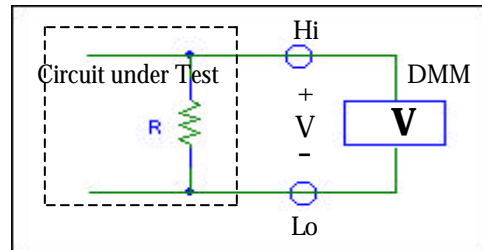
## How to Measure DC and AC Voltage

To measure a voltage, connect the probes to the **HI** and **LO** input terminals of the DMM. In order to activate the DMM for voltage measurements, select either the **AC V** or **DC V** button on the front panel (Figure 2).



**Figure 2.** How to Measure Voltage

Next, connect the leads of the probes to the circuit in parallel with the location of the voltage in question (Figure 3). The **Hi** lead connects to the “+” (pos) part of the circuit and the **Lo** to the “-” (neg). If these are reversed, a negative value for the voltage is obtained.



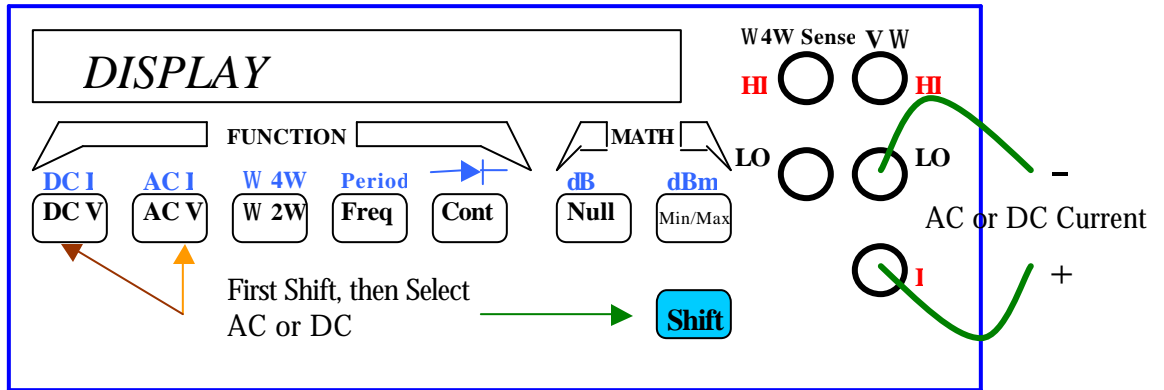
**Figure 3.** Probe/Meter placement on the circuit to Measure Voltage Across Resistor R



**CAUTION:** Do not exceed the maximum allowable voltage input (1000V DC). Also, never apply a voltage over the current input terminal (I) of the DMM.

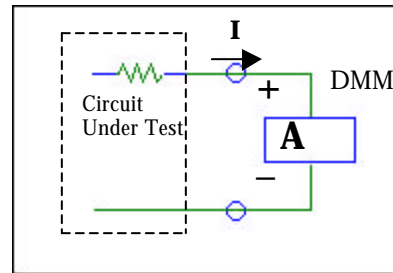
# How to Measure DC and AC Current

To use the DMM as an ammeter, connect the leads in which the current flows to the current (I) and LO terminals (Figure 4). To measure the current, either the DC I or AC I key must be selected by pushing SHIFT and DC V or AC V button.



**Figure 4.** How to Measure Current

Next, connect the leads of the probes to the circuit in series with the location of the current in question (Figure 5). The current (I) lead connects to the “+” (pos) part of the circuit and the LO to the “-” (neg). If these are reversed, a negative value for the current is obtained.



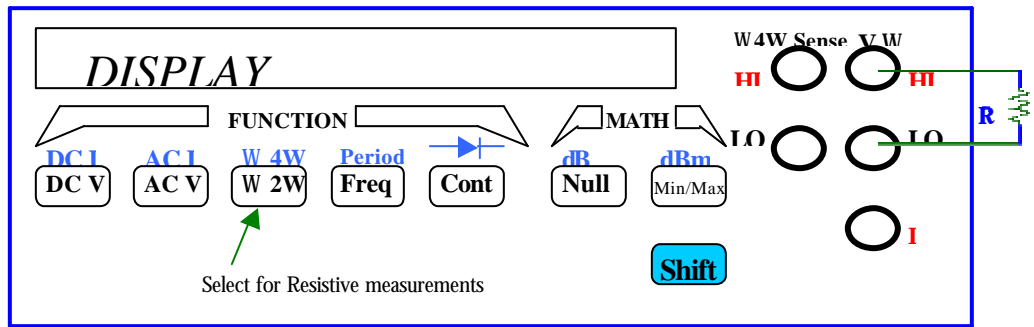
**Figure 5.** Probe/Meter Placement to Measure Current Through Meter



**CAUTION:** Do not exceed the maximum allowable current input (3A DC). Never apply a voltage over the current input terminal (I) of the DMM. This will cause a large current to flow through the small input resistor  $r_i$  and can damage the DMM.

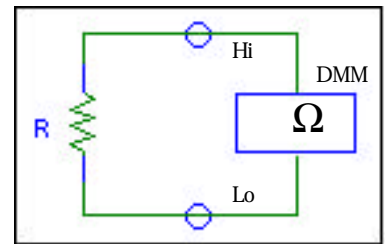
## How to Measure Resistance

To use the DMM for resistance measurements, connect the resistor to the terminals labeled **HI** (**VW**) and **LO**, select the resistance measurement function by pushing the **[W]** button on the front panel as shown below in Figure 6.



**Figure 6.** How to Measure Resistance

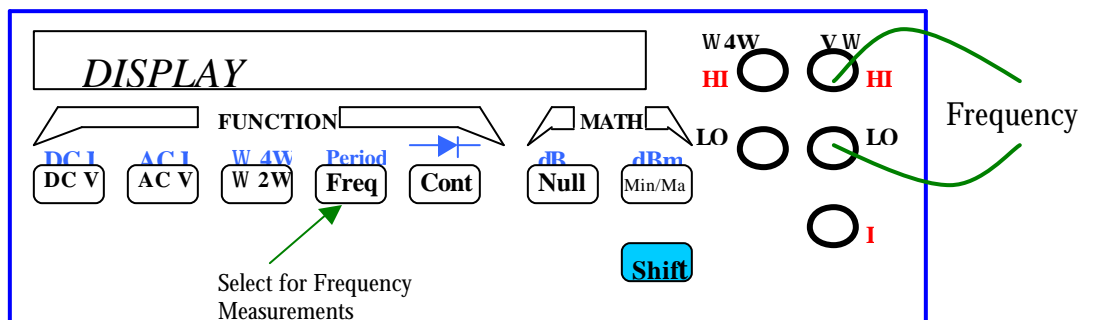
Then connect the leads of the probes to the circuit in parallel with the resistance in question (Figure 7).



**Figure 7.** Probe/Meter Placement to Measure Resistance Across Resistor R

## How to Measure Frequency

To use the DMM for frequency measurements, connect to the terminals labeled **HI** (**VW**) and **LO**. Select the frequency measurement function by pushing the **Freq** button on the front panel as shown below in Figure 8. The meter is connected in parallel the same as taking a resistance measurement (Figure 7).



**Figure 8.** How to Measure Frequency

## Troubleshooting



*What if the meter will not turn on?*

First make sure it's plugged in; if this is the case get a TA for assistance, the meter may have a blown fuse or need repair.

*The meter is on, but is not taking any readings when it's connected to the circuit.*

Make sure to check that the probe inputs have been inserted in the proper configuration, for this check back in the "Making Measurements, Section 2" (Notice: voltage and current are different).

Next, check to make sure that the Front/Rear input selection button is not depressed (located in the probe input panel to left of the "current (I)" input).

*The probe inputs are correct, but when the meter is connected to the circuit the meter reads invalid values or does not read at all.*

Check that the meter is connected to the circuit in the correct orientation. It must be connected in series for current readings and in parallel for voltage, frequency and resistance. Check back in the "Making Measurements, Section 2" for more information.

## Where to Find More Help

- The complete manual on the HP website:  
<http://www.tm.agilent.com/classes/MasterServlet?view=HomePage&language=eng&locale=US>
- The Lab Manual
- Lab TA

## References

- [1] "HP 34401A user's manual," [Online document], Feb. 1996, Available HTTP:  
[http://cp.tm.agilent.com/data/downloads/eng/tmo/manuals/  
pdf/34401A\\_UsersGuide\\_English.pdf](http://cp.tm.agilent.com/data/downloads/eng/tmo/manuals/pdf/34401A_UsersGuide_English.pdf)