Daffodil International University (DIU)
Department of Electrical and Electronic Engineering

EEE 422: Measurement and Instrumentation Lab

EXPERIMENT NO: 09

NAME OF THE EXPERIMENT: ELECTRONIC OHMMETER.

Theory:

A basic electronic ohmmeter is shown in the figure below

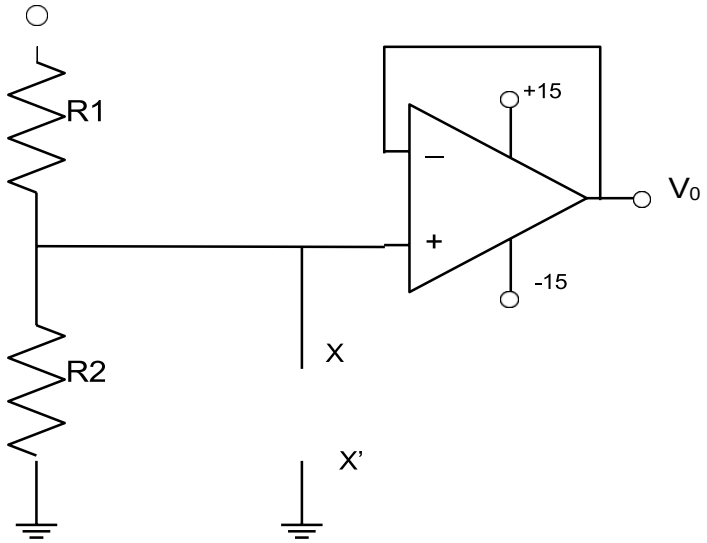

Fig.1: Electronic Ohmmeter

As can be seen by this circuit uses an Op-Amp configured as a non-inverting amplifier with a gain of one. The very much input impedance seen looking into the non-inverting input of the Op-Amp effectively isolates the meter movement from the resistive circuitry of the ohmmeter. The terminals to which a resistor of unknown value should be connected are identified as x and x`. This circuit is best analyzed by use of Thevenin's Theorem to find an equivalent circuit for the resistive network as seen at points A and. We must either disconnect op=amp or treat is as am infinite impedance, which we can justifiably do since it does represent a very high impedance. Thevenin's equivalent voltage is computed as

$$V_{TH} = V\frac{R2}{R1 + R2}$$

And Thevenin's equivalent resistance is computed as

$$R_{TH} = \frac{R1R2}{R1 + R2}$$

The Thevenin's equivalent circuit if the ohmmeter is shown in the below

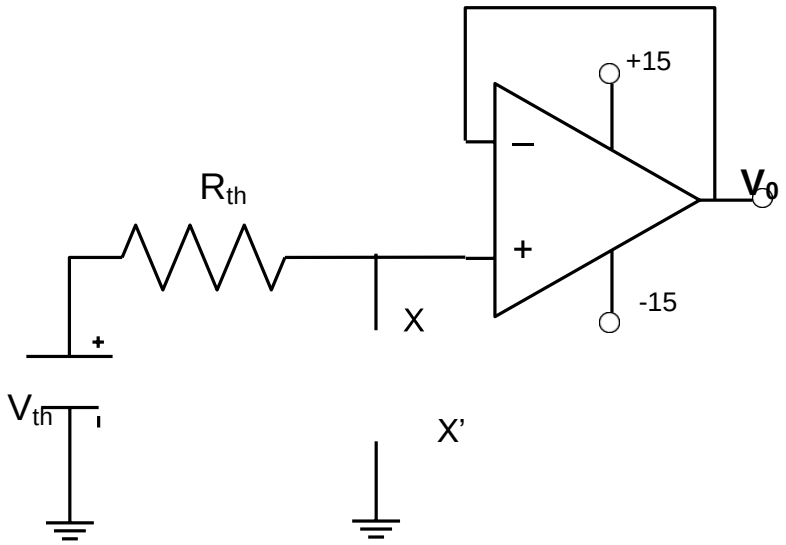

Fig. 2: Thevenin Equipment Circuit of Electronic Ohmmeter

By observation, it is obvious that if points x and x1 are shorted together, which represent a measurement of zero ohm, the input voltage to the op-amp is 0V. Therefore voltmeter reading shows an indication of 0 ohm. In addition, if test points are indicating an infinite resistance, the voltmeter should read the Thevenin's voltage VTh. If there is an unknown resistance Rx, the voltmeter reading follows from the equation:

V′0 (calculated)	V_0 (measured by multimeter)	R′x (multimeter)	Rx (calculated from V_0)
1. 0V			
2. (½ Vcc)			
3.			
4.			
5.			
6.			
7.			

List of Equipment:

1. IC 741 1
2. 10K resistor 2
3. Resistor of different values 10
4. DC power supply
5. DC voltmeter

Procedure:

1. Connect the circuit as shown in fig.1. R1 and R2 should be equal.
2. Power up the circuit.
3. Short the test points x and x` and observe the voltmeter reading. The reading should be zero.
4. Place a resistance of value equal to RTh between the test points. Voltmeter reading should be half of the Thevenin's voltage VTh.
5. If the observation seen in step 2, 3 and 4 do not match with the expected output then check the circuit connection to correct the error.
6. Now calibrate the reading of the voltmeter with the help of five various known resistors and complete Table 1.

Report:

1. Fill up the following table

Sl. No.	Actual Meter Reading (V)	Calibrated value of the meter(K ohm)	Measured value of the known resistor(K ojm)

2. Plot calibrated meter reading vs. measured resistance. Comment on this plot(Attach the graph).
3. Calculate resistive error for each reading using the following equation: Relative Error = $(R_{calibrated} - R_{measured})/R_{measured}$.
   Plot relative error vs. measured resistance (attach the graph).
4. Discussion