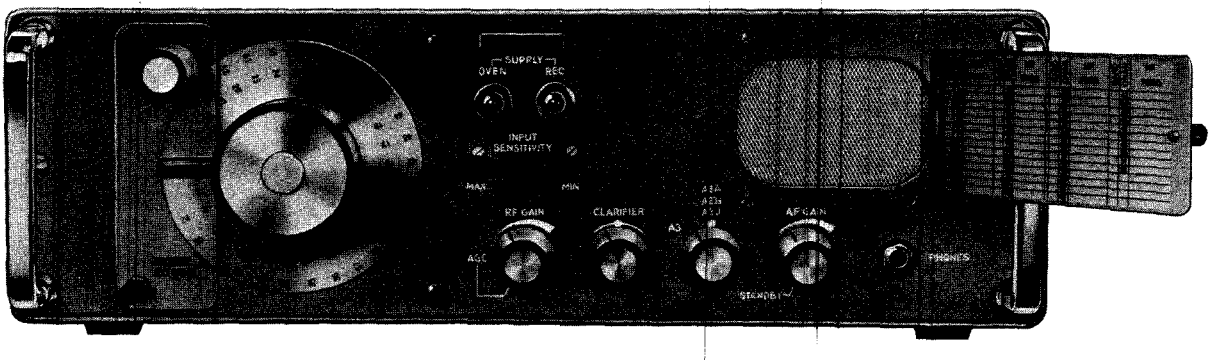
Eddystone

SOLID-STATE MULTI-CHANNEL

CRYSTAL-CONTROLLED RECEIVERS

MODEL EC964 SERIES



EC964/1

52-CHANNEL
HF/MF RECEIVERS
EC964/1
EC964/2

28-CHANNEL
MF RECEIVERS
EC964/3
EC964/5

Manufactured in England by

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Illustrations in text

Illustrations bound at rear

AMENDMENT RECORD

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1	Included in text.	Eddystone	Mar '71
2	Included in text.	Eddystone	Mar '71
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EC964 RECEIVERS

Circuit Modification On all receivers delivered after June 1971, the wiring of the STANDBY SWITCH S4A differs from that shown on the circuit diagrams in this handbook. S4A is now wired between the zener diode D37 and the +24V line feeding all stages in the receiver. Circuit diagrams should be annotated accordingly.

Section 1

GENERAL DESCRIPTION

The EC964 range of receivers is primarily intended for use in the maritime service for ship-to-ship and ship-to-shore communication. It has been designed for optimum performance and reliability coupled with simplicity in operation and is equally suited to ship or coastal radio station use. A self-contained power supply is provided for direct working from standard AC supplies and a DC/AC Converter is available as an accessory when it is necessary to operate the receiver from low-voltage DC.

All versions of the receiver provide reception facilities for telephony in the AM (double-sideband - A3) and SSB (upper sideband - A3A, A3H & A3J) modes. A1 & A2 telegraphy signals can also be received and variants are available with provision for FSK (F1) telegraphy working using an external keying unit (not supplied).

A double-conversion circuit is employed in which all local oscillator stages are crystal controlled. Channel selection is by change of 1st Oscillator frequency and the 2nd Oscillator is variable (±300Hz) to permit precise frequency setting. A low-frequency 2nd IF is used with separate filters and detectors for AM, SSB (and FSK) reception. Two AGC systems are incorporated which control the RF and IF Stages separately. A panel loudspeaker is fitted and separate outputs are available for telephone headset and remote lines, the latter being independent of the speaker/headset output.

EC964 receivers are classified according to their frequency coverage and bear identities as follows:-

Model	MF Coverage	HF Coverage
EC964/1	1.6-4.5MHz (28 Channels)	8 Ranges (3 Channels each Range)
EC964/2	1.6-4.5MHz (28 Channels)	6 Ranges (4 Channels each Range)
EC964/3	1.6-4.5MHz (28 Channels)	Nil
EC964/4	Refer to separate Handbook	
EC964/5	1.6-4.5MHz (28 Channels)	Nil

Marine Approval

Model EC964/1 is approved for marine use by the British Post Office to the relevant sections of Specifications TSC102 and TSC105. Model EC964/3, which provides MF cover only, is similarly approved to TSC105.

Other special variants are approved by Telecommunications Authorities in several European countries.

Minor Design Variations

EC964/1 & EC964/3	EC964/2 & EC964/5
Fitted with BNC aerial socket and UK-type AC connector. Fuse in live AC line only. Fitted with manual RF Gain control and AGC ON/OFF switch.	Fitted with UHF83 aerial socket and Continental-type AC connector. Fuses in both live and neutral AC lines.

TECHNICAL DATA

GENERAL

Frequency Coverage

Model	MF Coverage	HF Coverage
EC964/1	1.6-4.5MHz in 4 ranges. 28 channels. Range 1 : 1.6-2.1MHz. Range 2 : 2.1-2.7MHz. Range 3 : 2.7-3.5MHz. Range 4 : 3.5-4.5MHz.	4.0-27.5MHz in 8 ranges (marine allocations only.) 24 channels Range 1 : 4.0-4.45MHz. Range 2 : 6.2-6.525MHz. Range 3 : 8.15-8.85MHz. Range 4 : 12.3-13.25MHz. Range 5 : 16.4-17.4MHz. Range 6 : 22.0-22.72MHz. Range 7 : 25.01-25.6MHz. Range 8 : 26.1-27.5MHz.
EC964/2	1.6-4.5MHz in 4 ranges. 28 channels. Range 1 : 1.6-2.1MHz. Range 2 : 2.1-2.7MHz. Range 3 : 2.7-3.5MHz. Range 4 : 3.5-4.5MHz.	4.0-22.72MHz in 6 ranges (marine allocations only.) 24 channels. Range 1 : 4.0-4.45MHz. Range 2 : 6.2-6.525MHz. Range 3 : 8.15-8.85MHz. Range 4 : 12.3-13.25MHz. Range 5 : 16.4-17.4MHz. Range 6 : 22.0-22.72MHz.
EC964/3 & EC964/5	1.6-4.5MHz in 4 ranges. 28 channels. Range 1 : 1.6-2.1MHz. Range 2 : 2.1-2.7MHz. Range 3 : 2.7-3.5MHz. Range 4 : 3.5-4.5MHz.	HF coverage not available on these versions.

Channel Allocation

MF Band : 2182kHz fitted as standard plus 27 other channels to customers' requirements. Channels can be located in any combination, including all within one range if required.

HF Band : 3 channels per range on EC964/1

4 channels per range on EC964/2

Intermediate Frequencies (all versions)

1st IF :: 1.2MHz. 2nd Oscillator is variable ± 300Hz to provide 'Clarifier' fine tuning facility.

2nd IF :: 100kHz (carrier frequency).

Separate IF Filters are provided for AM & SSB. FSK Filter is not fitted on standard EC964 receivers.

Reception Facilities

Telephony

DSB (A3) and SSB (upper sideband only in A3A, A3H & A3J modes).

Telegraphy

FSK (F1) facilities can be made available on all versions to special order, low-level tone outputs being provided at 600 ohms impedance to feed an external keying unit. Receivers supplied for FSK working bear suffix 'X' in their type designation and may also be used for A1 telegraphy. A2 telegraphy can be received in A3 mode position.

Power Supplies

Single-phase AC mains 100/125V and 200/250V (40-60Hz), or low-voltage DC (12/24 volts) using external DC/AC Converter.

Consumption is of the order 45VA.

Input and Output Impedances

Aerial Input :: 50-ohms (unbalanced).

Audio Output :: Int. LS : 25-ohms.
Line : *600-ohms.
Headset : Low/medium-Z.

*balanced or unbalanced.

Semiconductor Complement

EC964/1 & EC964/2	42 transistors, 3 integrated circuits and 34 diodes.
EC964/3 & EC964/5	33 transistors, 3 integrated circuits and 25 diodes.

Two additional diodes are fitted on Models EC964/1 & EC964/3 (Manual RF gain control circuit.

Refer to Appendix 'C' for complete list of semiconductor types and circuit functions.

Dimensions

Refer to Section 3. Page 1.

T Y P I C A L P E R F O R M A N C E

(This data should not be interpreted as a Test Specification)

Sensitivity

AM :: 5µV for 12dB S/N (6kHz IF B/W).

SSB :: 1µV for 12dB S/N (2.4kHz IF B/W).

AM Selectivity

6kHz B/W at -6dB, 30kHz B/W at -60dB.

SSB Filter Characteristics

Assymmetrical response with bandwidth of 2.4kHz at -3dB points. 60dB points lie at carrier +400Hz and carrier -3.5kHz.

Filter passes the lower sideband to accommodate sideband reversal in 1st Mixer Stage.

Carrier Insertion

SSB :: 100.00kHz) crystal-
FSK :: 102.21kHz) controlled.

IF Rejection

Greater than 90dB (80dB below 4MHz).

Image Rejection

Greater than 60dB up to 15MHz and greater than 45dB above 15MHz.

Cross Modulation

With a wanted signal 60dB above 1µV, the interference produced by an unwanted signal 20kHz off-tune and of level 90dB above 1µV will be more than 30dB below standard output.

Blocking

With a wanted signal 60dB above 1µV, an unwanted carrier 20kHz off-tune must be of a level exceeding 100dB above 1µV to affect the output by 3dB.

Intermodulation

The level of third-order intermodulation products given by two signals of equal strength lying at carrier + 1000Hz and carrier + 1600Hz will be at least 30dB below the level of either of the original signals.

Frequency Stability

Drift will not exceed 20Hz in any 15 minute period with constant ambient and supply variation of 10%.

A temperature change of 0°C to +40°C will not effect the tune frequency by more than 100Hz.

Overall Response

Does not fall by more than 6dB over the range 350Hz to 2.4kHz (SSB mode).

AGC Characteristic

Output level is maintained within 6dB when input level is increased by 90dB from 2μV reference level.

Audio Output

1.5W at less than 5% distortion to built-in loudspeaker. (2W maximum).

10mW to 600-ohm line. (Adjustable)

Audio Response

Level within 3dB from 300Hz to 3000Hz.

Radiation

Typically 20pW and not greater than 400pW at any frequency.

Operational Temperature Rating

0°C to + 40°C.

Muting

Gain reduction of 120dB of local associated transmitter signal.

Clarifier Range

± 300Hz.

FSK Output

Tone frequencies of 2125Hz (mark) and 2295Hz with 170Hz carrier shift.

CIRCUIT DESCRIPTION

GENERAL

All variants of the EC964 Receiver employ a dual-conversion circuit with crystal controlled local oscillators, channel selection being achieved by switching the 1st Oscillator crystal. Intermediate frequencies of 1.2MHz and 100kHz are used and the 2nd Oscillator (although crystal-controlled), is variable over a small range to provide a 'clarifier' fine tuning facility.

Separate front-end circuits of similar design are utilised for coverage of the MF and HF Bands in the case of the dual-band versions (EC964/1 & EC964/2). The HF circuitry is omitted on the EC964/3 & EC964/5 which provide MF cover only.

Independent AGC systems control the RF and IF stages. Manual RF gain facilities are provided on the EC964/1 and EC964/3 which are designed to meet the requirements of British Post Office Specifications TSC102/105 and TSC105 respectively. The AGC circuit is disabled when using the manual control.

Detection circuits are standard on all versions, except that the FSK crystal is omitted when not required. Separate audio channels are provided for speaker/headset and line.

THE RF SECTION

Method of Channel Selection

The basic system of channel selection employed in the EC964 range of receivers is best understood by considering first the EC964/3 & EC964/5 variants which cover the MF Band only. The RF Sections of these two receivers are identical and those minor differences which do exist in other parts of the circuit will be covered elsewhere.

The MF Band (1.6-4.5MHz) is divided into four separate ranges which cover the frequencies listed below:-

Range 1	::	1.6-2.1MHz.	Range 3	::	2.7-3.5MHz.
Range 2	::	2.1-2.7MHz.	Range 4	::	3.5-4.5MHz.

Range selection is achieved in the conventional manner by switching a series of inductors with a normal BANDSWITCH. This has five positions, the fifth position being unused on MF-only receivers. The four operative positions are marked 'A', 'B', 'C' & 'D' to avoid confusion with the channel marking. 'A' = Range 1, 'B' = Range 2 etc. The appropriate BANDSWITCH setting for each channel is marked on the Channel Frequency Allocation Table supplied with the receiver.

Selection of the channel is by rotation of the large CHANNEL SELECTOR which drives a 28-position turret assembly comprising a total of five printed circuit disks. Two of these introduce the correct Local Oscillator crystal for the required channel, while the other three place pre-set trimming capacitors across the signal frequency circuits in the RF Amplifier and 1st Mixer Stages. Channels on the MF Band are numbered 1-28, Channel 1 being reserved for the 2182kHz Distress and Calling frequency.

On dual-band receivers (EC964/1 & EC964/2), the fifth position of the BANDSWITCH introduces a totally separate front-end circuit for coverage of the HF Band. This employs a total of eleven printed circuit turret disks and covers either six ranges (EC964/2) or eight ranges (EC964/1). Individual ranges are as follows, Ranges 7 & 8 not appearing in the case of the EC964/2:-

Range 1	::	4.0-4.45MHz.	Range 5	::	16.4-17.4MHz.
Range 2	::	6.2-6.525MHz.	Range 6	::	22.0-22.72MHz.
Range 3	::	8.15-8.85MHz.	Range 7	::	25.01-25.6MHz.
Range 4	::	12.3-13.25MHz.	Range 8	::	26.1-27.5MHz.

Twenty-four channels are available on the HF Band, these being equally divided between the available number of ranges, i.e. 3 channels per range on the EC964/1 and 4 per range on the EC964/2. Turret positions 1 & 2 and 27 & 28 are not used on the HF Band because space is required in the turret assembly for the crystal oven and associated control circuit which is not present on the MF Band.

Whereas on the MF Band, inductors for the appropriate range are selected by the BANDSWITCH, this is not the case on the HF Band. Here the inductors form part of the disk circuitry and are arranged to remain in circuit for either three or four adjacent turret positions depending on whether the receiver is a /1 or /2 variant. Selection of the required channel is carried out in exactly the same manner as on the MF Band, i.e. by introducing the correct Local Oscillator crystal (2 disks) and the appropriate preset trimmers in the signal frequency circuits (3 disks).

Channel selection and range selection occur simultaneously on the HF Band, the BAND SWITCH serving only to activate the appropriate front-end stages when set to the position marked 'H'. Channels are numbered 29-52 and appear as a second series of numbers concentric with those for the MF Band.

Aerial Attenuator

The aerial feeder is routed to the RF Section proper via a switched aerial attenuator which serves as a form of RF gain control for use when taking signals of above average strength, i.e. when overloading or cross modulation effects are likely to occur. The attenuator switch provides settings of 0dB, -20dB and -40dB to suit all conditions of reception.

MF Band RF Circuitry

The MF Band signal frequency circuits employ TR1 & TR2, together with the two transistors TR3 & TR4 which are common to both MF and HF circuits in the dual-band versions (EC964/1 & EC964/2). TR3/4 provide AGC control and will be considered later in this Section.

The RF Amplifier and 1st Mixer (TR1 and TR2) both employ dual-gate MOSFET's (RCA 40673) with signal input applied to gate 1 in each case. Aerial input is taken through a single tuned circuit to the RF Amplifier and this in turn is coupled to the Mixer Stage by a double-tuned bandpass circuit using mutual inductance coupling between primary and secondary.

Inductors for each of the four MF ranges are selected by the BANDSWITCH wafers S2E, S2D, S2F & S2G which are also arranged to short-circuit all unused coils to prevent absorption effects.

Each of the three inductors in circuit on any given range is tuned by pre-set trimming capacitors which are located on Turret Disks 'H', 'I' & 'J'. A fixed capacitor takes the place of the trimmer at turret position 1, this setting being used for reception on 2182kHz. Capacity taps across the tuned circuits are used to feed the signal gates of the two transistors, the one connected to the RF Amplifier being switched by S2C to maintain standard performance on all four MF ranges.

Initial operating conditions for the RF Amplifier are set during test and alignment by adjustment of the pre-set potentiometer RV1. This allows precise setting of the gate 1/source voltage, and compensates for spread in the FET characteristics. D5, D6 & D7 provide a regulated source of voltage for this circuit and so ensure long-term stability for the RV1 adjustment.

IF breakthrough at the 1st IF is attenuated by an IF filter wired across the capacity tap feeding the 1st Mixer Stage. This takes the form of a series acceptor circuit comprising a miniature ferrite-cored choke (CH2) tuned by the pre-set trimmer C18. Total rejection of signals at the 1st IF is of the order 80dB or greater.

The drain circuit of the Mixer Stage is tuned to 1.2MHz by L13/C22, this being the primary circuit of a bandpass pair, the secondary of which is located in the 1st IF Module. Coupling between primary and secondary is by means of C23 which feeds a coaxial interconnecting lead terminating at PL/SK3. In the case of the dual-band versions, a second primary IF circuit is included in the drain of the HF Band Mixer and selection of the appropriate primary is a function of the BANDSWITCH wafer S2H. Another wafer (S2I) is arranged to earth the unused primary circuit. S2H & S2I are omitted on the 'MF-only' versions (EC964/3 & /5).

MF Band Local Oscillator

The complete Local Oscillator circuitry comprises TR5, TR6, D11 & D12. TR5 (2N4254) is the oscillator proper, the two diodes and TR6 (BC107B) being used as an automatic level control (ALC) circuit to maintain similar output with the inevitable variations which exist between individual crystals. Control is effected by variation of the oscillator base voltage.

Provision is made for installing up to 28 crystals which are housed in the space between Turret Disks 'O' & 'P'. A series trimmer is included for each crystal to permit precise adjustment to frequency. Turret position 1 always carries a 3382.0kHz crystal to suit the 2182kHz Distress and Calling Channel.

The method of crystal selection used in the EC964 receiver employs two pairs of parallel-connected turret wiper contacts, one pair for Disk 'O' and the other for Disk 'P'. Only one pair is operative at any given turret setting, the other pair being open-circuited by the absence of a complete circuit between the two disk contacts to which contact is made. Two adjacent channels are selected from each disk alternately as can be seen from inspection of the Main Circuit Diagram.

Local Oscillator drive is taken to gate 2 of the Mixer transistor from the base of the Crystal Oscillator Stage. Injection frequency is equal to the crystal frequency and is 1.2MHz higher than the required signal channel.

HF Band RF Circuitry

The basic circuit configuration employed on the HF Band is very similar to that used on the MF Band but with the following salient differences.

1. Inductors for the HF Band are included in the turret disk circuitry.

2. The double-tuned bandpass circuit is located directly at the aerial input and a single tuned circuit is used to couple the RF Amplifier to the Mixer.

3. An IF filter as used on the MF Band is not required due to the greater spacing which exists between the signal and intermediate frequencies.

4. All HF crystals are housed in an oven to provide stability comparable with that achieved on the MF Band.

5. A Frequency Doubler Stage is included in the Local Oscillator Section for use on Ranges 6, 7 & 8 only.

Transistor types are identical to those used on the MF Band and the additional Frequency Doubler Stage employs a further 2N4254 (TR11).

Aerial input is derived from the 'HF BAND' position of the BANDSWITCH wafer S2E and is applied via turret wiper contact TW2 to the selected contact segment on the front face of Turret Disk 'A'. The disk contact extends over three adjacent turret positions in the case of the EC964/1, or four adjacent positions on the EC964/2; i.e. the circumference of the disk is subdivided into eight equal contact segments each three positions wide (EC964/1), or six equal segments four positions wide (EC964/2).

Each contact segment is connected by an inter-disk link to the adjacent disk ('B') where it is wired to the appropriate aerial coupling coil on the bandpass primary tuned circuit. There are either six or eight such primary circuits (depending on receiver type) located on Disk 'B', selection being by means of TW4 which applies an earth connection to the selected coil.

A second series of inter-disk links is provided between Disks 'A' & 'B'. These connect the 'top' of each tuned primary winding to a group of three or four trimmers located on Disk 'A'. One trimmer is provided for each channel (24 trimmers in all) and channel selection is by means of the earth applied through turret wiper TW1.

The remaining contact on Turret Disk 'B' (TW3) provides a continuous earth connection to the copper surface on one face of the disk which serves as a screen between the primary and secondary circuits.

Coupling between primary and secondary is by means of the top capacity method, the six (or eight) capacitors required being carried on Disk 'C'. Also on this disk are the bandpass secondary circuits which are selected by TW5 & TW6. Inter-disk links are provided between the 'top' end of the primary on Disk 'B' and the coupling capacitor on Disk 'C'.

Connection of the required trimming capacitor across the selected secondary is achieved in a slightly different manner from that employed on the primary circuit. TW6 (contacting the top end of the secondary) is linked directly to TW8 (Disk 'D') to pick up one end of the appropriate group of trimmers. This obviates the need for a series of inter-disk links as used between Disks 'A' & 'B'. Channel selection is by TW7 which applies an earth to the selected trimmer as on Disk 'A'.

The signal gate of the RF Amplifier is fed directly from TW6/8 via C35, the amplifier circuitry being identical to that used on the MF RF Amplifier except that the output (drain) circuit is series-fed via an untuned primary on the selected Mixer coil.

Selection of the tuned circuit between the RF Amplifier and the Mixer is a function of Disks 'E', 'F' & 'G', the switching arrangement being very similar to that used in the bandpass circuit. The Mixer Stage is identical to that used on the MF Band and is fed via C44 which connects to gate 1. The 1.2MHz IF primary circuit comprises L14/C45 and is coupled via C46 to the HF BAND position of the BANDSWITCH wafer S2H.

HF Band Local Oscillator

The basic crystal oscillator circuit employed on the HF Band is identical to that used on the MF Band, and oscillator injection is applied to gate 2 of the Mixer as before. Crystals are located between Disks 'M' & 'N' which form the sides of a rotatable crystal oven, the element for which is wired in series with the collector of the oven control transistor.

Four transistors are involved in the oven control circuit, namely TR12-TR15. TR12 (BC107B) serves as the oven temperature sensor and is located in the oven proper. The remainder of the circuit is carried on Turret Disk 'K' and comprises a 3-stage DC Amplifier control circuit using a BC107B, 2N3053 and 2N3055. All stages except the sensor run from a +26V unregulated supply fed in via contacts on Turret Disk 'N'. Variable resistor RV4 allows precise setting of the oven control circuit operating conditions during initial factory testing, long-term stability being assured by zener regulation of the sensor supply (D20/21).

Crystal selection is carried out in exactly the same manner as on the MF Band, but with 24 crystal positions in lieu of 28. Output is taken as before from the base of the oscillator transistor and is routed via C54 and TW24 to Turret Disk 'L'. This disk carries no components and serves only as a 'switching' disk to introduce the Frequency Doubler Stage TR11 when this is required on Range 6 (and 7 & 8 on the EC964/1).

On ranges where the Doubler is not required, the input connection to Disk 'L' is connected via an inter-disk link to the output contact on the adjacent Disk 'K'. Turret wiper TW22 which mates with this contact routes the oscillator injection to gate 2 of the Mixer via C58. At the same time, a further inter-disk link (between TW23 and TW21) is arranged to ground the base of the Doubler transistor so rendering it inoperative.

The Doubler Stage is automatically introduced by Disks 'K' & 'L' for signal frequencies above 22MHz where the crystal frequency is chosen at half the required injection frequency. TW24 is then directly linked to TW23 so completing the oscillator output feed to the base of the Doubler Stage. A tuned circuit is simultaneously introduced in the collector circuit of the Doubler Stage by Turret Disk 'K' (three such circuits are provided on the EC964/1, only one on the EC964/2). The circuit(s) is/are tuned to the centre frequency of the injection frequency band appropriate to the range in use.

RF Unit Power Supplies

With the exception of the oven circuit which runs from a +26V unregulated supply, all stages in the RF Section derive their operating voltage from a separate +24V regulated line. This is switched to the appropriate stages by the BANDSWITCH wafer S2A in the case of the dual-band versions, but S2A is omitted on those variants which cover the MF Band only. Individual zener regulators provide separate +12V lines for the RF Amplifier and Mixer/Oscillator Stages, while the Doubler (TR11) runs direct from the +24V supply.

A further zenered supply of +12V and a negative line of -5.6V are provided for the RF AGC Control circuit comprising TR3 & TR4. The operation of this circuit is described on page 8 of this Section.

1ST IF STAGES

1.2MHz IF Amplifier and 2nd Mixer

The secondary 1.2MHz IF circuit associated with L13/C22 or L14/C45 in the appropriate 1st Mixer output, is located in the 1.2MHz IF Module and feeds a cascode amplifier employing a pair of UC734B junction FET'S (TR16/17). 1st IF bandwidth is kept to some 10kHz at 6dB down by a second 1.2MHz bandpass circuit (L16/17) which couples the IF Amplifier to the 2nd Mixer for conversion to the 2nd IF (100kHz).

The 2nd Mixer Stage has two UC734B's (TR18 & TR20) in a common-source circuit with oscillator injection introduced in the common source return by a third UC734B (TR19). This configuration provides extremely good signal handling and lower intermodulation products than single-FET mixers.

The source returns of the IF Stage and the Mixer are taken to a voltage divider (R84/85) which is wired across the 24V supply to provide bias for desensitising the receiver when used in close proximity to an associated transmitter. The source circuit is shorted to ground for normal operation, connection being to the 12-way connector SK5 at the rear of the set. A wire link is fitted in the free plug to permanently earth the source circuit when desensitising facilities are not required.

Output at 100kHz is derived from the damped choke (CH3) in the drain circuit of TR20 and is fed via a coaxial interconnection to the 100kHz IF Pre-amplfier Module.

2nd Local Oscillator (Clarifier)

Oscillator injection for the 2nd Mixer is derived from two separate crystal oscillators (TR21 & TR22) whose outputs are fed into a single-FET mixer to provide the 1.1MHz frequency required. The crystal oscillators operate at 14.0MHz and 15.1MHz, both crystals being housed in a temperature-controlled oven.

Voltage-variable capacitance diodes (D23 & D24) are wired in series with each crystal in such a manner that one crystal will be pulled higher in frequency and the other lower in frequency by adjustment of the panel CLARIFIER control RV9. A shift of ± 300 Hz is available at the output of the oscillator mixer (TR23)feeding the 2nd Mixer stage. This is adequate for any normal tuning correction required to compensate for drift at both transmitter and receiver.

RV5 and RV6 are adjusted during factory test to provide equal levels of undistorted drive to TR23. RV7 and RV8 are also adjusted at this time to set the actual frequency swing provided by the CLARIFIER control. Long-term stability of these adjustments is high due to ovening of the crystals and also because of the symmetrical circuit configuration which tends to make any uncompensated variations cancel in the oscillator mixer stage. TR21-23 operate from a zenered supply of +12V as a further precautionary measure. The oven heater supply is 12V AC taken directly from T2.

2ND IF STAGES

100kHz IF Pre-amplifier

Output from the 2nd Mixer is applied to the 100kHz IF Pre-amplifier TR24 (BC107B) via a three-section L/C bandpass filter having a 6dB bandwidth of 6kHz. This is incorporated in the IF Pre-amplifier Module and although primarily intended for AM (DSB) reception, does in fact remain in circuit for all signal modes. Two outputs are taken from the collector of TR24, one feeding the MODE SWITCH wafer S3A and the other the RF AGC circuit which is described on the opposite page.

SSB & FSK Filters

Filters for the SSB and FSK modes are located directly at the output of the IF Pre-amplifier Stage. Both are multi-pole block crystal types, the FSK filter being omitted on receivers not equipped for FSK working. Selection of the appropriate filter is a function of MODE SWITCH wafers S3A & S3B which are wired to introduce a direct link when set to the 'AM' position. Unused circuits are grounded to prevent leakage and S3B feeds directly to the main 100kHz IF Amplifier Module. Frequency response is quoted on page 3 of Section 1, the FSK filter being symmetrical and the SSB filter assymmetrical. The latter passes the lower sideband at the 100kHz IF to accommodate the signal inversion which occurs in the 1st Mixer Stage due to this being operated with oscillator injection on the high-frequency side of the incoming signal.

Main 100kHz IF Amplifier

This module comprises a two-stage untuned resistance-capacity coupled amplifier feeding an emitter follower. All three stages (TR28-TR30) employ BC107B transistors running from a zener regulated 18V supply. A further BC107B is also included in this module and serves as the IF AGC control element. Its action will be considered later in this Section.

Two separate outputs are provided from the emitter of TR30, one via the tuned transformer L22/L23 to feed the Detectors and the other direct from the emitter via C170. This latter output drives the IF AGC Amplifier located in the AGC Module.

AGC Circuits

The complete AGC circuits involve a total of nine transistors, six of which are located in the AGC Module proper. Two of the remaining three transistors are included in the RF Section and are common to both MF and HF Band stages in the case of dual-band receivers (EC964/1 and EC964/2). The other transistor is found in the 100kHz IF Amplifier Module. Independent RF and IF AGC lines are provided together with facilities for manual RF gain control on the EC964/1 & EC964/3 (meeting TSC102/105).

RF AGC System

This comprises TR31, TR32, D28 and the two transistors TR3/4 located in the RF Section of the receiver. TR31 (BC107B) serves as RF AGC Amplifier and is driven at 100kHz from the IF Pre-amplifier TR24. Input level can be controlled by RV14 (pre-set RF AGC GAIN) to facilitate adjustment of the AGC circuit for correct operation. D28 functions as the RF AGC Rectifier and is driven from TR31 via the Emitter Follower TR32 (BC107B) to produce a positive control voltage for the RF AGC Control Stage TR3/TR4 which employs a further pair of BC107B's. These are wired in a long-tailed pair configuration and provide a negative controlling voltage for gate 2 of the appropriate RF Amplifier. Gate returns from TR1 and TR7 are switched by BANDSWITCH wafer S2B on those receivers providing dual-band coverage (EC964/1 & /2). S2B is omitted on 'MF-only' versions.

RV2 permits adjustment of the RF AGC delay and is set during factory test so that automatic control of the RF Amplifier is introduced at the correct point on the IF AGC characteristic. This ensures optimum performance of the combined RF and IF control arrangement employed. The RF AGC time constant is fast on both charge and discharge.

IF AGC System

The IF AGC system employs a total of five transistors and two diodes in a circuit of unconventional design. One of the five transistors (TR27) serves as the AGC control element and is essentially a variable resistance forming part of a potential divider across the 100kHz signal path at the input to the main 100kHz IF Amplifier. The transistor is wired as the lower resistor in the divider, the top one being fixed and of value 10,000-ohms (R161).

The control range of TR27 is extended by incorporating a second resistive divider comprising a 330 ohm fixed resistor (R162) and a diode (D26 :: OA202). Input to the 100kHz IF Amplifier is taken straight off the diode which like the transistor acts as a variable resistance.

Controlling voltage for TR27 is taken from the output of a three-stage circuit which comprises the following stages driven from the Emitter Follower TR30 at the output of the main 100kHz IF Amplifier.

TR33	::	100kHz Amplifier (IF AGC Amp).
TR34/35	::	Schmitt Trigger.
TR36	::	Pulse Counter.

The circuit action is briefly as follows. At signal levels higher than about 2μV (at aerial input), the amplitude of the 100kHz signal at the input to TR33 is sufficient to switch the Schmitt Trigger at intermediate frequency rate. 100kHz square-wave pulses appearing at the Schmitt Trigger output charge the 820pF capacitor C202 through the diode D29 (OA202). Rapid charging is achieved by virtue of the 1mH choke in series with the final collector load which tends to make the trigger circuit ring.

On the half cycles following the charging of C202, current flows through TR36 (BCY 32) transferring the charge on C202 to the larger capacitor in its collector circuit (C203 - 25μF). The build-up in voltage across C203 is transmitted to the base of TR27 causing it to conduct and so attenuating the 100kHz input to the main IF Amplifier.

The consequent reduction in output which occurs is transmitted through the system and if great enough will cause the Schmitt Trigger to cease functioning until such time as the charge on C203 has leaked away sufficiently to provide the increase in gain needed to re-establish operation of the trigger circuit. Thereafter, the trigger functions at intervals to maintain a charge on C203 which is proportional to the level of received signal.

The time constants in the circuit are such that at 'SSB' (and 'FSK'), rapid charge and delayed discharge are provided. At 'AM', the charge time constant is lengthened and the discharge shortened by introducing an additional resistor and capacitor across C203 by means of MODE SWITCH wafer S3C.

Manual RF Gain Control (EC964/1 & EC964/3 only)

The two AGC lines to TR3/4 and TR27 are taken via two SPDT switches (S5A & S5B) ganged to the manual RF GAIN control. With the RF GAIN set to 'AGC' (fully anti-clockwise) the AGC circuits function in the normal manner as described earlier. Advancing the control in a clockwise direction throws the two switches to the other position so grounding the control line to the RF Section and at the same time returning the IF control line to the slider of the RF GAIN which forms part of a potential divider across the 24V supply.

Manual control is therefore achieved by variation of gain in the IF Section of the receiver with the RF Amplifier running at a fixed gain setting. The arrangement permits individual control of IF and RF levels since the latter can be set by use of the Aerial Attenuator.

Detector Circuits

Two CA3002 linear integrated circuits are employed as detectors, one for AM and the other for SSB (and FSK on receivers bearing suffix 'X'). Output is selected from the appropriate detector by MODE SWITCH wafer S3D and routed via an IF filter to the AF GAIN control RV12. An independent LINE LEVEL control (RV13) is wired directly in parallel with RV12 and is located in the Line Audio Module (pre-set adjustment).

A third integrated circuit (IC3 :: CA3000) serves as crystal oscillator for SSB and FSK reception, the two crystals being selected by a diode switching circuit (D30/31) controlled by MODE SWITCH wafer S3E. This introduces a 100.0kHz crystal for SSB and a 102.21kHz crystal for FSK. The 102.21kHz crystal is omitted on receivers not equipped for FSK.

The 102.21kHz crystal fitted for FSK working provides standard tone output frequencies of 2125Hz and 2295Hz for example when receiving an FSK signal with 170Hz shift. The CLARIFIER control is off-set by half the shift frequency to ensure that the signal lies in the centre of the FSK filter passband.

Oscillator drive to the SSB/FSK Detector is taken via an Emitter Follower (TR37 :: BC107B) which provides isolation and matching between the two circuits. Zener regulated supplies of 12V and 6.2V are provided for the oscillator/emitter follower.

T H E A U D I O S E C T I O N

Two totally separate audio channels are provided, the main channel employing five transistors (TR38-42) to drive the built-in monitor loudspeaker. A transformerless circuit is used which matches directly to the speaker impedance of 25 ohms. Provision is made for connecting a low/medium impedance headset, the circuit being arranged such that the speaker is interrupted by an auxiliary contact on JK1 when the headset is in use.

The other audio channel utilises two BC107B transistors (TR43/44) and provides a low-level 600-ohm output to feed external line circuits. The output transformer is electrostatically screened and can be arranged for balanced or unbalanced operation. Output is set by means of the pre-set LINE LEVEL control RV13 and is restricted to a maximum of 10mW.

P O W E R S U P P L Y C I R C U I T S

The power transformer has two secondary windings, one of which feeds a bridge rectifier (D38 :: OSH02/200) providing an unsmoothed supply of +26V for the 1st Oscillator oven and control circuit (HF Band versions only - not connected on 'MF-only' sets). The +26V supply is smoothed and zener-regulated to give a 24V positive line which feeds all stages in the receiver.

The other secondary winding provides a 12V AC supply for the 2nd Oscillator oven, and a rectified zener-regulated supply of -5.6V for the RF AGC Control Stage TR3/4. The rectifier (D35) and smoothing circuit for this negative supply are housed for convenience within the Line Audio Module.

Supply input switching is not provided on the receiver proper and should be arranged externally at the supply source. Neon LP2 will light immediately the supply is completed to the receiver and gives a visual indication that both oven supplies are available (neon bears legend 'OVEN SUPPLY').

Switching of the 24V receiver supply is incorporated to provide a 'standby' facility (with both ovens running) for use when the receiver is not required but must be available for immediate use without the inconvenience of normal warm-up. Switching is by means of a double-pole switch (S4A/S4B) ganged to the AF GAIN potentiometer which breaks the circuit when set to 'STANDBY'. A second neon (LP1) is switched by S4B to indicate availability of the receiver low-voltage supply (marked 'REC SUPPLY').

Fusing is included in the 26V DC secondary and also in the AC input, both poles of which are fused on the EC964/2 and EC964/5. A single fuse in the live line only is fitted on the EC964/1 and EC964/3.

MECHANICAL CONSTRUCTION

GENERAL

All receivers in the EC964 Series are available for bench-mounting, rack installation, or with anti-vibration mounts for mobile use. Conversion from one form of mounting to another is achieved by attachments fitted to the outer cover. Rack-mounted receivers bear suffix /RM and those with anti-vibration mounting /SM. Conversion kits are available from Eddystone Radio Limited.

Weight

Minor variations in weight occur between the various versions of the EC964. An average figure applicable to the dual-band versions is 33.5 lb (15.2kg).

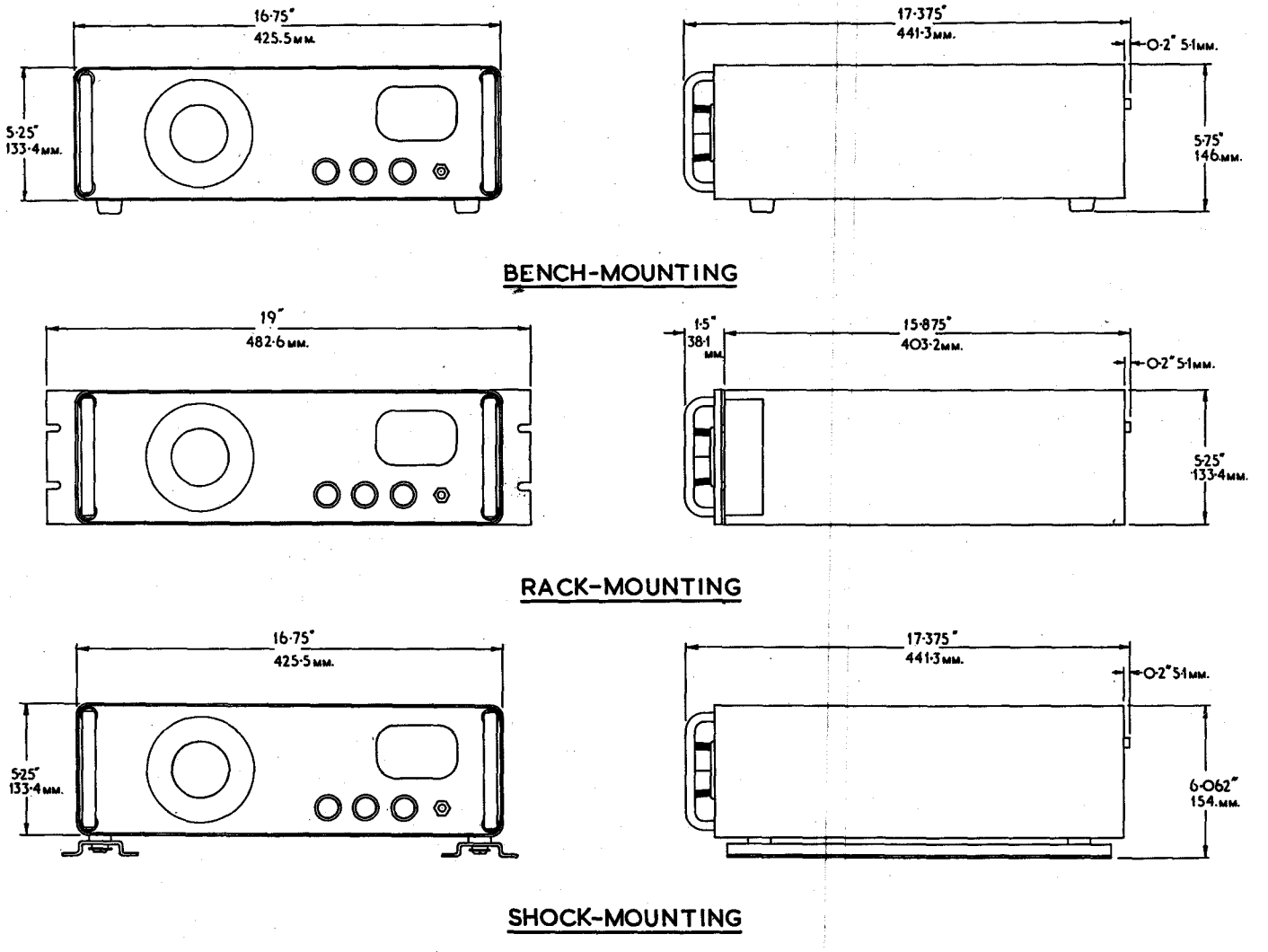


Fig. 3-1. Outline drawings of EC964 Series in all mounting styles.

Internal Layout

EC964 Series receivers are constructed largely on modular lines to facilitate servicing by substitution methods, and to simplify spares holding for establishments using a number of receivers of the same type. The modules employ printed wiring techniques, are housed in protective screening cans and can be easily taken out by removing two 6BA screws. Terminations for all leads are made with miniature pin and socket connectors to simplify this operation, wires being coded numerically to assist technicians when fitting replacements. All modules are mounted on a flat chassis plate which also carries the major power supply components.

The RF Section of the receiver is non-modular, comprising three separate printed boards which between them carry all the basic circuitry associated with the RF Turret Assembly. Sixteen printed-circuit turret disks are used for channel selection on those versions which provide combined MF and HF cover, but only five on receivers without HF coverage. The disks are identified by a letter code which runs alphabetically in the sequence 'A' to 'P' (inclusive) from the rear of the set.

The complete Turret Assembly is totally screened and is located to the left-hand side of the module chassis. Access is by removal of a set of cover plates and provision is made for extracting turret disks in the event of servicing being required. Disk contacts are self-cleaning and require no attention with normal use.

All controls are mounted on the panel assembly except for the LINE LEVEL CONTROL which is a pre-set adjustment located internally (Line Audio Module). An adjustment aperture provides access after removal of the cabinet.

MODULES, PRINTED BOARDS AND TURRET DISKS

Table 3-1. Component Complement - Modules

Module No.	Designation	Semi-conductors	Inductors etc.	Capacitors	Resistors
1	Aerial Attenuator	-	-	-	R1-R6
2	1.2MHz IF Module	TR16-TR20	L15-L17 CH3	C70-C83	R70-R85
*3	2nd Oscillator Module (Clarifier)	TR21-TR23 D22-D24	L18	C90-C108	R90-R111
4	100kHz IF Pre-amplifier (incorporating AM Filter)	TR24	L19-L21	C120-C129	R120-R125
5	100kHz IF Amplifier	TR27-TR30 D25-D27	L22 L23	C160-C174	R160-R177
6	AGC Module	TR31-TR36 D28 D29	CH4 CH5	C190-C203	R190-R212
**7	Detector Module	TR37 D31-33 IC1-IC3	CH6	C220-C239‡	R220-R247 ‡‡

‡ excluding C229, C231 and C233.

‡‡ excluding R234, 235, 236, 240 and 241

Table 3-1. (Contd.)

Module No.	Designation	Semi-conductors	Inductors etc.	Capacitors	Resistors
8	Main Audio Module	TR38-TR42		C250-C258	R250-R262
9	Line Audio Module (600-ohm) (incorporating -5.6V supply)	TR43 TR44 D34 D35	T1	C270-C280	R270-R281

* Also contains crystal oven and crystals XL1 and XL2.

** Also contains crystal XL3 (and XL4 on receivers equipped for FSK)

Table 3-2 Component Complement - RF Assembly (Boards)

EC964/1 & EC964/2

Board No.	Designation	Semi conductors	Inductors etc.	Capacitors	Resistors
1	HF RF Amp. & AGC Control	TR3 TR4 TR7 D10, D13-16		C27-C28 C35-C41 C35A C44A	R23-R26 R33-R38**
2	MF RF Amp	TR1 D5-D8	L1-L12 CH1 CH2	C8-C18* excluding C10	R11-R16 inc. R14A when fitted
3	HF & MF Mixer/Oscillator	TR2, TR5 TR6, TR8-11 D9, D11, D12 D17-D19	L13 L14	C19-C25 C29-C34 C42-C58 C42A	R17-R22 R27-R32 R39-R56

EC964/3 & EC964/5

Board No.	Designation	Semi-conductors	Inductors etc.	Capacitors	Resistors
1	AGC Control	TR3 TR4 D10		C27 C28	R23-R26
2	MF RF Amplifier	TR1 D5-D8	L1-L12 CH1 CH2	C8-C18* excluding C10	R11-R16
3	MF Mixer/Oscillator	TR2, TR5 TR6 D9 D11 D12	L13	C19-C25 C29-C34	R17-R22 R27-R32

* C5-C7 mounted on S2C.

** inc. R36A when fitted.

Table 3-3. Component Complement - Turret Disks

Ref	Band	Designation	Rec 964	Semi-conductors	Inductors etc.	Capacitors	Resistors
A	HF	Bandpass Primary Trimmer Disk	/1 /2			C300-C323 C300-C323	
B	HF	Bandpass Primary Coil Disk	/1 /2		L30-L37 L30-L35	C330-C337 C330-C335	
C	HF	Bandpass Secondary Coil Disk	/1 /2		L38-L45 L38-L43	C340-C354* C340-C351	(*) excl-uding C353
D	HF	Bandpass Secondary Trimmer Disk	/1 /2			C360-C383 C360-C383	
E	HF	Mixer Trimmer Disk	/1 /2			C390-C413 C390-C413	
F	HF	Mixer Coil Disk (Sec)	/1 /2		L46-L53 L46-L51	C420-C423 C420-C423	
G	HF	Mixer Coil Disk (Pri)		-	-	-	-
H	MF	Aerial Trimmer Disk				C430-C457	
I	MF	Bandpass Primary Trimmer Disk				C460-C487	
J	MF	Bandpass Secondary Trimmer Disk				C490-C517	
K	HF	Doubler Output Disk (incorporating Oven Control)	/1 /2	TR13-TR15 D20 D21 TR13-TR15 D20 D21	L54-L56 L54	C60, C520-C525 C60, C520-C521	R60-R67** R60-R67**
L	HF	Doubler Input Disk					(**) excl-uding R66
M	HF	Crystal Disk 1		TR12		C350-C553	
N	HF	Crystal Disk 2				C560-C583	
O	MF	Crystal Disk 1				C590-C617	
P	MF	Crystal Disk 2				C620-C647	

NB: Turret Disks A-G and K-M are omitted on EC964/3 & EC964/5.

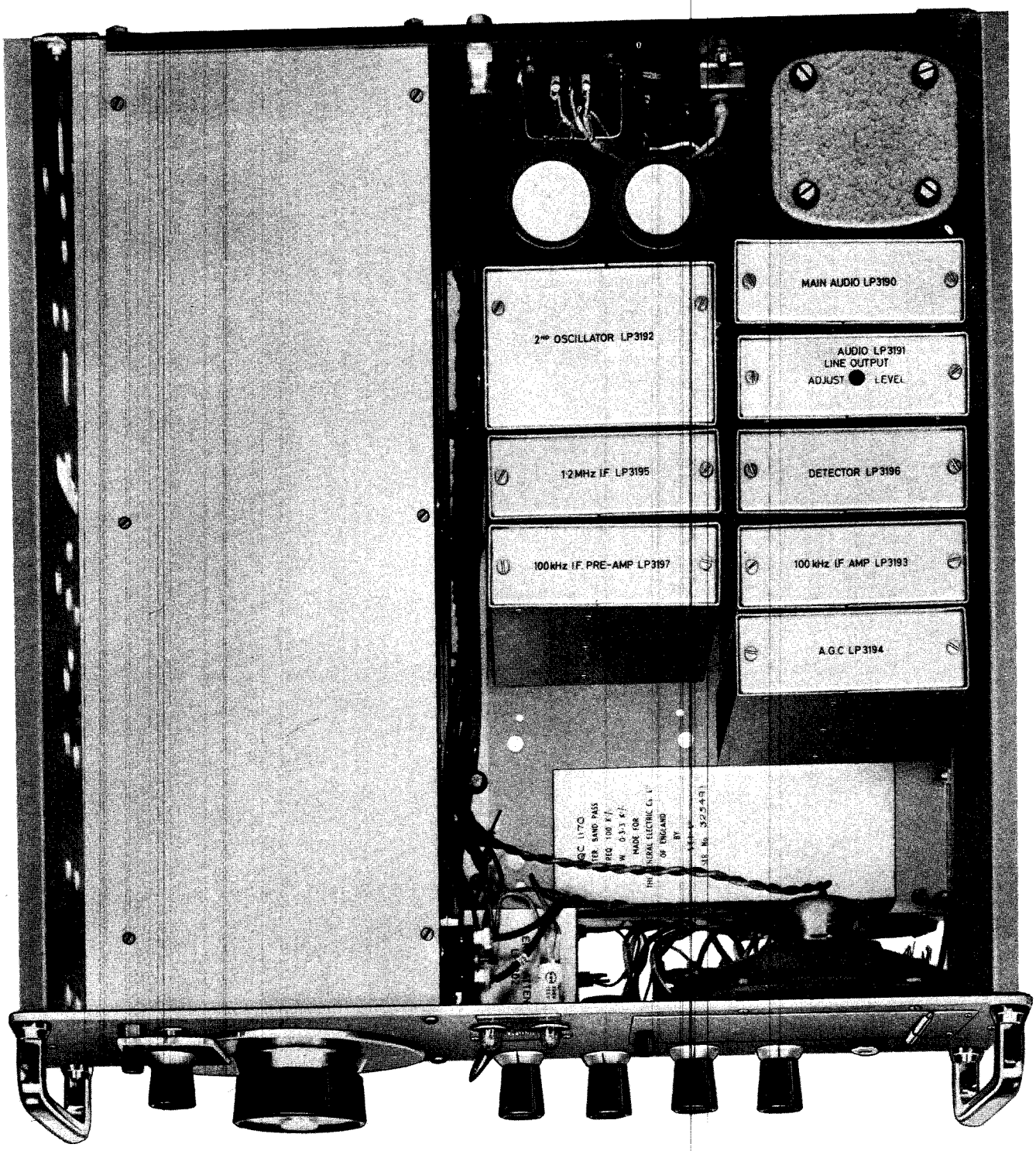


Fig. 3.2 Plan view of Model EC964/1 showing location of modules

Section 4

INSTALLATION

GENERAL

Channel Allocation

Receivers normally leave the factory equipped with a full complement of crystals to suit the channel allocation required and are pre-tuned to these channels. No further trimming adjustments are necessary after installation. Signal frequencies are listed on the Channel Frequency Allocation Table (on hinged cover over speaker aperture).

In the event of it becoming necessary to alter the original channel allocation, full instructions for carrying out the appropriate adjustments will be found in Section 6.

Mounting

The EC964 Series is normally supplied in a form suitable for bench-mounting, either with rubber feet (standard) or with shock-absorbent mounting (to special order). All variants can be supplied in rack-mounting form to suit standard 19-inch rack installations (panel height : 5¼-inches). Conversion kits are available to permit modification of standard receivers to rack-mounting. (Refer to Appendix 'E' for relevant Part No's)

Accessories, Spares and Tools

The following items are supplied with each receiver:-

1. AC Supply Connector complete with 6-feet of three-core PVC cable.
2. Aerial Plug (suitable for coaxial cable of up to ¼-inch diameter).
3. 12-way free plug (for Desensitising and Line Output).
4. Standard Telephone Plug.
5. Set of four rubber mounting feet (7132P), complete with screws.
6. Spare Fuses:- 2 @ 1A, 2 @ 3A. (or 2 @ 2A on MF-only versions).
7. Three trimming tools.
8. Complement of crystals to suit required channel allocation.
9. Allen key to fit screws in control knobs.

ASSEMBLY INSTRUCTIONS

General

Rubber mounting-feet or rack-mounting brackets are packed separately and are not attached to the receiver when despatched from the factory. Hank-bushes are provided in the underside of the cabinet and near the leading edge of the two vertical sides to facilitate rapid assembly. Special shock-absorbent mountings are also packed separately for assembly on installation. All necessary screws will be found in the carton.

Bench-Mounting

Attach rubber mounting-feet to underside of cabinet using 2BA screws supplied. The correct hank-bushes are those closest to the four corners.

Rack-Mounting

Attach rack-mounting brackets to leading edges of the cabinet using the 2BA screws supplied. The brackets are reversible (i.e. not left/right-hand) and provide fixing points to suit standard 19-inch racking.

Shock-absorbent Mounting (LP2817/1)

Receivers equipped with shock-absorbent mountings should be assembled as detailed below:-

1. Invert receiver.
2. Place the large neoprene washers over the fixing holes provided in the underside of the cabinet with stepped face uppermost.
3. Lower the channel-shaped mounting brackets onto the washers, keeping the fixing flange towards the outside of the receiver and at the same time making sure that the step on the washers locates with the holes in the bracket.
4. Place the smaller neoprene washers on the inside of the channel and pass the 2BA screws (with brass washers) through both neoprene washers.
5. Locate screws in hank-bushes and tighten.
6. Fix channel mounting brackets to bench top with suitable screws. Take care to bond the brackets to the bench top if this is of metal construction.

SUPPLY VOLTAGE ADJUSTMENT

Unless otherwise specified, all receivers are despatched from the factory with the power transformer input tappings set for 240V operation. Receivers set to other voltages on delivery can be readily identified by a small label attached to the rear which indicates the actual setting in use.

The power transformer is located in the rear right-hand corner of the receiver, its primary tappings being accessible from the underside of the chassis after removal of the transparent protective cover. Removal of the receiver cabinet is effected by taking out the two knurled screws behind the panel handles.

Care should be taken when adjusting the tappings, not to disconnect the two VIOLET leads which are wired to the 0V and 240V taps. These wires feed the two neon circuits and must always be connected in this manner irrespective of the supply voltage in use. The two mains input connections are coloured WHITE for ease of identification.

Tappings are marked 10V - 0V - 110V - 200V - 220V - 240V, and connections should be arranged as follows:-

Supply Voltage	Connect to	Supply Voltage	Connect to
100-115V (110V nom)	0V & 110V	230V	10V & 220V
115-125V (120V nom)	10V & 110V	240V	0V & 240V
200V	0V & 200V	250V	10V & 240V
210V	10V & 200V		
220V	0V & 220V		

WARNING: DISCONNECT FROM AC SUPPLY BEFORE ADJUSTING VOLTAGE TAPPING.

OPERATION FROM LOW-VOLTAGE DC SUPPLIES

Refer to Appendix 'A' at rear of Handbook.

EXTERNAL CONNECTIONS

AC Supply

All variants of the EC964 must be installed with provision for AC supply switching external to the receiver proper. Any normal wall or bench socket with switching facility will suffice. Receivers are supplied complete with 6-feet of 3-core supply cable terminated with a connector to mate with the AC SUPPLY socket at the rear of the set. The actual type of connector depends on the particular variant and will be as follows:-

EC964/1 & EC964/3 :: UK-type connector, Eddystone Part No. D2311/1.

EC964/2 & EC964/5 :: Continental-type connector, Type No. C2000.

One end of the supply cable is left free for termination with a connector suited to the available supply point. Colour coding of the three wires conforms to the new European Standard:-

LIVE :: BROWN. NEUTRAL :: LIGHT BLUE. EARTH :: GREEN & YELLOW.

Aerial Input

The coaxial aerial input socket is fitted at the rear and a matching connector is supplied with the receiver. The actual type of connector depends on the particular type variant and will be as follows:-

EC964/1 & EC964/3 :: :: BNC

EC964/2 & EC964/5 :: :: UHF 83

Input impedance is nominally 50-ohms unbalanced and is suitable for normal coaxial feed arrangements using coaxial cable of that impedance. Both types of connector are arranged to suit cables of up to 0.25-inch outside diameter. The UHF 83 is supplied with a reducing sleeve for this purpose.

Earth Terminal

Bond to frame of rack when equipment is installed as a rack-mounted installation. Connect to suitable earth stake or rod on bench-mounted installations.

Line Output/Desensitising (see Fig. 4.1 on page 4)

Terminations for these facilities are located on the 12-way connector at the rear. The line output is of 600-ohms impedance and is suitable for connection to balanced or unbalanced lines. Output level is of the order 10mW max.

Outboard FSK keying units should be connected to this output. Note that output level is pre-set by means of the internal LINE LEVEL control which is accessible through top of Line Audio Module after removal of receiver cabinet.

Line Output :: :: Connect line to pins 10 & 12. Fit link between pins 11 (centre-tap) and 4 (earth) for balanced operation with grounded tap.

Desensitising :: Connect external switch (or relay contact) across pins 1 & 4. External circuit must be closed for normal operation and opened to desensitise the receiver.

IMPORTANT. Receivers not installed with desensitising facility must have link fitted between pins 1 & 4 for normal operation.

Telephones

The telephone socket is located on the front panel and a suitable plug is supplied with the receiver. Any headset of low/medium impedance (nominally 600-ohms) will be found suitable.

An auxiliary contact on the panel socket is arranged to interrupt the internal loud-speaker circuit when telephones are in use.

Fuses

The fuse complement is dependent on the receiver type variant. Fuses are fitted at the rear as follows:-

EC964/1 & EC964/3 :: 1 @ 1A in live AC line. 1 @ 3A in low-voltage transformer secondary circuit (2A on EC964/3),

EC964/2 & EC964/5 :: 2 @ 1A in live and neutral AC lines. 1 @ 3A in low-voltage transformer secondary circuit (2A on EC964/5).

NB: Increase AC fuse to 2A when operating from 100/125V supply.

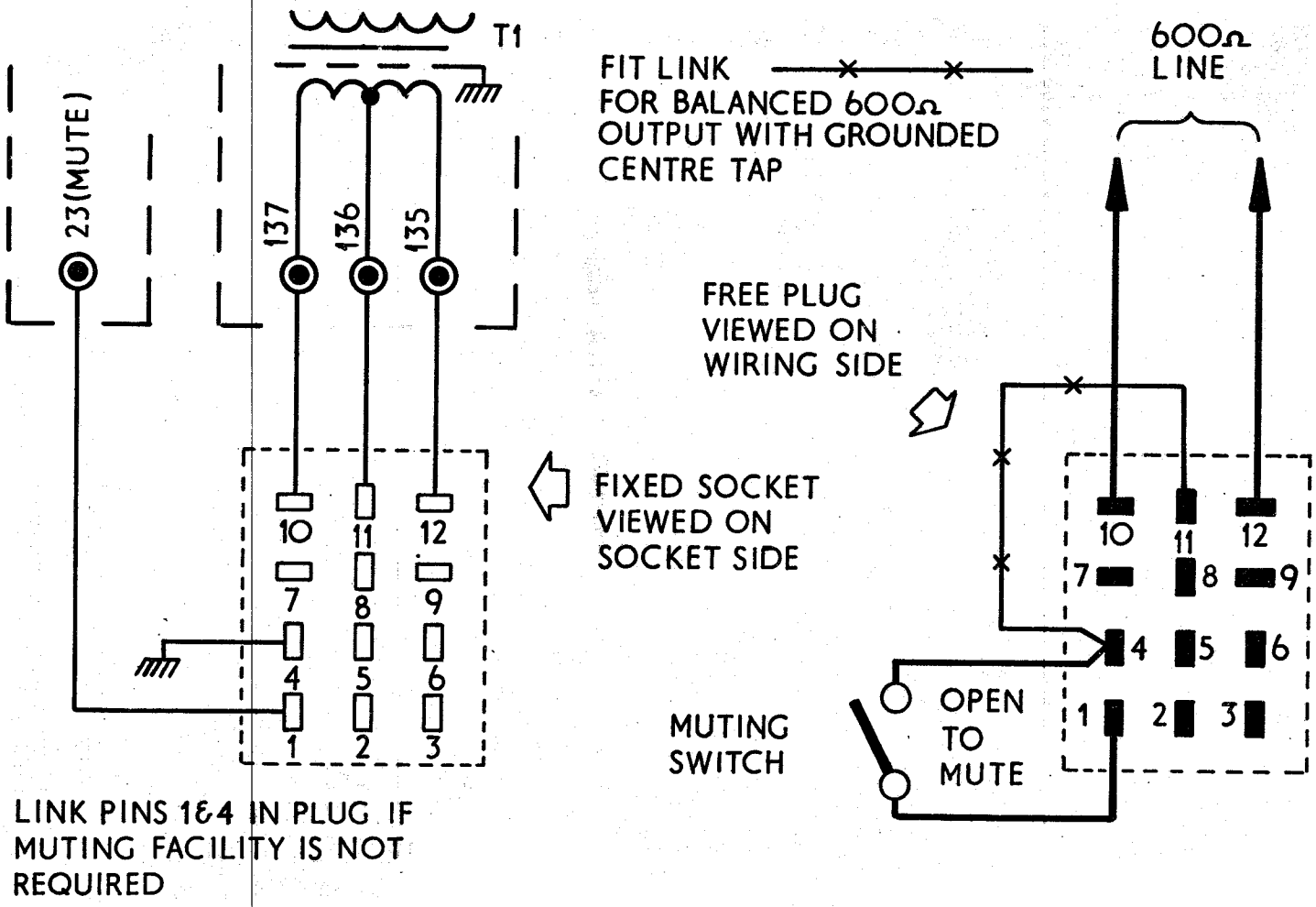


Fig. 4-1 Wiring of 12-way connector.

Section 5

OPERATION

CONTROLS

Six controls (seven on the EC964/1 & EC964/3) are provided for operation of the receiver. A supply switch is not fitted and arrangements for this facility should have been made externally at the supply source. The panel controls are as follows:-

CHANNEL SELECTOR	MODE SWITCH	AERIAL ATTENUATOR
BANDSWITCH	AF GAIN/STANDBY SWITCH	*RF GAIN/AGC SWITCH
CLARIFIER		

*Fitted on EC964/1 & EC964/3 only.

CONTROL FUNCTIONS

Channel Selector

This is a 28-position control which rotates the complete RF Turret Assembly to select (a) the appropriate 1st Oscillator crystal, and (b) the correct pre-set trimming capacitors which tune the signal frequency circuits to the required channel.

On the HF Band only, the CHANNEL SELECTOR also selects the inductors for the signal frequency circuits and therefore functions as a combined channel selector and range switch. Each set of coils selected by the CHANNEL SELECTOR remains in circuit for either three or four adjacent positions of turret rotation depending on whether the receiver is a /1 or /2 variant. Only 24 of the 28 available turret positions are used on the HF Band. Positions 1 & 2 and 27 & 28 are the ones which are not used. Actual frequency coverage for the other turret positions is indicated in the Table below.

Range	Frequency Coverage	Turret Positions	
		EC964/1	EC964/2
1	4.0-4.45MHz	3-4-5	3-4-5-6
2	6.2-6.525MHz	6-7-8	7-8-9-10
3	8.15-8.85MHz	9-10-11	11-12-13-14
4	12.3-13.25MHz	12-13-14	15-16-17-18
5	16.4-17.4MHz	15-16-17	19-20-21-22
6	22.0-22.72MHz	18-19-20	23-24-25-26
7	25.01-25.6MHz	21-22-23	-
8	26.1-27.5MHz	24-25-26	-

A further switching function carried out by the CHANNEL SELECTOR on the HF Band is the introduction of a Frequency Doubler Stage in the Local Oscillator Circuit for channel frequencies of 22.0MHz and above. This allows crystals of half the required injection frequency to be employed and so limits the highest crystal frequency to less than 19MHz.

Range selection on the MF Band is achieved by means of the BANDSWITCH, the CHANNEL SELECTOR being used only to select the appropriate crystal and signal frequency trimmers. As a result of this, MF channels can be installed in any combination, including all channels in one single range if so required. The Distress and Calling Channel (2182kHz) however, is always fitted in turret position No. 1 which occurs at the fully anti-clockwise setting of the CHANNEL SELECTOR. All other channels will normally be arranged to increase progressively in frequency with clockwise rotation of the control.

Channels are marked on the CHANNEL SELECTOR dial by channel numbers which correspond with those printed on the Channel Frequency Allocation Table supplied with the receiver. The inner ring of numbers (1-28) are the MF channels and the outer ring (29-52) are the HF channels. The appropriate setting of the BANDSWITCH for any selected channel is determined by reference to the Channel Frequency Allocation Table.

Bandswitch

This control has five positions, only four of which are employed on the MF-only receivers EC964/3 & EC964/5. These positions are marked 'A', 'B', 'C' & 'D', and provide frequency cover as follows:-

'A'	1.6	-	2.1MHz	(Range 1)
'B'	2.1	-	2.7MHz	(Range 2)
'C'	2.7	-	3.5MHz	(Range 3)
'D'	3.5	-	4.5MHz	(Range 4)

On dual-band receivers (Models EC964/1 & EC964/2), the fifth position of the BAND SWITCH (marked 'H') is used to disable the MF Section of the receiver and at the same time applies power to the HF Section for coverage of the 24 channels in the HF Band. Subsidiary functions of the BANDSWITCH on these two versions also include such other changeover operations as correct routing of the aerial input, 1st IF output etc. to the appropriate stages for the band in use. Bandswitch settings are included in the Channel Frequency Allocation Table (hinged flap over loudspeaker aperture).

Clarifier

This control is a potentiometer which adjusts the voltage applied to a pair of voltage-variable capacitance diodes in the 2nd Oscillator circuit to provide a means of correcting minor errors in frequency setting at both transmitter and receiver. The tuning range is restricted to 300Hz either side of the nominal centre setting and frequency is arranged to increase with clockwise rotation. In operation, the CLARIFIER is merely adjusted for optimum intelligibility of the received transmission.

During FSK reception, the CLARIFIER must be off-set by half the shift frequency on the high frequency side of the normal correct tuning point to ensure that the received signal lies in the centre of the FSK filter response.

Mode Switch

This is a two-position switch except on receivers equipped for FSK working (suffix 'X') in which case a three-position control is fitted. Switch positions are marked as follows:-

A3	-	A3A J&H	-	F1
(AM)		(SSB)		(FSK)

The switch is operated to select the appropriate filter and detector circuit to suit the type of transmission being received. AGC time constants are modified automatically when the switch is set to 'A3'. Upper-sideband is accepted at A3A, J & H.

AF Gain/Standby Switch

Audio power to the built-in loudspeaker or telephone headset is adjusted by means of this control. Maximum output is obtained when set to the fully clockwise position.

A switch is operated when the AF GAIN is rotated in an anti-clockwise direction to the position marked 'STANDBY'. This interrupts the 24V line supplying all receiver stages but does not affect operation of the oven circuit(s) which continue to function normally. The 'STANDBY' position can be used at any time when the receiver is not required but must be available for immediate operation. Stability is maintained during standby periods and the REC SUPPLY neon will remain extinguished until the receiver is restored to normal working.

NB The OVEN SUPPLY neon will be illuminated at all times so long as the AC supply to the receiver is maintained.

Aerial Attenuator

The AERIAL ATTENUATOR (marked INPUT SENSITIVITY on EC964/1 & EC964/3 receivers), is a three-position switch which controls the level of signal input to the RF Amplifier(s). In normal operation, the control should be set to 0dB (INPUT SENSITIVITY : MAX), the other two positions being used if severe interference is experienced when taking weak signals in the presence of extremely strong stations on adjacent channels. Attenuation in the other two positions amounts to 20dB and 40dB (INPUT SENSITIVITY : MIN).

RF Gain/AGC Switch

This control is fitted only on EC964/1 & EC964/3 receivers.

The RF GAIN is inoperative when set to the position marked 'AGC' and the receiver then functions with automatic control of pre-detector gain. Advancing the RF GAIN in a clockwise direction operates a switch to disable the AGC circuits and provides manual adjustment of RF level in the IF Section of the receiver. Maximum gain occurs with the RF GAIN at its fully clockwise setting.

Line Level Control

Independent control of the audio output appearing at the external line terminations is achieved by adjustment of the pre-set LINE-LEVEL control potentiometer located within the receiver. It is accessible through an adjustment hole in the top of the Line Audio Module, adjustment being carried out with a small screwdriver. The control should be set for the required output by reference to the normal external line monitoring facilities provided on the installation.

Operation of the panel AF GAIN does not significantly affect the line output level except when set to 'STANDBY'. In this case the line output will also be muted.

OPERATING INSTRUCTIONS

NB It is assumed that the receiver has been installed in accordance with the instructions given in the preceding Section.

1. Apply AC supply to receiver from external source. Availability of the supply will be indicated by illumination of the 'OVEN SUPPLY' neon. The 'REC SUPPLY' neon may or may not be illuminated depending on the setting of the AF GAIN control. If this is at 'STANDBY', the neon will be extinguished. Rotate control clockwise to complete 24V supply to receiver stages.

2. Refer to Channel Frequency Allocation Table on hinged cover over speaker aperture and determine Channel number and Band letter for frequency required.

3. Set BANDSWITCH to 'A', 'B', 'C', 'D' or 'H' as appropriate. Note that position 'H' is used for all HF channels and that MF channels may fall on 'A', 'B', 'C' or 'D'. Rotate CHANNEL SELECTOR until wanted channel number appears in cursor window.

4. Set MODE SWITCH to suit type of transmission to be received:-

   'A3' for double-sideband AM. 'F1' (when available) for FSK reception.

   'A3A, J&H' for upper sideband SSB signals.

5. Adjust CLARIFIER for greatest intelligibility of the received transmission. This control will require adjustment only for SSB and FSK signals. Set to centre-position when receiving AM transmissions.

   In FSK working, adjust CLARIFIER by reference to tuning monitor provided on the external keying unit.

   It should be noted that output for the keying unit is taken from the line terminations at the rear (LINE OUTPUT & DESENSITISING SOCKET). Output is set by adjustment of the internal LINE LEVEL control which will normally be pre-set on installation of the receiver. The panel AF GAIN does not affect output level on the line channel.

6. Adjust AF GAIN for required output level from built-in loudspeaker. This control also varies the output at the telephone socket and the circuit is arranged so that the speaker will be muted when telephones are in use.

7. AERIAL ATTENUATOR (INPUT SENSITIVITY) should be set to 0dB position for normal reception. 20dB and 40dB settings can be used to improve reception when coping with strong adjacent channel interference, especially when the wanted signal is rather weak.

8. Receivers EC964/1 & EC964/3 are fitted with manual RF GAIN control and AGC SWITCH not found on the other variants.

   The RF GAIN is disabled when rotated fully anti-clockwise to the position marked 'AGC'. (Control will click as switch operates).

   Clockwise rotation from this setting disables the AGC for the IF Stages which are then controlled by the RF GAIN. The AERIAL ATTENUATOR (INPUT SENSITIVITY CONTROL) can be used in conjunction with the RF GAIN to supplement its effective control range when handling signals of above average strength.

9. The receiver can be disabled at any time by setting the AF GAIN to the position marked 'STANDBY'. The 'REC SUPPLY' neon will extinguish at this setting but the 'OVEN SUPPLY' neon will stay alight.

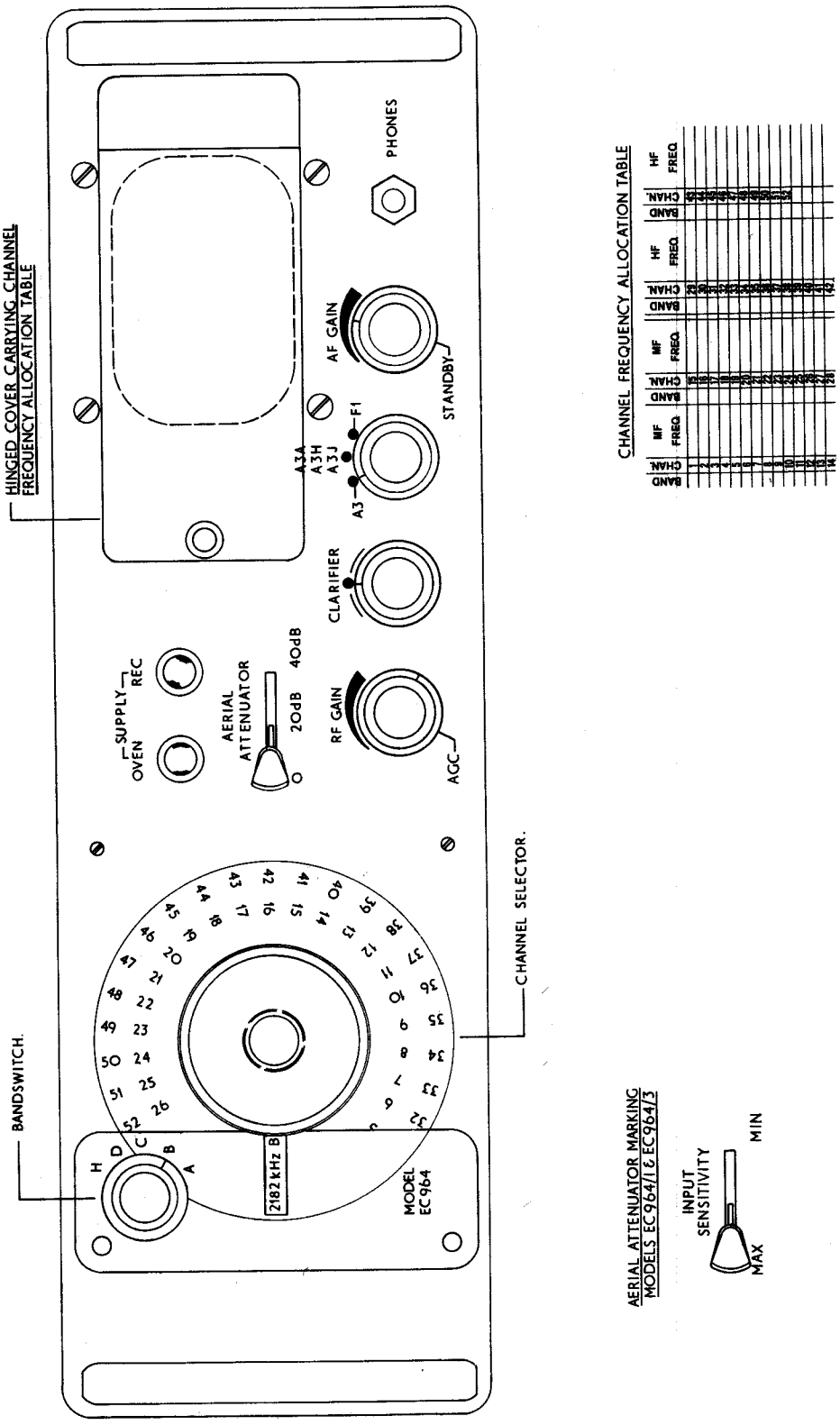


Fig. 5.1. Front view of EC964/2 showing controls.

Section 6

MAINTENANCE

GENERAL

Receivers in the EC964 Series are suitable for continuous use under arduous operating conditions and should require very little in the way of routine maintenance over quite long periods of operation. All components with the exception of the semiconductors are guaranteed by the Manufacturer for a period of one year from date of purchase. The semiconductors are covered by a separate guarantee.

As with all Eddystone receivers, EC964 variants can be returned to the manufacturer at any time should major servicing become necessary. In this event, the receiver should normally be returned via one of the many Eddystone Agents, but can be sent direct provided prior arrangements are made with Eddystone Radio Ltd. The Ser. No. of the set should be quoted in all communications, and extreme care should be taken to ensure that the receiver is well protected against possible damage during transit.

Spares for user-servicing can be supplied, and helpful advice will be freely given when required. Any enquiries relating to service matters should be directed to the 'Sales and Service Dept.' at our usual address.

FUSE REPLACEMENT

The fuse complement is dependent on receiver type and is detailed in the Table which follows. Fuses are standard 5/8" x 3/16" glass cartridge type located in holders at the rear. Two spare fuses of each value are supplied with every receiver.

NB: Fit 2A AC fuse(s) when operating from 100/125V supply.

Type	AC Fuse(s)		DC Fuse	
	Qty/Value	Part No.	Qty/Value	Part No.
EC964/1	1 @ 1A*	7173P	1 @ 3A**	6709P
EC964/2	2 @ 1A*	7173P	1 @ 3A**	6709P
EC964/3	1 @ 1A*	7173P	1 @ 2A**	6704P
EC964/5	2 @ 1A*	7173P	1 @ 2A**	6704P

(*) Quick-blow. (**) Thermal Delay.

NEON REPLACEMENT

The two neon indicators are both of the same type and spares are available under Eddystone Part No. 6858P.

FAULT DIAGNOSIS

Servicing techniques on a receiver of this type, although necessarily somewhat different from those adopted on older equipment of non-modular construction, do not deviate significantly from the well established procedures commonly employed in all advanced electronics workshops. Lack of immediate access to many supposedly vital components, though perhaps disturbing at first, will be found not to present a serious obstruction to systematic servicing procedures. In fact, the many access points which are readily available for signal tracing etc., tend to simplify rather than complicate logical progression through the circuit. The service engineer should resist any temptation to carry out haphazard module replacement in an effort to identify the area in which a fault lies.

Reference should be made to Section 1 for overall performance data, and to Appendix 'B' for detailed voltage analysis.

RE-ALIGNMENT

General

All Modules employed in EC964 Series Receivers are tested and pre-aligned on factory test jigs before being fitted to the main chassis assembly. Further major adjustment is not normally required apart from precise setting of pre-set potentiometers RV10, RV11 and RV14. These are adjusted on final test to suit the operating conditions established by earlier adjustment of RV1 and RV2 (and RV3 on dual-band sets).

Replacement Modules supplied for user-servicing are treated in a similar manner, and with two exceptions can be installed without further adjustment. The exceptions are the Main 100kHz IF Amplifier Module and the RF/IF AGC Module. Minor adjustment of pre-set potentiometers will be required if either of these modules is changed. Adjustment is restricted to the potentiometers located in the replacement module, relevant procedures appearing later in this Section.

Turret Disks are pre-aligned and tested in a similar fashion to Modules and are then subjected to precise alignment after installation in the receiver. Initial in-situ factory alignment will hold for a long period of time and re-alignment should only be contemplated if channel frequencies are changed or where there is a clear indication that such action is in fact required. Disks supplied for user-servicing will also require final adjustment when fitted in the actual receiver. Such adjustments will be of a minor nature except in the case of Trimmer Disks which cannot of course be pre-aligned in the normal manner.

NB All pre-set adjustments are self-locking and should not be sealed with wax or other similar substances.

Installation of Channel Crystals and associated alignment

1. Determine the required crystal frequency and order crystal from Eddystone Radio Ltd. by quoting the Part No. and frequency as detailed on page 6 of Appendix 'E'.

   Crystal frequencies for A3, A3A, A3H, A3J and F1 reception are calculated as follows

   MF Band

   CRYSTAL FREQUENCY = CHANNEL FREQUENCY + 1200kHz.

HF Band (Ranges 1-5 only)

CRYSTAL FREQUENCY = CHANNEL FREQUENCY + 1200kHz.

HF Band (Ranges 6, 7 & 8)

$$\text{CRYSTAL FREQUENCY} = \frac{\text{CHANNEL FREQUENCY} + 1200\text{kHz}}{2}$$

CW Reception

When calculating crystal frequencies for CW (A1) reception, substitute 1199kHz for 1200kHz in all formulae above. The A3A, H & J position is used for A1 reception and this adjustment in crystal frequency places the CW carrier within the passband of the lower sideband filter which is fitted, i.e. 2nd IF for A1 reception = 99kHz.

2. Remove both 'L-shaped' cover plates from RF Assembly.

3. Locate appropriate crystal holder in Turret Disk Assembly and fit crystal, using the following notes for guidance.

   (a) MF Channel crystal holders are located between Disks 'O' & 'P' in the part of the Turret Assembly nearest to the front panel.

   (b) HF Channel crystal holders are located between Disks 'M' & 'N'. Reference should be made to the Table on Page 1 of Section 5 when fitting crystals for HF Band channels which must be installed in accordance with the range coverage provided, e.g. Turret positions 6, 7 & 8 are suitable only for frequencies in the range 6.2-6.525MHz (EC964/1).

   (c) All crystal holders are arranged in groups of four, each group being enclosed by a specially shaped snap-on cover.

   (d) All crystal holders are numbered to correspond with turret position, the numbers being marked between the individual crystal pin sockets. It should be noted that the turret position numbering is the same as the MF channel numbering 1-28 which appears on certain receivers in the range. Turret position No. 1 occurs with the CHANNEL SELECTOR at its extreme anti-clockwise setting (2182kHz).

   (e) Turret positions 1 & 2 and 27 & 28 are not used on the HF Band. The oven control sensor is located in this section of the turret and has a cover of the same type employed for the crystals.

   (f) The CHANNEL SELECTOR should be rotated as necessary to position the appropriate crystal group at the top of the turret for access to the crystal holder.

4. Trim crystal to exact frequency by following the procedure detailed below:-

   (a) Set CHANNEL SELECTOR and BANDSWITCH to appropriate settings for required channel frequency.

   (b) Select A3A A3H A3J position of MODE SWITCH.

   (c) Set CLARIFIER to mid-position.

4. (contd.)

(d) Feed an unmodulated signal to aerial socket from an accurate frequency source set to a frequency exactly 1kHz higher than the actual channel frequency.

(e) Connect 600-ohm line output (pins 10 and 12 of PL5) to a frequency counter or audio frequency meter readable to within 10Hz.

(f) Adjust AF GAIN for suitable output and roughly align the signal frequency trimmers on Disks H, I & J (MF Band) or Disks A, D & E (HF Band). Access holes for trimming will be found in both the sideplate and printed boards. Identify disks by counting A, B, C etc from rear of set.

(g) Locate appropriate crystal trimmer and adjust for 1kHz output using insulated trimming tool. Refer to Fig. 6.1. for trimmer location.

5. Align signal frequency circuits to channel frequency as follows:-

(a) Connect Power Output Meter to 600-ohm terminations.

(b) Feed in an unmodulated signal on the channel frequency from a standard signal generator matched to 50-ohms. Adjust attenuator on generator to prevent overloading of receiver.

(c) Disable AGC circuits as follows:- EC964/1 & EC964/3 - set RF GAIN to fully clockwise position.. EC964/2 & EC964/5 - Fit shorting links between Pins 82A & 84A and Pins 87A & 89A on IF/RF AGC Module. (Pins 82A, 84A etc are adjacent to pins 82, 84 etc near edge of board.)

(d) Peak trimmers on Disks H, I & J (MF Band) or Disks A, D & E (HF Band) for maximum output.

(e) Set input for 10mW output with LINE LEVEL control at maximum. Check that the signal + noise / noise ratio is better than 12dB for an input of 1μV.

6. Replace 'L-shaped' cover plates, fit cabinet and return receiver ready for use.

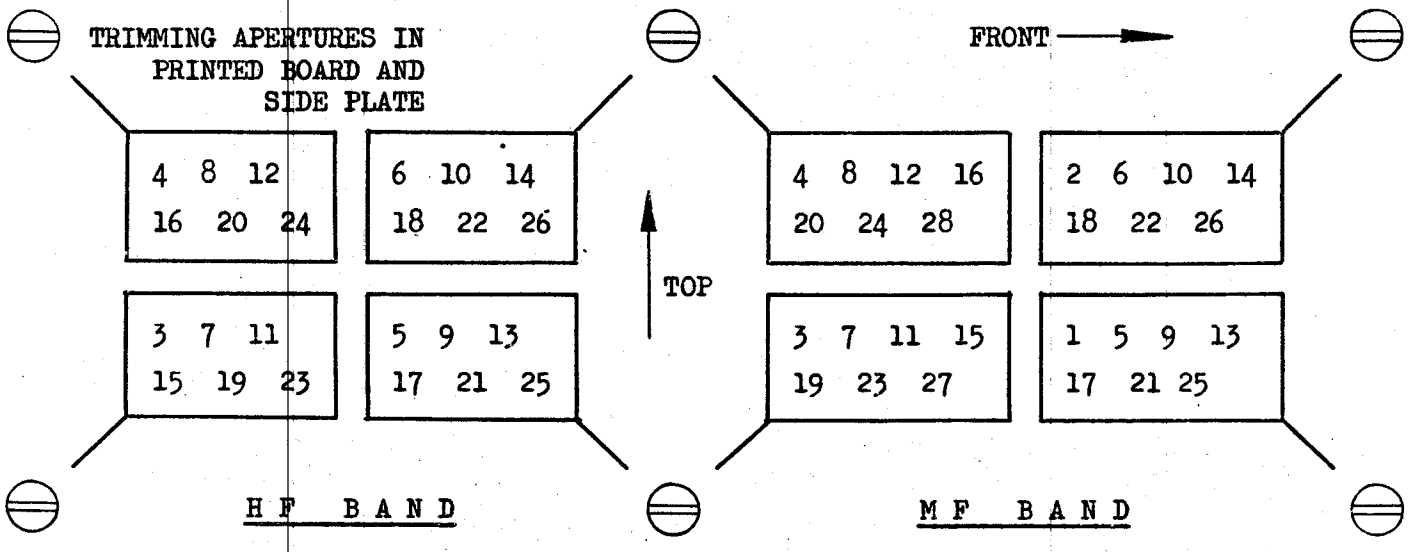


Fig. 6.1. Location of crystal trimmers by turret position.

MODULE REPLACEMENT

General

All modules except two can be changed without the need for any adjustment of the internal pre-set controls. Adjustment procedures are given below for the 100kHz IF Amplifier Module and the AGC Module which are not directly interchangeable.

100kHz IF Amplifier Module

Adjust RV10 by following the procedure outlined below. This ensures correct functioning of the IF AGC circuit.

(a) Install replacement module with cover removed for access to RV10.

(b) Set RV10 to fully clockwise position.

(c) Adjust receiver on any channel for normal reception in A3A mode with RF GAIN at maximum setting.

(d) Connect standard signal generator matched to 50Ω to aerial input socket and tune to selected channel. Set generator output to 1μV.

(e) Connect Power Output Meter to 600Ω terminations (pins 10 & 12 of PL5).

(f) Set RF GAIN 30° back from maximum setting.

(g) Rotate RV10 in an anti-clockwise direction to the point at which the audio output just begins to fall.

(h) Retain this setting of RV10.

(i) Fit module cover.

NB In the case of receivers not fitted with manual RF GAIN control (EC964/2 & EC964/5, RV10 is set for 5.5V at pin 73 of 100kHz IF Module with 2μV signal at aerial input.

AGC Module

Adjust RV11 and RV14 by following the procedure outlined below. This ensures correct functioning of the IF AGC circuit (RV11) and the RF AGC circuit (RV14).

NB The settings of associated pre-set adjustments RV1, RV2, RV3 and RV10 must not be disturbed from the positions determined during factory testing.

(a) Install replacement module with cover removed for access to adjustments.

(b) Set RV11 and RV14 to fully anti-clockwise position.

(c) Adjust RV11 first as follows:-

(i) Adjust receiver on any channel for normal reception in 'SSB' mode.

(ii) Connect standard signal generator matched to 50-ohms to aerial input socket and tune to selected channel. Adjust generator to provide CW signal which falls within the passband of the SSB filter. Generator o/p 100μV.

(iii) Connect oscilloscope to Pin 110 of Detector Module.

(iv) Advance RV11 (clockwise) until oscilloscope indicates that amplitude of 100kHz drive to Detectors is 130mV p-p.

(v) Retain this setting of RV11.

AGC Module Replacement (contd.)

(d) Continue by adjusting RV14 as follows:-

(i) Transfer MODE SWITCH to 'A3' position.

(ii) Increase level of input signal to 100mV and modulate 30% at 1kHz.

(iii) Advance RV14 (clockwise) until there is no apparent increase in modulation depth indicated on oscilloscope connected to Pin 110.

(iv) On EC964/1 and EC964/2 dual-band versions only, select any channel in the other Band and repeat check on adjustment of RV14. Retain setting of RV14 which gives normal modulation envelope on both HF and MF Bands.

(v) Check that distortion at this setting does not exceed 5%.

(e) Fit module cover.

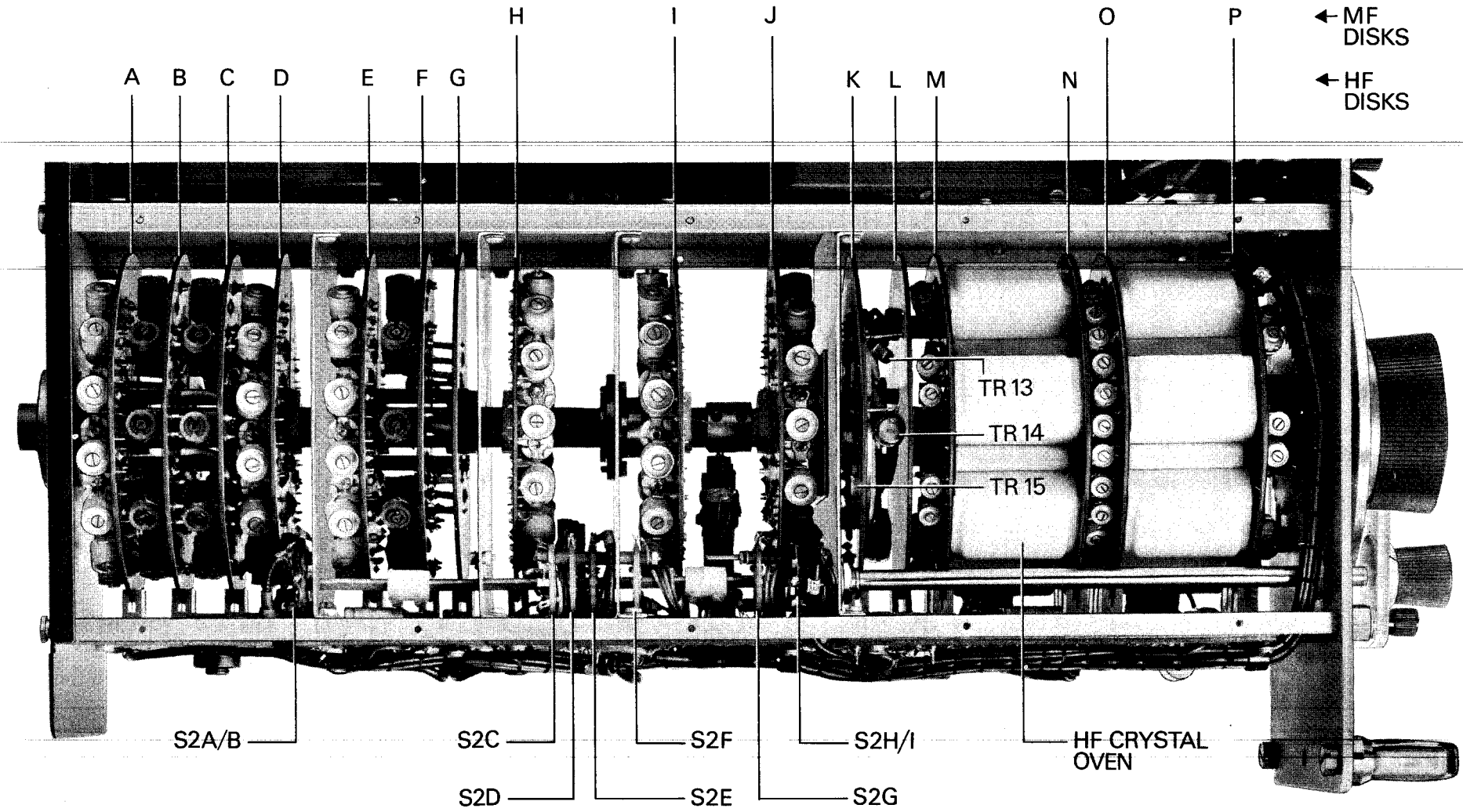


Fig. 6.2 Plan view of RF Assembly showing disk locations etc.

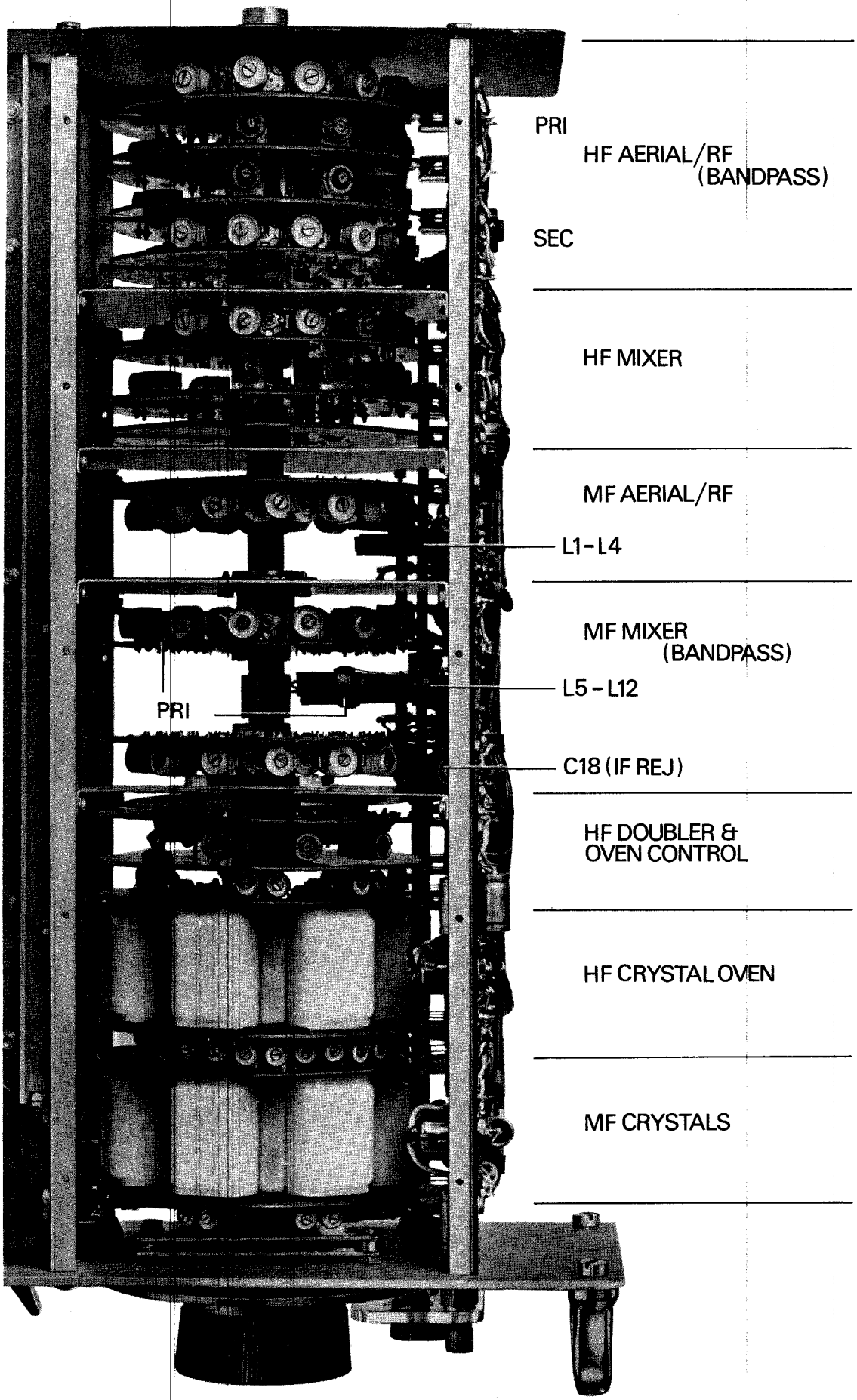
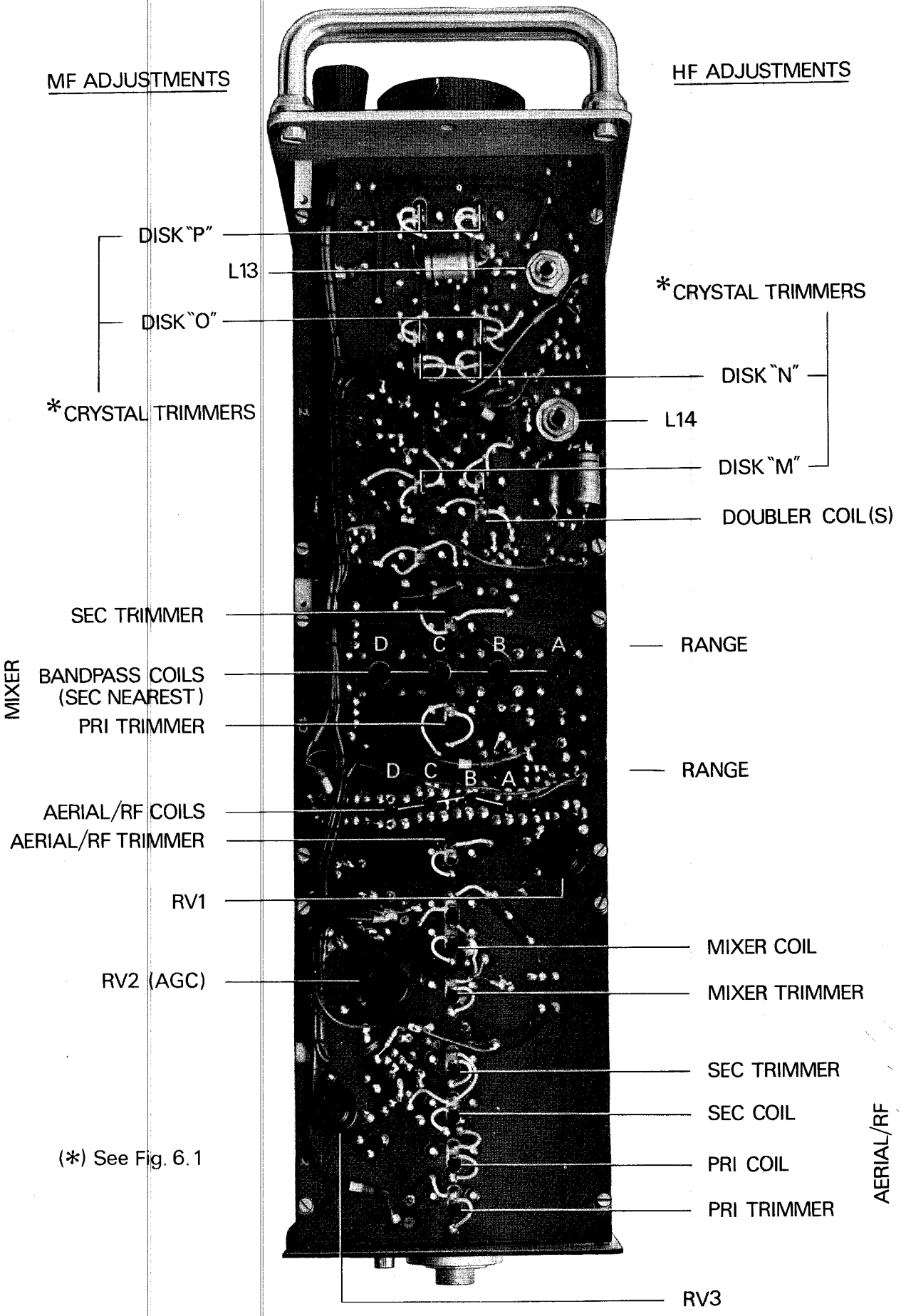


Fig. 6.3 Underside view of RF Assembly



(*) See Fig. 6.1

Fig. 6.4 Side view of RF Assembly showing alignment adjustments

APPENDIX 'A'

OPERATING THE EC964 RECEIVER FROM LOW-VOLTAGE DC SUPPLIES

General

The EC964 Receiver can be installed with a DC/AC Converter Unit for operation from low voltage DC supplies. The units available provide conversion efficiencies of the order 80% and are designated as follows:-

DC/AC Converter Type 978/12 :: for 12V working
DC/AC Converter Type 978/24 :: for 24V working

Both units provide a nominal 50Hz square-wave output of 250V and are basically identical. The notes which follow refer to either type.

Input

A heavy gauge cable is provided for connection to an accumulator, leads being coded RED +ve and BLACK -ve. If extension of the existing leads proves necessary to suit the installation, care should be taken to select a suitable cable to avoid excessive voltage drop. Neither pole of the supply is earthed.

WARNING: Under no circumstances should the unit be connected to a supply source other than an accumulator, unless such source is shunted with an accumulator of the correct voltage required. Place unit well clear of battery fumes.

Switching

Switching of the input supply is achieved by means of an internal relay. The circuit includes a reverse-polarity protection diode to prevent operation of the relay in the event of the input leads being inadvertently reversed.

Provision is made for local or remote switching, connection for the latter being to a terminal block on the front of the unit. A single-pole switch is required.

REMOTE SWITCHING : Supply switch on unit must be left permanently in 'ON' position.
LOCAL SWITCHING : Terminal block connections must be shorted with wire link.

Fusing

Input is fused by an internal fuse link of rating specified on label.

Earthing

The case of the unit should be effectively earthed. A terminal is provided for this purpose.

Output

A suitable connector is supplied with unit. A surge-limiting inductor is included in the output circuit.

Maximum output rating 50 watts.

Case Dimensions

Approximately 8 in x 6 in x 4 in.

APPENDIX 'B'

VOLTAGE ANALYSIS

In the event of the receiver failing to operate normally, initial voltage checks should be carried out at all appropriate module terminations etc. to determine whether the fault lies in the circuit wiring or in one of the modules. If the latter should prove to be the case, modules can be easily taken out and re-connected with covers removed to allow access for checking the voltages on any suspected stage. Two separate Voltage Analysis Tables are provided here, the first covering voltage checks on module terminations etc., and the second giving a full summary of the stage voltages throughout the entire receiver.

Except for certain voltages where a valve voltmeter is required for satisfactory measurement, all readings given in the Tables which follow were taken with a standard 20,000 ohms/volt testmeter (AVO Model 8). A normal tolerance of 10% applies to cover usual zener and semiconductor spreads and this should be increased if checks are made with a less sensitive meter than that specified.

Controls should be adjusted initially as indicated below, settings being altered as necessary for the check being carried out (see 'Remarks' column).

†CHANNEL	::	::	2182kHz
MODE SWITCH	::	::	'A3'
CLARIFIER	::	::	mid-position
AF GAIN	::	::	mid-position
*RF GAIN	::	::	'AGC'

(†) Use any HF channel above 22MHz when checking TR7-15.

(*) Models EC964/1 & EC964/3 only.

TABLE B-1 : MODULE SUPPLIES ETC.

Module	Pin	Service	Voltage/Remarks
	1-19		Not allocated
1.2MHz IF Module	20	Earth	
	21	1.1MHz Osc. drive to TR19	560mV RMS.
	22	100kHz IF Output	To Pin 45 of 100kHz IF Pre-amp Module.
	23	Desensitising line	Normally earthed via pins 1/4 of PL5. +12V when pins 1/4 open (Rec. muted).
	24	TR16-20 supply	+24V
	25	1.2MHz Input	
	26	Earth	
	27-29		Not allocated

Module	Pin	Service	Voltage/Remarks
Clarifier Module (Osc. 2)	30	Clarifier pot. (-ve)	+4.2V (nominal)
	31	Clarifier pot. (slider)	Varies between +4.2V and +9.6V (nom) for full travel of slider.
	32	1.1MHz Output	560mV RMS
	33	Earth	
	34	Clarifier pot. (+ve)	+9.6V (nominal)
	35	TR21-23 supply	+24V
	36	Oven supply	) 12V AC
	37	Oven (earthy)	)
	38		Not allocated
	39		
100kHz IF Pre-ampr.	40	Earth	
	41	100kHz O/P to S3A	
	42	100kHz O/P to RF AGC (TR31)	
	43	Earth	
	44	TR24 supply	+24V
	45	100kHz Input	From Pin 22 of 1.2MHz IF Module
	46	Earth	
	47-60		Not allocated
SSB Filter	61	INPUT	
	62	OUTPUT	
FSK Filter	63	INPUT	
	64	OUTPUT	
	65-69		Not allocated

Module	Pin	Service	Voltage/Remarks
100kHz IF Amplifier	70	Earth	
	71	TR27-TR30 supply	+24V
	72	100kHz IF Input	From S3B
	73	IF AGC Control Line	
	74	Earth	
	75	Earth	
	76	100kHz IF Output	To Detector Module
	77	100kHz IF Output	To AGC Module (IF AGC)
	78	Earth	
	79		Not allocated
AGC Module	80	Earth	
	81	100kHz IF Input	From No. 77 (100kHz IF Amplifier)
	82	Earth	
	83	To S3C	AM time constant
	84	IF AGC Control Line	Pins 82A, 84A, 87A & 89A can be linked to disable AGC. Refer Main Circuit.
	85	No connection	
	86	TR31-TR36 supply	
	87	RF AGC Control Line	
	88	100kHz IF Input	From No. 42 (IF Pre-amplifier)
	89	Earth	
	90 to 99		Not allocated
Detector Module	100	Earth	
	101	Diode switching (SSB)	+24V with MODE SWITCH at SSB position
	102	Diode switching (FSK)	+24V with MODE SWITCH at FSK position
	103	Audio Output	To AF GAIN
	104	TR37 & IC3 supply	+24V
	105	Audio Input	From S3D

Module	Pin	Service	Voltage/Remarks
Detector Module (contd.)	106	Earth	
	107	Earth	
	108	Audio Output (AM)	To S3D
	109	IC1/IC2 supply	+24V
	110	100kHz IF Input	From No. 76 (100kHz IF Amplifier)
	111	Audio Output (SSB/FSK)	To S3D
	112 to 119		Not allocated
Main Audio Module	120	Earth	Return from loudspeaker/telephones
	121	Audio Output	To loudspeaker/telephones
	122	TR38-TR42	+24V
	123	Audio Input	From slider of AF GAIN
	124	Earth	
	125 to 129		Not allocated
Line Audio Module	130	)	
	131	) AC supply from T2	12V AC
	132	-5.6V supply out	-5.6V
	133	Earth	
	134	Audio Input	From AF GAIN
	135 to 137	600-ohm output	136 = centre-tap
	138	TR43/TR44 supply	+24V
	139		Not allocated
RF Assembly	140	Oven supply	+26V
	141	TR1-TR11 supply	+24V
	142	TR3/4 negative supply	-5.6V
Misc	150	Supply to S3E	+24V
	151	Supply to RF GAIN	+24V

Nos. 143-149 not allocated

TABLE B-2 : STAGE VOLTAGES

NB: Control settings should be as detailed on page B-1, except where modified by the Notes listed in the right-hand column. Tolerances etc. specified previously apply to all readings given below. Voltages are +ve w.r.t. earth unless indicated.

T R A N S I S T O R S

Module etc.	Ref	Emitter /Source	Base/ Gate/Gate 1	Gate 2	Collector / Drain	Notes
RF Assembly	TR1	7.1V	6 to 8V(!)	8.4V(!)	11.5V	NOTE 1
	TR2	0.4V	0V	0.65V*	10.7V	
	TR3	-0.4V	0V		8.4V(!)	NOTE 2
	TR4	-0.4V	0.2V		11.5V	NOTE 2
	TR5	0.25V	0.7V		-	NOTE 3
	TR6	0V	0.65V		-	NOTE 3
	TR7	7.1V	6 to 8V(!)	8.4V(!)	11.0V	NOTE 4
	TR8	0.3V	0V	0.7V*	12.0V	
	TR9	0V	0.7V		-	NOTE 3
	TR10	0.5V	1.2V		-	NOTE 3
	TR11	2.2V*	2.4V*		-	NOTE 3
	TR12	0.1V	0.6V		4.7V	
	TR13	4.5V	4.7V		10.5V	
	TR14	4.0V	4.5V		10.5V	
	TR15	3.4V	4.0V		10.5V	
1.2MHz IF Module	TR16	1.6V	0V		7.3V	
	TR17	7.3V	5.8V		15.0V	
	TR18	7.0V	5.6V(!)		20.0V	
	TR19	0.9V	0V		7.0V	
	TR20	7.0V	5.6V(!)		19.0V	
Clarifier Module	TR21	1.7V	2.0V		4.0V	NOTE 5
	TR22	1.7V	2.0V		4.0V	NOTE 5
	TR23	5.2V	3.9V(!)		22.0V	
100kHz IF Pre-amp	TR24	3.2V	3.7V		13.7V	

(*) Taken on 10V range. (!) Valve voltmeter. NB: Refs TR25/26 not allocated.

Module etc.		Ref	Emitter /Source	Base Gate/Gate 1	Gate 2	Collector / Drain	Notes
100kHz IF Amplifier		TR27	-	-		-	NOTE 6
		TR28	1.4V*	2.0V(!)		11.4V(!)	
		TR29	1.4V*	1.7V*		6.9V	
		TR30	6.8V	6.9V		18.7V	
AGC Module		TR31	1.0V	1.7V(!)		10.7V	
		TR32	10.4V	10.7V		21.5V	
	+	TR33	1.6V*	2.2V(!)		14.5V	
+Voltages taken with pin 81 disconnected.	+	TR34	2.5V	2.9V(!)		2.3V(!)	
	+	TR35	2.5V	0.7V(!)		24.5V	
	+	TR36	24.0V(!)	24.5V		0 to 8V	NOTE 7
Detector Module		TR37	7.4V	8.0V		11.8V	
Main Audio		TR38	12.5V	11.5V		3.8V	
		TR39	3.2V	3.8V		26.0V	
		TR40	0V	0.7V		12.5V	
		TR41	13.0V	12.5V		0V	
		TR42	13.2V	13.8V		26.0V	
Line Audio		TR43	0.6V*	1.2V(!)		9.0V**	
		TR44	1.5V	2.0V		14.6V	

(*) Taken on 10V range. (**) 25V range. (!) Valve voltmeter.

INTEGRATED CIRCUITS

(Located in Detector Module)

Ref	1	2	3	4	5	6	7	8	9	10	Notes
IC1	6.3V	0V	2.0V	2.4V	5.8V	0V	7.8V	9.4V	12.5V	6.0V	8
IC2	6.4V	0V	0V	0V	5.6V	7.1V	0V	7.2V	12.5V	6.1V	8
IC3	6.0V	6.0V	0V	2.0V	2.4V	6.0V	0V	7.8V	12.0V	8.0V	8

N O T E S

NOTE 1. Gate No. 1 voltage dependent on setting of RV1.
Gate No. 2 voltage dependent on setting of RV2.

NOTE 2. Collector voltage dependent on setting of RV2.

NOTE 3. Collector voltage dependent on crystal activity.

NOTE 4. Gate No. 1 voltage dependent on setting of RV3.
Gate No. 2 voltage dependent on setting of RV2.

NOTE 5. Collector voltage dependent on crystal activity.

NOTE 6. Subject to wide variation dependent on setting of RV10.

NOTE 7. Collector voltage dependent on setting of RV10.

NOTE 8. Readings taken with MODE SWITCH at 'A3' position.

APPENDIX 'C'

SEMICONDUCTOR COMPLEMENT

Ref	Type	Manufacturer	Circuit Function
TR1	40673	RCA	RF Amplifier) MF BAND
TR2	40673	RCA	1st Mixer)
TR3	BC107B	Mullard	)
TR4	BC107B	Mullard	) RF AGC Control
TR5	2N4254	Texas	1st Oscillator) MF BAND
TR6	BC107B	Mullard	ALC Amplifier)
*TR7	40673	RCA	RF Amplifier)
*TR8	40673	RCA	1st Mixer)
*TR9	BC107B	Mullard	ALC Amplifier)
*TR10	2N4254	Texas	1st Oscillator) HF BAND
*TR11	2N4254	Texas	Frequency Doubler)
*TR12	BC107B	Mullard	))
*TR13	BC107B	Mullard	))
*TR14	2N3053	RCA	) Oven Control)
*TR15	2N3055	RCA	))
TR16	UC734B	Union Carbide	)
TR17	UC734B	Union Carbide	) 1.2MHz IF Amplifier (Cascode)
TR18	UC734B	Union Carbide	)
TR19	UC734B	Union Carbide	) 2nd Mixer
TR20	UC734B	Union Carbide	)
TR21	2N4254	Texas	2nd Oscillator (Clarifier) 1
TR22	2N4254	Texas	2nd Oscillator (Clarifier) 2
TR23	UC734B	Union Carbide	Clarifier Mixer
TR24	BC107B	Mullard	100kHz IF Pre-amplifier
TR25	-	-	Reference not allocated
TR26	-	-	Reference not allocated
TR27	BC107B	Mullard	IF AGC Control
TR28	BC107B	Mullard	100kHz IF Amplifier
TR29	BC107B	Mullard	100kHz IF Amplifier
TR30	BC107B	Mullard	100kHz IF Amplifier
TR31	BC107B	Mullard	RF AGC Amplifier
TR32	BC107B	Mullard	Emitter Follower (RF AGC)
TR33	BC107B	Mullard	IF AGC Amplifier
TR34	BC107B	Mullard	)
TR35	BC107B	Mullard	) Schmitt Trigger (IF AGC)
TR36	BCY32	Mullard	)
TR37	BC107B	Mullard	Pulse Counter (IF AGC)
TR38	U17220	Fairchild	Emitter Follower (Carrier Insertion)
TR39	U17221	Fairchild	)
TR40	U17222	Fairchild	)
TR41	U17223	Fairchild	) Audio Amplifier (Speaker/Headset)
TR42	U17224	Fairchild	)
TR43	BC107B	Mullard	)
TR44	BC107B	Mullard	) Audio Amplifier (Line Output)

*Fitted on EC964/1 & EC964/2 only.

Ref	Type	Manufacturer	Circuit Function
D1-D4	-	-	References not allocated
D5	OA202	Mullard	
†D6	OA202	Mullard	
†D7	BZY88C6V2	Mullard	Voltage Regulator (6.2V)
D8	BZY88C12	Mullard	Voltage Regulator (12V)
D9	BZY88C12	Mullard	Voltage Regulator (12V)
D10	BZY88C12	Mullard	Voltage Regulator (12V)
D11/12	OA47	Mullard	ALC Rectifier
*D13	OA202	Mullard	
*D14	OA202	Mullard	
†*D15	BZY88C6V2	Mullard	Voltage Regulator (6.2V)
*D16	BZY88C12	Mullard	Voltage Regulator (12V)
*D17	BZY88C12	Mullard	Voltage Regulator (12V)
*D18/19	OA47	Mullard	ALC Rectifier
*D20	BZY88C6V2	Mullard	Voltage Regulator (6.2V)
*D21	BZY88C12	Mullard	Voltage Regulator (12V)
D22	BZY88C12	Mullard	Voltage Regulator (12V)
D23	BA150/60	Telefunken	VVC Diode (XL1 Clarifier)
D24	BA150/60	Telefunken	VVC Diode (XL2 Clarifier)
D25	BZY88C6V2	Mullard	Voltage Regulator (6.2V)
D26	OA202	Mullard	IF AGC Control
D27	BZY88C18	Mullard	Voltage Regulator (18V)
D28	OA47	Mullard	RF AGC Rectifier
D29	OA202	Mullard	
††D30	OA202	Mullard	RF Switch (FSK Crystal)
D31	OA202	Mullard	RF Switch (SSB Crystal)
D32	BZY88C6V2	Mullard	Voltage Regulator (6.2V)
D33	BZY88C12	Mullard	Voltage Regulator (12V)
D34	BZY88C5V6	Mullard	Voltage Regulator (5.6V)
D35	DD006	Lucas	Supply Rectifier (-5.6V)
D36	OAZ230	Mullard	} Voltage Regulator (+24V)
D37	OAZ230	Mullard	}
D38	OSH02/200		Supply Rectifier (+26V/+24V)
**D39	BZY88C12	Mullard	Voltage Regulator (12V)
**D40	BZY88C5V6	Mullard	Voltage Regulator (5.6V)
IC1	CA3002	RCA	AM Detector
IC2	CA3002	RCA	SSB/FSK Detector
IC3	CA3000	RCA	SSB/FSK Carrier Oscillator

* Fitted on EC964/1 & EC964/2 only.

**Fitted on EC964/1 & EC964/3 only.

† May be BZY88C5V6 or as selected on factory test.

††Fitted on FSK-equipped receivers only.

APPENDIX 'D'

LIST OF COMPONENT VALUES, TOLERANCES AND RATINGS

PART 1 :: MAIN RECEIVER

PART 2 :: TURRET DISKS (Page D-9)

MAIN RECEIVER

Location Code

Each component listed in the Tables which follow is allocated a reference letter which will assist in location. Coding is as follows:-

A : Aerial Attenuator.
B : RF Assembly
C : 1.2MHz IF Module
D : 2nd Oscillator Module (Clarifier).
E : 100kHz IF Pre-amplifier Module. (incorporating AM Filter).
F : Not allocated.
G : Main 100kHz IF Amplifier Module.
H : RF/IF AGC Module.
I : AM/SSB (& FSK) Detector Module.
J : Main Audio Module (Speaker/Headset)
K : Line Audio Module (600-ohms).
L : Chassis Assembly.
M : Panel Assembly.
N : Oven Control Circuit (Disk 'K')

Capacitors

Ref	Value	Type	Tolerance	Wkg. V.	Loc
C1	-	Reference not allocated	-	-	-
C2	-	Reference not allocated	-	-	-
C3	-	Reference not allocated	-	-	-
C4	-	Reference not allocated	-	-	-
C5	12pF	Polystyrene	10%	125V	B
C6	20pF	Polystyrene	10%	125V	B
C7	39pF	Polystyrene	10%	125V	B
C8	15pF	Polystyrene	10%	125V	B
C9	0.1µF	Polycarbonate	20%	100V	B
C10	-	Reference not allocated	-	-	-
C11	0.01µF	Polycarbonate	20%	100V	B
C12	0.1µF	Polycarbonate	20%	100V	B
C13	100pF	Polystyrene	10%	125V	B
C14	0.1µF	Polycarbonate	20%	100V	B
C15	20pF	Polystyrene	10%	125V	B
C16	20pF	Polystyrene	10%	125V	B
C17	51pF	Polystyrene	10%	125V	B
C18	10-40pF	Ceramic Trimmer	-	-	B
C19	0.1µF	Polycarbonate	20%	100V	B

Ref	Value	Type	Tolerence	Wkg. V.	Loc
C20	80µF	Tubular Electrolytic	+50% -10%	25V	B
C21	0.1µF	Polycarbonate	20%	100V	B
C22	970pF	Silvered Mica	2%	350V	B
C23	8.2pF	Tubular Ceramic	0.5pF	750V	B
C24	0.1µF	Polycarbonate	20%	100V	B
C25	0.1µF	Polycarbonate	20%	100V	B
C26	-	Reference not allocated	-	-	-
C27	10µF	Tubular Electrolytic	+50% -10%	16V	B
C28	80µF	Tubular Electrolytic	+50% -10%	25V	B
C29	100pF	Polystyrene	2%	125V	B
C30	100pF	Polystyrene	2%	125V	B
C31	80µF	Tubular Electrolytic	+50% -10%	25V	B
C31A	125µF	Tubular Electrolytic	+50% -10%	16V	B
C32	0.001µF	Disk Ceramic	20%	500V	B
C33	0.1µF	Polycarbonate	20%	100V	B
C34	0.001µF	Disk Ceramic	20%	500V	B
*C35	20pF	Polystyrene	5%	125V	B
*C35A	10pF	Polystyrene	±1pF	125V	B
*C36	0.1µF	Polycarbonate	20%	100V	B
*C37	0.1µF	Polycarbonate	20%	100V	B
*C38	0.1µF	Polycarbonate	20%	100V	B
*C39	0.1µF	Polycarbonate	20%	100V	B
*C40	80µF	Tubular Electrolytic	+50% -10%	25V	B
*C41	0.1µF	Polycarbonate	20%	100V	B
*C42	80µF	Tubular Electrolytic	+50% -10%	25V	B
*C42A	10µF	Tubular Electrolytic	+50% -10%	16V	B
*C43	0.1µF	Polycarbonate	20%	100V	B
*C44	0.1µF	Polycarbonate	20%	100V	B
*C44A	27pF	Polystyrene	5%	125V	B
*C45	970pF	Silvered Mica	2%	350V	B
*C46	8.2pF	Tubular Ceramic	0.5pF	750V	B
*C47	0.1µF	Polycarbonate	20%	100V	B
*C48	0.001µF	Disk Ceramic	20%	500V	B
*C49	0.1µF	Polycarbonate	20%	100V	B
*C50	0.001µF	Disk Ceramic	20%	500V	B
*C51	80µF	Tubular Electrolytic	+50% -10%	25V	B
*C52	68pF	Polystyrene	2%	125V	B
*C53	68pF	Polystyrene	2%	125V	B
*C53A	0.1µF	Polycarbonate	20%	100V	B
*C54	0.1µF	Polycarbonate	20%	100V	B
*C55	220pF	Polystyrene	10%	125V	B
*C56	6.8pF	Tubular Ceramic	0.5pF	750V	B
*C57	0.1µF	Polycarbonate	20%	100V	B
*C58	0.1µF	Polycarbonate	20%	100V	B
C59	-	Reference not allocated	-	-	-
C60	0.1µF	Polycarbonate	20%	100V	N
C61-69	-	Reference not allocated	-	-	-
		*Not fitted on EC964/3 & /5			

Ref	Value	Type	Tolerance	Wkg. V.	Loc
C70	970pF	Silvered Mica	2%	350V	C
C71	0.047µF	Polycarbonate	20%	100V	C
C72	80µF	Tubular Electrolytic	+50% -10%	25V	C
C73	0.1µF	Polycarbonate	20%	100V	C
C74	4.7pF	Tubular Ceramic	10%	750V	C
C75	0.1µF	Polycarbonate	20%	100V	C
C76	140pF	Polystyrene	2%	125V	C
C77	140pF	Polystyrene	2%	125V	C
C78	0.01µF	Polycarbonate	20%	100V	C
C79	0.0014µF	Polystyrene	2%	125V	C
C80	0.1µF	Polycarbonate	20%	100V	C
C81	0.1µF	Polycarbonate	20%	100V	C
C82	0.1µF	Polycarbonate	20%	100V	C
C83	0.1µF	Polycarbonate	20%	100V	C
C84-C89	-	References not allocated	-	-	-
C90	0.001µF	Disk Ceramic	20%	500V	D
C91	0.1µF	Polycarbonate	20%	100V	D
C92	0.001µF	Disk Ceramic	20%	500V	D
C93	100pF	Polystyrene	5%	125V	D
C94	100pF	Polystyrene	5%	125V	D
C95	0.1µF	Polycarbonate	20%	100V	D
C96	0.001µF	Disk Ceramic	20%	500V	D
C97	0.1µF	Polycarbonate	20%	100V	D
C98	100pF	Polystyrene	5%	125V	D
C99	100pF	Polystyrene	5%	125V	D
C100	0.001µF	Disk Ceramic	20%	500V	D
C101	0.001µF	Disk Ceramic	20%	500V	D
C102	590pF	Polystyrene	5%	125V	D
C103	590pF	Polystyrene	5%	125V	D
C104	80µF	Tubular Electrolytic	+50% -10%	25V	D
C105	0.1µF	Polycarbonate	20%	100V	D
C106	0.1µF	Polycarbonate	20%	100V	D
C107	590pF	Polystyrene	5%	125V	D
C108	150pF	Polystyrene	5%	125V	D
C109	-	Reference not allocated	-	-	-
C110-119	-	References not allocated	-	-	-
C120	0.0014µF	Polystyrene	2%	125V	E
C121	120pF	Polystyrene	5%	125V	E
C122	0.0027µF	Polystyrene	2%	125V	E
C123	0.0032µF	Polystyrene	2%	125V	E
C124	120pF	Polystyrene	5%	125V	E
C125	0.0013µF	Polystyrene	2%	125V	E
C126	120pF	Polystyrene	5%	125V	E
C127	0.1µF	Polycarbonate	20%	100V	E
C128	0.047µF	Polycarbonate	20%	100V	E
C129	80µF	Tubular Electrolytic	+50% -10%	25V	E
C130-139	-	References not allocated	-	-	-
C140-149	-	References not allocated	-	-	-

Ref	Value	Type	Tolerance	Wkg. V.	Loc
C150-159	-	References not allocated	-	-	-
C160	0.1µF	Polycarbonate	20%	100V	G
C161	0.01µF	Polycarbonate	20%	100V	G
C162	80µF	Tubular Electrolytic	+50% -10%	25V	G
C163	560pF	Polystyrene	10%	125V	G
C164	0.1µF	Polycarbonate	20%	100V	G
C165	0.1µF	Polycarbonate	20%	100V	G
C166	0.1µF	Polycarbonate	20%	100V	G
C167	0.047µF	Polycarbonate	20%	100V	G
C168	0.1µF	Polycarbonate	20%	100V	G
C169	0.1µF	Polycarbonate	20%	100V	G
C170	0.1µF	Polycarbonate	20%	100V	G
C171	0.0068µF	Polystyrene	5%	125V	G
C172	0.0068µF	Polystyrene	5%	125V	G
C173	470pF	Polystyrene	5%	125V	G
C174	80µF	Tubular Electrolytic	+50% -10%	25V	G
C175-179	-	References not allocated	-	-	-
C180-189	-	References not allocated	-	-	-
C190	200pF	Polystyrene	5%	125V	H
C191	0.1µF	Polycarbonate	20%	100V	H
C192	0.1µF	Polycarbonate	20%	100V	H
C193	2.5µF	Tubular Electrolytic	+50% -10%	64V	H
C194	0.1µF	Polycarbonate	20%	100V	H
C195	80µF	Tubular Electrolytic	+50% -10%	25V	H
C196	0.1µF	Polycarbonate	20%	100V	H
C197	0.1µF	Polycarbonate	20%	100V	H
C198	0.1µF	Polycarbonate	20%	100V	H
C199	0.001µF	Disk Ceramic	20%	500V	H
C200	0.1µF	Polycarbonate	20%	100V	H
C201	80µF	Tubular Electrolytic	+50% -10%	25V	H
C202	820pF	Polystyrene	5%	125V	H
C203	25µF	Tubular Electrolytic	+50% -10%	25V	H
C204-209	-	References not allocated	-	-	-
C210-218	-	References not allocated	-	-	-
C219	80µF	Tubular Electrolytic	+50% -10%	25V	M
C220	0.022µF	Polycarbonate	20%	100V	I
C221	0.1µF	Polycarbonate	20%	100V	I
C222	0.1µF	Polycarbonate	20%	100V	I
C223	0.1µF	Polycarbonate	20%	100V	I
C224	80µF	Tubular Electrolytic	+50% -10%	25V	I
C225	0.1µF	Polycarbonate	20%	100V	I
C226	10µF	Tubular Electrolytic	+50% -10%	16V	I
C227	10µF	Tubular Electrolytic	+50% -10%	16V	I
‡C228	0.01µF	Polycarbonate	20%	100V	I
‡C229	0.01µF	Polycarbonate	20%	100V	I

‡Fitted on FSK-equipped receivers only.

Ref	Value	Type	Tolerance	Wkg. V.	Loc
†‡C230	0.01µF	Polycarbonate	20%	100V	I
†‡C231	0.1µF	Polycarbonate	20%	100V	I
†‡C232	0.1µF	Polycarbonate	20%	100V	I
†‡C233	0.1µF	Polycarbonate	20%	100V	I
C234	0.1µF	Polycarbonate	20%	100V	I
C235	10µF	Tubular Electrolytic	+50% -10%	16V	I
C236	80µF	Tubular Electrolytic	+50% -10%	25V	I
C237	0.022µF	Polycarbonate	20%	100V	I
C238	0.01µF	Polycarbonate	20%	100V	I
C239	0.047µF	Polycarbonate	20%	100V	I
C240-249	-	References not allocated	-	-	-
C250	0.047µF	Polycarbonate	20%	100V	J
C251	250µF	Tubular Electrolytic	+50% -10%	25V	J
C252	125µF	Tubular Electrolytic	+50% -10%	16V	J
C253	180pF	Polystyrene	10%	125V	J
C254	125µF	Tubular Electrolytic	+50% -10%	16V	J
C255	470pF	Polystyrene	10%	125V	J
C256	250µF	Tubular Electrolytic	+50% -10%	25V	J
C257	10µF	Tubular Electrolytic	+50% -10%	16V	J
C258	400µF	Tubular Electrolytic	+50% -10%	40V	J
C259	-	Reference not allocated	-	-	-
C260-269	-	References not allocated	-	-	-
C270	0.022µF	Polycarbonate	20%	100V	K
C271	10µF	Tubular Electrolytic	+50% -10%	16V	K
C272	10µF	Tubular Electrolytic	+50% -10%	16V	K
C273	0.005µF	Metallised Paper	20%	250V	K
C274	0.1µF	Polycarbonate	20%	100V	K
C275	1.6µF	Tubular Electrolytic	+100% -10%	25V	K
C276	25µF	Tubular Electrolytic	+50% -10%	25V	K
C277	80µF	Tubular Electrolytic	+50% -10%	25V	K
C278	125µF	Tubular Electrolytic	+50% -10%	16V	K
C279	400µF	Tubular Electrolytic	+50% -10%	40V	K
C280	0.1µF	Polycarbonate	20%	100V	K
C281-289	-	References not allocated	-	-	-
C290	4,000µF	Tubular Electrolytic	+50% -10%	40V	L
C291	4,000µF	Tubular Electrolytic	+50% -10%	40V	L
C292-298	-	References not allocated	-	-	-
C299	80µF	Tubular Electrolytic	+50% -10%	25V	M

†‡Fitted on FSK-equipped receivers only.

Resistors

Ref	Value	Tol	Rtg	Loc
R1	39 ohms w.w.	5%	6W	A
R2	10 ohms w.w.	5%	2½W	A
R3	39 ohms	5%	0.1W	A
R4	39 ohms	5%	0.1W	A
R5	10 ohms	5%	0.1W	A
R6	39 ohms	5%	0.1W	A
R7				
-9	Not allocated	-	-	-
R10	Not allocated	-	-	-
R11	0.47 Megohm	5%	0.1W	B
R12	0.1 Megohm	5%	0.1W	B
R13	10,000 ohms	5%	0.1W	B
R14	0.15 Megohm	5%	0.1W	B
‡!R14A	120 ohms	5%	0.1W	B
R15	560 ohms	5%	0.1W	B
R16	100 ohms	5%	0.1W	B
R17	820 ohms	5%	0.1W	B
R18	150 ohms	5%	0.1W	B
R19	0.47 Megohm	5%	0.1W	B
R20	0.22 Megohm	5%	0.1W	B
R21	15,000 ohms	5%	0.1W	B
R22	100 ohms	5%	0.1W	B
R23	56,000 ohms	5%	0.1W	B
R24	68,000 ohms	5%	0.1W	B
R25	56,000 ohms	5%	0.1W	B
R26	6,800 ohms	5%	0.1W	B
R27	0.47 Megohm	5%	0.1W	B
R28	0.47 Megohm	5%	0.1W	B
R29	1,000 ohms	5%	0.1W	B
R30	2,200 ohms	5%	0.1W	B
R31	47,000 ohms	5%	0.1W	B
R32	2,200 ohms	5%	0.1W	B
*R33	0.47 Megohm	5%	0.1W	B
*R34	0.1 Megohm	5%	0.1W	B
*R35	10,000 ohms	5%	0.1W	B
*R36	0.15 Megohm	5%	0.1W	B
‡!R36A	120 ohms	5%	0.1W	B
*R37	560 ohms	5%	0.1W	B
*R38	100 ohms	5%	0.1W	B
*R39	820 ohms	5%	0.1W	B
*R40	150 ohms	5%	0.1W	B
*R41	0.47 Megohm	5%	0.1W	B
*R42	0.22 Megohm	5%	0.1W	B
*R43	15,000 ohms	5%	0.1W	B
*R44	100 ohms	5%	0.1W	B
*R45	2,200 ohms	5%	0.1W	B
*R46	47,000 ohms	5%	0.1W	B
*R47	2,200 ohms	5%	0.1W	B
*R48	1,000 ohms	5%	0.1W	B
*R49	0.47 Megohm	5%	0.1W	B
*R50	0.47 Megohm	5%	0.1W	B
*R51	2,200 ohms	5%	0.1W	B
*R52	22,000 ohms	5%	0.1W	B
*R53	270 ohms	5%	0.1W	B
*R54	22,000 ohms	5%	0.1W	B
*R55	2,200 ohms	5%	0.1W	B
*R56	220 ohms	5%	0.1W	B
R57				
-59	Not allocated	-	-	-
R60	1,500 ohms	5%	0.1W	N
R61	68 ohms	5%	0.1W	N
R62	1,000 ohms	5%	0.1W	N
R63	10,000 ohms	5%	0.1W	N
R64	22 ohms	5%	0.1W	N
R65	1,200 ohms	5%	0.1W	N
R66	Not allocated	-	-	-
R67	3.3 ohms w.w.	5%	6W	N
R68				
-69	Not allocated	-	-	-
R70	15,000 ohms	5%	0.1W	C
R71	5,600 ohms	5%	0.1W	C
R72	330 ohms	5%	0.1W	C
R73	330 ohms	5%	0.1W	C
R74	2,200 ohms	5%	0.1W	C
R75	470 ohms	5%	0.1W	C
R76	0.22 Megohm	5%	0.1W	C
R77	220 ohms	5%	0.1W	C
R78	0.39 Megohm	5%	0.1W	C
R79	0.47 Megohm	5%	0.1W	C
R80	22,000 ohms	5%	0.1W	C
R81	470 ohms	5%	0.1W	C
R82	470 ohms	5%	0.1W	C
R83	1 Megohm	5%	0.1W	C
R84	47,000 ohms	5%	0.1W	C
R85	47,000 ohms	5%	0.1W	C
R86				
-89	Not allocated	-	-	-
R90	8,200 ohms	5%	0.1W	D
R91	2,700 ohms	5%	0.1W	D
R92	1,000 ohms	5%	0.1W	D
R93	4,700 ohms	5%	0.1W	D
R94	1,800 ohms	5%	0.1W	D
R95	1 Megohm	5%	0.1W	D
R96	1 Megohm	5%	0.1W	D
R97	1 Megohm	5%	0.1W	D
R98	1 Megohm	5%	0.1W	D
R99	1,800 ohms	5%	0.1W	D

*Not fitted on EC964/3 or EC964/5.

‡ Fitted only when alternative source connection is used on TR1 and/or TR7.

Ref	Value	Tol	Rtg	Loc
R100	4,700 ohms	5%	0.1W	D
R101	8,200 ohms	5%	0.1W	D
R102	1,000 ohms	5%	0.1W	D
R103	2,700 ohms	5%	0.1W	D
R104	2,700 ohms	5%	0.1W	D
R105	2,700 ohms	5%	0.1W	D
R106	1 Megohm	5%	0.1W	D
R107	0.27 Megohm	5%	0.1W	D
R108	2,200 ohms	5%	0.1W	D
R109	2,700 ohms	5%	0.1W	D
R110	68 ohms	5%	0.1W	D
R111	1,500 ohms	5%	0.1W	D
R112 -119	Not allocated	-	-	-
R120	82,000 ohms	5%	0.1W	E
R121	22,000 ohms	5%	0.1W	E
R122	330 ohms	5%	0.1W	E
R123	100 ohms	5%	0.1W	E
R124	1,000 ohms	5%	0.1W	E
R125	560 ohms	5%	0.1W	E
R126 -129	Not allocated	-	-	-
R130 -137	Not allocated	-	-	-
R138	1,000 ohms	5%	0.1W	L
R139	1,000 ohms	5%	0.1W	L
R140 -159	Not allocated	-	-	-
R160	10,000 ohms	5%	0.1W	G
R161	10,000 ohms	5%	0.1W	G
R162	330 ohms	5%	0.1W	G
R163	10,000 ohms	5%	0.1W	G
R164	680 ohms	5%	0.1W	G
R165	1 Megohm	5%	0.1W	G
R166	0.12 Megohm	5%	0.1W	G
R167	10,000 ohms	5%	0.1W	G
R168	100 ohms	5%	0.1W	G
R169	82,000 ohms	5%	0.1W	G
R170	82,000 ohms	5%	0.1W	G
R171	0.27 Megohm	5%	0.1W	G
R172	33,000 ohms	5%	0.1W	G
R173	2,200 ohms	5%	0.1W	G
R174	18,000 ohms	5%	0.1W	G
R175	680 ohms	5%	0.1W	G
R176	10,000 ohms	5%	0.1W	G
R177	220 ohms	5%	0.1W	G
R178 -179	Not allocated	-	-	-

Ref	Value	Tol	Rtg	Loc
R180 -189	Not allocated	-	-	-
R190	6,800 ohms	5%	0.1W	H
R191	0.39 Megohm	5%	0.1W	H
R192	33,000 ohms	5%	0.1W	H
R193	1,000 ohms	5%	0.1W	H
R194	10,000 ohms	5%	0.1W	H
R195	1,000 ohms	5%	0.1W	H
R196	2,200 ohms	5%	0.1W	H
R197	0.12 Megohm	5%	0.1W	H
R198	0.12 Megohm	5%	0.1W	H
R199	330 ohms	5%	0.1W	H
R200	0.47 Megohm	5%	0.1W	H
R201	47,000 ohms	5%	0.1W	H
R202	560 ohms	5%	0.1W	H
R203	270 ohms	5%	0.1W	H
R204	56,000 ohms	5%	0.1W	H
R205	5,600 ohms	5%	0.1W	H
R206	3,300 ohms	5%	0.1W	H
R207	330 ohms	5%	0.1W	H
R208	1,500 ohms	5%	0.1W	H
R209	3,300 ohms	5%	0.1W	H
R210	1,200 ohms	5%	0.1W	H
R211	0.68 Megohm	5%	0.1W	H
R212	100 ohms	5%	0.1W	H
R213 -218	Not allocated	-	-	-
R219	12,000 ohms	5%	0.1W	M
R220	33,000 ohms	5%	0.1W	I
R221	3,300 ohms	5%	0.1W	I
R222	10,000 ohms	5%	0.1W	I
R223	10,000 ohms	5%	0.1W	I
R224	10,000 ohms	5%	0.1W	I
R225	10,000 ohms	5%	0.1W	I
R226	2,700 ohms	5%	0.1W	I
R227	2,200 ohms	5%	0.1W	I
R228	470 ohms	5%	0.1W	I
R229	470 ohms	5%	0.1W	I
R230	680 ohms	5%	0.1W	I
R231	1,200 ohms	5%	0.1W	I
R232	1,000 ohms	5%	0.1W	I
R233	1,000 ohms	5%	0.1W	I
‡R234	1,000 ohms	5%	0.1W	I
‡R235	470 ohms	5%	0.1W	I
‡R236	0.1 Megohm	5%	0.1W	I
R237	1,000 ohms	5%	0.1W	I
R238	470 ohms	5%	0.1W	I
R239	0.1 Megohm	5%	0.1W	I

‡ Fitted on FSK-equipped receivers only.

Ref	Value	Tol	Rtg	Loc
‡!R240	6,800 ohms	5%	0.1W	I
‡!R241	6,800 ohms	5%	0.1W	I
R242	6,800 ohms	5%	0.1W	I
R243	6,800 ohms	5%	0.1W	I
R244	1,000 ohms	5%	0.1W	I
R245	680 ohms	5%	0.1W	I
R246	1,000 ohms	5%	0.1W	I
R247	2,200 ohms	5%	0.1W	I
R248 -249	Not allocated	-	-	-
R250	22,000 ohms	5%	0.1W	J
R251	22,000 ohms	5%	0.1W	J
R252	22 ohms	5%	0.1W	J
R253	2,200 ohms	5%	0.1W	J
R254	15,000 ohms	5%	0.1W	J
R255	3,900 ohms	5%	0.1W	J
R256	3,900 ohms	5%	0.1W	J
R257	1,000 ohms	5%	0.1W	J
R258	100 ohms	5%	0.1W	J
R259	470 ohms	5%	0.1W	J
R260	330 ohms	5%	0.1W	J
R261	8 ohms w.w.	5%	2½W	J
R262	8 ohms w.w.	5%	2½W	J
R263 -268	Not allocated	-	-	-
R269	2,200 ohms	5%	0.1W	M
R270	1.8 Megohm	5%	0.1W	K
R271	0.15 Megohm	5%	0.1W	K
R272	10,000 ohms	5%	0.1W	K
R273	39 ohms	5%	0.1W	K
R274	10,000 ohms	5%	0.1W	K
R275	82,000 ohms	5%	0.1W	K
R276	100 ohms	5%	0.1W	K
R277	47,000 ohms	5%	0.1W	K
R278	8,200 ohms	5%	0.1W	K
R279	150 ohms	5%	0.1W	K
R280	1,000 ohms	5%	0.1W	K
R281	2,200 ohms	5%	0.1W	K
R282 -289	Not allocated	-	-	-
R290	16 ohms w.w.	5%	6W	L
R291	16 ohms w.w.	5%	6W	L
R292 -295	Not allocated	-	-	-
*R296	1,000 ohms	5%	0.1W	M
*R297	1,000 ohms	5%	0.1W	M
*R298	5,600 ohms	5%	0.1W	M
*R299	1,800 ohms	5%	0.1W	M

*Fitted on EC964/1 & EC964/3 only.
‡!Fitted on FSK-equipped receivers only.

Potentiometers

Ref	Description	Loc
RV1	4,700 ohms Lin. law pre-set carbon.	B
RV2	10,000 ohms Lin. law pre-set carbon.	B
*RV3	4,700 ohms Lin. law pre-set carbon.	B
*RV4	100 ohms Lin. law pre-set helical.	N
RV5	10,000 ohms Lin. law pre-set carbon.	D
RV6	10,000 ohms Lin. law pre-set carbon.	D
RV7	10,000 ohms Lin. law pre-set carbon.	D
RV8	10,000 ohms Lin. law pre-set carbon.	D
RV9	5,000 ohms Lin. law carbon (CLARIFIER)	M
RV10	560 ohms Lin. law pre-set carbon.	G
RV11	47,000 ohms Lin. law pre-set carbon.	H
RV12	0.5 Megohm Log. law carbon (AF GAIN)	M
RV13	0.1 Megohm Lin. law pre-set carbon (LINE LEVEL)	K
RV14	47,000 ohms Lin. law pre-set carbon.	H
**RV15	20,000 ohms Lin. law carbon (RF GAIN)	M

*EC964/1 & EC964/2 only.
**EC964/1 & EC964/3 only.

APPENDIX 'D'

PART 2 :: TURRET DISKS

General

The Turret Disks used in the EC964 Series of Receivers can be broadly classified as follows:-

Type	Identity
Trimmer Disks	A, D, E, H, I & J
Coil Disks	B, C, F & K
Crystal Disks	M, N, O & P
Switching Disks	G & L

The HF Disks (A-G & K-M) exist in two types, one series for use with EC964/1 eight-range receivers, and the other for EC964/2 (six ranges). Disks are therefore further identified by suffix (8) or (6) as appropriate.

The MF Disks (H, I, J, O & P) are identical in all EC964 variants and are the only ones fitted in the EC964/3 & EC964/5.

Trimmer Disks

All Trimmer Disks are produced from one master disk pattern on which copper track is removed as necessary to provide the required contact/wiring configuration. The MF Trimmer Disks in all receivers are similar to the HF Trimmer Disks D(8) and E(8) used in the EC964/1.

Coil Disks

Coil Disks are employed on the HF ranges only and exist in two distinct types, one set for the EC964/1 and the other for the EC964/2. They are not produced from one master pattern.

Crystal Disks

The MF Crystal Disks (O & P) are two identical disks which are assembled with their unetched sides facing one another. The HF Crystal Disks (M & N) are similar but with provision for 24 instead of 28 crystals. Additionally, their inner surfaces are etched to provide contact paths for the 26V supply feeding the Crystal Oven circuit.

Switching Disks

HF Disks G & L fall in this category and carry no components whatsoever. Like the Trimmer Disks, Disk L is fabricated from one master pattern suitably modified to suit the number of HF ranges involved, but individual Disks G are employed.

TURRET DISK 'A' (Fitted on EC964/1 & EC964/2 only)

Ref	Value	Type	Tolerance	Wkg. V.
C300-C323	10-40pF	Ceramic Disk Trimmers	-	-
C324-C329	-	References not allocated	-	-

TURRET DISK 'B' (Fitted on EC964/1 & EC964/2 only)

Ref	Value	Type	Tolerance	Wkg. V.
C330	100pF	Polystyrene	5%	125V
C331	120pF	Polystyrene	5%	125V
C332	120pF	Polystyrene	5%	125V
C333	70pF	Polystyrene	5%	125V
C334	27pF	Polystyrene	5%	125V
C335	20pF	Polystyrene	5%	125V
*C336	15pF	Polystyrene	5%	125V
*C337	10pF	Polystyrene	5%	125V
C338 -339	-	References not allocated		

(*) Not fitted on EC964/2

TURRET DISK 'C' (Fitted on EC964/1 & EC964/2 only)

Ref	Value	Type	Tolerance	Wkg. V.
C340	1.5pF	Tubular Ceramic	10%	750V
C341	100pF	Polystyrene	5%	125V
C342	1.5pF	Tubular Ceramic	10%	750V
C343	120pF	Polystyrene	5%	125V
C344	1.5pF	Tubular Ceramic	10%	750V
C345	120pF	Polystyrene	5%	125V
C346	0.5pF	Tubular Ceramic	±0.1pF	750V
C347	50pF	Polystyrene	5%	125V
C348	0.5pF	Tubular Ceramic	±0.1pF	750V
C349	15pF	Polystyrene	5%	125V
C350	0.5pF	Tubular Ceramic	±0.1pF	750V
C351	10pF	Polystyrene	5%	125V
*C352	0.5pF	Tubular Ceramic	±0.1pF	750V
C353	-	Reference not allocated		
*C354	0.5pF	Tubular Ceramic	±0.1pF	750V
C355	-	Reference not allocated		
C356 -359	-	References not allocated		

(*) Not fitted on EC964/2

TURRET DISK 'D' (Fitted on EC964/1 & EC964/2 only)

Ref	Value	Type	Tolerance	Wkg. V.
C360 -383	10-40pF	Disk Ceramic Trimmers	-	-
C384 -389	-	References not allocated	-	-

TURRET DISK 'E' (Fitted on EC964/1 & EC964/2 only)

Ref	Value	Type	Tolerance	Wkg. V.
C390 -413	10-40pF	Disk Ceramic Trimmers	-	-
C414 -419	-	References not allocated		

TURRET DISK 'F' (Fitted on EC964/1 & EC964/2 only)

Ref	Value	Type	Tolerance	Wkg. V.
C420	80pF	Polystyrene	5%	125V
C421	120pF	Polystyrene	5%	125V
C422	110pF	Polystyrene	5%	125V
C423	40pF	Polystyrene	5%	125V
C424 -429	-	References not allocated	-	-

TURRET DISK 'G' (Fitted on EC964/1 & EC964/2 only)

There are no components on this disk.

TURRET DISK 'H'

Ref	Value	Type	Tolerance	Wkg. V.
C430	36pF	Polystyrene	2%	125V
C431 -457	10-40pF	Disk Ceramic Trimmers	-	-
C458 &459	-	References not allocated	-	-

TURRET DISK 'I'

Ref	Value	Type	Tolerance	Wkg. V.
C460	36pF	Polystyrene	2%	125V
C461 -487	10-40pF	Disk Ceramic Trimmers	-	-
C488 &489	-	References not allocated	-	-

TURRET DISK 'J'

Ref	Value	Type	Tolerance	Wkg. V.
C490 C491	36pF	Polystyrene	2%	125V
-517	10-40pF	Disk Ceramic Trimmers	-	-
C518 &519	-	References not allocated	-	-

TURRET DISK 'K' (Fitted on EC964/1 & EC964/2 only)

Ref	Value	Type	Tolerance	Wkg. V.
C520	360pF	Polystyrene	5%	125V
C521	120pF	Polystyrene	5%	125V
*C522	300pF	Polystyrene	5%	125V
*C523	100pF	Polystyrene	5%	125V
*C524	240pF	Polystyrene	5%	125V
*C525	82pF	Polystyrene	5%	125V
C526 -529	-	References not allocated	-	-

(*) Not fitted on EC964/2.

C60 & R60-67 are also fitted on this disk. See Part 1 of this Appendix.

TURRET DISK 'L' (Fitted on EC964/1 & EC964/2 only)

There are no components on this disk.

TURRET DISK 'M' (Fitted on EC964/1 & EC964/2 only)

Ref	Value	Type	Tolerance	Wkg. V.
C530 -541	4.5-20pF	Disk Ceramic Trimmers	-	-
C542	39pF (nom)	Polystyrene	2%	125V
C543	39pF (nom)	Polystyrene	2%	125V
C544	39pF (nom)	Polystyrene	2%	125V
C545	39pF (nom)	Polystyrene	2%	125V
C546	39pF (nom)	Polystyrene	2%	125V
C547	39pF (nom)	Polystyrene	2%	125V
C548	39pF (nom)	Polystyrene	2%	125V
C549	39pF (nom)	Polystyrene	2%	125V
*C550	56pF (nom)	Polystyrene	2%	125V
*C551	56pF (nom)	Polystyrene	2%	125V
C552	56pF (nom)	Polystyrene	2%	125V
C553	56pF (nom)	Polystyrene	2%	125V
C554 -559	-	References not allocated	-	-

*39pF (nominal) on EC964/2

TURRET DISK 'N' (Fitted on EC964/1 & EC964/2 only)

Ref	Value	Type	Tolerance	Wkg. V.
C560 -571	4.5-20pF	Disk Ceramic Trimmers	-	-
C572	39pF (nom)	Polystyrene	2%	125V
C573	39pF (nom)	Polystyrene	2%	125V
C574	39pF (nom)	Polystyrene	2%	125V
C575	39pF (nom)	Polystyrene	2%	125V
C576	39pF (nom)	Polystyrene	2%	125V
C577	39pF (nom)	Polystyrene	2%	125V
C578	39pF (nom)	Polystyrene	2%	125V
*C579	56pF (nom)	Polystyrene	2%	125V
*C580	56pF (nom)	Polystyrene	2%	125V
*C581	56pF (nom)	Polystyrene	2%	125V
C582	56pF (nom)	Polystyrene	2%	125V
C583	56pF (nom)	Polystyrene	2%	125V
C584 -589	-	References not allocated	-	-

*39pF (nominal) on EC964/2

TURRET DISK 'O'

Ref	Value	Type	Tolerance	Wkg. V.
C590 -603	4.5-20pF	Disk Ceramic Trimmers	-	-
C604	30pF (nom)	Polystyrene	2%	125V
C605	30pF (nom)	Polystyrene	2%	125V
C606	30pF (nom)	Polystyrene	2%	125V
C607	30pF (nom)	Polystyrene	2%	125V
C608	30pF (nom)	Polystyrene	2%	125V
C609	30pF (nom)	Polystyrene	2%	125V
C610	30pF (nom)	Polystyrene	2%	125V
C611	30pF (nom)	Polystyrene	2%	125V
C612	30pF (nom)	Polystyrene	2%	125V
C613	30pF (nom)	Polystyrene	2%	125V
C614	30pF (nom)	Polystyrene	2%	125V
C615	30pF (nom)	Polystyrene	2%	125V
C616	30pF (nom)	Polystyrene	2%	125V
C617	30pF (nom)	Polystyrene	2%	125V
C618 &619	-	References not allocated	-	-

TURRET DISK 'P'

Ref	Value	Type	Tolerance	Wkg. V.
C620 -633	4.5-20pF	Disk Ceramic Trimmers	-	-
C634	30pF (nom)	Polystyrene	2%	125V
C635	30pF (nom)	Polystyrene	2%	125V
C636	30pF (nom)	Polystyrene	2%	125V
C637	30pF (nom)	Polystyrene	2%	125V
C638	30pF (nom)	Polystyrene	2%	125V
C639	30pF (nom)	Polystyrene	2%	125V
C640	30pF (nom)	Polystyrene	2%	125V
C641	30pF (nom)	Polystyrene	2%	125V
C642	30pF (nom)	Polystyrene	2%	125V
C643	30pF (nom)	Polystyrene	2%	125V
C644	30pF (nom)	Polystyrene	2%	125V
C645	30pF (nom)	Polystyrene	2%	125V
C646	30pF (nom)	Polystyrene	2%	125V
C647	30pF (nom)	Polystyrene	2%	125V

APPENDIX 'E'

SPARES LIST FOR EC964 SERIES RECEIVERS

The following list details all major spares for EC964 variants. Spares should be ordered by quoting the Circuit Ref. (where applicable), the written description given in the list and the Part No. in the right-hand column. All orders and enquiries should be directed to the address below, quoting the Serial No. of the receiver in all communications.

EDDYSTONE RADIO LIMITED,
SALES & SERVICE DEPT.,
ALVECHURCH ROAD,
BIRMINGHAM B31 3PP, ENGLAND.

Telephone : 021-475 2231
Telex : 337081
Cables : EDDYSTONE, Birmingham

Ref	Description	Part No.
	MODULES, PRINTED BOARDS ETC.	
	Aerial Attenuator Unit	LP3202
	1.2MHz IF Module	LP3195
	2nd Oscillator Module (Clarifier)	LP3192
	100kHz IF Pre-Amplifier (incorporating AM Filter)	LP3197
	100kHz IF Amplifier Module	LP3193
	AGC Module	LP3194
	Detector Module (less FSK crystal)	LP3196
	Detector Module (with FSK crystal)	LP3196/1
	Main Audio Module	LP3190
	Line Audio Module	LP3191
	SSB Filter (GEC QC1170D)	7605PA
	RF Assembly Boards (EC964/1 & EC964/2 only)	
	HF RF Amp & AGC Control	LP3200
	MF RF Amp	LP3198
	HF & MF Mixer/Oscillator	LP3199
	RF Assembly Boards (EC964/3 & EC964/5 only)	
	AGC Control	LP3220
	MF RF Amp	LP3198
	MF Mixer/Oscillator	LP3216
	TURRET DISKS (MF Disks - fitted on all variants)	
Disk H	Aerial Trimmer Disk	D4275
Disk I	Bandpass Primary Trimmer Disk	D4276
Disk J	Bandpass Secondary Trimmer Disk	D4275
Disks O & P	Crystal Oscillator Disks (combined assembly, less crystals)	LP3203

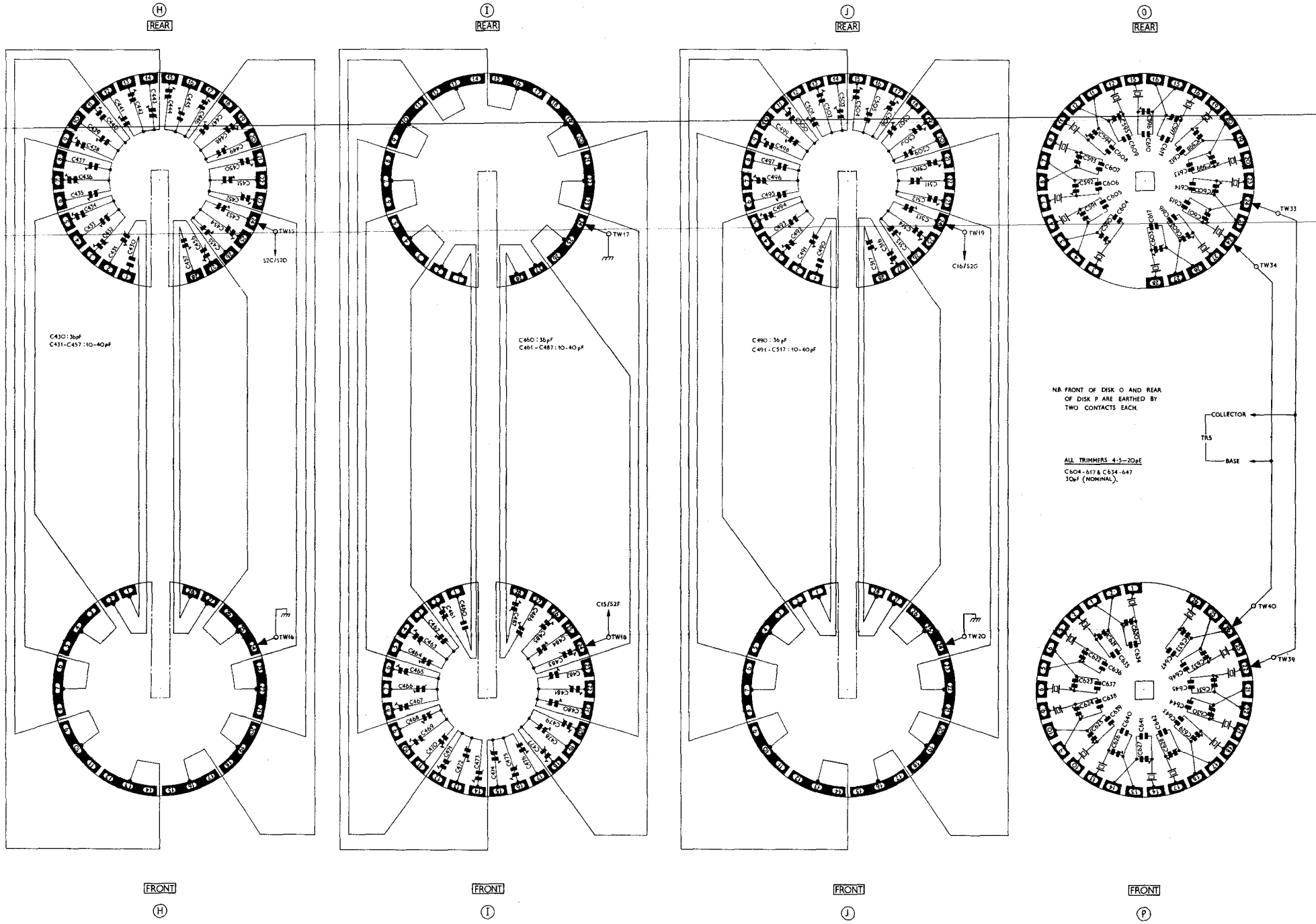
Ref	Description	Part No.
	TURRET DISKS (HF Disks - EC964/1 only)	
Disk A(8)	Bandpass Primary Trimmer Disk	D4277
Disk B(8)	Bandpass Primary Coil Disk	D4282
Disk C(8)	Bandpass Secondary Coil Disk	D4281
Disk D(8)	Bandpass Secondary Trimmer Disk	D4278
Disk E(8)	Mixer Trimmer Disk	D4278
Disk F(8)	Mixer Coil Disk (Secondary)	D4280
Disk G(8)	Mixer Coil Disk (Primary)	D4279
Disk K(8)	Doubler Output Disk (incorporates oven control)	D4274
Disk L(8)	Doubler Input Disk	D4273
Disks M(8) & N(8)	Crystal Oscillator Disks (combined assembly, less crystals)	LP3204
	TURRET DISKS (HF Disks - EC964/2 only)	
Disk A(6)	Bandpass Primary Trimmer Disk	D4285
Disk B(6)	Bandpass Primary Coil Disk	D4290
Disk C(6)	Bandpass Secondary Coil Disk	D4289
Disk D(6)	Bandpass Secondary Trimmer Disk	D4286
Disk E(6)	Mixer Trimmer Disk	D4286
Disk F(6)	Mixer Coil Disk (Secondary)	D4288
Disk G(6)	Mixer Coil Disk (Primary)	D4287
Disk K(6)	Doubler Output Disk (incorporates oven control)	D4284
Disk L(6)	Doubler Input Disk	D4283
Disks M(6) & N(6)	Crystal Oscillator Disks (combined assembly, less crystals)	LP3236
	TURRET DISK CONTACTS	
	Contact Wipers only	7905P
	Complete contact assembly	D4270
	SWITCHES	
S1	Aerial Attenuator Switch	7491P
S2	Bandswitch: Wafers S2A/B, S2C, S2H/1	7285P
	Wafers S2D, S2E, S2F, S2G	7286/1P
	Couplers	7353P
	Switch spindle (3½")	7934P
	Switch spindle (1½")	7934/1P
	Clicker Assembly	7933P
S3	Mode Switch (complete assembly with 3 wafers) 2 posn	D4292
	3 posn	D4292/1

Ref	Description	Part No.
	POTENTIOMETERS	
RV1	4,700 ohms Lin. law, pre-set carbon	6844P
RV2	10,000 ohms Lin. law, pre-set carbon	6840P
*RV3	4,700 ohms Lin. law, pre-set carbon	6844P
*RV4	100 ohms Lin. law, pre-set helical	8040P
RV5	10,000 ohms Lin. law, pre-set carbon	6840P
RV6	10,000 ohms Lin. law, pre-set carbon	6840P
RV7	10,000 ohms Lin. law, pre-set carbon	6840P
RV8	10,000 ohms Lin. law, pre-set carbon	6840P
RV9	5,000 ohms Lin. law, carbon. CLARIFIER	7939P
RV10	560 ohms Lin. law, pre-set carbon	6843P
RV11	47,000 ohms Lin. law, pre-set carbon	6488P
RV12	0.5 Megohm Log. law, carbon AF GAIN (with D.P.S.T. switch)	7938P
RV13	0.1 Megohm Lin. law, pre-set carbon. LINE LEVEL	8041P
RV14	47,000 ohms Lin. law, pre-set carbon	6488P
**RV15	20,000 ohms Lin. law, carbon. RF GAIN (with D.P.D.T. switch)	7947P
	*Not fitted on EC964/3 or EC964/5. **Not fitted on EC964/2 or EC964/5.	
	TRIMMERS	
	4.5-20pF Disk Ceramic	7567P
	10-40pF Disk Ceramic	8035P
	PLUGS & SOCKETS	
PL1	Aerial Input Plug:- EC964/1 & /3 - Standard BNC	8012P
	EC964/2 & /5 - UHF 83	6712/1P
	Reducer	6713P
PL2	Miniature B/L coaxial plug	7293P
PL3/4	Miniature B/L dual coaxial plug	8033P
PL5	12-way miniature Jones-type plug (with case)	8037P
SK1	Aerial Input Socket:- EC964/1 & /3 - Standard BNC	8039P
	EC964/2 & /5 - UHF 83	8038P
SK2	Miniature B/L coaxial socket	7292P
SK3/4	Miniature B/L dual coaxial socket	8034P
SK5	12-way miniature Jones-type socket	8036P
JK1	Telephone socket	6660P
-	Telephone plug	6567P
-	Octal socket (as used for Clarifier Oven)	6689P
-	Mains input connector (chassis-mounted component)	
	EC964/1 & /3	D2310/1
	EC964/2 & /5	D3095
-	Mains input connector (with 6' x 3-core lead) EC964/1 /3	D2311/1
	EC964/2 /5	D4293

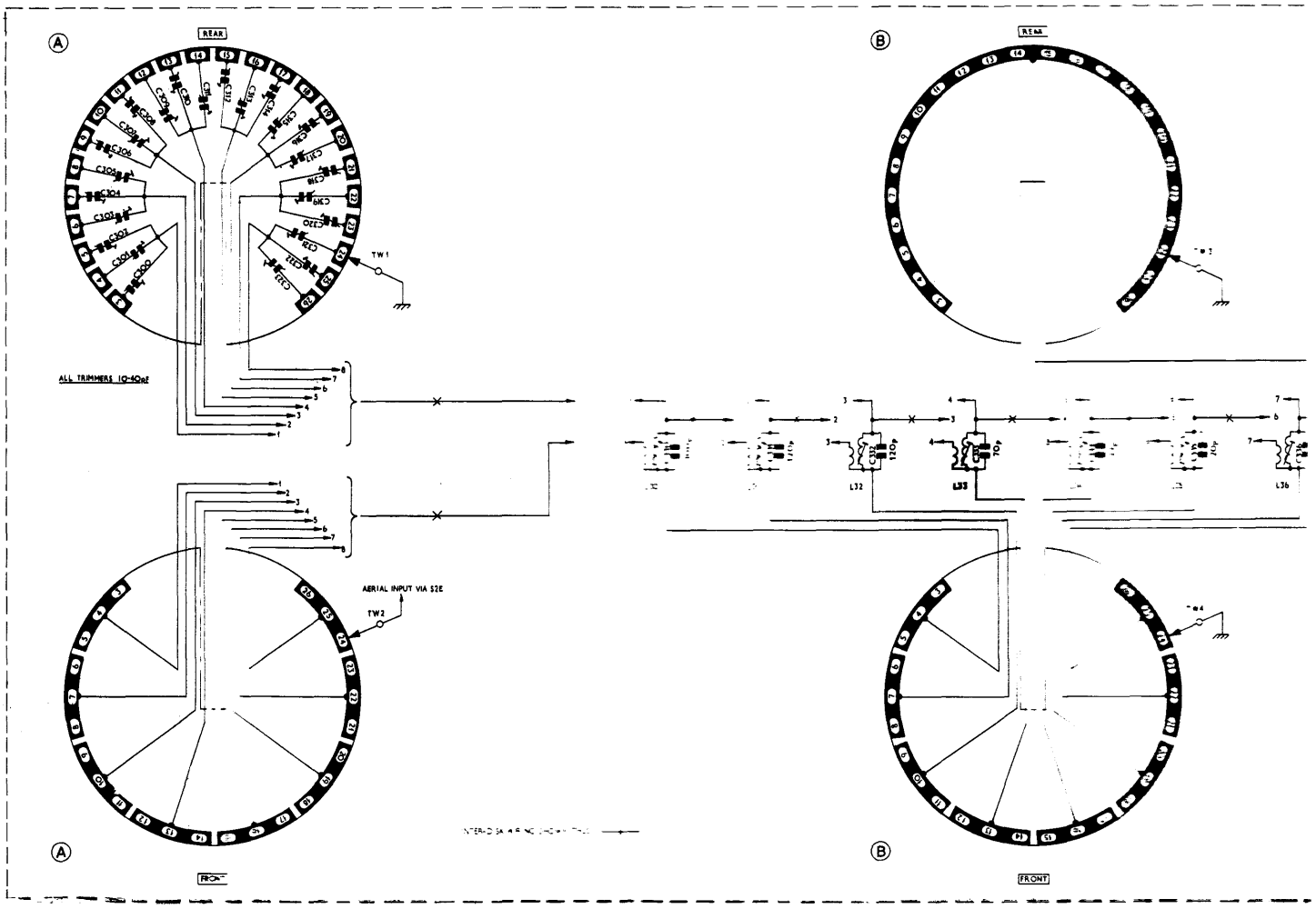
Ref	Description	Part No.
	KNOBS AND ASSOCIATED ITEMS	
	Bandswitch	D3617/2
	Clarifier/Mode Switch/AF Gain/RF Gain	D3614
	Channel Selector Knob	D4294
	Channel Selector Dial - EC964/1 & EC964/2 (HF/MF)	8047P
	EC964/3 & EC964/5 (MF-only)	7895P
	Perspex Dial Cursor - EC964/1 & EC964/2 (HF/MF)	8048P
	EC964/3 & EC964/5 (MF-only)	7896P
	INDUCTORS ETC.	
	Many of the inductors employed in the EC964 Series of Receivers are of miniature construction. Great care should be exercised if replacement is necessary, the task being considerably simplified if proper de-soldering equipment is available. In many cases it will be found best to return the faulty module etc. to the factory so that the fault can be rectified under ideal conditions by personnel who are familiar with the intricate construction used. Items returned for servicing of this nature should carry a cover note giving the Receiver Serial No. and the Reference of the particular component(s) suspected of being faulty.	
L1	MF Aerial Coil - Range 1	D4187
L2	MF Aerial Coil - Range 2	D4188
L3	MF Aerial Coil - Range 3	D4189
L4	MF Aerial Coil - Range 4	D4190
L5/9	MF Bandpass Coils - Range 1 (combined assembly)	D4183
L6/10	MF Bandpass Coils - Range 2 (combined assembly)	D4184
L7/11	MF Bandpass Coils - Range 3 (combined assembly)	D4185
L8/12	MF Bandpass Coils - Range 4 (combined assembly)	D4186
L13	1st 1.2MHz IF Transformer Primary Coil (MF Band)	D4181
L14	1st 1.2MHz IF Transformer Primary Coil (HF Band)	D4181
L15	1st 1.2MHz IF Transformer Secondary Coil	D4181
L16	2nd 1.2MHz IF Transformer Primary Coil	D4180
L17	2nd 1.2MHz IF Transformer Secondary Coil	D4180
L18	Clarifier Mixer Output Coil (1.1MHz)	D4178
L19	1st AM Filter Coil (100kHz)	D4182
L20	2nd AM Filter Coil (100kHz)	D4182
L21	3rd AM Filter Coil (100kHz)	D4182
L22	100kHz IF Transformer Primary Coil	D4179
L23	100kHz IF Transformer Secondary Coil	D4179
L24-L29	References not allocated	

Ref	Description	Part No.
	INDUCTORS ETC. (contd.)	
L30	Range 1 Bandpass Primary Coil	D4219
L31	Range 2 Bandpass Primary Coil	D4221
L32	Range 3 Bandpass Primary Coil	D4223
L33	Range 4 Bandpass Primary Coil	D4225
L34	Range 5 Bandpass Primary Coil	D4227
L35	Range 6 Bandpass Primary Coil	D4229
*L36	Range 7 Bandpass Primary Coil	D4385
*L37	Range 8 Bandpass Primary Coil	D4387
L38	Range 1 Bandpass Secondary Coil	D4220
L39	Range 2 Bandpass Secondary Coil	D4222
L40	Range 3 Bandpass Secondary Coil	D4224
L41	Range 4 Bandpass Secondary Coil	D4226
L42	Range 5 Bandpass Secondary Coil	D4228
L43	Range 6 Bandpass Secondary Coil	D4230
*L44	Range 7 Bandpass Secondary Coil	D4386
*L45	Range 8 Bandpass Secondary Coil HF BAND	D4388
L46	Range 1 Mixer Coil	D4219
L47	Range 2 Mixer Coil	D4221
L48	Range 3 Mixer Coil	D4223
L49	Range 4 Mixer Coil	D4225
L50	Range 5 Mixer Coil	D4227
L51	Range 6 Mixer Coil	D4229
*L52	Range 7 Mixer Coil	D4385
*L53	Range 8 Mixer Coil	D4387
L54	Range 6 Doubler Coil	D4231
*L55	Range 7 Doubler Coil	D4231
*L56	Range 8 Doubler Coil	D4231
	(*) Not fitted on EC964/2	
	CHOKES	
CH1	350µH RF Choke	D2414
CH2	560µH RF Choke	8042P
CH3	100mH RF Choke	7350P
CH4	100mH RF Choke	7350P
CH5	1mH RF Choke	7754P
CH6	100µH RF Choke	7760P
	TRANSFORMERS	
T1	600-ohm Line Output Transformer	7524P
T2	Power Transformer	7941P

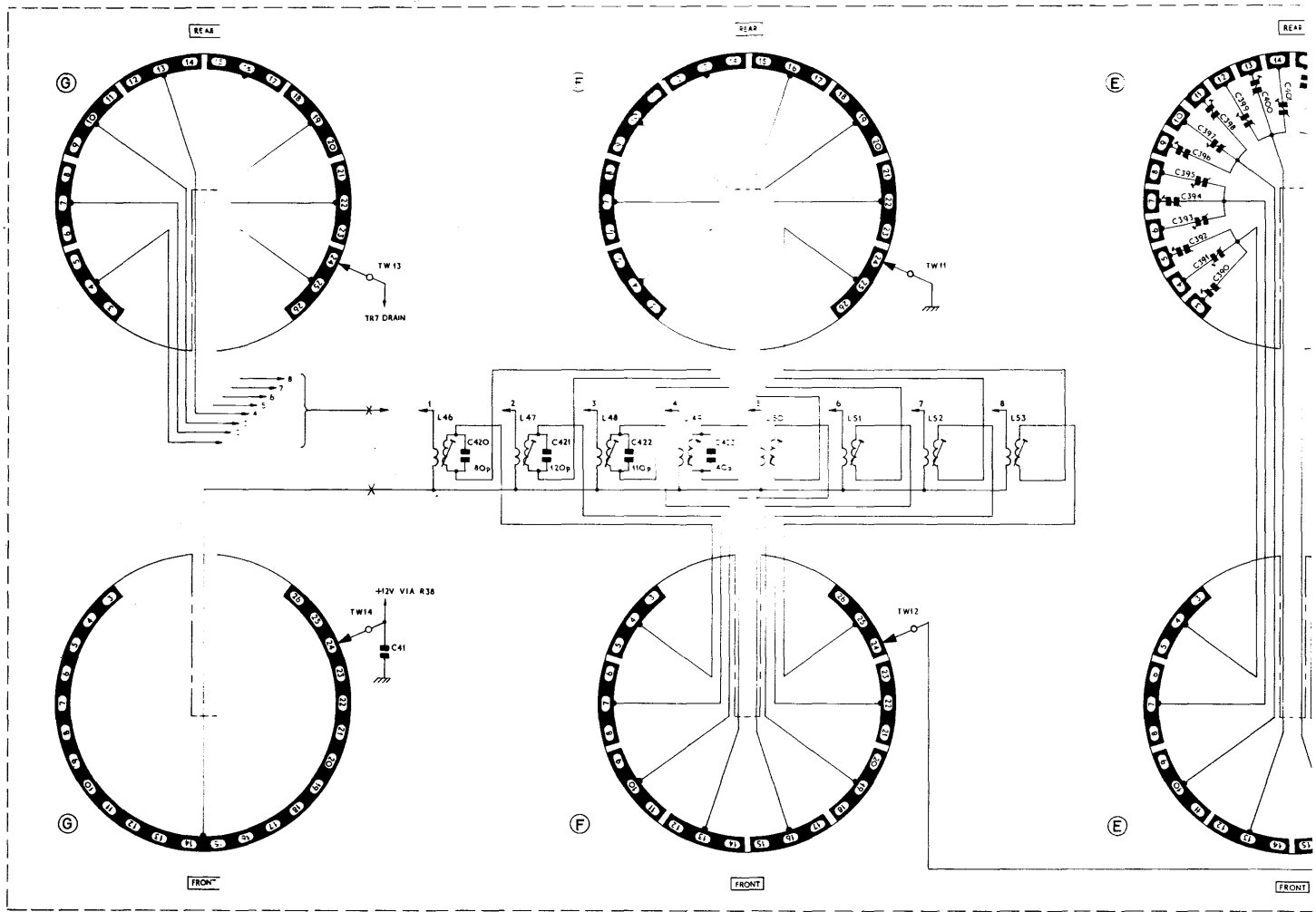
Ref	Description	Part No.
	CRYSTALS	
XL1	15.1MHz Style 'D'.) 'Clarifier' crystals - supplied	8045P
XL2	14.0MHz Style 'D'.) as matched pair only.	8046P
XL3	100.00kHz	8044P
XL4	102.2lkHz (not fitted on non-FSK receivers)	8043P
	Channel Crystals (Style 'D')	
	Crystals should be ordered from Eddystone Radio Ltd. by specifying Part No. followed by crystal frequency in 'kHz'.	
	e.g. 8050/1P - 3,056.5kHz.	
	MF BAND: Crystal frequencies will lie in the range 2,800kHz - 5,700kHz and are calculated by adding 1,200kHz to the required channel frequency. Specify Part No.:-	8050/1P
	HF BAND: Ranges 1-5 only. Crystal frequencies will lie in the range 5,200kHz - 18,600kHz and are calculated by adding 1,200kHz to the required channel frequency. Specify Part No:-	8050/2P
	Ranges 6, 7 & 8. Crystal frequencies will lie in the range 11,600kHz - 14,850kHz and are calculated by adding 1,200kHz to the required channel frequency and dividing the result by 2. Specify Part No:-	8050/3P
	NB: When channel crystal is required for A1 (CW) reception, substitute 1199kHz for 1200kHz in formulae above. See Section 6 Page 3.	
	MISCELLANEOUS	
	Panel Handles	6553P
	Fuses:- 1A : 7173P. 2A : 6704P. 3A : 6709P	-
	Fuseholder	6372P
	Neon	6358P
	Loudspeaker (25-ohm, eliptical)	7940P
	Cabinet Fixing Screws	5446PC
	Trimming Tool	8049P
	Earth Terminal	6371P
	Rack-mounting Brackets	7093P
	Fixing Screws (R/M Brackets)	40A-246
	Shock-absorbent Mounting Kit	LP2817/1



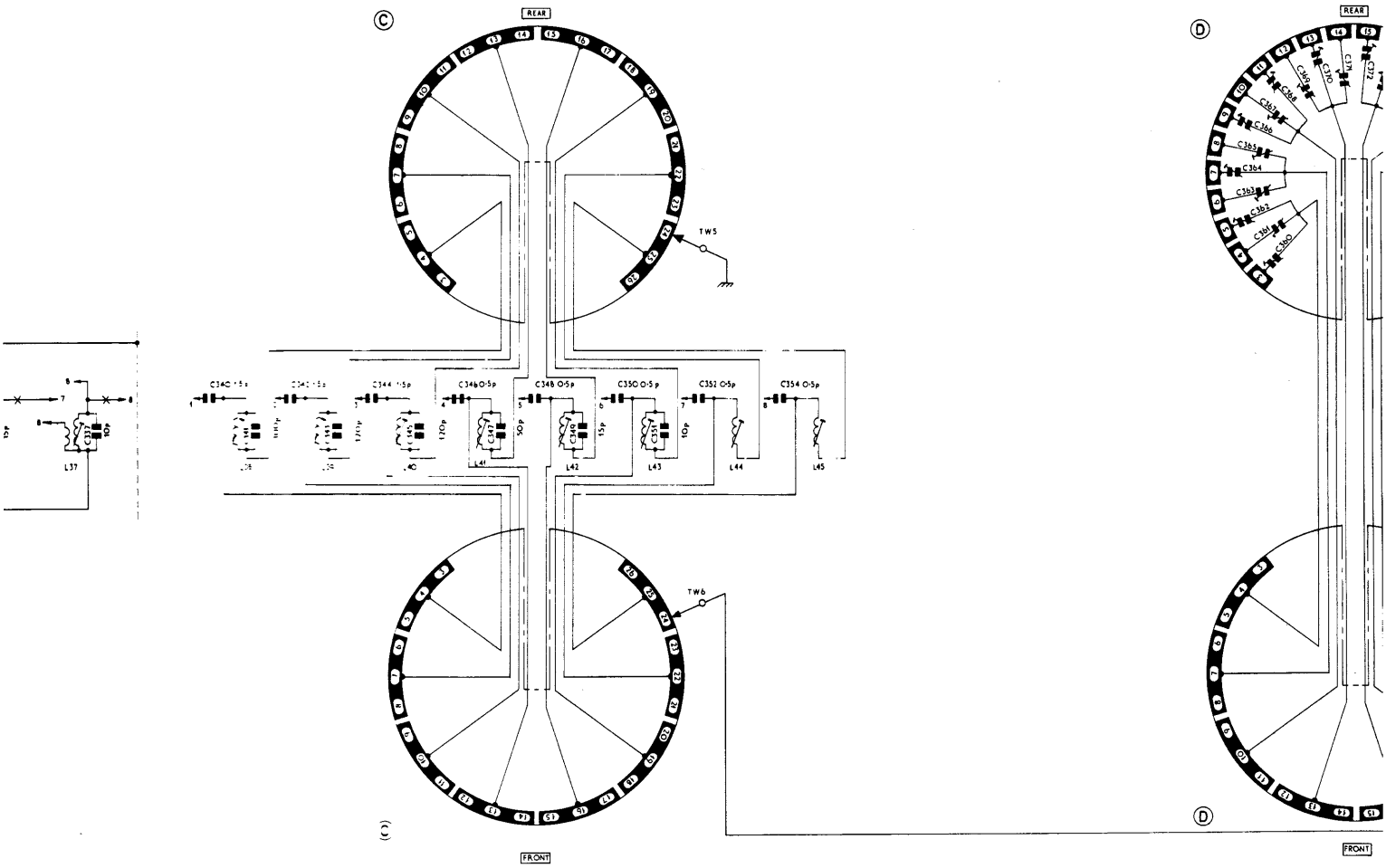
TURRET DISK CIRCUITRY - MF BAND (ALL VERSIONS) - BP1252.



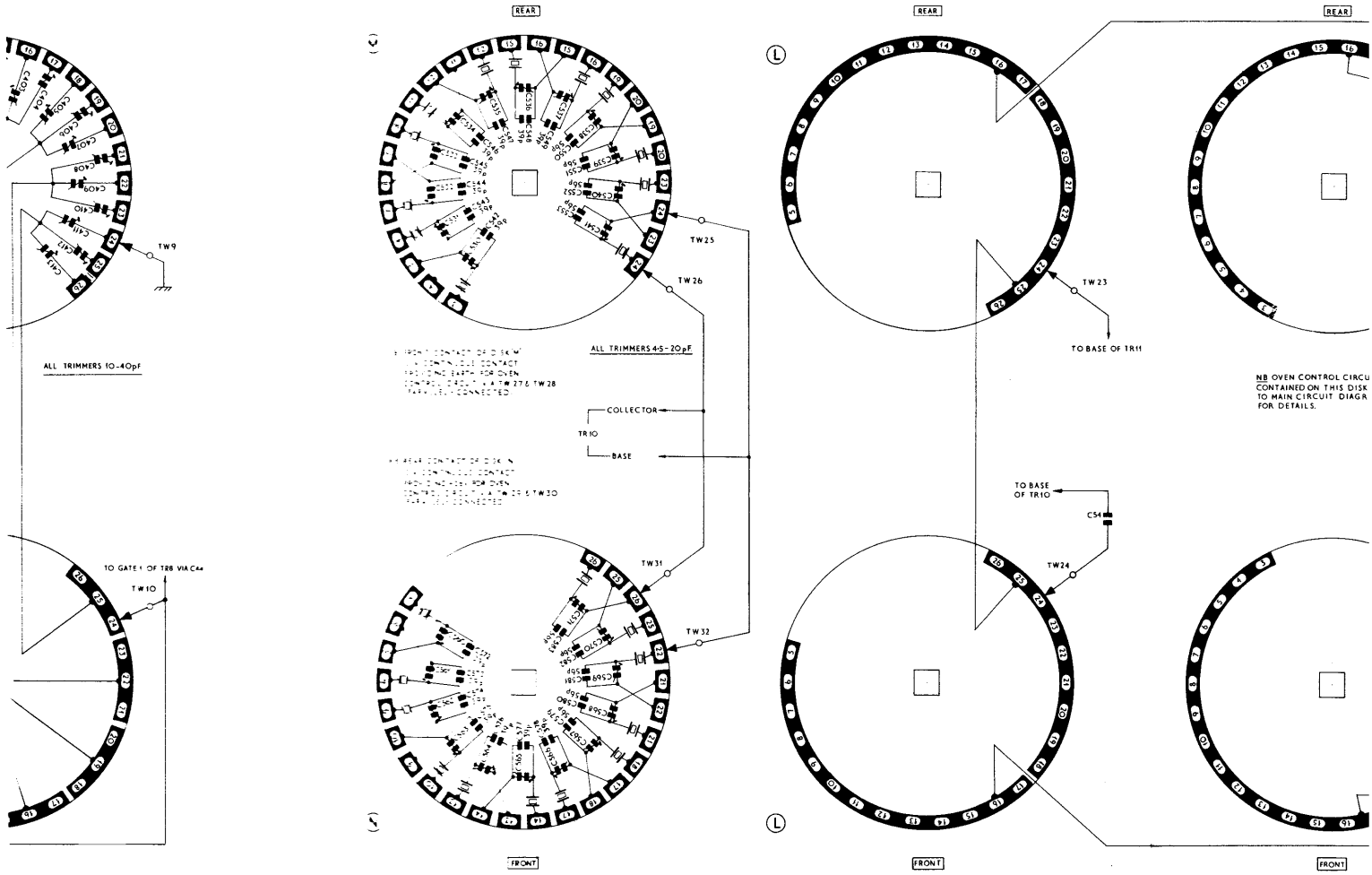
MIXER DISKS - EC 964/1

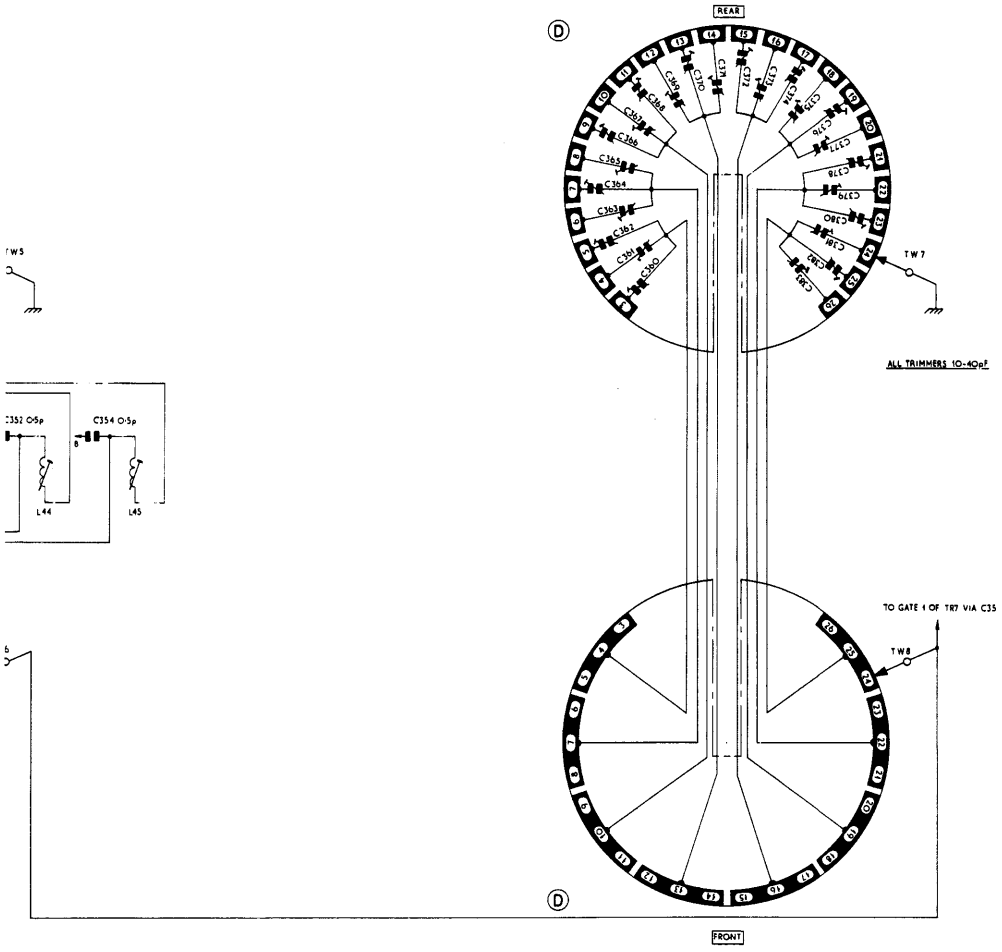


HF BANDPASS DISKS - EC964/1

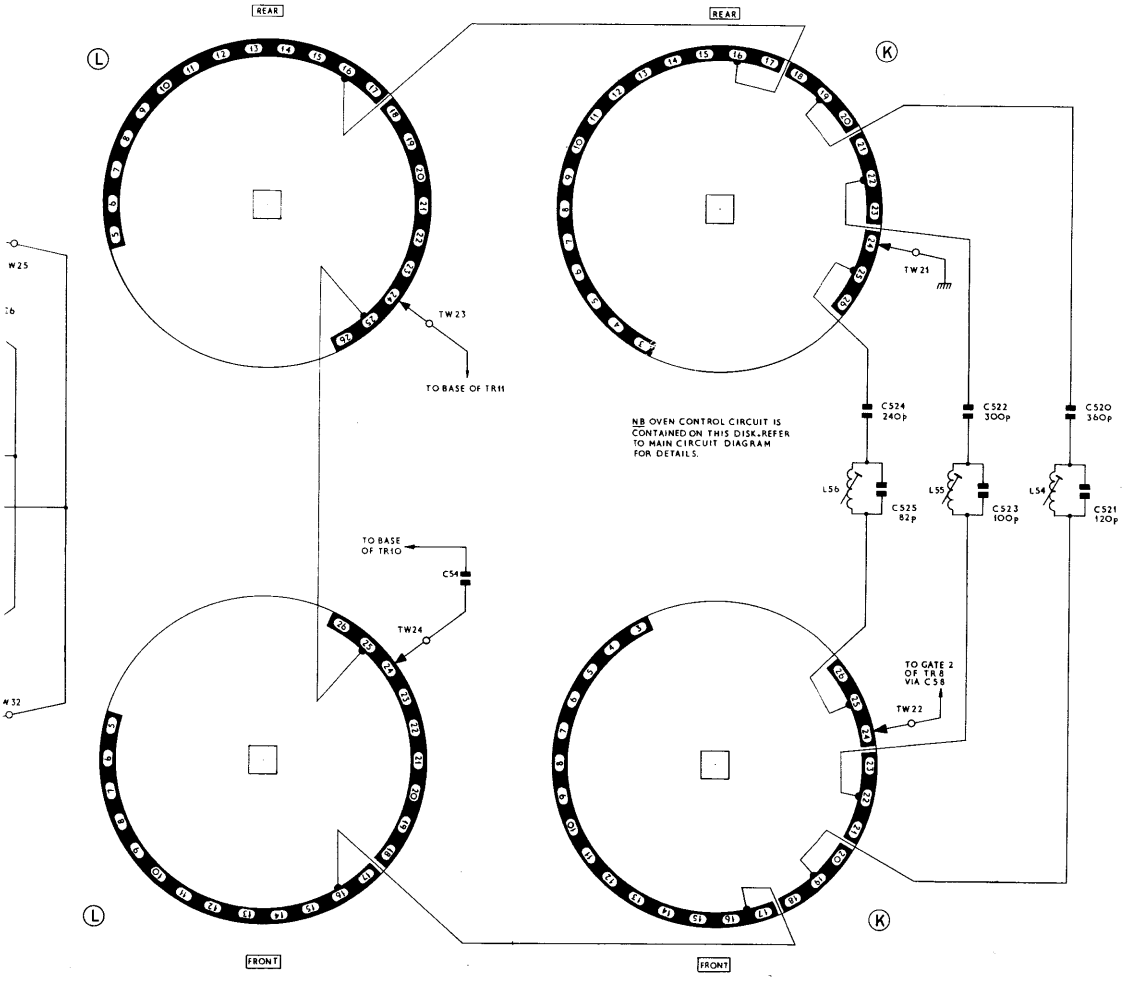


HF CRYSTAL OSC & DOUBLER DISKS - EC964/1

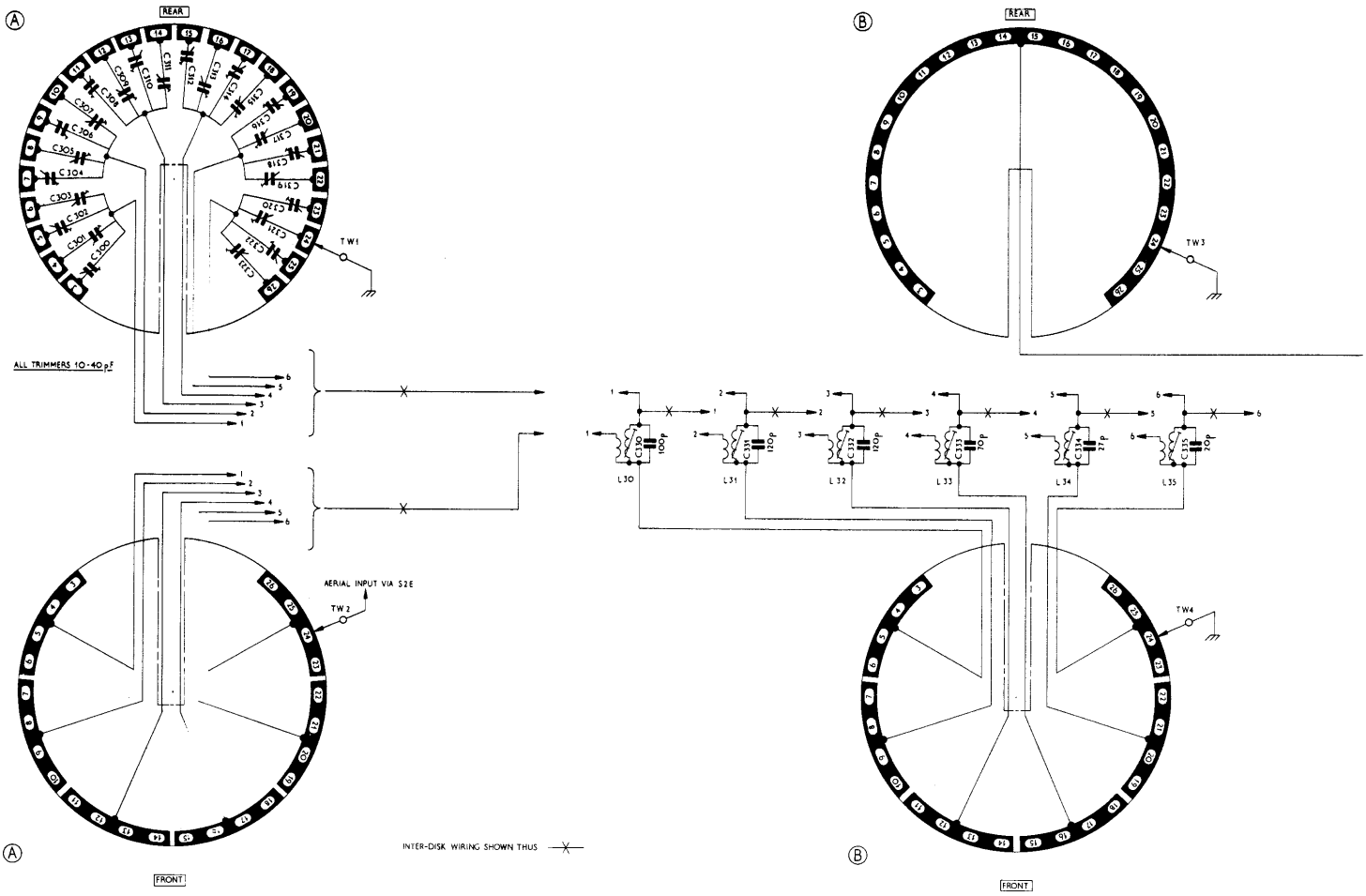




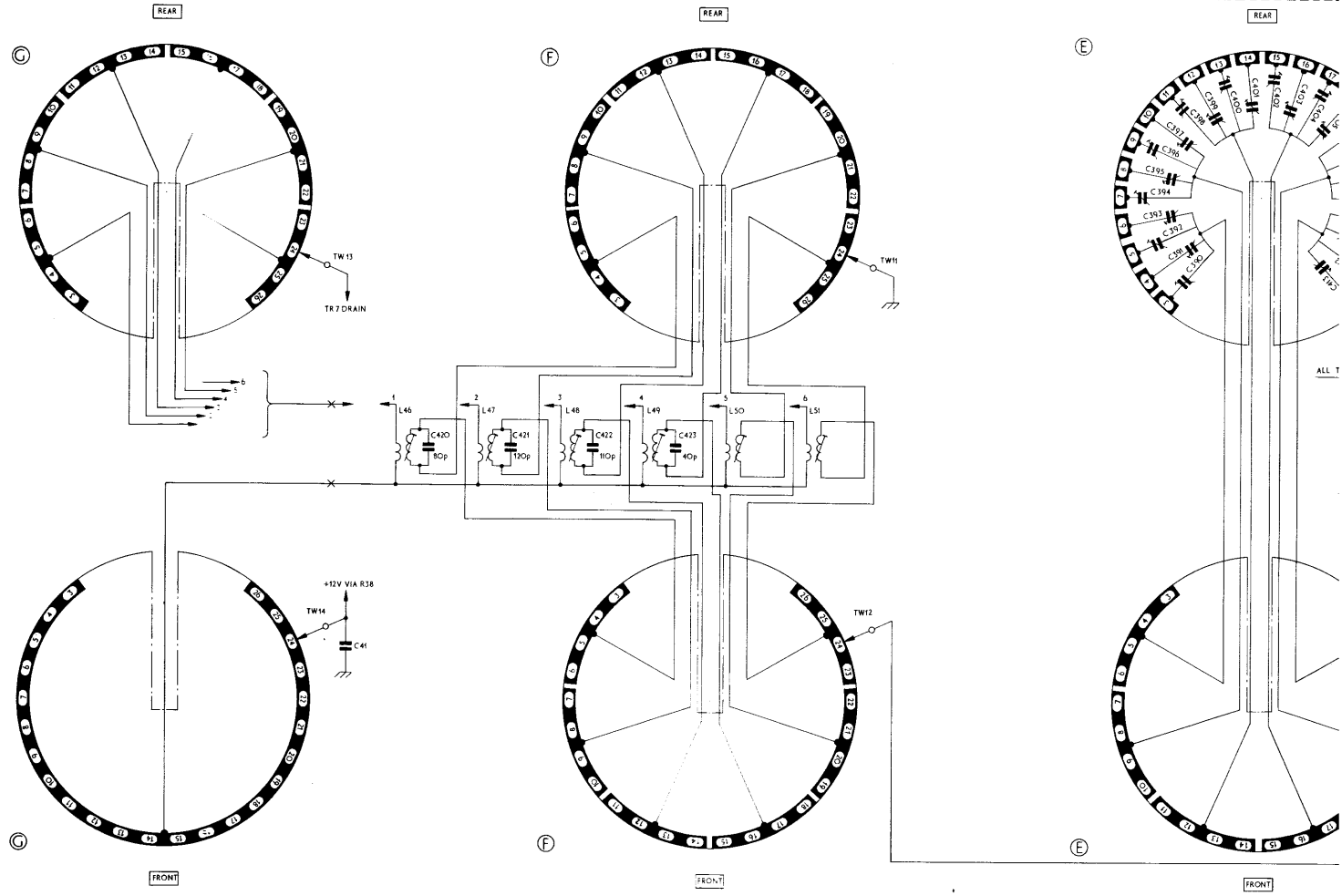
HF CRYSTAL OSC & DOUBLER DISKS - EC964/1



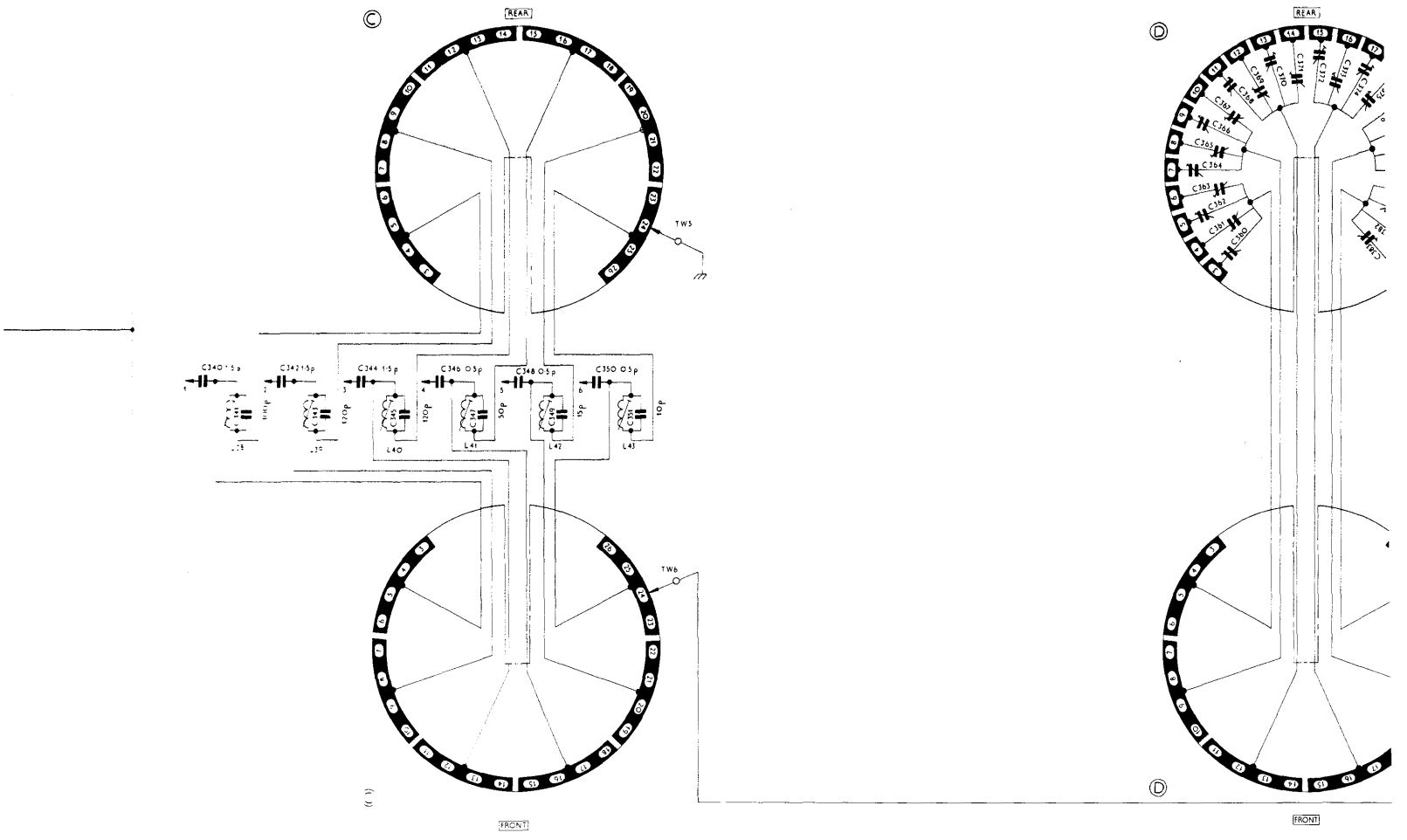
HF DISK CIRCUITS – MODEL EC964/1 BP1253



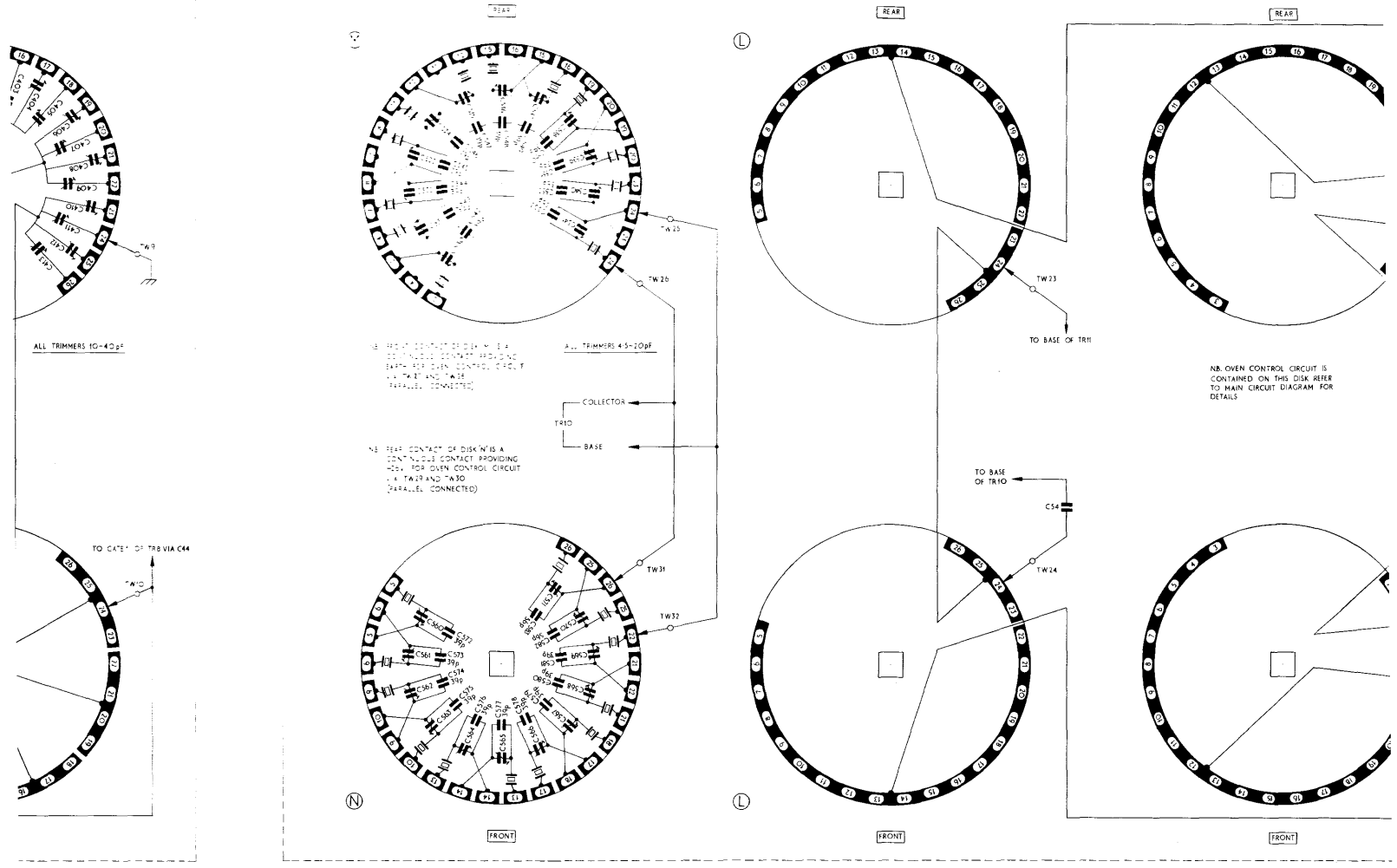
H.F. MIXER DISKS-EC 964/2

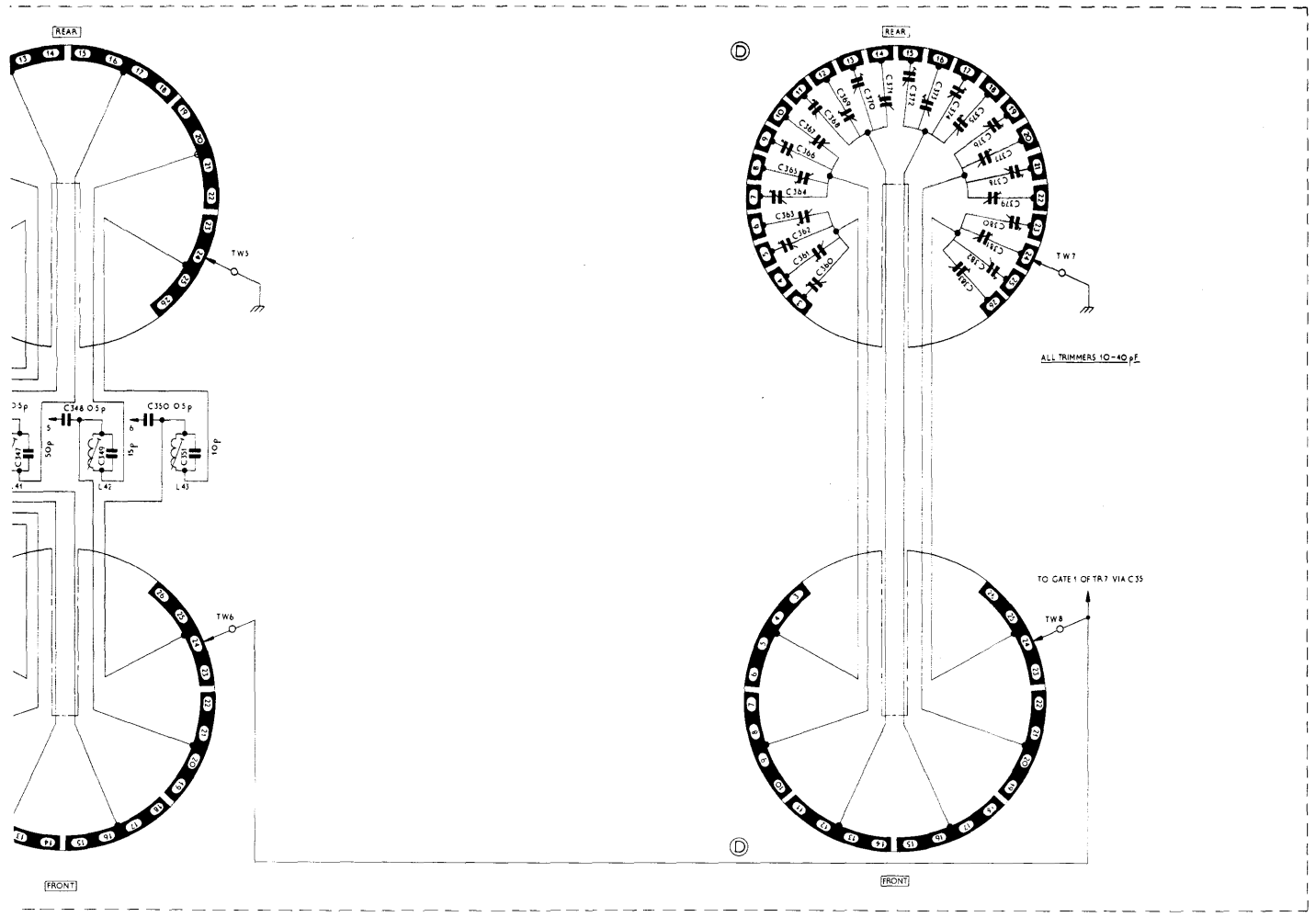


H F BANDPASS DISKS-EC964/2

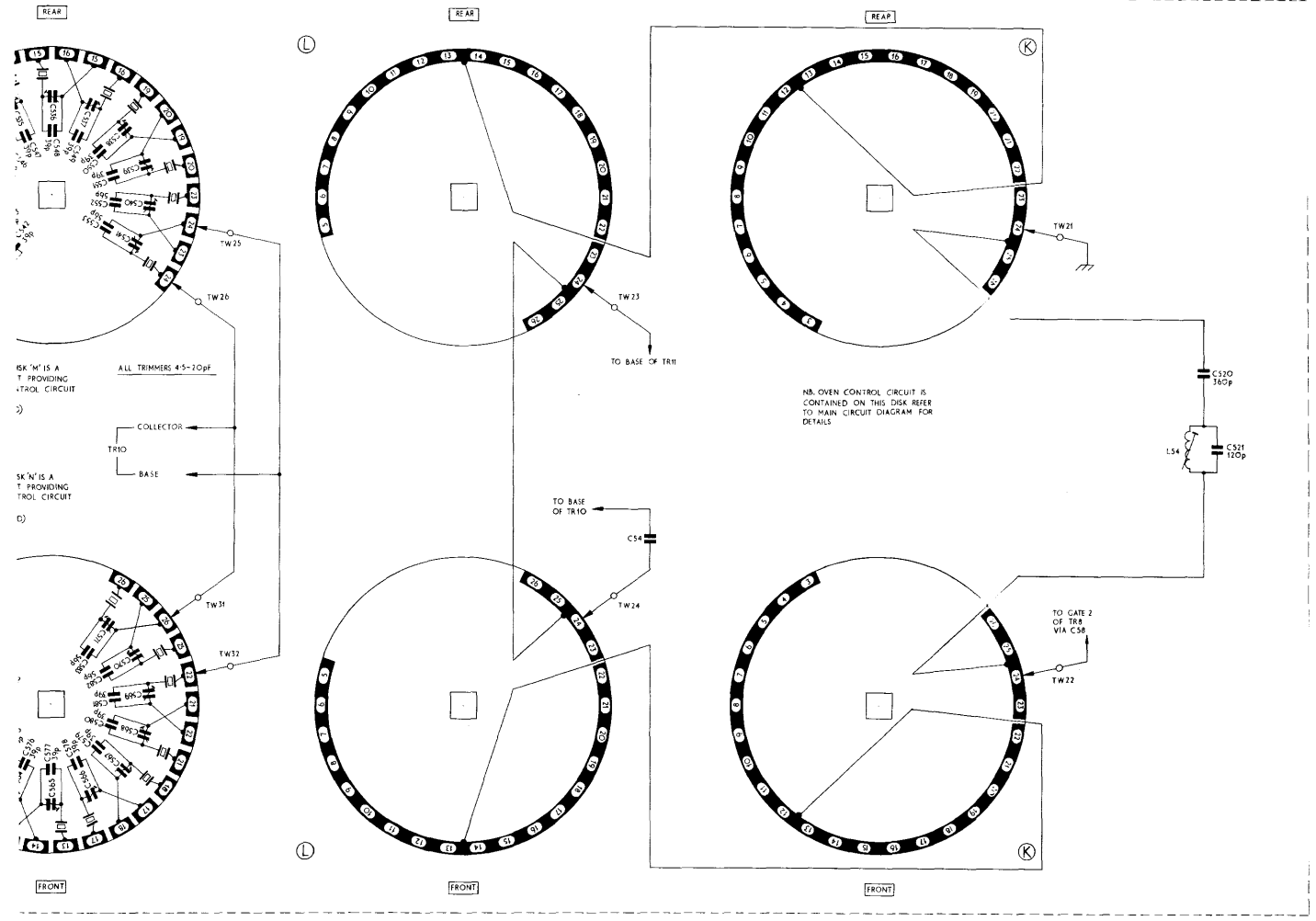


H.F. CRYSTAL OSC & DOUBLER DISKS-EC 964/2

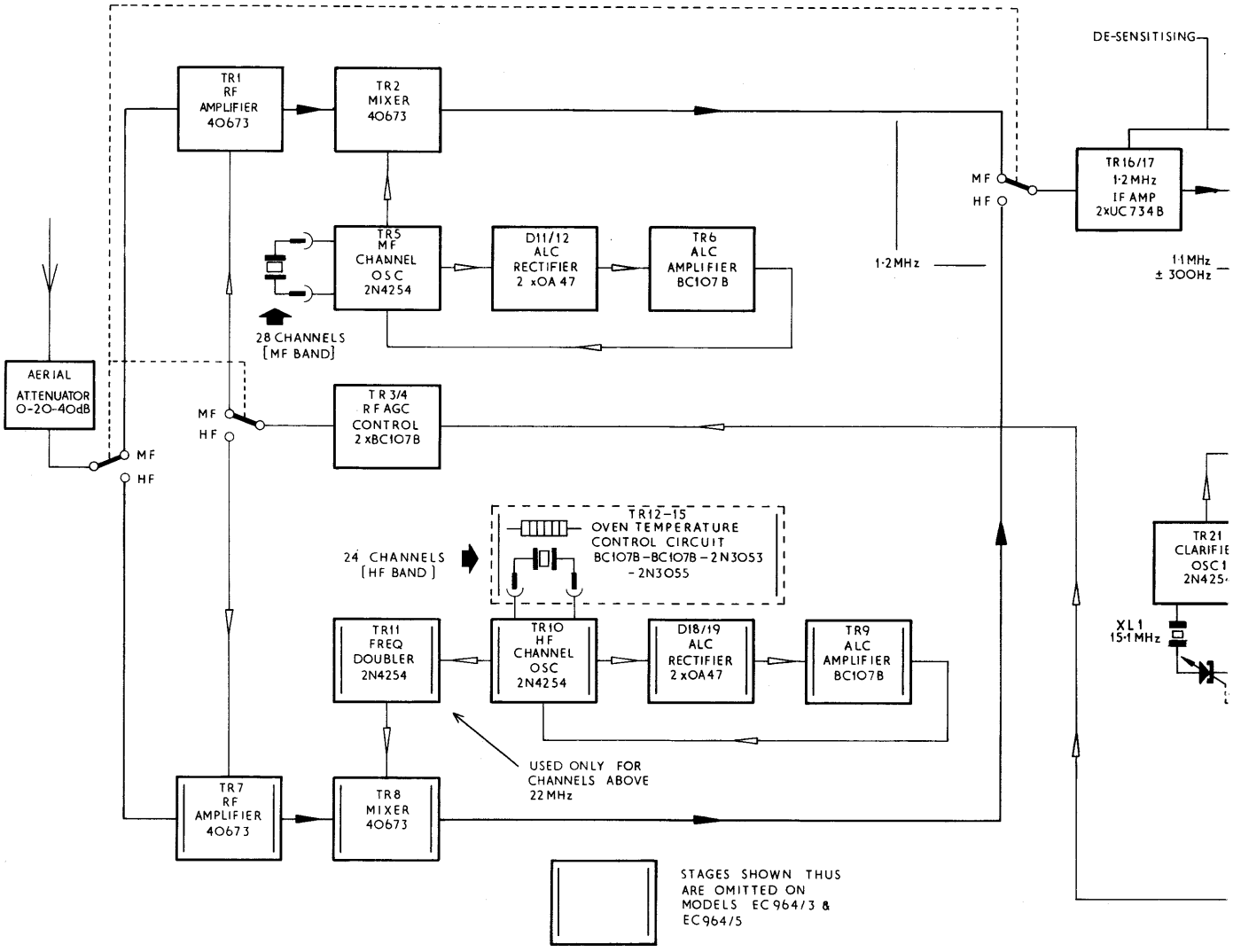


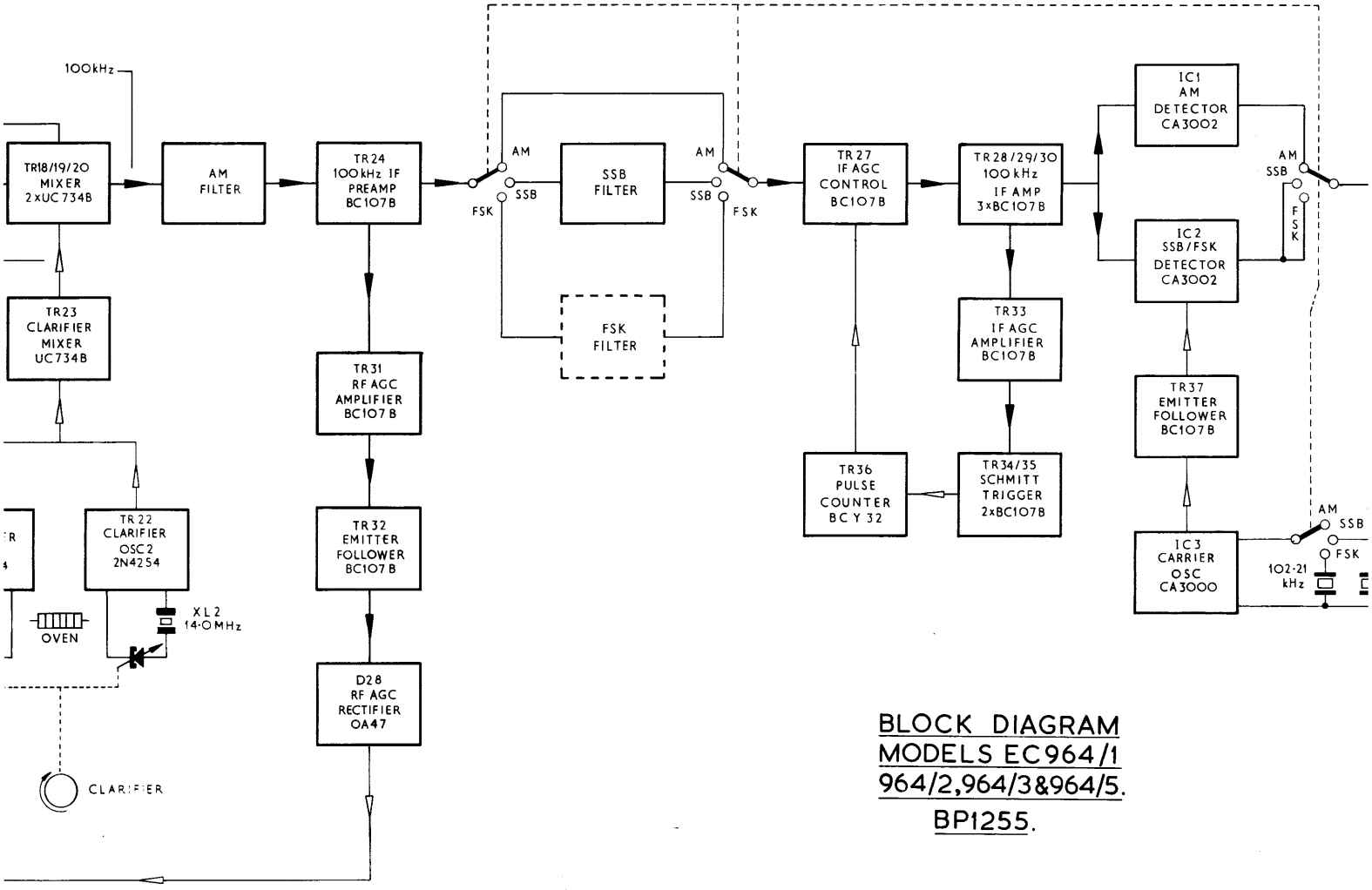


H.F. CRYSTAL OSC & DOUBLER DISKS-EC 964/2

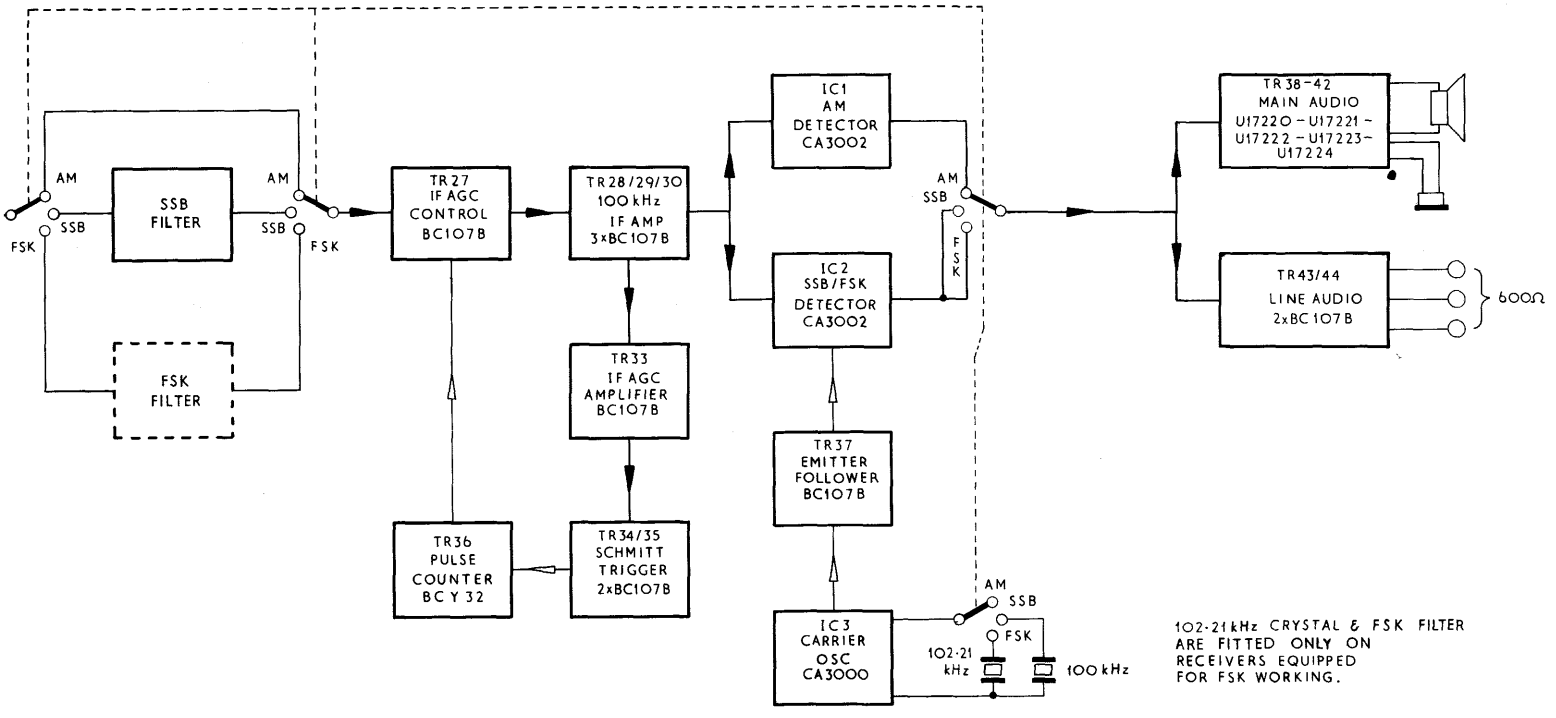


HF DISK CIRCUITS – MODEL EC964/2 BP1254

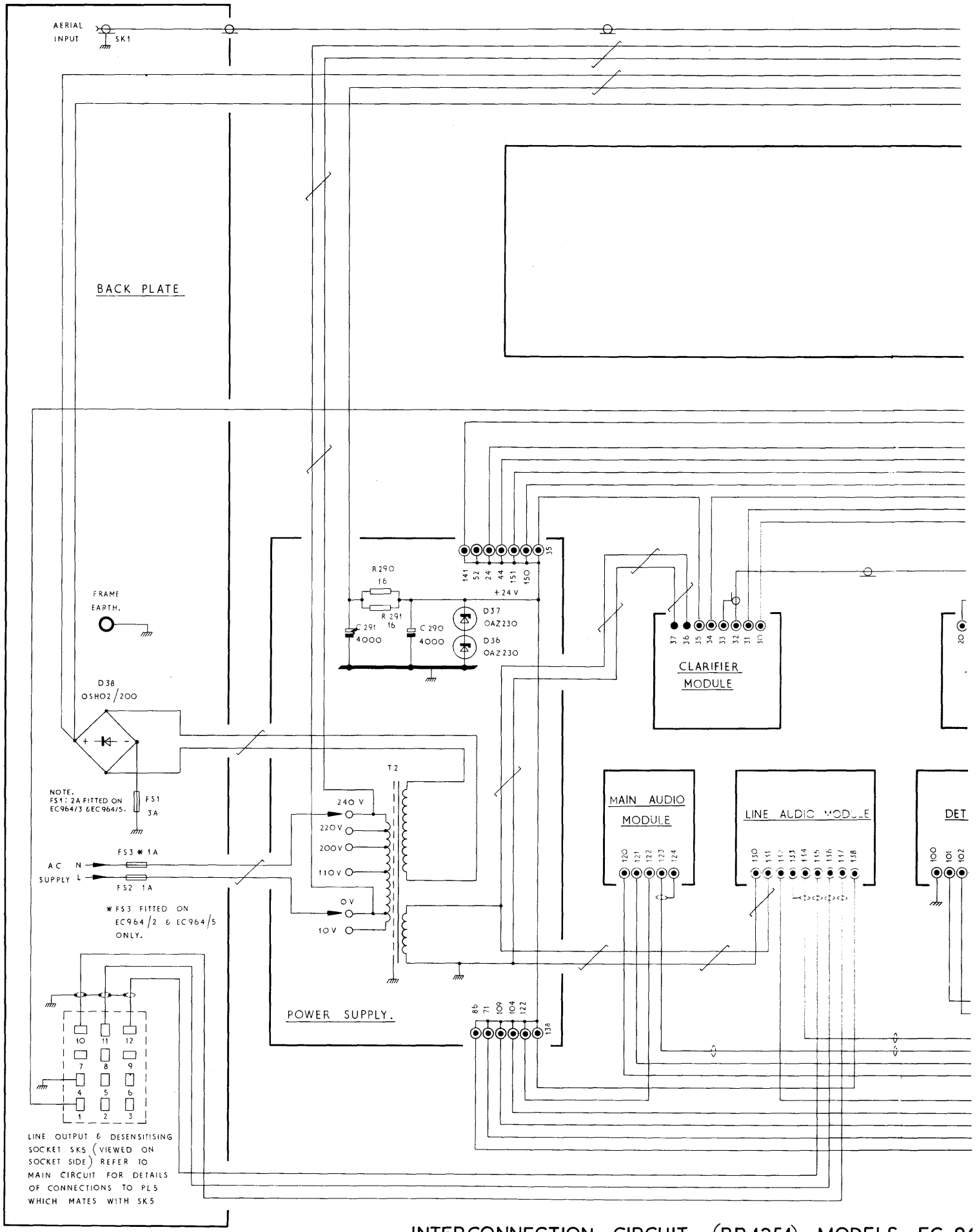

DE-SENSITISING
TR1
RF
AMPLIFIER
40673
TR2
MIXER
40673
TR16/17
1·2MHz
IF AMP
2xUC734B
MF
HF
1·2MHz
1·1MHz
± 300Hz
TR5
MF
CHANNEL
OSC
2N4254
D11/12
ALC
RECTIFIER
2 xOA47
TR6
ALC
AMPLIFIER
BC107B
28 CHANNELS
[MF BAND]
AERIAL
ATTENUATOR
0-20-40dB
MF
HF
TR3/4
RF AGC
CONTROL
2 xBC107B
MF
HF
TR12-15
OVEN TEMPERATURE
CONTROL CIRCUIT
BC107B-BC107B-2N3053
-2N3055
24 CHANNELS
[HF BAND]
TR21
CLARIFIE
OSC1
2N425·
XL1
15·1MHz
TR11
FREQ
DOUBLER
2N4254
TR10
HF
CHANNEL
OSC
2N4254
D18/19
ALC
RECTIFIER
2 xOA47
TR9
ALC
AMPLIFIER
BC107B
USED ONLY FOR
CHANNELS ABOVE
22MHz
TR7
RF
AMPLIFIER
40673
TR8
MIXER
40673
STAGES SHOWN THUS
ARE OMITTED ON
MODELS EC964/3 &
EC964/5



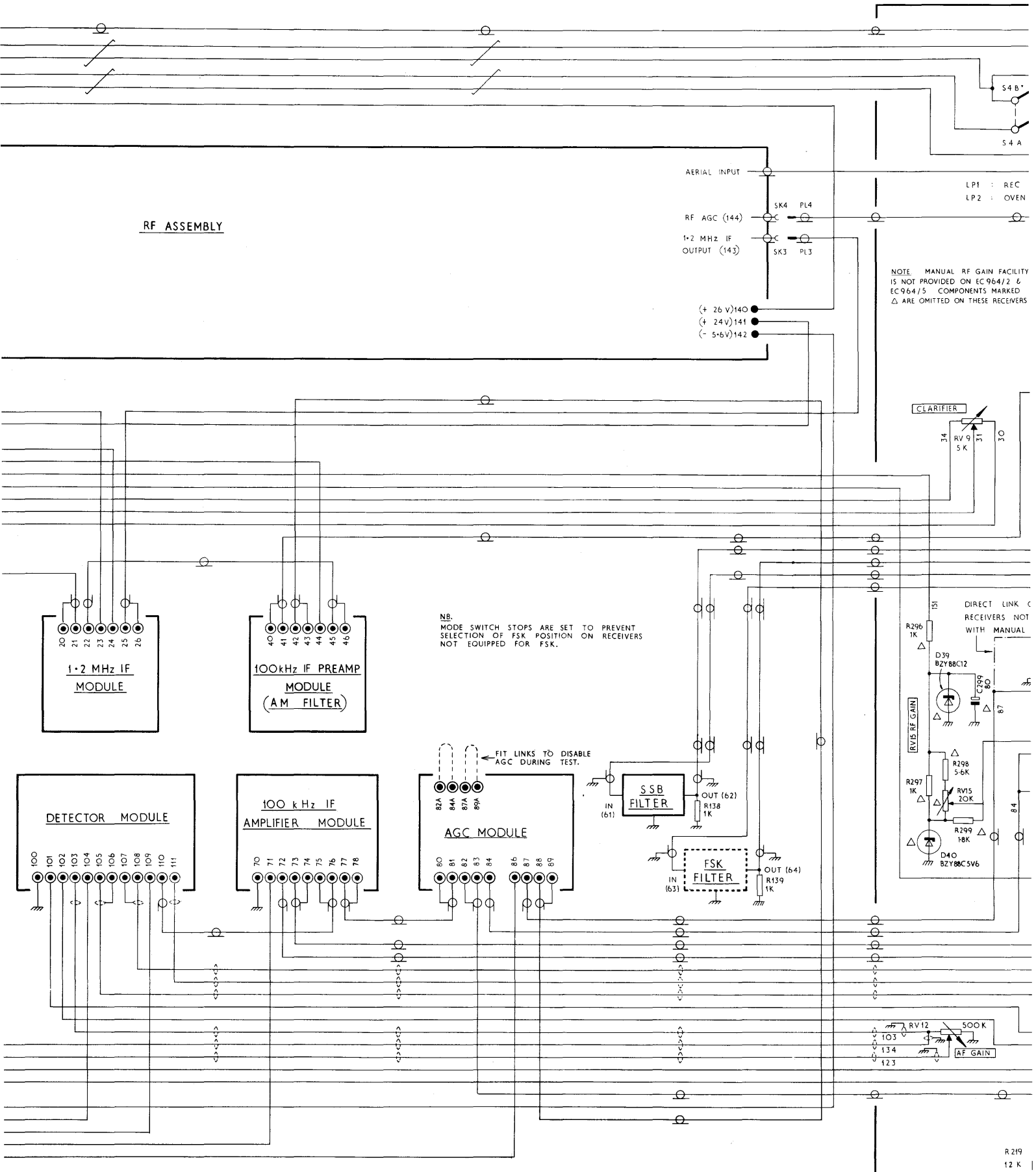
BLOCK DIAGRAM
MODELS EC964/1
964/2,964/3&964/5.
BP1255.



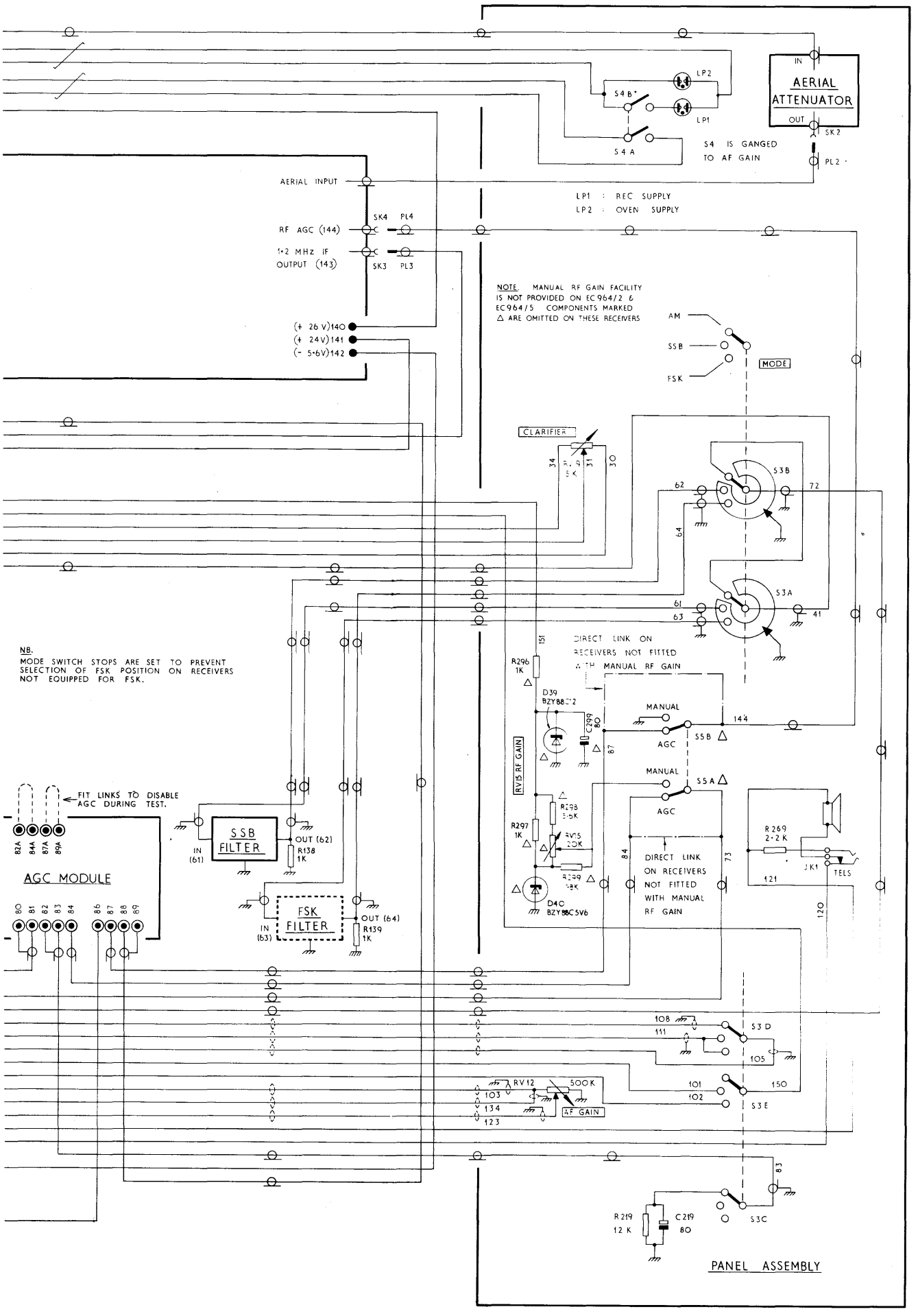
BLOCK DIAGRAM MODELS EC964/1 964/2,964/3&964/5. BP1255.

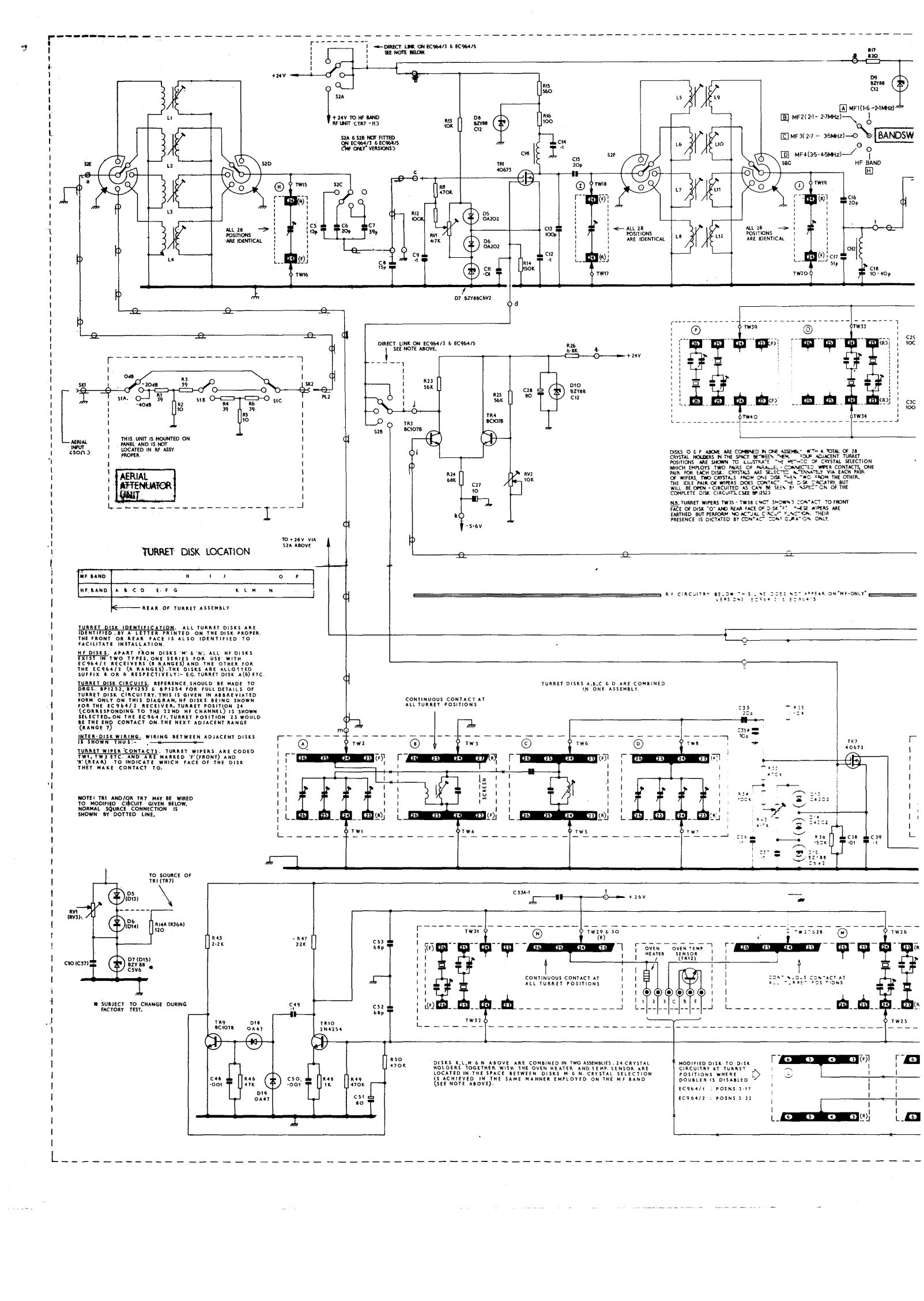


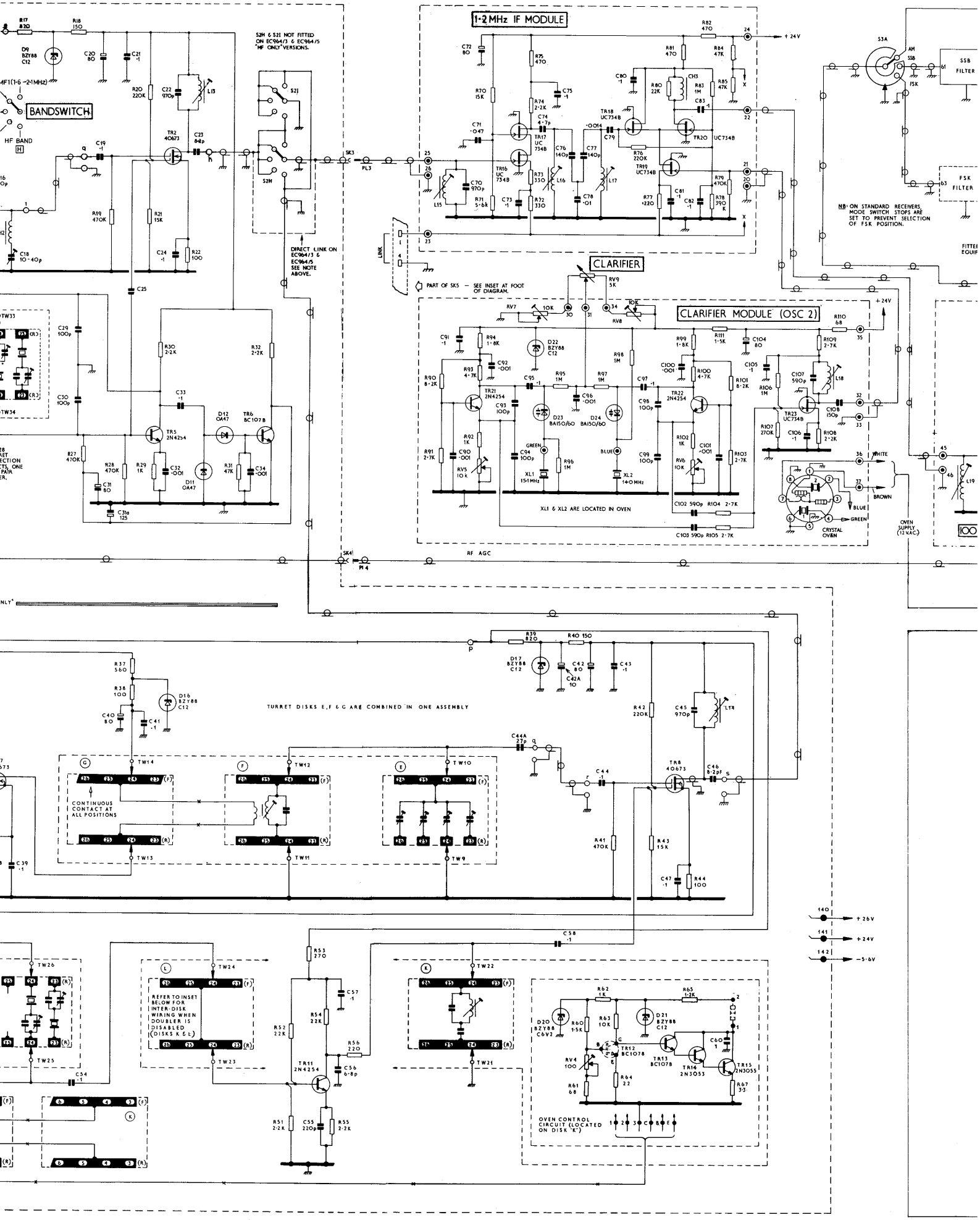
INTERCONNECTION CIRCUIT (BP 1251) MODELS EC 96

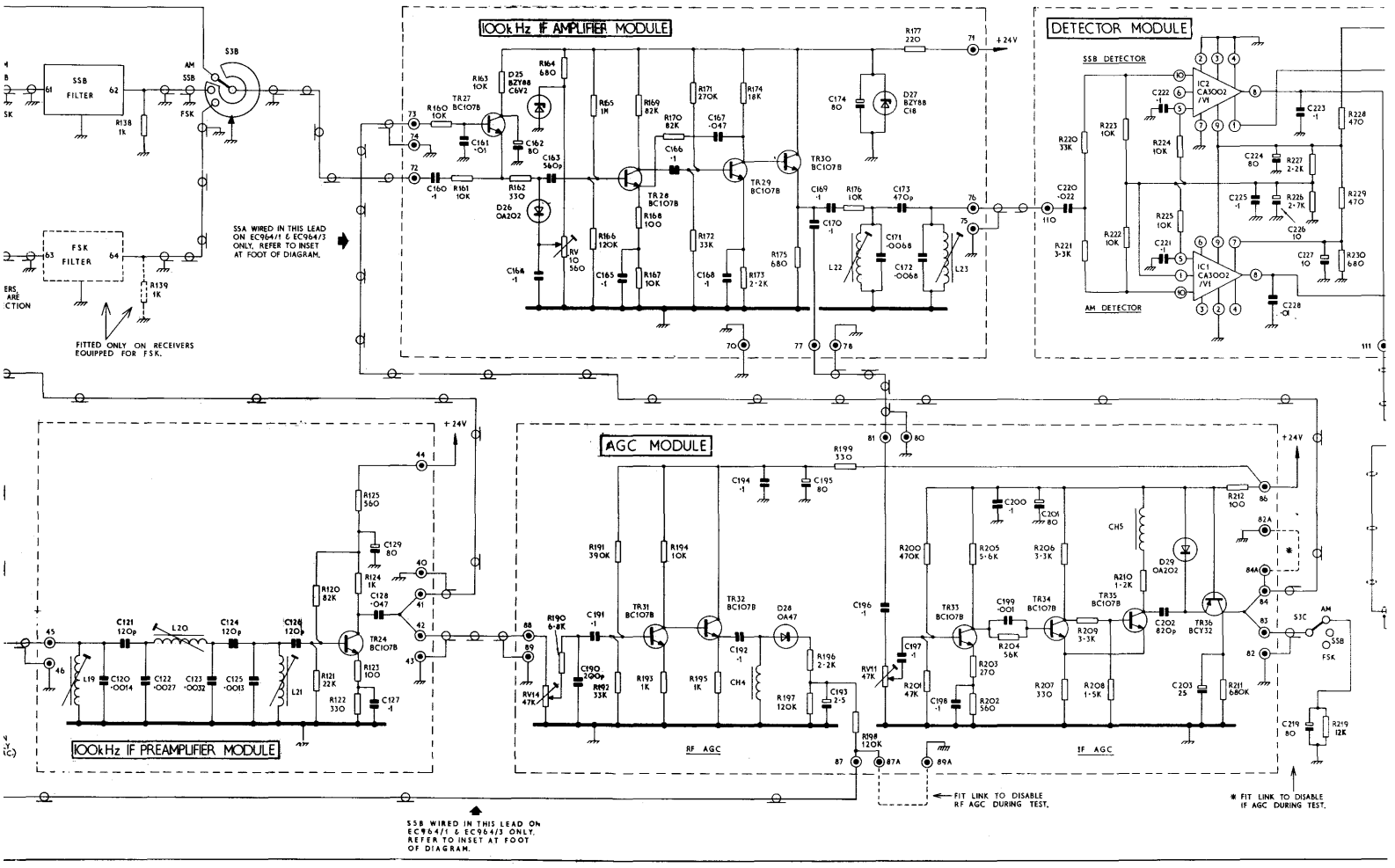


EC 964/1, 964/2, 964/3 & 964/5.


AERIAL INPUT
RF AGC (144)
1·2 MHz IF OUTPUT (143)
SK4 PL4
SK3 PL3
(+ 26 V)140
(+ 24V)141
(- 5·6V)142
LP1 : REC SUPPLY
LP2 : OVEN SUPPLY
S4 B*
S4 A
LP2
LP1
IN
AERIAL ATTENUATOR
OUT
SK2
PL2
S4 IS GANGED TO AF GAIN
NOTE. MANUAL RF GAIN FACILITY IS NOT PROVIDED ON EC964/2 & EC964/5 COMPONENTS MARKED △ ARE OMITTED ON THESE RECEIVERS
AM
SSB
FSK
MODE
CLARIFIER
S3B
S3A
S3D
S3E
S3C
NB.
MODE SWITCH STOPS ARE SET TO PREVENT SELECTION OF FSK POSITION ON RECEIVERS NOT EQUIPPED FOR FSK.
DIRECT LINK ON RECEIVERS NOT FITTED WITH MANUAL RF GAIN
R296 1K
D39 BZY88C2
C299 80
MANUAL
AGC
SSB
S5A
RV15 RF GAIN
R298 5·6K
R297 1K
RV15 20K
R299 1K
D40 BZY88C5V6
DIRECT LINK ON RECEIVERS NOT FITTED WITH MANUAL RF GAIN
R269 2·2K
JK1
TELS
FIT LINKS TO DISABLE AGC DURING TEST.
AGC MODULE
SSB FILTER
IN (61)
OUT (62)
R138 1K
FSK FILTER
IN (63)
OUT (64)
R139 1K
RV12 500K
AF GAIN
R219 12 K
C219 80
PANEL ASSEMBLY


DIRECT LINK ON EC964/3 & EC964/5 SEE NOTE BELOW.
+24V
S2A
+24V TO HF BAND RF UNIT CTR7 - 11
S2A & S2B NOT FITTED ON EC964/3 & EC964/5 ("MF ONLY" VERSIONS)
R17 330
D9 BZY88 C12
R15 560
R16 100
D8 BZY88 C12
R13 10K
C14 ·1
CH1
TR1 40673
C15 20p
S2F
S2G
A MF1(1·6 - 2·1MHz)
B MF2(2·1 - 2·7MHz)
C MF3(2·7 - 35MHz)
D MF4(3·5 - 4·5MHz)
BANDSW
HF BAND H
S2E
S2D
L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
L11
L12
TW15
TW16
TW17
TW18
TW19
TW20
S2C
C5 12p
C6 20p
C7 39p
C8 15p
R11 470K
R12 100K
RV1 4·7K
D5 OA202
D6 OA202
C9 ·1
C11 ·01
R14 150K
C12 ·1
C13 100p
D7 BZY88C6V2
ALL 28 POSITIONS ARE IDENTICAL
C16 20p
C17 51p
CH2
C18 10-40p
DIRECT LINK ON EC964/3 & EC964/5 SEE NOTE ABOVE.
R26 6·8K
+24V
R23 56K
R25 56K
C28 80
D10 BZY88 C12
TR3 BC107B
TR4 BC107B
S2B
R24 68K
C27 10
RV2 10K
-5·6V
SK1
SK2
PL2
S1A
S1B
S1C
0dB
-20dB
-40dB
R1 39
R2 10
R3 39
R4 39
R5 10
R6 39
AERIAL INPUT 450Ω
THIS UNIT IS MOUNTED ON PANEL AND IS NOT LOCATED IN RF ASSY PROPER
AERIAL ATTENUATOR UNIT
TW39
TW33
TW40
TW34
C25 100
C30 100
DISKS O & P ABOVE ARE COMBINED IN ONE ASSEMBLY WITH A TOTAL OF 28 CRYSTAL HOLDERS IN THE SPACE BETWEEN THEM. FOUR ADJACENT TURRET POSITIONS ARE SHOWN TO ILLUSTRATE THE METHOD OF CRYSTAL SELECTION WHICH EMPLOYS TWO PAIRS OF PARALLEL-CONNECTED WIPER CONTACTS, ONE PAIR FOR EACH DISK. CRYSTALS ARE SELECTED ALTERNATELY VIA EACH PAIR OF WIPERS, TWO CRYSTALS FROM ONE DISK THEN TWO FROM THE OTHER. THE IDLE PAIR OF WIPERS DOES CONTACT THE DISK CIRCUITRY, BUT WILL BE OPEN-CIRCUITED AS CAN BE SEEN BY INSPECTION OF THE COMPLETE DISK CIRCUITS. (SEE BP 1252)
N.B. TURRET WIPERS TW35 - TW38 (NOT SHOWN) CONTACT TO FRONT FACE OF DISK "O" AND REAR FACE OF DISK "P". THESE WIPERS ARE EARTHED BUT PERFORM NO ACTUAL CIRCUIT FUNCTION, THEIR PRESENCE IS DICTATED BY CONTACT CONFIGURATION ONLY.
TO +24V VIA S2A ABOVE
TURRET DISK LOCATION
MF BAND H I J O P
HF BAND A B C D E F G K L M N
REAR OF TURRET ASSEMBLY
R.F. CIRCUITRY BELOW THIS LINE DOES NOT APPEAR ON "MF-ONLY" VERSIONS OF EC964/3 & EC964/5
TURRET DISK IDENTIFICATION. ALL TURRET DISKS ARE IDENTIFIED BY A LETTER PRINTED ON THE DISK PROPER. THE FRONT OR REAR FACE IS ALSO IDENTIFIED TO FACILITATE INSTALLATION.
HF DISKS. APART FROM DISKS 'M' & 'N', ALL HF DISKS EXIST IN TWO TYPES, ONE SERIES FOR USE WITH EC964/1 RECEIVERS (8 RANGES) AND THE OTHER FOR THE EC964/2 (6 RANGES). THE DISKS ARE ALLOTTED SUFFIX 8 OR 6 RESPECTIVELY:- E.G. TURRET DISK A(8) ETC.
TURRET DISK CIRCUITS. REFERENCE SHOULD BE MADE TO DRGS. BP1252, BP1253 & BP1254 FOR FULL DETAILS OF TURRET DISK CIRCUITRY. THIS IS GIVEN IN ABBREVIATED FORM ONLY ON THIS DIAGRAM, HF DISKS BEING SHOWN FOR THE EC964/2 RECEIVER. TURRET POSITION 24 (CORRESPONDING TO THE 22ND HF CHANNEL) IS SHOWN SELECTED. ON THE EC964/1, TURRET POSITION 23 WOULD BE THE END CONTACT ON THE NEXT ADJACENT RANGE (RANGE 7)
INTER-DISK WIRING. WIRING BETWEEN ADJACENT DISKS IS SHOWN THUS:-
TURRET WIPER CONTACTS. TURRET WIPERS ARE CODED TW1, TW2 ETC. AND ARE MARKED 'F' (FRONT) AND 'R' (REAR) TO INDICATE WHICH FACE OF THE DISK THEY MAKE CONTACT TO.
NOTE: TR1 AND/OR TR7 MAY BE WIRED TO MODIFIED CIRCUIT GIVEN BELOW. NORMAL SOURCE CONNECTION IS SHOWN BY DOTTED LINE.
TURRET DISKS A,B,C & D ARE COMBINED IN ONE ASSEMBLY.
CONTINUOUS CONTACT AT ALL TURRET POSITIONS
TW1
TW2
TW3
TW4
TW5
TW6
TW7
TW8
SCREEN
C35 20p
C35A 10p
R35 1·5K
TR7 40673
R32 47K
R34 150K
R33 4·7K
D13 OA202
D14 OA202
D15 BZY88 C5V2
R36 150K
C38 ·01
C39 ·1
C37 ·1
TO SOURCE OF TR1 (TR7)
RV1 (RV3)
D5 (D13)
D6 (D14)
R14A (R36A) 120
C10 (C37)
D7 (D15) BZY 88 C5V6
* SUBJECT TO CHANGE DURING FACTORY TEST.
R45 2·2K
R47 22K
C53 68p
C52 68p
C49 ·1
TR9 BC107B
D18 OA47
TR10 2N4254
C48 ·001
R46 47K
D19 OA47
C50 ·001
R48 1K
R49 470K
R50 470K
C51 80
C53A·1
+26V
TW31
TW29 & 30 (R)
TW32
TW27 & 28
TW26
TW25
OVEN HEATER
OVEN TEMP SENSOR (TR12)
1 2 3 C 6 E
CONTINUOUS CONTACT AT ALL TURRET POSITIONS
DISKS K,L,M & N ABOVE ARE COMBINED IN TWO ASSEMBLIES. 24 CRYSTAL HOLDERS TOGETHER WITH THE OVEN HEATER AND TEMP. SENSOR ARE LOCATED IN THE SPACE BETWEEN DISKS M & N. CRYSTAL SELECTION IS ACHIEVED IN THE SAME MANNER EMPLOYED ON THE MF BAND (SEE NOTE ABOVE).
MODIFIED DISK TO DISK CIRCUITRY AT TURRET POSITIONS WHERE DOUBLER IS DISABLED
EC964/1 : POSNS. 3-17
EC964/2 : POSNS. 3-22

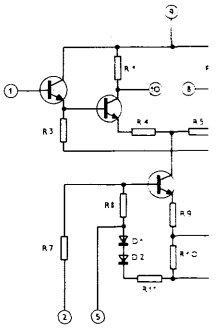

1-2 MHz IF MODULE
BANDSWITCH
CLARIFIER
CLARIFIER MODULE (OSC 2)
S2H & S21 NOT FITTED ON EC964/3 & EC964/5 'HF ONLY' VERSIONS.
DIRECT LINK ON EC964/3 & EC964/5 SEE NOTE ABOVE.
PART OF SK5 — SEE INSET AT FOOT OF DIAGRAM.
XL1 & XL2 ARE LOCATED IN OVEN
RF AGC
NB: ON STANDARD RECEIVERS, MODE SWITCH STOPS ARE SET TO PREVENT SELECTION OF FSK POSITION.
SSB FILTER
FSK FILTER
CRYSTAL OVEN
OVEN SUPPLY (12 VAC.)
TURRET DISKS E, F & G ARE COMBINED IN ONE ASSEMBLY
CONTINUOUS CONTACT AT ALL POSITIONS
REFER TO INSET BELOW FOR INTER-DISK WIRING WHEN DOUBLER IS DISABLED (DISKS K & L)
OVEN CONTROL CIRCUIT (LOCATED ON DISK 'K')
+24V
+26V
-5·6V



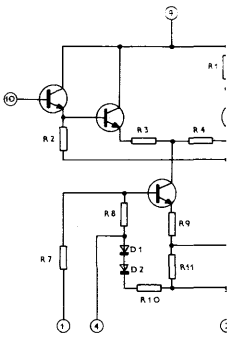
CIRCUIT MODIFICATIONS

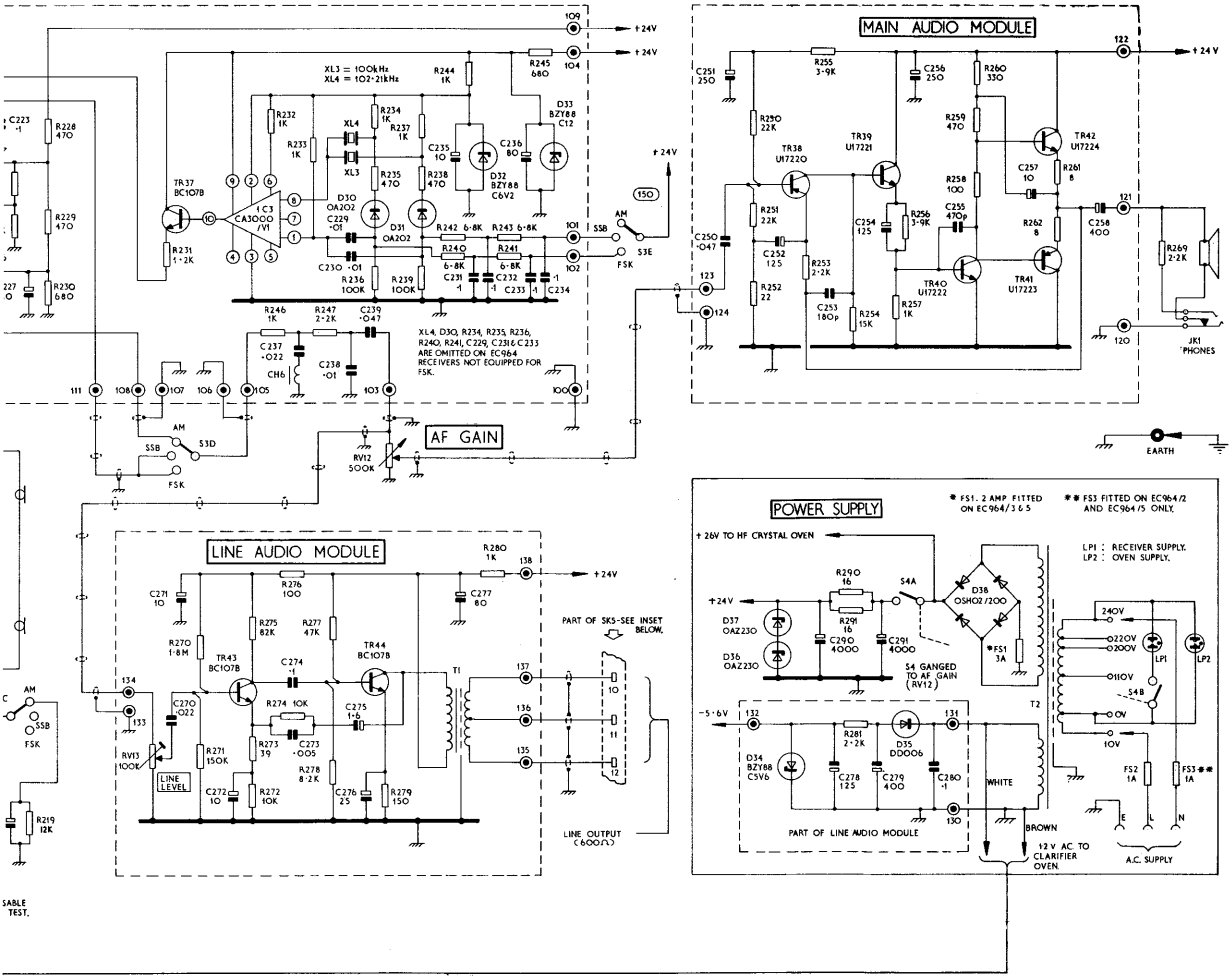
2N4254 TO-92	**BC107B** TO-18
1. BASE 2. COLLECTOR 3. EMITTER	1. EMITTER 2. BASE 3. COLLECTOR AND CASE
2N3053 U17223/4 TO-5	**BCY32** TO-5
1. EMITTER 2. BASE 3. COLLECTOR AND CASE	1. EMITTER 2. BASE 3. COLLECTOR
2N3055 TO-3	**UC734B** TO-72
1. BASE 2. EMITTER 3. COLLECTOR AND CASE	1. SOURCE 2. DRAIN 3. GATE 4. CASE
40673 TO-72	**U17220/1/2**
1. DRAIN 2. GATE 2 3. GATE 1 4. SUBSTRATE SOURCE & CASE	1. EMITTER 2. BASE 3. COLLECTOR

CA3C

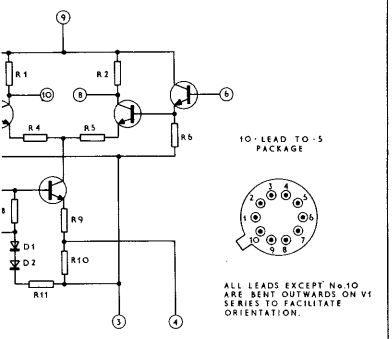


CA3C

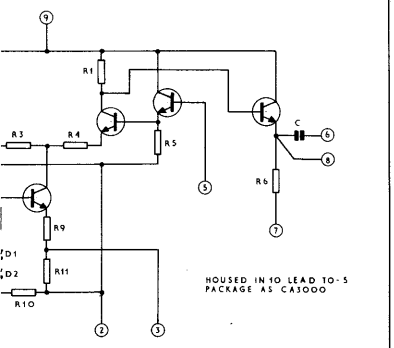




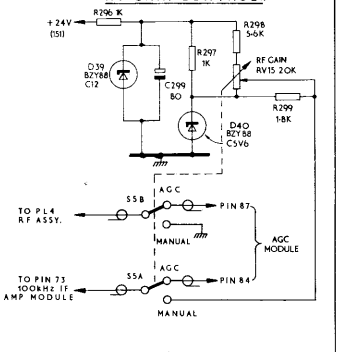
CA3000



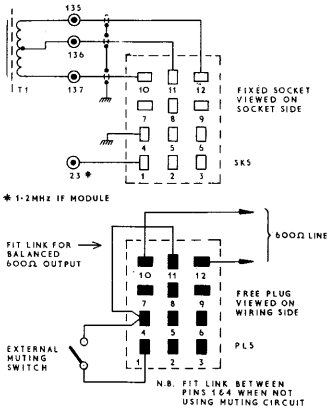
CA3002



RF GAIN CONTROL*



WIRING DETAIL - PL5



EC964 VARIANTS

EC964 RECEIVERS ARE CLASSIFIED ACCORDING TO FREQUENCY COVERAGE

MODEL	M.F. COVERAGE	H.F. COVERAGE
EC964/1	1·6 - 4·5 MHz (28 CHANNELS)	8 RANGES (5 CHANNELS EA)
EC964/2		6 RANGES (4 CHANNELS EA)
EC964/3	1·6 - 4·5 MHz (28 CHANNELS)	NIL
EC964/5		NIL

NOTES

THIS CIRCUIT DIAGRAM CONFORMS GENERALLY TO THE RECOMMENDATIONS GIVEN IN B.S. 3939. DIAGRAMS OF INTEGRATED CIRCUITS CA3000 AND CA3002 ARE REPRODUCED BY PERMISSION OF RCA LIMITED.

THE FOLLOWING ASSOCIATED DIAGRAMS SHOULD BE USED IN CONJUNCTION WITH THIS CIRCUIT.
BP1251 INTERCONNECTION CIRCUIT.
BP1252 - 1254 TURRET DISK CIRCUITRY.
BP1255 BLOCK DIAGRAM

INTERCONNECTIONS ALL WIRING TERMINATIONS ARE CODED NUMERICALLY 1-151. THE FOLLOWING NUMBERS ARE NOT ALLOCATED: 11-19, 27-29, 38-39, 47-60, 65-69, 79, 85, 90-99, 112-119, 125-129, 139, 143-149

MOST CONNECTIONS ARE MADE WITH SINGLE PIN AND SOCKET CONNECTORS WHICH ARE SHOWN THUS :-

SOLDERED TERMINATIONS ARE SHOWN THUS :-

INTER-BOARD CONNECTIONS IN RF ASSEMBLY ARE MARKED

MAIN CIRCUIT DIAGRAM - BP. 1250

MODELS EC 964/1, 964/2, 964/3 & 964/5.