DESCRIPTION & OPERATING INSTRUCTIONS FOR HF COMMUNICATIONS RECEIVER

Type CR.150/6

600 DR. FREDERICKS BLVD
VILLE ST LAURENT

H4M-2S9
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Technical Handbook T.2719/2

Marconi

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Receiver Type CR. 150/6

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DESCRIPTION & OPERATING INSTRUCTIONS
FOR
HF COMMUNICATIONS RECEIVER
TYPE CR.150/6

1 INTRODUCTION

1.1 GENERAL

The CR150/6 receiver shown in the Frontispiece *(Fig.1)* is a modified version of the CR150/3 and covers the range 2 to 32 Mc/s in four bands. The receiver is a double-superheterodyne employing intermediate frequencies of 1600 kc/s and 465 kc/s. A crystal-controlled first oscillator operating on six spot frequencies is incorporated in addition to the variable LC-controlled oscillator. Four pass-bands of 1, 3, 8 and 13 kc/s are provided. All valves used in the receiver are British Services preferred types. There are three models of the CR150/6 receiver; Edition A for table mounting is shown in the Frontispiece *(Fig.1)*; Edition B is similar but is suitable for rack mounting, and Edition C which is supplied without a cover and is intended for mounting in a cabinet.

To reduce temperature changes in the receiver, the power supply unit is contained in a separate case which may be placed beside the receiver or in any other convenient position. There are two similar types of Supply Unit; the Type 1325/4 for table mounting and the Type 1325/5 for Rack or Cabinet mounting. Electrically, the receivers are identical and so are the Supply Units. The dimensions and weights of the receiver and supply unit are given in Table 1.

TABLE 1

Unit	Width	Depth	Height	Weight
Receiver Unit Type CR150/6	20.5in. (52 cm)	17in. (43 cm)	14 in. (35.6cm)	16 lb. (28kg)
Supply Units Type 1325/4	5.25in. (13.3 cm)	15in. (38 cm)	12 in. (30.5cm)	25 lb. (11.3kg)

2 TECHNICAL SUMMARY

2.1 SALIENT FEATURES

2.1.1 Types of Service

The receiver is designed for the reception of CW, MCW or telephony transmissions and covers the range 2 Mc/s to 32 Mc/s (150 to 9.4 metres) in four bands. If desired, diversity reception may be employed by using two or more receivers. For this purpose, connections are provided on the receiver for an external common oscillator and for a common automatic gain control circuit.

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2.1.2 RF Input

The aerial may be connected directly to the receiver or via a 75-100 ohm balanced or unbalanced feeder.

2.1.3 AF Output

Output connections for a 3 ohm loudspeaker, high or low resistance phones and a 600 ohm line are provided.

2.1.4 Tropical Use

The receiver is suitable for continuous operation under tropical conditions.

2.1.5 Power Supplies

The receiver supply unit Type 1325/4 or 1325/5 will operate from a single-phase 50-60 c/s AC source of 200 to 250 volts, or the receiver alone may be operated from batteries.

2.2 ELECTRICAL CHARACTERISTICS

2.2.1 Circuit Details

The receiver employs a double superheterodyne circuit with a first IF of 1600 kc/s and second IF of 465 kc/s. Two signal frequency amplifiers and an amplifier at the first IF are followed by three amplifiers at the second IF incorporating the main selective circuits. The detector is followed by a noise limiter and two stages of audio-frequency amplification. A block diagram is given in Fig. 2.

2.2.2 Selectivity

High discrimination against adjacent channel interference is obtained by the use of band-pass crystal filters at 465 kc/s. Four pass-bands of 1, 3, 8 and 13 kc/s are provided so that the selectivity may be adjusted to suit the conditions of service. High discrimination against image response is obtained by using a relatively high first intermediate frequency (1600 kc/s).

2.2.3 Sensitivity

The sensitivity is good on all ranges and is limited only by the noise level inherent in the first RF stage.

2.2.4 Automatic Gain Control (AGC)

The automatic gain control circuits enable wide fluctuations of signal strength to be tolerated; alternative time constants are provided to suit the type of signal being received.

2.2.5 Crystal Control

The first oscillator may be crystal-controlled on any six spot frequencies.

2.2.6 Desensitising

A desensitising circuit enables the receiver to be fully or partially muted during transmission.

2.2.7 Metering

A meter, in conjunction with a selector switch, may be used to measure anode feeds or act as a tuning indicator.

2.3 TUNING

2.3.1 Frequency Selection

A single tuning control with fast or slow motion is employed and provides continuous coverage of each frequency band. The main tuning scale is calibrated directly in signal frequencies and there is also an auxiliary logging-scale with high discrimination. All receivers are individually calibrated.

2.3.2 Fine Tuning

A fine-tuning control operating on the second local oscillator covers the range ±4 kc/s at all signal frequencies.

2.3.3 Crystal Calibrator

A crystal-controlled calibrator oscillator is incorporated in the receiver. This oscillator provides check frequencies at intervals of 500 kc/s so that the frequency calibration of the main tuning scale may be checked; also, by interpolating on the logging scale between two check frequencies, the receiver may be tuned exactly to any desired frequency.

2.4 PERFORMANCE

2.4.1 Sensitivity

The receiver sensitivity is expressed in Table 2 as the input voltage in series with 75 ohms required to give a 20db signal-to-noise ratio on an unmodulated signal, or a 10db signal-to-noise ratio on a signal modulated 40% at 400 c/s. The passband switch is set at 8 kc/s.

TABLE 2

Wave Band	Frequency Range in Mc/s	Sensitivity (db rel. 1 μV)	Image Signal Protection	Frequency Drift per hour, less than.	Noise Factor.
1	2 to 4	+3 to +5db	110 - 90db	0.01%	+3 to +5db
2	4 to 8	+3 to+5db	110 - 90db	0.01%	+3 to +5db
3	8 to 16	+3 to +5db	100 - 70db	0.01%	+3 to +5db
4	16 to 32	+5 to +9db	85 - 50db	0.02%	+5 to +9db

2.4.2 Selectivity

The amount by which the image signal is attenuated is shown in column 4 of Table 2.

The adjacent-channel selectivity expressed as bandwidth at 6db and 40db attenuation is shown in Table 3. IF response curves are shown in Fig.10 (WZ.10604/B Sh.1).

TABLE 3

Passband switch set at	Bandwidth in c/s	
	-6db	-40db
1 kc/s	1000	4000
3 kc/s	3000	8500
8 kc/s	8000	18000
13 kc/s	13000	30000

2.4.3 Fidelity

The overall frequency response curves for the 8 kc/s and 13 kc/s passbands are shown in Fig.12 (WZ.10607/B Sh.1). Response curve for the audio frequency stages is shown in Fig.11 (WZ.10606/B Sh.1).

2.4.4 Thermal Stability

The frequency drift at any signal frequency up to 30 Mc/s is less than 5 kc/s per hour after 30 minutes from switching on.

2.4.5 Automatic Gain Control

The output of the receiver does not increase by more than 10db when the input signal is increased to 60db above the levels specified in column 2 *(Sensitivity)* of Table 2. The AGC time constant may be selected to suit the type of signal being received.

2.4.6 Outputs

The receiver provides three separate outputs as follows:-

1mW to high or low resistance headphones.

20mW to 600 ohm line.

100mW to 3 ohm loudspeaker.

2.4.7 Power Consumption

Mains operation:	60 watts (approximately)
Battery operation:	65mA at 280V; 3.7A at 6.3V.

3 GENERAL DESCRIPTION

3.1 CONTROLS

The receiver controls are as follows:-

3.1.1 Power Supply Switch

The power supplies for the receiver are normally switched on or off by the MAINS switch on the Supply Unit Type 1325/4 or 1325/5.

3.1.2 Band Change Switch

Any one of the four bands may be selected by the band change switch on the front of the receiver (SWA in WZ.8395/D Sh.1). When this switch is operated the appropriate frequency scale is automatically displayed on the calibrated drum.

3.1.3 Tuning Controls

Each receiver is individually calibrated during factory tests; the main tuning scale is calibrated to show the frequency directly in Mc/s. The main tuning control rotates the ganged variable capacitors C119 - C122, moves the pointer across the frequency scale and rotates the logging scale discs. The logging scale has an equivalent length of 18 feet and its 1250 divisions may be read to one quarter division. At 20 Mc/s one scale division corresponds to a 12 kc/s change of frequency. The fine tuning control operates on the second oscillator and enables a change of frequency of up to ±4 kc/s to be made at any frequency in the range. The control is normally set to centre zero.

3.1.4 Selectivity Control

The PASS-BAND switch introduces crystal or LC filters into the IF circuits and enables pass-bands of 1, 3, 8 or 13 kc/s to be selected.

3.1.5 Operational Switch

This switch has four separate functions:-

(a) Switches the AGC on or off.

(b) Switches the third oscillator on for CW reception.

(c) Switches on the calibration checking oscillator when required.

(d) Switches off the noise limiter in position 2.

3.1.6 Gain Controls

The HF GAIN control rotates the ganged potentiometers RV94 and RV93 in the cathode circuits of the RF and IF stages.

The AF GAIN control rotates the potentiometer RV92 in the grid circuit of the first AF amplifier V7.

3.1.7 Meter Switch

This switch enables individual valve feeds to be checked as described in Section 7.4.3. The meter may also be used as a tuning indicator.

3.1.8 Preset Controls

Access to the receiver desensitising control may be obtained by moving to one side the small cover plate on the front panel. The adjustment of this and other preset controls, including the signal-indicator zero setting and the third oscillator frequency, is described in Section 6.

3.2 LOCATION OF COMPONENTS

The position of each component in the receiver is shown in WZ.8395/D Sh.1. A label attached to the inside of the hinged cover lists the valve types and their positions in the receiver.

3.3 MECHANICAL CONSTRUCTION

The receiver components are mounted on a chassis which is housed in a steel case with a hinged lid so that valves and crystals may be changed and internal adjustments may be made without removing the chassis from its case. To withdraw the receiver for servicing it is necessary only to remove four screws from the front panel.

The receiver chassis is of the inverted tray type with the valves, IF transformers, main tuning capacitors and certain other components mounted on the upper deck and the control switches, fixed capacitors and resistors mounted underneath the deck. The RF circuits are included in a sub-assembly which is insulated from the main chassis to reduce the possibility of coupling between the signal-frequency circuits and the second and third oscillators.

4 CIRCUIT DESCRIPTION

4.1 GENERAL ARRANGEMENT

A block diagram of the receiver is shown in Fig.2 (WZ.10602/B Sh.1) and the circuit diagram is given in Fig.6 (WZ.8394/D Sh.1). The receiver employs two stages of signal frequency amplification followed by a heptode mixer with separate first frequency-change oscillator. The first intermediate frequency is 1600 kc/s and the first mixer is coupled directly to the second mixer via a pair of coupled circuits tuned to this frequency. The second mixer is a heptode with separate second frequency change oscillator; the output at the second intermediate frequency of 465 kc/s which is passed through a two-stage amplifier incorporating the main selective circuits and bandpass crystal filters. The 465 kc/s IF output is rectified by the two diodes of a double-diode triode; one diode provides an audio frequency output while the output from the other is used for AGC. The triode section of this valve functions as the first audio frequency amplifier and is followed by a triode output stage. The beat oscillator is coupled to the signal diode.

4.2 SIGNAL FREQUENCY CIRCUITS

The aerial input is taken to two coaxial sockets which are connected to the low impedance winding of the first RF transformer. The signal frequency circuits are designed to minimise the variation of gain with frequency. The first oscillator assembly is robustly constructed and has good mechanical and thermal stability; this oscillator may be crystal-controlled for reception on any six selected frequencies between 2 Mc/s and 32 Mc/s.

4.3 INTERMEDIATE FREQUENCY CIRCUITS

The first IF transformer is mounted on the RF sub-assembly and the output at 1600 kc/s is passed to the second mixer valve on the main receiver chassis. The second mixer is a heptode with a separate oscillator operating at a frequency of 1135 kc/s. This oscillator is provided with a FINE TUNING control on the front panel which enables a change of 4 kc/s to be made on each side of the centre zero so that the receiver may be tuned across the selectivity curve of the signal frequency and first intermediate frequency circuits; these circuits are designed so that mistuning by the FINE TUNING control does not cause more than one decibel of asymmetry at the worst point.

The second IF amplifier (465 kc/s) controls the overall selectivity of the receiver; the two widest passbands are determined by variation of coupling between two pairs of tuned circuits. One double crystal filter is introduced for the 3000 c/s passband and a second double crystal filter reduces the passband to 1000 c/s.

4.4 THIRD (BEAT) OSCILLATOR AND SIGNAL DETECTOR

The beat oscillator V13 is capacitance-coupled to the signal diode V7a which is supplied with the second IF at 465 kc/s from the secondary of the last intermediate frequency transformer IFT6. The amplitude of the beat oscillator voltage is such that, although it will fully modulate the strongest signal, it will not operate the automatic gain control. Efficient screening is employed to prevent harmonics from the beat oscillator circuits from interfering appreciably with the signal-frequency input.

4.5 AUDIO FREQUENCY CIRCUITS

The triode elements in V7 function as an audio-frequency amplifier which is resistance-capacitance coupled to the output valve V8 which provides outputs for headphones at jacks JKA and JKB and outputs for a 600 ohm line and for a 3 ohm loud-speaker at the secondaries of the output transformer TR1.

4.6 AUTOMATIC GAIN CONTROL CIRCUITS

The input to the automatic gain control diode V7b is taken from the primary of the last intermediate frequency transformer IFT6 via the capacitor C64. The full AGC voltage is applied to the second mixer valve and first IF amplifier and approximately one sixth of the AGC voltage is applies to the two signal-frequency amplifiers. A choice of two AGC time constants is available by using a selector board inside the receiver. This facility is required for high-speed recording applications.

The automatic gain control may be switched in or out by the operational switch on the front panel. This switch has seven positions which include the following:-

(a) Standby

(b) Third oscillator ON (with and without AGC)

(c) Third oscillator OFF (with and without AGC and noise limiter)

(d) Crystal calibrator.

4.7 NOISE LIMITER

The double-diode elements of V9 operate in an impulse noise-limiting circuit. The "series" diode at Pin 6 is in series with the two resistors R50 and R47 and is connected across the resistor R48 which is part of the detector load. This diode is normally conducting in the presence of a signal since its anode is at a positive potential relative to the cathode. When in this condition, the audio-frequency potential developed at the cathode is passed to the control grid of the first AF amplifier, the triode section of V7. The junction of R50 and R47 is held at earth potential to AF signals by the capacitor C72 and the time constants of the circuit are such that a noise impulse of short duration, equivalent to more than 100% modulation of the signal being received, will cause the anode potentiel of V9 (pin 6) to drop instantaneously to a value lower than that of its cathode and, therefore, the diode will cease to conduct.

Additional protection is afforded by the action of the "shunt" diode V9 (pin 5) which by-passes to earth through C72 any excessive noise impulse which may appear at the anode before the "series" diode has ceased to conduct.

4.8 CRYSTAL CALIBRATOR

The triode elements of V9 may be switched to work as a crystal-controlled oscillator, the frequency being controlled by an AT - cut crystal of low temperature - coefficient. The oscillator circuits are dimensioned to provide strong harmonics of the fundamental 500 kc/s oscillations and its output is coupled via the capacitor C83 to the second tuned circuit of the receiver. The amplitude of these harmonics is sufficient for checking the receiver calibration at any multiple of 500 kc/s up to 32 Mc/s.

4.9 DESENSITISING CIRCUIT

The cathode bias to the RF and IF stages can be increased by introducing a variable resistor RV95 between earth and the gain control potentiometers. Terminals marked DESENSITISING on the terminal board enable this resistor to be connected to the keying relay or to back contacts on the transmitting key. The receiver may thus be fully or partially muted during transmission.

4.10 SUPPLY UNITS

For operating the receiver from an AC source, the Supply Units Type 1325/4 and Type 1325/5 are provided. The two types are identical electrically, each employing a metal rectifier and paper dielectric capacitors. The Type 1325/4 is intended for table mounting and the 1325/5 for rack or cabinet mountings.

The circuit diagram Fig.8 shows that the mains are connected to a two pin plug from which connections are made via the ON/OFF switch and 2-amp mains fuses to the transformer primary. Tappings are provided for any standard supply voltage in the 110 volt or 220 volt range. An HT fuse, rated at 500mA, is connected between the centre tap on the HT secondary and earth. The 280 volt DC and 6.3 volt AC outputs are connected to a 5-pin socket mounted at the back of the chassis. A connector cord and plug convey the supplies to the receiver.

The inputs and outputs of the Supply Units are as follows:-

Input 200-250 volts, 50 to 60 c/s single-phase AC.

(Tappings at 100, 215, 230 and 250 volts permit adjustments to suit available mains voltages).

Outputs 280 volts DC at 65mA.
6.3 volts AC at 4 amps.

Consumption 60 watts.

5 INSTALLATION

5.1 FOR MAINS WORKING

The Supply Unit should be connected to the receiver by the connector cable terminated by a 7 pin socket. It is important to check that the primary taps on the mains transformer in the Supply Unit are set to suit the supply voltage before switching on the mains. The mains should be connected to the Supply Unit by means of a 3-core cable fitted with a 5-amp plug.

5.2 FOR BATTERIES OR FROM OTHER DC SOURCE

The Supply Unit is not required when the receiver is to be operated from a DC source. The DC supplies should be brought to the 7-pin plug on the receiver as follows:-

Pins 1 and 7 to LT 6.3 volts

Pins 2 and 3 to LT earth

Pin 4 to HT positive

Pin 5 to HT earth

Protective fuses should be connected in the supply lines.

5.3 AERIAL INPUT CONNECTIONS

Two coaxial input sockets are located at the back of the receiver for a balanced input 75 to 100 ohms. For an unbalanced input from a single coaxial feeder, one socket only is used and the inner and outer conductors of the other socket are connected together. With the same arrangement direct connection may be made to an aerial.

5.4 OUTPUTS

Terminals marked LS and LINE located on the rear of the receiver chassis are provided for connection to a 3-ohm loudspeaker and a 600 ohm line respectively.

Two telephone jacks mounted on the front panel are for use with either high or low resistance headphones; two pairs of headphones may be used simultaneously but one high and one low resistance pair connected in parallel will not give satisfactory results.

5.5 DESENSITISING FACILITIES

In a combined transmitting and receiving installation it may be necessary to mute the receiver during transmissions. For this purpose two terminals marked DESENSITISING are provided at the back of the receiver and are normally strapped together. When muting is employed the shorting link should be removed and the terminal connected by a screened pair of leads to the transmitter keying relay, or back contacts on the transmitting key.

When the transmitter key is pressed the RF and IF Cathode bias in the receiver is increased by introducing all or part of an additional 2500 ohm variable resistor RV95 at the earthy end of the RF and IF gain controls RV94 and RV93.

By moving the cover marked D on the front panel the potentiometer RV95 mounted above the HF GAIN control may be adjusted by a screwdriver so that the operator hears the transmitter at a convenient level.

5.6 AGC TERMINALS AND TIME CONSTANT ADJUSTMENT

For normal operation the AGC terminals 1 and 2 at the rear of the receiver should be strapped together. The AGC time constant adjustment consists of a two-pin connecting link and a small insulated panel with three pin sockets mounted immediately to the right of V7 and V13 on the top deck of the receiver chassis.

The position marked 0.5μF gives a time constant of approximately 0.2 secs. for the MOD. position and 1.75 secs. for the CW position of the operational switch; this position should be used for normal working.

The position marked 0.1μF gives a time constant of approximately 0.5 secs. for the CW and the MOD. positions of the operational switch; this position should be used for high-speed recording when the receiver is used with a Type HU.11 or other similar type of Recording Unit.

5.7 DIVERSITY CONNECTIONS

When a receiver forms part of a diversity equipment the plug marked EXT. OSC. at the back of the receiver chassis, is used to enable two or more receivers to be supplied from an external common first oscillator; when thus employed, the first oscillator selector switch (SWE) on the front panel should be set to EXT. OSC. The input required from the external oscillator is approximately 1 volt into 68 ohms).

An output at 465 kc/s is provided for use when an IF operated unit is employed in conjunction with the receiver.

The AGC terminals 1 and 2 should be strapped together and connected to the AGC terminals on the other receiver.

6 OPERATING INSTRUCTIONS

6.1 GENERAL

Assuming that the installation has been carried out in accordance with Section 5, the receiver may be switched on and set up for reception on the appropriate signal frequency. The sequence of operations for tuning the receiver and the use of the various controls are as follows:-

6.1.1 Preliminary Adjustments

(a) Switch on AC MAINS and switch on Supply Unit. The pilot lamp and scale illuminating lamps should light.

(b) Set operational switch to CW/MAN.

(c) Set passband switch to 3 kc/s.

(d) Set AF GAIN control to mid-position.

(e) Set HF GAIN control to maximum (fully clockwise), reducing if necessary to give comfortable level in headphones.

(f) Set BAND-CHANGE switch to frequency band required. The frequency calibration for each band is automatically brought into view on the calibration drum as the BAND-CHANGE switch is operated.

(g) Set the pointer on the calibration scale to the desired frequency by turning the larger tuning knob, and locate the wanted signal by using the small knob. If telephony is to be received, set the operation switch to MOD/MAN. and re-tune slightly. Reduce the signal to a suitable level by turning the HF gain control counter-clockwise.

(h) During short stand-by periods the HT supply to certain valves may be cut off by turning the operational switch to the OFF position.

6.1.2 Use of PASS BAND Switch

The 13 kc/s passband gives best intelligibility for reception of speech and also makes the tuning broader, but this passband may be used only when little interference is present. As the passband is narrowed by switching from 8 kc/s to 3 kc/s and then to 1 kc/s, interference will be cut down progressively but the signal must be tuned in more carefully and accurately.

NOTE:- *When receiving CW with the passband switch at 13 kc/s or 8 kc/s, it will be found that on tuning through zero beat, the beat note obtained is equally strong on both sides of zero, but when using the 3 kc/s or 1 kc/s passband the beat note will be stronger on one side than the other. Always tune to the stronger of the two.*

6.1.3 Use of AGC

AGC should be switched off (operational switch to MAN. position) when searching or when strong interference is present.

6.1.4 Use of Gain Controls

(a) With AGC on, set HF GAIN to maximum and AF GAIN as desired.

(b) With AGC off, set HF GAIN as desired and AF GAIN to approximately mid-position

6.1.5 Use of Calibrator

When the operational switch is set to the CALIBRATE position, a 500 kc/s oscillator is switched on and a calibrating signal may be heard every 500 kc/s up to 32 Mc/s.

6.1.6 Use of Meter as Tuning Indicator

When the FEEDS switch (SWD) is set to the SIGNAL INDICATOR position the meter may be used as a tuning indicator. Before using the meter in this way, it must be set to give zero reading in the absence of a signal as follows:-

(a) Set the operational switch to MOD-AGC and the HF GAIN control nearly to maximum.

(b) Adjust the tuning control to a silent point.

(c) Adjust the SIGNAL INDICATOR ZERO control, which is mounted on the chassis deck until zero reading is obtained.

With the meter switch set to the other positions the valve feeds of V1 to V6 and V10 to V13 may be measured; with the HF GAIN control at maximum these feeds should be within the limits specified in Table 8.

6.1.7 Use of Noise Limiter

The noise limiter is operative for all receiving positions of the operational switch except position 2 (MOD. AGC, NL. OFF).

The noise limiter does, however, introduce some unavoidable distortion of modulation peaks, and so when receiving transmissions of high quality, music or speech, it should be switched off by setting the operational switch to position 2.

6.1.8 Use of Logging Scale

This scale enables the operator to reset the receiver accurately to a station that has been received previously. Some slight allowance for initial frequency drift should be made if the receiver has been switched on for less than 30 minutes.

Read the scale divisions from right to left, main divisions on the upper scale and sub-divisions on the lower scale. Note that the scale reading increases as the frequency is increased.

The approximate discrimination of the scale at the lowest, middle and highest frequency in each band is given in Table 4.

TABLE 4

Switch Position	kc/s per small division (0.02)		
	Lowest	Middle	Highest
Band 1	1	2	2.5
Band 2	2	4	5
Band 3	4	8	10
Band 4	8	16	20

6.1.9 Use of Crystal Controlled First Oscillator

The receiver may be crystal controlled on six selected frequencies by setting the first oscillator selector switch to the appropriate crystal position and setting the band switch and main tuning control to the required signal frequency; the tuning should then be adjusted for maximum signal output. Holders are provided for six crystals.

The crystal frequency required for any specific signal frequency may be calculated as follows:-

For Bands 1, 2 and 3, crystal frequency = (signal frequency + 1600 kc/s).

For Band 4, crystal frequency = ½ (signal frequency + 1600 kc/s).

NOTE:- *When ordering crystals it is essential to specify the* **signal** *frequency required and* **not** *the crystal frequency*

6.1.10 Adjustment of Third Oscillator

The preset tuning capacitor for the third oscillator must be set correctly in the first instance and checked periodically to make the best use of the high selectivity of the receiver when it is switched to the 1 kc/s passband.

The capacitor, C102, is adjusted by means of a knob on the top of the screening box containing the third oscillator circuit. Three setting marks indicate approximately the positions for 1000 c/s above the IF, zero beat, and 1000 c/s below the IF.

The adjustment of this control should be checked as follows:-

(a) Set the passband switch to 1 kc/s.

(b) Set the BANDCHANGE switch to BAND 1.

(c) Tune to any silent point.

(d) Adjust C102 until the receiver noise level reaches maximum.

6.1.11 Warming Up

The receiver takes a few minutes to warm up and about 30 minutes to reach stability. The operational switch should be turned to OFF during short breaks as the valve heaters are left on and the receiver is ready for immediate use.

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7 MAINTENANCE

7.1 GENERAL

This Section covers the routine maintenance and complete realignment of the receiver using standard test equipment usually available.

It is strongly emphasised that random adjustments to trimmer capacitors or other preset controls should never be undertaken; any necessary adjustments to these controls should be made only by staff having appropriate experience and with suitable test equipment available.

7.2 ROUTINE MAINTENANCE

To avoid the accumulation of dust on the components and controls the receiver lid should always be kept closed except when making internal adjustments. It is desirable to lubricate occasionally the click register and bandchange mechanisms with a light machine oil of good quality; when lubricating it is essential to avoid applying any trace of oil to the switch wafers or other electrical contacts and keep the units reasonably clean.

If it becomes necessary to remove dust or other matter from the main tuning capacitor, a pipe-cleaner or feather should be carefully inserted between the plates.

Always switch off before servicing either unit internally.

NOTE:- *The receiver is safe when its supplies are switched off at the Supply Unit. The supply unit is completely safe only when isolated from the mains.*

7.2.1 Valve Replacements

The valve types used in the receiver and their functions are listed in Table 5. Valve feeds should be checked periodically as described in Section 7.4.3.1 and a record should be kept. Any valve whose feed is below the minimum specified in Table 8 should be renewed.

NOTE:- *For these routine checks it is not necessary to measure valve feeds under all the conditions shown in Table 8; the feeds should be measured with the HF GAIN control at maximum and the operational switch set to CW. MAN (pos.6).*

TABLE 5

List of Valve Types

Qty	Circuit Ref.	Type	Functions
2	V1, V2	CV.138 Pentode Marconi Z.77 (6AM6)	Signal Frequency Amplifier
1	V3	CV.453 Heptode Marconi X.77 (6BE6)	First Mixer
1	V4	CV.453 Heptode Marconi X.77 (6BE6)	Second Mixer

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TABLE 5 (Cont'd)

Qty	Circuit Ref.	Type	Functions
2	V5, V6	CV.131 Pentode Marconi W.77	Intermediate Frequency Amplifier
1	V7	CV.452 Double-Diode -triode Marconi DH.77 (6AT6)	Detector, AGC rectifier and AF Amplifier
1	V8	CV.133 Triode Marconi L.77 (6C4)	Audio Frequency Output
1	V9	CV.452 Double-diode - Triode Marconi DH.77 (6AT6)	Noise Limiter and Calibrating Oscillator
1	V10	CV.138 Pentode Marconi Z.77 (6AM6)	Crystal First Oscillator
1	V11	CV.138 Pentode Marconi Z.77 (6AM6)	Variable LC First Oscillator
1	V12	CV.133 Triode Marconi L.77 (6C4)	Second Oscillator
1	V13	CV.131 Pentode Marconi W.77	Third (beat) Oscillator
1	V14	CV.287 Marconi QS.150/15	Voltage Stabiliser

7.2.2 Renewing the Calibration Drum Drive Cord (See Fig. 5):

(a) Remove receiver from case.

(b) Remove all control knobs and disconnect meter.

(c) Remove front panel.

(d) Replace temporarily the band switch control knob and set the switch to BAND 4.

(c) Check that the rotors of this switch are correctly set to band 4.

(f) Remove the right-hand drum support bracket and cheek; withdraw the calibrated drum from the left-hand cheek A.

(g) Take 6 feet of cord, bring ends together and fold double. Pass loop through on periphery of cheek A and tie a knot near the end of the loop so that it is retained.

(h) Take one end (call this the LH cord). Pass this cord straight down over pulley B, then on to pulleys C and D and around the large-diameter drive pulley E to the hole in its periphery.

(i) Take the other end (call this the RH cord) 1½ times around cheek A, then down to pulleys G and F and around to the hole in the drive pulley E.

(j) Pass both ends of the cord through the hole in E and secure them to the end of the spring so that it is in tension.

7.2.3 Replacing the Pointer Drive Cord

(a) Set the 0-25 logging scale at 3.

(b) Release pointer from cord and pull cord out through inspection hole in the front plate of drive, but do not detach from spring.

(c) Thread new cord, which should be 44 inches long, through pointer slider and pass ends around the drum, the right-hand end clockwise and left-hand end counter-clockwise. Tuck the cord ends through the hole in the periphery of the drum; there should now be approximately 1½ turns of cord on the drum.

(d) Pull cord back through hole in drum thus extending the spring, and ease cord over small pulleys at each end of pulley guide.

(e) Secure pointer lightly to cord so that the pointer is at the middle of scale when logging scale is at 12.5.

(f) Check position of pointer on calibration scale by tuning receiver to a station of known frequency near the middle of scale. Secure pointer firmly to cord, taking care not to cut it.

(g) Replace front panel and control knobs.

7.3 CIRCUIT CHECKS

In the event of a receiver failure not due to valves or fuses, endeavour to narrow down the possible causes by a logical sequence of tests. For example, a failure observable on only one of the frequency bands would exonerate IF and AF circuits; a failure which occurs only when the passband switch set to 1 kc/s passband would probably be due to the crystal filter.

If the possible cause of a fault is localised in this manner the fault may often be traced by resistance checks using an Avometer or similar measuring instrument.

7.4 VOLTAGES AND FEEDS

A model 7 Avometer or other similar type of instrument should be used for measuring voltages and feeds. The receiver should have its full complement of valves and lamps; the links should be connected across the AGC and desensitising terminals. Unless otherwise stated, the receiver controls should be set as follows:-

Band Change switch (SWA) to BAND 1.

Passband Switch (SWB) to 1 kc/s.

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Operational Switch (SWC) to CW-MAN.

Meter Switch (SWD) to blank position (position 12)

First Oscillator Selector (SWE) to VARIABLE.

HF gain control (RV.93, RV94) to maximum (fully clockwise)

The measured values of current and voltage should be within the limits specified in Tables 6 to 10 when the mains input to the Supply Unit Type 1325/4 (or 1325/5) is 230 Volts.

7.4.1

TABLE 6

Power Consumption

HT current =	50 to 80mA at 280V
LT current =	2.6 to 4.0A at 6.3V, 50 c/s

7.4.2

TABLE 7

Voltages

(Voltages are measured on a Model 7 Avometer or other instrument of 500 ohms per volt)

Test	Test Points	Meter Range	Voltages	
			HF gain max.	HF gain min.
HT Voltage	Supplies plug (PLA) pin 4 and chassis	400V	250 to 310V	265 to 330V
Stabilised HT voltage	V14, pin 5 and chassis	400V	140 to 160V	140 to 160V
Heater voltage	Supplies plug (PLA) pins 1 and 7 and chassis	10V	5.6 to 7.0V	5.6 to 7.0V
RF Cathode line	Slider of RV94 (rear unit of HF gain control) and chassis	100V	0	2.8 to 4.2V
IF Cathode line	Slider of RV93 (front unit of HF gain control) and chassis	100V	0	16 to 24V

7.4.3 Valve Feeds

7.4.3.1 Metered Feeds

These valve feeds are measured on the meter incorporated in the receiver and should be within the limits specified in Table 8.

TABLE 8

Meter Switch position	Operational Switch position	Meter Reading HF gain to Max.	HF gain to Min.
V1	1-3, 5, 6 4, 7	1.8 to 3.6 0	0.2 to 0.5 0
V2	1-3, 5 - 7 4	1.8 to 3.6 0	0.2 to 0.5 0
V3	1-3, 5 - 7 4	1.5 to 3.0 0	1.7 to 3.4 0
V4	1-3, 5 - 7 4	1.3 to 2.6 0	0 0
V5	1-3, 5 - 7 4	3.5 to 5.3 4.0 to 6.0	0.4 to 0.8 2.2 to 3.4
V6	1.3, 5 - 7 4	5.8 to 8.8 0	6.4 to 9.7 0
(a) V10	1.3, 5 - 7 4	2.4 to 3.6 2.9 to 4.3	4.5 to 4.0 3.0 to 4.5
V11	1-7	3.7 to 5.7	3.7 to 5.7
V12	1-7	0.7 to 1.1	0.5 to 0.9
V13	1-4 5-7	0 1.6 to 2.6	0 1.6 to 2.6

(a) *With first oscillator selector switch to XL1. No crystal.*

7.4.3.2 Feeds to V7 and V8

The feeds to V7 and V8 are checked by measuring the cathode voltages on the 100 volt range of the Model 7 Avometer. These should be within the limits specified in Table 9.

TABLE 9

Test Points	Operational Switch position	Voltage
V7 to pin 2 and chassis	1-3, 5-7 4	12 to 18V 14 to 21V
V8 to pin 7 and chassis	1-3, 5-7 4	8.5 to 14V 10 to 16V

7.4.3.3 Feed to V9

The feed to the calibrator valve V9 is measured by setting the operational switch to CW-MAN. and connecting the Avometer (10mA range) between supplies plug PLA, Pin 4 and SWC1.R tag 8 (this tag is mounted on the rear side of the front wafer of the operational switch). If the cathode (pin 2) of V9 is then earthed, the feed to V9 may be read and should be 0.8 to 1.2mA when the anode inductor L24 is tuned for minimum feed.

7.4.3.4 Current Through Stabiliser Tube (V14)

The current through V14 is measured by connecting the Avometer in the load between pins 1, 2 and 3 of V14 and chassis. The current through V14 should be within the limits specified in Table 10.

TABLE 10

Operational Switch position	Current
1-3, 5-7	4.0 to 6.0mA
4	7.0 to 11.0mA

7.5 RECEIVER RE-ALIGNMENT

Unless otherwise stated all controls should be set as for Section 7.4; one of the aerial sockets should be short-circuited.

7.5.1 Test Equipment

(a) Signal generator(s) covering the range 0.45 to 32 Mc/s and having a maximum output of not less than 1 volt in series with 75 ohms.

(b) One alignment oscilloscope (Samwell and Hutton Type 43B, specify crystal frequency of 465 kc/s.

(c) One tone generator covering the range 100 to 6000 c/s and having a maximum output of not less than 5 volts in series with 600 ohms.

(d) One valve-voltmeter (Marconi Instrument Type TF.428B).

(e) One AF output meter to measure 0.1 to 100mW in impedances of 3 and 600 and 5000 ohms (Marconi Instrument Type TF.340A).

(f) One dummy load resistor, 600 ohms ±5%, ½ watt.

(g) One capacitor 0.1μF, 350 volt working, fitted with crocodile clips.

(h) One signal generator output lead fitted with signal generator and AM plugs and having a 68 ohm series resistor.

(j) One 100μA meter.

(k) One trimming tool type W.8201/C Sh.1 Ed.A. (mounted in spring clips on receiver chassis).

(l) One damping resistor 10,000 ohms ±20% ¼ watt.

(m) One damping resistor 1,000 ohms ±20% ¼ watt.

7.5.2 AF Amplifier Tests

Set the AF GAIN control to its mid-position.

7.5.2.1 Sensitivity

(a) Connect the 3 ohm output meter across the loudspeaker output terminals (LS).

(b) Apply an input at 400 c/s through the 0.1μF capacitor to the grid of V8 (pin 1).

(c) The input required for 50mW (+17dbm) output into 3 ohms should be 3.8 to 5.8 volts.

(d) Transfer the input to the slider of the AF gain control (RV92). The input required for 50mW output into 3 ohms should be 0.10 to 0.16 volts. Check that the relation between output and input is linear for output levels less than 100mW.

(e) Transfer the output meter to the 600 ohm line output terminals. The input to the AF gain control to obtain an output of 10mW (+10dbm) into 600 ohms should be 0.10 to 0.16 volts.

(f) Transfer the output meter to one of the phones jacks. The input to the AF gain control for 1mW (0dbm) output into 5000 ohms should be 0.08 to 0.14 volts. Repeat for the other phones jack.

7.5.2.2 Frequency Response

(a) Connect the 600 ohm dummy load to the line output terminals and connect the valve-voltmeter across it.

(b) Apply input at 1000 c/s through 0.1μF to the top of the AF gain control and set the input level to give 1.00 volts output into 600 ohms. The total variation in frequency response between 100 and 6000 c/s should not exceed 1.5db.

7.5.3 Alignment of 465 kc/s IF Amplifier Circuits

7.5.3.1 General

The complete alignment of the IF circuits incorporating crystal filters is impossible without a suitable alignment oscilloscope and should only be undertaken by skilled servicing staff. The alignment oscilloscope has been designed specially for this purpose, and the method of using it is described in Section 7.5.3.5. When no such oscilloscope is available, only the 8 kc/s and 13 kc.s band-pass filters should be re-aligned using the procedure described in Sections 7.5.3.6; it is most unlikely that IF circuits thus re-aligned would be fully satisfactory on the crystal-controlled passbands (3 kc/s and 1 kc/s) and, therefore adjustments should not be undertaken unless absolutely necessary.

7.5.3.2 Controls

Set the operational switch to MOD. - MAN. and the HF gain control to maximum; other controls as for Section 7.4.

7.5.3.3 Tuning IFT.4, IFT.5 and IFT.6 (without alignment oscilloscope)

(a) Set the passband switch to 1 kc/s. Apply a modulated signal at 465 kc/s to V4 at the junction of R25 and R28 and tune the signal to the crystal filter (i.e. for maximum output).

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(b) Set the passband switch to 8 kc/s and apply the signal to V6 (SWB.4.2). Adjust the upper and lower cores of IFT.6 for maximum output.

(c) Apply the signal to V5 (SWB.2.1) and connect the 10 kilohm damping resistor across the primary of IFT.4 (V5 pin 5 and C53). Adjust the trimmer capacitor C57 for maximum output.

(d) Set the passband switch to 13 kc/s and adjust the trimmer C126 for maximum output. Transfer the damping resistor to the secondary of IFT.4, (SWB4 tag 11 and chassis) and adjust the lower core of IFT.4 for maximum output. Remove the damping resistor.

NOTE:- *The settings of the upper cores of IFT.4 and IFT.5 and the capacitance trimmer in IFT.5 should not be disturbed.*

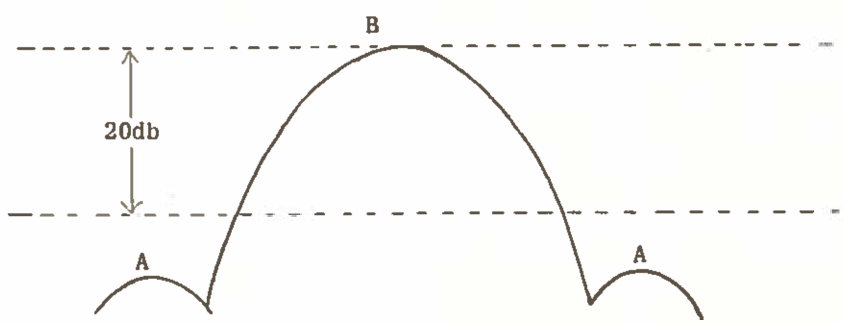
7.5.3.4 Tuning IFT.4, IFT.5 and IFT.6 (with alignment oscilloscope)

(a) Check that the Operational switch is set to Mod. - MAN and the HF GAIN control to near maximum.

(b) Set the passband switch to 1 kc/s. Apply a modulated signal at 465 kc/s to V4, (junction of R25 and R28) and tune it to the crystal filter. Adjust the cores in IFT.6, IFT.5, IFT.4, IFT.3 and IFT.2 for maximum output. Disconnect the signal generator.

(c) Connect the amplifier input of the alignment oscilloscope to the signal diode (V7 pin 5) through a 1 to 2pF capacitor. Connect the IF output from the alignment oscilloscope to V5 grid (SWB2.1).

(d) Using the logarithmic display, adjust the two cores in IFT.4 and the core in IFT.5 until the response is greatest near the crystal resonant frequencies which are seen as sharp peaks and dips in the response.



(e) Adjust the crystal balancing capacitor C58 at the top of IFT.5 until the two dips appear on either side of the main response. These dips should be moved out until the return humps A in the sketch below are at least 20db below the main response B. Adjust the cores in IFT.4 and IFT.5 until the centre peak is as high and as wide as possible; the upper cores of these transformers will have the greatest effect on the bandwidth.

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(f) Set the passband switch to 8 kc/s and connect the 10 kilohm damping resistor across the secondard of IFT.4 (SWB4 tag 11 and chassis). Adjust both cores in IFT.6 and the lower core only in IFT.4 for maximum response at the mid-band frequency of the 1 kc/s crystal filter. Remove the damping resistor and adjust the capacitance trimmer C57 for a response symmetrical about this mid-band frequency.

(g) Set the passband switch to 13 kc/s and adjust the trimmer C126 for a response symmetrical about the mid-band frequency of the 1 kc/s filter.

(h) Set the passband switch to 1 kc/s and check that the response of the crystal filter is satisfactory; if necessary adjust the upper core of IFT.5 and the balancing capacitor C58.

7.5.3.5 Third Oscillator

Tuning

(a) With unmodulated input to V5 at the midband frequency of the crystal filter as for Section 7.5.3.3, set the operational switch to CW-MAN. and the third oscillator tuning capacitor C118 to its mid-position which should correspond to half-capacitance (C118 is mounted at the top of the third oscillator can).

(b) Adjust the core in the third oscillator screening can for zero beat between the third oscillator and the applied signal.

7.5.3.5 Third Oscillator, Tuning and Output Voltage

(a) Connect the valve-voltmeter between pin 2 of the third oscillator anode inductor (L31) and chassis. Tune L31 for maximum output on the meter; this output voltage should be greater than 50 volts.

(b) Disconnect the valve-voltmeter. Adjust the third oscillator tuning capacitor (C118) so that the beat note between the 465 kc/s signal applied as above and the third oscillator is approximately 1 kc/s; tune L31 for maximum AF output at this frequency.

(c) Connect the 100μA meter in series with the detector load resistor R49 and check that the third oscillator produces a detector current greater than 40μA.

(d) Disconnect the microammeter and set the operational switch to MOD. - MAN.

7.5.3.6 Tuning IFT.2 and IFT.3 (without alignment oscilloscope)

(a) Set the passband switch to 8 kc/s and apply the modulated signal at 465 kc/s, tuned to the crystal filter as for Section 7.5.3.3 to V4 (junction of R25 and R28).

(b) Connect the 10 kilohm damping resistor across the primary of IFT.2 (V4, pin 5 and C42), and adjust the trimmer C47 for maximum output. T.2719/6974

(c) Set the passband switch to 13 kc/s and adjust the trimmer C124 for maximum output.

(d) Transfer the damping resistor the secondary of IFT.2 (SWB2, tag 11 and chassis), and adjust the lower core of IFT.2 for maximum output. Remove the damping resistor.

NOTE:- *The settings of the upper cores in IFT.2 and IFT,3 and the capacitance trimmer in IFT.3 should not be disturbed.*

7.5.3.7 Tuning IFT.2 and IFT.3 (with alignment oscilloscope)

(a) Set the passband switch to 3 kc/s.

(b) Connect the IF output of the alignment oscilloscope to V4 grid (junction of R25 and R28).

(c) Tune IFT.2 and IFT.3 using the procedure described in Section 7.5.3.4.

(d) Set the passband switch to 8 kc/s and connect the 10 kilohm damping resistor across IFT.2 secondary (SWB2.11 and chassis).

(e) Adjust the lower core in IFT.2 for maximum response at the mid-band frequency of the 1 kc/s crystal filter. Remove the damping resistor and adjust the capacitance trimmer C47 for a response symmetrical about this mid-band frequency.

(f) Set the passband switch to 13 kc/s and adjust the trimmer C124 for a symmetrical response.

(g) Set the passband switch to 3 kc/s and check that the response of the crystal filter is satisfactory, if necessary adjusting the upper core of IFT.3 and the balancing capacitor C48.

7.5.3.8 Capacitance Trimmers C47, C124 C57 and C126

These trimmers are connected in parallel with fixed capacitors C46, C123, C56 and C125 respectively. If the minimum capacitance of any one of these combinations is too great to allow the circuit to be tuned with the trimmer, then the fixed capacitor should be disconnected.

7.5.3.9 Retuning IFT.6 (after using alignment oscilloscope)

(a) Disconnect the oscilloscope amplifier from the signal diode. Connect the 100μA meter in series with the diode load resistor R49.

(b) Apply input to V4 at the mid-band frequency of the 1 kc/s crystal filter and adjust the upper (secondary) core of IFT.6 for maximum meter reading.

7.5.4 Second Oscillator

Tuning

(a) Set the IF passband switch to 1 kc/s.

(b) Set the fine-tuning control (C102 to zero; this should correspond to its half-capacitance position.

(c) Set the signal generator to 1600 ±1 kc/s and connect it through a 0.1μF capacitance to V4 (junction of R25 and R28).

(d) Adjust the core in the second oscillator screening can for maximum IF output indicated on the microammeter.

Output Voltages

Connect the valve-voltmeter between the oscillator grid (pin 1) of V4 and chassis; the second oscillator voltage at this point should be 6 to 12 volts.

7.5.5 Selectivity of 465 kc/s IF Amplifier

The bandwidths of the 465 kc/s IF amplifier at 6db and at 40db below maximum for the four positions of the passband switch should be as shown in Table 11.

TABLE 11

Amplifier Selectivity

Switch Position	Passbands	
	−6db	−40db
1 kc/s	Greater than 700 c/s	Less than 5000 c/s
3 kc/s	Greater than 2500 c/s	Less than 10,000 c/s
8 kc/s	Greater than 7000 c/s	Less than 20,000 c/s
13 kc/s	Greater than 12,500 c/s	Less than 33,000 c/s

7.5.6 Stage Gains of 465 kc/s IF Amplifier

Before measuring the stage gains of the 465 kc/s IF amplifier the controls should be adjusted as follows:-

(a) Set the HF and AF gain controls to maximum.

(b) Set the Operational Switch to CW-MAN.

(c) Set the IF passband switch to 8 kc/s.

(d) Set the third oscillator tuning capacitor for 1 kc/s beat note (as in Section 7.5.3.5).

(e) Connect the 3 ohm output meter to the LS terminals.

(f) Set up the signal generator at 465 kc/s to the mid-band frequency of the 1 kc/s crystal filter.

(g) Connect the signal generator output through a 0.1μF capacitor to the control grids of V6, V5 and V4 in turn; measure the inputs required to give 50mW output into 3 ohms. These inputs should be within the limits shown in Table 12.

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TABLE 12

465 kc/s Stage Gains

Input at 465 kc/s to V6 grid for 50mW	87 - 93db rel. 1μV
Input at 465 kc/s to V5 grid for 50mW	52 - 58db rel. 1μV
Input at 465 kc/s to V4 grid for 50mW	26 - 32db rel. 1μV

(h) Apply input at 1600 kc/s through a 0.1μF capacitor to V4 control grid; the input for 50mW output into 3 ohms should be 27 - 33db relative to 1 microvolt.

7.5.7 Variation of Gain with Bandwidth

Controls to be set as for Section 7.5.6.

(a) Apply 465 kc/s input to V4 control grid at the mid-band frequency of the 1 kc/s crystal filter.

(b) Measure the input required to give 50mW output into 3 ohms for each of the four IF bandwidths; these inputs should be within the limits specified in Table 13.

TABLE 13

Variation of Gain with Bandwidth

IF Bandwidth	Input at 465 kc/s to V4 for 50mW output
1 kc/s	28 - 34db relative to 1μV
3 kc/s	26 - 32db relative to 1μV
8 kc/s	26 - 32db relative to 1μV
13 kc/s	35 - 41db relative to 1μV

7.5.8 1600 kc/s IF Amplifier

Set the receiver controls as follows:-

(a) Band change switch (SWA) to Band 1

(b) Tuning control to 2 Mc/s.

(c) First Oscillator switch (SWE) to VAR. OSC.

(d) Operational switch to MOD. - MAN.

(e) IF pass band switch to 8 kc/s.

(f) HF gain control to minimum.

7.5.8.1 IF.1 Response

(a) Using the valve-voltmeter, check that the RF voltage across the oscillator (front) section of the ganged tuning capacitors is 12 to 28 volts.

(b) Connect the VVM between V4 grid (junction of R25 and R28) and chassis.

(c) Tune the signal generator to 1600 kc/s and connect its output through a 0.1μF capacitor to V3 grid (junction of R17 and R18).

(d) Adjust both cores of IFT.1 for maximum output on the VVM.

(e) Connect the 10 kilohm damping resistor across the primary (between anode of V3, pin 5 and C35). Readjust the upper (secondary) core for maximum output.

(f) Remove the 10 kilohm resistor; connect a 1000 ohms damping resistor across the VVM and adjust the lower (primary) core for maximum output. Remove the damping resistor.

(g) Adjust the input level so that the output at 1600 kc/s is 1 volt. Measure the response of IF.1 on the VVM, maintaining the input level constant; the total variation in response over the band 1600 kc/s ±10 kc/s should be less than 1db.

7.5.8.2 Retuning IFT.1

(a) Remove the valve-voltmeter.

(b) Set the IF passband switch to 1 kc/s.

(c) Set the fine-tuning control to zero.

(d) Set the operational switch to CW-MAN.

(e) Apply input at 1600 kc/s to V3 and adjust the input frequency for maximum output.

(f) Connect the 10 kilohm damping resistor across the primary of IFT.1 and adjust the secondary (upper) core for maximum output. Remove the damping resistor.

7.5.8.3 IF.1 Gain

(a) Set the HF and AF gain controls to maximum.

(b) Set the operational switch to CW-MAN.

(c) Set the IF passband switch to 8 kc/s.

(d) Set the fine-tuning control to zero.

(e) Apply unmodulated input at 1600 kc/s through a 0.1μF capacitor to V3 grid (junction of R17 and R18); measure the input required to give 50mW output

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into 3 ohms; the input should be 12 to 18db relative to 1 microvolt.

(f) Repeat this measurement with input at 2 Mc/s; this input should be 18 to 24db relative to 1 microvolt.

7.5.9 Signal Frequency Amplifier

7.5.9.1 First Oscillator Alignment

(a) Set the bandchange switch to Band 4.

(b) Set the first oscillator selector to VAR. OSC.

(c) Set the passband switch to 3 kc/s.

(d) Set the operational switch to CW-MAN.

(e) Apply input at 8 Mc/s from the signal generator to V3 (junction of R17 and R18) through a 0.1μF capacitor.

(f) Set the tuning pointer to the 16 Mc/s calibration mark and adjust the core of Band 4 oscillator coil (L26) for zero beat.

(g) Set the input frequency and tuning pointer to 32.00 Mc/s and adjust the penny plate capacitor C98(b) *(See Fig.7 upper deck plan)* for zero beat. Do not under any circumstances alter the compensating capacitor C98(a). Repeat this procedure until the oscillator frequency corresponds with the printed calibration marks at 16 and 32 Mc/s.

(h) Set the bandchange switch to Band 3. Set the input frequency and pointer to 8 Mc/s and adjust the core of Band 3 oscillator coil (L27) for zero beat. Check that the calibration is approximately correct at 16 Mc/s.

(i) Set the bandchange switch to Band 2. Set the input frequency and pointer to 4 Mc/s and adjust the core of Band 2 oscillator coil (L28) for zero beat. Set the input frequency and pointer to 8 Mc/s and adjust the capacitance trimmer C130 for zero beat. Repeat this procedure until the oscillator frequency corresponds with the calibration marks at 4 Mc/s and 8 Mc/s.

(j) Set the bandchange switch to Band 1 and repeat the procedure at 2 and at 4 Mc/s, adjusting the core of L29 and capacitor C97.

7.5.9.2 Alignment of Signal Frequency Circuits

(a) Connect the signal generator through a 68 ohm resistor to one aerial socket and short circuit the other aerial socket.

(b) Set the bandchange switch to Band 1 and the tuning pointer to 2 Mc/s. Tune the signal generator (at 2 Mc/s) to the receiver. Adjust the cores in the mixer (L12), HF(L8) and the aerial (L4) coils on band 1 for maximum receiver output.

(c) Set the signal generator to 4.0 Mc/s and tune in the signal at the high frequency end of Band 1. Adjust the capacitance trimmers C27, C14 and C4.

(d) Repeat the adjustments of the inductor coils at the LF end of the band and the capacitance trimmers at the HF and until no further improvement in ganging is obtained.

(e) Gang the receiver in a similar manner on Bands 2 and 3.

(f) On Band 4, set the passband switch to 13 kc/s and then gang as before, taking care to retune the receiver oscillator after every adjustment of the trimmers in the SF amplifier.

7.5.10 First Oscillator Voltages

7.5.10.1 Variable LC Oscillator

Connect the valve-voltmeter across the oscillator section of the gang capacitor and measure the oscillator voltages throughout each band; these voltages should be within the limits specified in Table 14.

TABLE 14

Variable first Oscillator Voltage

Band	Frequency in Mc/s	Voltages
1	2 - 44	15 - 35
2	4 - 88	12 - 30
3	8 - 16	10 - 25
4	16 - 32	6 - 14

7.5.10.2 Crystal Oscillator

(a) Set the first oscillator selector switch to XL.1.

(b) Connect the valve-voltmeter across the oscillator section of the gang capacitor.

(c) Set the band switch and tuning control to the corresponding signal frequency and adjust the tuning for maximum output on the VVM.

(d) Repeat this procedure for the other five crystals; the voltages measured on the VVM should be within the limits shown in Table 15.

TABLE 15

Crystal Oscillator Voltages

Band	1	2	3	4
Output in Volts	15 - 45	12 - 36	10 - 30	5 - 15

7.5.10.3 External Oscillator

(a) Set the first oscillator selector switch to EXT.OSC.

(b) Connect the VVM across the temperature compensator.

(c) Connect the signal generator through a 68 ohm resistor to the external oscillator Pye plug at the rear of the receiver.

(d) Set the receiver tuning to 2 Mc/s and tune the signal generator at 3.6 Mc/s for maximum output on the VVM.

(e) Measure the input for 1 volt output on the VVM.

(f) Repeat this measurement at the frequencies shown in Table 16; the inputs, in series with 78 ohms, required to give 1 volt output should be within the limits specified.

TABLE 16

External Oscillator Inputs

Band	Signal Frequency in Mc/s	Input Frequency in Mc/s	Input in db rel. 1μV in series with 78 ohms.
1	2.0	3.6	100 - 106
	4.0	5.6	98 - 104
2	4.0	5.6	101 - 107
	8.0	9.6	99 - 105
3	8.0	9.6	101 - 107
	16.0	17.6	100 - 106
4	16.0	17.6	103 - 109
	32.0	33.6	100 - 106

7.6 OVERALL PERFORMANCE

Set the passband switch to 8 kc/s.

7.6.1 CW Sensitivity

The nominal input in series with 75 ohms required to give 20db signal-to-noise ratio is given in column 3 of Table 17.

7.6.2 Sensitivity for Modulated Signals

With the signal generator modulated 40% at 400 c/s, the nominal input in series with 75 ohms required to give 10db signal-to-noise ratio is given in column 3 of Table 17.

7.6.3 AGC

The increase in output when the signal is increased by 60db above the sensitivity figures given in Table 17 should not be more than 10db.

7.6.4 Image Protection

The nominal attenuation offered to the image signal is given in column 4 of Table 17.

TABLE 17

Performance

Band	Frequency in Mc/s	Sensitivity (db rel. 1µV)	Image Protection in db
1	2	3	110
	3	4	100
	4	5	90
2	4	3	110
	6	4	100
	8	5	90
3	8	3	100
	12	4	85
	16	5	70
4	16	6	85
	24	5	65
	32	9	50

7.7 ADDITIONAL PERFORMANCE DATA

7.7.1 Stage Gains of Signal Frequency Amplifier

(a) Set the operational switch to CW-MAN

(b) Connect the slider of the rear section (RV.94) of the HF gain control to earth so that, for this test, control is applied only to the IF valves.

(c) The input to the aerial socket is measured with the signal generator in series with 68 ohms; the inputs to the valve grids are measured with the signal generator in series with 0.1µF. The nominal stage gains should be as shown in Table 18.

TABLE 18

Nominal SF Stage Gains

Band	Frequency in Mc/s	Voltage gain in decibels		
		Aerial to V1	V1 to V2	V2 to V3
1	2	19	16	6
	3	20	7	9
	4	20	2	10
2	4	17	12	6
	6	18	6	11
	8	19	2	13

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TABLE 18 (Cont'd)

Band	Frequency in Mc/s	Voltage gain in decibels		
		Aerial to V1	V1 to V2	V2 to V3
3	8	14	16	9
	12	14	10	11
	16	15	8	14
4	16	9	16	18
	24	9	9	21
	32	9	6	18

7.7.2 Selectivity of SF Amplifier

The attenuation of the image signal is a measure of the selectivity of the SF stages. It is measured with the input applied to V1 and V2 grids through a 0.1μF capacitor and to the aerial through 68 ohms.

The nominal image signal protection in db is shown in Table 19.

TABLE 19

SF Amplifier Selectivity

Band	Frequency in Mc/s	Image protection in decibels		
		Input to V2 Grid	Input to V1 Grid	Input to aerial
1	2	25	72	110
	3	25	70	100
	4	25	62	90
2	4	35	76	110
	6	35	66	100
	8	35	58	90
3	8	35	64	100
	12	32	58	85
	16	27	48	70
4	16	25	62	85
	24	19	50	65
	32	15	35	50

7.7.3 SF Amplifier Detune Ratios

(a) Set the IF passband switch to 8 kc/s.

(b) Set the operational switch to CW-MAN.

(c) Set the HF gain control to maximum.

(d) Disconnect the signal generator from the aerial socket so that the receiver input circuit is not loaded by the aerial impedance.

(e) Adjust the aerial trimmer capacitor for maximum noise output. Note this output and then short-circuit V1 grid to chassis through a 0.1μF capacitor and again note the output; the reduction in noise output in decibels is the detune ratio and the nominal values are shown in Table 20.

TABLE 20

SF Amplifier Detune Ratios

Band	1	2	3	4
Detune Ratio (db)	9	8	6	5

(f) Apply input at 78 ohms impedance to the aerial socket and reset the capacitance trimmers in the aerial circuit for maximum output at 4, 8, 16 and 32 Mc/s.

7.8 SUPPLY UNIT

The voltages measured across the output terminals of the supply unit with no load and with the receiver load (HT = 65mA, LT = 3.7A) should be within the limits shown in Table 21. The ripple voltage should not exceed 0.1%.

TABLE 21

Supply Unit Outputs

	With no load	With receiver load
HT Volts	370 - 470V	250 - 310V
LT Volts	6.6 volts AC ±10%	6.3 volts AC ±10%

8 USEFUL AUXIALIARY EQUIPMENT

At locations where a number of receivers are installed it is usually desirable to equip the station with a set of instruments for routine performance checks and re-alignment. The list of apparatus included in Table 22 is a brief guide to suitable items for this purpose. The Marconi Instrument Co. Ltd., catalogue gives performance figures of all types of instrument manufactured by that Company.

TABLE 22

Test Apparatus

Apparatus	Marconi Instruments Type
Signal Generator 15 kc/s to 30 Mc/s	TF.867
Beat Frequency Oscillator	TF.195L
Audio Power Meter	TF.340

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9 COMPONENTS & SPARES

9.1 MAIN ITEMS

The equipment comprises two of the three main units listed in Table 23.

TABLE 23

Unit	Type No.
Receiver	CR. 150/6
Supply Unit or Supply Unit	1325/4 1325/5

9.2 ACCESSORIES

These are loose items, other than valves, which are included with the main items listed in Table 23.

TABLE 24

Accessories

Qty	Description	Identity
1	Connector Assembly (Supply Unit to Receiver)	WZ.3956/C Sh.1
2	Connector (Supply Unit to Mains)	WIS.3206/C Sh.1
2	Plugs (Aerial input)	W.6015/A Ref.72
1	Socket (Ext. Oscillator input)	W.6015/A Ref.227
1	Socket (465 kc/s output)	W.6015/A Ref.227
1	Trimming Tool	W.8201/C Sh.1 Ed.B

NOTE:- *When the receivers and supply units are mounted in a cabinet or rack, the external connectors are part of the cableform supplied with the equipment.*

9.3 COMPONENTS LIST

Receiver Type CR150/6	No.1
Supply Unit Type 1325/4 Supply Unit Type 1325/5	No.2

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COMPONENTS LIST No. 1
FOR
HF. COMMUNICATIONS RECEIVER TYPE CR. 150/6
(Drg. No. W.35074)

NOTES

1. When ordering spares quote information from all columns for identities marked * or identity only for all other items.
2. The references in column 1 are shown on circuit diagram, Fig. 6 and component location diagram, Fig. 7.
3. For identical items the total quantity is given at the first entry.

Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No./Ref.
			CAPACITORS			
1		C1	Air Dielectric Trimmer	3-30pF	75V	WSK. 13605/16
2		C2	Air Dielectric Trimmer	3-30pF	75V	WSK. 13605/15
3		C3	Air Dielectric Trimmer	3-30pF	75V	WSK. 13605/14
4		C4	Air Dielectric Trimmer	3-30pF	75V	PC. 18801/10
5		C5	Moulded Mica	.01μF ±20%	350V	WSK. 13605/19
6		C6	Ceramic	5pF ±20%	750V	W. 36827/38
7		C7	Ceramic	5pF ±20%	750V	WSK. 13607/42
8						
9		C9	Moulded Mica	.01μF ±20%	350V	PC. 18801/10
10		C10	Moulded Mica	.01μF ±20%	350V	PC. 18801/10
11		C11	Ceramic	5pF ±20%	750V	W. 36827/38
12						
13		C13	Moulded Mica	.01μF ±20%	350V	PC. 18801/10
14		C14	Air Dielectric Trimmer	3-30pF	75V	WSK. 13607/14
15		C15	Air Dielectric Trimmer	3-30pF	75V	WSK. 13607/13
16		C16	Air Dielectric Trimmer	3-30pF	75V	WSK. 13607/12

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Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No./Ref.
			CAPACITORS (Cont'd)			
17		C17	Air Dielectric Trimmer	3-30pF	75V	WSK.13607/11
18		C18	Silver Mica	10pF ±10%	350V	WSK.13607/20
19		C19	Silver Mica	100pF ± 5%	350V	PC.18702/1
20		C20	Silver Mica	220pF ± 5%	750V	PC.18802/17
21		C21	Silver Mica	.002μF ± 5%	350V	WSK.13607/18
22		C22	Moulded Mica	.01μF ±20%	350V	PC.18801/10
23		C23	Moulded Mica	.01μF ±20%	350V	PC.18801/10
24		C24	Air Dielectric Trimmer	3-30pF	75V	WSK.13606/13
25		C25	Air Dielectric Trimmer	3-30pF	75V	WSK.13606/14
26		C26	Air Dielectric Trimmer	3-30pF	75V	WSK.13606/15
27		C27	Air Dielectric Trimmer	3-30pF	75V	WSK.13606/16
28		C28	Moulded Mica	.01μF ±20%	350V	PC.18801/10
29		C29	Ceramic	5pF ±20%	350V	W.36827/38
30		C30	Silver Mica	100pF ± 5%	350V	PC.18802/13
31		C31	Ceramic	100pF ±20%	350V	PC.18202/13
32		C32	Moulded Mica	.01μF ±20%	460V	PC.18801/10
33		C33	Silver Mica	10pF ±10%	350V	WSK.13608/39
34		C34	Moulded Mica	.01μF ±20%	350V	PC.18801/10
35		C35	Paper Tubular	.1μF ±15%	350V	W.36677/B/3
36		C36	Silver Mica	100pF ± 5%	350V	PC.18802/13
37		C37	Silver Mica	22pF ± 5%	350V	PC.18802/5
38		C38	Paper Tubular	.02μF ±20%	350V	W.35074/12
39		C39	Paper Tubular	.1μF ±20%	1000V	W.35074/9
40		C40	Silver Mica	470pF ±20%	350V	PC.18802/21
41		C41	Paper Tubular	.1μF ±20%	1000V	W.35074/9
42		C42	Paper Tubular	.1μF ±20%	1000V	W.35074/9
43		C43	Silver Mica	220pF ± 5%	350V	PC.18802/17
44		C44	Silver Mica	180pF ± 5%	350V	PC.18802/16
45		C45	Paper Tubular	.02μF ±20%	350V	W.35074/1/12
46		C46	Silver Mica	20pF ± 5%	350V	PC.18802/5
47		C47	Air Dielectric Trimmer	3-30pF	75V	W.36666/14

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Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No./Ref.
			CAPACITORS(Cont'd)			
48		C48	Trimmer	2-8pF	75V	W.20048/B/15
49		C49	Ceramic	6.8pF ±10%	350V	W.20048/B/3
50		C50	Silver Mica	56pF ± 5%	350V	W.20048/B/16
51		C51	Paper Tubular	.1μF ±20%	1000V	W.35074/15
52		C52	Paper Tubular	.1μF ±20%	1000V	W.35074/9
53		C53	Paper Tubular	.1μF ±20%	1000V	W.35074/9
54		C54	Silver Mica	220pF ± 5%	350V	PC.18802/17
55		C55	Silver Mica	180pF ± 5%	350V	PC.18802/16
56		C56	Silver Mica	20pF ± 5%	350V	PC.18802/5
57		C57	Air Dielectric Trimmer	3-30pF	75V	W.36666/15
58		C58	Trimmer	2-8pF	75V	W.20048/B/3
59		C59	Ceramic	6.8pF ±10%	350V	PC.18201/7
60		C60	Silver Mica	56pF ± 5%	350V	W.20048/B/15
61		C61	Paper Tubular	.1μF ±20%	1000V	W.35074/9
62		C62	Paper Tubular	.1μF ±20%	1000V	W.35074/9
63		C63	Paper Tubular	.1μF ±20%	1000V	W.35074/9
64		C64	Moulded Mica	100pF ±20%	350V	PC.18802/13
65		C65	Moulded Mica	100pF ±20%	350V	PC.18702/1
66		C66	Paper Tubular	.01μF ±20%	350V	PC.19202/9
67		C67	Silver Mica	180pF ± 5%	350V	PC.18802/16
68		C68	Silver Mica	220pF ± 5%	350V	PC.18802/17
69		C69	Ceramic	2pF ±20%	350V	PC.18201/3
70		C70	Moulded Mica	100pF ±20%	350V	PC.18702/1
71		C71	Moulded Mica	100pF ±20%	350V	PC.18702/1
72		C72	Paper Tubular	.1μF ±20%	1000V	W.35074/9
73		C73	Paper Tubular	1μF ±20%	350V	PC.19202/20
74		C74	Paper Tubular	.01μF ±20%	350V	PC.19202/9
75		C75	Electrolytic	25μF	25V	PC.18402/12
76		C76	Silver Mica	500pF ± 5%	350V	PC.18702/4
77		C77	Paper Tubular	.01μF ±20%	350V	PC.19202/9
78		C78	Electrolytic	25μF	25V	PC.18402/15
79		C79	Paper Tubular	.1μF ±20%	350V	PC.19202/14
80		C80	Moulded Mica	.001μF ±20%	350V	PC.18801/4
81		C81	Silver Mica	200pF ± 5%	350V	WSK.13289/16
82		C82	Silver Mica	1000pF ± 5%	350V	PC.18801/4
83		C83	Ceramic	1pF ±50%	350V	PC.18201/1

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Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No./Ref.
			CAPACITORS (Cont'd)			
84		C84	Paper Tubular	.1μF ±20%	1000V	W.36827/36
85		C85	Paper Tubular	.1μF ±20%	1000V	W.36827/36
86		C86	Ceramic	100pF ±20%	350V	PC.18202/13
87		C87	Silver Mica	47pF ±20%	350V	W.36827/48
88		C88	Ceramic	47pF ±20%	350V	PC.18201/17
89		C89	Moulded Mica	500pF ±20%	350V	PC.18702/4
90		C90	Ceramic	100pF ±10%	350V	PC.18202/13
91						
92		C92	Ceramic	100pF ±10%	350V	PC.18202/13
93		C93	Silver Mica	1700pF ±15%	350V	WSK.13608/14
94		C94	Silver Mica	890pF ±10%	350V	WSK.13608/15
95		C95	Silver Mica	480pF ± 5%	350V	WSK.13608/16
96		C96	Silver Mica	263pF ± 5%	350V	WSK.13608/17
97		C97	Air Dielectric Trimmer	3-30pF	75V	WSK.13608/44
98		C98	Temperature Comp.			W.36827/1/24
99						
100		C100	Silver Mica	220pF ± 5%	350V	PC.18802/17
101		C101	Silver Mica	500pF ± 5%	350V	WSK.13160/15
102		C102	Trimmer	10pF		WSK.13160/10
103		C103	Silver Mica	2000pF ± 5%	350V	WSK.13160/17
104		C104	Paper Tubular	.1μF ±20%	1000V	W.35074/9
105		C105	Paper Tubular	.1μF ±20%	1000V	W.35074/9
106		C106	Paper Tubular	.1μF ±20%	1000V	W.35074/9
107		C107	Paper Tubular	.5μF ±25%	150V	PC.19301/3
108		C108	Paper Tubular	.1μF ±20%	350V	PC.19202/14
109		C109	Paper Tubular	.02μF ±20%	350V	W.35074/12
110		C110	Paper Tubular	.1μF ±20%	1000V	W.35074/9
111		C111	Paper Tubular	.1μF ±20%	350V	PC.19202/14
112		C112	Paper Tubular	.1μF ±20%	350V	PC.19202/14
113		C113	Paper Tubular	.1μF ±20%	350V	PC.19202/14
114		C114	Moulded Mica	470pF ± 5%	350V	PC.18802/21
115		C115	Silver Mica	100pF ± 5%	350V	PC.18802/13
116		C116	Silver Mica	420pF ± 5%	350V	WSK.13161/12
117		C117	Silver Mica	2000pF ± 5%	350V	WSK.13161/13
118		C118	Trimmer	10pF		WSK.14161/8

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Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No./Ref.
			CAPACITORS (Cont'd)			
119		C119)				
120		C120)	4 Gang Variable			
121		C121)	163.8pF Per			W.36827/2
122		C122)	Section			
123		C123	Silver Mica	22pF ± 5%	750V	PC.18802/5
124		C124	Air Dielectric Trimmer	3-30pF	75V	W.36666/15
125		C125	Silver Mica	22pF ± 5%	750V	PC.18802/5
126		C126	Air Dielectric Trimmer	3-30pF	75V	W.36666/15
127						
128		C128	Ceramic	2.2pF ± 5%	500V	PC.18201/3
129		C129	Ceramic	4.7pF ± 5%	500V	PC.18201/5
130		C130	Air Dielectric Trimmer	2-8pF	75V	WSK.13608/43
131						
132						
133						
134						
135						
			RESISTORS			
136		R1	Carbon	47kΩ ±20%	1/4W	PC.66610/45
137		R2	Carbon	820 Ω ± 5%	1/4W	PC.66611/24
138		R3	Carbon	6.8kΩ ±20%	1/4W	PC.66610/35
139		R4	Carbon	22 Ω ±20%	1/4W	PC.66610/5
140		R5	Carbon	330 Ω ±20%	1/4W	PC.66610/19
141		R6	Carbon	150kΩ ±20%	1/4W	PC.66610/51
142		R7	Carbon	10kΩ ±20%	1/4W	PC.66610/37
143		R8	Carbon	10kΩ ±20%	1/4W	PC.66610/37
144		R9	Carbon	100 Ω ± 5%	1/4W	PC.66604/13
145		R10	Carbon	10kΩ ±20%	1/4W	PC.66610/37
146		R11	Carbon	47kΩ ±20%	1/4W	PC.66610/45
147		R12	Carbon	68 Ω ±20%	1/4W	PC.66610/11
148		R13	Carbon	150kΩ ±20%	1/4W	PC.66610/51
149		R14	Carbon	330 Ω ±20%	1/4W	PC.66610/19

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Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No./Ref.
			RESISTORS (Cont'd)			
150		R15	Carbon	100 Ω ± 5%	1/4W	PC. 66604/13
151		R16	Carbon	10kΩ ±20%	1/4W	PC. 66610/37
152		R17	Carbon	10kΩ ±20%	1/4W	PC. 66610/37
153		R18	Carbon	22 Ω ±20%	1/4W	PC. 66610/5
154		R19	Carbon	22 Ω ±20%	1/4W	PC. 66610/5
155		R20	Carbon	22kΩ ±20%	1/4W	PC. 66610/41
156		R21	Carbon	330 Ω ±20%	1/4W	PC. 66610/19
157		R22	Carbon	33kΩ ±20%	10W	PC. 67010/22
158		R23	Carbon	100 Ω ± 5%	1/4W	PC. 66604/3
159		R24	Carbon	22kΩ ±20%	1/4W	PC. 66610/41
160		R25	Carbon	47 Ω ±20%	1/4W	PC. 66610/9
161		R26	Carbon	47kΩ ±20%	1/4W	PC. 66610/45
162		R27	Carbon	47 Ω ±20%	1/4W	PC. 66610/9
163		R28	Carbon	6.8kΩ ±20%	1/4W	PC. 66610/35
164		R29	Carbon	330 Ω ±20%	1/4W	PC. 66610/19
165		R30	Wirewound Vitreous Enamel	33kΩ ±10%	10W	PC. 67010/22
166		R31	Carbon	100 Ω ± 5%	1/4W	PC. 66604/13
167		R32	Carbon	22kΩ ±20%	1/4W	PC. 66610/41
168		R33	Carbon	10 Ω ±20%	1/4W	PC. 66610/1
169		R34	Carbon	47kΩ ±20%	1/4W	PC. 66610/45
170		R35	Carbon	1kΩ ±20%	1/4W	PC. 66610/25
171		R36	Carbon	47kΩ ±20%	1/4W	PC. 66610/45
172		R37	Carbon	1kΩ ±20%	1/4W	PC. 66610/25
173		R38	Carbon	100 Ω ± 5%	1/4W	PC. 66604/13
174		R39	Carbon	10 Ω ±20%	1/4W	PC. 66610/1
175		R40	Carbon	330 Ω ±20%	1/4W	PC. 66610/19
176		R41	Carbon	47kΩ ±20%	1/4W	PC. 66610/45
177		R42	Carbon	100 Ω ± 5%	1/4W	PC. 66604/13
178		R43	Carbon	10kΩ ±20%	1/4W	PC. 66610/37
179		R44	Carbon	220kΩ ±20%	1/4W	PC. 66610/53
180		R45	Carbon	150kΩ ±20%	1/4W	PC. 66610/57
181		R46	Carbon	330kΩ ±20%	1/4W	PC. 66610/55
182		R47	Carbon	1MΩ ±20%	1/4W	PC. 66610/61
183		R48	Carbon	100kΩ ±20%	1/4W	PC. 66610/49
184		R49	Carbon	22kΩ ±20%	1/4W	PC. 66610/41
185		R50	Carbon	470kΩ ±20%	1/4W	PC. 66610/57

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Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No./Ref.
			RESISTORS (Cont'd)			
186		R51	Carbon	22kΩ ±20%	1/4W	PC. 66610/41
187		R52	Carbon	47kΩ ±20%	1/4W	PC. 66610/45
188		R53	Carbon	1kΩ ±20%	1/4W	PC. 66610/25
189		R54	Carbon	10kΩ ±20%	1/4W	PC. 66610/37
190		R55	Carbon	1MΩ ±20%	1/4W	PC. 66610/61
191		R56	Carbon	1.5kΩ ±20%	1/4W	PC. 66610/27
192		R57	Carbon	47kΩ ±20%	1/4W	PC. 66610/45
193		R58	Carbon	4.7kΩ ±20%	1/4W	PC. 66610/33
194		R59	Carbon	100kΩ ±20%	1/4W	PC. 66610/49
195		R60	Carbon	1MΩ ±20%	1/4W	PC. 66610/61
196		R61	Carbon	22kΩ ±20%	1/4W	PC. 66610/41
197		R62	Carbon	47kΩ ±20%	1/4W	PC. 66610/45
198		R63	Carbon	68kΩ ±20%	1/2W	PC. 66611/47
199		R64	Carbon	22kΩ ±20%	1/4W	PC. 66610/41
200		R65	Carbon	47kΩ ±20%	1/4W	PC. 66610/45
201		R66	Carbon	100 Ω ± 5%	1/4W	PC. 66604/13
202		R67	Carbon	100 Ω ± 5%	1/4W	PC. 66604/13
203		R68	Carbon	1kΩ ±20%	1/4W	PC. 66610/25
204		R69	Carbon	10kΩ ±20%	1W	PC. 66612/31
205		R70	Carbon	22 Ω ±20%	1/4W	PC. 66610/5
206		R71	Carbon	10 Ω ±20%	1/4W	PC. 66610/1
207		R72	Carbon	10kΩ ±20%	1/4W	PC. 66610/37
208		R73	Carbon	22kΩ ±20%	1/4W	PC. 66610/41
209		R74	Carbon	100 Ω ± 5%	1/4W	PC. 66604/13
210		R75	Carbon	100kΩ ±20%	1/4W	PC. 66610/49
211		R76	Carbon	2.2MΩ ±10%	1/2W	PC. 66610/65
212		R77	Carbon	470kΩ ±20%	1/4W	PC. 66610/57
213		R78	Carbon	2.2MΩ ±20%	1/4W	PC. 66610/65
214		R79	Carbon	470kΩ ±20%	1/4W	PC. 66610/57
215		R80	Carbon	220kΩ ±20%	1/4W	PC. 66610/53
216		R81	Carbon	100 Ω ± 5%	1/4W	PC. 66604/13
217		R82	Carbon	2.2kΩ ±20%	1/4W	PC. 66610/29
218		R83	Carbon	10kΩ ±20%	1/4W	PC. 66610/37
219		R84	Carbon	100kΩ ±20%	1/4W	PC. 66610/49
220		R85	Carbon	220kΩ ±20%	1/4W	PC. 66610/53
221		R86	Carbon	820 Ω ± 5%	1/4W	PC. 66610/24
222		R87	Carbon	14kΩ ± 5%	10W	W. 36679/B/9

Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No./Ref.
			RESISTORS (Cont'd)			
223		R88	Carbon	220 Ω ±20%	1/4W	PC. 66610/17
224		R89	Carbon	1kΩ ±20%	1/4W	PC. 66610/25
225		R90	Carbon	1kΩ ±20%	1/4W	PC. 66610/25
226		RV91	Variable Linear W.W	2.5kΩ ±10%	1/2W	PC. 67401/25
227		RV92	Variable Log Law Carbon	1MΩ ±20%	3/8W	PC. 67206/38
228		RV93)	Two Ganged	2.5kΩ ±20%	1/2W	W. 35074/6
229		RV94)	Inverse Law	2.5kΩ ±20%	1/2W	W. 35074/6
230		RV95	Variable Linear Carbon	2.5kΩ ±20%	3/4W	PC. 67203/5
231		R96	Carbon	10kΩ ±20%	1/4W	PC. 66610/37
232		R97	Carbon	68 Ω ±20%	1/4W	PC. 66610/11
233		R98	Carbon	68kΩ ±10%	1/2W	PC. 66610/47
234		R99	Carbon	10kΩ ±10%	1/2W	PC. 66610/37
235		R100	Carbon	15kΩ ±10%	1/2W	PC. 66610/39
236		R101	Carbon	10kΩ ±10%	1/2W	PC. 66610/37
237		R102	Carbon	15kΩ ±10%	1/2W	PC. 66610/39
238		R103	Carbon	47kΩ ±10%	1/2W	PC. 66610/45
239						
240		R104	Carbon	470kΩ ±10%	1/4W	PC. 66610/21
			INDUCTORS			
241		L1	Aerial Section Range 4			WSK. 13605/9
242		L2	Aerial Section Range 3			WSK. 13605/8
243		L3	Aerial Section Range 2			WSK. 13605/7
244		L4	Aerial Section Range 1			WSK. 13605/6
245		L5	HF Section Range 4			WSK. 13607/8
246		L6	HF Section Range 3			WSK. 13607/6
247		L7	HF Section Range 2			WSK. 13607/5
248		L8	HF Section Range 1			WSK. 13607/4

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Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No./Ref.
			INDUCTORS (Cont'd)			
249		L9	Mixer Section Range 4			WSK. 13606/9
250		L10	Mixer Section Range 3			WSK. 13606/8
251		L11	Mixer Section Range 2			WSK. 13606/7
252		L12	Mixer Section Range 1			WSK. 13606/4
253		L13	I.F.T.1 Bottom			W. 36907/1
254		L14	I.F.T.1 Top			W. 36907/1
255		L15	I.F.T.2 Bottom			W. 16193/B/2
256		L16	I.F.T.2 Top			W. 16193/B/1
257		L17	I.F.T.3			W. 20048/B/1
258		L18	I.F.T.4 Bottom			W. 16193/B/2
259		L19	I.F.T.4 Top			W. 16913/B/1
260		L20	I.F.T.5			W. 20048/B/1
261		L21	Choke			W. 20039/B/14
262		L22	I.F.T.6 Bottom			W. 16199/B/2
263		L23	I.F.T.6 Top			W. 16199/B/1
264		L24	Calibrator			WSK. 13289/32
265		L25	Calibrator			WSK. 13289/14
266		L26	Oscillator Section Range 4			WSK. 13608/7
267		L27	Oscillator Section Range 3			WSK. 13608/6
268		L28	Oscillator Section Range 2			WSK. 13608/5
269		L29	Oscillator Section Range 1			WSK. 13608/4
270		L30	2nd Oscillator			WSK. 13160/32
271		L31	3rd Osc. Anode Coil			W. 35074/24
272		L32	Choke			W. 20039/B/15
273		L33	3rd Oscillator			W. 13161/18
274						
275						

Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No./Ref.
			CRYSTALS			
276		XL1	)			
277		XL2	)			
278		XL3	) Specified When			
279		XL4	) Ordering			
280		XL5	)			
281		XL6	)			
282		XL7	Calibrator Crystal			WSK.13289/12
283		XL8	I.F.3 Crystal			W.20048/B/9
284		XL9	I.F.5 Crystal			W.20048/B/8
285						
			PLUGS			
286		PLA	5 Pin			W.35074/16
287		PLB	Co-axial			W.35074/17
288		PLC	Co-axial			W.35074/17
289						
290						
			SOCKETS			
291		SKA	Co-axial Aerial Socket			W.20272/C/3
292		SKB	Co-axial Aerial Socket			W.20272/C/3
293						
294						
295						
			SWITCHES			
296		SWA1	) Bandchange 4			WSK.13605/3
297		SWA2	) Position			WSK.13605/3
298		SWA3	)			WSK.13607/2

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Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No./Ref.
			SWITCHES (Cont'd)			
299		SWA4	)			WSK. 13607/2
300		SWA5	) Bandchange 4			WSK. 13606/3
301		SWA6	) Position			WSK. 13608/2
302		SWA7	)			WSK. 13608/2
303		SWB1	)			W. 35074/33
304		SWB2	) Passband 4			W. 35074/33
305		SWB3	) Positions			W. 35074/33
306		SWB4	)			W. 35074/33
307		SWC1	)			W. 35074/34
308		SWC2	) AGC Calibrator			W. 35074/34
309		SWC3	) 7 Positions			W. 35074/34
310		SWD1	) Meter Switch 11			W. 35074/29
311		SWD2	) Positions			W. 35074/29
312		SWE1	) 1st Oscillator			W. 35074/35
313		SWE2	) Selector			W. 35074/35
314		SWE3	) 8 Positions			W. 35074/35
315		SWE4	)			W. 35074/35
316		SWF	AGC Selector			W. 35074/31
317						
318						
319						
320						
			VALVES			
321		V1	CV. 138			
322		V2	CV. 138			
323		V3	CV. 453			
324		V4	CV. 453			
325		V5	CV. 131			
326		V6	CV. 131 = W77			
327		V7	CV. 452			
328		V8	CV. 133 = 6C4			
329		V9	CV. 452 = 6AT6			
330		V10	CV. 138			

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Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No./Ref.
			VALVES (Cont'd)			
331		V11	CV.138			
332		V12	CV.133			
333		V13	CV.131			
334		V14	CV.287			
335						
			MISCELLANEOUS			
336		TR1	Output Trans.			W.35074/4
337		M1	Meter (Feeds)			W.35074/60
338		LP1	Illuminating Lamp	8V	1.6W	PC.48701/4
339		LP2	Illuminating Lamp	8V	1.6W	PC.48701/4
340		JKA	Phones Jack			WSK.13972/2
341		JKB	Phones Jack			WSK.13972/2
342			Valveholder B8G			W.35074/2
343			Valveholder B7G			W.36827/5
344			Valveholder B7G			W.36830/B/3
345						

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COMPONENTS LIST No. 2
FOR
SUPPLY UNITS TYPE 1325/4 & 1325/5
(Drg. No. W.35074)

NOTES

1. When ordering spares quote information from all columns for identities marked * or identity only for all other items.
2. The references in column 1 are shown on circuit diagram, Fig. 8 and component location diagram, Fig. 9.
3. For identical items the total quantity is given at the first entry.

Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No./Ref.
			CAPACITORS			
1		C1	TCC Type 82	8μF ±15%	400V	W.25413/A/18
2		C2	TCC Type 82	8μF ±15%	400V	W.25413/A/18
3		C3	TCC Type 82	8μF ±15%	400V	W.25413/A/18
4						
5						
			FUSES			
6		FS1	Fuse	2Amp		W.25413/A/12
7		FS2	Fuse	2Amp		W.25413/A/12
8		FS3	Fuse	500mA		W.25413/A/11
9						
10						
			INDUCTORS & TRANSFORMERS			
11		CH1	Inductor	15-20H		W.25413/A/14
12		CH2	Inductor	15-20H		W.25413/A/14
13						
14		TR1	Transformer			W.25413/A/13
15						

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Item No.	Unit No.	Circuit Ref.	Description	Value and Tolerance	Rating Watts, Working Voltage DC, etc.	GA. No /Ref.
			MISCELLANEOUS			
16		R1	Resistor	220,000 Ω ±10%		W.25413/A/19
17		SWA	Switch DP On/Off			W.25413/A/15
18		MR1	Rectifier			W.25413/A/9
19		LP1	Signal Lamp	8V 0.2A		PC.48701/4
20		PLA	3 Pin 5 Amp			W.25413/A/50

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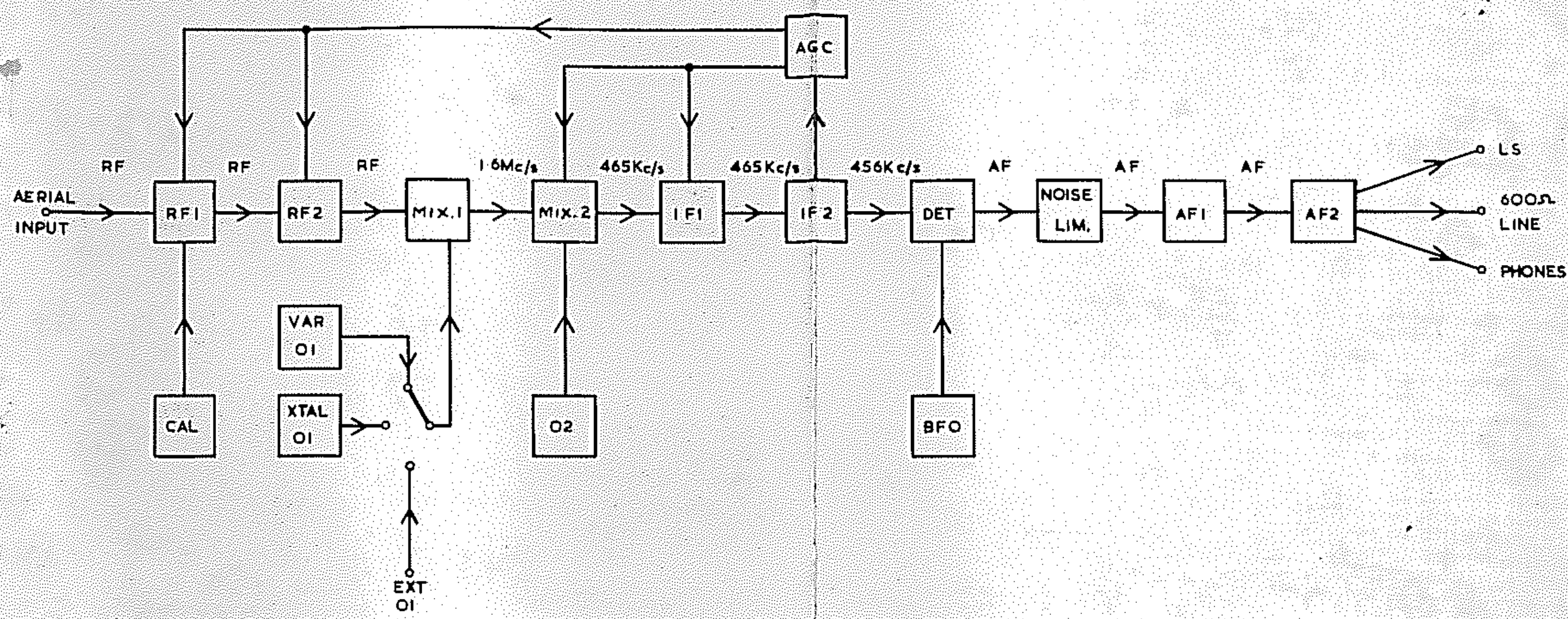
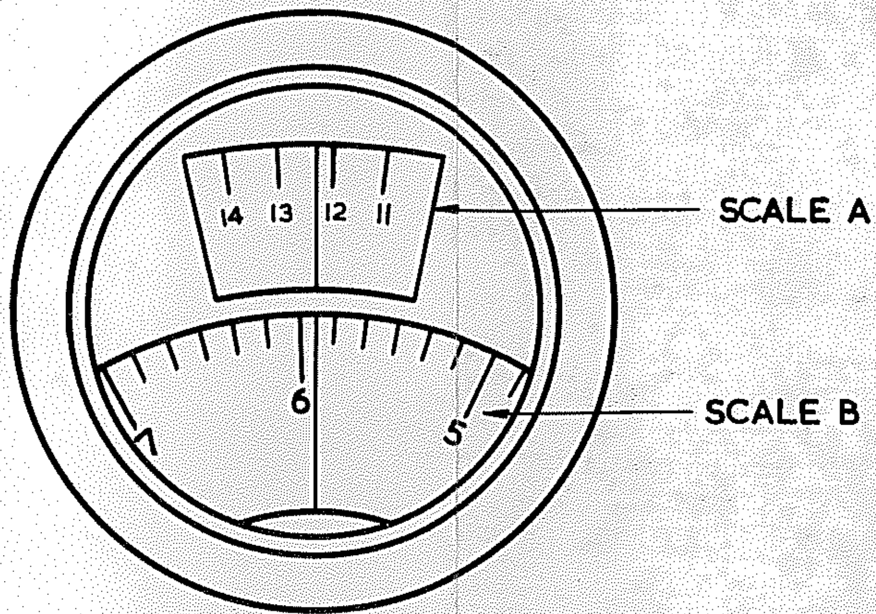


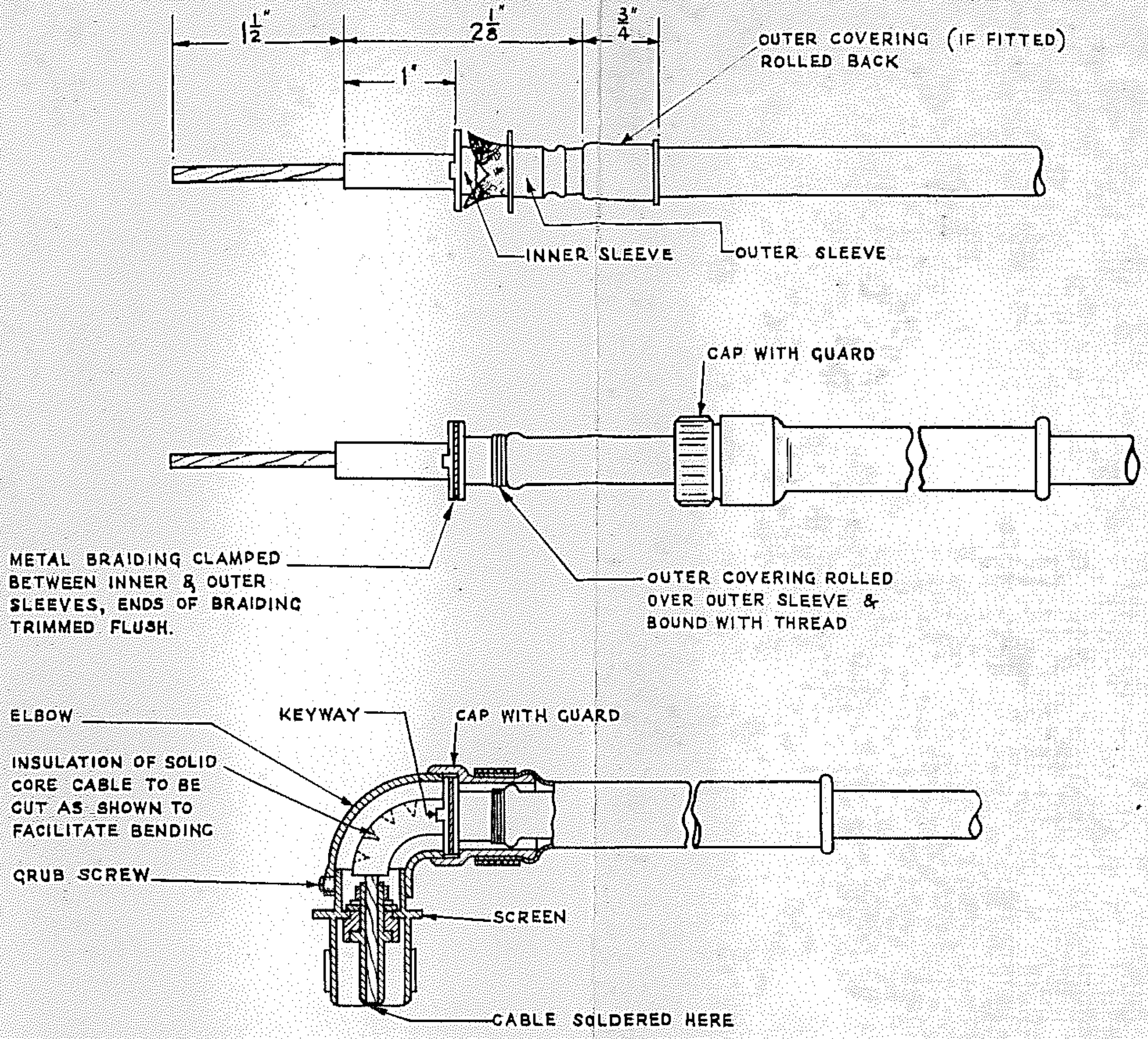
BLOCK DIAGRAM
WZ.10602/B SHEET 1

FIG. 2



LOGGING SCALE
WZ.10953/C SHEET 1

FIG. 3

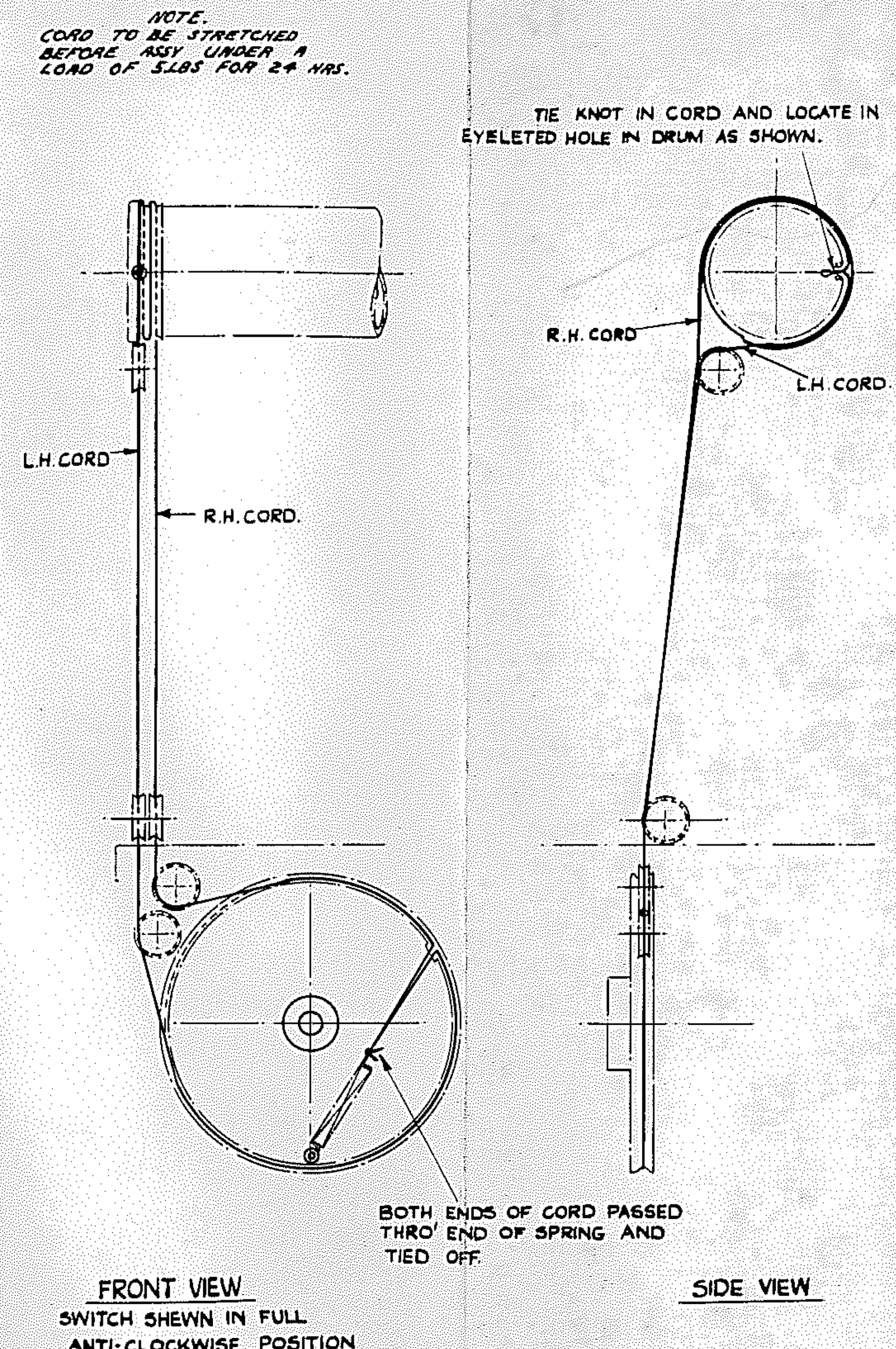


PLACE ELBOW OVER END OF CABLE WITH PROJECTION ON INNER SLEEVE IN ITS KEYWAY & SCREW HOME CAP WITH GUARD.
CLEAN THE CONDUCTOR & PASS THROUGH HOLE IN PLUG. SCREW HOME SCREEN INTO ELBOW & TIGHTEN GRUB SCREW.
SPLAY OUT CONDUCTOR & SECURELY SOLDER AS SHOWN. PROJECTING ENDS TO BE TRIMMED FLUSH WITH PLUG.

SUITABLE CABLES
75 Ω UNI-RADIO Nos. 1, 18 & 19. TELCON AS 42, AS 42M, PT29, PT29M.
100 Ω UNI-RADIO No 31. TELCON AS 48M, PT34, PT34M.

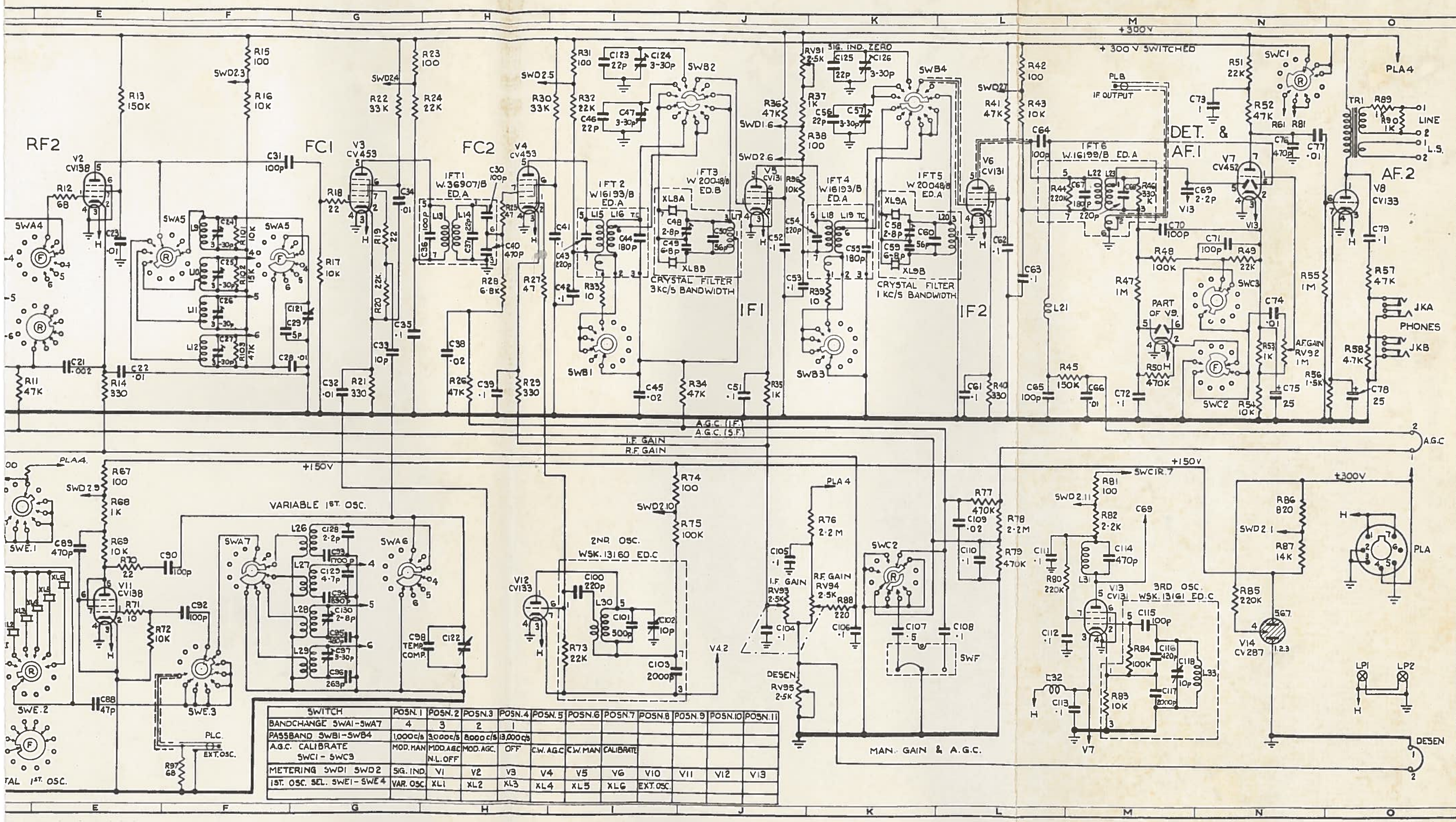
METHOD OF FIXING AERIAL FEEDER CABLE TO PLUG
WZ.5328/B SHEET 1

FIG. 4



CORD DRIVE ASSEMBLY
WSK.13976, SHEET 1

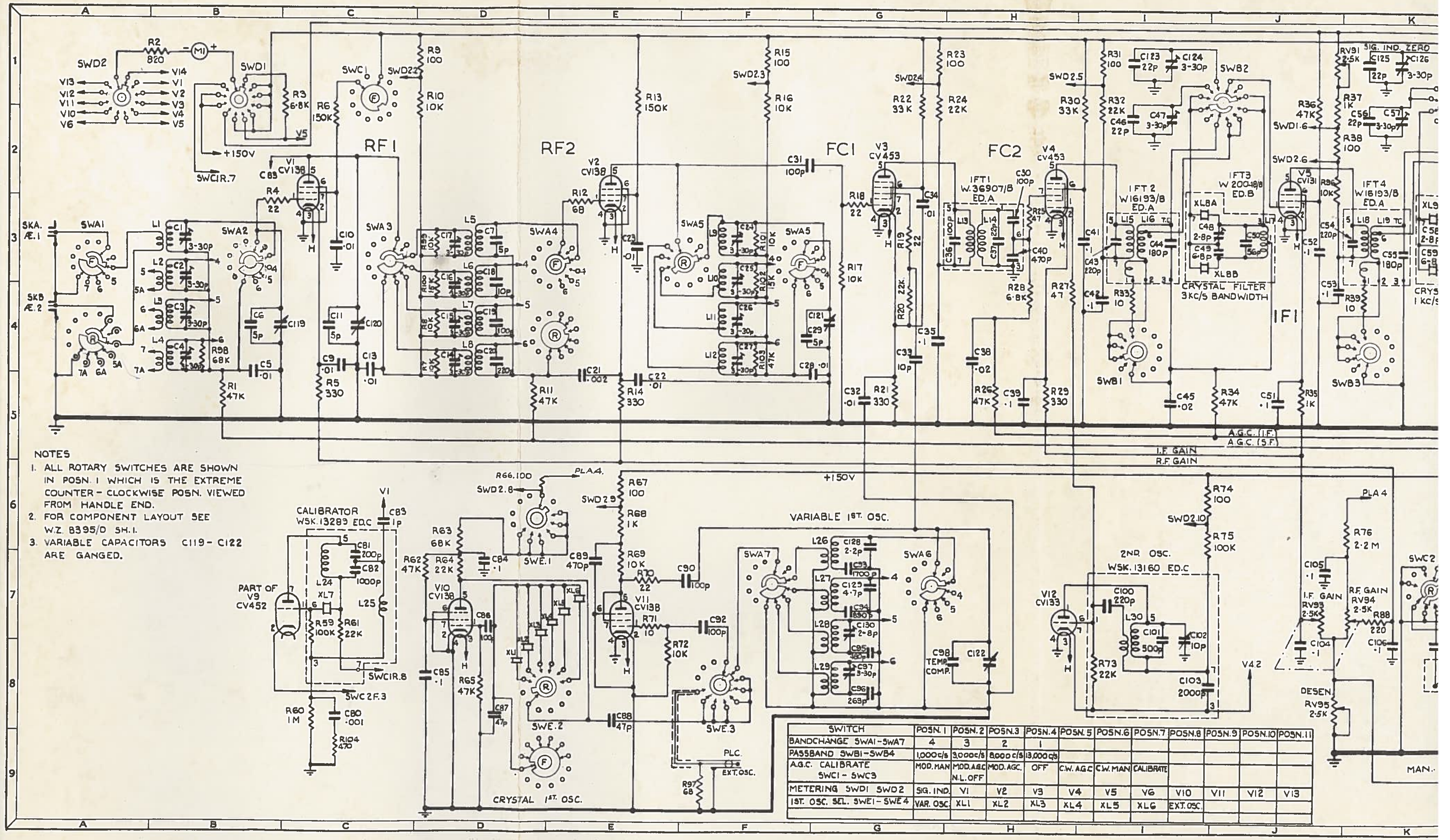
FIG. 5



SWITCH	POSN.1	POSN.2	POSN.3	POSN.4	POSN.5	POSN.6	POSN.7	POSN.8	POSN.9	POSN.10	POSN.11
BANDCHANGE SWA1-SWA7	4	3	2	1							
PASSBAND SWB1-SWB4	1,000 c/s	3,000 c/s	8000 c/s	13,000 c/s							
A.G.C. CALIBRATE SWC1 - SWC3	MOD. MAN	MOD. A.G.C N.L. OFF	MOD. AGC.	OFF	C.W. A.G.C	C.W. MAN	CALIBRATE				
METERING SWD1 SWD2	SIG. IND.	V1	V2	V3	V4	V5	V6	V10	V11	V12	V13
1ST. OSC. SEL. SWE1 - SWE4	VAR. OSC.	XL1	XL2	XL3	XL4	XL5	XL6	EXT. OSC.			

CIRCUIT DIAGRAM OF RECEIVER
WZ.8394/D Sh.1 Iss.10

FIG. 6

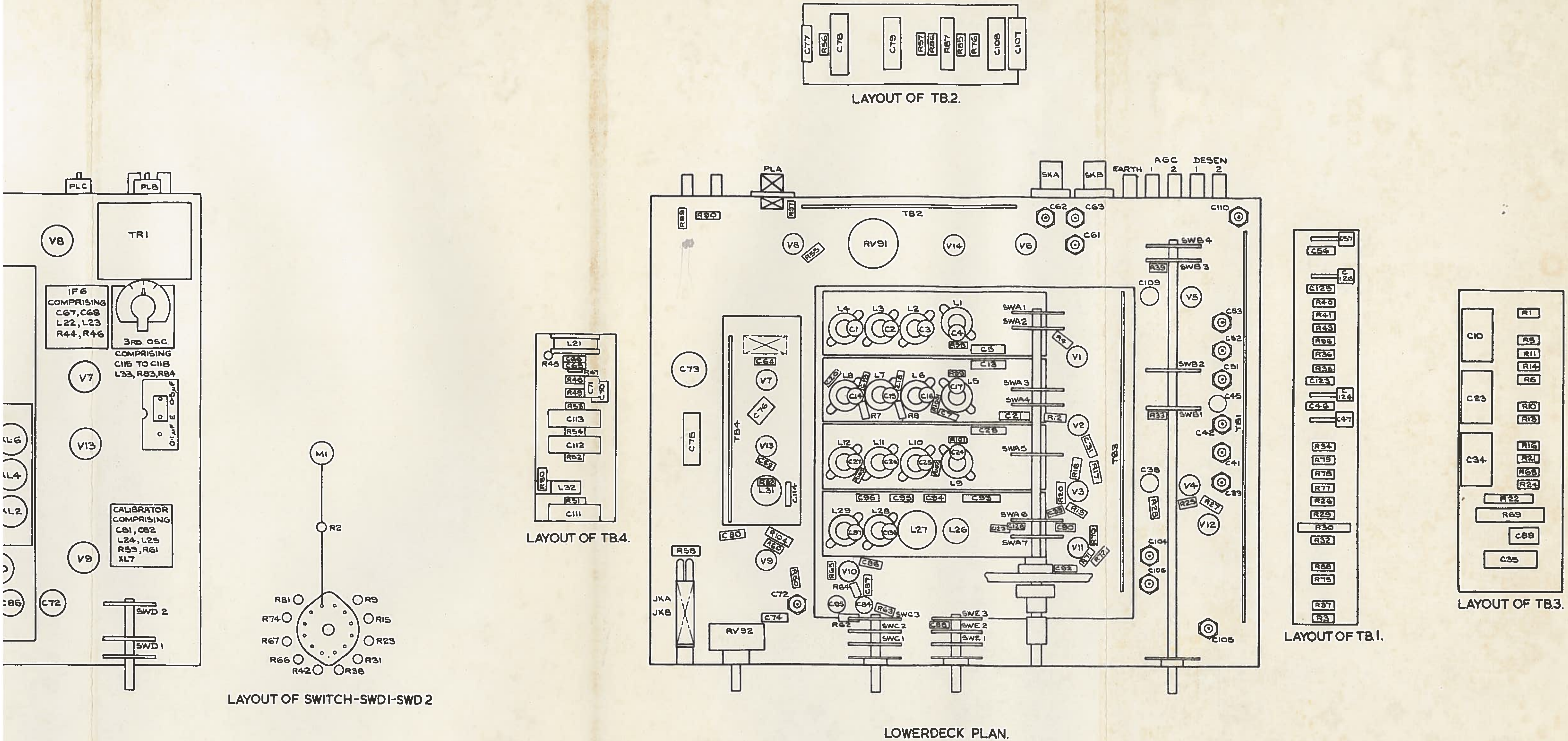


NOTES

1. ALL ROTARY SWITCHES ARE SHOWN IN POSN. 1 WHICH IS THE EXTREME COUNTER-CLOCKWISE POSN. VIEWED FROM HANDLE END.
2. FOR COMPONENT LAYOUT SEE W.Z. 8395/D SH.1.
3. VARIABLE CAPACITORS C119 - C122 ARE GANGED.

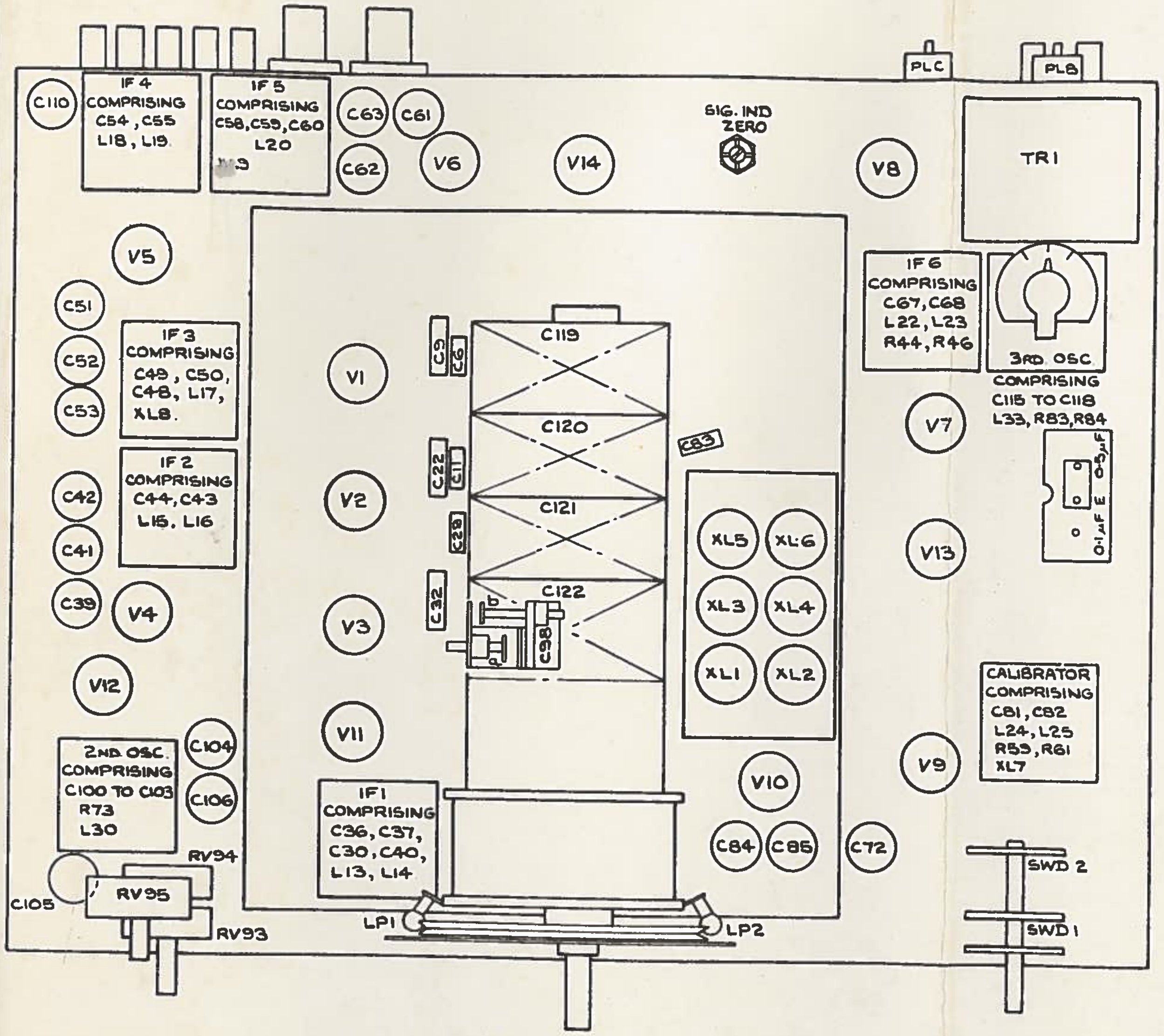
SWITCH	POSN.1	POSN.2	POSN.3	POSN.4	POSN.5	POSN.6	POSN.7	POSN.8	POSN.9	POSN.10	POSN.11
BANDCHANGE SWA1-SWA7	4	3	2	1							
PASSBAND SWB1-SWB4	1,000c/s	3,000c/s	8,000c/s	13,000c/s							
A.G.C. CALIBRATE SWC1 - SWC3	MOD.MAN	MOD.A.G.C N.L.OFF	MOD.AGC.	OFF	C.W.AGC	C.W.MAN	CALIBRATE				
METERING SWD1 SWD2	SIG.IND.	V1	V2	V3	V4	V5	V6	V10	V11	V12	V13
1ST. OSC. SEL. SWE1-SWE4	VAR.OSC.	XL1	XL2	XL3	XL4	XL5	XL6	EXT.OSC.			

CIRCUIT DIAGRAM OF RECEIVER
WZ. 8394/D Sh.1 Iss.10

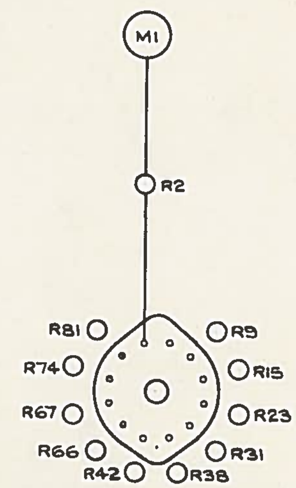


COMPONENT LAYOUT OF RECEIVER
WZ.8395/D SHEET 1

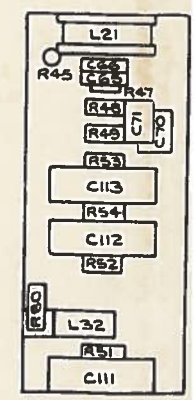
FIG. 7



UPPERDECK PLAN.

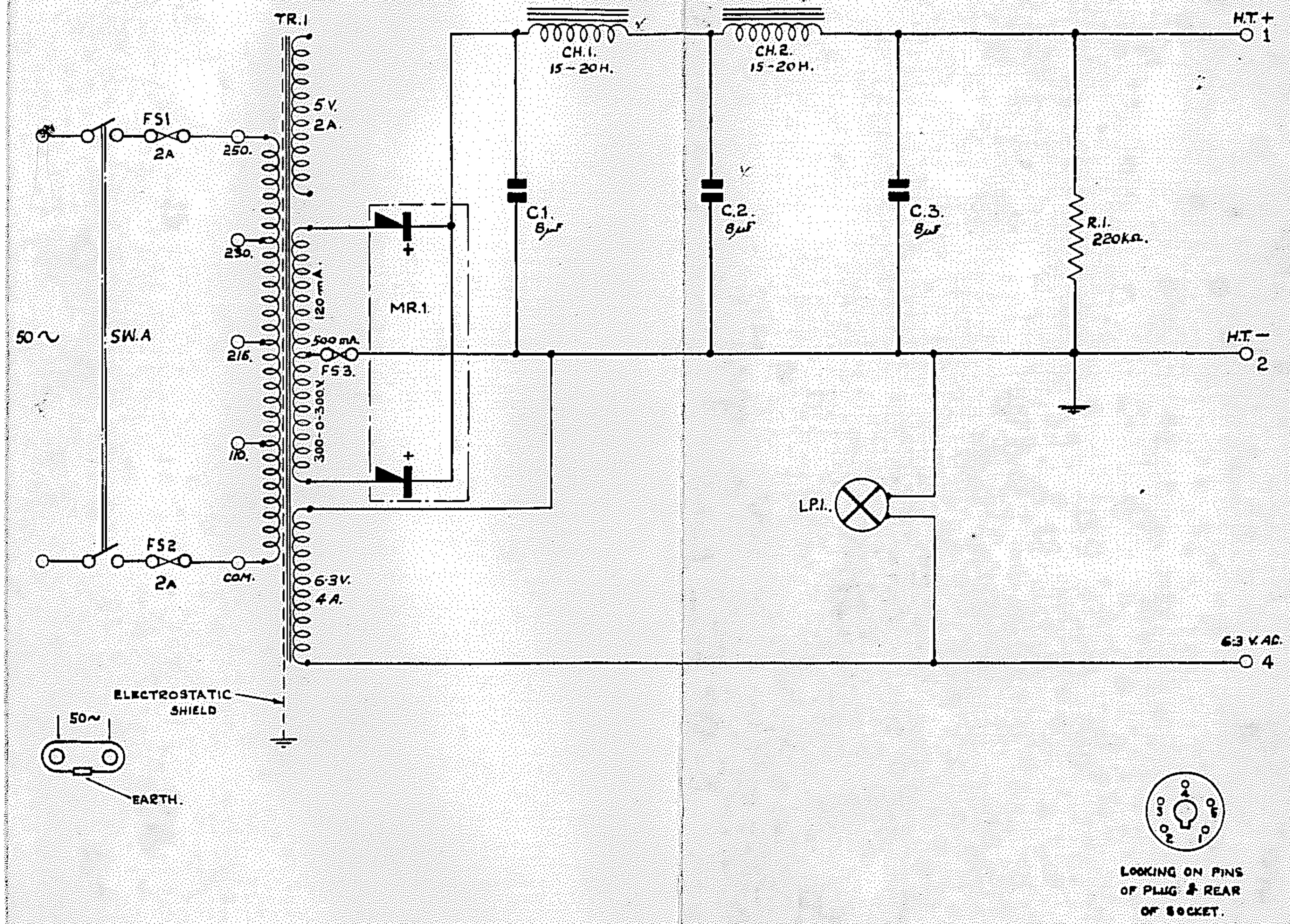


LAYOUT OF SWITCH-SWD1-SWD 2



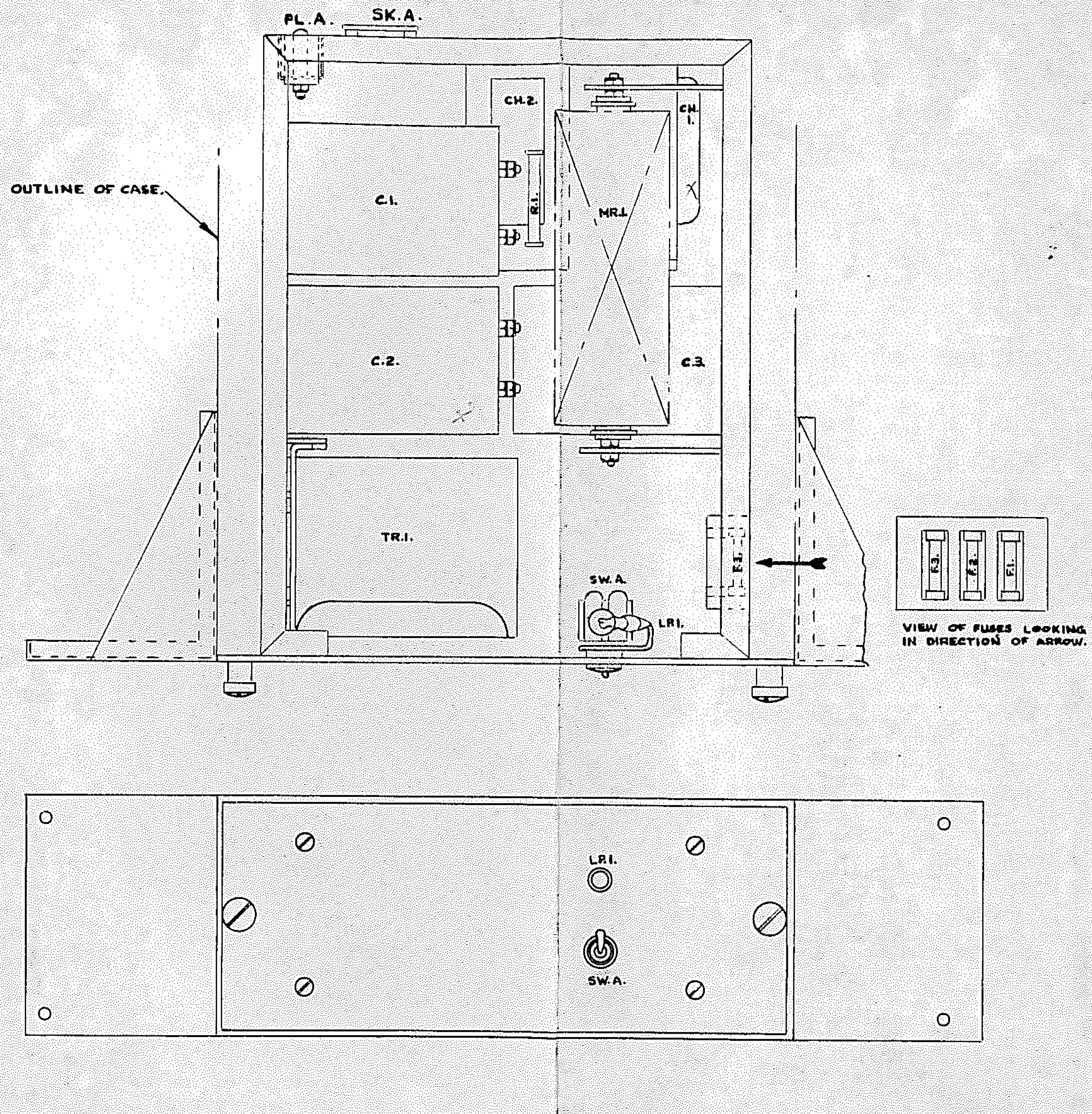
LAYOUT OF TB

COMPONENT LAYOUT C
WZ.8395/D SHEET



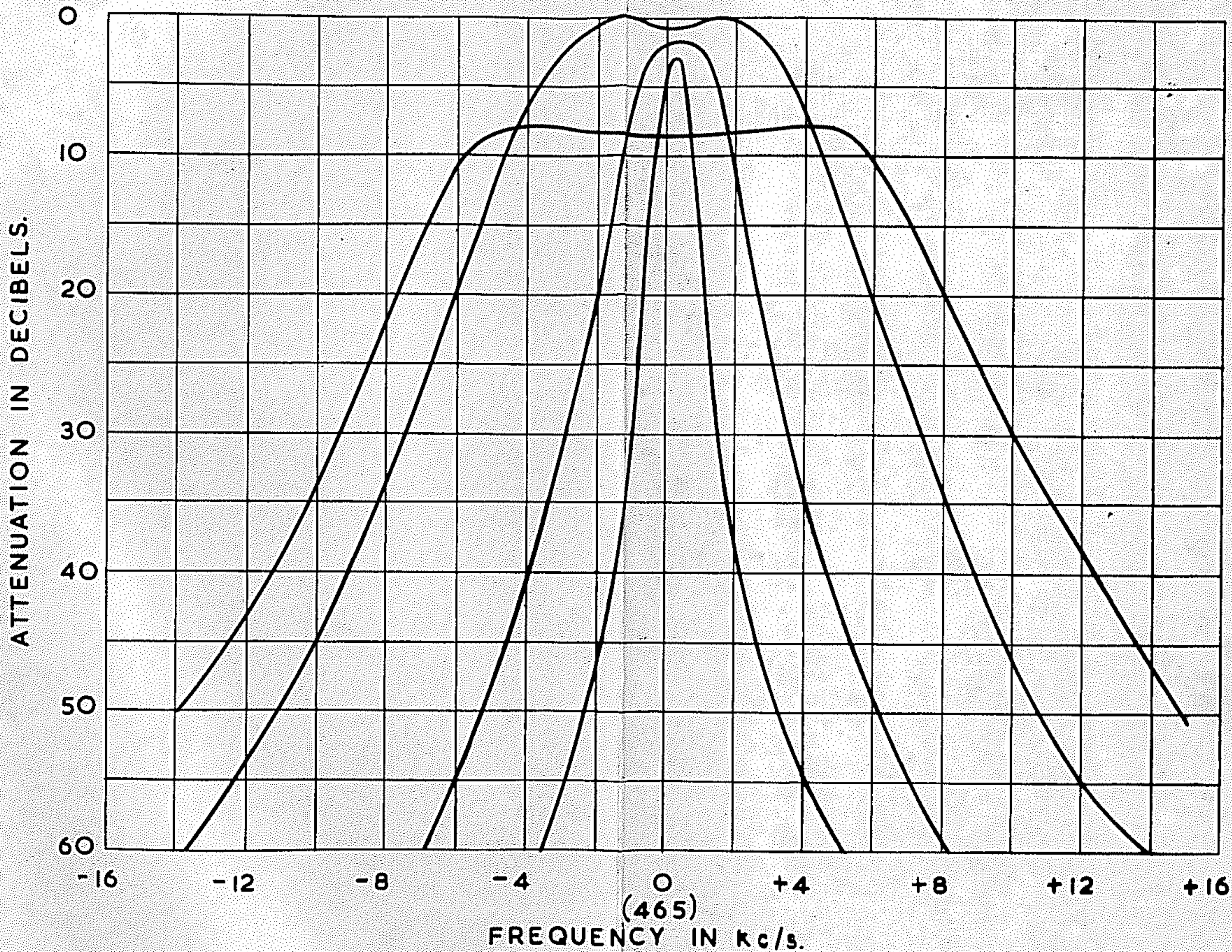
CIRCUIT DIAGRAM OF SUPPLY UNIT
WZ.4768/B SHEET 1

FIG. 8



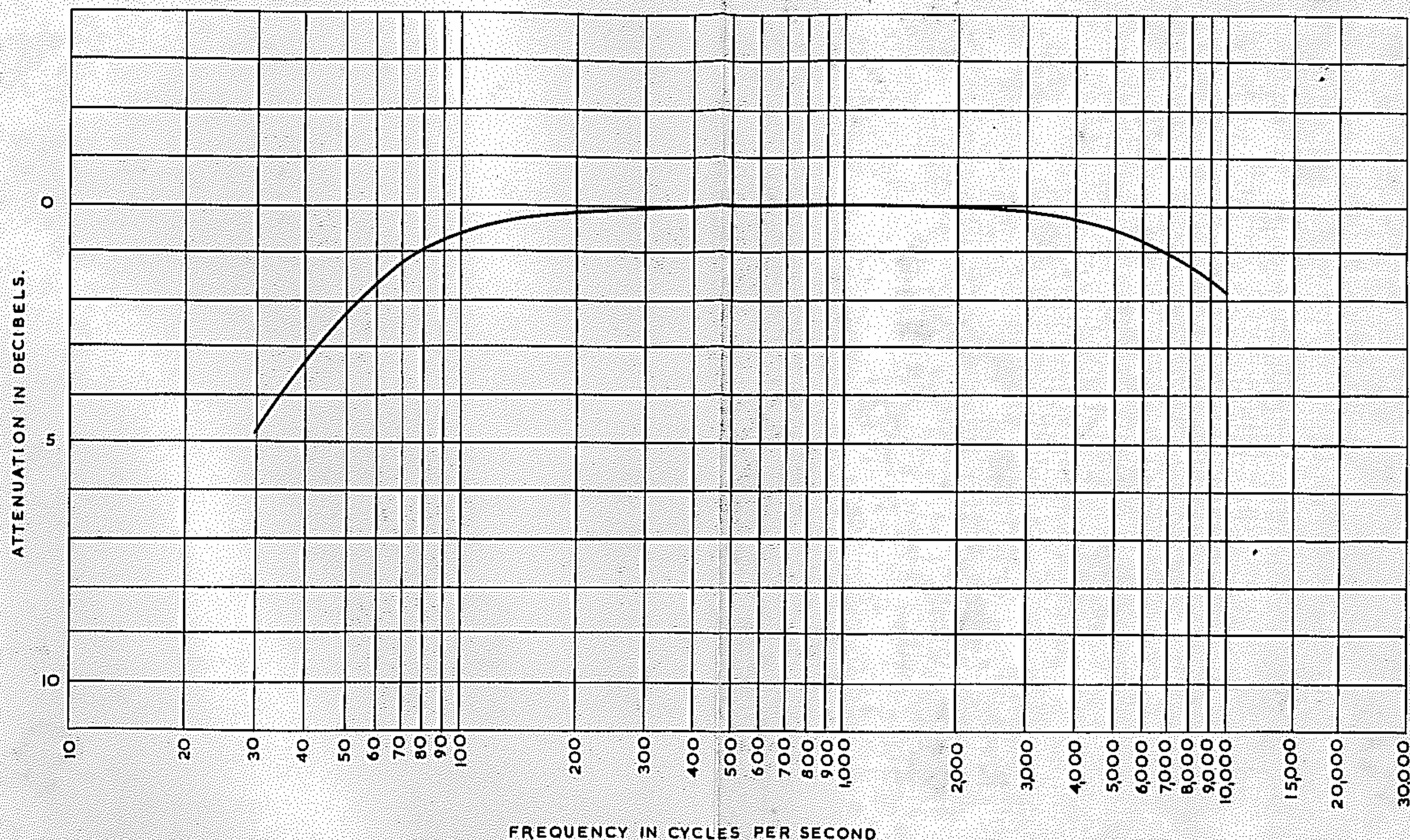
COMPONENT LAYOUT OF SUPPLY UNIT
WZ.10728/B SHEET 1

FIG. 9



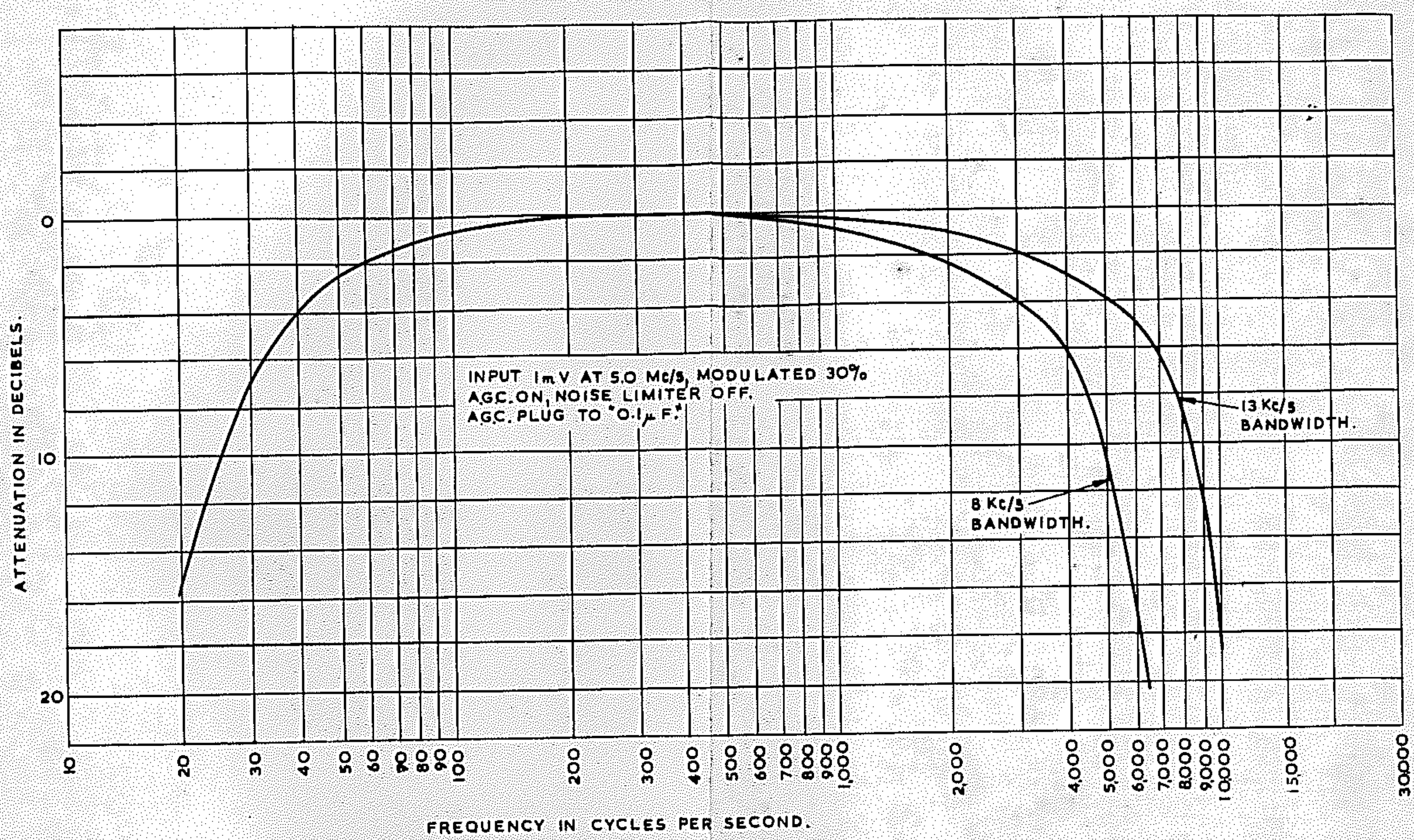
IF RESPONSE
WZ.10604/B SHEET 1

FIG. 10



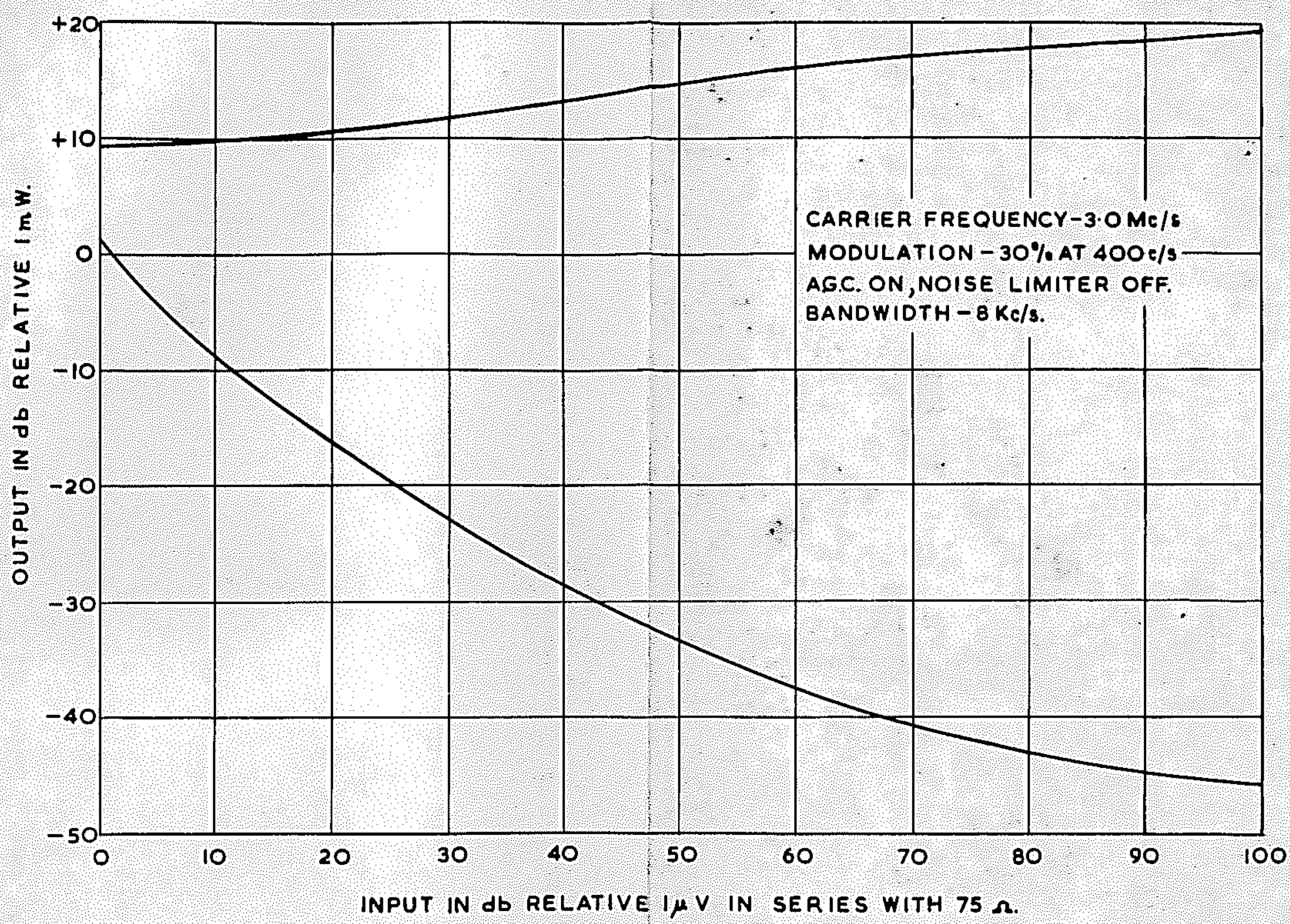
AF RESPONSE
WZ.10606/B SHEET 1

FIG. 11



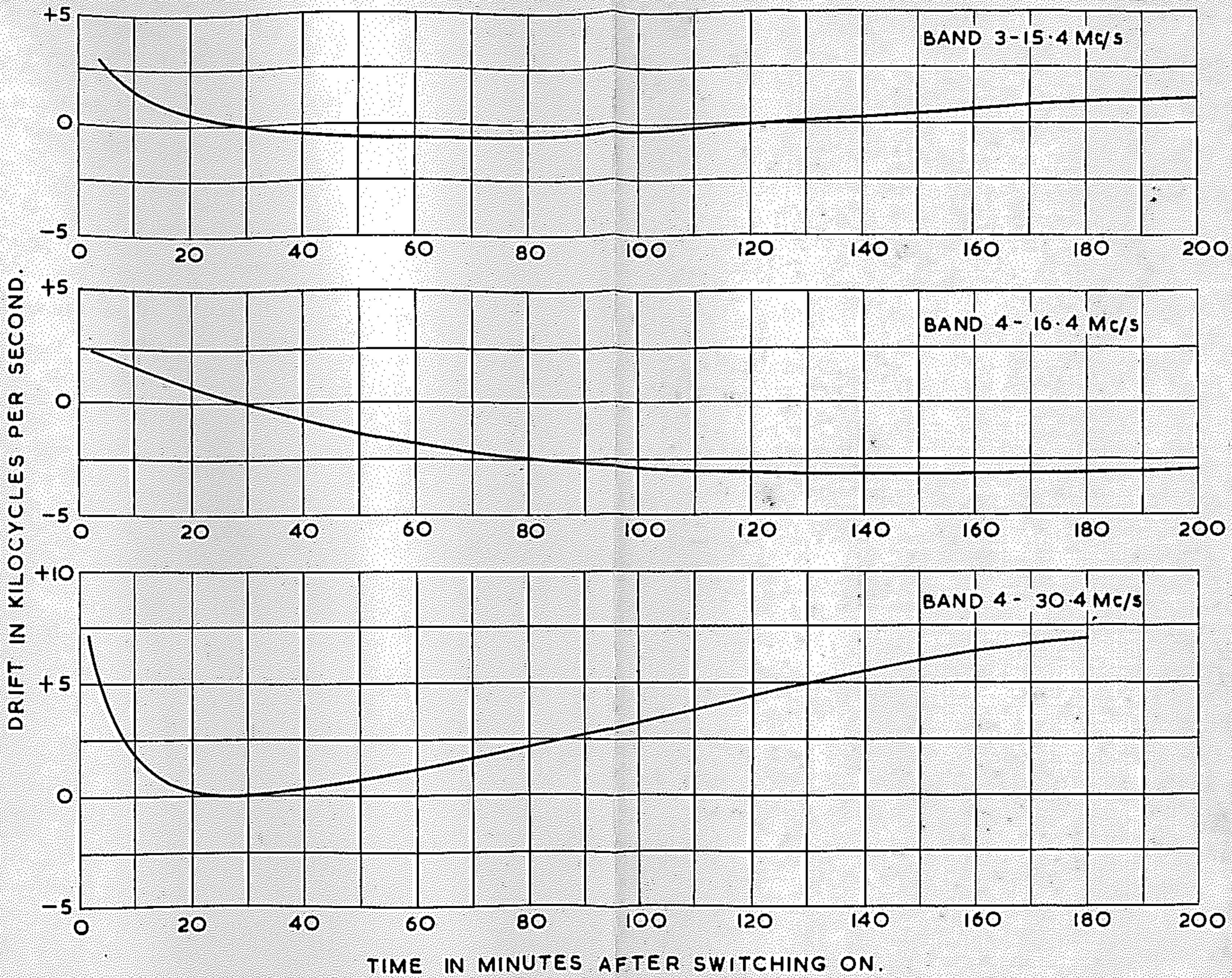
OVERALL FREQUENCY RESPONSE
WZ.10607/B SHEET 1

FIG. 12



AGC CHARACTERISTIC
WZ.10605/B SHEET 1

FIG. 13



FREQUENCY DRIFT
WZ.10603/B SHEET 1

FIG. 14