Instruction Manual
H 52603-304P
2nd Edition

RF Electronic Millivoltmeter
TF 2603

Code Nos. 52603-304P
-305X

MARCONI INSTRUMENTS LIMITED
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Note

Each page bears the date of the original issue or the code number and date of the latest amendment (Am. 1, Am. 2 etc.). New or amended material of technical importance introduced by the latest amendment is indicated by triangles positioned thus > .....< to show the extent of the change. When a chapter is reissued the triangles do not appear.

Any changes subsequent to the latest amendment state of the manual are included on inserted sheets coded Cl, C2 etc.

NOTES AND CAUTIONS

ELECTRICAL SAFETY PRECAUTIONS

This equipment is protected in accordance with IEC Safety Class 1. It has been designed and tested according to IEC Publication 348, 'Safety Requirements for Electronic Measuring Apparatus', and has been supplied in a safe condition. The following precautions must be observed by the user to ensure safe operation and to retain the equipment in a safe condition.

Defects and abnormal stresses

Whenever it is likely that protection has been impaired, for example as a result of damage caused by severe conditions of transport or storage, the equipment shall be made inoperative and be secured against any unintended operation.

Removal of covers

Removal of the covers is likely to expose live parts although reasonable precautions have been taken in the design of the equipment to shield such parts. The equipment shall be disconnected from the supply before carrying out any adjustment, replacement or maintenance and repair during which the equipment shall be opened. If any adjustment, maintenance or repair under voltage is inevitable it shall only be carried out by a skilled person who is aware of the hazard involved.

Note that capacitors inside the equipment may still be charged when the equipment has been disconnected from the supply. Before carrying out any work inside the equipment, capacitors connected to high voltage points should be discharged; to discharge mains filter capacitors, if fitted, short together the L (live) and N (neutral) pins of the mains plug.

Mains plug

The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action shall not be negated by the use of an extension lead without protective conductor. Any interruption of the protective conductor inside or outside the equipment is likely to make the equipment dangerous. Before fitting a non-soldered plug to the mains lead, cut off the tinned ends of the mains lead. Otherwise cold flowing of the solder could cause intermittent connections.

Fuses

Note that the supply fuse is connected in series with the brown (live) wire of the supply lead. If the equipment is connected to the supply via a two-pin plug, it will be possible for the fuse to become connected to the neutral side depending upon the orientation of the plug in its socket. In these circumstances certain parts of the instrument could remain at supply potential even after the fuse has ruptured.

To provide protection against breakdown of the supply lead, its connectors, and filter where fitted, an external supply fuse (e.g. fitted in the connecting plug) should be used in the live lead. The fuse should have a continuous rating not exceeding 6 A.

Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of mended fuses and the short-circuiting of fuse holders shall be avoided.

► RADIO FREQUENCY INTERFERENCE

This equipment conforms with the requirements of EEC Directive 76/889 as to limits of r.f. interference. ◄

► *CAUTION :* STATIC SENSITIVE COMPONENTS

Components identified with the symbol ⚠ on the circuit diagrams and/or parts lists are static sensitive devices. The presence of such devices is also indicated in the equipment by orange discs, flags or labels bearing the same symbol. Certain handling precautions must be observed to prevent these components being permanently damaged by static charges or fast surges.

(1) If a printed board containing static sensitive components (as indicated by a warning disc or flag) is removed, it must be temporarily stored in a conductive plastic bag.

(2) If a static sensitive component is to be removed or replaced the following anti-static equipment must be used.

A work bench with an earthed conductive surface.

Metallic tools earthed either permanently or by repeated discharges.

A low-voltage earthed soldering iron.

An earthed wrist strap and a conductive earthed seat cover for the operator, whose outer clothing must not be of man-made fibre.

(3) As a general precaution, avoid touching the leads of a static sensitive component. When handling a new one, leave it in its conducting mount until it is required for use.

MOUNTING ARRANGEMENTS

Excessive temperatures may affect the instrument's performance; therefore, completely remove the plastic cover, if one is supplied over the case, and avoid standing the instrument on or close to other equipment that is hot.

SAFETY TESTING

Where safety tests on the mains input circuit are required, the following procedures can be applied. These comply with BS 4743 and IEC Publication 348. Tests are to be carried out as follows and in the order given, under ambient conditions, to ensure that mains input circuit components and wiring (including earthing) are safe.

(1) Earth lead continuity test from any part of the metal frame to the bared end of the flexible lead for the earth pin of the user's mains plug. Preferably a heavy current (about 25 A) should be applied for not more than 5 seconds.

Test limit : not greater than 0.5 Ω.

(2) 500 V d.c. insulation test from the mains circuit to earth. ◄

Test limit : not less than 2 MΩ.

Chapter 1

GENERAL INFORMATION

CONTENTS

INTRODUCTION

1. The TF 2603 is a highly sensitive, general purpose millivoltmeter, covering the frequency range 50 kHz to 1500 MHz; eight ranges, giving full-scale deflections from 1 mV to 3 V, enable voltages down to 300 µV to be measured.

2. Meter readings are very close to true r.m.s. values up to 30 mV, or 3 V when using the 100:1 multiplier; above this value the response gradually changes, and approaches a peak-to-peak reading (calibrated in r.m.s. value of a sine wave) on the higher ranges. The meter is also calibrated in decibels giving an effective range of 0 to 71 dB with respect to 3.162 V. Full wave detection of the input signal by the probe minimizes errors associated with single diode probes.

3. The voltmeter may be operated from mains or battery supplies. Two versions of the voltmeter are available, differing only in the range of accessories supplied.

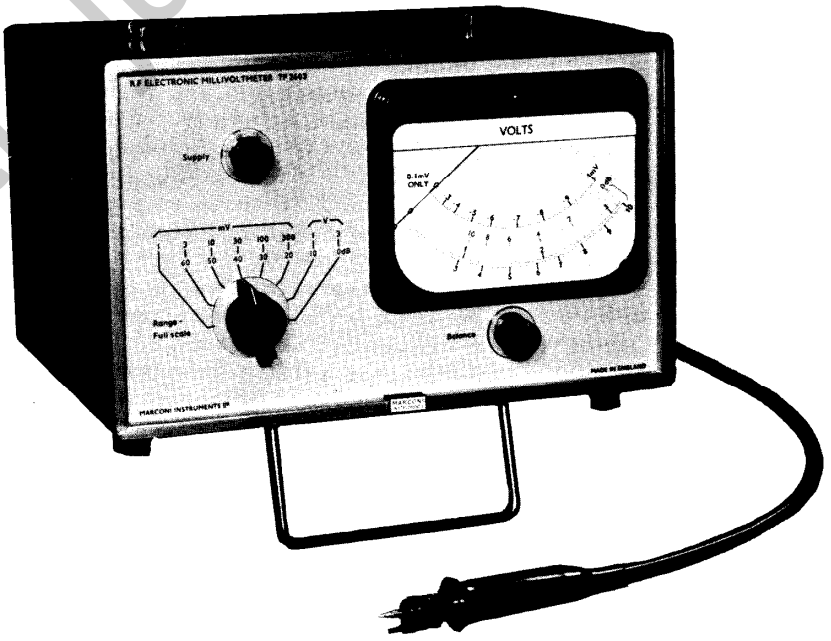


Fig. 1 RF Electronic Millivoltmeter TF 2603

PERFORMANCE DATA

4.	Voltage range	1 mV r.m.s. full-scale deflection, to 3 V r.m.s. full-scale deflection in 8 ranges. Maximum input, 8 V r.m.s. Probe will withstand up to 300 V d.c.
5.	Frequency range	50 kHz to 1500 MHz.
6.	Accuracy (from 18°C to 28°C)	10 mV and higher ranges : ±3% of full-scale. 3 mV range : ±5% of full-scale. 1 mV range : ±5% of full-scale. 200 kHz to 50 MHz.
7.	Frequency response (When fitted with coaxial T Connector TM 7948 and terminated with 50 Ω)	With respect to 200 kHz. 50 kHz to 200 kHz : +0, -0.4 dB. 50 MHz to 200 MHz : ±0.4 dB. 200 MHz to 500 MHz : ±1.0 dB 500 MHz to 900 MHz : ±2.0 dB. 900 MHz to 1500 MHz : ±3.0 dB.

Notes...

(1) The instrument will usually be operated in the frequency range 200 kHz to 50 MHz, and the error over this range is shown against Accuracy.

(2) When using the instrument at other frequencies, the Frequency response error must be added to the appropriate Accuracy figure to obtain the overall accuracy.

(3) Chapter 2, Fig. 3 shows in detail the typical spread of the probe frequency response limits.

8.	Meter scales	0 to 3.162, and 0 to 10 virtually linear. Calibrated in the r.m.s. value of a sine wave. Special scale for 1 mV range. Decibel scale 0 to 11 dB, 0 dB at full-scale. Range switch in 10 dB steps. The dB scale is not applicable to the 1 mV range.
9.	Input impedance	Input capacitance : less than 2.5 pF at 1 MHz and 1 V r.m.s. Input resistance : greater than 125 kΩ at 1 MHz and 1 V r.m.s. Chapter 2, Fig. 4 shows in detail the typical variation of input resistance with frequency.
10.	Probe	Uses two crystal diodes in a full wave detecting circuit which minimizes errors when measuring non-sinusoidal waveforms. A built-in heater ensures that ambient temperature variations have minimum effect. Response is very close to true r.m.s. with inputs of 30 mV or less.
11.	Power requirements	
	AC supply	45 Hz to 500 Hz : 190 V to 265 V or 95 V to 132 V (also 500 Hz to 1000 Hz at ±10% on 230 V).
	Power consumption	5.4 VA.

Battery supply	20 V to 32 V floating;	142 mA (heater on), 67 mA (heater off).	

12. Dimensions and weight

Height	Width	Depth	Weight
204 mm (8 in)	292 mm (11½ in)	280 mm (11 in)	9.8 kg (22 lb)

ACCESSORIES

13. With version 52603-304P, items (1) to (7) are supplied and items (8)to (11) are optional. With version 52603-305X items (1) to (11) are all supplied.

(1) Mains lead — MI code : 43129-071D.

(2) Earth prod, TM 7936 — MI code : 44314-602L. A spring loaded earthing prod which clips on to the probe body.

(3) Earthing sleeve — MI code : 33631-901J. Provides earthing of the probe at the higher frequencies.

(4) Earth spring clip — MI code : 22328-013N. Allows the use of a flexible earth connection.

(5) Printed wiring plug — MI code : 23421-031K. Connects with test point sockets on printed boards.

(6) Multiplier, TM 7947 — MI code : 44416-050G.

100:1 capacitive divider for voltages up to 316.2 V over the frequency range 500 kHz to 500 MHz.

Accuracy (with respect to exact 100:1 ratio):

0.5 to 20 MHz	±0.1 dB
20 to 100 MHz	±0.3 dB
100 to 300 MHz	±0.7 dB
300 to 500 MHz	±1.5 dB

Input impedance :

Resistance, greater than 20 MΩ at 1 MHz,
greater than 1 MΩ at 50 MHz,
greater than 150 kΩ at 300 MHz.

Capacitance, less than 2.5 pF.

Maximum input :

316.2 V up to 100 MHz.
Above 100 MHz maximum r.m.s. voltage =

$$\frac{3 \times 10^6}{f^2}$$

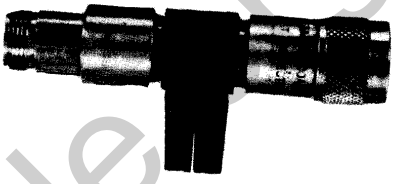
where f is in MHz.
V d.c. plus V a.c. peak must not exceed 1000 V.

(7) Accessory case, TM 7960

MI code : 41673-015N.

(8) Coaxial T connector, TM 7948

MI code : 43167-007Z.

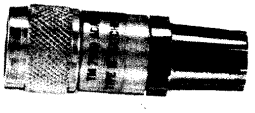


VSWR not greater than 1.2:1 at 1500 MHz when terminated in 50 Ω and voltmeter probe plugged in side entry.

Accuracy and Frequency response specification given in Performance Data applies to voltage across 50 Ω load.

(9) Adapter N terminated, TM 7949

MI code : 43168-011S.



Allows voltage measurement across load mounted in 50 Ω type N plug.
Maximum power input, 0.25 W.
VSWR when mounted on voltmeter probe:-

maximum 1.1:1, 50 kHz to 500 MHz,
maximum 1.2:1, 500 kHz to 900 MHz.

(10) Adapter N unterminated, TM 7950 MI code : 43168-010V.

50 Ω type N adapter with specification as terminated adapter but without 50 Ω load.

(11) 50 Ω Load, TM 7967 MI code : 44411-015N.

Load mounted in type N plug.
VSWR not greater than 1.05:1, d.c. to 1500 MHz.

Please note that items 8 to 11 are optional accessories as per para 13 above. These are not supplied in the instruments from Technical and Scientific Supplies. Some may be available at additional cost.

The 75 and 50 ohm adaptors are NOT interchangeable! The larger diameter pin on the one will fracture the socket on the other if mis-mated!!

Chapter 2

OPERATION

CONTENTS

CONTROLS AND CONNECTORS

1. The controls and connectors on the front panel of the voltmeter (Fig. 1) are as follows:-

(1) SUPPLY switch. For switching on/off the a.c. or battery supply. Red screening is visible when switched on.

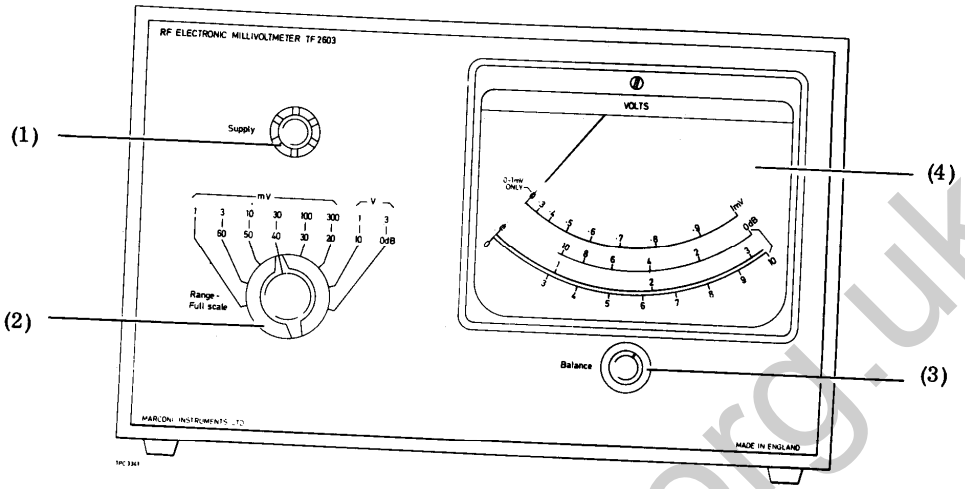


Fig. 1 Controls and connectors on front panel

(2) RANGE switch. For selecting the appropriate range for the voltage to be measured.

(3) BALANCE control. For adjusting meter to zero with zero input and probe warmed up.

(4) METER. For indicating on a scale calibrated in r.m.s. values and dB, the voltage detected by the probe.

2. The controls and connectors on the rear panel of the voltmeter (Fig. 2) are as follows:-

(5) MAINS/BATTERY switch. Set to position appropriate to supplies being used.

(6) BATTERY supply terminals.

(7) MAINS supply range switch. Selects a.c. voltage range.

(8) BLANKING plate. For securing the mains supply range switch in the selected position.

(9) AC FUSE. Value determined by a.c. supply voltage : 50 mA for 190 V to 265 V, 100 mA for 95 V to 132 V.

(10) MAINS supply plug. For connecting the a.c. supply by means of the mains lead.

(11) DC FUSE. 160 mA. Connected by mains/battery switch to battery supply or rectified a.c. supply line.

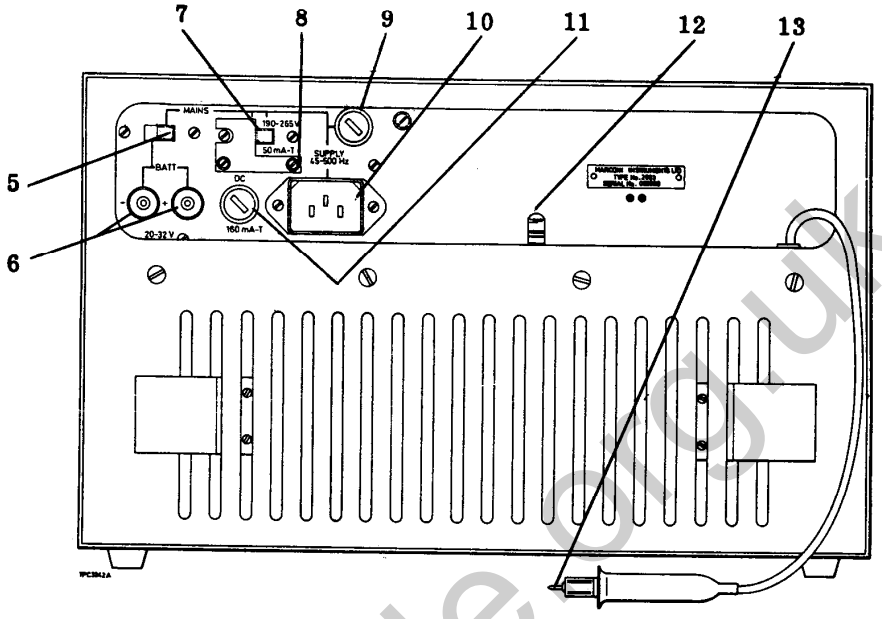


Fig. 2 Controls and connectors on rear panel

(12) PROBE clip. For retaining the voltmeter probe when not in use.

(13) PROBE. For connecting direct or via the accessories, to the voltage under test.

PREPARATION FOR USE

Meter location

3. The sensitivity of the meter is affected by its location in the front panel cut-out. As the meter has been calibrated when positioned at the bottom of the cut-out, it should be verified, on unpacking the instrument, that the meter has not moved.

AC power supply

4. The mains lead is a free cable fitted at one end with a cable mounted socket which connects with the instrument. When fitting a supply plug ensure that the conductors are connected as follows:-

Earth - Green/Yellow
Neutral - Blue
Live - Brown

5. Ensure that the front panel SUPPLY switch is in the off position and set the MAINS/BATTERY switch to the MAINS position.

6. Set the MAINS supply range switch to the correct position for the a.c. supply voltage to be used and secure the BLANKING plate.

7. Check that the AC FUSE rating is compatible with the a.c. supply voltage:-

50 mA for 190 V to 265 V,
100 mA for 95 V to 132 V.

Battery supply

8. Ensure that the front panel SUPPLY switch is in the off position and set the MAINS/BATTERY switch to the BATTERY position.

9. Connect the battery supply (20 V to 32 V) to the BATTERY terminals, ensuring that correct polarity is observed and that neither side of the supply is earthed.

Mechanical zero

10. Adjust the mechanical zero as follows:-

(1) Turn the adjustment screw to move the pointer up the scale, towards full-scale deflection and approach the zero mark from this side.

(2) Once the pointer is exactly on the mark, slightly turn back the adjustment screw so that it is free from the meter suspension.

SWITCHING ON

Warm-up period

11. If the probe is free (connected by wires or clips), the instrument will warm up sufficiently for most measurements 4 minutes after switching on. Maximum accuracy will be achieved after approximately 15 minutes.

12. With the probe connected to a large thermal mass (e.g. to a slotted line, via the coaxial T connector), the times stated in the previous paragraph should be amended to 15 minutes and 45 minutes.

13. The thermostat controlling the probe heater is mounted inside the oscillator box. The voltmeter should not be operated on top of any equipment etc. which may raise its internal temperature. To do so may introduce errors due to the thermostat prematurely switching off the probe heater.

Balance

14. After the correct warm-up period has elapsed, read the mean position of the meter pointer and adjust the BALANCE control to zero the meter. If the meter will not adjust to zero on the 1 mV range refer to para. 20 and Chap. 4, para. 47.

15. The BALANCE control requires no adjustment when voltages above 30 mV are to be measured.

16. For measurements at frequencies below approximately 20 MHz it is sufficient just to earth the probe tip. Above this frequency the tip must be screened from external interference in order that the meter can be adjusted to zero.

17. The BALANCE control injects a small d.c. voltage into the probe circuit

to balance out the diodes pn potential and any thermal voltages which develop in the associated input circuits. To check that the noise voltage level is normal proceed as follows:-

(1) See the RANGE switch to the 1 mV position.

(2) Ensure that there is no input to the probe.

(3) Adjust the BALANCE control for a reading between 0.3 and 0.4 mV.

(4) Check that the peak-to-peak pointer movement does not exceed 0.06 mV (3 small scale divisions).

(5) After confirming that the noise level is normal, reset the zero (para. 14).

Screening

18. The voltmeter has characteristics similar to a wide band, medium sensitivity, untuned receiver and care should be taken not to operate the set near high intensity fields.

19. If it is not possible to switch off the source of any such field during the voltmeter tests, ensure that the probe is screened sufficiently to eliminate any pick-up errors.

20. To check if any pick-up error exists, proceed as follows:-

(1) Switch off any field generating device.

(2) Set the voltmeter zero (para. 14).

(3) Switch on the field generating device and note any increase in meter reading.

(4) Reduce this reading to a minimum by screening.

OPERATING PROCEDURE

Voltage limitations

21. Maximum r.m.s. input should not exceed 8 V, but this may be superimposed on 300 V d.c. This restriction is governed by the peak inverse voltage limitation on the probe diodes.

22. Voltages in excess of 8 V may be measured using the 100:1 Multiplier TM 7947.

Probe input impedance

23. The probe presents to the source under test a capacitance of less than 2.5 pF and a shunt resistance which varies with frequency and voltage. Fig. 4 shows typical resistance variation with frequency and voltage.

Range selection

24. Set the RANGE switch to the nearest full scale above the expected voltage level. If the level is not known select the 3 V range.

25. When making a measurement on the 1 mV range read the mean position of the meter pointer.

Range switching

26. When a measurement is to be made on one of the lower ranges immediately after using the voltmeter on a higher range, the following procedure should be used to switch to the new position:-

(1) Hold the RANGE switch in a position between the required range (e.g. 1 mV) and the range immediately above it (e.g. 3 mV).

(2) Hold the switch in this position for at least 10 seconds.

(3) Switch to the required range (e.g. 1 mV).

27. This procedure allows time for switch SA3F to discharge the input circuit capacitors. An alternative but less satisfactory method is to very slowly turn the RANGE switch to the new position.

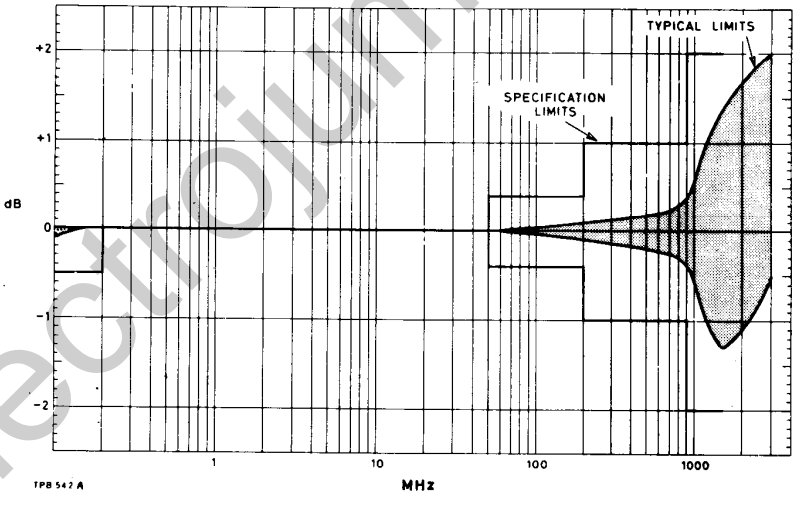


Fig. 3 Voltmeter frequency response limits

Accessory selection

28. The Accuracy and Frequency response specification given in Chapter 1 will only apply if the probe spike makes direct contact with the live point under test, and the earth connection between probe case and circuit earth has negligible inductance and resistance.

29. The earth connection can be a 150 mm length of 16/0.2 mm wire, or its equivalent for measurement frequencies up to 20 MHz. The wire is attached to the spring clip which clamps on to the probe body.

30. The telescopic earth prod (TM 7936) clamped to the probe body can be used up to 100 MHz or up to 300 MHz if an additional 2.5% error can be tolerated.

31. Above 100 MHz the probe body must make direct contact with a good earth point on the system under test. Alternatively, accessories TM 7947, TM 7948, TM 7949 or TM 7950 can be used.

32. Above 900 MHz in order to achieve a suitably low impedance earth connection it is essential in most measurements to use the coaxial T connector TM 7948.

33. The four accessories TM 7947, TM 7948, TM 7949 and TM 7950 can prove useful at frequencies below 100 MHz where their screening properties enable measurements to be made in the presence of stray fields.

34. Table 1 will assist in selecting the correct accessory for particular measurements.

Use of accessories

35. The use of the telescopic earth prod and the earth clip with lead is not satisfactory for high accuracy measurements at frequencies above approximately 250 MHz.

Earthing sleeve

36. This allows a direct connection to be made to the voltage source under test. Use as follows:-

(1) Bolt the sleeve to the chassis of the equipment under test using the three tapped 6BA holes in the base of the sleeve. The sleeve should be mounted so that it is concentric with the live point to be measured.

(2) Push the probe into the earthing sleeve until contact is made with the live point. The probe tip may be unscrewed before connecting the probe.

Multiplier TM 7947

37. Insert the probe into the multiplier ensuring that the probe point engages in the mating socket and push home.

38. The multiplier can be used to measure voltages up to 300 V r.m.s. at a frequency up to 100 MHz. Above 100 MHz the maximum r.m.s. voltage is given by the expression:-

$$V = \frac{3 \times 10^6}{f^2}$$

where f is in MHz.

TABLE 1 FREQUENCY RANGE OF ACCESSORIES

Frequency	Earth prod TM7936	Earth spring clip	Earth sleeve	100:1 Multi-plier TM7947	Coaxial T con-nector TM7948	Termi-nated Adapter TM7949	Unter-minated Adapter TM7950	Dummy 50 ohm Load TM7967
50kHz-20MHz	B	BW	X	C	X	X	X	X
20 -100MHz	B	-	X	X	X	X	X	X
100 -300MHz	AE	-	X	X	X	X	A	X
300 -500MHz	E	-	X	X	X	X	-	X
500 -900MHz	E	-	X	-	X	X	-	X
900 -1500MHz	T	-	X	-	X	-	-	X
1500 -3000MHz	T	-	X	-	D	-	-	F

X Usable in frequency range stated.

- Does not meet the specification at these frequencies but may be used provided the additional errors can be tolerated.

A Usable up to 300 MHz provided an error of up to 2.5% in addition to specification can be tolerated.

B Assumes that the live probe spike makes direct contact with the measurement point.

C Cannot be used below 500 kHz.

D May be used up to 3000 MHz with good results. VSWR may deteriorate but indication of voltage across load remains reasonably accurate.

E At these frequencies the probe body should be held (or clamped) firmly against a good earth point on the system under test. Alternatively use other accessories.

F VSWR may deteriorate above 1500 MHz.

T Use coaxial T connector TM 7948.

W With 150 mm of 16/0.2 mm wire, attached to the clip as an earth connection.

Note ...

Wires should never be soldered directly to the probe tip. If this type of connection is required, solder the wire to an earth tag. Unscrew the probe tip and then clamp the tag to the probe with the tip.

39. When measuring a.c. voltages superimposed on d.c., the peak value of the a.c. voltage plus the standing d.c. or mean voltage must not exceed 1000 V.

40. Multiplier errors (Chap. 1) are generally of opposite sign to those of the probe. Total error therefore will probably not exceed that shown in Chapter 1 under Accuracy and Frequency response.

41. Fig. 4 shows typical variations of input resistance when using Multiplier TM 7947.

Coaxial T Connector TM 7948

42. Plug the probe directly into the T connector ensuring that the probe point engages in the mating socket.

43. The series arms of the T connector are fitted with type N connectors. An arrow on the connector body points towards the arm which should be terminated with a 50 ohm load. The voltmeter indicates the voltage across the load when the test voltage is connected to the remaining arm.

44. Fig. 5 shows the typical insertion loss for the T connector plus the probe.

Terminated Adapter TM 7949

45. The probe plugs directly into the adapter which provides a matched 50 ohm coaxial termination. The 50 ohm load is fitted into the type N connector and the voltmeter indicates the voltage across this termination.

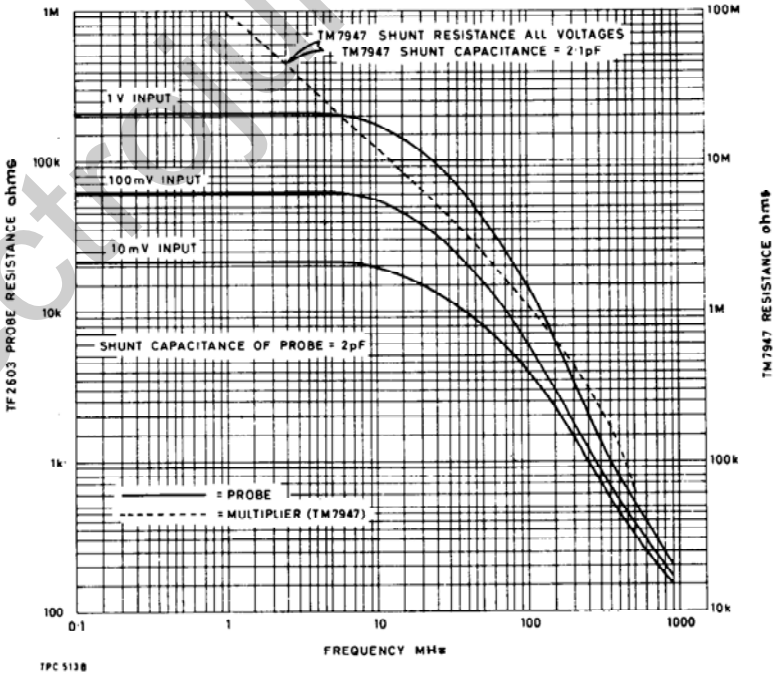


Fig. 4 Probe and multiplier input resistance (typical)

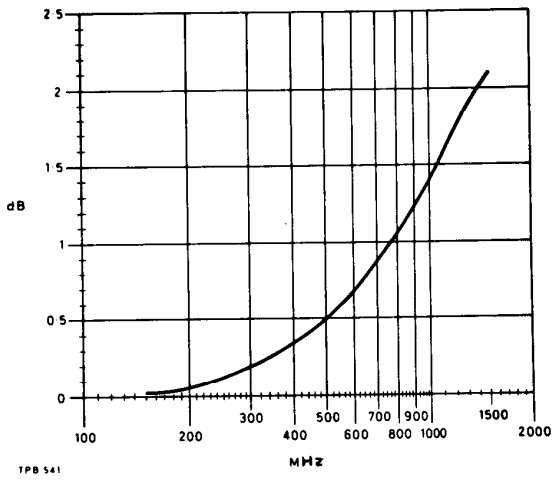


Fig. 5 Insertion loss curve for T connector and probe (typical)

46. Maximum power input is 0.25 W.

Unterminated adapter

47. Conditions of use are the same as for the terminated adapter but the load is omitted.

50 ohm Load TM 7967

48. The 50 ohm load is fitted into a type N connector and provides a matched coaxial termination for use with the T connector.

dB measurements

49. The decibel ranges are in 10 dB steps from 0 dB to 60 dB and are marked on the voltmeter front panel under the voltage figures. When making a measurement, add the reading on the meter decibel scale to the range reading to obtain the total decibel value.

50. The meter decibel scale is of particular value when relative levels in successive measurements are required, e.g. for instance when determining amplifier or filter response characteristics.

APPLICATIONS

51. The following applications are typical of the many that can only be made by this type of voltmeter:

(1) Measurements of low level signals in semi-conductor circuits - especially transistors and tunnel diodes.

(2) Measurement of transistor parameters - for instance, fT in the 500 MHz to 1500 MHz range.

(3) Voltage measurement on strip-line circuits.

(4) Measurements on battery operated equipment at locations remote from mains supplies.

(5) In conditions where accurate voltage measurement is difficult due to circuit earth loops, errors can often be eliminated by using a battery energized TF 2603.

(6) Because of the good r.m.s. response up to 30 mV, noise measurements can be made. If the 100:1 Multiplier (TM 7947) is used the measurement range is increased to 3 V.

(7) Distortion measurements are possible over a wide frequency range.

$$\text{Total distortion } \% = 100\,\frac{V1}{V2}$$

where V1 = voltage due to harmonics,
and V2 = voltage due to harmonics plus fundamental.

V1 should be measured by connecting the TF 2603 to the output terminals of a network (e.g., a bridged T) capable of suppressing the fundamental, and using the r.m.s. region of the instrument.

(8) Used in conjunction with a Q meter, e.g., TF 1245, measurements can be carried out at low voltage levels; the TF 2603 is connected across the test circuit capacitor. This method is extremely useful with most transistors or circuits containing them. To make direct measurements of Q at low levels, the ΔC method should be used in order to avoid errors due to the shunting effect of TF 2603 probe. If required, a much higher resistance can be obtained by also using the 100:1 Multiplier (TM 7947) if the voltage across the Q meter capacitor is 30 mV or more.

(9) Despite all precautions regarding layout, feedback and inclusion of 'stopper' resistors, a wide band video multi-stage amplifier may develop spurious oscillation of frequency between 1 MHz and 1000 MHz. A loop connected to the TF 2603 probe can be held near each part of the circuit in turn to ascertain if unwanted oscillations are present.

(10) The tuning of narrow band amplifiers and filters, and other cases where a multiplicity of tuned circuits require adjustment, is made easy by use of the more sensitive ranges of TF 2603. The probe spike can be held close to circuit conductors and the preceding circuit tuned for a maximum voltage reading. Because of the loose coupling used, removal of the probe will have negligible effect, and little if any tuning correction will be required.

(11) Testing of filter frequency response, particularly in the stop band, can be achieved without excessive voltage requirements from the signal generator. For example, 50 dB attenuation can be measured using a generator capable of delivering 0.1 V to the filter input terminals.

(12) In wide band r.f. bridge measurements TF 2603 can be used as a null detector in place of several radio receivers, provided sufficient source voltage is available. If necessary, a simple resonant step-up circuit can be inserted between the bridge and TF 2603.

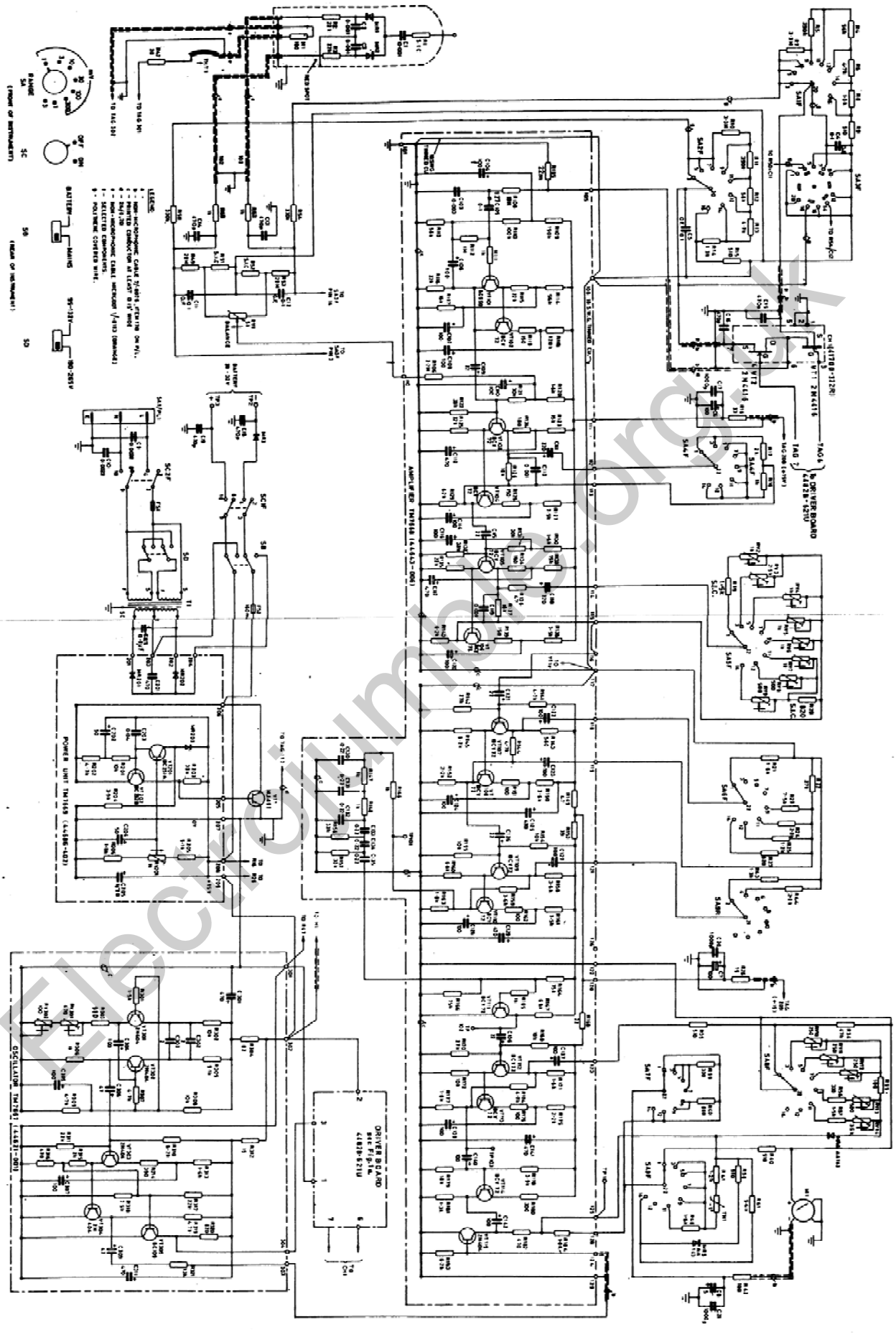


Fig. 1 SZ52603-304P Issue 14

TF 203 : Circuit diagram

Fig.1 Chan.7

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