

STANDARD SIGNAL GENERATOR

TYPE TF 144.G.

FOR SERVICE MANUALS
CONTACT:
MAURITRON TECHNICAL SERVICES
www.mauritron.co.uk
TEL: 01844 - 351694
FAX: 01844 - 352554

STANDARD SIGNAL GENERATOR

TYPE TF.144G

CONTENTS

1. <u>INTRODUCTION</u>		4. <u>MAINTENANCE</u>	
General.....	1.1	Valves.....	4.1
Basic Arrangement.....	1.2	Contacts.....	4.2
2. <u>DETAILED DESCRIPTION</u>		Thermocouple Replacement	4.3
Radio-Frequency Circuits	2.1	Exchange of Coil Units..	4.4
Modulation System.....	2.2	Service.....	4.5
Power Supply.....	2.3	5. <u>SPECIFICATION</u>	
3. <u>OPERATION</u>		Standard Signal Generator	
Initial Adjustments.....	3.1	Type TF 144G.....	5.1
Connection to Receiver..	3.2	Special Instruments.....	5.2
Operation Unmodulated...	3.3	6. <u>ILLUSTRATIONS</u>	
Incremental Tuning.....	3.4	&	
Internal Modulation.....	3.5	<u>CIRCUIT DIAGRAM</u>	
External Modulation.....	3.6	At end.	

SCHEDULE OF PARTS SUPPLIED

The complete equipment comprises the following parts:-

- | | |
|--|---|
| 1. One Instrument Type TF.144G. | 5. One spare Thermocouple mounted on the attenuator cover plate. |
| 2. One Set of valves packed in sockets, viz:
Three - AC/P or ML4
One - UU5 or MU 12/14
Lamp One - 6.3V,0.35A,M.E.S. | 6. One A.W. Dummy Aerial, Type TM.1758 fitted to screened lead with concentric screened socket. |
| 3. One Mains Lead fitted with 8 pole socket. | 7. One spare concentric screened socket. |
| 4. One Battery Lead fitted with switch and 8 pole socket. | 8. One Instruction Book EB.144G. |

GUARANTEE

We guarantee this instrument free from defects in material, workmanship and design..

During a period of one year after date of despatch to the original purchaser we will make good any defects developing in parts of our own manufacture under proper use and arising from faulty design, workmanship or material, provided such parts are promptly returned to our laboratories and provided that neither they nor the apparatus of which they form part have been tampered with or modified.

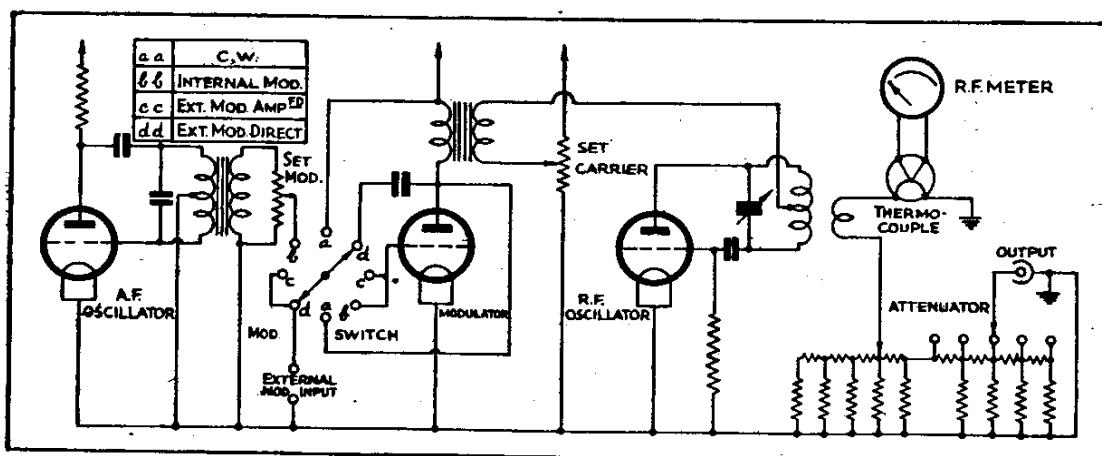
EB 144G.

5-9/44

1. INTRODUCTION

1.1 General. Methods of investigating the overall performance of Radio Receivers, such as on the lines laid down by the Radio Manufacturers' Association specifications, are well understood and are outside the scope of this Instruction Handbook. The following pages are, therefore, chiefly concerned with familiarising the user with the characteristics of Standard Signal Generator TF.144G. itself. In conjunction with the necessary accessories the Generator may also be employed for field strength measurements or for the evaluation of the constants of R.F. transmission lines.

1.2 Basic Arrangement. The standard instrument is designed for alternative A.C. mains or battery operation, covers a radio-frequency range of 85 kc/s to 25 Mc/s, gives a continuously variable output of one microvolt to one volt controlled by a calibrated attenuator and may, as required, be modulated either externally or by the internal 400 c/s oscillator. The R.F. current entering the attenuator is monitored by a meter on the panel. The skeleton schematic diagram below illustrates the essential arrangement:-



2. DETAILED DESCRIPTION

2.1 Radio Frequency Circuits. The complete R.F. oscillator system is housed in a cast aluminium screen and employs a triode valve in a Hartley circuit. The tuning coils for the various frequency ranges are mounted inside a cylindrical screen and switching is accomplished by rotating this unit bodily. Auxiliary contacts are arranged to short-circuit those coils out of use which otherwise might resonate. The tuning condenser is constructed in two sections, the wiring of the coil assemblies being such that a single section only is in use above 1.3 Mc/s while both are in operation at lower frequencies.

The calibrated tuning dial is attached directly to the main spindle and is rotated by a friction drive engaging its outer edge. Incremental

FOR SERVICE MANUALS
CONTACT:
MAURITRON TECHNICAL SERVICES

www.mauritron.co.uk

TEL: 01844 - 351664

FAX: 01844 - 352554

-3-

tuning is accomplished by rocking, over a small angle, the stator of the main condenser. The amplitude of R.F. oscillation is controlled by varying, by means of a potentiometer (SET CARRIER), the H.T. voltage supplied to the oscillator valve. The output attenuator is inductively coupled to the tuned circuit in series with a thermocouple operating a meter calibrated so that deflection to the SET CARRIER mark represents 1 volt across the attenuator. The slide wire section of the latter is similar to a constant-impedance ladder network and is designed so as to reduce the variation of input impedance with setting to approximately $\pm 1\%$; the scale is logarithmic and is calibrated in dB. above one microvolt in addition to voltage output. The slide wire is terminated by the input impedance of the multiplier which is arranged as a six-position ladder network having 20 dB steps. The internal output impedance is independent of the slide-wire setting except in the neighbourhood of maximum output on the highest multiplier range.

2.2 Modulation System. Modulation is applied to the anode of the R.F. Oscillator by the inclusion of the secondary of the modulation transformer in the anode supply circuit. The primary of the transformer, which is short-circuited in the C.W. position of the selector switch, is arranged so that it may be energised either directly from an external source or by the preceding triode modulator valve. The grid of this valve, in turn, may be controlled either from such an external source or by the output of the internal A.F. oscillator. The modulation depth is determined in each case by direct or indirect reference to the increase in R.F. current consequent upon heavy modulation, the SET MODULATION mark on the meter corresponding to 80% peak modulation with sinusoidal input. Since the indication is in R.M.S. terms, errors in peak modulation may arise where the applied external wave-form is complex. Errors from this source do not arise when employing internal modulation.

The tone source used for internal modulation consists of a triode oscillator operating in a Hartley circuit tuned to 400 c/s. The output from a secondary winding coupled to the oscillator coil is taken to two potentiometers in cascade, the second of which adjusts the input to the modulator valve and constitutes the calibrated PERCENT MOD. control. The preceding potentiometer, SET MOD; determines the input to this PERCENT MOD. potentiometer and must be adjusted to produce 80% modulation - the SET MODULATION mark on the meter - when the latter is at maximum; a condition brought about, in effect, by switching to SET on the modulation control switch.

When external modulation is used, modulation-depth must be controlled by adjusting the signal input voltage. In the AMPLIFIED position the input required is small, about 1 volt produces 15% modulation, and the input impedance high, but for accurate fidelity determinations the DIRECT position must be used.

2.3 Power Supply. The internal power supply equipment for A.C. mains operation follows standard practice, using a full-wave valve rectifier with associated smoothing circuit. The supply leads to the generator are brought out at an 8-way plug on the panel, changeover from mains to external battery operation being accomplished by use of the appropriate lead and socket provided.

FOR SERVICE MANUALS
CONTACT:
MAURITRON TECHNICAL SERVICES

www.mauritron.co.uk
TEL: 01844 - 351694
FAX: 01844 - 352554

-4-

3. OPERATION

An illustrated Instruction Chart summarising the main operational data will be found affixed to the top of the instrument case.

3.1 Initial Adjustments. The instrument is normally supplied with the valves in position and with the mains transformer adjusted to the 230 volt tapping (40 to 100 c/s mains). Connection with the supply should be made to the input plug on the front panel via the cable and socket marked MAINS. In cases where the supply is other than 230 v. it is necessary to change the tappings on the mains transformer to suit. This necessitates removal of the case which may most easily be carried out, after extraction of the twelve coin-slotted screws from the edge of the panel, by turning the instrument over on its face so that it rests on the panel-rails; the cover can then be lifted off.

For battery operation the lead and socket engraved BATTERIES should be used, the batteries themselves being kept remote from the receiver under test to ensure complete freedom from radiation pick-up. The L.T. and H.T. batteries should be capable of supplying 4.0 volts at 3.5 amperes and 200 volts at 35 milli-amperes respectively. Before switching on, verify that the multiplier is not set at the maximum range (protection against this is partially provided by the safety catch) and that the SET CARRIER control is turned to minimum. An adequate time should be allowed, before attempting to set up the instrument, for the valve cathodes to attain normal operating temperature.

3.2 Connection to Receiver. A screened cable, fitted with a concentric plug for insertion into the OUTPUT socket and terminated by an All-Wave Dummy Aerial Type TM.1758, is supplied for making connection to the receiver under investigation. This arrangement is suitable for normal measurements and comparative tests at all frequencies. The receiver should be earthed through a substantial conductor; the earth link to the generator is via the cable screen. For sensitivity measurements of great precision at the highest frequencies, a short screened cable of known characteristic should be used in conjunction with a low-resistance link between the earthy side of the concentric plug and the earth point of the apparatus under test. A spare cable connector is supplied with the instrument. The accuracy of the attenuator, and therefore of the output voltage, will be adversely affected if the external load impedance is less than the values stated in the table below, which also gives the values of internal impedance at the various multiplier settings:-

MULTIPLIER SETTING	INTERNAL OUTPUT IMPEDANCE	MINIMUM EXTERNAL LOAD IMPEDANCE (FOR 5% OUTPUT VOLTAGE DROP)
x1 Microvolts to x10 Millivolts	10 Ω	200 Ω
x100 Millivolts	52.5 Ω	1000 Ω

The safety catch is fitted to the multiplier to prevent accidental switching to the highest output range, as a load on this range of much less than 500 Ω may damage the thermocouple.

3.3 Operation Unmodulated. Set the modulation control switch to C.W., the RANGE selector to the appropriate frequency range and the OUTPUT VOLTAGE control and MULTIPLIER to the required R.F. level. Adjust the FREQUENCY dial to the required frequency, with the INCREMENTAL TUNING dial at its centre zero, and bring up the SET CARRIER control until the meter reads SET CARRIER. Always temporarily reduce the output, by means of the SET CARRIER control, when operating the RANGE switch.

3.4 Incremental Tuning. This control is provided for obtaining fine frequency adjustment over a limited range at any given setting of the main tuning dial, as required for selectivity or incremental tuning determinations. After setting the FREQUENCY control it should be locked by means of the clamp knob provided. The range of adjustment now obtainable by rotating the INCREMENTAL TUNING dial from zero to either end of its scale is indicated by the hair-lines engraved on either side of the centre indicating line on the cursor of the main frequency dial. As the INCREMENTAL TUNING dial is divided into one hundred parts, each part represents, in terms of actual frequency change, one-hundredth of the total range on the main dial enclosed between the aforementioned outer hair-lines.

3.5 Internal Modulation 400 c/s. Adjust the R.F. conditions as previously described, then turn the SET MOD. control to minimum and re-set the modulation control switch to the SET position. Next adjust the SET MOD. control to bring the meter indication to SET MODULATION and finally turn the modulation control switch to NORMAL. The desired modulation depth can now be obtained by means of the PERCENT MOD. dial. As the radio-frequency oscillator anode swing does not vary very greatly with tuning, it is not essential to set up the carrier and modulation when the radio frequency is changed slightly; restoration of the R.F. meter reading by adjustment of the SET CARRIER control is sufficient to ensure accuracy of modulation depth within 5%.

3.6 External Modulation. Connect the source of modulation to the EXTERNAL MOD. terminals, the control switch being set to AMPLIFIED or DIRECT as required. The AMPLIFIED position is intended mainly for use with shallow modulation at medium frequencies, an input of 3 volts (into 1M Ω) being required to produce approximately 40% modulation. The DIRECT position must be used for deep modulation, for low modulation frequencies, and for all accurate fidelity measurements and requires an input of the order of 30 volts (into 6,000 Ω) to produce 40% modulation. The frequency characteristic of the modulation system, with constant input, is in either case within the limits ± 2.5 dB from 50 to 10,000 c/s at any radio frequency between 100 kc/s and 25 Mc/s. At 1 Mc/s, with DIRECT modulation, it is within ± 1 dB from 30 to 10,000 c/s. The frequency characteristic is, of course, eliminated if the A.F. input voltage is adjusted so as to maintain the reading of the R.F. output meter. This, however, is not practicable in the AMPLIFIED position when working at considerable modulation depth as, at high or very low modulation frequencies, the input to the modulating valve might have to be increased to a point where overloading occurs. Modulation depth may be set either by reference to an external voltmeter across the modulation input terminals or by comparison, by means of the R.F. output meter, with that produced by the internal source. For the first method set the R.F. meter, with zero A.F. input, to the SET CARRIER mark by means of the SET CARRIER control and then note the A.F. input required to raise the indicator to the SET MODULATION mark. This corresponds to 80% modulation and lower modulation depths can be obtained by reducing the A.F. input proportionally.

For the second method, recommended for modulation depths above 30%, set up the instrument as described in section 3.5 (Internal Modulation) and note the reading of the R.F. output meter at the required modulation depth. Now switch to the external modulation source and, having checked that the R.F. output meter reads SET CARRIER with zero A.F. input, restore the meter reading to its previous indication by bringing up the A.F. input level.

SPECIAL NOTE: At low carrier frequencies both depth and frequency of modulation must be limited somewhat to avoid distortion of the modulation envelope. A schedule indicating these values is given below which, for convenience, includes figures relating to two ranges of frequencies lower than those covered by the standard instrument. When required, these are supplied in lieu of the normal highest pair of frequency ranges.

RANGE	CARRIER FREQUENCY	HIGHEST MODULATION FREQUENCY AT WHICH 80% MOD. CAN BE USED	MAXIMUM MOD DEPTH AT 5000 c/s.
20/40 kc/s	20 kc/s	500 c/s	20%
	40 kc/s	500 c/s	20%
40/85 kc/s	40 kc/s	500 c/s	20%
	85 kc/s	500 c/s	20%
85/200 kc/s	85 kc/s	1500 c/s	40%
	200 kc/s	2000 c/s	50%
200/500 kc/s	200 kc/s	2000 c/s	50%
	500 kc/s	5000 c/s	80%

In the above cases where the maximum depth which may be used is less than 80%, the modulation should be set as follows:- Note the input voltage required at 400 c/s (using EXTERNAL MOD. DIRECT), by the methods previously described, to produce the desired modulation depth. Then apply this same voltage at the higher modulation frequency; the resulting peak modulation will not be in error by more than 5% in most cases.

4. MAINTENANCE

4.1. Valves. All valves are of standard commercial types, with 4 volt heaters, as under :-

- Triodes (3) = AC/P or ML4 - 5 pin.
- Rectifier (1) = UU5 or MU 12/14 - 4 pin.

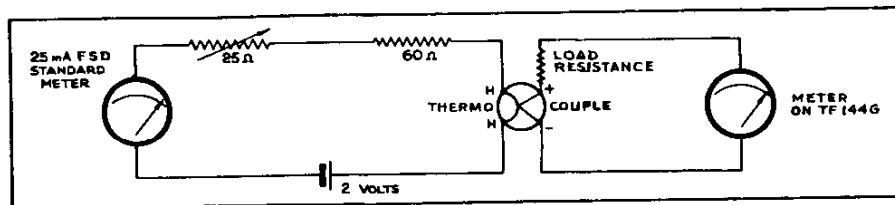
When replacing the R.F. oscillator, care should be taken that no serious disturbance of frequency calibration results. As the effect of such a change is likely to be more pronounced at the highest frequencies, a valve should be selected which introduces the least possible error at 25 Mc/s and which, also, is capable of giving the full normal output. Any departure from calibration on the part of the PERCENT MOD. dial as a result of replacing the R.F. oscillator valve will normally fall within the limits specified.

4.2 Contacts. All contacts are designed to have a self-cleaning action. Should symptoms of poor contact develop due to infrequent use, the best treatment is to operate the control in question a number of times until the trouble disappears.

- 7 -

4.3. Thermocouple Replacement. A spare thermocouple Type TA 13634 is supplied with each instrument, mounted on the outside of the multiplier cover plate, and replacement instructions will be found on the adjacent slide wire cover. All spare thermocouples have already been adjusted during manufacture and no further adjustments are normally needed; if required, however, a check may be made with the H terminals disconnected from the instrument and energised from a cell as shown below. The current required to produce deflection to the SET CARRIER mark (nominally 20mA) should lie between the limits 19.5mA and 20.5mA - if not, adjust the load resistance joined to the + terminal of the couple.

The increase in current for deflection to the SET MODULATION mark should lie between +13.8% and +16.2%. If outside of these limits, use as SET MODULATION mark the meter reading obtained with when an increase of 15% is applied in excess of the measured SET CARRIER figure.



The accuracy of the output voltage calibration of the Signal Generator depends directly, of course, on the accuracy of measurement of the standardising current. A B.S.I. 25 mA. D.C. meter will provide sufficient accuracy for normal purposes.

4.4 Exchange of Coil Units. In special cases additional coil units (each unit carrying two ranges) are supplied to extend the frequency cover of the instrument. These extra units, which are calibrated in terms of degrees on the frequency dial, must be substituted in the coil-drum for a unit or units covering a standard range. To make this exchange withdraw the instrument from its case and remove the cover-plate from the rear of the R.F. oscillator screening box. Next remove the horizontal strip carrying the rear bearing of the coil-drum shaft and also the two 2 BA nuts on the coil-drum. With the drum turned to such a position between ranges that the contacts are free, it can be withdrawn as a whole. Individual coil units are affixed to the drum by two 4 BA. screws at one end and a nut on a 4 BA stud at the other.

4.5 Service. Should it become necessary to return the instrument for service at any time, our Service Section will be assisted by the following procedure:-

- (1) Write to - Service Department
Marconi Instruments Ltd.

LONDON,
ENGLAND

giving the fullest possible details of the fault or of the service required and quoting the Type number and Serial number of the instrument as engraved on the panel.

- (2) Send the instrument complete with accessories and Instruction Book suitably packed to the above address and include a copy of the above letter describing the fault. This information will facilitate the work of our Service Section and expedite the return of the instrument.

5. SPECIFICATION

5.1 STANDARD SIGNAL GENERATOR TYPE TF.144G

CARRIER FREQUENCY RANGE:.....85 kc/s to 25 Mc/s in eight ranges

INCREMENTAL CONTROL:.....Range: at 1 Mc/s \pm 1%. Discrimination: 0.02% frequency change (approx.)

OUTPUT VOLTAGE:.....Continuously variable from 1 microvolt to 1 volt. The output level in dB above 1 microvolt is also directly indicated.

Accuracy.....Below 4.5Mc/s: \pm 10% \pm 0.2 μ V.
4.5 to 15 Mc/s: \pm 15% \pm 0.3 μ V.
15 to 25 Mc/s: \pm 25% \pm 0.5 μ V.

OUTPUT IMPEDANCE:.....1 microvolt to 100 millivolts:- 10 Ω
100 millivolts to 1 volt:- 52.5 Ω

INTERNAL MODULATION:.....An internal 400 c/s Oscillator provides modulation up to 75%.

Accuracy..... \pm 3% modulation depth.

EXTERNAL MODULATION:.....External modulation may be applied directly to the primary of the modulating transformer or to the grid of the modulating valve.

Input Impedance:.....Direct:- 5,000 Ω approx. Amplified:- 1M Ω approx.

Input for 40% Mod:.....Direct:- 30 volts approx. Amplified:- 3 volts approx.

Frequency Characteristic:.....Direct at 1 Mc/s:- \pm 1dB from 30 to 10,000 c/s. Amplified or direct at any radio frequency between 500 kc/s and 25 Mc/s: \pm 2.5dB from 50 to 10,000 c/s. The frequency characteristic deteriorates at greater modulation depths and the latter are limited at low radio frequencies as tabulated on Page Six.

FREQUENCY MODULATION:.....Varies with tuning capacity and range. At 30% modulation the frequency modulation averages about 25 parts in 100,000.

HUM MODULATION:.....Not exceeding 0.2% at 50 c/s.

POWER SUPPLY:

Mains:.....200 - 250 volts, 40 - 100 c/s. Consumption approximately 40 watts.

Batteries: (External).....4 volts 3.5 amps. H.T:- 200 volts 30 mA max.

DIMENSIONS:.....29 $\frac{1}{4}$ " x 12 $\frac{1}{4}$ " x 10" (over projections)

WEIGHT:.....93 lbs. approx, with accessories.

5.2 SPECIAL INSTRUMENTS: Below are tabulated, by their type numbers, Signal Generators of the TF.144G. class which incorporate certain departures from standard. With the exception of the variations described, these instruments substantially conform to the standard specification.

TYPE NUMBER	DEPARTURE FROM STANDARD
TF.144G/1	Frequency range 20 kc/s to 8 Mc/s
TF.144G/2	Frequency range 40 kc/s to 15 Mc/s
TF.144G/3	Standard range covering 85 kc/s to 25 Mc/s, but with overlap linking the six upper ranges.
TF.144G/4	1,000 c/s internal modulation in place of 400 c/s
TF.144G/5	Frequency Range 20 kc/s to 8Mc/s and Attenuator or Multiplier modified to have 150 Ω Output to operate with special terminating unit.
TF.144G/6	Special rack-mounting model with mains inlet at rear. Internal modulation at 1,000 c/s.

STANDARD SIGNAL GENERATOR. TYPE TF. 144G.

FOR SERVICE MANUALS
CONTACT:

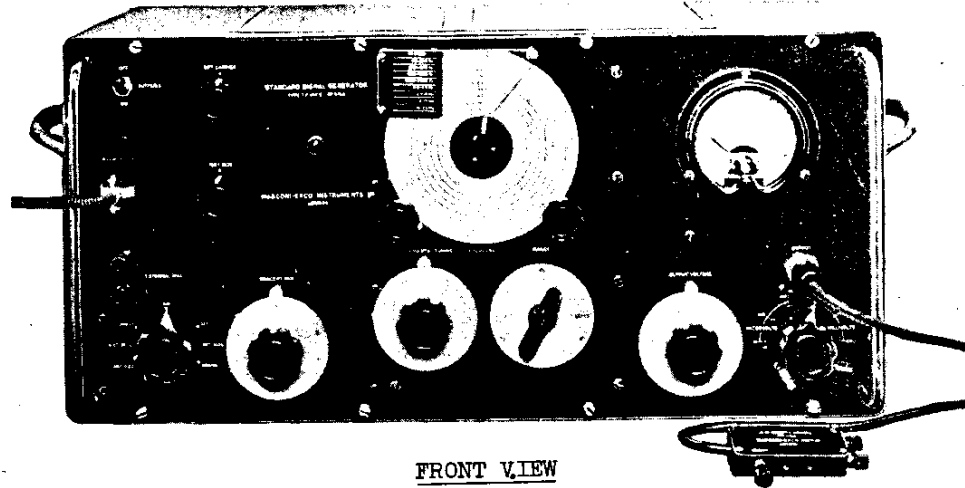
MAURITRON TECHNICAL SERVICES

www.mauritron.co.uk

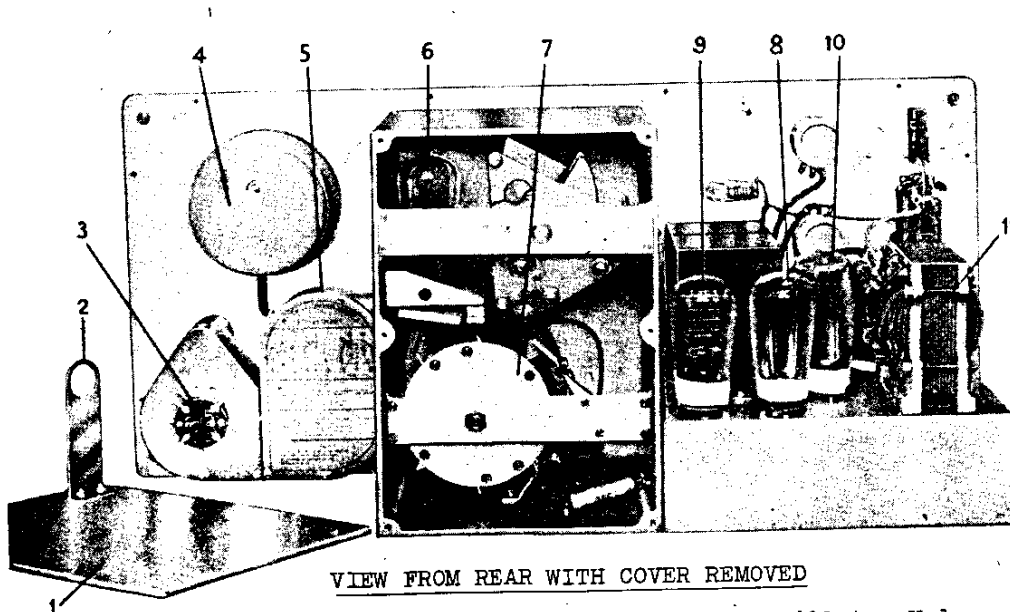
TEL: 01844 - 351694

FAX: 01844 - 352554

6. ILLUSTRATIONS



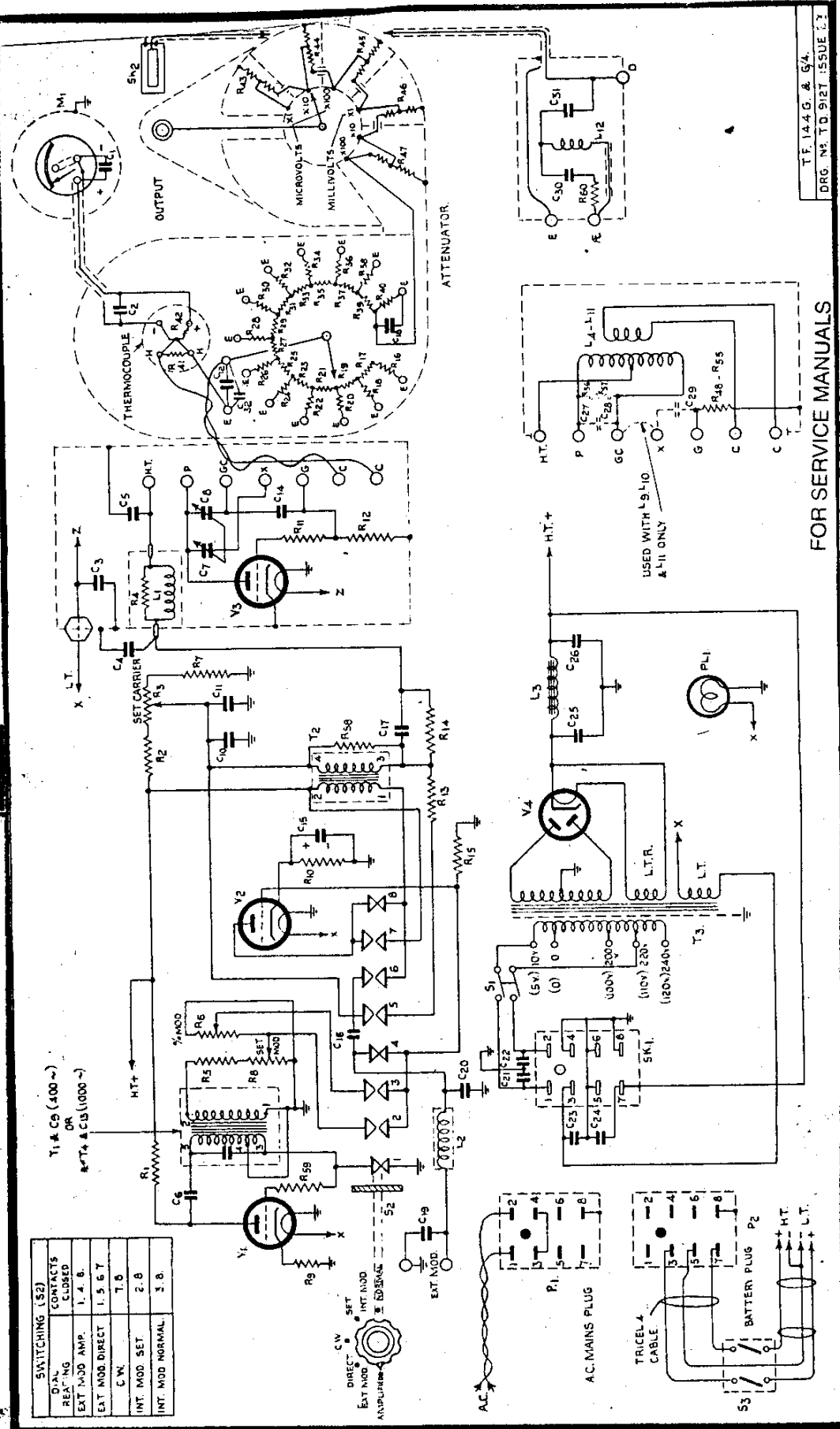
FRONT VIEW



VIEW FROM REAR WITH COVER REMOVED

- | | |
|-----------------------------------|---------------------------|
| 1. Oscillator Cover. | 6. R.F. Oscillator Valve. |
| 2. Valve Retaining Clip. | 7. Coil Drum. |
| 3. Spare Thermocouple. | 8. Modulator Valve. |
| 4. Output Meter. | 9. A.F. Oscillator Valve. |
| 5. Thermocouple Replacement Data. | 10. Rectifier. |
| | 11. Mains Transformer. |

SWITCHING (S2)	
DIAL READING	CONTACTS CLOSED
EXT MOD AMP	1.4. B.
EXT MOD DIRECT	1.5. 5. 7.
C.W.	7.0.
INT. MOD. SET	2.8.
INT. MOD. NORMAL	3.0.



T.F. 1A4.G. & G/4.
 DRG. NO. TD. 912T. ISSUE 1.2

FOR SERVICE MANUALS
 CONTACT:

MAURITRON TECHNICAL SERVICES
 www.mauritron.co.uk
 TEL: 01844 - 351694
 FAX: 01844 - 352554

FOR SERVICE MANUALS
CONTACT:
MAURITRON TECHNICAL SERVICES
www.mauritron.co.uk
TEL: 01844 - 351694
FAX: 01844 - 352554

1 DRG. No. TD 9127 ISSUE 2

RESISTANCES R			RESISTANCES R			CONDENSERS C			TRANSFORMERS T			
INDEX	VALUE	REF. N°	INDEX	VALUE	REF. N°	INDEX	VALUE	REF. N°	INDEX	VALUE	REF. N°	
R1	10,000 Ω ± 10%	10W/27	R.33	22.05 Ω	10W/1126	C1	1.1 μF ± 20%	10C/1126	T1	OSCILLATOR COIL	10C/1654	10K/1654
R2	3,300 Ω ± 10%	10W/6324	R.34	500 Ω	SPECIAL	C2	100 μF ± 25%	10C/1123	T2	MODULATION TRANSFORMER	10C/1653	10K/1653
R3	25,000 Ω ± VAR	10W/7448	R.35	22.05 Ω	SPECIAL	C3	1.1 μF ± 20%	10C/1126	T3	MAINS TRANSFORMER 1/200V OR 240V	10C/1652	10K/1652
R4	10,000 Ω ± 10%	10W/1481	R.36	500 Ω	SPECIAL	C4	100 μF ± 15%	10C/96	T4	OSCILLATOR COIL 1000~		
R5	1,000 Ω ± 10%	10W/1678	R.37	22.05 Ω	SPECIAL	C5	100 μF ± 2%	10C/3961		INDUCTANCES "L"		
R6	50,000 Ω VAR	10W/1845	R.38	500 Ω	SPECIAL	C6	1.1 μF ± 15%	10C/14194	L1	H F CHOKE	10C/14156	10C/14156
R7	22,000 Ω ± 10%	10W/1614	R.39	22.05 Ω	SPECIAL	C7	305 μF VARIABLE	10C/14194	L2	H F CHOKE	10C/14193	10C/14193
R8	5,000 Ω VAR	10W/7752	R.40	570 Ω	SPECIAL	C8	125 μF VARIABLE	10C/14157	L3	SMOOTHING CHOKE	10C/4038	10C/4038
R9	1,000 Ω ± 10%	10W/1878	R.41	DETERMINE IN CALIBRATION		C9	25 μF 350 V W		L4	TUNING COIL 15 - 25 MC/S		10V/576
R10	470 Ω ± 10%	10W/875	R.42	1 Ω	SPECIAL	C10	1 μF ± 15%	10C/14194	L5	TUNING COIL 8 - 15 MC/S		
R11	27 Ω ± 10%	10W/1743	R.43	22 Ω ± 11 Ω		C11	1 μF ± 15%	10C/1126	L6	TUNING COIL 4.5 - 8 MC/S		10V/577
R12	22 MEG ± 10%	10W/287	R.44	99 Ω ± 12.22 Ω	SPECIAL	C12	25 μF 20% 350 V W	10C/3383	L7	TUNING COIL 2.5 - 4.5 MC/S		
R13	10,000 Ω ± 10%	10W/27	R.45	99 Ω ± 12.22 Ω	SPECIAL	C13	40 μF ± 2%	10C/14196	L8	TUNING COIL 1300 - 2500 KC/S		
R14	3,300 Ω ± 10%	10W/6324	R.46	99 Ω ± 12.22 Ω	SPECIAL	C14	100 μF ± 2%	10C/0569	L9	TUNING COIL 500 - 1500 KC/S		10V/578
R15	1 MEG ± 10%	10W/130	R.47	99 Ω ± 12.22 Ω	SPECIAL	C15	100 μF ± 2%	10C/12423	L10	TUNING COIL 200 - 500 KC/S		10V/579
R16	94.5 Ω		R.48	10,000 Ω ± 10%	10W/27	C16	4 μF ± 15%	10C/2809	L11	TUNING COIL 85 - 200 KC/S		10C/14192
R17	22.05 Ω		R.49	5,000 Ω ± 10%	10W/1683	C17	1.1 μF ± 20%	10C/1126	L12	COL. 50T. 36.5 MG. D.S.C. CU 7/6 DIA		
R18	500 Ω		R.50	22,000 Ω ± 10%	10W/1614	C18	30 μF ± 20% NOM. DET IN CAL	10C/10946		VALVES "V"		
R19	22.05 Ω		R.51	27,000 Ω ± 10%	10W/1482	C19	100 μF ± 15%		V1	VALVE M.L. 4	10E/17	10E/17
R20	500 Ω		R.52	27,000 Ω ± 10%	10W/1482	C20	100 μF ± 15%		V2	VALVE M.L. 4	10E/17	10E/17
R21	22.05 Ω		R.53	47,000 Ω ± 10%	10W/339	C21	100 μF ± 5%		V3	VALVE M.L. 4	10E/17	10E/17
R22	500 Ω		R.54	47,000 Ω ± 10%	10W/339	C22	100 μF ± 5%		V4	VALVE M.L. 12/14	10E/17	10E/17
R23	22.05 Ω		R.55	47,000 Ω ± 10%	10W/339	C23	1.1 μF ± 20%			MISCELLANEOUS		10E/9B00
R24	500 Ω		R.56	47,000 Ω ± 10%	10W/339	C24	1.1 μF ± 20%		S1	SWITCH DP. ON - OFF	10F/391	10F/391
R25	22.05 Ω		R.57	27 MEG ± 10%	10W/289	C25	15 μF ± 20%		S2	SWITCH 5 POS. 8 WAY	10F/2316	10F/2316
R26	500 Ω		R.58	47,000 Ω ± 10%	10W/289	C26	15 μF USE WITH L10 ONLY		S3	SWITCH DP. ON - OFF	10F/2316	10F/2316
R27	22.05 Ω		R.59	200 Ω ± 2%	10W/339	C27	15 μF USE WITH L10 ONLY		M1	METER		
R28	500 Ω		R.60	390 Ω ± 5%	10W/382	C28	100 μF USE WITH L11 ONLY		P1/P2	PLUG 8 WAY. FLAT PIN TYPE		
R29	22.05 Ω					C29	400 μF ± 2%		S1	SOCKET 8 WAY. FLAT PIN TYPE		
R30	500 Ω					C30	200 μF ± 2%		S2	SOCKET SINGLE POLE CONCENTRIC	10N/17955	10N/17955
R31	22.05 Ω					C31	200 μF ± 2%		PL1	PILOT LAMP 6.5V. 3 AMP		5L
R32	500 Ω					C32	20 μF ± 20% NOM. 35T. CAL.					

T.D.9127 ISSUE 2 T.F.14.04.84