measuring meter resistance

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IT IS OFTEN HANDY TO KNOW THE RESISTance of a meter movement. The resistance of milliammeters ranges from fractions of an ohm to around 100 ohms and the resistance of many microammeters is in the thousands of ohms. These values are often high enough to affect circuit performance so the technician should know the resistance of the meters he uses. Some people get away with using an ohmmeter but it is hardly recommended. The ohmmeter may burn out the meter or damage it.

Figs. 1 and 2 illustrate a technique which will give the meter resistance with an accuracy better than 1%. If followed exactly, there is no danger of burning out the meter. The series potentiometer in Fig. 1 is chosen according to the meter being measured. Its value must be high enough to reduce current in the circuit below the rating of the meter. For instance, if you wish to measure the resistance of a 0 to 1 microammeter, the resistance should be

$$\text{greater than } R = \frac{1.5\text{ v}}{1 \times 10^{-6}\text{ amp}} = 1.5$$

megohms. For a 0 to 1 milliammeter it should be greater than 1,500 ohms.

After choosing the potentiometer, *set it to its maximum value.* Then hook up the circuit of Fig. 1. Vary the potentiometer slowly and carefully until the meter reads full scale. Then place a second potentiometer across the meter as in Fig. 2. You will have to guess at the value of this parallel potentiometer. As a first try, use a 500-ohm unit for milliammeters and a 5,000-ohm unit for microammeters. Vary it until the meter reads exactly half scale. Since the battery and the series potentiometer will act approximately as a constant-current source, half the current is now passing through the meter and the other half through the potentiometer. Remove the parallel potentiometer and measure its resistance. The result will be the resistance of the meter.

For more accurate results, use the circuit of Fig. 3. It is essentially the same as Fig. 2 except that another meter has been added in series with the battery. The rating of this meter should be equal to the meter being tested or slightly higher. The procedure is now the same as before with one difference: While varying the parallel potentiometer, maintain current in the series meter at its initial value by slightly changing the series potentiometer. In this way, you make the battery act as a constant-current source. The accuracy of this method of calculating the resistance of the meter is only limited by the accuracy with which the meter itself indicates half scale. END

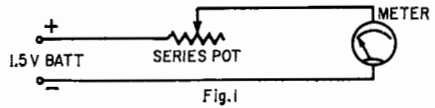

Fig.1

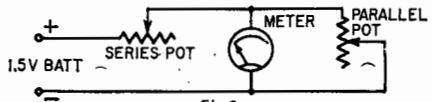

Fig.2

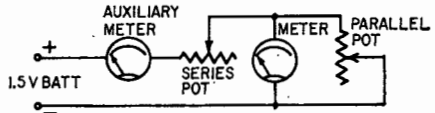

Fig.3