Measuring Milliohms with a Multimeter

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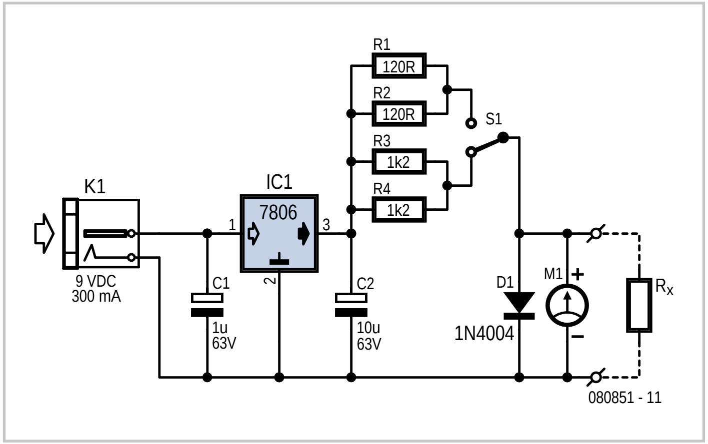
Low values of resistance can be troublesome especially when large currents flow through them. A current of, say, 10 A passing through a terminal with a contact resistance of 50 mΩ will produce a voltage difference of 0.5 V. This resulting power loss of five watts is dissipated in the termination and can give rise to a dangerously high temperature which may degrade insulation around the wires.



Measuring low values of resistance is not easy. Low cost multimeters do not include a milliohm measurement range and specialist equipment is expensive. The simple circuit described here allows milliohm measurements to be made safely on a standard multimeter. The circuit consists of little more than a 6 V voltage regulator and a mains adapter capable of supplying around 300 mA at 9 to 12 V.

The circuit supplies a fixed current output of 100 mA or 10 mA selected by switch S1. This connects either the 60 Ω or 600 Ω resistor into the constant current generator circuit. The resistor values are produced by paralleling two identical resistors; 120 Ω and 1.2 kΩ from the E12 standard resistor range. Two test leads with probes are used to deliver current to the test resistance. The resultant voltage drop is measured by the multimeter (M1). With the

test current set to100 mA a measurement of 1 mV indicates a resistance of 10 mΩ. At 10 mA (with S1 in the position shown in the diagram) a measurement of 1 mV indicates a resistance of 100 mΩ while 0.1 mV is equal to 1 mΩ. Diode D1 protects the meter from too high an input voltage.
With the voltmeter connected as shown in the diagram it measures not only the voltage drop across R_X but also that produced by the resistance of the test leads, and probes. To make a true measurement, first touch the probes close together on the same lead of the test resistance and note the reading, now place the probes across the test resistance and note the reading again. The first reading measures just the test leads and probes while the second includes the resistance R_X. Subtract the first measurement from the second to get the value of R_X.

The accuracy of the measurements are influenced by the contact resistance of switch S1, the precision of resistors R1 to R4, the 6 V supply level and of course the accuracy of the measuring voltmeter.

For optimum decoupling C1 should be fitted as close as possible to pin1 of IC1. An additional electrolytic capacitor of around 500 µF can be used at the input to the circuit if the input voltage from the AC power adapter exhibits excessive ripple.

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