MARCONI
INSTRUMENTS

EBX 1064B/6
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PRELIMINARY

OPERATING INSTRUCTIONS

for

V.H.F. SIGNAL GENERATOR

TYPE TF 1064B/6

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DRAWINGS	Drg. No.
Mains Input Connections	TLC 28392
Block Schematic Diagram	XD 37038/6
Circuit Diagram and Component Lists	XD 36577

1 GENERAL INFORMATION

1.1 INTRODUCTION

The V.H.F. Signal Generator Type TF 1064B/6 is one of a series of composite r.f., i.f. and a.f. signal sources covering the mobile radio bands. Although it forms a self-contained unit it is designed as a companion instrument to the Transmitter and Receiver Output Test Set Type TF 1065 (Series). Together, Signal Generator and Test Set provide comprehensive facilities for testing f.m. mobile transmitter/receiver equipment, their compactness and portability making them particularly suitable for field use. Receiver sensitivity and image rejection, bandwidth and i.f. alignment, signal-to-noise ratio and quieting, discriminator linearity and symmetry, are examples of tests that can be made using the Signal Generator in conjunction with the TF 1065 or other suitable output indicator.

1.2 DATA SUMMARY

R.F. SIGNAL

Frequency

Ranges:	(A) 30 to 50 Mc/s (B) 118 to 185 Mc/s (C) 450 to 470 Mc/s
Tuning Control:	The main dial has a total scale length of approximately 27 inches.
Calibration Accuracy:	0.5%.
Frequency Stability:	The generator is designed for use with narrow-band receivers and has good short-term stability.
Attenuator Reaction:	Negligible over the calibrated output range.
Incremental Frequency Control:	±25 kc/s on all ranges.

1.2 (continued)

R. F. SIGNAL (continued)

Incremental Accuracy:	Within ±20% of reading or ±2% of full scale, whichever is the greater.
Spurious Signals:	There are no sub-harmonics at carrier frequencies between 30 and 185 Mc/s; on the highest range the f/3 sub-harmoni is approximately 12 dB down.

Output

Output Level:	0.5 μV to 10 mV source e.m.f., continuously variable. The attenuator dial shows directly, and in decibels relative to 1 μV (a) source e.m.f. and (b) volts across a 50 Ω load. Uncalibrated higher outputs of at least 200 mV (100 mV across 50 Ω) are also obtainable.
Output Accuracy:	2 dB.
Source Impedance:	Nominally 50 Ω.
V.S.W.R.:	Better than 2.0. Using 20-dB Pad TM 5573, v.s.w.r. is better than 1.15.
Stray Radiation:	Permits full use of lowest output.

MODULATION (on r.f. signal only)

Internal 1,000 c/s F.M.:	Fixed deviation, 10 kc/s. Variable deviation, 0 to 15 kc/s.
External F.M.:	At the lower modulation frequencies, up to 10 V input across 600 Ω gives 10 kc/s deviation.

1.2 (continued)

R.F. SIGNAL (continued)

Deviation Accuracy:	In general, better than 10% for fixed deviation and 10% of full-scale for variable deviation.
Spurious A.M. on F.M.:	Typically, less than 1% modulation depth at maximum deviation.
Residual F.M.:	The f.m. deviation due to hum, noise and microphony is typically less than 0.001% of carrier frequency or 100 c/s whichever is the greater, in a quiet location.

I.F. SIGNAL

Crystal Frequencies:	The i.f. crystal oscillator will function at any frequency between 290 kc/s and 16 Mc/s. Five switch-selected sockets are provided for crystals. Crystals are not supplied, but may be ordered separately - see Accessories Available.
Frequency Accuracy:	Crystal tolerance: 0.01% when working into a 30 pF circuit. Each crystal can be adjusted to higher accuracy by associated trimmer.
Output Level:	Greater than 100 mV across a 1 kΩ load.
Modulation:	The crystal oscillator can be amplitude modulated by internal 1,000 c/s source for signal identification.

A.F. SIGNAL

Frequency:	1,000 c/s.
Output Level:	0 to approx. 2 V e.m.f. continuously variable.

1.2 (continued)

POWER SUPPLY:	200 to 250 V and 100 to 150 V, 40 to 100 c/s; 30 W.			
DIMENSIONS & WEIGHT:	Height	Width	Depth	Weight
	8½ in (21.5 cm)	12 in (31 cm)	8½ in (21.5 cm)	26 lb (12 kg)

1.3 ACCESSORIES AVAILABLE

I.F. Oscillator Crystals: Miniature metal-cased, 2-pin Marconi Type QO 1670 Series; frequencies as specified, subject to availability.

Output Lead Type TM 4969: comprises a 50 Ω coaxial cable, 42 inches long and terminated at both ends with BNC plugs.

50 to 75 Ω Matching Unit Type TM 5569; for use when testing 75 Ω apparatus. This series unit, inserted between the Signal Generator and the load, converts the output impedance of the Generator to 75 Ω. Fitted with a Type BNC input socket and a Belling-Lee coaxial output plug.

I.F. Level Control, Type TM 5570; for use when a reduced i.f. output is required, this accessory consists of a variable potentiometer mounted in a metal case. The unit is fitted with a Type BNC plug and socket to facilitate its insertion between the Signal Generator and the apparatus under test.

20 dB Pad, Type TM 5573; this is a single π network housed in a small metal cylinder, with a Type BNC plug at one end and a Type BNC socket at the other end. In addition to providing 20 dB of attenuation, this pad improves the output v.s.w.r. of the Signal Generator.

6 dB Pad, Type TM 5573/1; this is also a single π network, and as with the 20 dB pad above, is fitted with a Type BNC at one end and a Type BNC socket at the other. This pad also improves the output v.s.w.r., although not to the same degree as the 20 dB Pad.

2 OPERATION

2.1 INSTALLATION

V.H.F. Signal Generator, Type TF 1064B/6 can be adjusted to allow operation from any 40 c/s to 100 c/s power supply in the voltage ranges 100 to 150 V and 200 to 250 V.

Full instructions for adjusting the internal power unit to suit the local supply are given in Section 4.2, MAINS INPUT ARRANGEMENTS.

2.2 SWITCHING ON

BEFORE SWITCHING ON, be sure that the instrument is correctly adjusted to suit the particular mains supply to which it is to be connected; then proceed as follows :-

(1) Check that the mechanical zero of the meter is correctly set.

(2) Make connection to a suitable supply socket by means of the mains lead provided.

(3) Turn the SUPPLY switch ON and note that the pilot lamp glows. The SUPPLY switch is located on the rear panel of the instrument.

(4) Before proceeding further, allow ten or fifteen minutes to elapse for the internal circuits to warm up; if a particularly high order of stability is required, this time should be extended to, say, one hour.

2.3 CONNECTORS

The R.F. and I.F. panel outlets are both 50 Ω type BNC sockets. Connection to these outlets can be made by means of the two plugs supplied with the instrument; these are 50 Ω type BNC plugs, Transradio Ltd. (Gt. Britain) Code No. BN.1/5, U.S. Military No. UG-88/U. A recommended cable for use with these plugs is U.S. type RG-58A/U.

2.4 TUNING THE INSTRUMENT

The r.f. generator tuning ranges are as follows :-

Range A : 30 to 50 Mc/s
Range B : 118 to 185 Mc/s
Range C : 450 to 470 Mc/s

To obtain the required output frequency :-

(1) Select the appropriate frequency range by means of the three-position RANGE switch.

(2) Set the incremental frequency dial to zero. The calibration of the main frequency dial is correct only when the incremental frequency dial is in this position.

(3) Rotate the main frequency dial until the desired frequency marking on the scale corresponds with the cursor hair-line.

Using the Incremental Frequency Control

This control may be used to make accurately known carrier frequency changes up to plus or minus 25 kc/s on all three r.f. bands. The incremental dial is calibrated every 2.5 kc/s.

The instrument should be tuned as described above, after which the incremental frequency control may be rotated to make increments or decrements in the output frequency, as required.

In order to obtain maximum accuracy of incremental tuning, it is recommended that the procedure detailed below be adopted; this nullifies slight frequency inaccuracies due to hysteresis effects in the ferrite core of the reactor T3.

(1) Before setting the incremental dial to the required point, turn the dial to maximum deviation from zero, on the appropriate side ('+' or '-') of the zero line.

(2) Turn the dial back to the zero line.

(3) 'Retune- by means of the main frequency control - to the centre frequency of the equipment under test.

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2.4 (continued)

(4) Now turn the dial from the zero point to the desired incremental point on the appropriate side ('+' or '-') as in (1).

For further increments or decrements away from zero, simply turn the dial to consecutive points. For decrements or increments back towards zero from a previously-set incremental point, the complete procedure described in (1) to (4) above should be carried out.

2.5 SETTING UP FOR C.W. OUTPUT

To use the r.f. generator with an unmodulated output :-

(1) Set the CARRIER switch to C.W.

(2) Tune to the desired radio frequency in the manner described in Section 2.4.

(3) Adjust the SET CARRIER control to bring the pointer of the CARRIER LEVEL meter exactly to the reference mark - at approximately two thirds of full scale.

Note : The carrier level should be readjusted whenever the pointer deviates from the reference mark.

(4) Adjust the r.f. output to the desired level by means of the calibrated attenuator control.

The attenuator dial has two scales, one calibrated directly in voltage units and the other in decibels relative to 1 μV. The associated cursor is engraved with two hair lines marked O/C and LOADED respectively. When using the line marked O/C the instrument can be regarded as a zero-impedance voltage source, generating the e.m.f. indicated on the attenuator dial, in series with a 50 Ω resistor. The line marked LOADED is for use only when the instrument is working into a matched (50 Ω) load; in this condition the line indicates the actual p.d. developed across the matched load.

2.5 (continued)

The attenuator is calibrated up to 10 mV, e.m.f., but greater output can be obtained by adjusting the dial over the blank section above 10 mV. When full output (approximately 200 mV) is required, turn the attenuator and the SET CARRIER control to maximum output. Under these conditions the meter indication should be ignored.

NOTE : It is recommended that, where possible, the higher output levels should not be used over long periods, in order to ensure maximum oscillator valve life.

2.6 SETTING UP FOR F.M. OUTPUT

Internal 1 kc/s frequency modulation is available on all the r.f. ranges. A fixed deviation of 10 kc/s, or a deviation which is variable up to approximately 15 kc/s, may be obtained, depending on the position of the CARRIER switch. A further position of the CARRIER switch allows the r.f. carrier to be frequency-modulated from an external source.

To set up the instrument for f.m. operation :-

(1) Switch the front-panel A.F. OSC. switch to ON and turn the CARRIER switch to F.M. 1 for variable deviation, or to F.M. 2 for 10 kc/s fixed deviation. Alternately, if the a.f. modulating signal is to be provided from an external source, set the CARRIER switch to EXT. F.M.

(2) Tune to the desired carrier frequency in the manner described in Section 2.4.

(3) Adjust the SET CARRIER control to bring the pointer of the CARRIER LEVEL meter exactly to the reference mark - at approximately two thirds of full-scale.

Note : The carrier level should be readjusted whenever the pointer deviates from the reference mark.

2.6 (continued)

(4) If variable internal f.m. is being used, set the DEV. kc/s control to the desired deviation figure. If an externally-derived modulating signal is to be used, apply the a.f. signal between the A.F. and E terminals on the front panel. These terminals present a load impedance of approximately 600 Ω to the external source.

(5) By means of the attenuator control, adjust the output voltage in the manner previously described (see Section 2.5.).

2.7 SPECIAL R.F. OUTPUT CONDITIONS - USE OF OPTIONAL ACCESSORIES

The accessories mentioned in this section are described in Section 1.

2.7.1 Voltage Developed across Non-Matching Load

The nominal source impedance of the r.f. generator is 50 Ω. Assuming that the connecting lead to the equipment under test has a characteristic impedance of 50 Ω, the source impedance at the output end of the lead can also be regarded as 50 Ω.

When the load formed by the equipment under test is 50 Ω (resistive), the voltage developed across it is indicated under the LOADED line of the attenuator cursor. If, however, the load has an impedance other than 50 Ω, recourse must be made to the general expression

$$\text{voltage across load} = \frac{E_S \times Z_L}{Z_S + Z_L}$$

where E_S is the source e.m.f., i.e. open-circuit voltage, indicated by the attenuator,

Z_L is the load impedance, which may consist of resistive and reactive components, and

Z_S is the source impedance - in this case 50 Ω resistance.

2.7.1 (continued)

In particular, if the load is predominantly resistive and has a value R_L, then

$$\text{voltage across load} = \frac{E_S \times R_L}{50 + R_L}$$

2.7.2 Increasing the Source Impedance

If it is necessary to present the equipment under test with a source resistance of more than 50 ohms, the source resistance of the r.f. generator can be increased to the required value R_R by connecting a single resistor R_A in series between the output lead and the equipment under test. The value of the resistor which must be added is

$$R_A = R_R - 50\ \Omega$$

When a load R_L is connected to this arrangement

$$\text{voltage across load} = \frac{E_S \times R_L}{50 + R_A + R_L}$$

where E_S is the source e.m.f. indicated by the attenuator at the line marked O/C.

If it is required to raise the source impedance to 75 Ω, the 50 to 75 Ω Matching Unit Type TM 5569 enables the above modification to be made easily and in a manner suitable for v.h.f. conditions.

2.7.3 Reducing the Source Impedance

If it is necessary to present the equipment under test with a source resistance of less than 50 Ω, then the output resistance of the r.f. generator can be made equal to the required value R_R by shunting the output cable, at the load end, with a resistor R_B, where

$$R_B = \frac{50 \times R_R}{50 - R_R}\ \Omega$$

2.7.3 (continued)

Under these conditions, the effective source e.m.f., i.e. open-circuit voltage is,

$$E_{eff.} = \frac{E_S \times R_B}{50 + R_B}$$

where E_S is the source e.m.f. indicated by the attenuator at the line marked O/C.

When a load R_L is connected to this arrangement

$$\text{voltage across load} = \frac{E_{eff.} \times R_L}{R_R + R_L}$$

2.7.4 Use of External Attenuator Pads

A separate 50 Ω fixed attenuator may be fitted between the output leads of the r.f. generator and an equipment under test in order to extend the lower end of the output range, or to ensure that the load is fed from a source which is known to be 50 Ω (resistive) to a high degree of accuracy. The 20 dB Pad Type TM 5573 and the 6 dB Pad Type TM 5573/1 may be employed for these purposes.

By using the 20 dB Pad, the calibrated voltage range of the r.f. generator is modified so that it is 0.05 μV to 1 mV. This method of obtaining very low levels has the advantage that stray signals picked up by the connecting lead are attenuated by the pad before reaching the equipment under test.

The source impedance of the r.f. generator is nominally 50 Ω, but some departure from this value may occur, particularly at the load end of the output cable. By adding one of the Pads at the load end, you can ensure that the equipment under test is fed from a source impedance very close to 50 Ω. The 20 dB Pad is the more effective for this purpose, but the 6 dB Pad may be preferred since it imposes less attenuation. When either of these Pads is used, remember that the e.m.f. read from the attenuator on the V.H.F. Signal Generator must be divided by a factor of 10 or 2, as appropriate, when determining the e.m.f. applied to the load.

2.8 A.F. OUTPUT

In addition to providing a modulating signal for the r.f. and i.f. oscillators, the a.f. oscillator delivers a separate 1 kc/s output to the terminals marked A.F. and E. To obtain this 1 kc/s output, turn the CARRIER switch to any of its first four positions and the A.F. OSC. switch to ON. The open-circuit output voltage is continuously variable up to approximately 2 V by means of the DEV. kc/s control. The source impedance is about 22 kΩ.

2.9 I.F. OUTPUT

A fixed crystal-controlled output is available at the I.F. socket on the front panel. The frequency is determined by the I.F. CRYSTAL control, which has six positions. Any one of five crystals may be selected by this control, while in the extreme counter-clockwise position the i.f. oscillator is switched off.

2.9.1 Oscillator Crystals

Crystals are not automatically supplied with the instrument, but are available to special order, as detailed in Section 1 - ACCESSORIES AVAILABLE.

When first setting up, note the frequencies of the five crystals fitted in the numbered sockets at the rear of the instrument; the socket numbers correspond to the engraved switch positions on the front panel. The crystal frequencies should be marked on the small plate fitted below the attenuator dial.

Each crystal frequency can be adjusted by means of the trimmer beside the holder. The range of adjustment is of the order of 50 parts in 10^6 (.005%).

The i.f. oscillator may be used alone, or in conjunction with the r.f. generator applied to the aerial inlet of a receiver under test. In the latter case, with the i.f. output loosely coupled to the i.f. amplifier of the receiver, when the r.f. generator is adjusted to the radio frequency to which the receiver is tuned, a beat note will be produced. Since the beat occurs when the r.f. signal causes a resultant

2.9.1 (continued)

i.f. which coincides with the crystal-controlled frequency of the i.f. oscillator, it serves as a reference point about which the resultant i.f. can be adjusted by means of the r.f. generator incremental control. This control can then be used for plotting and adjusting the overall response of the receiver (usually determined by the i.f. circuits).

It will be appreciated that by using the method just described with the receiver having a crystal-controlled local oscillator, the r.f. generator is set to the receiver channel frequency with a degree of precision normally associated with exact crystal control; although the accuracy of the i.f. reference signal is that of the simple crystal oscillator in the instrument, in terms of frequency error it corresponds to a considerably greater degree of accuracy at the receiver r.f. input.

2.9.2 Amplitude Modulation of I.F. Output

With the A.F. OSC. switch set to ON, the i.f. output is modulated at low level by a 1,000 c/s tone. The depth of modulation is unaffected by the setting of the DEV. kc/s control and this facility is intended for signal identification purposes only.

3

TECHNICAL DESCRIPTION

It is suggested that the following sections should be read in conjunction with the Block Schematic and Circuit Diagram included at the end of this handbook.

3.1 R.F. GENERATOR

The design of the r.f. generator eliminates the necessity for r.f. contacts in the range-switching circuits. Independent oscillator stages are used for each of the three r.f. bands, and the final tuned circuits are all permanently coupled to a common piston attenuator which controls the output level. The appropriate frequency range is selected by switching the h.t. supply to the oscillators.

Signals in the two lower frequency ranges are obtained directly from separate Colpitts oscillators, each of these using one half of double triode V4. Frequency modulation of each oscillator is provided by a ferrite reactor T3 having separate r.f. windings tapped across the two oscillator tuning inductors L14 and L15.

The 450 to 470 Mc/s range employs a frequency-multiplier system. A 150 to 156.6 Mc/s oscillator, V2, drives an x3 multiplier, V3, a common-cathode double-triode in push-pull circuit. Its low-Q anode circuit, with fixed tuning, couples this stage to the piston attenuator. V2 can be frequency-modulated from the internal a.f. oscillator or from an external source.

The filament supplies to the r.f. oscillator valves are derived from two sources: an a.c. supply and a regulated d.c. supply. These supplies are switched with the frequency RANGE switch, so that the oscillator for the frequency band actually in use is supplied from the regulated supply whilst the oscillator valves not in use are supplied from the a.c. source. The d.c. heater supply helps to keep drift and spurious f.m. to a minimum.

3.2 FREQUENCY MODULATION & INCREMENTAL FREQUENCY CONTROL

Frequency modulation can be applied internally from the 1,000 c/s a.f. oscillator, V5A, or from an external a.f. source.

3.2 (continued)

Bands A and B

Internal f.m. and incremental tuning on the two lower bands is accomplished by means of a ferrite reactor, T3. The oscillator coils, L15 and L14, of the two ranges concerned are partially shunted by small inductors forming part of the reactor. These latter coils are wound on a common ferrite core. This core is included in the megnetic circuit of a modulation winding which magnetically biases the reactor core to a suitable part of its permeability characteristic; as a result, the inductances of the r.f. coils vary in accordance with the instantaneous current in the modulator winding. A signal from the internal 1,000 c/s oscillator and an adjustable direct current are simultaneously applied to the modulator winding. The direct current causes the biasing of the ferrite core, and also, by adjustment, provides the incremental frequency control; the applied a.f. signal produces the frequency modulation.

The deviation and incremental frequency range are held constant throughout both the lower frequency bands by the action of a variable correcting potentiometer, RV4, which is ganged to the main tuning capacitor. The levels of the a.f. modulating voltage and the d.c. applied to the potentiometer are determined on each range by switched series preset resistors, RV10 and RV11, while the load presented via the potentiometer is kept reasonably constant, for all positions of its slider, as a result of R29 or R37 at one end balancing R30, C35, and T3 at the other end; C35 is employed to compensate for the reactance of T3 at the modulation frequency of 1,000 c/s. Resistors RV14 and RV15, which are virtually short-circuited at 1,000 c/s by C46 and C48 respectively, provide means of independently setting up the sensitivity of the incremental control on each of the two frequency ranges.

The 1,000 c/s signal generated by the a.f. oscillator is developed across R16 and RV3 in series, and also R47, R6, and R7 in series. The voltage appearing at the slider of RV3 is used to provide a variable deviation from zero to approximately 15 kc/s when the CARRIER switch is set to F.M.1. The voltage appearing at the junction of R47 and R6 is employed to generate a fixed deviation of 10 kc/s when the CARRIER switch is set to F.M.2; RV6 is employed to set this voltage. The direct current for the incremental frequency control and biasing purposes is obtained, via R5, from potentiometer RV2 which is connected in series with R42 across the h.t. supply; R5 isolates the modulating signal from the d.c. source.

3.2 (continued)

450 to 470 Mc/s Band

On this range, incremental tuning is achieved by varying the anode voltage of the 150 to 156.6 Mc/s oscillator V2, by means of RV2 which, via R5 and R19 with RV8 in parallel, modifies the h.t. voltage applied to V2 anode.

Frequency modulation is accomplished by means of variable-capacitance diode, MR6. The modulating voltage is applied to MR6 via C37, RV12 and R64; C37 isolates the modulator diode from the incremental frequency control voltage, and RV12 allows the level of modulating voltage to be set. Deviation is held constant throughout the band by the action of RV4 which is ganged to the main tuning control and, in conjunction with R61 and R10, determines the standing bias voltage applied to MR6.

3.3 CARRIER LEVEL MONITOR

The r.f. input to the piston attenuator is monitored by a crystal-diode voltmeter, which is inductively coupled by L16 to the launching coils. The voltmeter circuit comprises a silicon rectifier, MR4, feeding the built-in meter via switched series variable resistors RV16, RV17, and RV18. These variable resistors are adjusted to provide correct carrier-level indication on all ranges.

3.4 OUTPUT ATTENUATOR

The piston attenuator is of the mutual-inductance type, in which the output is controlled by varying the distance between a launching coil and co-planar pick-up element mounted in a waveguide operated below its cut-off frequency.

The launching coil comprises one of the three anode-tuning inductors, L13, L14, or L15, depending on the frequency-band in use. The design is such that, for any one range, the coupling between the launching and pick-up coils is substantially independent of frequency. A 47Ω resistor of non-helical construction, R11, is used as the attenuator pick-up element.

3.5 I.F. OSCILLATOR

The i.f. oscillator uses one section of a double triode, V5, in a crystal-controlled circuit. A switch, SC, allows any one of a bank of five crystals to be brought into circuit. In the OFF position of the switch, the grid of V5 is returned to chassis so that the valve receives cathode bias from R32 - this bias is removed in the oscillating condition due to grid resistor R31 being returned to cathode. The crystal holders are accessible without removing the instrument from its case, and crystals of any frequency between 290 kc/s and 16 Mc/s can be plugged in. Trimmer capacitors C57 to C61 enable the frequency of each crystal to be adjusted independently. The output signal is available at a Type BNC coaxial socket on the front panel. The i.f. signal can be amplitude-modulated to a fixed depth by the internal a.f. oscillator, via C36 and R50, from the secondary winding on the a.f. oscillator transformer.

3.6 A.F. OSCILLATOR

The a.f. oscillator comprises a series-fed Hartley circuit, using the remaining section of double triode V5. In addition to providing a modulating signal for the r.f. and i.f. generator circuits, the output is fed to a pair of panel terminals via R59 and the potentiometer formed by R16 and the DEV. kc/s control RV3. The a.f. oscillator is switched off when the A.F. OSC. switch, SE, is in the OFF position.

3.7 POWER UNIT

A self-contained power unit is mounted on the rear panel of the instrument; interconnection between the power unit and the generator chassis is by means of an International Octal plug and socket, PL2 and SKT1.

The heater supplies to the r.f. oscillator valves are derived from one of two sources :- direct from winding LT1 on T1, or from a regulated d.c. supply. These supplies are switched with the RANGE switch, so that only the oscillator for the frequency band actually in use is supplied from the d.c. output. The heaters of the oscillator valves not in use are maintained in pre-heated condition by the raw a.c. l.t. supply. The i.f./a.f. oscillator valve, V5, heaters are supplied direct from LT1. The regulated l.t. supply is derived from LT2 via MR1 and transistor VT1; the transistor forms a series control element, and its base voltage is kept constant by the Zener diode MR5.

3.7 (continued)

H. T. is derived from a winding on T1 feeding metal rectifiers MR2 and MR3 in a full-wave circuit. Conventional series-regulation of the h. t. supply is provided by valves V1, V6 and V7.

The mains transformer, T1, has a double-wound primary, the two tapped sections of which can be connected in series or parallel to allow operation from a selection of supply voltages in the ranges 100 to 150 V and 200 to 250 V.

The mains supply is switched by means of double-pole switch SA, and both input lines are fitted with 0.5 A cartridge fuses.

4 MAINTENANCE

4.1 REMOVAL OF CASE - ACCESS TO COMPONENTS

Removing the Case

The instrument case is constructed from three parts : a front panel with its surround, carrying the main chassis and controls; a rear panel with its surround, on which the power unit is mounted; and a one-piece formed aluminium centre-section. Separating these parts involves the following procedure :-

(1) Place the instrument on its face, knobs downwards.

(2) Remove the two 2 BA coin-screws securing the rear panel and lift the latter, complete with the power unit, clear of the case. One screw is located immediately to the right of the SUPPLY ON/OFF switch, the other being at the top left-hand side, next to the i.f. crystal sockets.

(3) Separate the Internal Octal plug and socket connecting the power unit to the main chassis.

(4) The rear panel may now be set aside and the sheet-metal centre section removed from the generator.

Obtaining Access to the Power Unit Components

The components of the power unit are mounted on a small chassis attached to the rear panel. The 'top' of this chassis faces towards the front panel and, in order to obtain access to components mounted 'below chassis', it is necessary to separate the power unit from the rear panel. The procedure for doing so is as follows :-

(1) Unsolder the wires leading from the power unit to the two fuseholders.

(2) Remove the four 4 BA instrument-headed screws arranged in a vertical line at the left of the fuse-holders and mains ON/OFF switch.

4.1 (continued)

(3) With the rear panel flat on the bench, transformer and chokes uppermost, remove the four 6 BA nuts and two 6 BA screws securing the remaining edge of the power unit. The unit may now be lifted off the panel. (The four screws from which the nuts are removed are held captive beneath the panel surround; if difficulty is experienced when replacing the power unit, due to these screws turning, remove the surround to expose the screw heads.)

Obtaining Access to the R.F. Unit Components

The periphery of the r.f. screening cover is attached to the r.f. unit by means of 6 BA cheese-headed screws; these should be removed in order to release the cover, taking care not to lose the washers beneath the screw heads. When replacing the cover, it is important that all the screws should be replaced and fully tightened.

4.2 MAINS INPUT ARRANGEMENTS

The mains transformer has a double-wound primary with arrangements for connection of the two tapped sections in series for the 200 to 250 V range, or in parallel for the 100 to 150 V range.

The arrangements of the connections to the input of the mains transformer are shown diagramatically on Drawing No. TLC 28392.

The input voltage tappings are made by means of soldered connections to tags mounted on the transformer winding. The tags are accessible through the aperture in the rear panel, after removal of the transparent cover plate.

The two sections of the double-wound primary are connected together by linking the appropriate tags as in 'A' on the diagram. To change from one major voltage range to another, alter the linking on the transformer as shown.

Selection of intermediate voltages within the range is made by means of fly-leads on the transformer tags. These tags are common to both ranges, and are therefore each marked with two voltages; the applicable voltage depends on the position of the major range links.

4.2 (continued)

One fly-lead must always be connected to either the '0' or '+10' tag; the other is connected to the tag whose voltage, added to 0 or 10 as appropriate, equals the mains supply voltage. For example, for a 240 V supply, connect the fly-leads to the '0' and '240' respectively; for a 210 V supply, connect the fly-leads to '+10' and '200' respectively. Do not connect either fly-lead to the tags marked TAP A or TAP B.

4.3 REPLACEMENT OF VALVES, SEMICONDUCTORS, & CRYSTALS

Valves. All valves are accessible after removing the instrument from its case as described in Section 4.1.

The transistor is secured to the chassis by means of two 6 BA screws in its collector flange. Connections to the transistor are soldered.

When replacing the transistor, the mica insulating gasket and plastic bushes on the collector flange must be used. The mica gasket should be lightly smeared with silicone grease before replacement; this ensures maximum conduction of heat from the transistor flange to the chassis.

Normally, all the valves may be replaced without special selection; it should be appreciated, however, that if the old and new valves possess significantly different parameters, then some change may occur in the performance of the associated circuits.

Semiconductors. To gain access to the silicon diode MR4, forming part of the CARRIER LEVEL meter circuit, the cover should be removed from the r.f. unit as described in Section 4. Replacement of MR4 may affect the sensitivity of the meter circuit.

It is most unlikely that the components which form part of the piston attenuator head assembly will need to be replaced or adjusted. Replacement of any of these components would, however, necessitate the partial dismantling of the attenuator and subsequent major adjustments to the r.f. tuned circuits. It is therefore, strongly recommended that an instrument with a piston attenuator suspected of being defective should be returned to Marconi Instruments Limited for servicing.

4.3 (continued)

Crystals. The five plug-in i.f. oscillator crystals are accessible at the rear of the instrument; these can be inspected and, if necessary, replaced without removing the instrument from its case.

4.4 WORKING VOLTAGES

The following voltages were obtained from measurements on a typical TF 1064B/6; the voltmeter employed had an input impedance of 20 kΩ/V. Component and valve number codings refer to the Circuit Diagram supplied with this handbook.

Power Supplies

Measurement	Connection	Reading
LT1, LT3	Across transformer windings	6.3 V a.c.
LT2	Across transformer winding	14.5 V a.c.
A.C. H.T.	Across transformer winding	160 V a.c.
Unsmoothed l.t.	Across C3	-14 V d.c.
Smoothed l.t.	Across C4	-11.5 V d.c.
Stabilized l.t.	VT1 Base and Earth	-7.5 V d.c.
L.T. for V3	SKT1, pin 7 and Earth	-6.3 V d.c.
L.T. for V2 and V4	SKT1, pin 8 and Earth	-5.6 V d.c.
Unsmoothed h.t.	Across C1 and C53	320 V d.c.
H.T. supply to V6	Across C2	315 V d.c.
Stabilized h.t.	SKT1, pins 4 and 5 to Earth	150 V d.c.*

* Set by means of RV5; this preset control is mounted on the side of the power unit chassis, near the mains switch and fuses.

4.4 (continued)

Valve Electrode Voltages

Valve No.	Anode	Cathode	Conditions
V1	320	150 ✓	
V2	75 (pin 2) 1 plate	-	Range C
V2	75 (pin 6) 5 (100 V)	-	Range C
V3	120 (pin 1)	3 (pin 7)	Range C
V3	120 (pin 2)	-	Range C
V4	95 (pin 2)	-	Range B
V4	65 (pin 6)	-	Range A
V5	145 (pin 1)	4.5 (pin 3)	
V5	150 (pin 6)	7 to 13 (pin 8) depending on crystal	
V6	140	85	
V7	85	-	