

# MILLI-OHMETER



- 1 milliohm to 200 ohms
- 0.1% accuracy
- Safe test current - 5mA max

# Description

This battery operated digital resistance meter is designed to measure accurately low resistance from 0.001 ohm to 200 ohms, using four-terminal measurement network which eliminates errors caused by test lead resistance.

The instrument is small and light weight and is used easily in one hand with only an ON button to operate. It has auto-ranging, auto-decimal point and auto-powerdown after three minutes. It has

long battery life and is powered by a single PP3 or MN 1604 battery

### Some typical applications

Relay . switch and connector contacts . PC-plated through holes .  
 PC track resistance . Transformer and motor windings . Ring circuit testing . Earth conductor continuity . Wire-wrapped and solder joints .  
 . RFI sheilding and coil resistance.

## Specification

Ranges (selected automatically)	...	...	...	...	...	...	1.999, 19.99, 199.9 Ohms
Increment	...	...	...	...	...	...	0.001, 0.01, 0.1 Ohms
Accuracy	...	...	...	...	...	...	±0.1% of range
Zero offset	...	...	...	...	...	...	±0.001 Ohms
Test current	...	...	...	...	...	...	5mA Max
Test power	...	...	...	...	...	...	5mW Max
Temp. drift	...	...	...	...	...	...	0.1%°C of lowest range
Operating range	...	...	...	...	...	...	5 to 35°C
Display	...	...	...	...	...	...	3½ digit L.C.D.
Weight	...	...	...	...	...	...	480 gms.
<b>Dimensions</b>							
Approximate weight (instrument only)	...	...	...	...	...	...	170 gms.
(instrument incase with batteries leads M21019A)	...	...	...	...	...	...	510 gms.
Approximate dimensions: Instrument	...	...	...	...	...	...	H: 15cm, w: 8.0cm, D: 3.8cm
Case	...	...	...	...	...	...	H: 15.5cm, w: 14.5cm, D: 4.5cm
Battery	...	...	...	...	...	...	9v (PP3 MN 1604 or equiv.) 1EC6F22

## Packing list

### SET COMPRISING:

- ONE Milli-ohmmeter M210.....M210
- ONE Set standard spring clip connectors and leads.....M210/9A
- ONE Instructions leaflet
- ONE Ever-ready case

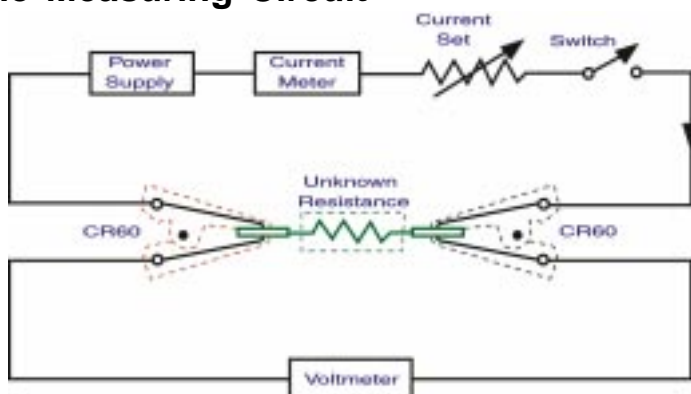
### OPTIONAL EXTRAS:

- SET Probe and contact connectors.....M210/9B



Milli-ohmmeter being used to test a reed relay.  
 Note the ease of connection.

## The Measuring Circuit



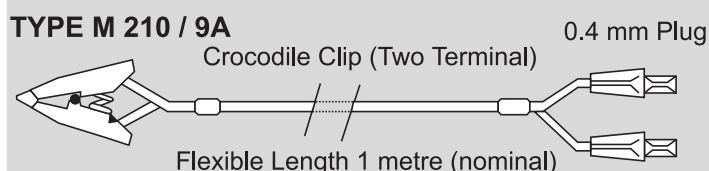
In the four-terminal "Kelvin" configuration four wires are used to connect the circuit under test to the instruments.

One pair of wires carries current generated by the instrument, the other pair connect to the voltage-measuring circuit.

The current circuit is low impedance, the voltage circuit high impedance. When connected a current flows through the component or circuit under test and the voltage drop across the test points is measured.

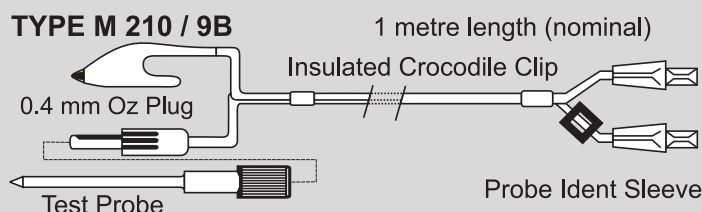
## Instructions for use

### Using standard clip leads M210/9A (Supplied as Standard)



1. Plug either black plug into either black socket in the top of the instrument and red plugs into red sockets.
2. Clip leads to circuit or component to be tested. Ensure that both faces of clip make good electrical contact.
3. Press the ON button to read resistance.

### Using probe and contact connectors clip leads M210/9B (Optional Extras)



1. Insert plugs into their respective sockets as illustrated. The outer plugs form the current circuit via the clips. The inner plugs (with yellow bands) connect the probes in the voltage measuring circuit.
2. Clip leads to circuit under tester.
3. Press ON button to read resistance when probes are in contact with the circuit.

## Interpreting the display

1. The Milli-ohmmeter will read directly in ohms or milli-ohms.
2. Fluctuating readings displayed. Check that the clips are making good contact with the circuit under test, then look for the cause of intermittency, e.g. dry solder joint, oxidised or corroded terminals; slight mechanical movement of the component(s) in the circuit under test should quickly reveal the source of the problem.
3. Flashing "1" indicates that resistance in circuit exceeds

200 ohms.

4. "LO-BAT" displayed indicates low battery.

## Battery Replacement

Slide down the cover at the rear, bottom of the instrument. Fit new battery 9 volt pp3 (MN1604 or equivalent). Replace cover.

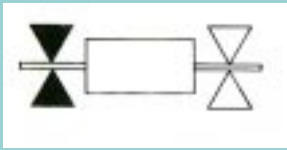
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The ratio between the current and the voltage drop is calculated by the instrument using Ohm's law ( $R=E/I$ ) to display the result in ohms.

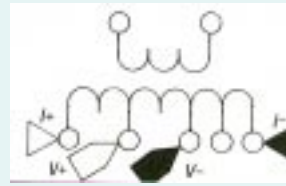
Four clips would normally be required for connection but this could be tedious so a form of clip is used with the Milli-ohmmeter. The jaws are moulded in robust plastic and inset into each jaw face is a copper / silver inlay contact; these are insulated from each other by the plastic mouldings. One contact face on each clip is connected to the current-generating circuit, the other face is connected to the voltage-measuring circuit. In this way four wires are connected instantly by two clips. The resistance of the connecting wires plays no part in the measuring so no "backing-off" is required as would be the case if a multi-meter were to be used for the same measurement.

# Test procedures

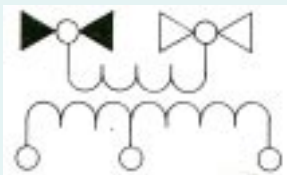
Using standard lead set for dhecking



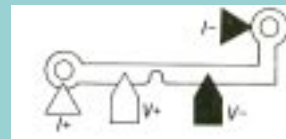
1. Checking continuity value and mechanical stability of resistive components. Also used to measure resistance/temperature coefficient.  $R_2 - R_1 \times 100 R_1$  (t2 - t1)



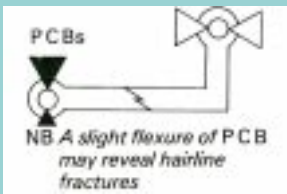
7. Multi-tapped transformers are quickly checked and the tapping points identified on an unknown transformer or coil assembly.



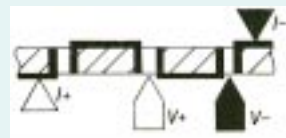
2. Testing the resistance of windings to determine continuity, good electrical connection to tails, and to ascertain resistive imbalance in centre-tapped transformers.



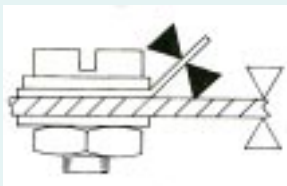
8. Etching defects show up as an unexpected variation in track resistance.



3. Checking the electromechanical stability of printed circuits and mounted components. Dry solder joints can be located by connecting one clip to the track, the other clip to the component tail or tag.



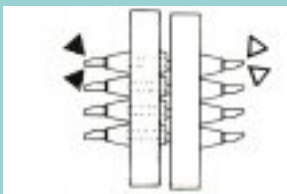
9. Through hole plated tracks on a PCB are checked for continuity and unexpectedly high resistance.



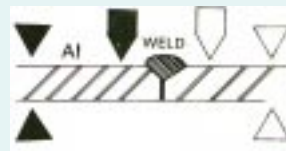
4. Ensuring that earth points make good electrical contact to earthing strip or chassis. Looking for defects due to rust, corrosion or defective plating and anodic films.



10. Clipping the leads to the probes makes for an easy-to-use continuity tester which is accurate.



5. Plugs and sockets of all types rely on friction contact between mating surfaces. Looking for defects due to oxydisation, grease or dirt.



11. Welded joints which are imperfect have a high resistance. Aluminium welds over 0.7 ohms are rejected. Small variations in resistance may indicate inclusions or voids in the weld.



6. Testing ring mains circuits to meet Appx. 15 1 EE wiring regulations. The resistance in the ring, including the resistance of the protective conductor are checked before and after connection.

