

TESTER SA 9083—FAULTSMEN'S TEST SET

Description and Use

1. **General.**—The "Tester SA 9083" (see Fig. 1) is a portable tester and is primarily intended for use by faultsmen for maintenance testing of subscribers' installations connected to exchanges where faultsmen do not have testing access to a test desk, or where the testing equipment at the local exchange is not staffed during normal working hours. This Instruction describes the facilities afforded by the instrument and how it is used for making the various tests.

2. **Description.**—The tester, which affords facilities similar to those obtainable at a test desk, consists essentially of a first-grade moving-coil meter—"Meter, Multi-range, No. 9"—which is a rectangular flush-mounting meter with a sensitivity of 1 mA. FSD (full-scale deflexion); its resistance is 100 ohms. The scales are arranged to indicate volts, milliamperes and ohms. The ranges of the two patterns of the instrument are as follows:—

0-250V. A.C.	} Mark 1	} Mark 2
0-5 megohms		
0-50,000 ohms		
0-5V. D.C.		
0-50V. D.C.		
0-250V. D.C.		
0-50 mA.		
0-500 mA.		

Facilities are available on both Mark 1 and 2 instruments for testing batteries on the 0-5V. and 0-50V. ranges. The tester is self-contained in an aluminium-alloy case (approx. 8 in. x 5½ in. x 4½ in.) and includes a 67.5-V. battery ("Battery, Dry, No. 18") and a 1.5-V. battery ("Cell, Leclanche, D.S. No. 7A" or "Battery, Dry, No. 20"), see par. 17; these batteries are used for insulation-resistance tests

and for loop-resistance tests, respectively. Connections to the line are made by means of terminals 'A' and 'B' and terminal 'E' is used for earth connections.

3. **Range selection** is effected by rotating a rotary-type switch, which selects the test to be applied. On the Mark 2 instrument, the switch has ten positions and on the Mark 1 instrument there are seven positions; the switches are wired for tests as follows:—

Position	1—0-250V. A.C.
"	2—Testing for earth B (and earth on A), see par. 6
"	3—Testing for battery B (and batt. on A), see par. 7
"	4—Measurement of insulation resistance, and ballistic test, of subscribers' lines
"	5—Measurement of loop resistance of subscribers' lines
"	6—Measurement of 0-5V. D.C., and testing two primary cells in series, see par. 10
"	7—Measurement of 0-50V. D.C., and testing of ten primary cells in series, see par. 11
"	8—Measurement of 0-250V. D.C. (on Mk. 2 only)
"	9—Measurement of 0-50 mA. D.C. (on Mk. 2 only)
"	10—Measurement of 0-500 mA. D.C. (on Mk. 2 only)

The ranges to be used for individual tests, and data for these tests, are shown in Table 1.

TABLE 1

Scale	Range	Value per division	Resistance (ohms)
A.C. volts	0-250 volts	5 volts	250,000
D.C. volts	0-5 volts	0.1 volt	5,000
	0-50 volts	1 volt	50,000
	0-250 volts	5 volts	250,000
D.C. mA.	0-50 mA.	1 mA.	2
	0-500 mA.	10 mA.	0.2
Ohms (loop test)	x1	—	Mid-scale reading 500
	x100	— 50,000
Test battery B (or A)†	0-50 volts	1 volt	50,000
Test earth B (or A)†	As for ohms	—	—
	x100		

† By operation of line-reversing toggle switch.

4. Method of Use.—At subscribers' premises, the tester should be used at the point where the internal and external wires are joined. When making resistance measurements, the external line should, preferably, be disconnected to avoid damage to the instrument (see par. 21). At those exchanges provided with a test case or a portable tester without a permanently-connected voltmeter, the "Tester SA

9083" may be used instead of a "Detector No. 2 or No. 4". If the ohms ranges of the tester are to be used, however, the exchange battery must be disconnected from the test-case voltmeter terminals. The facilities for testing provided on each position of the selecting switch, and the circuit condition obtaining during each test, are described in the paragraphs which follow.

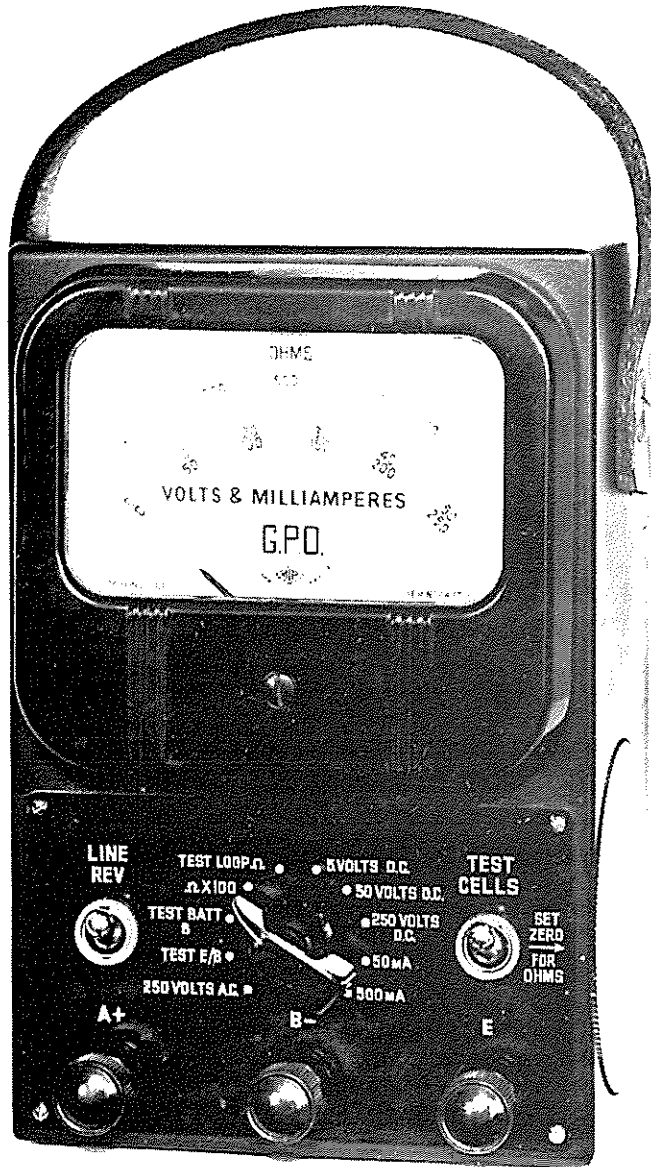


FIG. 1

5. Switch in Posn. 1 (0-250V. A.C.).—This range is intended primarily to check that there is no A.C. on the line which is being tested. In this position of the switch, the A and B terminals are extended to one side of a bridge rectifier, via a 225K resistor and a 1 μ F. capacitor, the instrument being connected across the other two terminals of the rectifier as shown in Fig. 2. The capacitor prevents the flow of D.C. when making A.C. measurements.

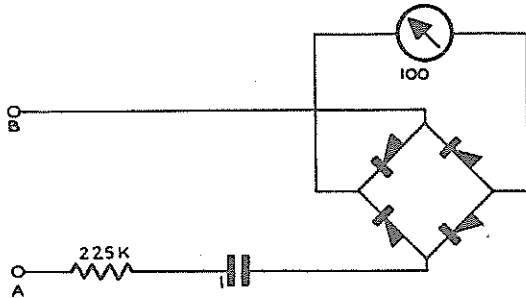


FIG. 2

6. Switch in Posn. 2 (Test for earth B, and earth A).—The earth terminal of the tester should be connected to earth. In this position of the switch, a resistance—variable between 200 and 500 ohms—is connected in parallel with the meter and the meter is connected between the B and E terminals, via the 67.5-V. battery and a 50,000-ohm resistor. The resistance value is adjusted so that, when a short-circuit exists between the B line and earth, a full-scale deflexion will be given. Adjustment of the variable resistor enables correct readings to be obtained with varying voltages down to 60 volts. The circuit condition for this test is shown in Fig. 3 and, with these connexions, it is also possible to measure insulation resistance to earth on the B line. Operation of the line-reversing toggle switch connects the instrument to the A line for a similar test. If the 'zero ohms' adjustment is correct, the combined resistance of the earth and line can be read directly on the meter scale; see also par. 9.

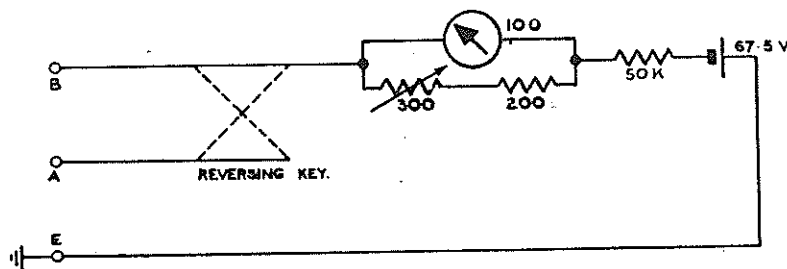


FIG. 3

7. Switch in Posn. 3 (Test for battery B, and battery A).—In this position of the switch, a 50,000-ohm resistor is connected in series with the meter between terminals B and E and the meter then acts as a voltmeter with a full-scale deflexion of 50 volts D.C. The circuit for this test is shown in Fig. 4. Operation of the line-reversing toggle switch enables tests for battery on the A line to be made.

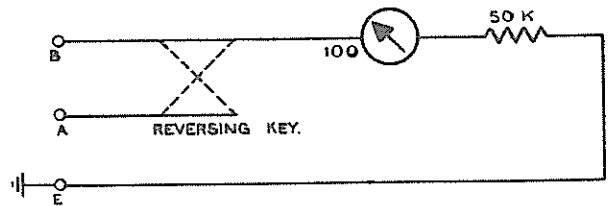


FIG. 4

8. Switch in Posn. 4 (Measurement of insulation-resistance—ohms \times 100).—The meter scale is calibrated from 0 to 50,000 ohms; the reading with the switch in this position is multiplied by 100 to obtain the actual value of the resistance measured. The accuracy of the meter is least at the extremes of the scale but can be relied upon for all normal measurements between 5,000 and 500,000 ohms; for resistances below 5,000 ohms, the lower scale should be used. [Before making a resistance measurement, it is first necessary to check the 'zero ohms' reading. This is done by short-circuiting the terminals B and A on the tester and then turning the milled disk (on the side of the tester, see Fig. 12) until a full-scale deflexion is obtained. This adjustment should not be confused with the screw adjustment which is used to set the meter pointer in the 'zero' position at the left-hand end of the scale]. The insulation-resistance between the A and B lines may then be obtained by connecting the A and B terminals of the tester to the apparatus, or line, to be tested.

The earth terminal of the tester is left disconnected during this test. The circuit conditions are similar to those for position 3 (see par. 7), except that the test circuit is applied between terminals A and B, as shown in Fig. 5. It is also possible to make the normal hallistic test of a subscriber's line. The presence of any capacitance across the line may be checked by repeated operations of the line-reversing toggle switch when the A and B terminals are connected to the subscriber's line. The operation of the switch charges and discharges the capacitor and causes the pointer to be momentarily deflected to a point near the centre of the scale.

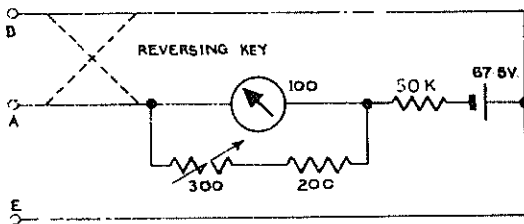


FIG. 5

9. Switch in Posn. 5 (Measurement of resistance of a subscriber's line).—Measurements on this range are accurate only between 1/10th and ten times the mid-scale value, i.e. from 50 to 50,000 ohms. The 'zero ohms' adjustment is made, as described in par. 8, after short-circuiting the A and B terminals. It is advisable to check this adjustment before making a measurement, because separate batteries are used for the two ranges and there may, therefore, be a slight difference in the 'zero-ohms' reading when changing over from one range to the other. As shown in Fig. 6, the meter—with its adjustable shunt—is joined in series with 925-ohm resistor and a 1.5-V. battery. An additional 1,000-ohm resistor—connected in parallel—reduces the resistance of the instrument to 500 ohms and so reduces the sensitivity that, when an external 500-ohm resistance is joined between terminals A and B, half-scale deflexion is given.

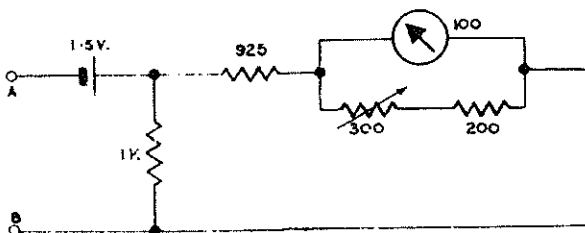


FIG. 6

10. Switch in Posn. 6 (5V. D.C., and testing of primary cells).—With the switch in this position, the instrument is suitable for use as a D.C. voltmeter with a range of 0-5 volts. Operation of the non-locking toggle switch connects a 4-ohm resistor across terminals A and B and enables the V1 and V2 tests of two primary cells to be made (SEE E12 C5001)

The circuit for this test is shown in Fig. 7 from which it will be seen that the meter is joined in series with a 4,900-ohm resistor and acts as a voltmeter with a full-scale deflexion of 5 volts. When the toggle switch is operated, a 4-ohm resistor is connected in parallel to enable the V2 and V3 tests to be taken on primary cells, see E12 C5001

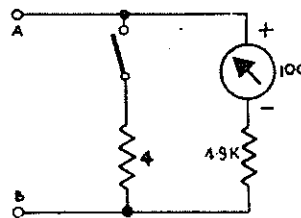


FIG. 7

11. Switch in Posn. 7 (50V. D.C., and testing of primary cells).—This range permits D.C. voltage measurements from 0 to 50 volts. A 49,900-ohm resistor is introduced into the circuit and the meter then gives a full-scale deflexion with 50 volts. Operation of the toggle switch connects a 20-ohm resistor across terminals A and B, to enable testing of ten primary cells in series; the connexions are shown in Fig. 8. A "Resistance Unit No. 2" is available and when this is connected in series with a Mark I instrument, the range of the scale is then extended from 0-50V. to 0-250V. (NOTE :-The cell testing resistors are 2 ohms and 40 ohms, respectively, in a Mark I instrument).

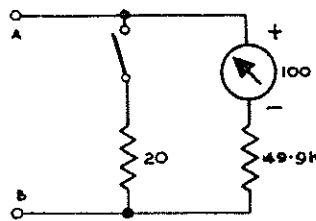


FIG. 8

12. **Mark II tester.**—The additional ranges provided on this instrument are described in pars. 13 to 15.

13. **Switch in Posn. 8 (0-250V. D.C.).**—The meter is connected in series with a 249,900-ohm resistor and then gives a full-scale deflexion with 250 volts. The circuit is shown in Fig. 9.

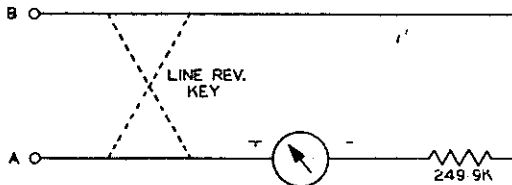


FIG. 9

14. **Switch in Posn. 9 (0-50 mA. D.C.).**—The meter movement is shunted by a resistor of 2.04 ohms. Since this is 1/49th of the resistance of the meter, 49 mA. will pass through the shunt and 1 mA. through the movement, giving a full-scale deflexion of 50 mA. The circuit for this test is shown in Fig. 10.

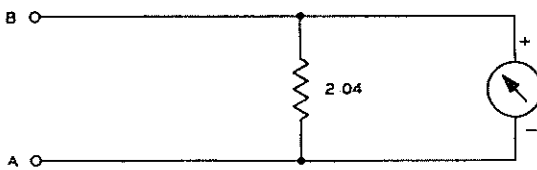


FIG. 10

15. **Switch in Posn. 10 (0-500 mA. D.C.).**—The connexions for this test are shown in Fig. 11. The shunt resistance is 0.2 ohms: this is approximately 1/10th of that used for the 0-50 mA. range and increases the maximum reading by ten times to 500 mA.

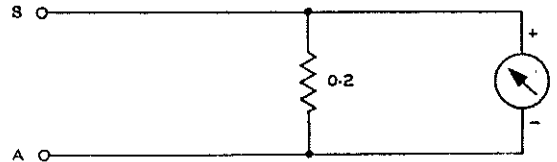


FIG. 11

16. **Reversing switch.**—The tester connexions are such that the B line is normally connected and operation of the switch is, therefore, necessary to apply similar tests to the A line. This switch is also used when making the ballistic test of a subscriber's line, as described in par. 8.

17. **Batteries.**—The back of the tester case is constructed in two halves: the lower half, which is behind the instrument controls, is sealed and *must not be opened by a faultsman*. The upper half, behind the instrument, encloses the batteries and access is gained by removing the two screws at the top of the case nearest the handle fixture (see Fig. 12). A battery should be changed when the voltage is insufficient to give a full-scale deflexion on the 'zero ohm' adjustment.

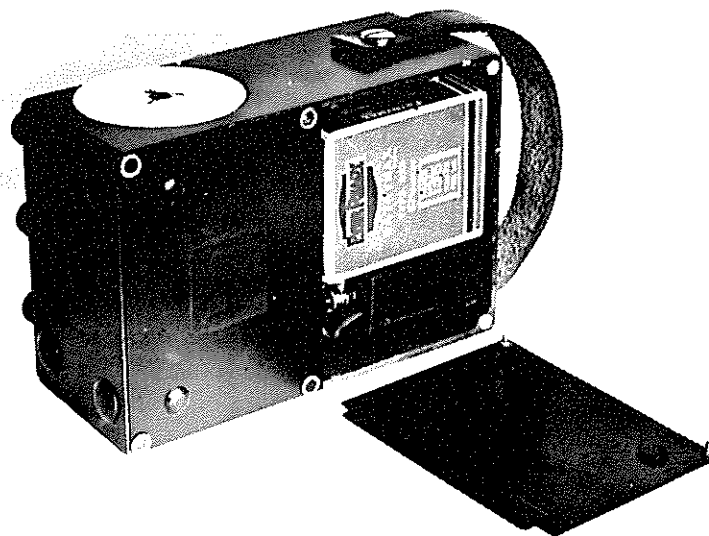


FIG. 12

The 67.5-V. battery ("Battery, Dry, No. 18") governs the deflexion on the insulation-resistance scale, and a 1.5-V. cell (in the Mark I tester, a "Cell, Leclanché, D.S., No. 7A": in the Mark II tester, a "Battery, Dry, No. 20") is used on the ohms range. To avoid damage due to exudation from the batteries, testers must not be stored for long periods with the batteries fitted inside them.

18. **Leather carrying case.**—This is provided to protect the instrument against unavoidable shocks. The instrument should be removed from the case *only* when it becomes necessary to change the batteries. There is additional space in the case large enough to contain three 72-in. lengths of connecting cords. "Straps, Carrying" can be associated with the leather case for use when carrying the tester. The Rate Book description of the case is "Case, Instrument, No. 6A" and the strap "Strap, Instrument, No. 5" (4 ft. 6 in. long) or "Strap, Carrying, No. 6" (14 in. long). The instrument is secured in the carrying case by two large-headed screws which pass through the case and are threaded into holes in the sides of the metal instrument container.

19. **Test leads for use with the tester.**—The leads listed in Table 2 are available for use with the tester.

The test leads have screwed sockets at each end into which can be screwed a "Part No. 1/STA/121"

(spade terminal), "Clips, Test, No. 33 or 34" (small or large), or a "Spike, Testing, No. 6" (insulated prod).

20. **Requisitioning of accessories.**—The tester is stocked without accessories and the batteries, case, carrying handle, test cords and parts, clips, and spikes should be requisitioned as required.

21. **Care in the use of the instrument.**—Care should be exercised in using and handling the instrument. When the rotary switch is in the 'measure ohms' positions 4 and 5, the instrument *must not be connected to any external source of battery supply*. The correct way to use the instrument is to start with the rotary switch in the first position and apply all the tests until the fault is identified or the desired switch position is reached. After use, the switch should be returned to the first position ('0-250V. A.C.') so that the instrument is ready for instant use and also because the bridge rectifier for the A.C. range acts as a low-resistance shunt across the moving-coil and damps the movement when the instrument is being transported.

22. **Maintenance procedure.**—Faulty instruments should be replaced under maintenance exchange procedure. No attempt should be made to repair instruments in the field and the *seals of the instruments must not be broken*.

TABLE 2

Title	Length	Colour
Cord, Test, No. 1/36D	36 in.	Black
" " " 1/36E	36 in.	Red
" " " 1/72A	72 in.	Black
" " " 1/72B	72 in.	Red
" " " 1/120A	120 in.	Black
" " " 1/120B	120 in.	Red

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