Ohmmeter Circuits

Input Connections

The two diagrams below illustrate a simple technique for using the DMS-20 and DMS-30 Series 3½ digit DPM's as ohmmeters. For a measurement range of 0-200 Ohms, the value of R1 is 2.7kΩ and R2 = 100Ω (see Figure 1). For a measurement range of 0-2kΩ, R1 = 27kΩ and R2 = 1kΩ (see Figure 2). RX is the unknown resistance whose value is to be measured.

The accuracy and stability of the measurement is strictly a function of R2 only. If a ±5% resistor is used for R2, the overall accuracy of the ohmmeter will be ±5%. Precision, metal-film resistors, in series with a stable multi-turn potentiometer, should be used for R2 when the greatest accuracies are required. R1 is a current limiting resistor whose value is not critical to overall ohmmeter accuracy.

The connections from RX to pins 11 ((+) INPUT HI) and 12 ((–) INPUT LO) should be as short as possible to minimize errors from voltage (IR) drops. Removal of RX will result in the display showing "1– – – ". This is the normal open-circuit indication for ohmmeters. When a short circuit is used for RX (simulating a zero Ohm resistor) most meters will display "000", however, this is highly dependent on careful wiring as previously noted.

Theory of Operation

To better understand how the circuit operates, assume that RX = 100Ω in the circuit of Figure 1. The voltage developed across R2 (also 100Ω) is equal to the voltage developed across RX since R2, RX and R1 form a series circuit. The meter's inputs are high impedance and draw negligible current. The circuit's transfer function (an equation that mathematically describes how the circuit operates) is:

$$\left(\frac{V_{IN}}{V_{REF}}\right) \times 1000 = \text{Display Reading}$$

Where: V_{IN} = Voltage drop across RX, V_{REF} is the voltage drop across R2. In this example, $V_{IN} = V_{REF}$ so the equation can also be written as:

(1) x 1000 = 100.0 (decimal point DP3 activated)

This type of circuit configuration has an upper resistance measurement limitation of 20kΩ. As the values of R1 and R2 are increased to change ranges, the amount of current available to develop a stable reference within the meter is reduced. For a 0-20kΩ range, the resistance required for R1 is 270kΩ and R2 is 10kΩ.

Summary

The meters that can be used in this application are the DMS-20PC-0, DMS-20LCD-0, DMS-30PC-0 and the DMS-30LCD-0. The "0" suffix on all these part numbers indicates that these meters have an input voltage range of ±200mV. 5V-powered meters are shown in the diagrams, but 9V-powered meters can also be used with no changes (except for the supply voltage) to the circuits or values of R1 and R2.

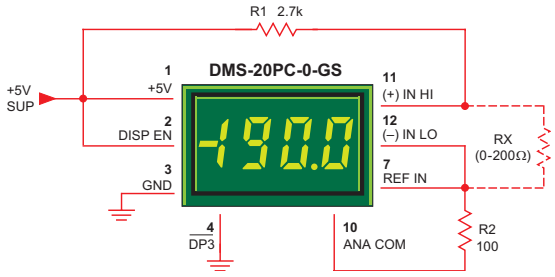

Figure 1. 0-200Ω Circuit (0.1Ω resolution)

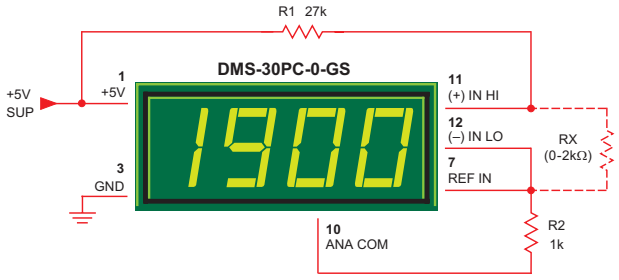

Figure 2. 0-2kΩ Circuit (1Ω resolution)