AlphaLab Inc.

High Resistance Meter Model HR2 Instructions

There is always a problem with ultra high resistance measurements: only a very small amount of current is flowing through the component that is being tested. Therefore certain precautions must be taken to prevent interference from external sources. An optional grounded conductive box allows testing of small components without interference from stray static electricity (usually caused by the operator's movements). This conductive box, snaps onto the meter (at "Case Ground"). In addition, the "sensitive" terminal (the terminal which is sensitive to static electric fields) can be connected through a shielded test cable (included) to measure any assembly that can't fit in the conductive box.

To measure samples that can fit inside the conductive box, use the two short clips that connect to the Shielded Sensitive Terminal and the Non-Sensitive Terminal. To "zero" the meter correctly, short the clips together, switch the center switch up "Ohms", and turn on the meter (to any range). It should read zero and will probably never need to be rezeroed. If it does not read zero, rotate the small recessed rotary control (in the rear face) using a small screwdriver, until the display reads zero. Then it will read zero on all 9 of the ohm ranges as long as the terminals are shorted together.

To measure > 10 G ohm accurately (or conductance < 100 pS), the "Current Offset" (knob on the edge of the meter) should be set. Its correct position will depend slightly on temperature. To set it, remove the clip from the Shielded Sensitive Terminal. (This action will minimize outside interference.) Set all 3 controls to the blue "pS" position. (Left switch = center, middle switch = down, right switch = 199.99 position. If the display is fairly stable, rotate the "Current Offset" until the average reading is zero.

You will notice that the display can be unstable, especially when something is plugged into the Shielded Sensitive Terminal. This instability can be minimized by plugging in the conductive box into the Case Ground jack (left of the two terminals), then setting the entire meter into a metal pail or a "crater" made of aluminum foil, which should have a height of at least half its diameter, then connecting the meter to earth ground (clip onto the side screw of the conductive box). The metal pail should also be connected to ground. Each of these actions will reduce interference. When using the conductive box, make sure that neither terminal touches the inside of the box, which is conductive. (This type of short will not harm the meter, but an accurate reading is only possible if nothing is touching there.)

To read resistance, set the middle switch to Ohms. The left switch selects the coarse range (K, M, or G ohms). K is units of a thousand, M is millions, and G is billions. The finer range selection is set with the rotary switch, which sets maximum ranges of 19.999 or 199.99 or 1999.9 (K, M, or G ohms). Select a range (of the 9 possible ranges) for best resolution. If the display reads "1 . ", the range selected is too low; select a higher range. If the display reads zero, select a lower range. The entire readable range spans from 1 ohm to 1999.9 G ohms.

To read conductance (the inverse of resistance), set all three switches to the blue pS position. Note for example that 10 pS corresponds to 100 G ohms, 3 pS is 333.33 G ohms, 1 pS is 1000 G ohms, and 0.01 pS is 100,000 G ohms (100 T ohms), which is the highest resistance that can be distinguished from a perfect insulator using this meter. Conductance readings can be made faster than resistance readings if the sample has some capacitance. This happens because resistance readings are at constant current whereas conductance is at constant voltage (1 volt).

Two common effects may interfere with high resistance (and low conductance) readings. If the conductance is due to humidity, there is usually an electrochemical (battery) effect which contributes a small current. However, a small current can cause a large error if the sample resistance is high. To avoid this, make sure the clips are clean and that there are no chemical differences between one side and the other of the sample, where the clips are attached. Try reversing the connections on the sample to see if there is any difference. If there is, use the pS range and take the average of the forward and backward readings. (One of the readings could even be negative. This negative value will reduce the average, but the computed average should nonetheless be positive.) Another effect occurs if the sample is coated with some plastic (or other insulator). If the plastic is accidentally rubbed, it will charge. As it slowly self-discharges, a small current may be generated. This current eventually dissipates, but it can be removed immediately by dipping the sample in water and shaking dry, or by exposing it to ac AC ionizer to discharge it.

On "Ohms", a specific current is applied, which ranges in decades from 100 microamps (19.999kΩ) to 1 pA (1999.9 GΩ). The sensitive terminal is negative on Ohms (but positive on conductance settings). The Ohms voltage is always proportional to the display reading and is always 1.00 volt (+/- 1%) if the display is at 50%. For example, with a range of 199.99 MΩ, the supplied current is 10nA and if the resistance being read is 100 MΩ, the display will read 100.00 and the applied voltage will be 1.00 volt. If 150 MΩ is being read, the voltage will be 1.50 volts.

The conductance settings are easier to use if there is a current source in the sample. The applied voltage is always just below 1V (typically .95V). Use the blue "pS" settings for the right-side switch and knob. If the left-side switch is set to GΩ, (pS), it will be in pS. If set to MΩ, you will be reading in nS. If on kΩ, you will be reading μS. To measure the applied voltage on your meter, use a voltmeter across the two test contacts and set the left-side switch to kΩ and the other switch to pS.

In order to subtract out any unwanted current source in the sample, take the average of the conductance with the test contacts connected, vs. the contacts connected in the opposite polarity. (One of those two numbers may be negative.) For example, if the switches are on MΩ, pS and 199.99 (pS), you may get 100.00 nS with one polarity, and -20.00 nS in the opposite polarity. The actual conductance is 40 nS (-20 + 100 divided by 2).

Specifications:

The HR2 Meter measures resistance in 9 ranges from 19.999 K ohms to 1999.9 G ohms). Accuracy is +/-2% of the reading +/- 1 count. The 9 measurement currents are 100 micro amps down to 1 pico amp in factors of 10. The voltage applied is proportional to the displayed number; for each resistance range, the maximum displayable number (19.999, 199.99, or 1999.9) corresponds to 1.9999 volts across the sample. Therefore half scale corresponds to about 1 volt.

Measures conductance in three ranges: 199.99 pico siemens, 199.99 nano siemens and 199.99 micro siemens. Accuracy is +/- 2% of reading +/- 1 count. During conductance measurements, 1 volt is applied across the component.

Battery is a standard rectangular 9 Volt type, with "LOW BATTERY" appearing on the display when approximately one hour of battery life remains. Battery life is about 50 hours using an alkaline, and 25 hours using a regular battery. A battery is included.

The warranty period for this meter is one year from the date of delivery.

Manufactured in the USA by AlphaLab, Inc. 3005 South 300 West Salt Lake City, Utah 84115 USA www.trifield.com - mail@trifield.com - (801)487-9492