BROMAN MODEL 210

CONTACT RESISTANCE TEST SET

SERIES 5

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CONTACT RESISTANCE TEST SET

SERIES 5

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WARRANTY

Miller Instruments Ltd. warrants each Broman Contact Resistance Test Set it manufactures to be free of defects in material and workmanship under normal use and service for a period of 10 years from the date of purchase. It does not apply if the Broman Contact Resistance Test Set has been misused, altered, or damaged by accidental or abnormal conditions of operation. For warranty service send the Broman Contact Resistance Test Set with a description of the problem to Miller Instruments Ltd. At its sole discretion Miller Instruments Ltd. will repair, replace, or refund the purchase price of the Broman Contact Resistance Test Set if it is found to be defective in material or workmanship. However if it is found that the failure was caused by misuse, alteration, or an abnormal condition of operation you will be billed for the repair. Miller Instruments Ltd. assumes no liability, expressed or implied beyond the obligation to repair, replace, or refund the purchase price of the defective Broman Contact Resistance Test Set.

1.0 DESCRIPTION

1.1 The Broman Model 210 Contact Resistance Test Set is designed to measure the resistance of high-current-carrying devices such as circuit breaker contacts and bus bar interconnections.

1.2 The Model 210 operates on the principle of Ohm's Law. The supply current is accurately measured electronically and the potential drop of this current across the device under test is measured electronically. The results of these measurements are used to electronically calculate the resistance by dividing the potential drop by the current. The result of this calculation is displayed on the microhm meter. The advantage of this measurement system over others is that the resistance measurement is not changed with small differences in the supply current that usually occur during adjustment of the current to 100 amperes.

Separate leads and clips are used for current and potential measurements, making the measurement free of errors resulting from contact resistance.

1.3 Please refer to the data sheet at the back of these instructions for a detailed description and specification.

2.0 OPERATING PROCEDURE

2.1 Before switching the instrument on, ensure that the CURRENT SET control is set at zero.

2.2 Switch the instrument on by depressing the push-button switch designated ON/OFF.

2.3 Set the pointer of the MICROHM meter to zero using the following procedure:

a) Clip the outboard ends of the current leads together.
b) Clip the outboard ends of the potential leads to negative current clip.
c) Adjust the ZERO SET control to obtain zero deflection on the microhmeter.

2.4 Connect the current and potential leads to the test subject, observing polarity-red to red; black to black (see Fig. 1).

2.5 Set the MICROHM RANGE switch to the appropriate range. If the approximate resistance of the test subject is not known, set the MICROHM RANGE switch to 5000.

2.6 Advance the CURRENT SET control until the DC AMPERE meter indicates precisely 100 amps.

2.7 Read the resistance of the test subject on the MICROHM meter.

4 - TERMINAL CONNECTION METHOD

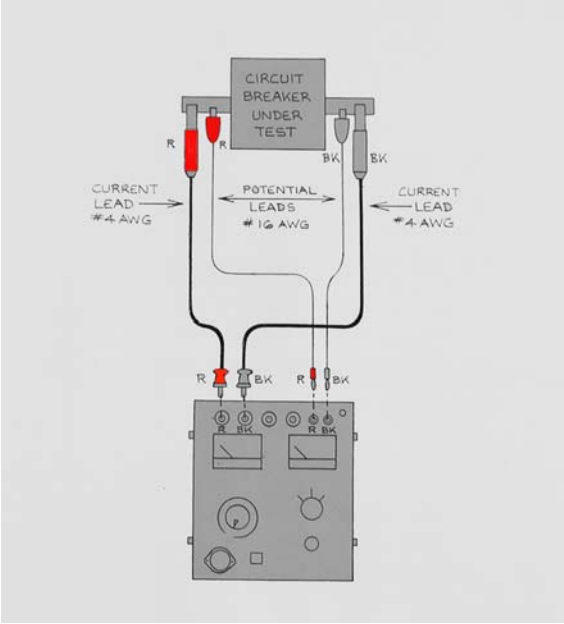

figure 1

Note that when the MICROHM RANGE switch is set at 5000, the meter scale should be interpreted as indicating 0-5000 microhms; similarly, when the range switch is set at 50, the meter scale should be interpreted

as indicating 0-50 microhms and, when the range switch is set at 1000, the meter scale should be interpreted as indicating 1000 microhms.

If the MICROHM meter deflection is less than 20 percent of full scale, advance the MICROHM RANGE switch to the next more sensitive position. Recheck the zero indication by momentarily reducing the test current to zero; adjust the ZERO SET control if necessary.

CAUTION: The model 210 is designed for intermittent operation. Do not apply the 100-amp test current for longer than 2 minutes. Actually, it should be possible to complete a measurement within 10 to 15 seconds (see Para 4.1).

2.8 Reduce the test current to zero as soon as the microhm reading is secured.

2.9 Disconnect leads from the test subject.

2.10 Switch the instrument off by depressing the ON/OFF push-button switch.

3.0 CALIBRATION CHECK

3.1 Take the following steps to prepare the instrument for a calibration check:

Set the CURRENT CONTROL to the zero position.
Attach the current and potential test leads to the instrument.
Clip the outboard ends of the current leads together.
Clip the outboard ends of the potential leads to the CAL CHECK terminals.

3.2 Push the instrument power switch to the “on” position.

3.3 Set the range selection switch to the 500 μΩ position and zero the microhm meter using the ZERO SET control. Advance the CURRENT SET control and observe the microhm meter. The meter pointer will immediately try to indicate the resistance under test (*see note 1*). In this case the resistance of the internal reference shunt. As the current is increased beyond the 20 ampere level the microhm meter should settle to the 500 μΩ position.

The ranges may be checked and compared to the table below (*see note 2*). The uncertainty of a calibration check (± 10 μΩ for example) can be reduced by monitoring the calibration check terminals with a good quality multimeter. The improved calibration check is carried out by simultaneously monitoring the multimeter reading and the microhmeter reading while the current meter is set to exactly 100 amperes. For example, while the current meter is reading exactly 100 amperes the microhmeter reading may be 49.0 ± 0.2 μΩ and the digital multimeter may read 49.45 ± 0.04 mV DC. Ideally the two readings will be identical. In our example it can be said that the microhmeter reading is within 0.5 μΩ which is 1% of the 49.0 μΩ reading and therefor within specification (i.e. 2% of reading).

Note 1: As the CURRENT SET control is increased the microhm meter pointer immediately moves to
indicate the resistance of the device under test. Thus, when the resistance of the device under test is independent of current there will be very little change in the microhmeter for current levels beyond 20 amperes. This is a different behavior than earlier versions of the Broman 210.

Note2: The resistance of the internal reference shunt is 500 μΩ and therefore cannot be displayed on the 100 μΩ or the 50 μΩranges. The instrument compensates for this when the 100 μΩ and 50 μΩ ranges are selected. During the calibration check one-tenth the actual value of the reference shunt being measured is displayed when the 100 μΩ and 50 μΩ ranges are selected.

BROMAN 210 CALIBRATION CHECK

RANGE SELECTION	REQUIRED READING
5000 μΩ	(500 ± 32) μΩ
1000 μΩ	(500 ± 12) μΩ
500 μΩ	(500 ± 10) μΩ
100 μΩ	(50 ± 1.3) μΩ
50 μΩ	(50 ± 1.0) μΩ

4.0 IMPORTANT OPERATING AND HANDLING INSTRUCTIONS

4.1 As mentioned in Para 2.7, the Model 210 is designed for intermittent operation. Observe the 20% duty cycle limitation. Perform measurements as quickly as possible. If it is necessary to deliver the 100 amp test current for the maximum period of 2 minutes, then allow 10 minutes to cool off. A thermal switch, mounted on the rectifier heat sink, is provided as a safety device. Should the unit be inadvertently left on while delivering 100 amps, this switch will open and remove power from the primary of the main transformer. The switch will automatically reset when the heat sink cools down (approximately 5 minutes).

4.2 Guard against rough handling. The instrument is equipped with resiliently mounted aluminum skids designed to absorb the shock and vibration of normal handling. It can be transported to and from the work site without special precautions except for one important reservation:

heavy objects should not be stacked on top of the instrument - this practice will defeat the shock mounting system. The instrument should be free to “float”.

4.3 If the instrument is to be shipped frequently by public carrier, it is advisable to protect it with a padded transit case.

4.4 Use the instrument only when plugged into a properly grounded supply. The line monitor indicator, situated close to the input receptacle on the front panel, will flash if the supply is not grounded and/or if the line and neutral connections are reversed. Should this situation occur, correct before proceeding.

4.5 Do not store line cord, leads, etc. under the cover - this may damage the meters.

4.6 When not in use, the instrument should be stored in a warm, dry place to prevent condensation.

5.0 MAINTENANCE

5.1 Remove case occasionally and check for loose bolts or connections. The case is easily removed:

Place the unit on the floor. Remove the six 10-32 pan head screws that secure the handles. Grasp the top edge of the case and pull upward.

5.2 Inspect test leads occasionally. Tighten connections, or rework if necessary (see also Para 5.5)

5.3 Check the integrity of the line cord occasionally. Ensure that the ground connection is sound.

5.4 Check the calibration from time to time, as described in Section 3.0. If the check of Para 3.7 reveals a significant error, accuracy may be restored by adjusting the trimpot on the amplifier printed circuit board - easily accessible with the case removed. This adjustment should be required only rarely.

5.5 If the instrument is suspected of being faulty, check it out by performing the basic calibration check of Para 3.7. If operation still appears to be faulty, check the condition of the test leads (experience has indicated that many apparent faults actually are caused by defective test leads - the shielded potential leads are particularly vulnerable). With the current leads shorted together as in Para 3.7, it should be possible to get a full-scale deflection of the ammeter (100 amps) with a CURRENT SET dial (the actual setting will depend on the length of the current leads). If the potential leads are suspect, replace them (for the purpose of this test) with a pair of short leads between the POTENTIAL jacks and CAL CHECK binding posts.

5.6 If, after performing the checks of Para 5.5, the instrument definitely appears to be faulty, contact MILLER INSTRUMENTS LTD, or its agent, for further instructions. When reporting a fault, or when ordering spare parts, please state the serial number of your unit.

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