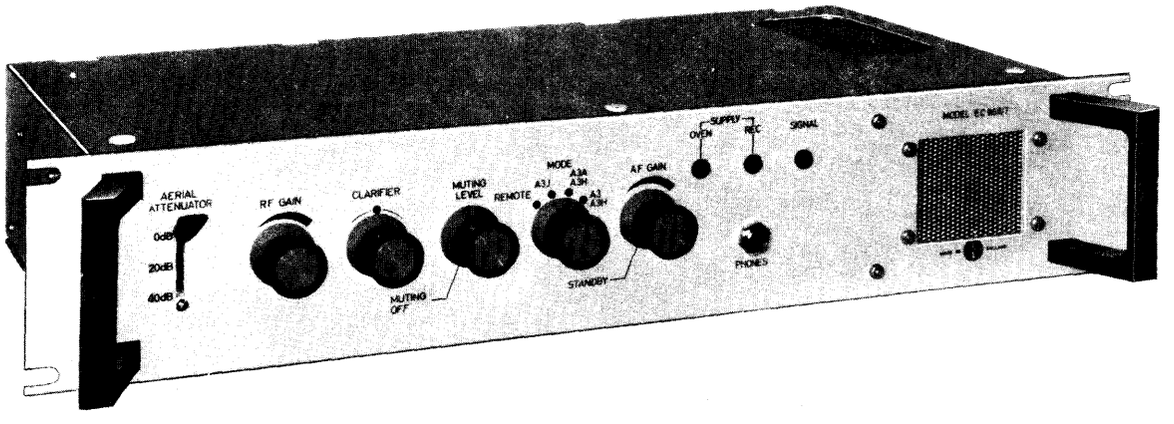
Eddystone

SINGLE-CHANNEL HF/MF SSB RECEIVER

MODEL EC964/7 SERIES



THIS HANDBOOK COVERS MODELS EC964/7A, 7B & 7C
AND WITH SUPPLEMENT COVERS MODELS EC964/7E, 7F & 7G

Manufactured in England by

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Eddystone Radio Limited reserve the right to modify the content of this publication as necessary to accommodate modifications, design improvements etc. Amendment Sheets will be incorporated where applicable at date of issue.

SINGLE CHANNEL HF/MF RECEIVER MODEL EC964/7 SERIES

AMENDMENT NO. 3 NOVEMBER 1975

This amendment incorporates amendments numbers 1 & 2 dated July and October 1975 and should be read in conjunction with the complete handbook. The sections of this amendment are in the same order as, and correspond with, the sections of the complete handbook.

The major changes in the receiver are in the power supply. The voltage regulator board and transistor have been replaced by a single integrated circuit, and the mains transformer tappings have been changed. The filament indicator lights have been replaced by the more reliable light emitting diodes, and the line output level potentiometer has been moved to the back panel. There have also been some component changes.

Section 2. CIRCUIT DESCRIPTION

MUTING BOARD: Lamp LP1 is now a light emitting diode D25 and is fed via a current limiting resistor R82. R159 provides a 12V supply to SK2 pin 15 when remote operation is selected for indication purposes.

AUDIO AMPLIFIERS: The circuit operation remains as described in the handbook, but the line output level potentiometer is now mounted on the rear panel. This enables adjustment to be made without removing the covers.

POWER SUPPLY: (This section replaces the description on P.15 of the manual)

The power input requirements for the receiver are covered by three options: 12VDC only; 12/24V DC only; 12/24V DC or 40-60Hz AC supply. The following paragraphs describe the operation of the latter version using an AC supply, succeeded by separate descriptions concerning the differences between this and the DC-only versions. Details of the links on plug PL5 can be found in the handbook in Section 4 (INSTALLATION).

12/24V DC or standard AC supply version: The AC supply fed in via plug PL4 is stepped down by transformer T1 and rectified by bridge rectifier D22 to provide a nominal DC output of 18V. This is fed via the appropriate links on PL5 and DC fuse FS2 to smoothing capacitor C199. Should a battery supply be connected incorrectly, with reversed polarities, diode D24 will provide a short circuit to blow FS2, so protecting the remainder of the receiver. The output from C199 is fed via the appropriate pins on PL5 to the voltage regulator. IC14 is a precision voltage regulator having a fixed output of 12V. Current limiting is provided internally. The device is mounted in a T03 case and is located adjacent to the mains transformer. The +12V regulated output is fed via the appropriate links on PL5 to the crystal ovens, the oven supply lamp and standby switch S4 (ganged to the AF GAIN control). The temperature of the crystal ovens is internally regulated at 65^{o}C and in order to minimise the time needed for the receiver to stabilise these are always fed with power. The oven supply lamp is a light emitting diode (LED) D27 and its current is limited by R84. The switched supply from S4 is fed directly to the parts of the receiver requiring +12V and to the RECEIVER SUPPLY lamp (also a LED D26 with current limiting resistor R83). Zener diodes D10, D11, D12 and associated components R70-R73, C73-C77 provide independently stabilised supplies of +6V, +10V and +9V.

12/24V DC only version: This is identical to the power supply described above, except that T1 and D22 are not fitted, the power being fed directly to PL5, pin 11. If a 12V supply is used, the voltage regulator is excluded from the circuit by linking directly between pins 5 & 6 on PL5.

12V DC only version: This version is the same as the above, but does not include the voltage regulator IC14. The 12V supply is fed to PL5, pin 11 and pins 5 & 6 linked as above.

Section 3. MECHANICAL CONSTRUCTION

Note that the Voltage Regulator Board is omitted, the voltage regulator IC is mounted in place of the power transistor on the screening panel, which is also used as a heatsink.

Section 4. INSTALLATION

Table 4.1. Contents of Accessories Kit

The following items are not now necessary and are no longer included in the Accessories Kit.

3 Spare Bulbs (Part No. 8656P) 1 Allen Key (Part No. 8449P)

The AC Supply Connector is now Part No. D4815, not D2311/1 as stated.

Mains Transformer Voltage Adjustment

The voltage tappings on transformers used in receivers in current production are as shown below, and not as shown on P20 in the manual:

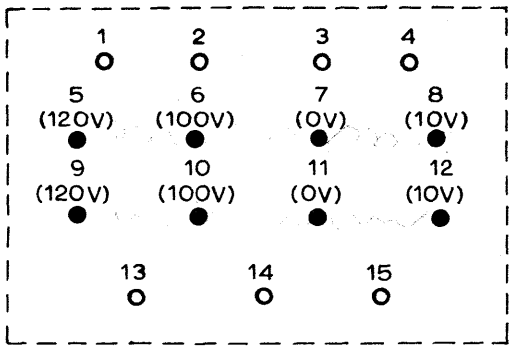


Fig. 4. 1a Power Transformer Winding Connections

Table 4.2 details the full range of tapping configurations and should be used in conjunction with Fig. 4.1a above.

Fig. 4.1 and Table 4.2 on P20 should be disregarded.

Table 4.2a. Tapping Configurations

Voltage	Link	Input
100V	6 & 10 7 & 11	6 & 7
110V	6 & 10 8 & 12	6 & 8
120V	5 & 9 7 & 11	5 & 7
130V	5 & 9 8 & 12	5 & 8
200V	7 & 10	6 & 11
210V	7 & 10	6 & 12

Voltage	Link	Input
220V	7 & 10	5 & 11
230V	7 & 10	5 & 12
240V	8 & 10	5 & 12
250V	8 & 9	5 & 11
260V	8 & 9	5 & 12

600Ω line output: RV5 (line output level potentiometer) is now mounted on the rear panel, not internally as stated.

Remote Operation: Fig. 4.5 SK2 pin 15 should be labelled "Remote Selected". A +12V signal appears on this pin when REMOTE is selected on the MODE switch.

Section 6. MAINTENANCE

Indicator Lamp Replacement: The three filament lamps on the front panel have been replaced by light emitting diodes which should not normally need replacement.

Voltage Regulator Board: This board is no longer fitted.

Re-alignment and Stage Testing:

Power supply: The output voltage of the regulator IC is fixed and no adjustment is possible.

APPENDIX 'A'

Table 2 (IC Voltages): This will now read, for IC14 -

Pin 1	18V
Pin 2	12V
Case	0V

Note: Receiver operating from AC

Table 3 (Transistor Voltages):

Delete: Voltage regulator TR21 and associated data.

APPENDIX 'B'

Semiconductor Complement:

The following changes should be made:-

Delete:	IC14	Type 8862P	Voltage Regulator (12V)	
	TR21	2N3055	Voltage Regulator	
Add:	IC14	Type MC7812KC	Voltage Regulator (12V)	Location H
Add:	D25	Type 8797P	Light emitting diode	" K
	D26	Type 8797P	Light emitting diode	" K
	D27	Type 8797P	Light emitting diode	" K

APPENDIX 'C'

Component Values, Tolerances and Ratings

Capacitors:

Delete:	C51	22pF	Polystyrene	
Add:	C183	.01µF	Polycarbonate 10%	400V

Resistors:	Delete:	R8	2200Ω	5%	0.3W	Location B
	Add:	R8	820Ω	5%	0.3W	" B
	Delete:	R48	2200Ω	5%	0.3W	" B
	Add:	R48	1000Ω	5%	0.3W	" B
		R158	100Ω	5%	3W	" K
		R159	1000Ω	5%	0.3W	" K
		R82	560Ω	5%	0.3W	" B
		R83	560Ω	5%	0.3W	" B
		R84	560Ω	5%	0.3W	" B

Potentiometers:

Delete:	RV14	10000Ω lin	Carbon preset	Location B
Add:	RV14	47000Ω lin	Carbon preset	" B

APPENDIX 'D'

List of Spares:

Printed Circuit Boards (with components, less screens)

Delete: Regulator Board Part No. LP3318/20

Potentiometers:

Delete: RV14 AM Detector output, 10000Ω lin carbon preset Part No.7762/1P
Add: RV14 AM Detector output, 47000Ω lin carbon preset Part No.9438/P

Plugs & Sockets:

Delete: PL4 AC Supply Connector, Part No. D2310/1
SK4 AC Supply Connector, Part No. D2311/1

Add: PL4 AC Supply Connector, Part No. 8730P
SK4 AC Supply Connector, Part No. D4815

Miscellaneous:

Delete: Indicator Lamps: 14V 0.75W Part No. 8656P
Indicator Lampholder Part No. 8655P

Circuit Diagram:

Note the following changes:-

1. Omit C51 (22pF Carrier Insertion Oscillator)
2. Change value of R8 from 2K2 to 820 (Mixer stage)
3. Change value of R48 from 2K2 to 1K (SSB Detector stage)
4. Add resistors R158, 159 as shown in Fig. (i)
5. Change voltage regulator circuit as shown in Fig. (ii)
6. Change LP1, LP2, LP3 to D25, D26, D27, and add R82, R83, R84 as shown in Fig. (iii)
7. Change value of RV14 from 10K to 47K (AM Detector stage)
8. Add C183 (.01μF) from Pin 16 to Frame Earth.

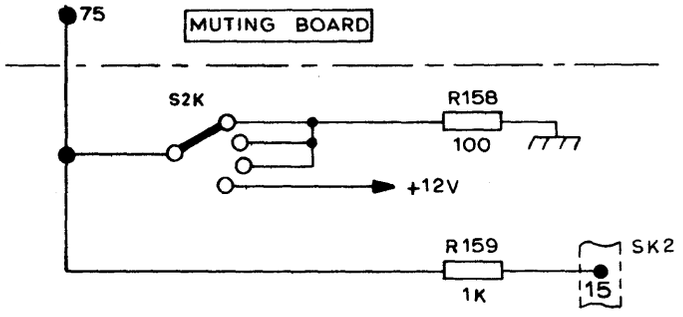


Fig (i)

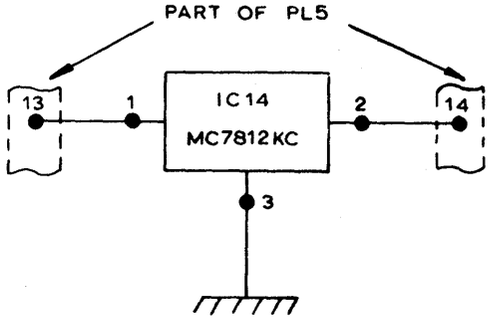
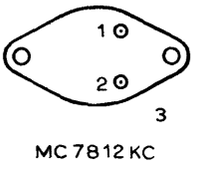


Fig (ii)



1 INPUT
2 OUTPUT
3 COMMON CASE

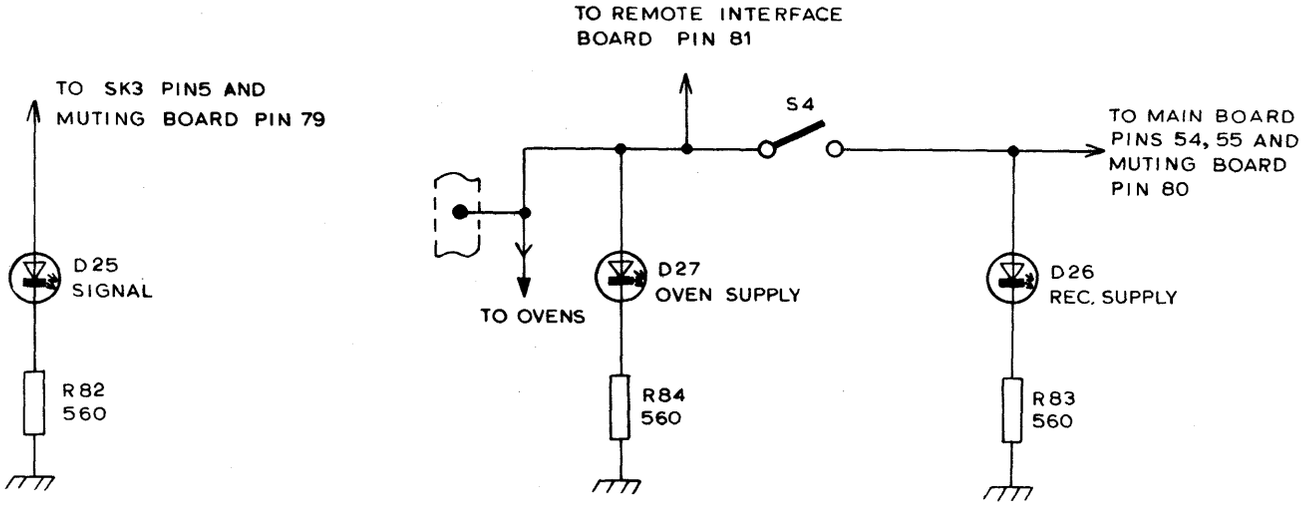


Fig (iii)

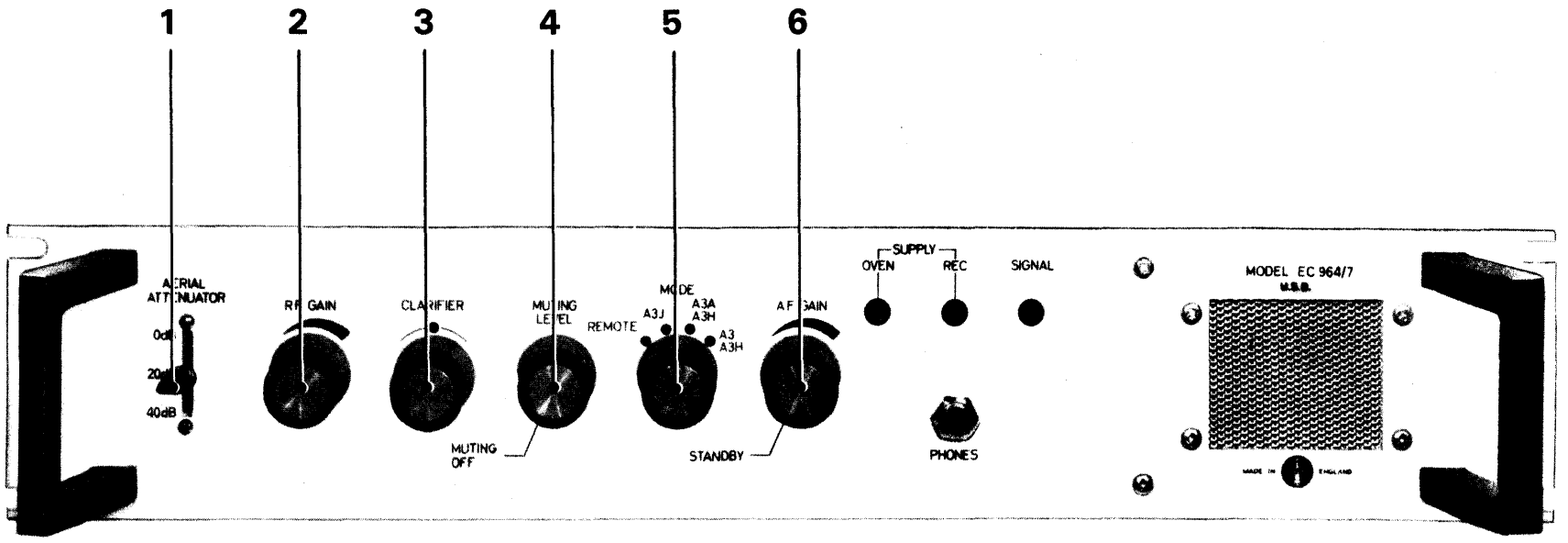


Fig. IV Front panel controls of EC964/7 series receivers

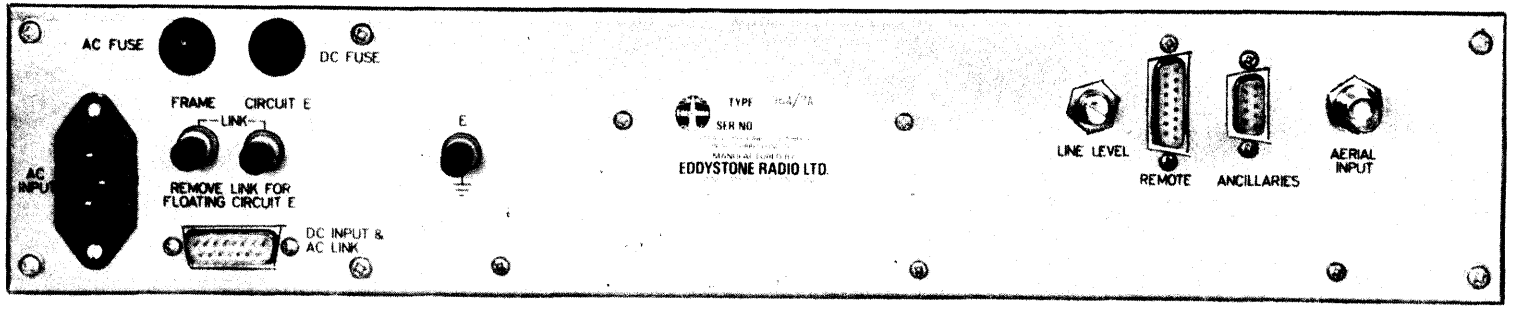


Fig. V Rear view of EC964/7 showing external connections

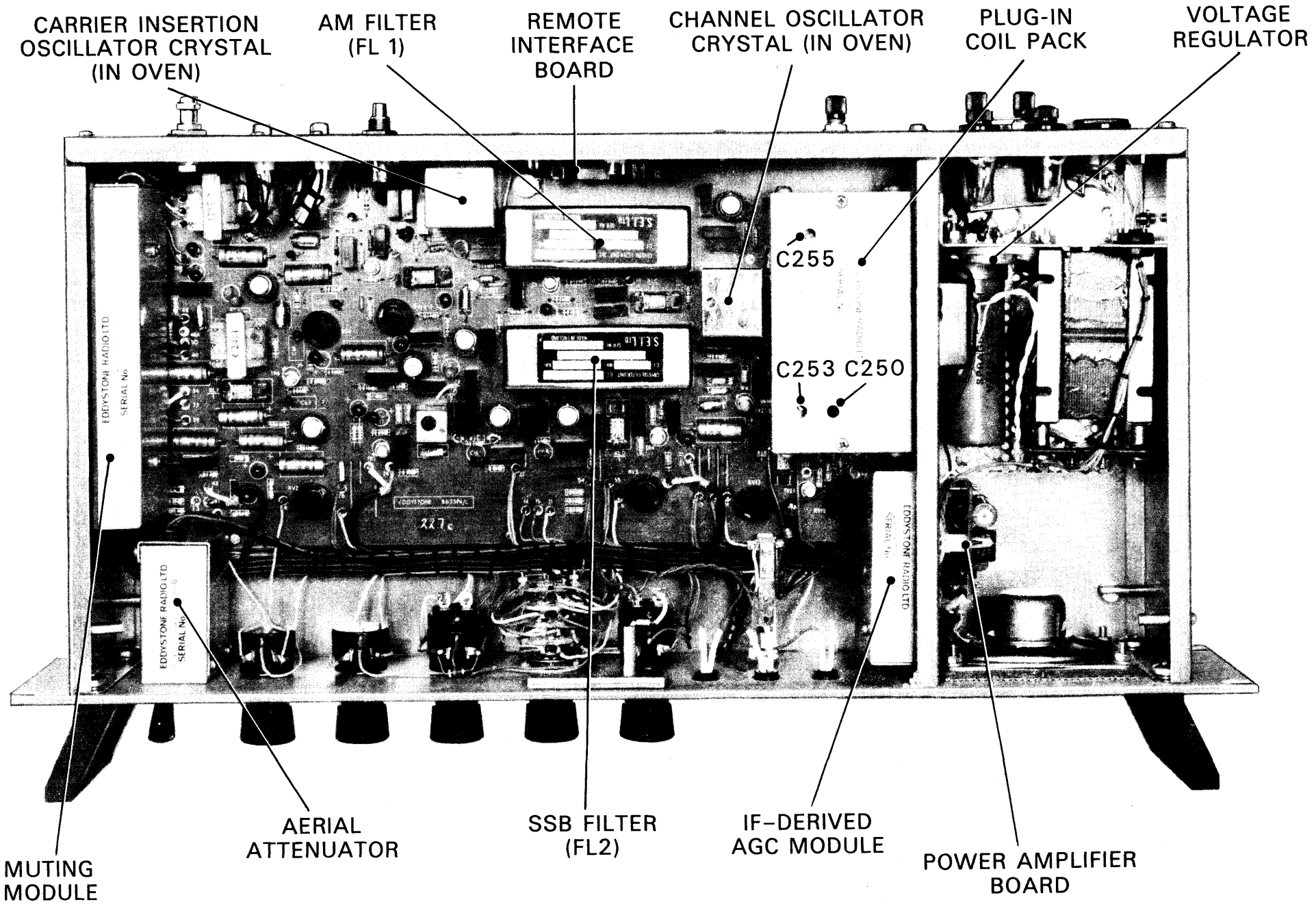


Fig. VI Plan view of EC964/7 receiver

SUPPLEMENT TO EC964/7 HANDBOOK TO COVER VARIANTS

EC964/7E, EC964/7F & EC964/7G

The Eddystone Model EC964/7 range of receivers has now been extended to include two models for CW working and one with a modified filter response. These are:-

EC964/7E	: :	Reception Modes A3J, A3A, A3H
EC964/7F	: :	Reception Mode A1 only
EC964/7G	:	Reception Mode A1 only

The differences between these and the earlier receivers are restricted to the IF filter characteristic, the carrier insertion oscillator frequency and AGC facilities.

Model EC964/7E

This is similar to the EC964/7B but is fitted with a filter type QC1473G for LSB operation or type QC1473H for USB operation.

Circuit Operation: The circuit operation is now as follows, referring to the main circuit diagram:

Signals from the aerial input socket are passed through the aerial attenuator unit, the RF amplifier (IC1) and the mixer (IC2) as before. From C10 an extra matching coil is included, see fig.(i), and this then feeds directly into the SSB filter. The output of this filter goes via C28 directly into the first IF amplifier (IC3). The signal then proceeds through the remaining IF stages, SSB detector, buffer (TR7) to the line and Main output stages. The AGC feed from either the Audio AGC Board or the IF AGC module, as selected by relay RLF/1, is now fed to D7 and then to the front panel switch S5 (see fig.(ii)). In the closed position the AGC facility functions normally - AGC ON - whilst in the open position - AGC OFF - the AGC line will be controlled by the DC level fed to the RF Gain control input (remote control SK2 pin 6), or by the RF gain potentiometer RV8 (local control). The Diversity AGC output (SK3 pin 2) is similarly controlled. The remainder of the circuit is unchanged and operates as described in the manual.

Model EC964/7F

This is similar to the EC964/7A but is fitted with a 300Hz bandwidth filter suitable for CW reception in place of the SSB filter. The carrier insertion oscillator frequency is offset from 1.4MHz by a suitable amount to give an audio output at the frequency desired. This is done by fitting a different crystal. There is no AGC switch.

Model EC964/7G

This is similar to the EC964/7F. An AGC switch is inserted as in the EC964/7E.

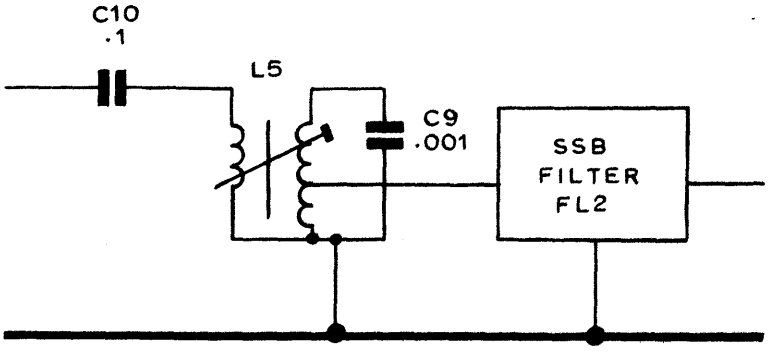


Fig i

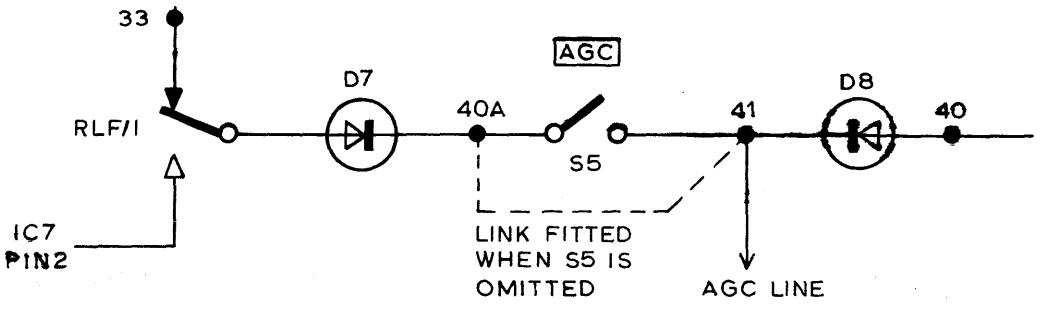


Fig ii

MAINTENANCE

The maintenance procedures for these receivers are essentially the same as for the original models and this is fully detailed in the handbook. However, note that the AGC switch when fitted must be ON for testing the overall performance and, of course, for testing the AGC performance. When testing selectivity, allowance must be made for the different filter characteristics.

The following figures should be met:-

EC964/7E (USB) :	filter type QC1473H (LSB) :
within 2dB	+ 200Hz to + 3000Hz
- 25dB	- 100Hz & +3400Hz
- 60dB	- 500Hz & + 3700Hz
EC964/7E (LSB) :	**filter type QC1473G (USB) :**
within 2dB	- 200Hz to - 3000Hz
- 25dB	+ 100Hz & - 3400Hz
- 60dB	+ 500Hz & - 3700Hz
EC964/7F & EC964/7G :	**filter type QC1512T (CW) :**
- 6dB	± 300Hz
- 60dB	± 700Hz

Add to Appendix C, component lists :-

C9	.001µF	Polystyrene	2%	63V

Add to Appendix D, list of spares:-

L5	Filter inter-stage coupling transformer		Part No. D4985
S5	AGC Switch DPDT		Part No. 7352P
FL2	SSB Crystal Filter : LSB*	QC1473H	Part No. 9460P
	USB*	QC1473G	Part No. 9461P
	CW	QC1512T	Part No. 9462P

* Sideband quoted is that of filter, consult P35 before ordering

Section 1

GENERAL DESCRIPTION AND PERFORMANCE SUMMARY

Eddystone Model EC964/7 is a compact receiver primarily intended for single-sideband reception in the frequency bands 1.6 – 27.5MHz and 400 – 535kHz. Three versions of the receiver are available, covering the different SSB reception modes listed at the end of this description. In addition to the SSB modes, the most comprehensive version can also accommodate double-sideband reception.

All three versions of this receiver are constructed for 483 mm (19 in.) rack mounting, and may be used in conjunction with an ERC 974 Controller to permit remote operation at distances of up to five kilometres using a 5-pair cable link.

The power supply for any of the above versions of the EC 964/7 receiver is also covered by three options: 12V DC; 12/24V DC; and 12/24V DC plus standard 40 – 60Hz AC supply. The 12V DC – only option has the supply fed directly to the receiver circuitry, whilst the other two include a series voltage regulator. All three options can accommodate any battery configuration, irrespective of earthing polarity, due to the floating circuit-earth design.

A single-conversion circuit design is employed, the channel frequency being determined by fitting an appropriate conversion crystal, together with a small plug-in coil unit which contains the signal frequency circuits for the front-end amplifier and mixer: six coil units cover all frequencies including the 400 – 535kHz band. The channel crystal is housed in a miniature oven and the circuit includes a varactor-tuned clarifier facility with a coverage of ± 300Hz.

These receivers are normally supplied for upper-sideband reception, with the channel oscillator injecting a signal of a higher frequency than that of the desired reception frequency. The IF amplifier operates at 1400kHz and utilises a multi-pole crystal filter. A double-balanced modulator is used as the detector, with the carrier insertion signal being derived from a 1400kHz crystal-controlled oscillator, again with the crystal contained in a miniature oven. The DSB version of the EC 964/7 includes an additional AM crystal filter in the IF section, and a separate AM detection circuit.

Audio-derived AGC is employed for A3J reception and IF – derived AGC for all other signal modes. Dual-diversity arrangements can be accommodated on all versions of the receiver. All versions also have a manual RF gain control and a fast-acting muting circuit. The latter provides 17 dB of noise-quieting and has provision for external signalling: it can be disabled when not required.

Two independent audio channels are available, one for local monitoring via a headset, and the other for connection to standard 600Ω line circuits. An optional 1-watt audio module and internal or external speaker may be fitted for local loudspeaker monitoring.

EC 964/7 Variants

EC 964/7-A : : Standard production version, A3J reception mode only.

EC 964/7-B* : : Reception modes A3J and A3A.

EC 964/7-C* : : Reception modes A3J, A3A and A3

These receivers are normally supplied for upper-sideband reception, but they are also available for lower-sideband working.

(*) These versions are also suitable for A3H reception.

GENERAL SPECIFICATION

Frequency Coverage

Pre-set to any specified channel in the band 1.6 – 27.5MHz with clarifier facility of ± 300Hz. Five plug-in coil packs cover the above range.

Frequency (MHz) Plug-in coil pack

1.6 – 3.0	LP3316/1
3.0 – 5.7	LP3316/2
5.7 – 10.8	LP3316/3
10.8 – 20.0	LP3316/4
20.0 – 27.5	LP3316/5

Also available for any spot-frequency in the range 400 – 535kHz by fitting plug-in coil pack number LP3316/6.

Intermediate Frequency

1400kHz (carrier frequency)

Aerial Input Impedance

50Ω, unbalanced. (30V continuously applied will not damage the receiver).

Reception Modes

Refer to list of variants, page 5 . Receivers are normally supplied for upper-sideband reception, but they are also available for lower-sideband working.

Environmental

Operational temp	–10°C to +55°C
Storage temp	–40°C to +70°C
Humidity	95% RH 40°C
Vibration	Compatible with all marine specifications

Power Supplies

AC : : 100/130V & 200/260V (40 – 60Hz) with optional internal power unit fitted.
Consumption : 25W

DC : : 12V or 12/24V versions
Consumption : 20W (12V)
30W (24V)

Semiconductor Complement

Basic EC 964/7-A version.

Integrated circuits	11
Transistors	16
Diodes	28+ bridge

Mounting Style

483 mm (19 in.) rack-mounting.

Dimensions and Weight

Refer to Section 3, Page 16.

TYPICAL PERFORMANCE

N.B. Performance figures in the data below are typical and should not be interpreted as a test specification.

Sensitivity

1μV for 15 dB SINAD (SSB mode)

Selectivity

In accordance with requirements of TSC 102/105 and CEPT specifications.

Image Rejection

Below 18MHz	Greater than 70 dB
Above 18MHz	Greater than 50 dB

IF Rejection

Below 2MHz	Greater than 80 dB
Above 2MHz	Greater than 100 dB

Frequency Stability

Tune frequency is maintained within 10Hz over the temperature range –10°C to +55°C at any setting of the clarifier control.

Cross Modulation

With a wanted carrier 60 dB above 1μV adjusted to produce standard output at an audio frequency of 1400Hz, an unwanted signal 20kHz off-tune and modulated 30% at 1000Hz must be of a level exceeding 100 dB above 1μV to produce an output greater than 30 dB below standard output.

Blocking

With a wanted signal 60 dB above 1μV, an unwanted carrier 10kHz off-tune must be of a level greater than 110 dB above 1μV to affect the output by 3 dB.

Intermodulation

The third-order intermodulation products at 400Hz and 2200Hz produced by two carriers of level 100 dB above 1μV tuned to produce outputs of 1000Hz and 1600Hz will be more than 30 dB below standard output when the individual carriers each provide an output equal to standard output.

AGC Characteristics

Output level does not change by more than 6 dB when the input level is increased by 100 dB from 2μV.

AGC Time Constant

SSB : 20ms attack, 2 sec. decay.
AM : 100ms attack, 250ms decay.

Audio Output

Line (600Ω balanced or unbalanced) : 10mW (pre-set).

Headset (600Ω) : 10mW (controlled by AF GAIN).

Loudspeaker (optional facility) : 1W.

Audio Response

Level within 6 dB, 200Hz to 3.7kHz.

Muting

Provides 17 dB of noise-quieting with variable threshold.

Overall Response

Level within 6 dB over the range 350Hz to 2.7kHz (SSB mode).

Section 2

CIRCUIT DESCRIPTION

Introduction

All versions of the EC 964/7 receiver are fully solid-state and make extensive use of integrated circuits. The basic operating voltage is 12V DC, although 24V DC and 40 – 60Hz standard mains supplies can be accommodated by inclusion of an optional series regulator board, and in the case of the AC version, a transformer and bridge rectifier circuit. Supplies with positive earth, negative earth and even batteries on float charge with neither pole at earth potential can be accommodated by virtue of the type of construction employed: this provides complete isolation between the internal circuit earth rail and the main frame of the receiver, i.e. outer cover, front panel, etc.

Isolation is extended to include external connections to the aerial input and the headset output, so ensuring complete safety when the internal circuitry is operating at other than true earth potential. A capacitor (C182) is fitted to provide an RF path between the two earths, and terminals at the rear permit linking of circuit earth to the frame when isolation is not required. The external earth return for the Diversity AGC outlet is taken directly to circuit earth and may therefore require isolated wiring in certain installations.

Most of the circuitry in the EC 964/7 series receivers is contained on one printed circuit board. Terminations to this and ancilliary components are coded, and the associated wiring is numbered for servicing convenience. Table 2.1 primarily lists sub-assemblies not directly mounted on the main printed-circuit board, but includes those components which change according to the receiver options. Pages 9 to 15 are devoted to a description of the circuit, found at the rear of this handbook, which breaks down to the various functions shown in the block diagram, which is bound in front of the circuit diagram.

TABLE 2.1. SUB-ASSEMBLIES AND COMPONENT VARIATIONS

Receiver Section	Sub-assembly or Component
RF SECTION	AERIAL ATTENUATOR UNIT PLUG-IN COIL PACK (According to desired channel) CHANNEL OSCILLATOR CRYSTAL & OVEN (According to desired channel).
IF SECTION	AM CRYSTAL FILTER (EC 964/7-C only). SSB CRYSTAL FILTER AM DETECTOR (EC 964/7-C only). CARRIER INSERTION OSCILLATOR CRYSTAL & OVEN IF AGC MODULE (EC 964/7-B and EC 964/7-C only) MUTING BOARD
AUDIO SECTION	HIGH LEVEL AUDIO BOARD & SPEAKER (Optional Extra)
MISCELLANEOUS	REMOTE INTERFACE BOARD. VOLTAGE REGULATOR BOARD (Not fitted on 12V DC only version). MAINS TRANSFORMER & BRIDGE RECTIFIER (Not fitted on 12V DC or 12/24V DC versions).

Aerial Attenuator

This unit is fitted between the aerial input socket and the input coupling to the RF Amplifier, and provides two levels of attenuation for use under strong signal conditions, e.g. a co-sited transmitter working on an adjacent channel.

A front panel switch – AERIAL ATTENUATOR – selects either a straight-through position or one or both of two identical T-networks to provide attenuation levels of 0 dB, 20 dB or 40 dB. When the receiver is under remote control, relays RLA/1 and RLB/1 are controlled by signals fed to SK2, pin 14 (see remote interface, page 13), such that the Attenuator Unit can be switched between 0 dB and the value selected by switch S1.

Protection against high induced aerial voltages is afforded by PC1 (8 diodes connected back-to-back between the aerial feed-in and frame earth).

RF Amplifier and Mixer

Signals from the Aerial Attenuator Unit are fed to RF Amplifier IC1 via the RF section (CP1) of the plug-in coil pack. This is a critically coupled high-Q bandpass filter, and is selected according to the desired reception frequency. The RF Amplifier has a nominal voltage gain of 10, and also provides the 1st application point for the AGC signal (see AGC Circuits, page 11).

Amplified RF signals are fed via R7/C4 to the mixer section (CP2) of the plug-in coil pack, which is employed to match the output from the RF Amplifier to the input of IC2. IC2 is a double balanced modulator used as a mixer, and provides a low impedance output for subsequent filter stages.

Channel Oscillator

This is a conventional crystal-controlled oscillator, supplying the Mixer with a signal 1.4MHz above the desired reception frequency. The output is taken from the base of oscillator transistor TR1 and fed via C17 to the carrier input of Mixer IC2. The collector of TR1 feeds a detector stage comprising C18, D2, D3, R15 and C19 to control feedback transistor TR2 and hence alter the bias to TR1, so maintaining a constant oscillator voltage.

Crystal XL1, maintained at a constant 65°C in a proportional oven, establishes the local oscillator frequency, with any small variations due to stray capacitance being compensated for by trimmer C257, contained in the mixer section (CP2) of the plug-in coil pack.

CLARIFIER control RV1 forms part of a potential divider, with the wiper output fed via the MODE switch to varactor diode D1. For all modes except REMOTE, RV1 can be adjusted to alter the bias on D1, effecting a change of 300Hz either side of the Channel Oscillator centre frequency. The REMOTE position of the MODE switch disconnects RV1 and allows the bias on D1 to be controlled from an external source: see Remote Interface Board, page 13.

1.4MHz IF Amplifier

All versions of the EC 964/7 employ an SSB crystal filter in the IF Amplifier, but the EC 964/7-C (DSB) version includes a preceeding AM crystal filter, together with two additional relays for switching the SSB filter out of circuit when used in the A3 mode. In the following paragraphs the EC 964/7-C version is discussed, succeeded by a separate paragraph covering the EC 964/7-A and EC 964/7-B versions.

EC 964/7-C: 1.4MHz IF signals from the Mixer stage are fed via C10 to FL1. This is an AM multi-pole crystal filter having a 6 dB bandwidth of −3.5kHz to +2.7kHz with respect to 1.4MHz. Filtered IF signals are fed to amplifier TR3 which normally has its emitter load resistor returned to circuit earth via a link on SK3. Removal of this link will desensitise the receiver by raising the emitter voltage to approximately +6V. With the link removed, this facility may be keyed remotely, e.g. during the transmission period of a co-sited transmitter.

The collector output of TR3 is fed via C23 to relay RLC/1, which in conjunction with RLD/1 switches SSB filter FL2 into circuit for Modes A3A and A3J, and bypasses this filter for the A3 (DSB) Mode. In the REMOTE Mode these relays are controlled by external signals. (See Remote Interface Board, page 13).

Because the Channel Oscillator works on the 'high side' of the desired reception frequency, a frequency inversion occurs, i.e. the oscillator forms the minuend and the received signal the subtrahend, such that the difference or IF signal is inverted. Consequently, for the reception of USB signals a lower sideband filter must be fitted at FL2.

FL2 exhibits a 6 dB bandwidth of −2700Hz to −350Hz with respect to 1.4MHz. If desired, reception of lower sideband signals can be accommodated in the EC 964/7series receivers by changing either the Channel Oscillator crystal or the filter. (See page 35).

Two outputs are taken from FL2: one feeds the muting circuitry via emitter follower TR4, and the other feeds IC3/IC4 which provide two stages of low noise voltage amplification. IC3 forms the second application point for the AGC signal, whilst the AGC input terminal on IC4 is normally held at 0V (maximum gain) by the same link on socket SK3 referred to in the second paragraph of the IF Amplifier description. Removal of this link raises the AGC input terminal to approximately +6V, shutting IC4 down. The output from IC4 is fed to a final IF transformer, which has an additional top-coupled output for the IF-derived AGC.

EC 964/7-A and EC 964/7-B: These versions of this receiver do not accommodate Mode A3 (DSB) and consequently do not require an AM filter. Therefore in these receivers FL1, inter-filter amplifier TR3, and relays RLC/1 and RLD/1 are not present, the 1.4MHz IF signal from Mixer IC2 being fed directly to SSB filter FL2. Desensitisation of these versions of the EC 964/7 is accomplished solely by the voltage variation on the AGC input terminal of IC4 – see previous paragraphs.

SSB Detector (IC6)

1.4MHz IF signals from the IF Amplifier are fed via C44 to the signal input of this device, which is a low noise double balanced modulator used as a product detector. The demodulating drive signal is derived from a separate 1.4MHz crystal-controlled Carrier Insertion Oscillator.

In the EC 964/7-A and EC 964/7-B versions of this receiver, demodulated signals are fed directly to an audio bandpass filter comprising C54, CH5 and C55, and then to emitter follower TR7, which acts as a buffer between the detection stage and the muting circuitry.

However, because the EC 964/7-C version includes an AM Detector for A3 reception, provision has to be made in this version to allow selection of either SSB or AM detection, depending upon the selected reception mode. The output from each detector is consequently fed to selector relay RLE/1, which is controlled by the MODE switch such that for all selected modes except A3, the output from the SSB Detector is utilised. Selection of A3 causes RLE/1 to switch to the AM Detector output.

Carrier Insertion Oscillator

This a conventional 1.4MHz crystal-controlled oscillator, with crystal XL2 maintained at a constant 65°C in a proportional oven. The supply for TR6 is fed from the +10V rail via the MODE switch, which removes this supply and therefore disables the oscillator for Modes A3 and REMOTE. Under remote operation the supply becomes dependant upon RLJ/1 (see Remote Interface Board, page 13).

AM Detector (IC5)

This unit is only fitted to the EC 964/7-C (DSB) version. 1.4MHz IF signals from the IF Amplifier are fed via C43 to pin 10 of IC5, which is a balanced differential amplifier with a constant current source, and is connected as an envelope detector. Capacitor C41 functions as a filter to remove the IF signal from the audio output which is then fed via RV14 to selector relay RLE/1. RV14 is adjusted to balance the output between this and the SSB Detector.

IF-derived AGC

1.4MHz IF signals, fed via C35 from the top coupling on the final IF transformer, are passed to emitter follower TR5 which acts as a buffer stage between the transformer and the first stage of the IF AGC Module.

Voltage amplifier TR9 feeds an emitter follower, TR10, which has a level-setting pre-set potentiometer as the emitter load. The output from this feeds a second emitter follower, TR11, connected as a transformer drive stage. Transformer L2, adjusted to have a bandpass at 1.4MHz, is top-coupled to a detector stage comprising D13, R119 and C126.

Mode A3 requires a longer detector time constant than the other modes: relay RLC/1 is controlled by the MODE switch to introduce R120/C127 to the detector circuit when A3 is selected. The REMOTE position of the MODE switch places RLC/1 under the control of external signals (see Remote Interface Board, page 13).

The detected signal is fed via the final stage, emitter follower TR12, to the AGC select relay, RLF/1. This relay is controlled by the MODE switch, and selects IF-derived AGC for all Modes except A3J (suppressed carrier) and REMOTE. Under remote operation RLF/1 is controlled by external signals (see Remote Interface Board, page 13).

For details of the RF GAIN control, AGC application line, and AGC derivation changes with receiver type, please see the following description concerning Audio-derived AGC.

Audio-derived AGC

Audio signals from emitter follower TR7 are fed to the muting diode and to pre-set potentiometer RV4 in the Audio AGC circuit. This adjusts the level of signal fed to emitter follower TR8, and subsequently the drive to AGC Generator IC7. This device generates an AGC voltage directly from the detected audio, and utilizes two internal detectors with different time constants (externally defined) to provide a high degree of immunity to noise bursts, and to maintain the AGC voltage constant for a period of approximately one second during pauses in speech. In addition to this, the device is capable of smoothly following the fading signals which are characteristic of HF communication, at rates of up to 20 dB/sec. The output from IC7 is fed to AGC select relay RLF/1, and hence to the AGC application line.

The EC 964/7-A version of this receiver only accommodates the A3J reception Mode, and consequently IF-derived AGC cannot be employed. Therefore in this version the IF AGC module is not incorporated, and relay RLF/1 is replaced by a wire, linked directly from the Audio AGC circuit, via diode D7, to the AGC line.

In order to preserve a low noise figure when used in the A3 (DSB) reception Mode, automatic gain control is primarily accomplished at the first IF amplifier stage, with the front-end (RF) AGC application point only being used to counteract large, long-term gain variation. Therefore the EC 964/7-C (DSB) version of this receiver includes a long-tailed pair, formed by TR22 and TR23, and a selector relay, RLK/1, in the AGC line.

For all reception Modes except A3, RLK/1 is energised and bypasses the long-tailed pair. Selection of A3 causes RLK/1 to feed the collector output from TR23 to the front-end AGC application point. The voltage on this collector is maintained at a fixed value until the signal level at the aerial input exceeds about 500μV.

RF GAIN control RV8 forms part of a potential divider network connected between +6V and circuit earth. The wiper output is fed via the MODE switch and diode D8 to the AGC line, setting the d.c. level on this line to a value corresponding to the desired gain. Blocking diodes D7 and D8 form a gate circuit, such that the AGC signal is dependent upon the relative levels of the selected AGC detector circuit and the RF GAIN control. When switched to REMOTE, RV8 is disconnected and the RF gain becomes dependant upon a d.c. level fed to pin 6, socket SK2. Pin 2 on this socket is connected directly to the AGC line, and provides the DIVERSITY AGC output.

Muting Board

1.4MHz IF signals from SSB filter FL2 are fed via emitter follower TR4 to transformer L3 on the Muting Board. L3 is tuned to have a bandpass centre frequency of 1.4MHz, passing signals in this range to three successive stages of voltage amplification provided by IC11, IC12 and IC13.

The muting threshold is determined by the voltage on the AGC terminal of IC11. At all positions of the MODE switch except REMOTE, this voltage is defined by the MUTING LEVEL control RV10, which forms part of a potential divider network connected between +6V and circuit earth. Under remote operation this voltage is externally defined (see Remote Interface Board, page 13).

Amplified signals from IC13 are passed via a second 1.4MHz acceptance transformer, L4, to source follower TR13. This feeds a detector formed by D15/C163, such that the level of base drive to TR15 is proportional to the incoming signal plus noise minus the threshold set by MUTING LEVEL control RV10. This is normally adjusted so that under no-signal (i.e. noise) conditions the detector supplies a low output; under signal conditions the threshold is exceeded, causing the detector output to assume a more positive state.

TR15 and TR16 form a Schmitt trigger: a low output from the detector (i.e. a mute demand) causing TR15 to turn OFF and TR16 to turn ON. The presence of an audio signal reverses these states, allowing TR16 collector to assume +12V. The collector load is formed by relay RLH/1, employed to switch signal lamp LP1, showing SIGNAL present. This lamp extinguishes when the receiver is muted.

Transistor TR14 and diode D16 form a disabling circuit: the MUTING LEVEL control RV10 is ganged to switch S3, so that when this control is switched to MUTING OFF TR14 is held OFF. The collector of this transistor is therefore at +12V, holding TR15 ON via D16 and consequently disabling the muting circuit, i.e. allowing audio signals to pass unimpeded from emitter follower TR7 to the audio amplifiers.

Switching S3 on, or selecting REMOTE on the MODE switch, raises the voltage on the base of TR14, reverse-biasing D16 and allowing the mute circuit to respond to signals from detector D15/C163. The mute circuit may also be disabled by an external signal (see Remote Interface Board, page 13).

Muting Diode (D4)

Muting control signals from the Schmitt trigger are fed via blocking diodes D17 and D5 to muting diode D4. R59/C60 prevent any audio signals being fed back to the Schmitt trigger or the remote lamp, which is also driven by the muting control signal, but via a separate blocking diode, D6.

The d.c. output level of emitter follower TR7 is approximately +5.5V, whilst the Schmitt trigger output from TR16 collector is +12V. Therefore diodes D17, D5 and muting diode D4 are normally forward-biased, offering the audio signal from TR7 a low impedance path to the audio amplifiers.

When a mute demand is made the output from TR16 collector is approximately +2.5V, and because TR7 emitter is at +5.5V diodes D4, D5 and D17 are reverse-biased. D4 therefore becomes a high impedance path, with only a small percentage of the audio signal (corresponding to a muting ratio of 17 dB) being fed to the audio amplifiers via C59/R58.

Audio Amplifiers

General: Two separate audio amplifiers are fitted to the EC 964/7 series of receivers: Main Audio, for local headphone monitoring purposes; and Line Audio for driving standard 600Ω lines. A separate High Level Audio board, together with an internal loudspeaker, can be incorporated when local loudspeaker monitoring is desired, or alternatively this amplifier can be used to feed an external loudspeaker.

Main Audio (IC9): This device is an audio pre-amplifier and class AB output stage, providing a nominal 10mW into 600Ω headphones. Audio signals from Muting Diode D4 are fed via C81 to the input of IC9, at pin 5. AUDIO GAIN control RV9 defines the voltage on the AGC terminal (pin 8) to effect a control range of approximately 60 dB. A small bias current is fed via D20 to the offset reference terminal (pin 9) to eliminate the threshold effect of the IC's AGC characteristic, ensuring that RV9 provides smooth control of the AF gain.

Audio output signals from IC9 are fed via C85 to impedance matching transformer T3, the secondary of which feeds the front panel headphone jack socket, JK1. A secondary output is also taken from IC9, and fed via C84 to an attenuator formed by R76/R76A. The attenuated signal is used to drive the High Level Audio board, if this is fitted – see Audio Amplifier, General.

Line Audio (IC18): This device is very similar to the Main Audio amplifier, with the input signal again derived from Muting Diode D4. The output level is pre-set by potentiometer RV5 to a nominal 10mW into 600Ω (balanced or unbalanced). The output from IC9 is fed via C70 to line matching transformer T2, which has a centre-tapped secondary feeding pins 1, 7 and 6 on socket SK1. For balanced output operation, pin 7 should be linked to frame earth (pin 8 on SK1) and the output taken from pins 1 and 6.

High Level Audio Board: This board is only fitted upon request and carries a 1 Watt integrated circuit audio amplifier, IC10, together with associated passive components. The output may be employed to drive either an internal loudspeaker, again only fitted upon request, or any 8Ω external loudspeaker to a maximum power level of 1 Watt. The latter connects to pins 2 and 5 on socket SK2.

The input drive signal for IC10 is taken from the attenuated output of IC9 (refer to Main Audio description), and in consequence the output level of IC10 is determined by AUDIO GAIN control RV9. Insertion of a headphone jack-plug into front-panel JK1 mutes the internal loudspeaker.

Remote Interface Board

All versions of the EC 964/7 receiver can be used in conjunction with an ERC974 Controller to permit remote operation at distances of up to 5 kilometres using a 5-pair cable link. Input information from the ERC974 is translated by circuitry contained on the Remote Interface Board into the necessary levels for controlling the internal circuitry and switching relays.

A full list of the circuit functions controlled by external signals under remote operation, together with the necessary drive levels, appears in Section 4 (INSTALLATION). The following sub-headings detail only those signals which are handled by the Remote Interface Board, and their subsequent switching sequences.

N.B. For remote operation, the front-panel MODE switch S2 is set to the REMOTE position.

Muting Level. When the receiver is switched to REMOTE, the Schmitt trigger formed by TR15/TR16 on the Muting Board is normally free to respond to the output from the muting detector stage, because both D16 on this board, and D18 on the Remote Interface Board, are reverse-biased by the detector output.

The muting threshold is dependent upon the d.c. level at the AGC terminal of IC11 on the Muting Board, which under remote operation is connected to pin 13, socket SK2. Application of between +2.7V and +3.7V to this pin will vary the threshold over the same range as that afforded by MUTING LEVEL control RV10 under local operation. The muting circuit can also be externally disabled by connecting pin 13 to 0V, which turns TR18 OFF and forward-biases D18.

Mode Selection: For convenience this is shown in tabular form. Note that the receiving mode capability is dependent upon the particular receiver version in use: the three different versions are listed in Section 1, page 5.

ERC 974 MODE switch	Socket SK2 pin no., and drive level necessary	Remote Interface Board circuit, and receiver relay states	Receiver circuit and effect of relays
A3	Pin 12: OV	TR19 : OFF TR20 : OFF RLJ/1 : OFF RLG/1 : OFF RLK/1 : OFF RLC/1 : OFF) RLD/1 : OFF) RLF/1 : OFF	Carrier Insertion Osc.: Inhibited IF AGC Module: Long detector time constant. AGC Application Line: Delayed 1.4MHz IF Amp: SSB filter FL2 switched out. AGC Select Relay: IF AGC
A3A	Pin 12: +6V	TR19 : OFF TR20 : ON RLJ/1 : ON RLG/1 : ON RLK/1 : ON RLC/1 : ON) RLD/1 : ON) RLF/1 : OFF	Carrier Insertion Osc.: Enabled IF AGC Module: Short detector time constant AGC Application Line: Direct 1.4MHz IF Amp: SSB filter FL2 switched in. AGC Select Relay: IF AGC
A3J	PIN 12: +12V	TR19 : ON TR20 : ON RLJ/1 : ON RLG/1 : ON RLK/1 : ON RLC/1 : ON) RLD/1 : ON) RLF/1 : ON	Carrier Insertion Osc.: Enabled IF AGC Module: Short detector time constant AGC Application Line: Direct 1.4MHz IF Amp: SSB filter FL2 switched in. AGC Select Relay: Audio AGC

Aerial Attenuator: Again, this is most conveniently shown in tabular form:—

ERC 974 AERIAL ATTENUATOR switch	Socket SK2 pin no., and drive level necessary	Remote Interface Board circuit and receiver relay states	Receiver circuit and effect of relays
0 dB	Pin 14: O/C	TR17 : ON RLA/1 : ON) RLB/1 : ON)	Aerial Attenuator Unit: Straight-through position.
20/40 dB	Pin 14: OV	TR17 : OFF RLA/1 : OFF) RLB/1 : OFF)	Aerial Attenuator Unit: 20 dB or 40 dB attenuation depending on locally selected value.

Power Supply

The power input requirements for this receiver are covered by three options: 12 DC only; 12/24V DC only; and 12/24V DC or standard 40 – 60Hz AC supply. The following paragraphs describe the operation of the latter version using an AC supply, succeeded by separate descriptions concerning the differences between this and the DC-only versions. Details of the links on plug PL5 can be found in Section 4 (INSTALLATION).

12/24V DC or standard AC supply version: The AC supply fed in via plug PL4 is transformed and rectified by T1 and bridge rectifier D22 to provide a nominal DC output of 18V. This is fed via the appropriate links on plug PL5 and DC fuse FS2 to smoothing capacitor C199. Diode D24 provides reverse polarity protection for the receiver when using battery supplies, causing FS2 to blow if the battery is inadvertently connected the wrong way round. The output from C199 is fed via appropriate links on PL5 to the Voltage Regulator Board.

IC14 is a precision voltage regulator with it's current capability extended by transistor TR21. Pre-set potentiometer RV11 (adjusted to set the output at PL5, pin 14, to +12V under normal load conditions) forms part of a potential divider network connected between the output and circuit earth. The wiper of RV11 feeds a percentage of the output voltage to the inverting input of an internal differential amplifier, which has it's non-inverting input held at a constant potential by an internal temperature-compensated source.

Normally, the differential amplifier supplies a positive output, causing an internal transistor to conduct and hold TR21 ON. If the voltage fed back from RV11 exceeds the internal reference potential, then the amplifier output changes state and subsequently switches TR21 OFF, so maintaining a constant output voltage at PL5, pin 14. Capacitor C191 is included to provide frequency compensation for the differential amplifier.

Resistor R192 defines the current limit value of the regulator: when the voltage at pin 2 (current limit) rises by more than 0.65V with respect to pin 3 (current sense), the output from the differential amplifier is inhibited, ensuring that the drive to TR21 base does not rise beyond a specific value. In this instance, current limiting is designed to occur at 3 Amperes.

The +12V regulated output is fed via the appropriate links on PL5 to the crystal ovens, oven supply lamp LP3, and standby switch S4 (ganged to the AF GAIN control). The temperatures of the crystal ovens are internally regulated (65°C) and in order to minimise the time needed for the receiver to stabilise are always fed with power. The switched supply from S4 is fed directly to those parts of the receiver circuit requiring +12V, whilst zener diodes D10, D11 and D12 provide independently stabilised lines of nominally +6V, +10V and +9V respectively.

12/24V DC only version: This is identical to the previously described power supply, except transformer T1 and bridge rectifier D22 are not fitted, the power being fed directly to PL5, pin 11. If a 12V supply is employed, the Voltage Regulator Board is shorted out by a link on PL5 between pins 5 and 6.

12V DC only version: This version is the same as the above, but does not include the Voltage Regulator Board. The 12V DC supply is fed directly to PL5, pin 11, and pin 5 is again connected directly to pin 6.

Section 3

MECHANICAL CONSTRUCTION

General

All versions of the EC964/7 receiver have the same overall dimensions, shown in Fig. 3.1, and are designed for direct mounting in 483mm (19in.) racking. Fixing slots conform to a standard centre-spacing of 76mm (3in.), and the receiver should be secured to the rack by four ¼in. BSF chromium-plated screws (Eddystone ref. 40A-330). Damage to the front-panel finish can be prevented by the use of plain washers (Eddystone ref. 27E-57).

The figure of 50mm shown in Fig. 3.1 for rear-mounted plugs etc., includes sufficient space to allow cables entering the receiver in the same plane to be bent at right-angles over a reasonable radius.

Weight

7.7Kg (17lb) All versions weigh approximately the same amount.

Internal Construction

Most of the circuitry in the EC964/7 is contained on one large printed circuit board, secured to the bottom plate of the receiver by insulative mountings. The two crystal ovens are mounted directly on the main p.c.b., whilst the Muting, IF-derived AGC and Remote Interface circuits are contained on separate p.c.b's, also on insulative mountings: screening covers are fitted on the Muting and AGC boards. The Aerial Attenuator is attached to the front panel and is at frame earth potential.

This type of construction completely isolates the circuit earth rail from the receiver frame, i.e. the outer cover, front panel, etc., and therefore provides maximum safety when the receiver is powered from a battery which is on charge with both poles floating at a dangerous potential above true earth. An additional advantage is that it also eliminates the possibility of short-circuiting the supply if the receiver is powered by a battery which has it's positive pole earthed.

A single screening panel divides the receiver proper from the power supply components, e.g. the mains transformer and large reservoir capacitor. If the receiver is fitted with a stabilised supply (standard mains or 24V DC versions only), the screening panel also provides mechanical support for the Voltage Regulator Board, and acts as a heatsink for the series regulator power transistor.

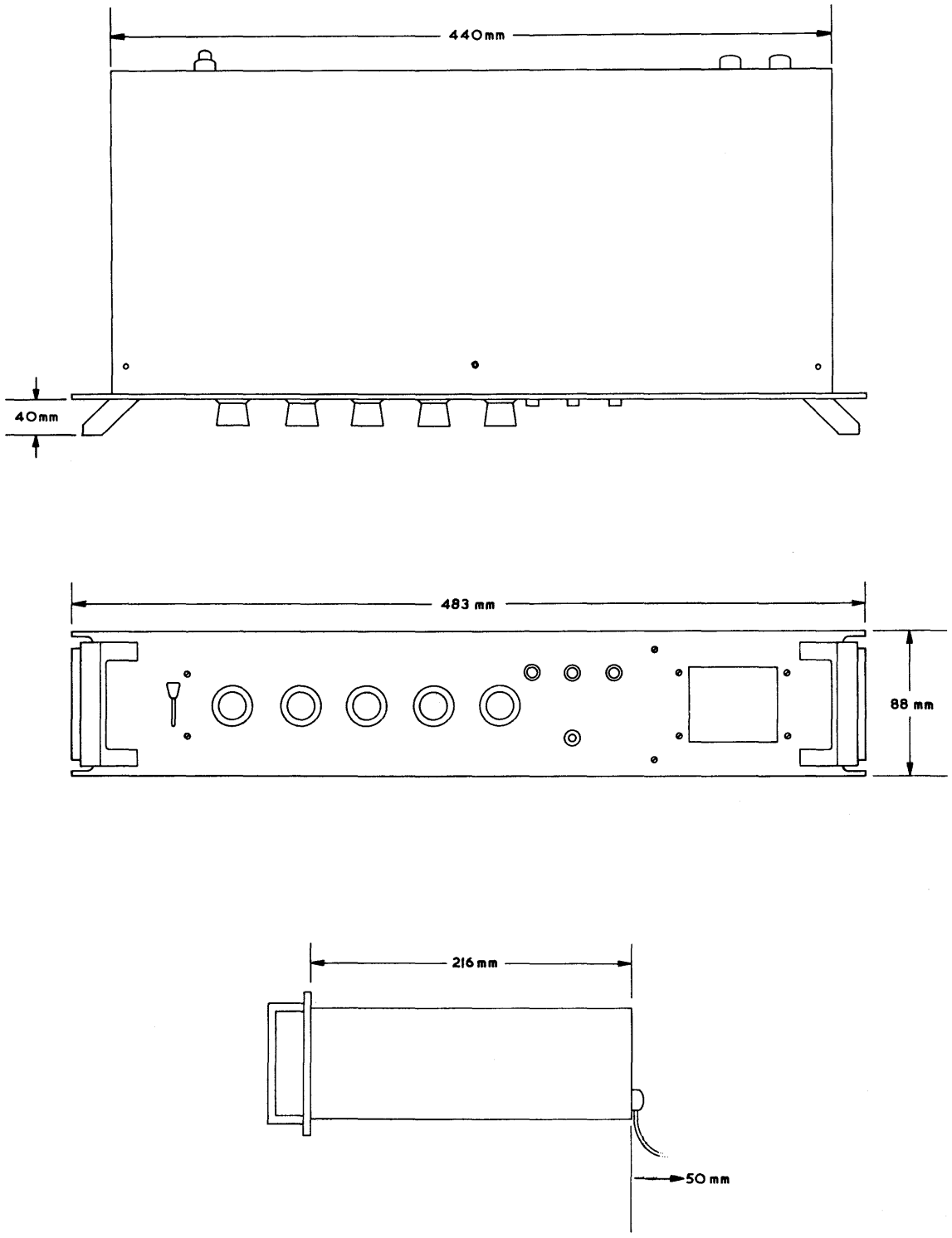


Fig. 3.1 Overall dimensions of EC964/7 series receivers.

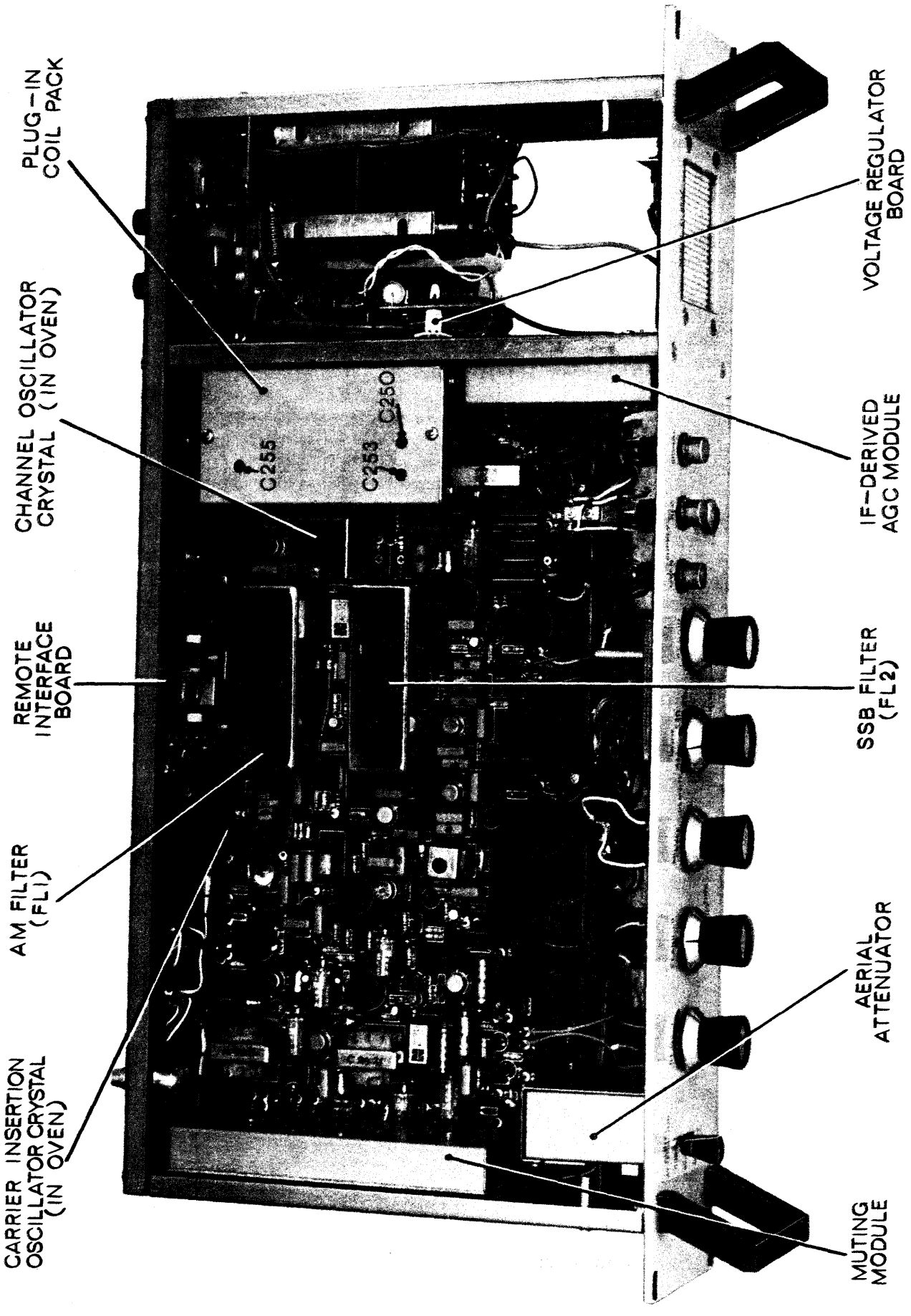


Fig. 3.2 Plan view of EC964/7 receiver.

Section 4

INSTALLATION

General

The following table lists the contents of the accessory kit supplied with those versions of the EC964/7 receiver which incorporate an AC power supply. For details of the variations in the accessory kit which occur with the DC-only versions of the EC964/7, refer to the paragraphs headed: Power Supplies and Fuse Complement.

Table 4.1 Contents of Accessories Kit

Quantity	Description	Part No.
1	AC Supply Connector (complete with 2 metres of 3-core cable)	D2311/1
1	AC Link (free-socket, ready-linked to suit AC operation)	D4757
1	DC Supply Connector (complete with 2 metres of 2-core cable, and ready-wired for 24V DC operation)	D4758
1	Ancillaries Connector (pins 9 & 4 ready-linked for receiver sensitisation)	D4703
1	Remote Connector (15-pin plug)	8902P
1	Aerial Connector (50Ω BNC plug)	8012P
3	Spare Bulbs(14V, 0.75W, for indicator lamps)	8656P
2	Spare Fuses (1A, for AC)	7173P
2	Spare Fuses (2A, for DC)	6704P
1	Allen Key (1/16in., for control knob grub screws)	8449P

Power Supplies and Fuse Complement

As stated in Section 1 of this handbook, the power supply for the EC964/7 series of receivers is covered by three options: 12/24V DC and standard AC mains; 12/24V DC only; and 12V DC only. The following sub-headings detail the voltage range to which the receiver is normally set, prior to being despatched from the factory, and any differences which exist in the contents of the Accessories Kit.

12/24V DC and standard AC mains: This power supply can accommodate AC inputs in the ranges 100–130V and 200–260V, and is normally set for 240V AC operation. Details of the power transformer primary connections can be found in the paragraphs headed: Mains Transformer Voltage Adjustment. When used with an AC input, the transformer/bridge rectifier should be connected to the voltage regulator by means of the AC Link, which is a pre-wired 15-way socket (SK5) fitted to a rear-mounted plug.

When used with a DC input, the AC Link is removed, and the DC Supply Connector fitted in it's place. The wiring inside this connector determines the DC range (i.e. either 12V or 24V) and is normally despatched from the factory to suit a 24V DC supply. For details of the connector wiring, refer to paragraphs headed: Installation for Battery Working.

Two fuses are fitted in this power supply: A 1A AC fuse on the 'Live' side of the transformer primary, and a 2A DC fuse between the bridge rectifier and the smoothing capacitor/voltage regulator. Note that the DC fuse remains in circuit during AC operation.

12/24V DC only: The accessory kit supplied with receivers fitted with this power supply does not include the AC Supply Connector, nor the AC Link. Again, the DC Supply Connector is pre-wired for 24V operation, and details of the wiring changes necessary for 12V operation can be found in the paragraph headed: Installation for Battery Working.

A single 2A fuse is fitted in the positive line before the voltage regulator, and will blow if the battery is inadvertently connected the wrong way round.

12V DC only: The accessory kit for this version is the same as the above, except that the DC Supply Connector is permanently wired for 12V. A single 2A fuse is fitted as before.

Mains Transformer Voltage Adjustment

The following description applies only to those versions of the EC964/7 receiver which incorporate a transformer/bridge rectifier for AC working. Unless otherwise specified at the time of ordering, all AC-working versions have their power transformer input tappings set for 240V operation.

The power transformer is located on the right-hand side towards the rear of the receiver, and is accessible after removing the top cover plate. Two independent 130V primary windings have their connections brought to a plate on top of the transformer, as shown in Fig. 4.1 below:

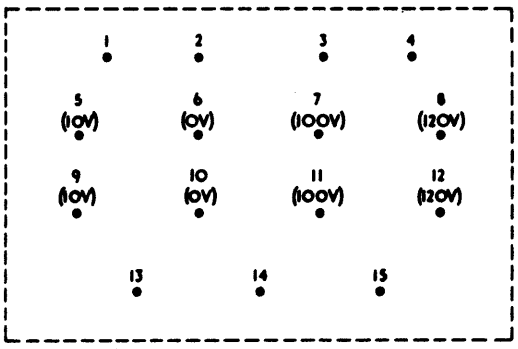


Fig. 4.1 Power Transformer Winding Connections

Table 4.2 details the full range of tapping configurations, and should be used in conjunction with Fig. 4.1. Note that the primaries are connected in parallel for voltages in the range 100–130V, and in series for the range 200–260V.

N.B. Disconnect from supply BEFORE adjusting taps.

Table 4.2 Tapping Configurations

Voltage	Link	Input
100V	6 & 10 7 & 11	6 & 7
110V	5 & 9 7 & 11	5 & 7
120V	6 & 10 8 & 12	6 & 8
130V	5 & 9 8 & 12	5 & 8
200V	7 & 10	6 & 11
210V	7 & 10	5 & 11

Voltage	Link	Input
220V	7 & 9	5 & 11
230V	8 & 10	5 & 11
240V	8 & 9	5 & 11
250V	8 & 10	5 & 12
260V	8 & 9	5 & 12

Frame/Circuit Earth Terminals

EC964/7 series receivers are assembled in such a manner that all internal circuitry is completely isolated from the outer frame, i.e. the front panel, outer cover, etc. This form of construction provides a floating circuit earth which allows complete freedom in earthing the outer frame in situations where the receiver is powered either from a battery which has it's positive pole connected to earth, or a battery that is connected to a charging circuit which places both poles above true earth potential. In neither case will there be any risk of short-circuiting the supply, and with the latter arrangement there is no danger of aerial connections, etc., attaining an unsafe potential.

Isolation of circuit earth from frame is unnecessary when operating from AC supplies or from a battery which has it's negative pole connected to earth: the same applies if the battery is free from any other connection. In all three cases the receiver should be installed with a wire link fitted between the CIRCUIT EARTH and FRAME EARTH terminals located at the rear.

N.B. This link must be removed when using any of the battery arrangements detailed in the previous paragraph.

When used with an AC supply, it is desirable for safety reasons to ensure that the earth lead (coloured green/yellow) of the AC Supply Connector is always wired to the earth pin of the local supply socket: this lead is internally connected to the frame of the receiver.

Installation for AC Working

(1) Check that pins 9 and 4 on the ancillaries connector (9-pin plug, PL3), are linked together in order to sensitise the receiver, and insert this connector into socket SK3 on the rear panel of the receiver.

(2) Check that the power transformer is set to the correct mains voltage — refer to paragraphs headed: Mains Transformer Voltage Adjustment.

(3) Place AC Link (15-way socket, SK5) onto plug PL5 on the rear panel of the receiver.

(4) Connect link between CIRCUIT EARTH and FRAME EARTH terminals on the rear panel of the receiver.

(5) Connect AC Supply Connector to AC INPUT socket on the rear panel of the receiver, and connect the mains lead to the local supply: BROWN = LIVE; BLUE = NEUTRAL; GREEN/YELLOW = EARTH.

(6) Check that OVEN SUPPLY indicator is illuminated. If not, check BOTH fuses.

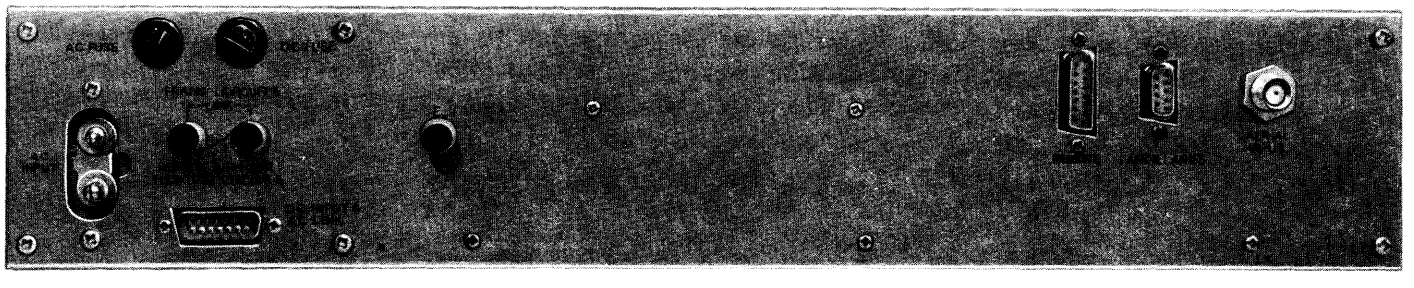


Fig. 4.2 Rear view of EC964/7 showing external connections.

Installation for DC Working

Before connecting a DC input to any of the three power supply options for the EC964/7 series of receivers, the linking of the DC Supply Connector (shown in Fig. 4.3) should be checked/adjusted in accordance with Table 4.3.

Table 4.3 DC Supply Connector Links

Voltage	Link	+ve Input	–ve Input
24V	6 & 14 5 & 13	11	15
12V	5 & 6	11	15

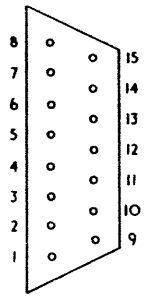


Fig. 4.3 DC Supply Connector (SK5)
Viewed on wiring side.

After carrying out the above check, and making any necessary adjustments, the following procedure should be adopted:

(1) Check that pins 9 and 4 on the ancillaries connector (9-pin plug, PL3). are linked together in order to sensitise the receiver, and insert this connector into socket SK3 on the rear panel of the receiver.

(2) Remove the AC Link (if fitted) from socket SK5 on the rear panel of the receiver, and fit the DC Supply Connector.

(3) Remove link between CIRCUIT EARTH and FRAME EARTH terminals on rear of receiver if necessary – refer to paragraphs headed: Frame/Circuit Earth Terminals.

(4) Connect DC Supply lead to appropriate voltage battery: RED = +ve; BLACK = –ve

(5) Check that OVEN SUPPLY indicator is illuminated. If not, check DC fuse.

Aerial Input

The BNC bayonet-lock coaxial connector supplied for connection to the Aerial Input socket is suitable for coaxial cable of up to 6.35mm (0.25in) outside diameter. The input impedance is close to 50Ω throughout the entire frequency coverage of the receiver, and efforts should be made to use aerial systems which approximate to this feed impedance.

Audio Output

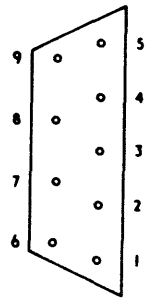
A front-panel jack socket provides connection to the audio output stage, which is capable of driving 600Ω headphones at a nominal power level of 10mW. Insertion of a jack plug in this socket mutes the internal speaker (if this, together with the associated High Level Audio Board, is fitted – refer to the appropriate paragraphs of the Circuit Description).

Ancillaries Connector

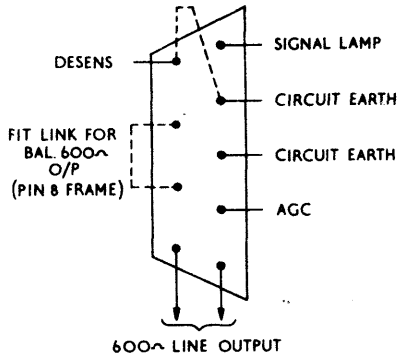
External connections for 600Ω LINES, DESENSITISATION, DIVERSITY AGC, and EXTERNAL SIGNAL LAMP are provided on the 9-way Ancillaries Connector: connections are shown in Fig. 4.4.

N.B. THE TWO EARTH CONNECTIONS OF THE ANCILLARIES CONNECTOR, USED IN CONJUNCTION WITH THE DESENSITISATION, DIVERSITY AGC, AND EXTERNAL SIGNAL LAMP CONNECTIONS, ARE RETURNED INSIDE THE RECEIVER TO CIRCUIT EARTH. CARE SHOULD BE TAKEN TO ARRANGE INSULATED EARTH RETURNS FROM THESE FACILITIES WHEN OPERATING THE RECEIVER WITH FLOATING CIRCUIT EARTH.

Fig. 4.4 External connections to Ancillaries Connector



Ancillaries Socket
viewed on socket side.



Ancillaries Plug
viewed on wiring side.

600Ω Line Output: Output level is adjustable up to a maximum of 10mW by means of an internal pre-set potentiometer (RV5). A balanced output can be provided by connecting the output transformer centre-tap to the frame of the receiver, achieved by linking pin 7 to pin 8 on the Ancillaries Connector.

Desensitisation: The IF Amplifier is normally enabled by a link fitted between pin 9 and pin 4 (circuit earth). Removal of this link will desensitise the receiver, and this connection can then be keyed from a remote location, e.g. during the transmission period of a co-sited transmitter.

Diversity AGC: The IF AGC application line is brought out on pin 2. Connections should be made with screened cable, the braid being earthed to pin 3 (circuit earth). For details concerning the operation of EC964/7 series receivers in dual-diversity, refer to the appropriate paragraphs in Section 5 (OPERATION).

External Signal Lamp: An external 14V, 0.75W lamp can be wired in parallel with the front panel SIGNAL indicator by connecting the external lamp between pin 5 and pin 4 (circuit earth) on the Ancillaries Connector. Either lamp indicates SIGNAL present, and extinguishes when the receiver is muted.

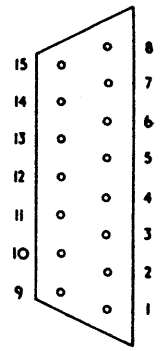
Remote Operation (with Remote Controller ERC974/2)

The EC964/7 series of receivers can be used in conjunction with an ERC 974 Controller to permit remote operation at distances of up to five kilometres. The ERC974 is a self-contained unit having it's own internal power supply (which can accept either AC or DC inputs); the unit provides the various DC levels necessary for controlling the EC964/7 receiver, these being fed via a five-pair cable link to the 15-way remote socket, SK2, mounted on the rear face of the receiver.

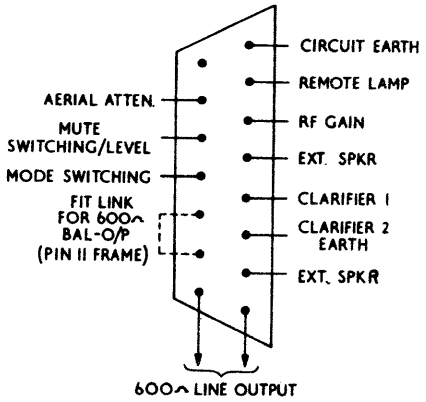
In addition to the above control levels, the cable link carries two signals from the receiver back to the Remote Control Unit: the receiver's audio output (LINE) is fed to an audio amplifier/loudspeaker in the ERC974; and the muting drive signal is fed to an amplifier and is subsequently employed to switch a front panel lamp (showing SIGNAL PRESENT when illuminated).

Fig. 4.5 External Connections to Remote connector

External Loudspeaker: In addition to the 'remote' connections on the Remote Connector, terminations are also provided (Nos 2 & 5) for connecting a local external loudspeaker (receivers equipped with High Level Audio only). The speaker should be of 8 Ω impedance, and unlike the internal speaker will not be interrupted when the headset is connected.



Remote Socket
viewed on socket side



Remote Plug
viewed on wiring side

The following table details those receiver functions which are controlled by the ERC974, the necessary drive levels, and the appropriate pin number of the remote socket, SK2. The control legends on the ERC974 are a facsimile of those on the receiver front panel, and use of the controls can therefore be extracted from the appropriate heading in Section 5 (OPERATION).

Table 4.4 Remote Operation Requirements

Function	Drive Level	Pin No.
MODE		
A3	0V	12
A3A	+6V	12
A3J	+12V	12
CLARIFIER		
For same range as local control	Between 0V and +9V, depending upon channel frequency.	4 (0V to +9V) 3 (Earth)
AERIAL ATTENUATOR		
0dB	0/C	14
20/40dB	0V	14 connected to 8
RF GAIN		
For same range as local control	+2.2V to +4.2V	6
MUTING LEVEL		
For same range as local control	+2.7V to +3.7V	13
Disabled	0V	13 connected to 8

Channel Frequency

For details concerning the procedure to be adopted for changing the channel frequency, please refer to Section 6 (MAINTENANCE).

Section 5

OPERATION

General

The following list details the full complement of operational controls provided on EC964/7 series receivers. The numbers in parentheses refer to Fig. 5.2., page 27.

AERIAL ATTENUATOR SWITCH (1)
RF GAIN CONTROL (2)
CLARIFIER (3)
MUTING LEVEL/MUTING SWITCH (4)
MODE SWITCH (5)
AF GAIN/STANDBY SWITCH (6)

Control Functions

AERIAL ATTENUATOR SWITCH

Selects either 0dB, 20dB or 40dB attenuation at the Aerial Input for use under strong signal conditions, e.g. a co-sited transmitter working on an adjacent channel. (The ERC974 Controller can only switch between 0dB and the locally selected value of attenuation).

RF GAIN CONTROL

Adjusts bias to AGC input of RF and IF amplifiers. Normally set to maximum gain position and only reduced when it is desired to lower the sensitivity of the receiver, e.g. under noisy signal conditions.

CLARIFIER

Alters the reception frequency some 300Hz either side of the Channel Oscillator centre frequency by varying the bias on a varactor-tuned circuit. Adjust for optimum signal reception.

MUTING LEVEL CONTROL/ MUTING SWITCH

Defines the noise/signal threshold at which muting will occur. Normally set so that receiver is muted for all conditions except reception of desired signal. When muted, the audio output decreases by 17dB.

MODE SWITCH

Selects the appropriate detector and effects various other circuit changes to suit the type of signal to be received. The four positions are marked:—
A3A/A3H – A3J – A3 – REMOTE
N.B. The reception mode capability is dependent upon the receiver variant. For details of these, please refer to Section 1, page 5.

AF GAIN CONTROL/ STANDBY SWITCH

This controls the audio output level from the front-panel jack socket (and the separate output from the High Level Audio Amplifier/Speaker if this is fitted) over a range of approximately 60dB.
In the STANDBY position, the supply to the receiver circuits is switched off, but power is still fed to the crystal ovens to minimise receiver settling time.

Setting-up Procedure

(1) For details of power supply connections refer to the paragraphs in Section 4 (INSTALLATION) appropriate to the intended input voltage. Check that the OVEN SUPPLY indicator is illuminated.

(2) Check that the Ancillaries Plug (PL3) is fitted, and that pin 9 is linked to pin 4 (unless it is intended that the receiver should be sensitised/desensitised from a remote key, in which case refer to Section 4: INSTALLATION, sub-heading Desensitisation).

(3) Connect the Aerial down-lead to the Aerial Input socket (SK1) by means of the BNC plug provided.

Setting-up Procedure (contd.)

(4) Unless the receiver incorporates a High Level Audio Amplifier and internal speaker, connect a pair of 600Ω headphones, via a jack-plug, to the front panel PHONES socket.

(5) Set the following controls to the positions stated:—

AERIAL ATTENUATOR SWITCH	:	0dB
RF GAIN CONTROL	:	Fully clockwise
CLARIFIER CONTROL	:	Mid-position
MUTING LEVEL CONTROL/SWITCH	:	MUTING OFF
MODE	:	Desired reception mode

(6) Advance the AF GAIN CONTROL from the STANDBY position, and check that the REC SUPPLY indicator becomes illuminated, and that the desired signal can be heard over the headphones or internal speaker. If the signal is predominantly noisy, lower the r.f. gain by backing-off the RF GAIN CONTROL in an anti-clockwise direction.

(7) Adjust the CLARIFIER CONTROL for optimum reception.

(8) During a suitable pause in transmission, advance the MUTING LEVEL CONTROL to a fully clockwise position, noting that the SIGNAL indicator illuminates, and then back the control off until the SIGNAL indicator just extinguishes. This indicator will now only illuminate during the transmission period of the desired signal, and shows that for all other conditions the receiver is muted.

(9) If a strong signal on an adjacent channel interferes with the normal working of the receiver, the RF signal from the Aerial can be reduced by setting the AERIAL ATTENUATOR SWITCH to either 20dB or 40dB, depending upon the signal strength. If the attenuation is altered, the settings of the other controls should be checked and if necessary re-adjusted to suit prevailing conditions.

Dual-diversity Operation

Two EC964/7 receivers can be operated in a dual-diversity mode by (1) interconnecting their DIVERSITY AGC outputs (pin 2 on the ANCILLARIES CONNECTOR, SK3), and (2) combining their 600Ω LINE OUTPUTS as shown in Fig. 5.1.

N.B. Coaxial cable should be employed to connect the DIVERSITY AGC outputs, with the braid connected to pin 3 on each ANCILLARY CONNECTOR, SK3. Care should be taken to insulate the braid, because this is connected to circuit earth, which may be at a dangerous potential above true earth if the FRAME/CIRCUIT EARTH LINK is not fitted — refer to Section 4, page 21.

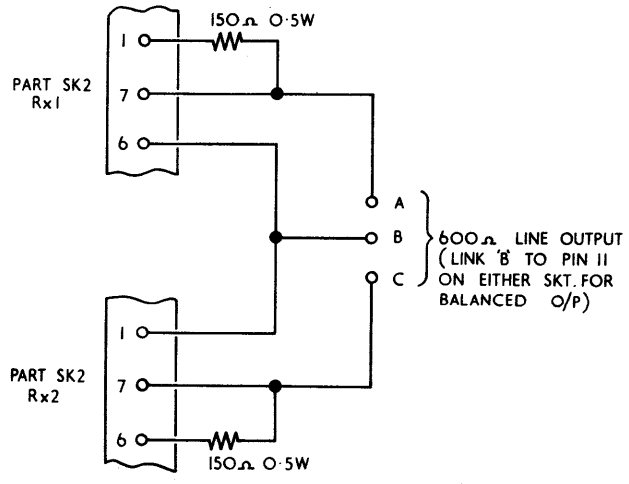


Fig. 5.1 600Ω LINE OUTPUT Connections for dual-diversity operation.

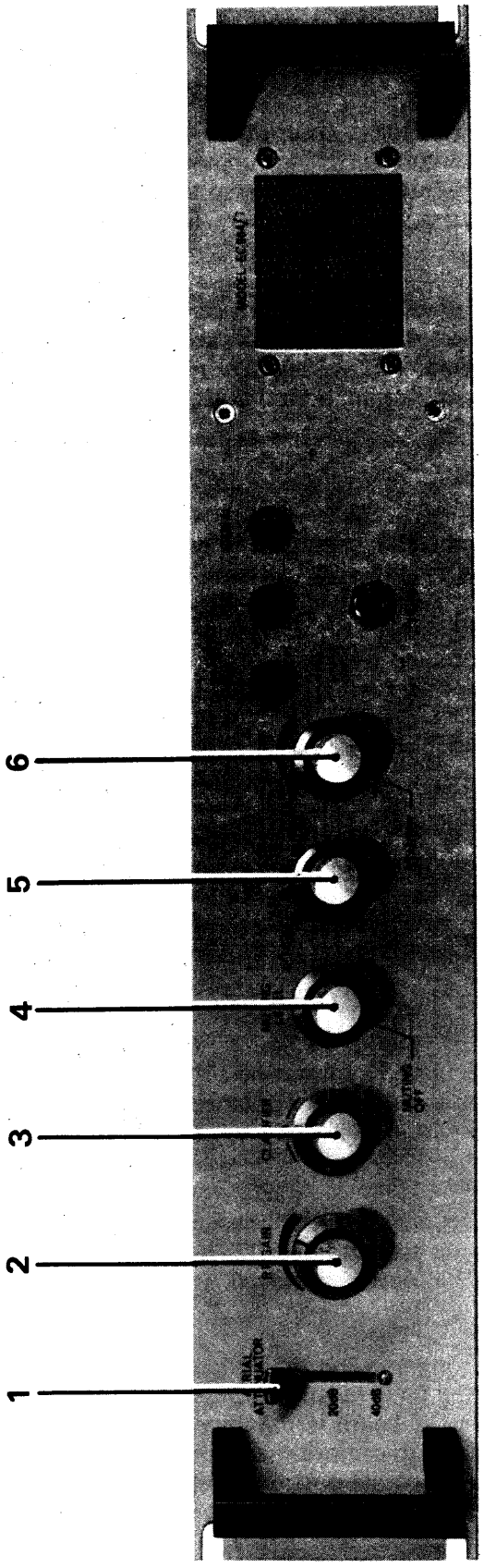


Fig. 5.2 Front Panel Controls of EC964/7 Series Receivers

Section 6

MAINTENANCE

General

The basic design features of the EC964/7 series receivers ensure that these are extremely reliable units, e.g. the use of vacuum-reed relays for the majority of circuit switching functions, and the use of a single main printed circuit board, both of which obviate a large number of interconnection points and switch connections. Consequently, these receivers should require very little in the way of routine maintenance, even when used continuously under arduous operating conditions.

This section of the Handbook gives guidance for simple operations such as changing fuses and indicator lamps, and then progresses to more detailed instruction on performance testing, re-alignment, etc. Appendix 'A' on page 36 contains a comprehensive analysis of all circuit voltages for reference when carrying out fault-finding, and should be used in conjunction with the circuit diagram bound at the rear of this handbook.

Fuse Replacement

Two screw-in type fuse holders are located on the rear panel of the receiver. The AC fuse (only included when the receiver incorporates on AC power supply) is rated at 1A; the DC fuse at 2A. The latter remains in circuit during AC operation.

Spare fuses are included in the accessory kit supplied with every receiver, and additional spares may be ordered by quoting Eddystone part number 7173P for the 1A fuse, and 6704P for the 2A fuse.

Indicator Lamp Replacement

The three front panel indicators: OVEN SUPPLY; REC SUPPLY; and SIGNAL, employ miniature bulbs rated at 14V, 0.75W. Access to these is obtained by simply unscrewing the coloured bezel. Three spare bulbs are included in the accessory kit supplied with every receiver, but further spares can be ordered by quoting Eddystone part number 8656P.

Circuitry Access and Sub-assembly Removal

General: Removal of the receiver top cover is achieved by inserting a screwdriver blade under each of the plastic 'pop-fasteners' in turn, and gently levering them up. All preset potentiometers and trimmer capacitors (with the exception of C257), including those contained within separately screened modules, are immediately accessible without further dismantling.

The variable inductors in this receiver (e.g. inter-stage coupling transformers) employ self-locking cores, and should not normally require re-adjustment. Access to these and C257, is therefore limited to the point at which the separately screened modules may have their covers removed, e.g. during complete re-alignment of the receiver.

The following paragraphs detail the procedure for removing the various screened modules and ancillary printed circuit boards, should this prove necessary during fault location or re-alignment. Complete removal of a board will necessitate unsoldering the cable-form from the board terminations: both these and the leads are numbered to facilitate replacement. It should not be necessary to remove the main printed circuit board, since access to the underside of this can be gained simply by removal of the bottom cover, which is retained in a similar fashion to the top.

Aerial Attenuator: Located behind the front panel at the bottom left-hand corner of the receiver. To remove this unit, the black plastic toggle should be pulled off, and the two front panel screws removed.

Plug-in Coil Pack: Located towards the rear of the receiver, adjacent to the dividing partition. This unit is simply lifted out of two sockets mounted on the main printed circuit board. Two screws secure the screen, removal of which gives access to C257 and the RF bandpass/mixer inductors. These components should not require re-adjustment.

IF-derived AGC Module: Not fitted on the EC964/7-A version. Located in front of the plug-in coil pack, mounted on the dividing partition. Two screws secure the screen, removal of which gives access to variable inductor L2. Two hexagonal pillars retain the board.

Muting Module: Mounted on the left-hand side panel of the receiver. The screen is retained by two screws, removal of which gives access to variable inductors L3 and L4. Two hexagonal pillars retain the board.

Remote Interface Board: Mounted on the back panel of the receiver, and secured by two 6BA nuts. If this board is removed and subsequently replaced, ensure that the wires terminating on the board do not short out against the securing nut.

Voltage Regulator Board: Only fitted on AC and 24V DC working versions of the EC964/7. Mounted on the right-hand side of the dividing partition, and secured by two plastic fasteners. To remove, gently squeeze each fastener in turn, at the same time pulling the board outwards.

High Level Audio Board: Only fitted upon request. Mounted in front of the voltage regulator board, and secured in a similar fashion to The Voltage Regulator Board.

Performance Testing

WARNING

The EC964/7 series of receivers have provision for operation with floating circuit earth to permit direct connection to DC power supplies which do not have their negative pole connected to earth. Personnel should note that when the receiver is operated in this manner, there is a possibility that on some installations a dangerous potential may exist between the internal circuitry and the outer frame. Caution must therefore be exercised in handling the set with the covers removed, and special precautions should be taken when connecting test equipment. Wherever possible the receiver should be transferred to an alternative power source which allows it to be operated with the FRAME/CIRCUIT EARTH LINK in position.

Voltage Analysis: A complete list of voltage values for all IC's and Transistors, etc., will be found in Appendix 'A' on page 36.

Test Equipment: The following equipment in the Marconi Instruments range is recommended for performance testing and re-alignment of the EC964/7 series of receivers.

TF2002B MF/HF AM/FM SIGNAL GENERATOR

Freq. range : 10kHz – 88MHz. High discrimination electrical fine tuning, calibrated against comprehensive crystal calibrator. Internal modulating frequency continuously variable from 20Hz – 20kHz.

TF2170B DIGITAL SYNCHRONIZER

Provides synthesiser accuracy for TF2002B signal generator. Freq. range: 32kHz – 88MHz. Digital locking facility in 10Hz steps.

TF2103 WIDE RANGE OSCILLATOR

Freq. range : 10Hz – 1MHz.
Sinewave and squarewave.

TF2331 DISTORTION FACTOR METER

Fundamental range: 20Hz – 20kHz. Distortion and noise from less than 0.05%.
Built-in demodulation.

TF2414A COUNTER

Frequency measurement to 40MHz.
10mV sensitivity.
Self-test facility.
Six digit read-out.

TF2603 RF ELECTRONIC MILLIVOLTMETER

Wide freq. range: 50kHz – 1500MHz.
High sensitivity: from 300 μV.
All solid state.

TF893A 10-WATT AF POWER METER

Freq. range: 20Hz – 20kHz.
Five power ranges: 1mW – 10W.
Impedance: 2.5Ω to 20KΩ in 48 steps.
Direct calibration in watts and dBm.

Overall performance check: If substandard performance is suspected, withdraw the receiver from service and carry out the overall performance check given below in the following paragraphs.

N.B. In all the following checks, and in the Re-alignment and Stage Testing procedure, it is assumed that a USB receiver is being tested and therefore, where appropriate, RF signals are referred to as 'Carrier Frequency + 1 kHz'. If an LSB receiver is being tested, these references should be ignored, and the RF signal should be Carrier Frequency – 1 kHz.

(a) Check that the sensitisation link is fitted (pins 9 and 4 on the ANCILLARIES CONNECTOR, PL3).

(b) Connect RF signal generator to AERIAL INPUT socket using BNC connector.

(c) Connect AF power meter (matched to 600Ω) to pins 1 and 6 on the ANCILLARIES CONNECTOR, PL3.

(d) Set receiver front panel controls as follows:

AERIAL ATTENUATOR : 0dB	MUTING LEVEL : MUTING OFF
RF GAIN : Max (clockwise)	MODE : A3J
CLARIFIER : Mid-position	AF GAIN : Max (clockwise)

(e) Tune RF signal generator to the appropriate carrier frequency + 1 kHz, and slowly increase the output level, noting the AF output displayed on the power meter. As soon as this ceases to increase (showing AGC threshold) note the RF input level: this should not be greater than 2 μV.

(f) If the overall sensitivity of the receiver, as measured above, is found to be low, carry out the audio and IF sensitivity checks detailed in the following paragraphs.

Audio Sensitivity Check: The following checks should be made with the front panel controls set to the same positions as they were in paragraph (d) of the overall performance check.

(1) 600Ω line output

(a) Connect AF power meter (matched to 600Ω) to pins 1 and 6 on the ANCILLARIES CONNECTOR, PL3.

(b) Remove test link between pins 35 and 36 on the main p.c.b., and inject a 1kHz signal from the AF generator into pin 36.

(c) AF input level required for 1mW output should not be greater than 10mV.

(d) Check AF bandwidth. Output should be level within 3dB over the range 250Hz to 3.5kHz.

(2) 600Ω phones output

(a) Using a jack plug, connect the AF power meter (matched to 600Ω) to the front panel PHONES socket.

(b) Repeat paragraph (b) of the 600Ω line output sensitivity test, and check that the output is at least 10mW for a 10mV input.

(c) Replace test link between pins 35 and 36.

(d) If the above checks do not reveal the reason for low overall sensitivity, proceed with the IF sensitivity check detailed in the following paragraphs.

IF Sensitivity Check: Receiver front panel controls should again be set as detailed in paragraph (d) of the overall performance check, unless otherwise specified.

(a) Connect AF power meter (matched to 600Ω) to pins 1 and 6 of the ANCILLARIES CONNECTOR, PL3.

(b) Remove test link between pins 27 and 28 on the main p.c.b., and inject a 1399 kHz signal from the RF generator into pin 28.

(c) Check that the input level required for an AF output of 1mW does not exceed 7.2mV.

(d) If the receiver is equipped for A3 reception (EC964/7–C versions only), set the MODE switch to A3, and inject a 1400kHz signal (modulated 50% at 1kHz) from the RF generator into pin 28.

(e) Check that the input level required for an AF output of 1mW does not exceed 7.2mV.

(f) Replace test link between pins 27 and 28.

(g) If the above check does not reveal the reason for low overall sensitivity, proceed with fault diagnosis and/or re-alignment.

Re-alignment and Stage Testing

General: Close tolerance components are used in all tuned circuits throughout the receiver, and re-alignment is not likely to be required unless coils and/or associated capacitors have been changed.

Detailed instructions for re-aligning all pre-set circuits are given in the following paragraphs on the assumption that the necessary adjustments will only be carried out by skilled personnel having a sound knowledge of the basic procedures involved. A suitable range of test equipment is listed on page 30. Receivers may be returned to Eddystone if this course of action is preferred.

General (Continued):

The receiver front panel controls should be set to the following positions unless otherwise specified:—

AERIAL ATTENUATOR : 0dB	MUTING LEVEL : MUTING OFF
RF GAIN : Max (clockwise)	MODE : A3J
CLARIFIER : Mid-position	AF GAIN : Max (clockwise)

N.B. (1) Refer to warning on page 29.

(2) Check that sensitisation link is fitted between pins 9 and 4 on the ANCILLARIES CONNECTOR, PL3.

(3) All pre-set components are self-locking.

Power Supply: If the receiver incorporates a voltage regulator board (24V DC and 24V DC/Standard AC mains versions only), pre-set potentiomenter RV11 on this board should be adjusted to set pin 96 at +12.0V.

Line Audio: Set standard output as follows:—

(a) Remove test link between pins 35 and 36 on the main p.c.b., inject a 1kHz AF signal into pin 36, and adjust RV5 to give a line output of 1mW into 600Ω for an input of 10mV. This output is now referred to as the STANDARD OUTPUT.

(b) Check that the frequency response is within 3dB over the band 250Hz to 3.5kHz.

(c) Check that the muting control effects a reduction in output of 17 ± 2dB.

Main Audio: Check that output from PHONES socket is at least 10mW into 600Ω for a drive level of 10mV to pin 36.

High Level Audio: This amplifier is only fitted to special order, and should be capable of providing an output of 1 Watt into 8Ω. Distortion should not be greater than 5% at 800mW.

Carrier Insertion Oscillator: Measure oscillator output at test point B using a low capacity probe. Voltage should be between 50 and 100mV. Adjust C52 to give a frequency of 1400.000kHz.

SSB Detector: Remove test link between pins 27 and 28 on the main p.c.b., inject an RF signal of 1399kHz into pin 28, and check that the level required for standard output is 7.2mV.

AM Detector: This is only fitted to the EC964/7—C version. Set MODE switch to A3, remove test link between pins 27 and 28 on the main p.c.b., and inject an RF signal at 1400kHz, modulated 50% at 1kHz and of level 7.2mV, into pin 28. Adjust RV14 for standard output.

IF Amplifiers: Set MODE switch to A3J. Short the AGC application line (pin 41 on main p.c.b.) to circuit earth, and inject an RF signal of 1399kHz at the junction of C25 and C28. Adjust L1 for maximum output, and then check that not more than 3.5 μV is required at C25/C28 for standard output.

Channel Oscillator: Measure oscillator output at test point A using a low capacity probe. Voltage should be between 50 and 150mV. Adjust CLARIFIER CONTROL (and RV2/RV3 if necessary) to bring output to channel frequency.

Selectivity (SSB): The following selectivity figures are for a standard version of the EC964/7, i.e. an upper sideband receiver, with the channel oscillator crystal on the 'high' side of the incoming carrier. For details of lower sideband reception and/or crystal changes, please refer to the paragraphs in this section headed: Procedure for Changing Channel Frequency, or Procedure for Changing Received Sideband.

Set MODE switch to A3J. Short the AGC application line (pin 41 on the main p.c.b.) to circuit earth, remove the plug-in coil box, and inject an RF signal of (carrier frequency + 1kHz) into pin 14 of the coil pack socket. With an RF millivoltmeter connected to pin 28 on the main p.c.b., the following selectivity figures should be met:—

−6dB : +350Hz to +2700Hz
−20dB : 0Hz
−35dB : +3100Hz
−60dB : −500Hz to +3400Hz

Notes: (1) All frequencies are with respect to carrier frequency.
(2) Maximum ripple at bandpass is not greater than 3dB.

Selectivity (AM): The AM filter (FL1) is only fitted to those receivers designed for mode A3 reception (i.e. EC964/7—C versions only). The technique for measuring AM selectivity is the same as the above test, but the MODE switch should be set to A3.

−6dB : −2700Hz to +3500Hz
−20dB : ±6kHz
−60dB : ±10kHz
−80dB : ±30kHz

Note: All frequencies are with respect to the carrier frequency.

Plug-in Coil Pack: The inductors in this module should not require re-adjustment: their cores are set at the factory, and any minor changes which may occur, e.g. if the coil pack is changed to allow a different channel frequency to be used, should be accommodated solely on the trimmer capacitors.

Re-insert the coil pack (removed for the previous selectivity tests), but leave the AGC application line shorted to circuit earth. Set MODE switch to A3J. Inject an RF signal at carrier frequency + 1kHz into the AERIAL socket, and adjust C250, C253 and C255 for maximum AF output. Standard output should be achieved for not more than 2 μV at the aerial.

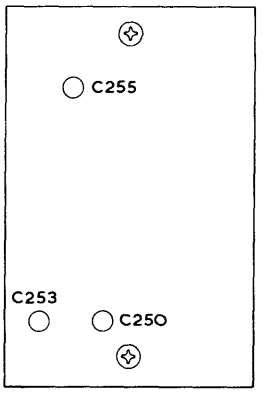


Fig. 6.1 Location of trimmer capacitors in plug-in coil pack.

Audio-derived AGC: Remove AGC application line shorting link, check that RF GAIN CONTROL is at maximum and MODE switch at A3J; apply an RF signal of (carrier frequency + 1kHz) to the AERIAL input. Monitor the AF output, and check that AGC threshold occurs at an input signal level of not greater than 2 μV. If necessary, adjust RV4. Increase the RF input level to 1mV, and re-adjust RV5 to give standard output (1mW into 600Ω).

IF-derived AGC: This circuit is not fitted to the EC964/7-A (Suppressed Carrier only) version of the receiver. Set MODE switch to A3A, RF GAIN CONTROL to approximately mid-travel, and RV6 to mid-travel. Inject an RF signal of (carrier frequency + 1kHz) into the AERIAL input socket, at an appropriate level to give an AF output 6dB down on standard output. Adjust L2 for maximum DC voltage at pin 66 on the IF-derived AGC board. Turn RF GAIN to maximum, set input level at AERIAL socket to 1mV, and adjust RV6 for standard output. Check that the AGC threshold is not greater than 2 μV.

Delayed AGC: Employed for A3 reception (Model EC964/7–C version only). Connect voltmeter to base of TR23, set RV12 to mid-position and adjust RV13 for reading of +3V. Select A3 mode. Introduce 50mV carrier at aerial input, modulated 30% at 1kHz and adjust RV12 for 3.7V at *collector* of TR23.

Decrease input level to 100μV and check that TR23 collector voltage falls to approximately 2V. If necessary, re-adjust RV13, and possibly RV12 also, for nominal reading of 2V.

Finally, check that a S/N ratio of 35dB or better is obtained for all signals greater than 50dB above 1μV.

Muting: Set MODE switch to A3J, and RF GAIN to maximum. Apply an RF signal to the AERIAL input of (carrier frequency + 1kHz) at a level of 100 μV. Advance the MUTING LEVEL CONTROL (RV10) to mid-position, and adjust L3 and L4 for maximum DC voltage across C163, with the SIGNAL lamp off. RV7 may need to be adjusted slightly to keep this lamp extinguished.

Replace the module cover, reduce the RF signal level to 1μV, and advance the MUTING LEVEL CONTROL to it's fully clockwise position. Adjust RV7 until the SIGNAL lamp just comes on. Check that an RF input signal of 100 μV can be muted when the control is fully anti-clockwise.

Clarifier: Set MODE switch to A3J, and apply an RF signal to the AERIAL input of (carrier frequency + 1kHz) at a level of 1mV. Set CLARIFIER CONTROL to mid-position, and adjust RV2/RV3 to set the wiper of the CLARIFIER CONTROL at +4.5V DC. Adjust C257 (located inside the plug-in coil pack, and not externally accessible) to give an AF output of 1kHz. Re-adjust RV2/RV3 until the required clarifier swing about the channel oscillator centre frequency is achieved (measured with a low-capacity probe at test point A).

RF GAIN CONTROL: Check that from a basic sensitivity of 2 μV, this control has a dynamic range of not less than 60dB.

AERIAL ATTENUATOR: Check the 20dB and 40dB attenuation positions.

Procedure for Changing Channel Frequency

General: EC964/7 receivers can accommodate one channel in the bands 1.6MHz to 27.5MHz, or 400kHz to 535kHz. The basic procedure for changing the channel frequency is to calculate the necessary channel oscillator crystal frequency, using the simple formula given below, and to then select the appropriate plug-in coil pack from Table 6.1.

The channel oscillator frequency is normally chosen to be on the 'high' side of the incoming carrier (i.e. crystal frequency = signal frequency + 1.4MHz). This causes an inversion process to take place in the mixer stage, so that for the reception of Upper Sideband (USB) signals, the SSB filter FL2 must have a Lower Sideband (LSB) bandpass. All receivers are fitted with a filter of this type unless otherwise specified at the time of ordering.

Calculation of Channel Oscillator Crystal Frequency: Use the formula given here to decide upon an appropriate crystal frequency and then check the plug-in coil pack type, listed in table 6.1.

CRYSTAL FREQUENCY = SIGNAL FREQUENCY +1.4MHz

Table 6.1 Plug-in Coil Pack Frequency Ranges

Frequency Range	Coil Pack No.
1.6 – 3.0 MHz	LP3316/1
3.0 – 5.7 MHz	LP3316/2
5.7 – 10.8 MHz	LP3316/3
10.8 – 20 MHz	LP3316/4
20 – 27.5 MHz	LP3316/5
400 – 535 kHz	LP3316/6

Channel Oscillator Crystal Removal: The channel oscillator crystal oven is located next to the plug-in coil pack. The single screw on top of the oven should be slackened off, allowing the cover to be moved to one side and lifted free. The crystal is a plug-in component, and may be pulled free by the tape which encircles it. Care should be exercised when replacing the crystal since the legs employ a glass to metal seal.

Ordering Crystals and/or Plug-in Coil Packs: These can be ordered from: Eddystone Radio Ltd., Alvechurch Rd., Birmingham B31 3PP. Quote Receiver Type and Serial No., CRYSTAL frequency and Coil Pack No.

Procedure for Changing Received Sideband

General: EC964/7 receivers are normally supplied for Upper Sideband (USB) reception, with the channel oscillator supplying the mixer with a signal on the 'high' side of the incoming carrier. Due to the inversion process that occurs in the mixer, these receivers are fitted with a Lower Sideband (LSB) bandpass filter (FL2). Therefore, if LSB reception is desired, FL2 must be changed to a USB bandpass type.

Alternatively, (for carrier frequencies above 3MHz only), LSB reception can be obtained using the standard LSB filter, provided the crystal frequency is calculated from the formula:—

CRYSTAL FREQUENCY = SIGNAL FREQUENCY – 1.4 MHz.

This procedure is limited to frequencies above 3MHz simply because of the physical size of relatively low frequency crystals, which cannot be accommodated in the crystal oven.

Removal of SSB Filter FL2: Located in the centre of the main p.c.b. in front of filter FL1, and secured to the board by two nuts and two soldered pins. Ensure that all solder is removed from these pins before attempting to remove the filter, and note that the extended application of heat is to be avoided, because the pins employ glass to metal seals. Use of an efficient desoldering tool is recommended.

Ordering Replacement SSB Filter: Replacement SSB filters can be ordered directly from Eddystone Radio Ltd., Alvechurch Rd., Birmingham B31 3PP by quoting the following codes:—

USB SSB FILTER FOR EC964/7 : 8939P
LSB SSB FILTER FOR EC964/7 : 8646P

N.B. The sidebands referred to in the above paragraph are those of the FILTER.

Appendix 'A'

VOLTAGE ANALYSIS

General

In the event of the receiver failing to operate normally, first check all voltages at the unit/board terminations listed in Table 1 below. If these voltages check out normally, refer to Tables 2 and 3 in this section, and carry out a detailed examination of individual IC and transistor voltages. The readings given in Table 1 were taken with a standard 20,000Ω/V testmeter (AVO Model 8): 10% variation should be allowed to cover the usual zener/semiconductor spreads. All voltages are with respect to circuit earth, and measurements should be taken using the 2.5V, 10V and 25V ranges of the testmeter, as appropriate.

Before commencing measurements, the receiver controls should be set to the following positions, or as indicated in the relevant column in Table 1.

AERIAL ATTENUATOR SWITCH	: 0dB	MUTING LEVEL CONTROL	: MUTING OFF
RF GAIN CONTROL	: Fully Clockwise	MODE SWITCH	: A3
CLARIFIER CONTROL	: Mid-position	AF GAIN CONTROL	: Mid-position

Table 1 Unit/Board Supplies, Etc.

Unit/Board	Pin	Service	Voltage/remarks
REGULATOR	92	Bridge output	+18V
	96	Regulator output	+12V
MAIN BOARD	54/55	+12V Voltage rail	+12V
	32	Carrier Insertion Oscillator supply	+10V with mode at A3A or A3J
	4	Varactor drive	Approximately +4.5V
	37	Muting Diode drive	+10V (MUTING LEVEL CONTROL set to MUTING OFF). +2V (MUTING LEVEL CONTROL advanced to point at which receiver mutes).
	26	Relay drive	+12V (MODE SWITCH set to A3 or REMOTE). 0V (MODE SWITCH set to A3A/A3H or A3J).
	39	Relay drive	+12V (MODE SWITCH set to A3A/A3H or A3 or REMOTE). OV (MODE SWITCH set to A3J). N.B. Reset MODE SWITCH to A3
	40	RF GAIN CONTROL output	Approximately +2V to +4V for full rotation of RF GAIN CONTROL.
IF AGC BOARD (not fitted on EC964/7-A)	64	+12V Voltage rail	+12V
	65	Relay drive	+12V (MODE SWITCH set to A3 or REMOTE) OV (MODE SWITCH set to A3A/A3H or A3J). N.B. Reset MODE SWITCH to A3

Table 1 **Unit/Board Supplies, Etc. (contd.)**

Unit/Board	Pin	Service	Voltage/remarks
MUTING BOARD	79 76	+12V Voltage rail Disabling circuit drive	+12V 0V (MUTING LEVEL CONTROL set to MUTING OFF) +0.7V (MUTING LEVEL CONTROL set to any position except MUTING OFF).
HIGH LEVEL AUDIO BOARD (if fitted)	59	+12V Voltage rail	+12V
REMOTE INTERFACE BOARD	81	+12V Voltage rail	+12V N.B. Remove REMOTE PLUG (PL2), if fitted.
	82	Aerial Attenuator relay drive	+0.3V
	86	AGC derivation relay drive	+12V (MODE at 'REMOTE')
	87	Mode switching relay drive	+12V
	88	+10V Voltage rail	+10V

Appendix 'A'

IC Voltages

The front panel controls should be set to the positions detailed on page 36, unless modified by the notes in the right-hand column of Table 2. All readings should be taken with a testmeter of 20,000Ω/V sensitivity (AVO Model 8), and as before, a 10% tolerance exists on these figures.

With the following exceptions, all IC's are mounted on the main printed circuit board:—

1) IC10 is mounted on the High Level Audio Board, which is only fitted to special order.
2) IC11, IC12, and IC13 are mounted on the Muting Board.
3) IC14 is mounted on the Voltage Regulator Board, which is fitted to the AC and 24V DC powered versions of the EC964/7.

Table 2 IC Voltages

IC Ref	Pin Numbers																Notes
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
IC1	—	6.0	1.6	0	0.9	0.9	1.6	0	—	—	—	—	—	—	—	—	1
IC2	0	2.7	2.7	6.0	3.4	—	2.7	0	—	—	—	—	—	—	—	—	
IC3	—	6.0	2.0	0	0.7	0.7	1.6	0	—	—	—	—	—	—	—	—	2
IC4	—	6.0	1.9	0	0.7	0.7	0	0	—	—	—	—	—	—	—	—	3
IC5	6.1	0	2.0	1.9	6.5	0	6.1	7.4	11.3	5.2	—	—	—	—	—	—	
IC6	0	2.1	2.1	4.7	2.7	—	2.1	0	—	—	—	—	—	—	—	—	
IC7	1.0	0	0.9	6.0	0.9	0.5	—	0	—	—	—	—	—	—	—	—	
IC8	5.7	11.2	7.1	1.3	1.8	1.8	0.5	1.8	0.6	0	—	—	—	—	—	—	4
IC9	6.1	12.0	7.5	1.3	1.8	1.9	0.6	1.1	0.6	0	—	—	—	—	—	—	5
IC10	0	7.1	0	6.3	0	5.9	0	9.7	11.7	0	11.7	11.7	6.2	0	0	0	
IC11	—	6.0	2.0	0	0.7	0.7		0	—	—	—	—	—	—	—	—	6
IC12	—	6.0	2.0	0	0.7	0.7	0	0	—	—	—	—	—	—	—	—	
IC13	—	6.0	2.0	0	0.7	0.7	0	0	—	—	—	—	—	—	—	—	
IC14	—	12.0	12.0	7.0	7.0	7.0	0	—	6.3	12.7	20.0	20.0	14.0	—	—		

Notes

(1) Voltage on pin 7 dependent upon RF GAIN CONTROL.
(2) Voltage on pin 7 dependent upon RF GAIN CONTROL.
(3) Sensitisation link fitted (pin 4 to pin 9, SK3)
(4) Voltages on pins 5,6,7 and 8 dependent upon RV5.
(5) Voltages on pins 5,6,7 and 8 dependent upon AF GAIN CONTROL.
(6) Voltage on pin 7 dependent upon MUTING LEVEL CONTROL.

Transistor Voltages

The front panel controls should again be set to the positions detailed on page 36, unless modified by the notes in the right-hand column of Table 3. All readings should be taken with a testmeter of 20,000Ω/V sensitivity (AVO Model 8) except where otherwise stated: a 10% tolerance exists on all voltages.

Table 3 Transistor Voltages

Unit/Board	Ref	Emitter/ Source	Base/ Gate	Collector/ Drain	Notes
Main Board	TR1	0.4	1.0	5.5	Collector voltage depends upon crystal activity
	TR2	0	0.6	2.8	
	TR3	3.5	4.2	7.6	Sensitisation link fitted (pin 4 to pin 9, SK3)
	TR4	5.2	5.5	11.5	
	TR5	5.4	5.5	12.0	
	TR6	1.6	2.0	7.0	Collector voltage depends upon crystal activity
	TR7	5.4	5.8	12.0	
	TR8	5.2	5.5	11.5	
IF AGC Module	TR9	4.7	5.3	7.4	Base voltage measured with valve voltmeter.
	TR10	7.0	7.4	10.7	
	TR11	0	0.6	3.5	
	TR12			11.5	Emitter and base voltages depend upon signal level
Muting Board	TR13	4.4	2.6	11.0	Gate voltage measured with valve voltmeter.
	TR14	0	0	1.9	MUTING LEVEL CONTROL set to MUTING OFF.
		0	0.7	0	MUTING LEVEL CONTROL set to any position except MUTING OFF.
	TR15	0.6	1.3	0.6	MUTING LEVEL CONTROL set to MUTING OFF.
		2.6	0.9	7.0	MUTING LEVEL CONTROL advanced to position at which receiver mutes.
	TR16	0.6	0.3	10.7	MUTING LEVEL CONTROL set to MUTING OFF.
		2.6	3.2	2.7	MUTING LEVEL CONTROL advanced to position at which receiver mutes.

Table 3 Transistor Voltages (contd.)

Unit/Board	Ref	Emitter/ Source	Base/ Gate	Collector/ Drain	Notes
					N.B. Remove REMOTE PLUG (PL2), if fitted.
Remote Interface Board	TR17	0	0.7	0.3	
		0	0	12.0	Pin 14 connected to pin 8 on SK2
	TR18	0	0.6	0	
		0	0.3	1.8	Pin 13 connected to pin 8 on SK2
	TR19	0	0	12.0	
		0	0	12.0	+6V applied to pin 12 on SK2.
		0	0.7	0.5	+12V applied to pin 12 on SK2.
	TR20	0	0	12.0	
		0	0.7	0.5	+6V applied to pin 12 on SK2.
Voltage Regulator (mounted on chassis)	TR21	12.5	13.0	19.5	Receiver operating from AC.
Main Board	TR22	1.0	0.6	6.2)	All voltages depend upon settings of RV12 and RV13.
	TR23	1.0	1.6	2.0)	

Appendix 'B'

SEMICONDUCTOR COMPLEMENT

General

The following list of semiconductors does not attempt to be definitive towards any one version of the EC964/7 receiver – i.e. some versions will not include all of the following devices. Where applicable, an asterisk follows the location code to denote that the inclusion of this semiconductor is dependent upon the receiver version and/or option. The circuit diagram found at the rear of this handbook shows which receiver types will contain such a semiconductor.

Location Code

A Aerial Attenuator
B Main Board
C High Level Audio Board
D IF AGC Module
E Muting Board
F Remote Interface Board
G Voltage Regulator Board
H Power Unit
I Plug-in Coil Pack (RF section)
J Plug-in Coil Pack (Mixer section)
K Front Panel
L Back Plate

Reference	Type	Circuit Function		Location
IC1	8576P	RF Amplifier SL 610 C	44-26	B
IC2	8580P	Mixer SL 641 C	44-11	B
IC3	8577P	1st 1400 kHz IF Amplifier } SL 612 C	44-27	B
IC4	8577P	2nd 1400 kHz IF Amplifier }	44-27	B
IC5	8581P	AM Detector CA 3002V1	44-2	B*
IC6	8580P	SSB Detector SL 641 C	44-11	B
IC7	8578P	Audio AGC Generator SL 621 C	44-28	B
IC8	8579P	Audio Amplifier (600Ω Line) SL 630 C	44-29	B
IC9	8579P	Audio Amplifier (600Ω Phones) "	44-29	B
IC10	8861P	Audio Amplifier (8Ω Loudspeaker) TCA 160	44-33	H*
IC11	8577P)	1400 kHz Amplifiers for muting } SL 612 C	44-27	E
IC12	8577P)	drive circuitry }		E
IC13	8577P)			E
IC14	~~8862P~~ MC7812KC	Voltage Regulator (12V) 723 (or 123 FP)	44-47 (44-34)	G*
TR1	2N4254	Channel Oscillator		B
TR2	BC107B	Channel Oscillator ALC Amplifier		B
TR3	BC107B	Inter-filter Buffer Stage		B*
TR4	BC107B	Emitter Follower		B
TR5	BC107B	Emitter Follower		B
TR6	2N4254	Carrier Insertion Oscillator		B
TR7	BC107B	Emitter Follower		B
TR8	BC107B	Emitter Follower		B
TR9	BC107B	Voltage Amplifier		D*
TR10	BC107B	Emitter Follower		D*
TR11	BC107B	Emitter Follower		D*
TR12	BC107B	Emitter Follower		D*
TR13	UC734B	Source Follower		E
TR14	BC107B	DC Switch (Mute Disable)		E

Appendix 'B'

Reference	Type	Circuit Function	Location
TR15	BC107B)	Schmitt Trigger	E
TR16	BC107B)		E
TR17	BC107B	DC Switch (Aerial Attenuator)	F
TR18	BC107B	DC Switch (Mute Enable)	F
TR19	BC107B	DC Switch (AGC Derivation Select)	F
TR20	BC107B	DC Switch (IF-derived AGC Time Constant)	F
TR21	2N3055	Voltage Regulator Series Element	H*
TR22	BC107B)	Long-tailed Pair	B*
TR23	BC107B)		B*
D1	BB105G	Varactor	B
D2	0A47	Clamp	B
D3	0A47	ALC Detector (Channel Oscillator)	B
D4	BAX13	Muting Diode	B
D5	BAX13	Blocking Diode	B
D6	BAX13	Blocking Diode	B
D7	BAX13	Blocking Diode	B
D8	BAX13	Blocking Diode	B
D9	BZY88/C6V2	6.2V Zener	B
D10	BZY88/C6V2	6.2V Zener	B
D11	BZY88/C10	10V Zener	B
D12	BZY88/C6V2	6.2V Zener	B
D13	OA47	Detector (IF-derived AGC)	D*
D14	BZY88/C6V2	6.2V Zener	E
D15	OA47	Detector (Muting Threshold)	E
D16	BAX13	Blocking Diode	E
D17	BAX13	Blocking Diode	E
D18	BAX13	Blocking Diode	F
D19	BZY88/C8V2	8.2V Zener	F
D20	OA47	Level Translator	K
D21		Reference not allocated	
D22	OSH02	Bridge Rectifier	H*
D23		Reference not allocated	
D24	IN4004	Reverse Polarity Protection	H
PC1	8 x IN4148	Input Stage Protection	A

Appendix 'C'

COMPONENT VALUES, TOLERANCES, AND RATINGS

General

In a similar manner to Appendix 'B', the following list of passive components does not attempt to be definitive towards any one version of the EC964/7 receiver, and comments similar to those in Appendix 'B' apply here. The location codes are identical.

Capacitors

Ref	Value	Type	Tolerance	Wkg. V	Loc
C1	0.01 μF	Polycarbonate	20%	100V	B
C2	0.1 μF	Polycarbonate	20%	100V	B
C3	1.5 μF	Tantalum	20%	35V	B
C4	0.01 μF	Polycarbonate	20%	100V	B
C5	0.01 μF	Polycarbonate	20%	100V	B
C6	0.1 μF	Polycarbonate	20%	100V	B
C7	0.1 μF	Polycarbonate	20%	100V	B
C8&C9	—	References not allocated	—	—	—
C10	0.1 μF	Polycarbonate	20%	100V	B
C11	0.01 μF	Polycarbonate	20%	100V	B
C12	0.01 μF	Polycarbonate	20%	100V	B
C13	100pF	Tubular Ceramic	5%	750V	B
C14	100pF	Tubular Ceramic	5%	750V	B
C15	0.01 μF	Polycarbonate	20%	100V	B
C16	0.01 μF	Polycarbonate	20%	100V	B
C17	0.001 μF	Polystyrene	2%	63V	B
C18	0.1 μF	Polycarbonate	20%	100V	B
C19	0.001 μF	Polystyrene	2%	63V	B
C20	150 μF	Tubular Electrolytic	+50%—10%	16V	B
C21	10 μF	Tantalum	20%	25V	B*
C22	0.1 μF	Polycarbonate	20%	100V	B*
C23	0.1 μF	Polycarbonate	20%	100V	B*
C24	0.1 μF	Polycarbonate	20%	100V	B*
C25	0.01 μF	Polycarbonate	20%	100V	B
C26	0.1 μF	Polycarbonate	20%	100V	B
C27	10 μF	Tantalum	20%	25V	B
C28	0.047 μF	Polycarbonate	20%	100V	B
C29	0.1 μF	Polycarbonate	20%	100V	B
C30	0.1 μF	Polycarbonate	20%	100V	B
C31	0.01 μF	Polycarbonate	20%	100V	B
C32	0.1 μF	Polycarbonate	20%	100V	B
C33	0.1 μF	Polycarbonate	20%	100V	B
C34	0.01 μF	Polycarbonate	20%	100V	B
C35	0.1 μF	Polycarbonate	20%	100V	B
C36	0.001 μF	Polystyrene	2%	63V	B
C37	10 μF	Tantalum	20%	25V	B
C38	22 μF	Tantalum	20%	16V	B*
C39	0.1 μF	Polycarbonate	20%	100V	B*
C40	10 μF	Tantalum	20%	25V	B*
C41	0.01 μF	Polycarbonate	20%	100V	B*

Appendix 'C'

Ref	Value	Type	Tolerance	Wkg. V	Loc
C42	150 μF	Tubular Electrolytic	+50%–10%	16V	B*
C43	0.047 μF	Polycarbonate	20%	100V	B*
C44	0.047 μF	Polycarbonate	20%	100V	B
C45	0.1 μF	Polycarbonate	20%	100V	B
C46	10 μF	Tantalum	20%	25V	B
C47	0.001 μF	Polystyrene	2%	63V	B
C48	0.1 μF	Polycarbonate	20%	100V	B
C49	0.1 μF	Polycarbonate	20%	100V	B
C50	360pF	Polystyrene	5%	63V	B
C51	22pF	Polystyrene	10%	125V	B
C52	8–60pF	Foil Dielectric Trimmer	–	–	B
C53	360pF	Polystyrene	5%	125V	B
C54	0.022 μF	Polycarbonate	20%	100V	B
C55	0.022 μF	Polycarbonate	20%	100V	B
C56	150 μF	Tubular Electrolytic	+50%–10%	16V	B
C57	0.1 μF	Polycarbonate	20%	100V	B
C58	1.5 μF	Tantalum	20%	35V	B
C59	0.1 μF	Polycarbonate	20%	100V	B
C60	10 μF	Tantalum	20%	25V	B
C61	1.5 μF	Tantalum	20%	35V	B
C62	10 μF	Tantalum	20%	25V	B
C63	1.5 μF	Tantalum	20%	35V	B
C64	100 μF	Tubular Electrolytic	+50%–10%	10V	B
C65	100 μF	Tubular Electrolytic	+50%–10%	10V	B
C66	100 μF	Tubular Electrolytic	+50%–10%	10V	B
C67	10 μF	Tantalum	20%	25V	B
C68	1.5 μF	Tantalum	20%	35V	B
C69	0.0027 μF	Polystyrene	2½%	160V	B
C70	22 μF	Tantalum	20%	16V	B
C71	0.001 μF	Polystyrene	2%	63V	B
C72	150 μF	Tubular Electrolytic	+50%–10%	16V	B
C73	10 μF	Tantalum	20%	25V	B
C74	0.1 μF	Polycarbonate	20%	100V	B
C75	150 μF	Tubular Electrolytic	+50%–10%	16V	B
C76	0.1 μF	Polycarbonate	20%	100V	B
C77	10 μF	Tantalum	20%	25V	B
C78	10 μF	Tantalum	20%	25V	B
C79	10 μF	Tantalum	2%	25V	B
C80	0.0027 μF	Polystyrene	2½%	160V	B
C81	1.5 μF	Tantalum	20%	35V	B
C82	0.001 μF	Polystyrene	2%	63V	B
C83	150 μF	Tubular Electrolytic	+50%–10%	16V	B
C84	0.1 μF	Polycarbonate	20%	100V	B
C85	22 μF	Tantalum	20%	16V	B
C86	10 μF	Tantalum	20%	25V	B
C87	10 μF	Tantalum	20%	25V	B
C88 to C99	–	References not allocated			
C100	1.5 μF	Tubular Electrolytic	+50%–10%	63V	C*
C101	150 μF	Tubular Electrolytic	+50%–10%	16V	C*
C102	22 μF	Tantalum	20%	16V	C*
C103	0.1 μF	Polycarbonate	20%	100V	C*
C104	220 μF	Tubular Electrolytic	+50%–10%	16V	C*

Ref	Value	Type	Tolerance	Wkg. V	Loc
C105	220 μF	Tubular Electrolytic	+50%—10%	16V	C*
C106	0.01 μF	Polycarbonate	20%	100V	C*
C107 to C119	—	References not allocated			
C120	0.1 μF	Polycarbonate	20%	100V	D*
C121	10 μF	Tantalum	20%	25V	D*
C122	0.1 μF	Polycarbonate	20%	100V	D*
C123	0.1 μF	Polycarbonate	20%	100V	D*
C124	10 μF	Tantalum	20%	25V	D*
C125	180pF	Polystyrene	2%,	63V	D*
C126	4 μF	Tubular Electrolytic	+50%—10%	63V	D*
C127	3.3 μF	Tantalum	20%	16V	D*
C128	10 μF	Tantalum	20%	25V	D*
C129 to C149	—	References not allocated			
C150	180pF	Polystyrene	2%	63V	E
C151	790pF	Polystyrene	5%	63V	E
C152	0.1 μF	Polycarbonate	20%	100V	E
C153	0.1 μF	Polycarbonate	20%	100V	E
C154	790pF	Polystyrene	5%	63V	E
C155	0.1 μF	Polycarbonate	20%	100V	E
C156	0.01 μF	Polycarbonate	20%	100V	E
C157	0.1 μF	Polycarbonate	20%	100V	E
C158	0.1 μF	Polycarbonate	20%	100V	E
C159	10 μF	Tantalum	20%	25V	E
C160	0.1 μF	Polycarbonate	20%	100V	E
C161	180pF	Polystyrene	2%	63V	E
C162	0.1 μF	Polycarbonate	20%	100V	E
C163	2.5 μF	Tubular Electrolytic	+50%—10%	63V	E
C164	150 μF	Tubular Electrolytic	+50%—10%	16V	E
C165 to C169	—	References not allocated			
C170	0.1 μF	Polycarbonate	20%	100V	F
C171	0.1 μF	Polycarbonate	20%	100V	F
C172	0.1 μF	Polycarbonate	20%	100V	F
C173	0.1 μF	Polycarbonate	20%	100V	F
C174 to C181	—	References not allocated			
C182	1 μF	Polycarbonate	20%	400V	L
C183 to C189	—	References not allocated			
C190	150 μF	Tubular Electrolytic	+50%—10%	16V	G*
C191	500pF	Polystyrene	5%	125V	G*
C192 to C198	—	References not allocated			
C199	4700 μF	Tubular Electrolytic	+50%—10%	25V	H

Appendix 'C'

Ref	Value	Type	Tolerance	Wkg. V	Loc
C200 to C249	–	References not allocated			
C250	8–135pF	Foil Dielectric Trimmer	–	–	I
C251	39pF	Polystyrene	1%	63V	I
C252	39pF	Polystyrene	1%	63V	I
C253	8–135pF	Foil Dielectric Trimmer	–	–	I
C254	39pF	Polystyrene	1%	63V	J
C255	8–135pF	Foil Dielectric Trimmer	–	–	J
C256		Depends upon range	–	–	J*
C257	0.8–6.0pF	Tubular Ceramic Trimmer	–	–	J

Resistors

Ref	Value	Tol	Rtg.	Loc
R1	39Ω	5%	0.3W	A
R2	39Ω	5%	0.3W	A
R3	10Ω	5%	0.3W	A
R4	39Ω	5%	0.3W	A
R5	39Ω	5%	0.3W	A
R6	10Ω	5%	0.3W	A
R7	100Ω	5%	0.3W	B
R8	2,200Ω	5%	0.3W	B
R9	100Ω	5%	0.3W	B
R10	1MΩ	5%	0.3W	B
R11	1MΩ	5%	0.3W	B
R12	0.47MΩ	5%	0.3W	B
R13	2,700Ω	5%	0.3W	B
R14	1,000Ω	5%	0.3W	B
R15	47,000Ω	5%	0.3W	B
R16	2,200Ω	5%	0.3W	B
R17	0.47MΩ	5%	0.3W	B
R18) R19)	Not used			
R20	1,000Ω	5%	0.3W	B*
R21	150Ω	5%	0.3W	B*
R22	2,700Ω	5%	0.3W	B*
R23	1,500Ω	5%	0.3W	B*
R24	1,000Ω	5%	0.3W	B*
R25	180Ω	5%	0.3W	B*
R26	680Ω	5%	0.3W	B*
R27	390Ω	5%	0.3W	B*
R28	1,500Ω	5%	0.3W	B
R29	1,000Ω	5%	0.3W	B
R30	1,000Ω	5%	0.3W	B
R31	22,000Ω	5%	0.3W	B
R32	5,600Ω	5%	0.3W	B
R33	1,000Ω	5%	0.3W	B
R34	100Ω	5%	0.3W	B

Ref	Value	Tol	Rtg.	Loc
R35	10,000Ω	5%	0.3W	B
R36	100Ω	5%	0.3W	B
R37	1,000Ω	5%	0.3W	B
R38	47,000Ω	5%	0.3W	B
R39	47,000Ω	5%	0.3W	B
R40	10,000Ω	5%	0.3W	B
R41	1,000Ω	5%	0.3W	B*
R42	10,000Ω	5%	0.3W	B*
R43	10,000Ω	5%	0.3W	B*
R44	270Ω	5%	0.3W	B*
R45	Not used			
R46	3,300Ω	5%	0.3W	B*
R47	180Ω	5%	0.3W	B
R48	2,200Ω	5%	0.3W	B
R49	1,800Ω	5%	0.3W	B
R50	8,200Ω	5%	0.3W	B
R51	4,700Ω	5%	0.3W	B
R52	2,700Ω	5%	0.3W	B
R53	8,200Ω	5%	0.3W	B
R54	1,000Ω	5%	0.3W	B
R55	22,000Ω	5%	0.3W	B
R56	22,000Ω	5%	0.3W	B
R57	5,600Ω	5%	0.3W	B
R58	4,700Ω	5%	0.3W	B
R59	10,000Ω	5%	0.3W	B
R60	1,000Ω	5%	0.3W	B
R61	10,000Ω	5%	0.3W	B
R62	10,000Ω	5%	0.3W	B
R63	5,600Ω	5%	0.3W	B
R64	6,800Ω	5%	0.3W	B
R65	270Ω	5%	0.3W	B
R66	39,000Ω	5%	0.3W	B
R67	82Ω	5%	0.3W	B
R68	2,700Ω	5%	0.3W	B

Ref.	Value	Tol	Rtg.	Loc.
R69	3,900Ω	5%	0.3W	B
R70	180Ω	5%	0.3W	B
R71	180Ω	5%	0.3W	B
R72	82Ω	5%	0.3W	B
R73	47Ω	5%	0.3W	B
R74	15,000Ω	5%	0.3W	B
R75	150Ω	5%	0.3W	B
R76	4,700Ω	5%	0.3W	B
R76A	10,000Ω	5%	0.3W	B
R77	10,000Ω	5%	0.3W	B*
R78	10,000Ω	5%	0.3W	B*
R79	3,300Ω	5%	0.3W	B*
R80	470Ω	5%	0.3W	B*
R81	18,000Ω	5%	0.3W	B*
R82 to R89	Not used			
R90	100Ω	5%	0.3W	C*
R91	5,600Ω	5%	0.3W	C*
R92 to R98	Not used			
R99	18Ω W.W.	5%	2.5W	C*
R100 to R109	Not used			
R110	47,000Ω	5%	0.3W	D*
R111	47,000Ω	5%	0.3W	D*
R112	10,000Ω	5%	0.3W	D*
R113	560Ω	5%	0.3W	D*
R114	6,800Ω	5%	0.3W	D*
R115	1,000Ω	5%	0.3W	D*
R116	470Ω	5%	0.3W	D*
R117	47,000Ω	5%	0.3W	D*
R118	47,000Ω	5%	0.3W	D*
R119	1,000Ω	5%	0.3W	D*
R120	39,000Ω	5%	0.3W	D*
R121	1,000Ω	5%	0.3W	D*
R122	10,000Ω	5%	0.3W	D*
R123 to R138	Not used			
R139	150Ω	5%	0.3W	E
R140	6,800Ω	5%	0.3W	E†
R141	3,300Ω	5%	0.3W	E
R142	100Ω	5%	0.3W	E
R143	220Ω	5%	0.3W	E
R144	1MΩ	5%	0.3W	E
R145	820Ω	5%	0.3W	E
R146	1,500Ω	5%	0.3W	E
R147	470Ω	5%	0.3W	E
R148	10,000Ω	5%	0.3W	E
R149	68,000Ω	5%	0.3W	E

† Value of R140 may be adjusted on test

Ref.	Value	Tol	Rtg.	Loc
R150	1,000Ω	5%	0.3W	E
R151	10,000Ω	5%	0.3W	E
R152	10,000Ω	5%	0.3W	E
R153	8,200Ω	5%	0.3W	E
R154	8,200Ω	5%	0.3W	E
R155	270Ω	5%	0.3W	E
R156	10,000Ω	5%	0.3W	E
R157	22Ω	5%	0.3W	E
R158 to R179	Not used			
R180	0.1MΩ	5%	0.3W	F
R181	10,000Ω	5%	0.3W	F
R182	1MΩ	5%	0.3W	F
R183	10,000Ω	5%	0.3W	F
R184	0.1MΩ	5%	0.3W	F
R185	22,000Ω	5%	0.3W	F
R186	1000Ω	5%	0.3W	F
R187 to R189	Not used			
R190	0.22Ω W.W.	5%	2.5W	H*
R191	3,300Ω	5%	0.3W	G*
R192	2,200Ω	5%	0.3W	G*
R193 to R197	Not used			
R198	4,700Ω	5%	0.3W	K

Potentiometers

Ref	Value	Type	Loc
RV1	5,000Ω Lin.	Wirewound	K
RV2	10,000Ω Lin.	Carbon preset	B
RV3	10,000Ω Lin.	Carbon preset	B
RV4	10,000Ω Lin.	Carbon preset	B
RV5	10,000Ω Lin.	Carbon preset	B
RV6	10,000Ω Lin.	Carbon preset	D*
RV7	10,000Ω Lin.	Carbon preset	E
RV8	5,000Ω Lin.	Wirewound	K
RV9	5,000Ω Lin.	Wirewound with switch	K
RV10	5,000Ω Lin.	Wirewound with switch	K
RV11	1,000Ω Lin.	Carbon preset	G*
RV12	10,000Ω Lin.	Carbon preset	B*
RV13	560Ω Lin.	Carbon preset	B*
RV14	10,000Ω Lin.	Carbon preset	B*

Appendix D

LIST OF SPARES FOR EC964/7 SERIES RECEIVERS

The following list details all major spares for EC964/7 series receivers. Spares should be ordered by quoting the circuit reference (where applicable), the written description, and the part number given in the right-hand column. All orders and communications should be directed to the address below, quoting the serial number of the receiver in all communications:—

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

Telephone : 021-475-2231

Telex : 337081

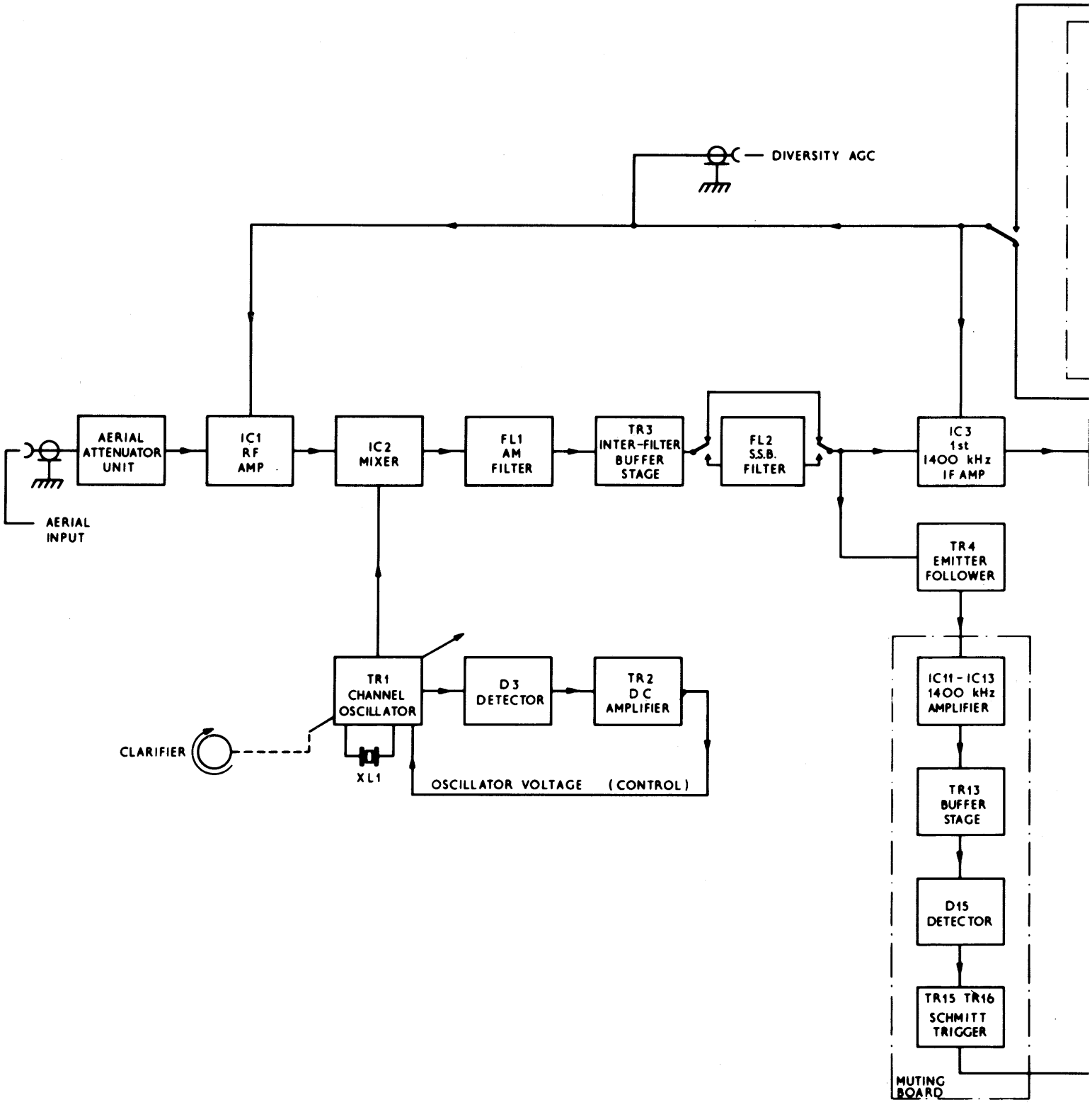
Cables : EDDYSTONE, Birmingham.

Circuit Ref.	Description	Part No.
	PRINTED CIRCUIT BOARDS (WITH COMPONENTS, LESS SCREENS)	
	Main Board EC964/7-A & B EC964/7-C	LP3318/19 LP3318/1
	Muting Board	LP3318/4
	Aerial Attenuator Board	LP3318/6
	Remote Interface Board	LP3318/5
	IF AGC Board (Not fitted on EC964/7-A)	LP3318/3
	Regulator Board (Not fitted on 12V DC Only version) No LONGER USED ©	LP3318/20
	High Level Audio Board (Fitted to order only) (LP3318/2 S50-146)	LP3318/2
	PLUG-IN COIL PACKS	
	1.6 – 3.0 MHz 23-650 S50-152	LP3316/1
	3.0 – 5.7 MHz 23-651 S50-153	LP3316/2
	5.7 – 10.8 MHz 23-652 S50-154	LP3316/3
	10.8 – 20 MHz 23-653 S50-155	LP3316/4
	20 – 27.5 MHz 23-654 NONE MADE S50-156	LP3316/5
	400 – 535 kHz NONE MADE S50-157	LP3316/6

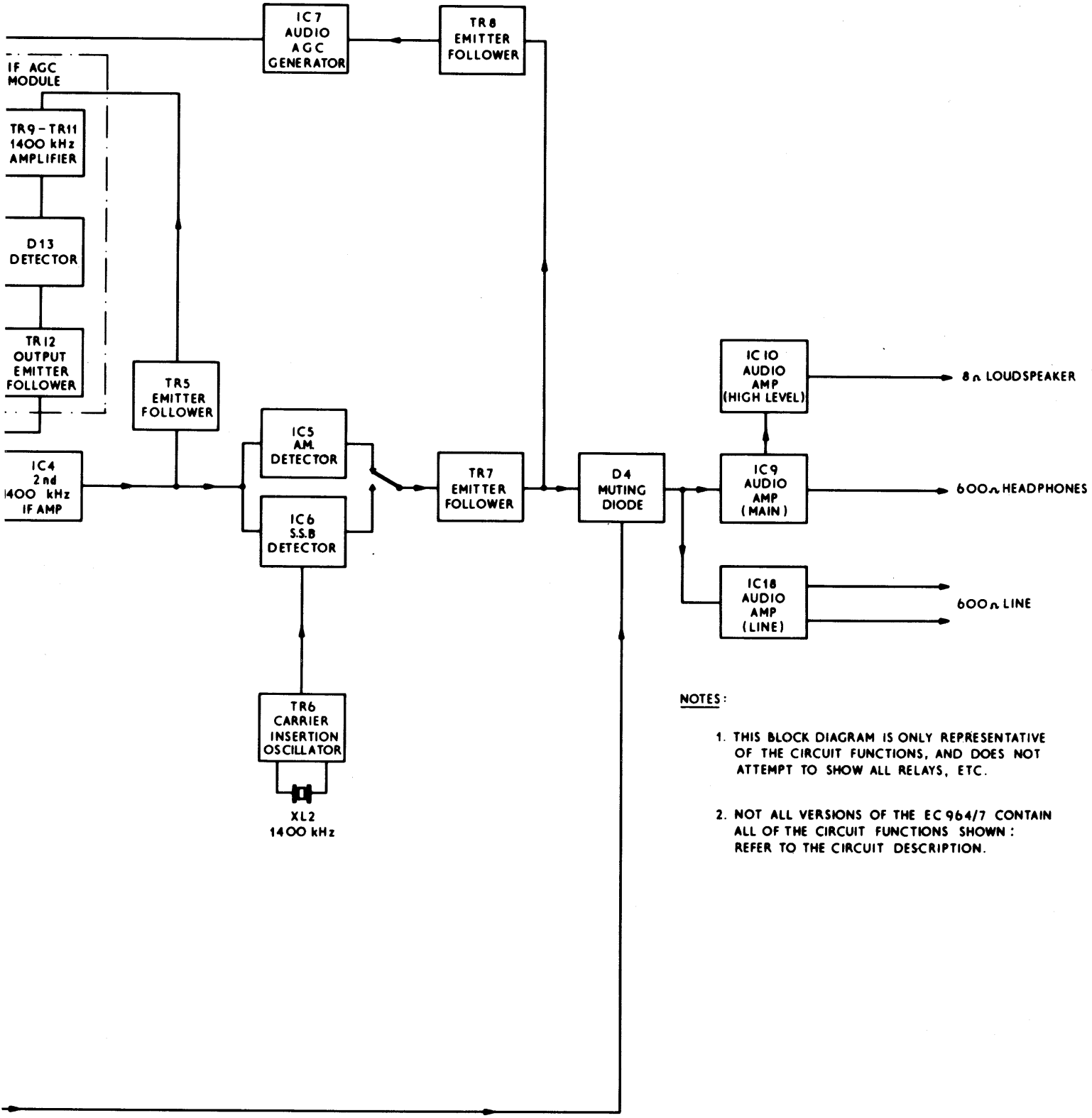
Circuit Ref.	Description	Part No.
	SWITCHES	
S1	ATTENUATOR SWITCH: 3-position lever operated. Not available as separate spares item: order switch +PCB	LP3318/6
S2	MODE SWITCH: Complete assembly comprising 4 wafers (3P4W) and spindle and clicker mechanism.	D4769
	POTENTIOMETERS	
RV1	CLARIFIER CONTROL: 5,000Ω Lin.WW	7939P
RV2	Clarifier Range Adjuster: 10,000Ω Lin. carbon pre-set	7762/1P
RV3	Clarifier Range Adjuster: 10,000Ω Lin. carbon pre-set	7762/1P
RV4	Audio-derived AGC Sensitivity: 10,000Ω Lin. carbon pre-set	7762/1P
RV5	LINE LEVEL CONTROL: 10,000Ω Lin. carbon pre-set	7762/1P
RV6	IF-derived AGC Sensitivity: 10,000Ω Lin. carbon pre-set	7762/1P
RV7	Muting Level Control Range Adjuster: 10,000Ω Lin. carbon pre-set	7762/1P
RV8	RF GAIN CONTROL: 5,000Ω Lin. WW	7939P
RV9/S4	AF GAIN CONTROL: 5,000Ω Lin. WW. C/W switch	8653P
RV10/S3	MUTING LEVEL CONTROL: 5,000Ω Lin. WW. C/W switch	8653P
RV11	Voltage Regulator Output: 1,000Ω Lin. carbon pre-set	6076/1P
RV12	Delayed AGC Adjuster: 10,000Ω Lin. carbon pre-set	7762/1P
RV13	Delayed AGC Adjuster: 560Ω Lin. carbon pre-set	8941/1P
RV14	AM Detector Output: 10,000Ω Lin. carbon pre-set	7762/1P
	TRIMMER CAPACITORS	
C52	Carrier Insertion Oscillator Frequency Adjust: 8-60pF	8643P
C250	RF Section of Plug-in Coil Pack: 8-135pF	8633P
C253	RF Section of Plug-in Coil Pack: 8-135pF	8633P
C255	Mixer Section of Plug-in Coil Pack: 8-135pF	8633P
C257	Mixer Section of Plug-in Coil Pack: 0.8 – 6.0pf (Osc. Adj)	8942P

Circuit Ref.	Description	Part No.
	PLUGS & SOCKETS	
PL1	AERIAL INPUT PLUG: 50Ω BNC bayonet-fixing plug	8012P
PL2	REMOTE CONNECTOR: 15-way free male c/w cover	8902P
PL3	ANCILLARIES CONNECTOR: 9-way free male c/w cover	D4703
PL4	AC SUPPLY CONNECTOR: 3-pin male (chassis-mounting)	D2310/1
PL5	DC SUPPLY CONNECTOR: 15-way male (chassis-mounting)	7772P
SK1	AERIAL INPUT SOCKET: 50Ω BNC bayonet-fixing chassis-mounting socket	7225P
SK2	REMOTE CONNECTOR: 15-way female (chassis-mounting)	7770P
SK3	ANCILLARIES CONNECTOR: 9-way female (chassis-mounting)	8943P
SK4	AC SUPPLY CONNECTOR: 3-pin free female complete with 2 metres of 3-core cable	D2311/1
SK5 *	DC SUPPLY CONNECTOR: 15-way free female complete with 2 metres of 2-core cable, linked for 24V DC working.	D4758
	AC LINK: 15-way free female linked for AC working	D4757
	(*) with Cover	
JK1	PHONES CONNECTOR: 2-pin jack socket	8463P
	CRYSTAL & CRYSTAL FILTERS	
XL1	Channel Oscillator Crystal: Frequency to order (Style D) check Spec	8944P
XL2	Carrier Insertion Oscillator Crystal: 1400 kHz. (Style D)	8665P
FL1	AM Crystal Filter	8645P
FL2	*SSB Crystal Filter: LSB 1-128 USB 1-133	8646P 8939P
	(*) Sideband quoted is that of filter: consult page 35 before ordering.	
	INDUCTORS	
L1	IF Output Transformer	D4640
L2	IF-derived Detector Drive Transformer	D4641
L3	Muting Board Input Coupling Transformer	D4641
L4	Muting Board Inter-stage coupling Transformer	D4641

Circuit Ref.	Description	Part No.
	CHOKES	
CH1	RF Amplifier: 1mH RF Choke	7754P
CH2	Mixer: 1mH RF Choke	7754P
CH3	1400 kHz IF Amplifier: 1mH RF Choke	7754P
CH4	1400 kHz IF Amplifier: 1mH RF Choke	7754P
CH5	Detector Filter: 100mH RF Choke	7350P
CH6	1400 kHz Amplifier (Muting): 1mH RF Choke	7754P
CH7	1400 kHz Amplifier (Muting): 1mH RF Choke	7754P
CH8	1400 kHz Amplifier (Muting): 1mH RF Choke	7754P
CH9	Muting Detector: 1mH RF Choke	7754P
	TRANSFORMERS	
T1	Mains Transformer	8658P
T2	LINE AUDIO Output Transformer	8641P
T3	MAIN AUDIO Output Transformer	8641P
	MISCELLANEOUS	
	Crystal Ovens (12V, 65°C)	8647P
	Fuses: 1A	7173P
	2A	6704P
	Fuseholder	6372P
	Indicator Lamps: 14V, 0.75W	8656P
	Indicator Lampholder	8655P
	Loudspeaker: 8Ω, 2" x 3"	8567P
	Terminals: screw type used on rear panel	6371P
	Handles: used on front panel	8540P
	Relays (S.P.D.T., 890Ω coil)	8445P



BLOCK DIAGRAM OF B

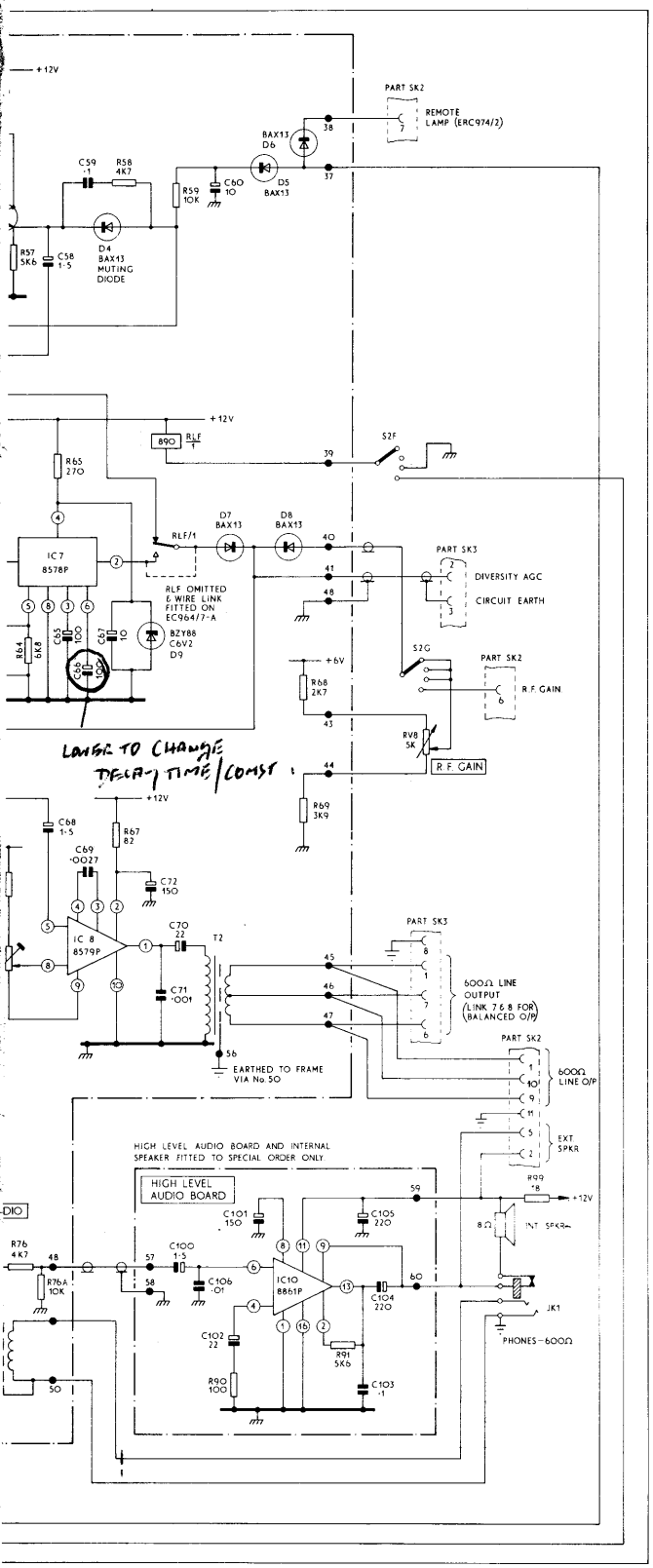


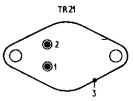
NOTES:

1. THIS BLOCK DIAGRAM IS ONLY REPRESENTATIVE OF THE CIRCUIT FUNCTIONS, AND DOES NOT ATTEMPT TO SHOW ALL RELAYS, ETC.

2. NOT ALL VERSIONS OF THE EC 964/7 CONTAIN ALL OF THE CIRCUIT FUNCTIONS SHOWN: REFER TO THE CIRCUIT DESCRIPTION.

ASIC EC964/7 RECEIVER





2N3055

1. BASE
2. EMITTER
3. COLLECTOR AND CASE

2N4254

1. BASE
2. COLLECTOR
3. EMITTER

UC734B

1. SOURCE
2. DRAIN
3. GATE
4. CASE

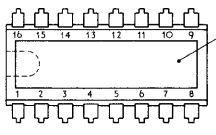
BC107B

1. EMITTER
2. BASE
3. COLLECTOR

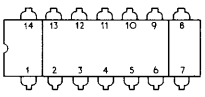
8576 P
8577 P
8578 P
8580 P

8579 P

8581 P

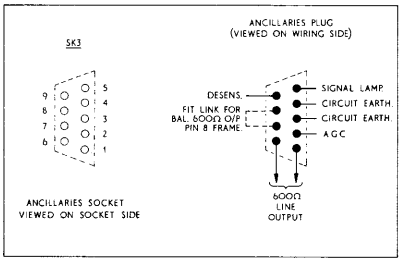


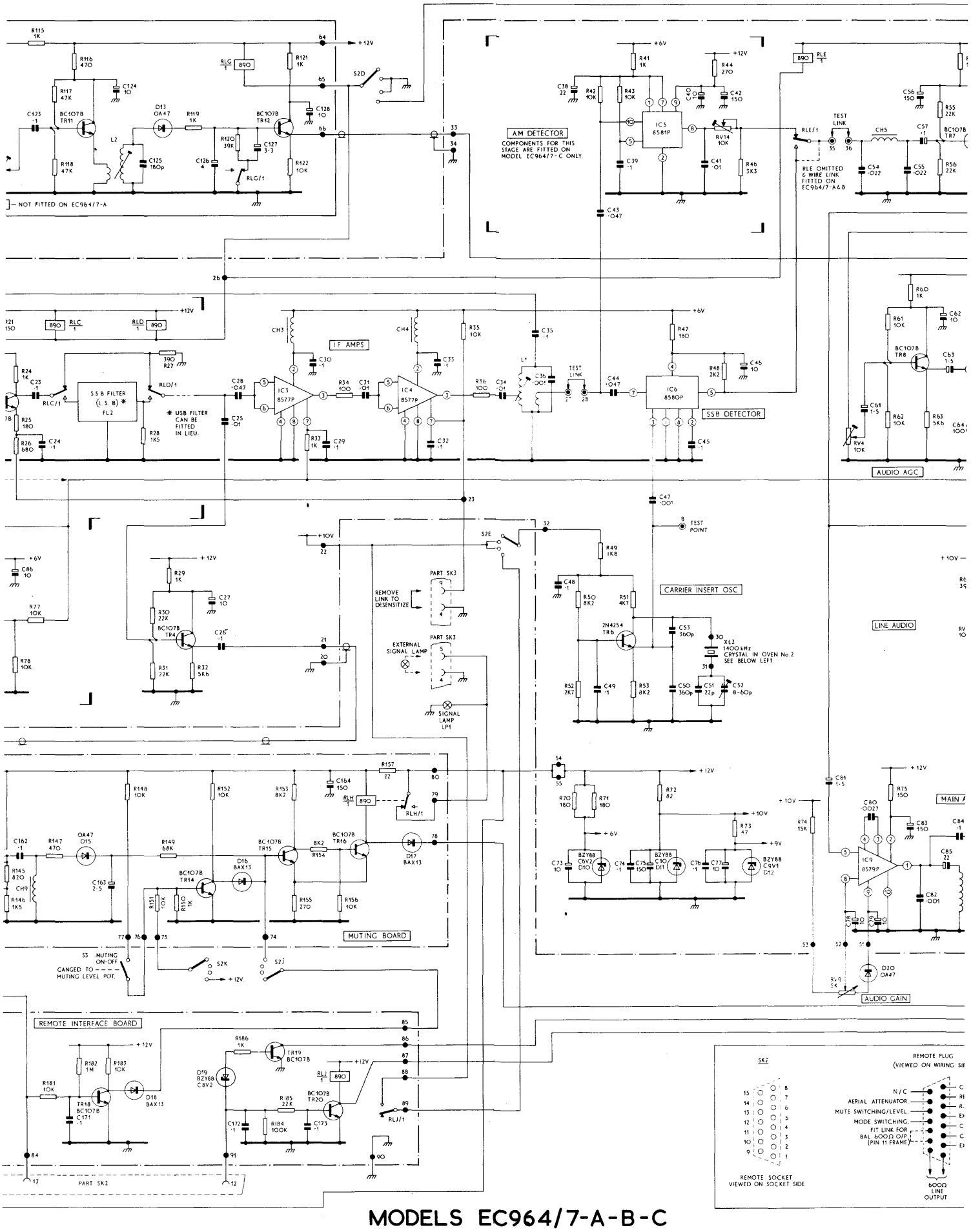
8861 P



8862 P

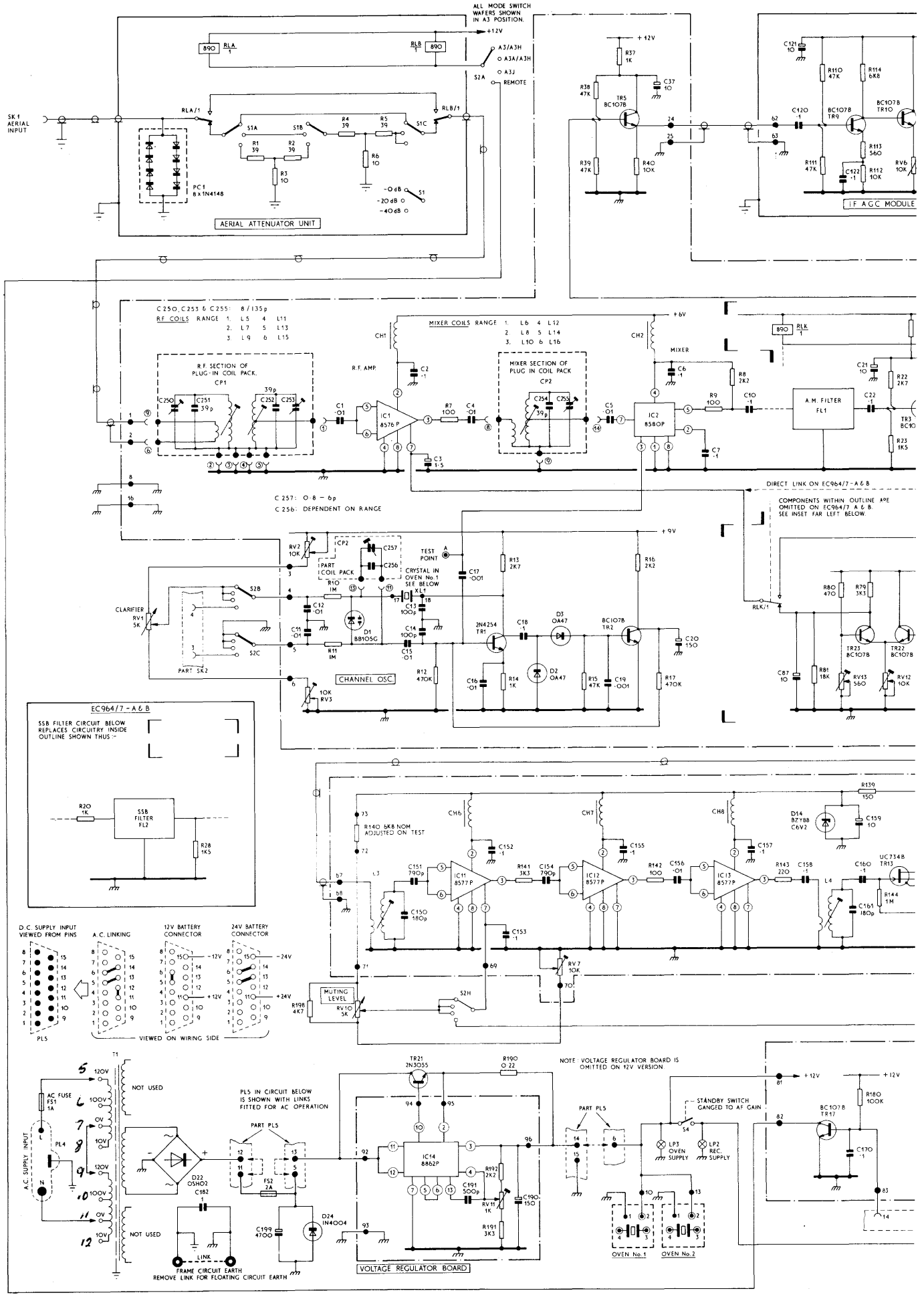
CUIT EARTH
OTE LAMP.
GAIN.
SPKR
RIFIER 1.
RIFIER 2. EARTH
SPKR

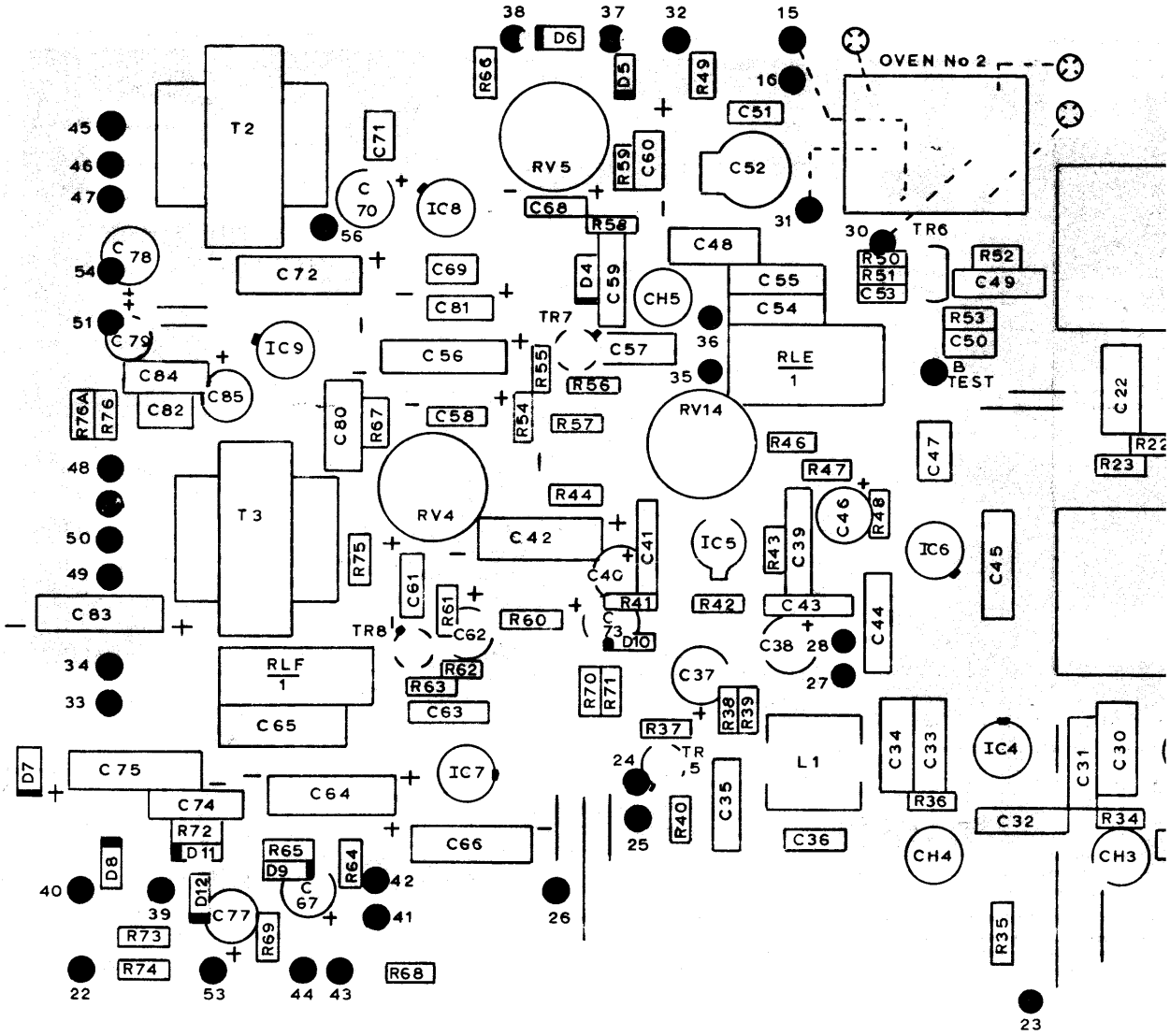




MODELS EC964/7-A-B-C

BP1299 ISSUE 3


ALL MODE SWITCH WAFERS SHOWN IN A3 POSITION.
SK1 AERIAL INPUT
AERIAL ATTENUATOR UNIT
I.F. A.G.C. MODULE
MIXER COILS RANGE
R.F. SECTION OF PLUG-IN COIL PACK
MIXER SECTION OF PLUG IN COIL PACK
R.F. AMP
MIXER
A.M. FILTER FL1
DIRECT LINK ON EC964/7-A&B
COMPONENTS WITHIN OUTLINE ARE OMITTED ON EC964/7 A & B. SEE INSET FAR LEFT BELOW.
CHANNEL OSC.
CRYSTAL IN OVEN No.1 SEE BELOW
EC964/7-A&B
SSB FILTER CIRCUIT BELOW REPLACES CIRCUITRY INSIDE OUTLINE SHOWN THUS :-
SSB FILTER FL2
D.C. SUPPLY INPUT VIEWED FROM PINS
A.C. LINKING
12V BATTERY CONNECTOR
24V BATTERY CONNECTOR
VIEWED ON WIRING SIDE
MUTING LEVEL
A.C. SUPPLY INPUT
AC FUSE FS1 1A
NOT USED
PLS IN CIRCUIT BELOW IS SHOWN WITH LINKS FITTED FOR AC OPERATION
FS2 2A
LINK
FRAME CIRCUIT EARTH
REMOVE LINK FOR FLOATING CIRCUIT EARTH
VOLTAGE REGULATOR BOARD
NOTE : VOLTAGE REGULATOR BOARD IS OMITTED ON 12V VERSION.
STANDBY SWITCH GANGED TO AF GAIN
OVEN No.1
OVEN No.2



EDDYSTONE 8635 P/L

MAIN BOARD: LP3318/19 (EC964/7–A & B)

N.B. Not all versions of the EC964/7 receiver have the total complement of components shown above. Components which are absent in a particular version are listed here, under the appropriate receiver type No.

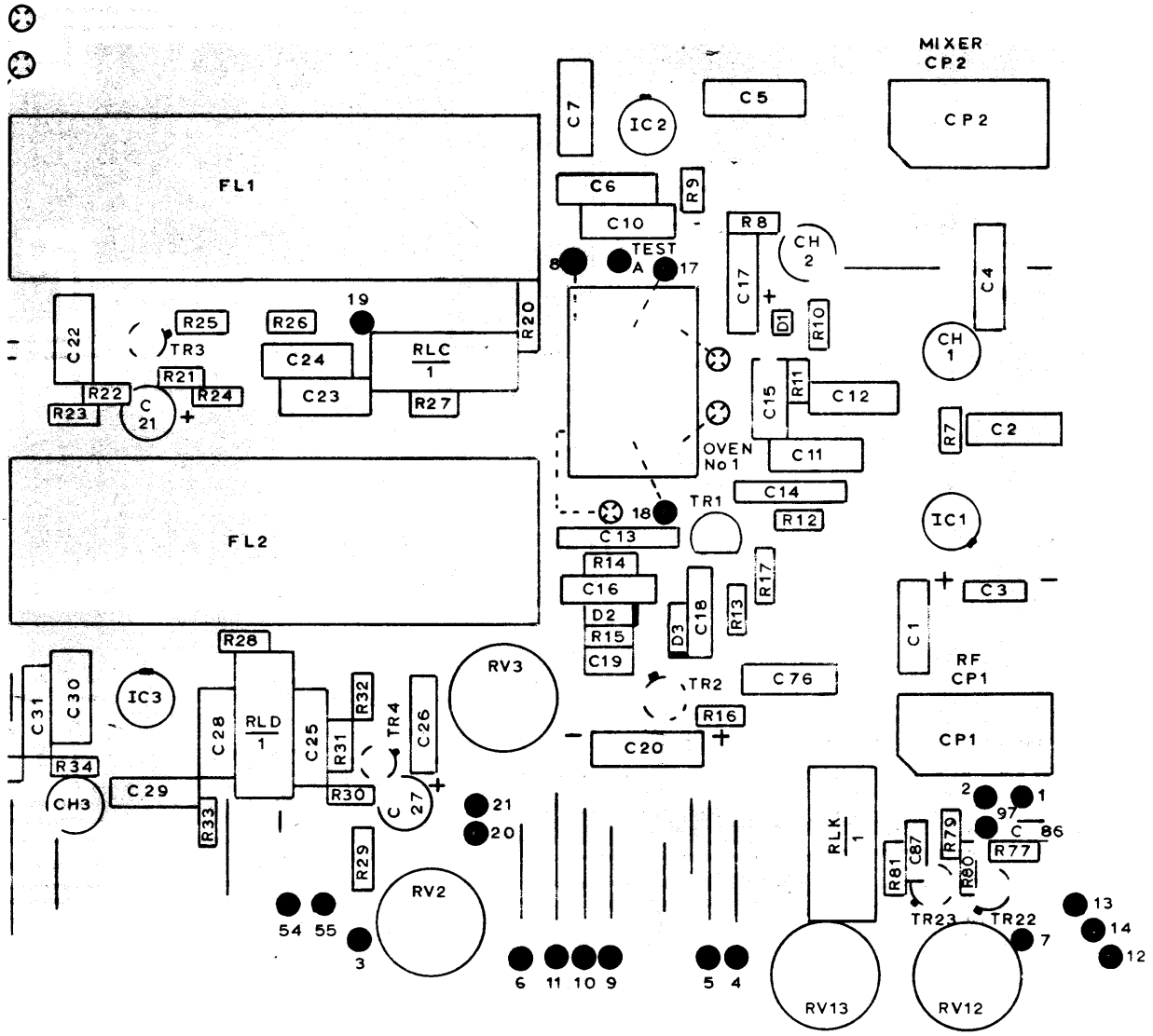
EC964/7–C.

Resistor: R20.

EC964/7–B

Semiconductors: IC5, TR3, TR22, TR23.
Filter: FL1.
Relays: RLC, RLD, RLE, RLK.
Capacitors: C21, C22, C23, C24, C
C42, C43, C86, C87.
Resistors: R21, R22, R23, R24,
R41, R42, R43, R44,
R79, R80, R81.
Potentiometers: RV12, RV13, RV14.

Printed Circuit Board Patterns and Legends – Sheet 1



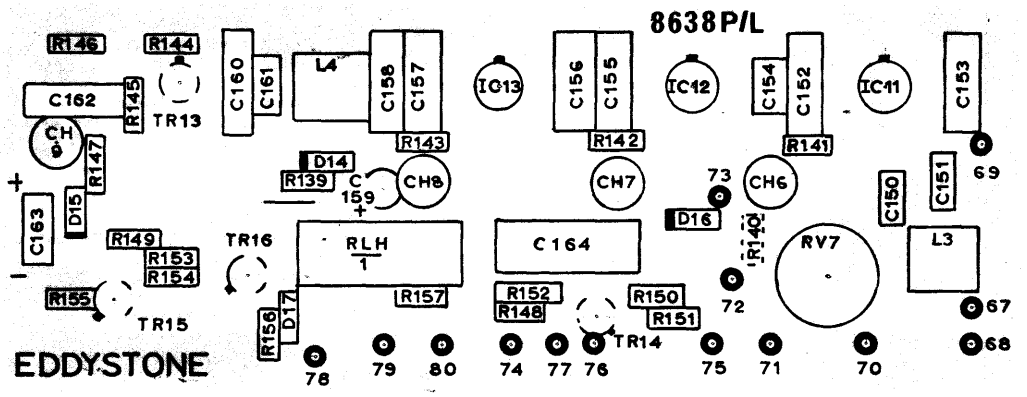
'—A & B) LP3318/1 (EC964/7—C)

EC964/7—A

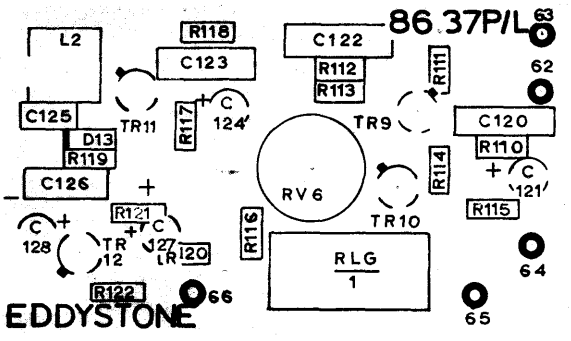
Semiconductors:	IC5, TR3, TR22, TR23.
Filter:	FL1.
Relays:	RLC, RLD, RLE, RLF, RLK.
Capacitors:	C21, C22, C23, C24, C38, C39, C40, C41, C42, C43, C86, C87.
Resistors:	R21, R22, R23, R24, R25, R26, R27, R41, R42, R43, R44, R46, R77, R78, R79, R80, R81.
Potentiometers:	RV12, RV13, RV14.

22, TR23.

LE, RLK.
3, C24, C38, C39, C40, C41,
, C87.
23, R24, R25, R26, R27,
43, R44, R46, R77, R78,
1.
RV14.

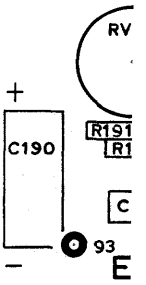


MUTING BOARD: LP3318/4



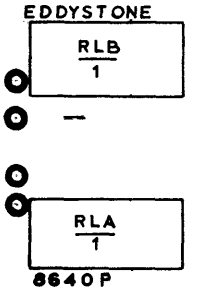
IF AGC BOARD: LP3318/3

(NOT FITTED ON EC964/7–A)



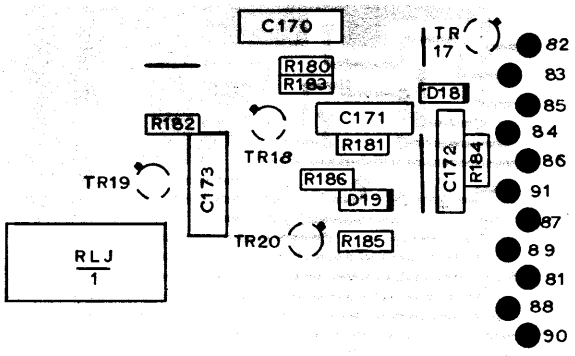
VOLTAGE REGULAT

(NOT FITTED ON 12'



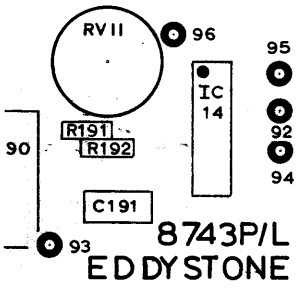
AERIAL ATTENUATOR BOARD (DO

Printed Circuit Board Patterns and Legends – Sheet 2



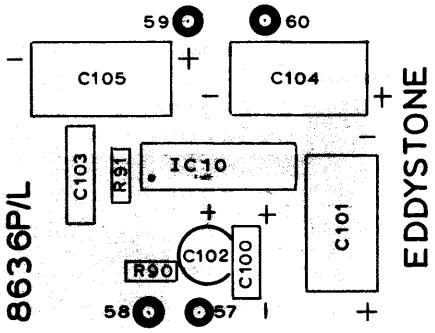
EDDYSTONE 8639P/L

REMOTE INTERFACE BOARD: LP3318/5



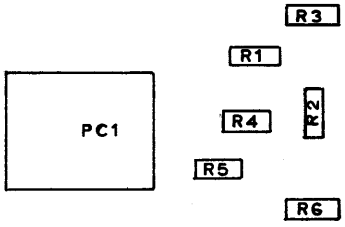
GULATOR BOARD: LP3318/20

) ON 12V DC ONLY VERSION)



HIGH LEVEL AUDIO BOARD: LP3318/2

(FITTED TO ORDER ONLY)



RD (DOUBLE-SIDED): LP3318/6