OHMMETER NO. 15B

1 GENERAL This instruction describes the operating procedure to be carried out when testing and fault locating with the Ohmmeter No. 15B.

The ranges of the instrument are:-

Insulation 0.01-20 and 20-1000 Mohms

Resistance 0.01-999.9 kohms

Murray and Varley tests may also be carried out.

2 METER ADJUSTMENT Place the ohmmeter on a level surface, and check that the meters read BAL and INF respectively. Correct by adjusting the screw on the outside of each meter cover.

3 CHECK BATTERY AND CALIBRATION Set to CAL position, then switch on. Check that the BRIDGE BAL meter reads BATT NORM and that the INS RES meter will adjust to 1 megohm knob. If not then change the battery.

4 INSULATION RESISTANCE TESTS

4.1 Wire-to-Wire Insulation Test Connect the two wires to the line terminals L1 and L2. Set to INS RES -20 megohm position, switch ON, and push the INS RES key to the TEST L1 position. If the reading is more than 20 megohms, set to INS RES -1000 megohm position. After one minute read the insulation resistance. Restore the INS RES key to the DISCHARGE position after each test and before the wires are touched.

4.2 Wire-to-Earth Insulation Test Connect the two wires to the line terminals L1 and L2, and an earth wire to the earth terminal E. Test as in 4.1.

With the INS RES switch in the TEST L1 position, terminal L2 is earthed. With the INS RES switch in the TEST L2 position, terminal L1 is earthed.

Restore the switch to the DISCHARGE position before disconnecting the wires.

Ensure that the test leads have a high insulation resistance value.

5 CONDUCTOR RESISTANCE TESTS Connect the two looped wires to the line terminals L1 and L2. Set to WHEATSTONE, and BRIDGE RATIO x 1. Switch ON, and adjust the rheostat (RHEO) until the pointer of the BRIDGE BAL meter is near the centre BAL mark. Move the ON/OFF key to the INCR BRIDGE SENSITIVITY position and readjust the RHEO until the pointer is on the centre BAL mark. The RHEO setting is equal to the conductor loop resistance to the nearest ohm. Change the BRIDGE RATIO values, if necessary, to give a setting on all four dials of the RHEO.

When long test leads are used, subtract their loop resistance from the total value to give the actual loop resistance of the pair.

6 EARTH FAULTS To locate an earth fault on a single wire, loop the faulty wire to a good wire at the far end, preferably in the same cable. Ensure that the insulation resistance of the good wire is at least ten times greater than that of the faulty wire.

Connect the good wire to terminal L1, the faulty wire to L2 and an earth to terminal E. Set to WHEATSTONE and measure the conductor loop-resistance (LOOP) as given in par 5.

To measure the resistance to the fault (x), set to the VARLEY or MURRAY position depending on the loop resistance, as given below.

Set BRIDGE RATIO as below and switch ON. Adjust the RHEO for balance. Move the ON/OFF switch to the INCR BRIDGE SENSITIVITY position and repeat the balance adjustment.

When the loop resistance value is:-

6.1 Greater than 1000 ohms, switch to VARLEY and BRIDGE RATIO x 1. At balance:-

$$\text{resistance to fault (X)} = \frac{\text{LOOP-RHEO}}{2} \text{ ohms}$$

6.2 Less than 1000 ohms, switch to VARLEY and BRIDGE RATIO ÷ 10. At balance:-

$$\text{resistance to fault (X)} = \frac{(10 \times \text{LOOP}) - \text{RHEO}}{11} \text{ ohms}$$

6.3 Less than 100 ohms, switch to VARLEY and BRIDGE RATIO ÷ 100. At balance:-

$$\text{resistance to fault (X)} = \frac{(100 \times \text{LOOP}) - \text{RHEO}}{101} \text{ ohms}$$

6.4 Less than 10 ohms, switch to MURRAY. For this test ignore the BRIDGE RATIO switch. At balance:-

$$\text{resistance to fault (X)} = \frac{\text{LOOP} \times \text{RHEO}}{1000 + \text{RHEO}} \text{ ohms}$$

7 CONTACT FAULTS Loop one faulty wire to a good wire at the far end. Connect as described in par 6 for an earth fault, but with the other faulty wire connected to terminal E. Repeat the test as for earth faults.

8 DISTANCE TO EARTH OR CONTACT FAULTS Provided that the conductor gauge is the same throughout the length of the good and faulty wires, the distance to the fault is as follows:-

$$\text{Distance to Fault} = \frac{\text{LOOP RES FAULTY PR}}{\text{LOOP RES GOOD PR}} \times \frac{\text{LENGTH OF GOOD WIRE}}{\text{LENGTH TO FAULT OF BAD WIRE}}$$

If the conductor gauge varies throughout the length of the wire, then the distance to the fault can be estimated using the information contained in the line plant records and the distance/resistance equivalents for different wire gauges given in Table 1.

TABLE 1

Dia mm	ohms/Km	ohms/100 m	m/ohm
0.32	215	21.5	4.7
0.4	135	13.5	7.4
0.5	85	8.5	11.8
0.63	55	5.5	18.2
0.90	27	2.7	37.0
Single Wire Resistance			

9 DISCONNEXION FAULTS To locate a disconnexion fault on a pair, or on one wire of a pair, connect the wires to the ohmmeter terminals using one of the following methods. Switch to MURRAY, but do not switch ON.

9.1 If a good spare pair exists which can be looped to the faulty pair at the far-end, loop the wires A-A and B-B. At the near end, connect the faulty A-wire to terminal L1, and the good A-wire to terminal L2. Connect a telephone or receiver across L1 and L2. Bunch the two B-wires together and connect them to one terminal of the oscillator (Oscillator No. 59B or 87B as used in the portable apparatus for cable track or pair location). Connect the other terminal of the oscillator to terminal E of the ohmmeter. Switch on the oscillator and adjust its output to give a continuous tone, then adjust the RHEO until the oscillator tone is a minimum. At minimum tone:-

$$\text{Distance to fault (D)} = \frac{\text{RHEO}}{1000 + \text{RHEO}} \times (\text{length of the good wire} + \text{length of the bad wire})$$

9.2 If a good spare pair exists in the cable which cannot be looped to the faulty pair at the far end, connect and test as for test 9.1 but with the far end on open-circuit. This test will not be so accurate as test 9.1 but at minimum tone:-

$$\text{Distance to fault (D)} = \frac{\text{RHEO}}{1000} \times \text{length of the good pair}$$

9.3 If no spare pairs exist, single wire disconnexions only can be found looping the faulty wire to a good wire at the far-end. At the near-end, connect the faulty wire to terminal L1, and the good wire to terminal L2. Connect a telephone or receiver across L1 or L2. Connect one terminal of the oscillator to an earth and the other terminal to terminal E of the ohmmeter. Adjust for minimum tone and use the same formula as given in par 9.1 above.

This method is not so accurate as the other tests, so repeat the test at the far end and determine the mid-point between the two measurements.

10 MAINTENANCE To replace the battery (Battery, Dry, No. 29) give the locking screws on the battery compartment a quarter of a turn each and remove the cover-plate. Lift the battery out and transfer the terminal-plate to a new battery.

Take care to conserve the battery when testing and switch ON for as short a time as possible, just sufficient to take a reliable measurement. Remove the battery before storing the ohmmeter for any period which may be longer than a week.

11 FAULTY INSTRUMENTS Maintenance exchange procedure should be used when an instrument is beyond local repair.

Sv5.2.2
(From Engineering Notes 3230) E N D