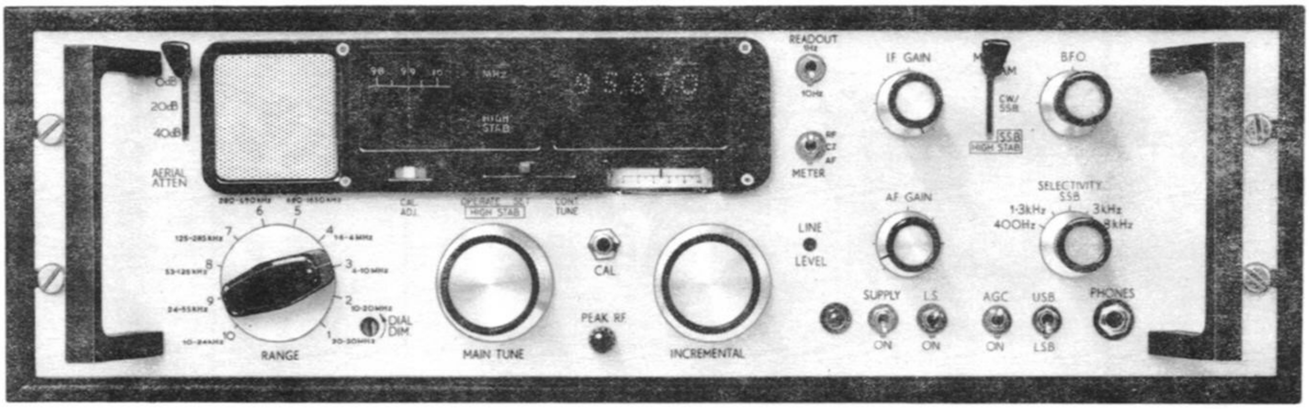
Eddystone

HIGH STABILITY

COMMUNICATION RECEIVER

MODEL EC958/7



10kHz – 30MHz

MODEL EC958/9: A SUPPLEMENT WILL BE INCORPORATED WHEN THIS HANDBOOK IS SUPPLIED WITH A RECEIVER TO THE EC958/9 SPECIFICATION

Manufactured in England by

EDDYSTONE RADIO LIMITED

MEMBER OF MARCONI COMMUNICATION SYSTEMS LTD.

ALVECHURCH ROAD, BIRMINGHAM B31 3PP

Telephone: 021–475 2231 Telex: 337081

ISSUE NUMBER 1, JANUARY 1974

PRINTED IN ENGLAND

AMENDMENT RECORD

Amend No.	Pages subject to change	Amended by	Date
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

The Manufacturer reserves the right to modify the content of this publication as necessary to accommodate modifications, design improvements etc. Relevant Amendment Sheets will be incorporated at date of issue.

FSK Module Cat. No. 1533

FSK Module Cat. No. 1533 is a direct mechanical replacement for the earlier module part number LP3058 described in the handbooks for the EC958 Series receivers. When the new module is fitted to a receiver all existing references in the handbook to the FSK Module should be deleted and the following description substituted. If Cat. No. 1533 is used as a replacement for LP3058 note that the value of R329 should be changed according to the table in the Realignment section.

Performance

With the module fitted to a correctly adjusted receiver, with 1μV signal, 400Hz filter selected and AGC on, the minimum shift of 85Hz enables a transmission rate of 100 bauds to be resolved. Generally the relation: shift/baud rate $\geqslant 0.5$ should be valid. The unit will respond to baud rates in excess of 300 (for shifts > 150Hz). The maximum shift generally depends on the I.F. filter selected.

Installation

1. Check the values of the resistors according to the table in the Realignment section.
2. Stand the receiver on its right-hand side.
3. Unplug the module leads from the dummy termination strip, noting the colour-code and sequence of the wires.
4. Remove the two 4BA retaining screws and the termination strip.
5. Place the module in position, replace the 4BA screws, shakeproof washers and earth tag (to pin 79).
6. Connect the leads to the module, in the sequence in which they were removed. Note that pin 82 is not used but is provided for safe stowage of the -6V supply lead.
7. Connect co-axial lead W to the spare socket on the 3-or 4-way junction box.

Circuit Description

The module is driven directly from the 100kHz I.F. Amplifier Module and provides solid-state switching for an external teleprinter supply. Bipolar supplies of ± 6V, ± 80V, or unipolar supplies of 12V or 100V, can be switched.

Input and Pulse Shaping Circuits.

A signal at 100kHz, taken from the output of the 100kHz I.F. Amplifier Module is coupled via R651 and C651 and IC31. This first stage is a combined limiter and quadrature discriminator. The discriminator characteristic is determined by the phase shift network formed by L33 and the series/parallel combination of C655, C656 and C657. A further 90° phase shift to provide mid-range discriminator output at the peak response of the tuned circuit is given by the phase-shift bridge network consisting of C656, C657, C658, R655. The output (at test point A) is a series of pulses which are coupled to IC32, a D.C. amplifier which provides a waveform of about 6V peak-to-peak amplitude. The D.C. level of this is adjusted under no-signal conditions to a nominal 5.5V by means of RV13. This stage limits when the RF input reaches about 400Hz peak-to-peak deviation. Pulses at the output of IC32 are shaped by the integration circuits R663/C666 and R665/C667 and fed to the tuning meter and a Schmitt trigger IC33. The trigger level is set by RV14 which is accessable through an aperture in the rear panel of the receiver, and is nominally 5.5V. The output from IC33 drives in antiphase the two LED's, which form part of the opto-isolators IC34 and IC35.

The power supply for the input and pulse shaping circuits is the receiver's 12V supply. Two independent 9V rails are derived from this by zener stabilisation. The discriminator and DC amplifier are fed from one rail and the Schmitt trigger and opto-isolators from the other, the total current drawn being about 40mA. Note that this part of the circuit is connected to the receiver circuit earth and is isolated from the output switching network.

Output Switching Network.

The drive to the switch is rectified so that voltage of the correct polarity is always applied to the switching transistors. In the description which follows the components used with Pin 86 positive and Pin 87 negative are shown without brackets whilst those used only when the polarities are reversed are bracketed.

When the L.E.D. in opto-isolator IC34 (IC35) is illuminated, the transistor will be turned "on" allowing a current to flow into the base of TR81. The supply for this is from the +80V rail via D89 (D90) and R673 (R674) and zener regulated and smoothed at 6.2V by D85 (D86) and C668 (C669). As the two L.E.D's are driven in anti-phase reversing the teleprinter supply will effect a mark-space reversal. With TR81 switched "on", TR82 will be "off" and TR83 "on". Current will flow through TR83 and D92 (D93) to the -80V supply and the output will therefore be held close to -80V and will sink current from the teleprinter.

When the L.E.D. in IC34 (IC35) is extinguished TR81 will be biassed "off" by R671, and current will flow via R672 into the base of TR82, turning it "on". TR83 will be "off". In this case current will flow from the +80V supply via D91 (D94) and TR82 and so the output will be held close to +80V and will source current to the teleprinter. Diodes D87 and D88 protect the transistors from high voltages generated by the inductive load of the 'printer. The output current is limited by R329 (mounted in the receiver) and R672, R673, R674 and R329 should be adjusted in value to suit the current required and the supply voltage. The current drawn from the teleprinter supply is 25mA (at 80-0-80V) in addition to the current drawn by the teleprinter. This part of the circuit is isolated from the receiver circuit earth.

Maintenance

Switch the receiver into CW/SSB mode, connect an RF signal generator to the aerial input and tune generator and receiver to a convenient frequency. A CW beat note should be heard from the loudspeaker, provided this is switched on and the ancillaries plug inserted and wired correctly. If a beat note is not heard it is likely that a fault exists elsewhere in the receiver.

Connect a D.C. Voltmeter to Pin 84, connect ± 80V printer supply (or use a bench supply) and check that a small change in frequency of the input signal, say ± 200Hz causes the output to switch between the two states. Check +12V at Pin 83 and earth connections. Check the input lead.

Realignment.

Temporarily short-circuit the I.F. input at "W" and adjust RV13 to give + 5.5V (± 0.2V) at test point C (Avo 8 - 25V DC).

Inject a 100kHz unmodulated signal of 50mV emf into co-axial lead 'W' (a suitable connector is included in the accessories kit), and adjust L33 to give +5.5V (± 0.5V) at test point C. Note that slight adjustment of the core should swing the voltage at TP 'C' a few volts either way. Check that an input of 999.750kHz gives approx. + 8.8V and 100.250kHz gives approx. +2.3V at TP 'C'. Restore the input signal to 50mV emf at 100.000 kHz. Monitor the voltage (AV08 - 25V. DC) at test point D and adjust RV14 so that this voltage just switches (between 2.5V and 8.0V). The following conditions will then be found.

Using a low capacity probe (7pF in parallel with 10MΩ) and oscilloscope or RF meter check the response at TP'B'. The bandwidths to 3dB points should be approx. 2.5kHz and the response at 100kHz should be within 1dB of the peak. Check the limiting action of IC31. Increasing the input level up to 200mV emf should cause only a small change in output, if any.

Output Switching Network.

The components fitted in this network suit a teleprinter supply of 80-0-80V to give an absolute maximum output current of 100-0-100mA bipolar, or 100V at 100mA unipolar. For different voltages and/or currents, the values should be altered according to the following table. In the case of intermediate values, the next highest resistance value should be used. It may be found that it is not necessary to lower the resistor values when a lower voltage is used. This is in order provided the 'printer operates satisfactorally. The reverse is NOT true and damage may result.

SUPPLY					
Bipolar	Unipolar	R672	R673	R674	R329
80-0-80V at 50-0-50mA	100V at 50mA	8.2kΩ 6 watt wirewound	33kΩ 1 watt wirewound	33kΩ 1 watt wirewound	1kΩ 12 watt wirewound
40-0-40V at 50-0-50 to 25-0-25mA	50V at 50 to 25mA	4.7kΩ 3 watt wirewound	15kΩ 1 watt metal film	15kΩ 1 watt metal film	390Ω to 1kΩ 12 watt w.w.
20-0-20V at 50-0-50 to 25-0-25mA	25V at 50 to 25mA	2.2kΩ 3 watt wirewound	4.7kΩ ½ watt metal film	4.7kΩ ½ watt metal film	150Ω 6 watt to 390Ω 12 watt wirewound
10-0-10V at 50-0-50 to 25-0-25mA	10V at 50 to 25mA	1kΩ 1 watt metal film	680Ω 1/3 watt carbon film	680Ω 1/3 watt carbon film	100Ω 3 watt to 150Ω 6 watt wirewound
6-0-6V at 25-0-25mA		470Ω 1/3 watt carbon film	100Ω 1/3 watt carbon film	100Ω 1/3 watt carbon film	100Ω 3 watt wirewound

Set the I.F. input to the module at 100.000kHz, 50mV emf, frequency modulated at 50Hz with a peak-to-peak deviation of 85Hz. Connect the appropriate supply voltage to Pins 86 and 87 and check that a square wave with an amplitude of approx. 2.5V less than the supply voltage is present on Pin 84 with printer disconnected. Slight adjustment of input frequency and of RV14 should change the mark-space ratio over nearly the full range. Repeat the check with 150Hz modulation at 150Hz peak-to-peak deviation. Check that the mark-space ratio remains sensibly constant when the I.F. input is increased to 100mV emf.

Voltage Analysis

The following voltages should be present, subject to usual tolerances to take account of manufacturing spreads in component values.

a. Input and Pulse Shaping Circuits.

IC31	Pin 1		+ 4.3V	
	5		+ 1.4V	
	12		+ 3.7V	
	13		+ 9.5V	
IC32	Pin 2		+ 4.7V)	With TP 'C' set at 5.5V
	3		+ 4.7V)	by RV13
	6		+ 5.5V)	
IC33	Pin 2		+ 5.5V	
	3		4-7V	Set by RV14. Output switches at 5.5V.
	6		+ 8.5V	"High" state
		or	+ 2.5V	"Low" state
	7		+ 9.5V	
IC34	Pin 2		8.5V	TP 'D' high
		or	4.9V	TP 'D' low
IC35	Pin 1		5.0V	TP 'D' high
			2.5V	TP 'D' low

b. Output Switching Network.

Voltages measured with respect to -80V line. Avo 8 on 25V or lowest available range DC.

	+80V pin 86 -80V pin 87		-80V pin 86 +80V pin 87	
	Output high	Output low	Output high	Output low
IC34 pin 4	0.8V	1.5V	1.6V	1.5V
pin 5	7.0V	2.1V	1.6V	1.0V
IC35 pin 5	1.6V	1.0V	7.0V	2.1V

TR81 collector	160V	1.0V	160V	1.0V
emitter	0.6V	0.6V	0.6V	0.6V
TR82 collector	160V	160V	160V	160V
base	160V	1.0V	160V	1.0V
emitter	160V	0.6V	160V	0.6V
TR83 collector	0.6V	0.8V	0.6V	0.6V

Note IC34 pin 4; IC35 pin 4; TR81 base are common
TR81 collector; TR82 base; TR83 base are common
TR82 emitter, TR83 emitter are common.

Components List.

Semiconductors.

TR81	2N3439	D81	BZY88 C9V1
TR82	2N3439	D82	BZY88 C9V1
TR83	2N5416	D83	BZY88 C3V3
		D84	BZY88 C3V3
IC31	MC1357	D85	BZY88 C6V2
IC32	741P	D86	BZY88 C6V2
IC33	741P	D87 - D94	IN4004
IC34	MCT2		
IC35	MCT2		

Coils

L33 Discriminator coil Part No. D5032
CH32 100mH choke Part No. 7350P

Capacitors

C651	0.1μF	Polycarbonate	20%	160V
C652	0.1μF	Polycarbonate	20%	160V
C653	0.22μF	Polycarbonate	10%	160V
C654	100pF	Polystyrene	2%	63V
C655	0.22μF	Polycarbonate	10%	160V
C656	4.7nF	Polystyrene	2%	63V
C657	4.7nF	Polystyrene	2%	63V
C658	68pF	Polystyrene	2%	63V
C659	1μF	Tantalum Electrolytic	20%	35V
C660	0.1μF	Polycarbonate	20%	160V
C661	22μF	Tantalum Electrolytic	20%	16V
C662	22μF	Tantalum Electrolytic	20%	16V

C663	22μF	Tantalum Electrolytic	20%	16V
C664	22μF	Tantalum Electrolytic	20%	16V
C665	22μF	Tantalum Electrolytic	20%	16V
C666	1μF	Tantalum Electrolytic	20%	35V
C667	1μF	Tantalum Electrolytic	20%	35V
C668	22μF	Tantalum Electrolytic	20%	16V
C669	22μF	Tantalum Electrolytic	20%	16V
C670	1nF	Disc Ceramic	20%	500V
C671	0.1μF	Polycarbonate	20%	250V

Resistors

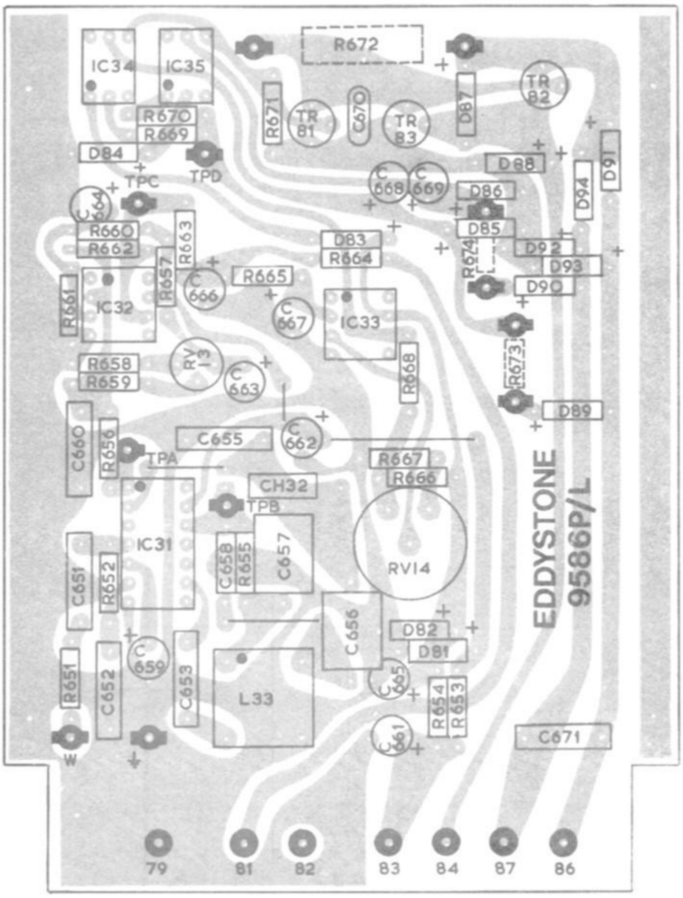
R651	390
R652	220
R653	100
R654	120
R655	22k
R656	6.8k
R657	1k
R658	1k
R659	6.8k
R660	6.8k
R661	6.8k

R662	68k
R663	680
R664	470k
R665	680
R666	1k
R667	1.5k
R668	22k
R669	220
R670	330
R671	10k

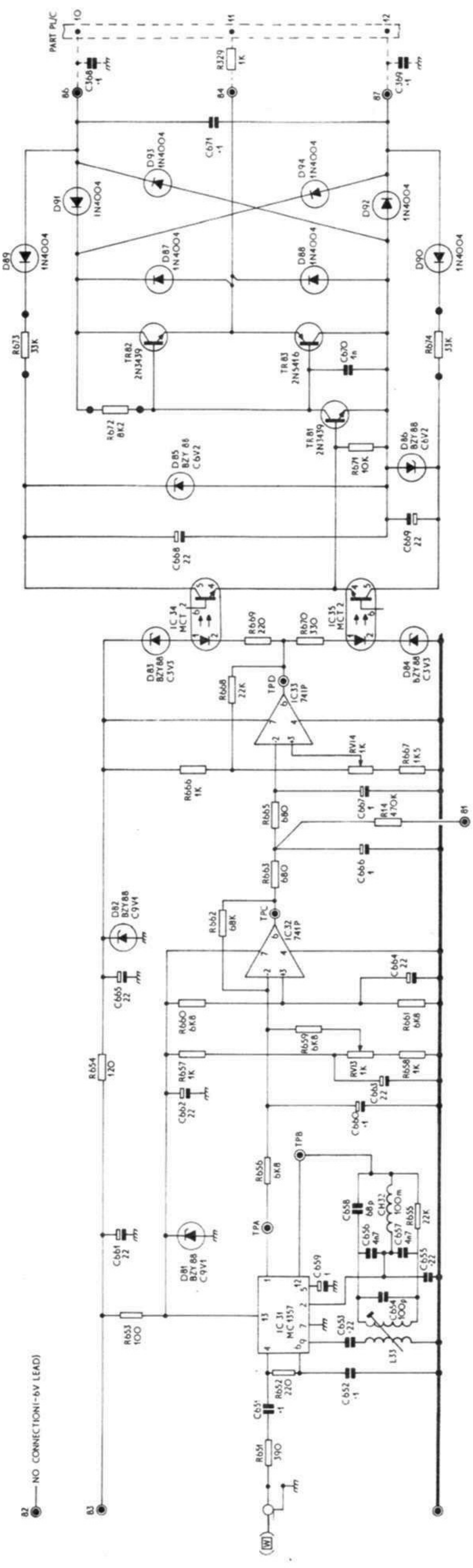
All the above are 5%, 1/3 W carbon film.
for the values and rating of R672, R673, R674 and R329 see table. 5% tolerance is adequate.

Potentiometers.

RV13	1kΩ	Cermet preset
RV14	1kΩ	moulded track preset



Cat. No. 1533 FSK MODULE Printed Circuit Board



Cat. No. 1533 FSK MODULE CIRCUIT DIAGRAM. BP 1385

Supplement for Model 958/7E

The 958/7E differs from its parent, the 958/7, in the following major respects:-

1. The Aerial and RF Coils are different, as are the Tuning Scales.
2. Calibrated Knobs are fitted to the tuning controls.
3. Provision is made for sidetone injection when used in conjunction with a transmitter.
4. The Aerial Attenuator Unit, LP3260/1 is replaced by the RF Sensitivity Unit, LP3280.
5. The rear panel layout is different.

The changes detailed below apply:-

Pages 6 - 9 Technical Data and Performance Summary.

Aerial Input. This should read:-

Ranges 1 - 3 : 75Ω unbalanced

Range 4 : suitable for an aerial of impedance equivalent to 200pF in series with 10Ω.

Ranges 5-10 : suitable for an aerial of impedance equivalent to 200-600pF in series with 10Ω.

Output Facilities. This should read:-

Other Input/Output Facilities.

1. 100kHz I.F. Output (low Z)
2. External Loudspeaker (4-8Ω)
3. Input to Internal Loudspeaker
4. Line Output (600Ω, balanced or unbalanced)
5. Headphone output (Low/Medium-Z).
6. FSK Output (Internal switch)
7. Diversity AGC
8. Incremental Oscillator (550-650kHz) for common oscillator working and corresponding mixer input.
9. Sidetone input
10. External final oscillator input

11. Muting relay input (internal H.S. reed relay controlled from associated transmitter interrupts aerial feeder and grounds input circuit during transmission).

Environmental. Add:-

DEF-133 standard is met when Shock Mounting Assembly LP3455 is fitted.

Image Rejection. This should read:-

10kHz -	1.6MHz	:	greater than 80dB.
1.6MHz -	18MHz	:	greater than 75dB.
18MHz -	30MHz	:	greater than 60dB.

I.F. Rejection. This should read:-

10kHz -	54kHz	:	greater than 60dB.
54kHz -	1.6MHz	:	greater than 80dB.
1.6MHz -	4MHz	:	greater than 90dB.
4MHz -	30MHz	:	greater than 100dB.

Cross Modulation. This should read:-

With a wanted signal at 60dBμV producing standard output, unwanted output will be at least 30dB below this level with an interfering signal 20kHz off-tune and of level 90dBμV.

Intermodulation.

The intermodulation product is no longer defined as being third-order, and the frequency difference restriction is now no closer than 20kHz only.

Audio Output. This should read:-

Ext. Loudspeaker (4Ω)	:	1W at 5% distortion.
Line (600Ω)	:	greater than 10mW.

Audio Response.

This refers to the audio amplifier stages, the overall response is of course governed by the filter configuration in use.

I.F. Output. This should read:-

Greater than 20mV into 75Ω for 3μV Signal.

FSK Performance.

Keying speeds upto greater than 300 Bauds and shifts 85Hz upwards can be accomodated when FSK Module Cat. No. 1533 is fitted.

Skirt 7089/1P is no longer required as a separate item.

Page 150. Change the part no. of L144 to D3896D.

Page 152. Optic-Scale Display. Change the part no. of the Main Display Calibration Disc to 8475/1P.

Miscellaneous. Change the part no. of the Speaker Grille to 6976/1P.
Add: Display Hood, part no. 8995P.
Add: Filtercon, 1500pF, ref. 6F-170.
Add: Incremental Oscillator Oven Thermostat, part no. 9412P.
Change the part no. of the Handles to 8253/1P.

Circuit Data. The following changes should also be made on the main circuit.

Page 158/159. Change TR4 to type BFR29.
Add: C29, (10p) in parallel with R40.
Note: IC2 may be type SA20 or SA21. If type SA20 is fitted, C56 is 2.2pF.

Page 160/161. Change the value of C394 to 0.0068 and add C397 (0.0068) in series with L144, and delete R352. On the turret disc (rear) break the copper track between the connection to L144 marked with a dot and C394, and insert C397 across the break.

Page 162/163. Move C401 so that it is wired directly in parallel with L44.
Change the value of C412 to 4.5 - 20pF.

Page 164/165. Move C421 so that it is wired directly in parallel with L54.
Change the value of C428 to 4.5 - 20pF.
Change the value of C438 to 4.5 - 20pF.

Page 166/167. Change the value of C460 to 0.0015μF.
Change the value of C476 to 15pF.
Change the value of C475 to 40pF.

Page 170/171. Delete R380 and replace by a short-circuit.

Page 172/173. Change the reference of the 15pF capacitor marked C83 to C88.
Add: R97 (100kΩ Adjust on test) in parallel with C101.
Add: R96 (560Ω) and D13A (1N4004) both in parallel with the coil of RLB.
The anode of the diode is connected to TR11 collector.

Page 175. Add: C225A (22μF Electrolytic) from pin 23 to common, the positive plate to pin 23.

Page 176/177. Add: C150 (22μF Electrolytic) from pin 23 to common, the positive plate to pin 23.
Change the value of C155 to 68pF.
Change the value of C158 to 0.1μF.

Page 178/179. This module has been replaced, the new circuit diagram and printed circuit board layouts are included in this amendment.

Page 180/181. Change the type no. of the 250kHz filter to Cat. no. S1504.

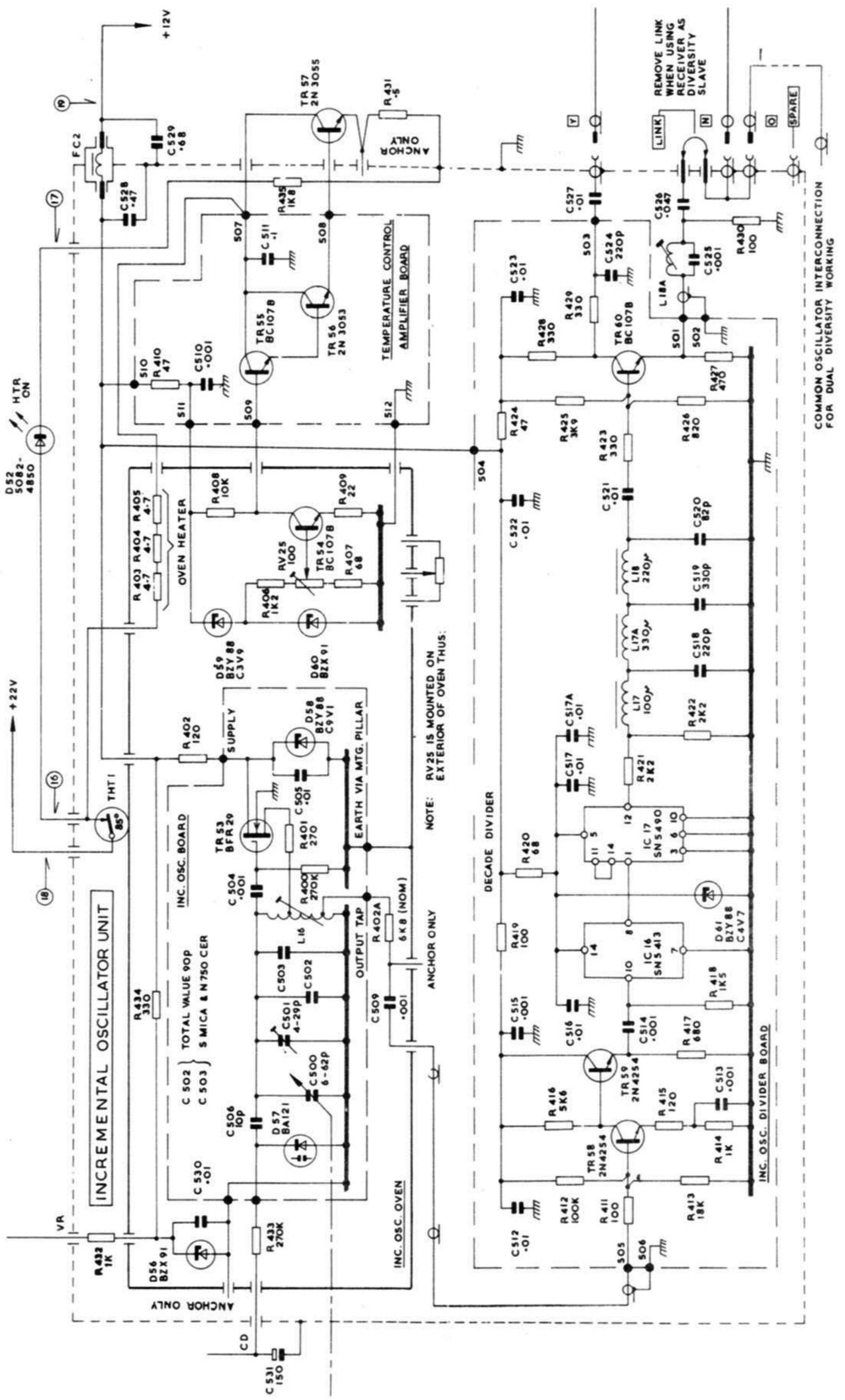
Page 187. Change the value of C350 to 100μF.
Change the value of R311 to 680Ω.

Page 188. Change the value of RV4 to 5.6kΩ.
Change the value of RV11 to 2.7kΩ.

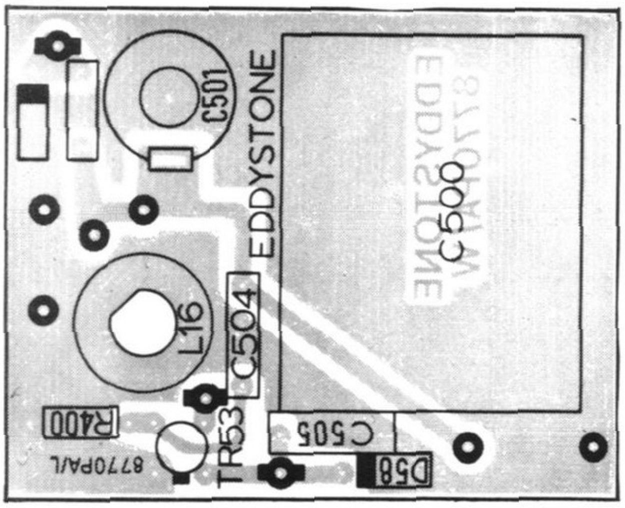
Page 194. Change the value of R299 to 33Ω.
Change the wiring of S5C so that ways "Cont Tune" and "Set" are earthed, not as shown. The main circuit diagram is correct.

Main Circuit Diagram only.

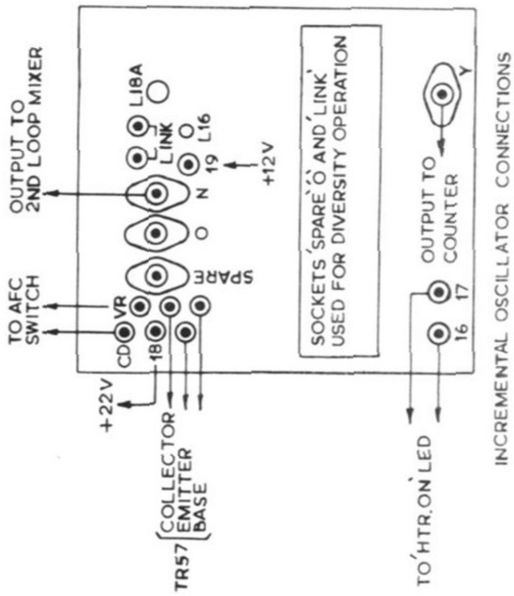
Change the value of R332 to 68Ω (Power Supply).



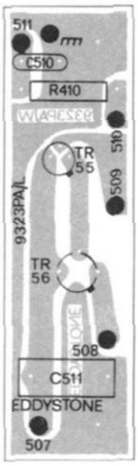
Incremental Oscillator Unit circuit



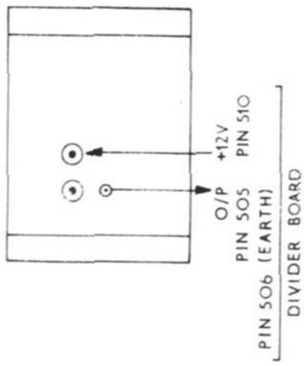
Incremental Oscillator board



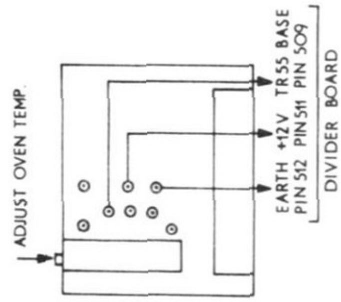
INCREMENTAL OSCILLATOR CONNECTIONS



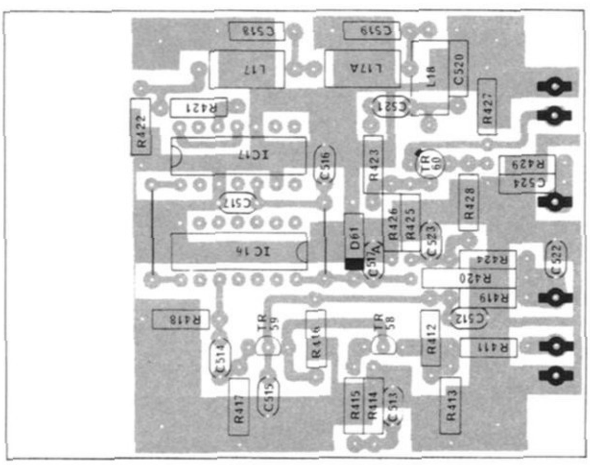
Temperature Control
Amplifier Board



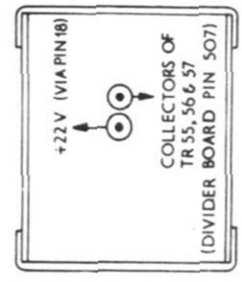
5.5-6.5 MHz OSCILLATOR
SIDE CONNECTIONS



5.5-6.5 MHz OSCILLATOR
REAR CONNECTIONS



Incremental Oscillator Divider board



5.5-6.5 MHz OSCILLATOR
TOP CONNECTIONS

Amendment No. 2.

Incremental Oscillator Unit type LP3347/1 is fitted to current receivers. It incorporates a thermostat to protect against the oven overheating and an L.E.D. mounted adjacent to the unit gives an indication that the oven heater is operating normally, otherwise the unit is similar to type LP3347 which it replaces. External connections are the same, with the addition of pin VR linked to pin CD, as the variable frequency facility offered by varicap diode D57 is not used on this receiver. The temperature control amplifier components (TR55, TR56 etc) are mounted on a separate circuit board which forms assembly LP3465 within the incremental oscillator unit proper.

Pages 10, 21, 56.	Change the type no. of the Incremental Oscillator Unit to LP3347/1.
Page 58.	Change the part no. of the AC Supply Connector to D4815. Add: Box Spanner (for knobs). Part No. 9057P.
Page 59.	Change the part no. of the Cabinet to LP3481 (Assembly LP3481 comprises cabinet with miscellaneous screws etc).
Page 124.	Change the type no. of TR4 to BFR29.
Page 125.	Add: D13A, 1N4004, ITT, Reverse voltage protection, E. Change the type no. of D16 to BZY96C5V1.
Page 126.	Change the type no. of D46 to BZY88C8V2 (See Amendment No. 1). Add: D52, 5082-4850, Hewlett-Packard, "Oven Working" LED, H. Add: D56, BZX91, Mullard, Zener regulator, H. Add: D57, BA121, ITT, V.V.C. (not used) H. Note: that IC2 may be type SA20 or SA21. If SA20 is fitted, C56 is 2.2pF. Note: that IC18 may be types TCA160A, TCA160B or TCA160C (refer to amendment no. 1). If type TCA160C is fitted as a replacement remove the aluminium clip supplied with the device and refit the Eddystone heatsink. The pin 1 end of the device is identified by the deeper notch.
Page 128.	Add: C29, 10pF, Tubular ceramic, 10%, 750V, D.
Page 131.	Add: C150, 220µF, Tubular Electrolytic, - 10% + 50%, 16V, G. Change the value of C155 to 68pF. Change the value of C158 to 0.1µF.
Page 132.	Add: C225A, 22µF, Tantalum Electrolytic, 20%, 16V, J.
Page 134.	Change the value of C339 to 150µF (See amendment No. 1). Change the value of C350 to 100µF. Change the value of C372 to 6800µF

Page 135.	Add: C506, 10pF, Tubular ceramic, 10%, 750V, H. Add: C530, 0.01µF, Disc ceramic, - 20% + 80%, 25V, H. Add: C531, 150µF, Tubular electrolytic, - 10% + 50% 16V, H.
Page 137.	Add: R96, 560Ω, 5%, 0.3W, E. Add: R97, 100kΩ Adjust on test, 5%, 0.3W, E.
Page 138.	Change the value of R299 to 33Ω. Change the value of R311 to 680Ω.
Page 139.	Change the value of R332 to 68Ω. Add: R432, 1kΩ, 5%, 0.3W, H. Add: R433, 270kΩ, 5%, 0.3W, H. Add: R434, 330Ω, 5%, 0.3W, H. Add: R435, 1.8kΩ, 5%, 0.3W, H.
Page 141.	Change the value of C394 to 6800pF. Add: C397, 6800pF, Polystyrene, 2%, 125V, 6. Change the value of C412 to 4.5 - 20pF.
Page 142.	Change the value of C428 to 4.5 - 20pF. Change the value of C438 to 4.5 - 20pF. Change the value of C460 to 0.0015µF.
Page 143.	Change the value of C475 to 40pF. Change the value of C476 to 15pF.
Page 144	Delete R380.
Page 145.	Change the part no. of RF Assembly to LP3375/1. Change the part no. of 935kHz Loop Amplifier Module to LP3055/1. Change the part no. of Incremental Oscillator Unit to LP3347/1. Add: to Printed Circuit Boards: Temperature Control Amp. Board, LP3465.
Page 146.	Change the part no. of 250kHz IF Filter to Cat. No. S1504.
Page 147.	Change the value of RV4 to 5.6kΩ, part no. 9372P. Change the value of RV11 to 2.7kΩ, part no. 6841P. Change the part no. of RV5 to 9439/1P. Change the part no. of RV7 to 9439P.
Page 148.	Change the part no. of Mains Input Connector (chassis mounted) to 8730P. Change the part no. of Mains Input Connector (with lead) to D4815. Change the part nos. of the knobs as follows:-

D3613/3	to LP3459/1
D3614	to LP3460/1
D3957	to LP3464/1
D3958	to D4933

Note. Image and I.F. rejection, cross and inter-modulation and blocking are measured with aerial impedances equivalent to that shown under "Aerial Input" above.

Page 16. For Aerial Attenuator read "RF Sensitivity Unit, LP3280". This provides attenuator settings of 0dB - 10dB - 20dB. There is no balun transformer, the aerial input impedances are as quoted above.

Page 62. Delete reference to High - Z Aerial input. The push terminals are used for the 600Ω line output.

Pages 63-65. Ancillaries Connector. This is as shown overleaf.

Page 74. Aerial Attenuator. The switch positions are 0dB - 10dB - 20dB. The notes regarding the use of this control still apply.

Page 76. A.F. Gain Control. Note that the sidetone volume is not directly controlled by the receiver controls. The level should be set externally on installation of the receiver.

Page 88. Performance Testing and Realignment. The aerial input to the receiver should be from an impedance equivalent to that given under "Aerial Input" above.

Page 136. Add:- C579, 0.01μF, Polycarbonate, 20%, 100V, S.
Change the values of R11, R12 to 39Ω.
Change the value of R13 to 47Ω.

Page 139. Add R570, 330kΩ, 5%, 0.3W, S.
R571, 10kΩ, 5% 0.3W, S.
R572, 100kΩ, 5%, 0.3W, S.
R573, 3.3Ω, 5%, 3W (Wirewound) S.
R574, 3.3Ω, 5%, 3W (Wirewound) S.

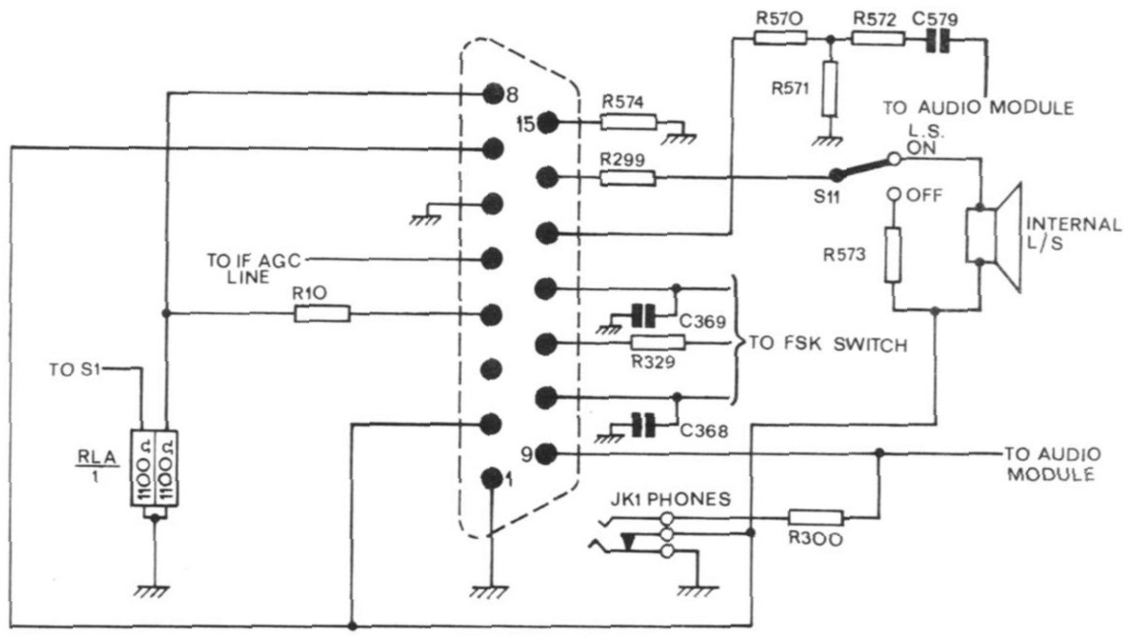
Page 141. Change the value of C412 to 4.5 - 20pF.
Add C413, 10pF, Tubular Ceramic, 10%, 750V, Range 10.

Page 145. Change the Aerial Attenuator Unit, part no. LP3260/1 to RF Sensitivity Unit, part no. LP3280.
Change the part no. of Aerial Disc (A) to LP3281.
Change the part no. of RF Disc (B) to LP3282.

Page 148. Change the part nos. for the Main Tuning and Incremental Tuning knobs to LP3487/1.

Page 150. Change the part nos. of the coils as follows:-

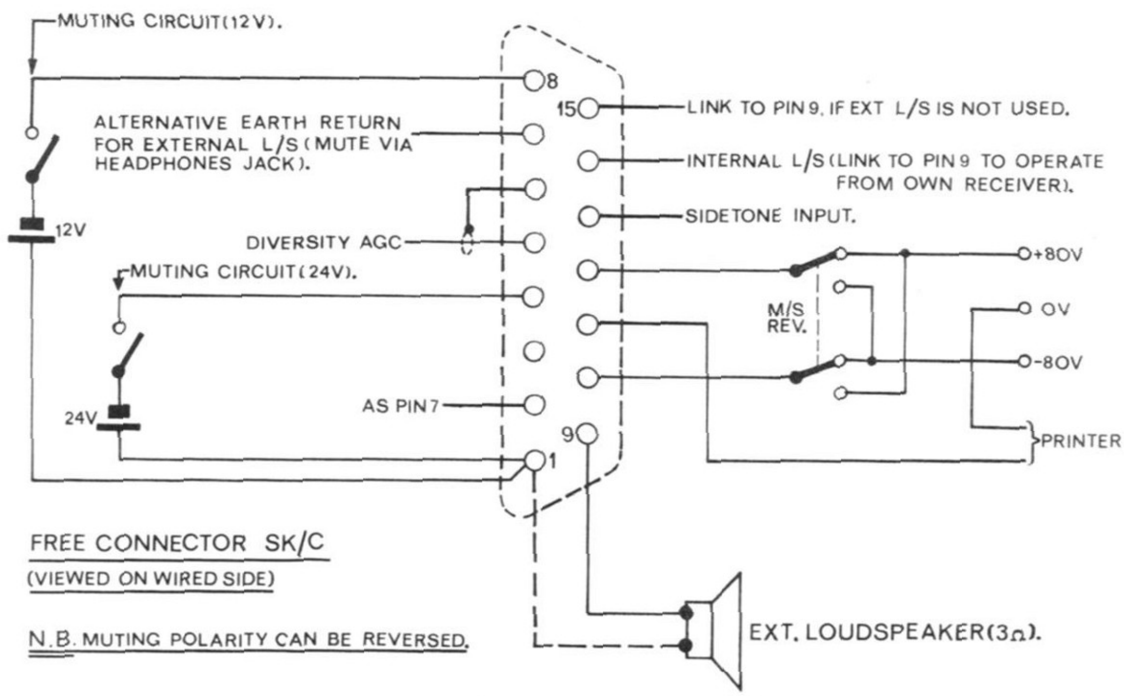
L136	to	D3892C	L44	to	D3900B
L137	to	D3893C	L45	to	D3901B
L138	to	D3894B	L46	to	D3902B
L139	to	D4433A	L48	to	D4438



FIXED CONNECTOR PL/C

(VIEWED ON PINS)

NB:: EXTERNAL EARTH CONNECTIONS CAN BE MADE TO SK/C-1 OR SK/C-6



FREE CONNECTOR SK/C

(VIEWED ON WIRED SIDE)

N.B. MUTING POLARITY CAN BE REVERSED.

MODEL 958/7E:: Ancillary Connections (PL & SK/C)

Page 150 Continued....

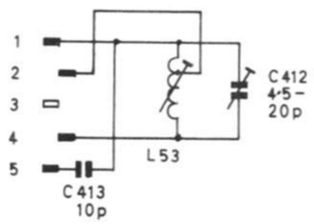
L142	to	D4434A	L49	to	D4439A
L143	to	D4435	L50	to	D4440A
L144	to	D3896B	L52	to	D4442A
L145	to	D4436A	D53	to	D4443
L146	to	D4437A			

Page 152. Optics. Change the part no. of the Tuning Scale disc to 8475P.

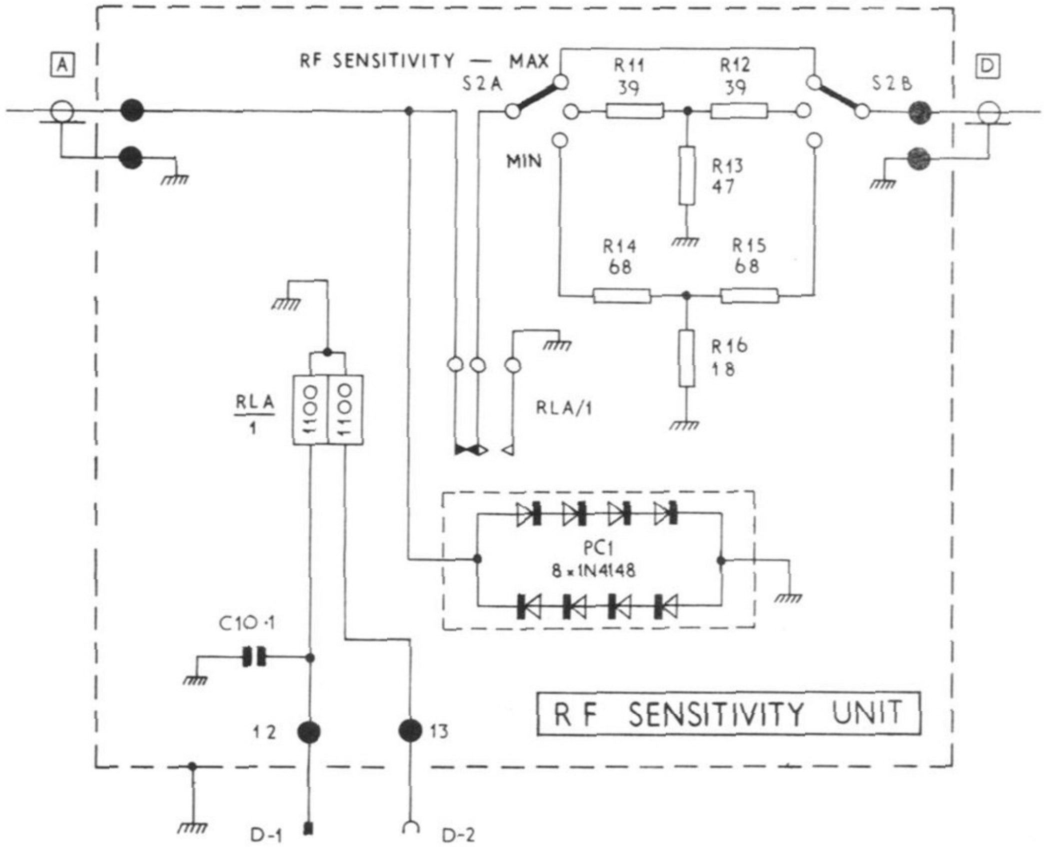
Page 157. Delete the Circuit Diagram and Printed Circuit Board Layouts and replace by those shown below.

Page 160. Delete R352. This component is mounted on the coil and therefore does not appear on the Disc layout.

Page 162. Delete the circuit for Range 10 and replace by that shown below. The disc layout is not affected.



Circuit Diagrams. Make the changes relating to the Ancillaries Connector (see page 4 of this amendment) and the changes shown below.



AMENDMENT NO. 1

Audio Module LP3385

This module has been superseded by Audio Module LP3431. External connections remain the same.

CW/SSB Detector & BFO Module LP3348

This module has been superseded by LP3432. External connections remain the same.

10kHz Calibrator Unit LP3441

This is an additional unit which is mounted above and to the rear of the Incremental Oscillator Unit. It works in conjunction with the 1MHz Crystal Calibrator. When the CAL switch button is pressed 1MHz calibration markers are provided on ranges 1-4 and 10kHz calibration markers are provided on ranges 5-10.

CORRIGENDA

Page 7 — Line 9 should read:–

The CW/SSB Detector employs a double-balanced mixer . . . etc.

Page 11 — Delete LP3385 and substitute LP3431
Delete LP3348 and substitute LP3432

Page 31 — The penultimate paragraph should read:–

The double-balanced mixer employs an integrated circuit (IC20 : SL641C) with signal (100kHz IF) input applied to pin 7 via coaxial interconnection 'V'.

Oscillator injection is to pin 3 and audio output is taken from pin 5 via a low-pass filter . . . etc.

Page 32 — Line 2 and line 7:–

For "gate 2 of detector" read "pin 3 of the mixer"

Line 17 and line 23:–

Delete LP3385 and substitute LP3431

Line 25: For SL414 read TCA160

Line 26: After AF GAIN (RV7), insert:–
via buffer stage TR34 (UC734B)

Line 28: Delete and replace with:
HF response roll-off is provided by R269/C330

Delete Line 29 and line 30:– (RV26 is not fitted)

Line 31: for C339 read C335

Page 33 Line 2 should read:–

This circuit comprises TR35 (UC734B), TR36 (BCY71) and IC19 (MFC4000B) as buffer, pre-amplifier and output amplifier.

Line 3: for D37A read D46

Line 8: for TR35 read TR37

Line 9: should read:

Meter Rectifiers D37 and D37A (OA47). Output from D37A . . . etc.

Pages 56 & 57. Table 3.3

Ref. 11. Audio Amplifier Module LP3431
Semi-conductors: TR34-37, IC18, IC19, D37, D37A, D46
Capacitors: C327-348
Resistors: R266-287
Misc: T2

Ref. 18. CW/SSB Detector & BFO Unit LP3432
Semi-conductors: TR32, D35, D36, D36A
Capacitors: C312-C326
Resistors: R251-R261
Misc: L32, CH28-31 and 31A

Page 63 Line 22:– Delete the sentence beginning:

"Total shut-down of the output . . ."
(Audio Module LP3431 does not incorporate an automatic shut-down feature).

Page 68 Line 21: Delete all references to IC shut-down.

Line 40: CALIBRATOR SWITCH: 10kHz markers are available on ranges 5-10.

Page 76 See CALIBRATOR SWITCH above and modify text where necessary.

Page 82 Line 20: Delete reference to automatic overload cut-out.

Page 88 Line 35: . . . sensitivity of 20mV for 100mW output should read: 6mV for 100mW output, (4 ohm load).

Page 97 Delete the paragraph headed: Product Detector Gain

Page 118 Pin 61. Service: Supply to IC20

Pin 66. Voltage should be approx. –4.5V for 10mW noise on panel meter

Pin 69. Service: Supply to IC18, TR34 and TR37. Internal zener feeds TR35, TR36 and IC19.

Page 120 Delete TR33

Voltage readings should be as below:–

	emitter/ source	base/ gate 1	collector/ drain
TR34	+1V	0V	+11.75V
TR35	+1V	0V	+ 8.75V
TR36	+4V	+3.4V	+ 0.75V

Page 122 **INTEGRATED CIRCUITS**

Voltage readings should be as below:—

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
IC18	0V	+7V	–	+6V	–	+5.6V	–	+9V	+12V	–	+12V	–	+6V	–	–	0V
IC21	–	–	–	–	–	–	0V	*	–	†	–	–	–	+5.2V	–	–
IC22	*	–	–	–	+5.2V	0V	–	–	–	0V	*	†	–	*	–	–

* Repetitive pulses present
† RF waveform present

Page 125 Delete TR33. TR34-37 should read as below:—

TR34; UC734B; Solidev; AF Amplifier (buffer)
TR35; UC734B; Solidev; AF Amplifier (buffer)
TR36; BCY771; Mullard; AF Amplifier (600 ohm line pre-amp)
TR37; BC107B; Mullard; AF Amplifier (Meter Rect. Driver)

Add:—

D1; BZY88C4V7; Mullard; Zener regulator

Page 126 Add:—

D36A; BZY88C6V2; Mullard; Zener regulator; L

Change D37A to read:—

0A47; Mullard; Meter rectifier O/P; M

Add:—

D46; BZY88C9V1; Mullard; Zener regulator; M

Change IC18 to read:—

TCA160; Mullard; Main Audio Amplifier; M

Add:—

IC20; SL641C; Plessy; Double-balanced mixer; L
IC21; SN7413; Texas; Schmitt Trigger; Y
IC22; SN7490; Texas; Decade Divider; Y

Page 128 Add to the location code:—

Y : 10kHz Calibrator Unit

C3, C4, and C5 references now allocated:

C3; 10μ F; Tantalum; 20% 20V; Y
C4; 0.01μ F; Disc ceramic; +80%–20%; 250V; Y
C5; 0.01μ F; Disc ceramic; +80%–20%; 250V; Y

Page 133 & Page 134 Delete C314, C317-324, and C330-348.
Note that these references, together with C325-329 which are now allocated, should read as listed below:–

Ref.	Value	Type	Tolerance	Wkg. V	Loc.
C314	0.01μF	Disc ceramic	+80%–20%	250V	L
C317	0.01μF	Disc ceramic	+80%–20%	250V	L
C317A	0.01μF	Disc ceramic	+80%–20%	250V	L
C318	0.01μF	Disc ceramic	+80%–20%	250V	L
C319	22μF	Tantalum	20%	16V	L
C320	22μF	Tantalum	20%	16V	L
C321	22μF	Tantalum	20%	16V	L
C322	0.022μF	Polycarbonate	20%	100V	L
C323	0.1μF	Polycarbonate	20%	100V	L
C324	0.1μF	Polycarbonate	20%	100V	L
C325	10μF	Tantalum	20%	25V	L
C326	10μF	Tantalum	20%	25V	L
C327	0.047μF	Polycarbonate	20%	100V	M
C328	22μF	Tantalum	20%	16V	M
C329	0.22μF	Polycarbonate	20%	100V	M
C330	0.0047μF	Polystyrene	5%	63V	M
C331	220μF	Tubular electrolytic	+50%–10%	16V	M
C332	22μF	Tantalum	20%	16V	M
C333	0.22μF	Polycarbonate	20%	100V	M
C334	22μF	Tantalum	20%	16V	M
C335	470μF	Tubular electrolytic	+50%–10%	25V	M
C336	220μF	Tubular electrolytic	+50%–10%	16V	M
C337	0.1μF	Polycarbonate	20%	100V	M
C338	1.0μF	Tantalum	20%	35V	M
C339	68μF	Tantalum	20%	20V	M
C340	0.047μF	Polycarbonate	20%	100V	M
C341	22μF	Tantalum	20%	16V	M
C342	0.047μF	Polycarbonate	20%	100V	M
C343	0.001μF	Disc ceramic	20%	500V	M
C344	100μF	Tubular electrolytic	+50%–10%	16V	M
C345	1.0μF	Tantalum	20%	35V	M
C346	100μF	Tubular electrolytic	+50%–10%	16V	M
C347	1.0μF	Tantalum	20%	35V	M
C348	4.7μF	Tantalum	20%	20V	M

Page 136 R5-9. Note that these references are now allocated as listed below:

Ref.	Value	Tol.	Rtg.	Loc.
R5	12,000Ω	5%	0.3W	Y
R6	68Ω	5%	1W	Y
R7	1,000Ω	5%	0.3W	Y
R8	1,800Ω	5%	0.3W	
R9	220Ω	5%	0.3W	

Page 138 Delete R253, R256-259, R261-263, and R270-287.
Note that these references, together with R260 and R266-269 which are now allocated, should read as listed below:–

Ref.	Value	Tol.	Rtg.	Loc.
R253	6,800Ω	5%	0.3W	L
R256	4,700Ω	5%	0.3W	L
R257	270Ω	5%	0.3W	L
R258	270Ω	5%	0.3W	L
R259	470Ω	5%	0.3W	L
R260	18,000Ω	5%	0.3W	L
R261	180Ω	5%	0.3W	L
R262	Not allocated			
R263	Not allocated			
R266	47,000Ω	5%	0.3W	M
R267	100Ω	5%	0.3W	M
R268	470Ω	5%	0.3W	M
R269	2,200Ω	5%	0.3W	M
R270	100Ω	5%	0.3W	M
R271	100Ω	5%	0.3W	M
R272	4,700Ω	5%	0.3W	M
R273	8.2Ω w.w.	5%	6W	M
R274	100Ω	5%	0.3W	M
R275	47,000Ω	5%	0.3W	M
R276	470Ω	5%	0.3W	M
R277	100Ω	5%	0.3W	M
R278	82,000Ω	5%	0.3W	M
R279	47,000Ω	5%	0.3W	M
R280	10,000Ω	5%	0.3W	M
R281	100Ω	5%	0.3W	M
R282	1,000Ω	5%	0.3W	M
R283	4,700Ω	5%	0.3W	M
R284	22,000Ω	5%	0.3W	M
R285	1,200Ω	5%	0.3W	M
R286	470Ω	5%	0.3W	M
R287	100,000Ω	5%	0.3W	M

Page 140 Delete RV21 & RV26

Page 145 Change LP3348 to read LP3432

Change LP3385 to read LP3431

Add: 10kHz Calibrator Unit LP3441

Page 147 Delete RV21

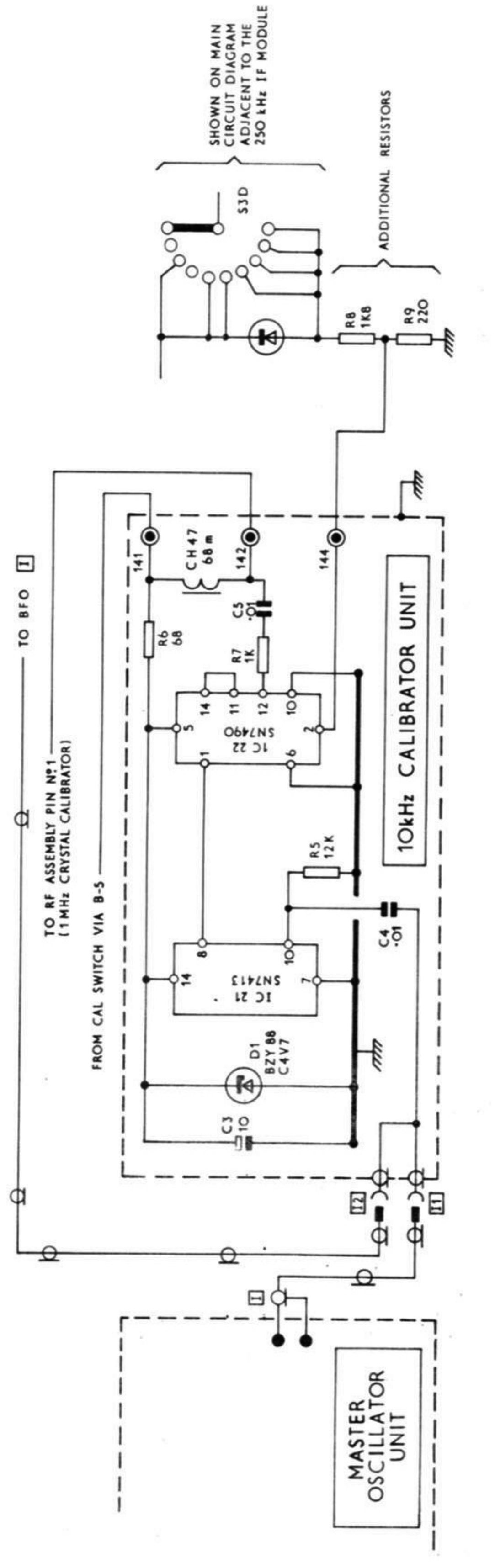
Page 151 Change CH31 to read: 10 millihenries
Part No. 9199P

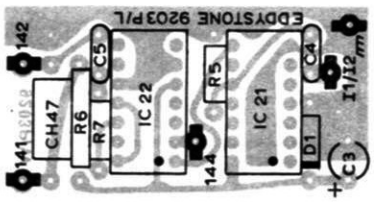
Add: CH31A; 22 millihenries. Part No. 9200P

Page 152 Add: CH47; 68 millihenries; 10kHz Calibrator; Part No. 7759P

Page 184	Note that the circuit diagram and printed circuit board layout of CW/SSB Detector and BFO Unit is now as included with this amendment.
Page 186	Note that the circuit diagram and printed circuit board layout of the Audio Amplifier Module is now as included with this amendment.
Block Diagram	Change TR33 (CW/SSB Detector) to read IC20 Change TR34 Audio Amp. to read TR35 Buffer Change TR35 to TR37 Insert TR36 Audio Amp. between TR35 Buffer and IC19 Insert TR34 Buffer before IC18 Insert 10kHz Calibrator between TR13 and Crystal Calibrator
Main Circuit Diagram	Note that the circuits of the Audio Module and the CW/SSB Detector and BFO are now as included with this amendment. For details of the 10kHz Calibrator circuit and interconnections also refer to this amendment. The connection from the CAL switch to pin 1 of the RF Assembly is routed via the 10kHz Calibrator Unit. The coaxial cable (I) linking the Master Oscillator Unit and the BFO is also routed via the 10kHz Calibrator Unit.

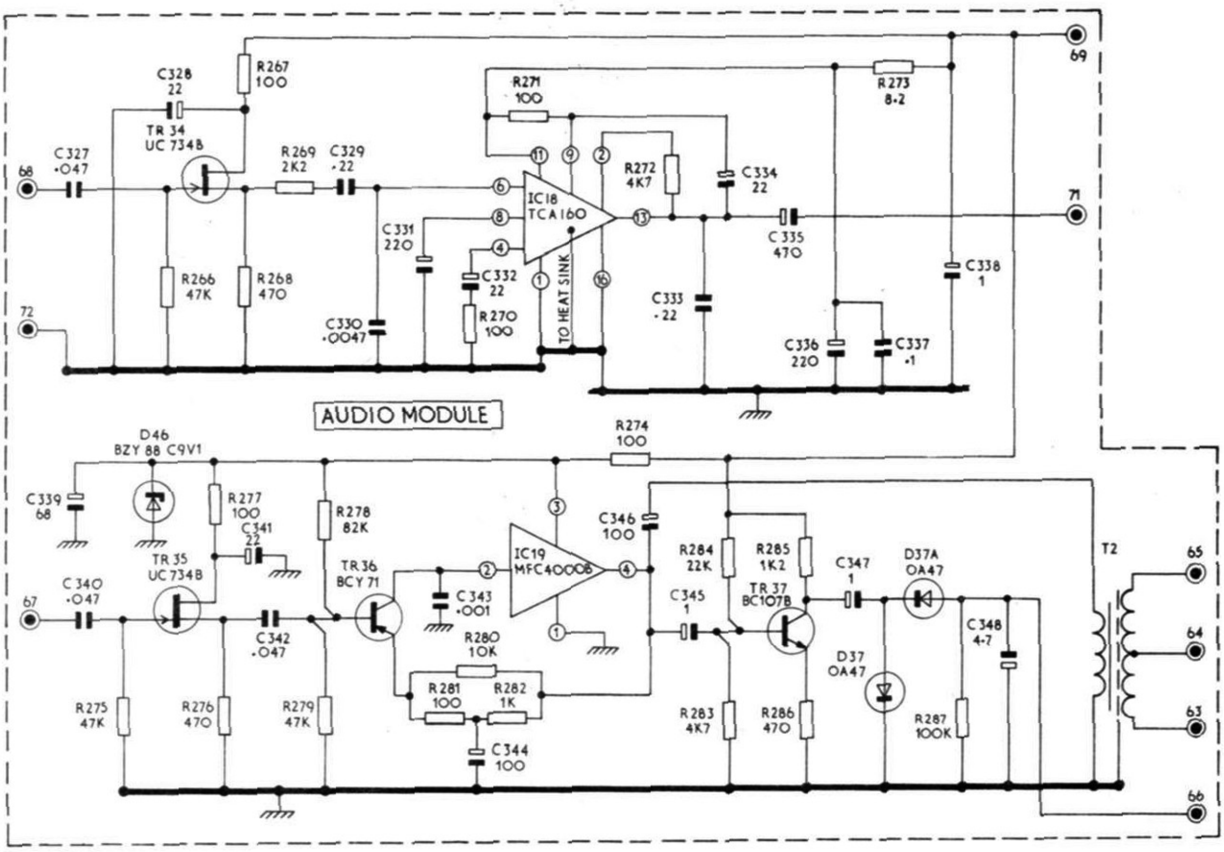
High Stability Communication Receiver   Amendment No. 1



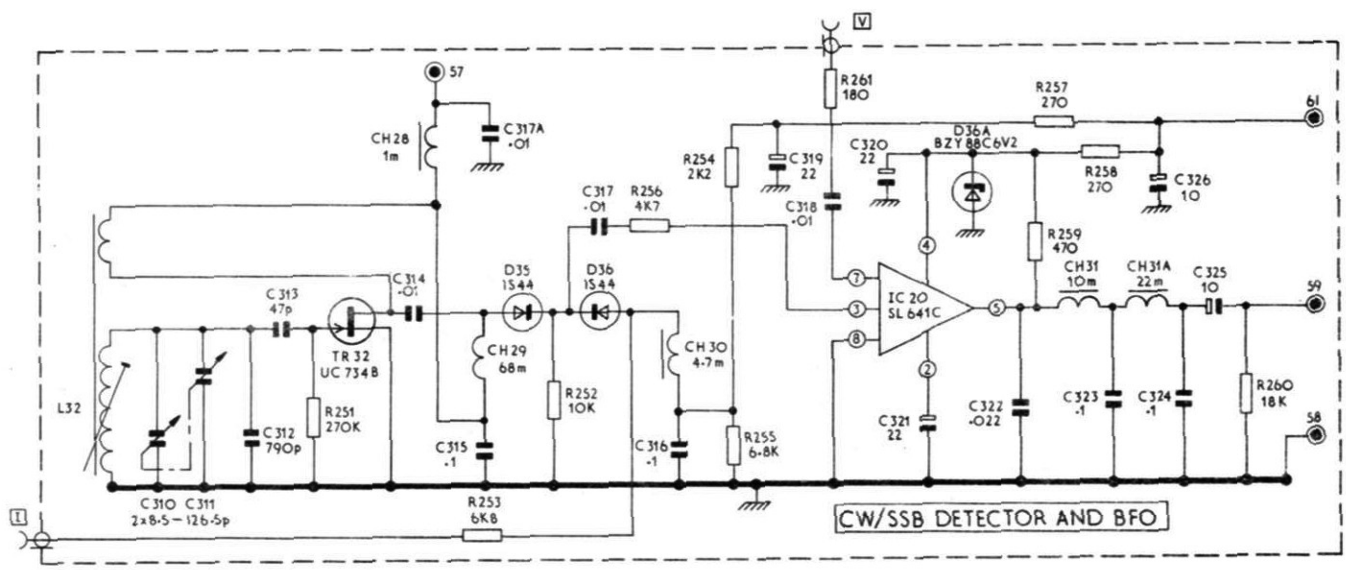


Circuit Diagram and Printed Circuit Board
10kHz Calibrator Unit LP3441

High Stability Communication Receiver Amendment No. 1

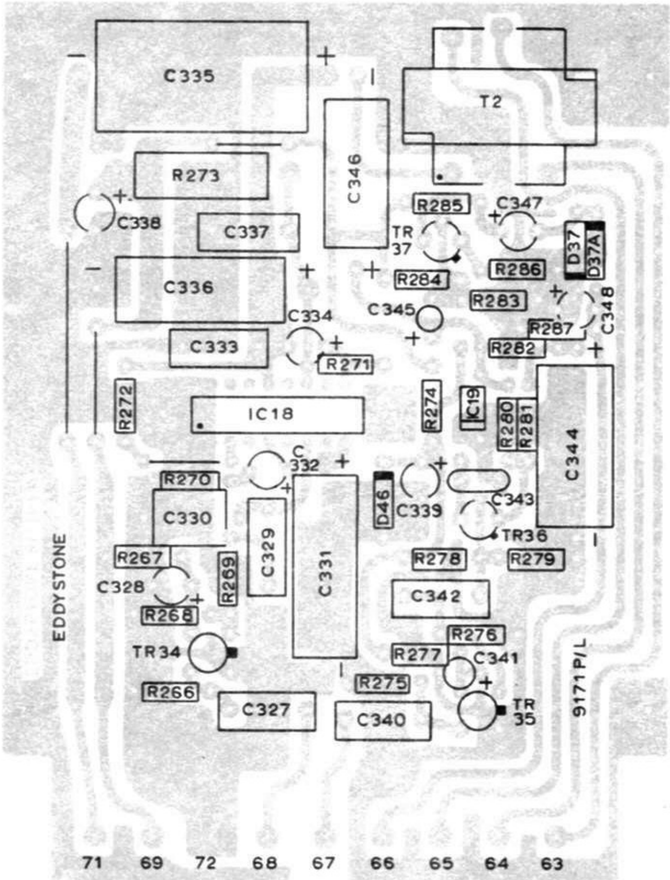


Circuit Diagram: Audio Module LP3431



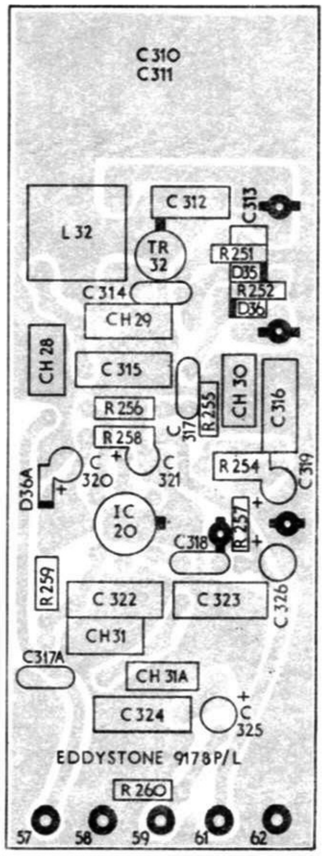
Circuit Diagram: CW/SSB Detector & BFO Module LP3432

High Stability Communication Receiver Amendment No. 1



Audio Module LP3431

PRINTED CIRCUIT BOARDS



CW/SSB Detector & BFO Module LP3432

GENERAL AMENDMENT 958 SERIES (ALL MODELS)

The following modification has been introduced in order to reduce the possibility of failure of the 3rd. signal mixer stage formed by TR20 (250kHz IF Module).

ADD:-

1 off IN4004 diode to the a/m module circuitry connected from the drain of TR20 to ground. The diode is connected across pin Q/L and the ground pin. In all model variants the cathode of the diode is connected towards pin Q/L.

For 958/12 variant connect diode across pin CA/Q/L and ground; cathode towards pin CA/Q/L.

July 1978.

GENERAL AMENDMENT 958/7 SERIES

ERRATA

CIRCUIT DIAGRAM : : USB/LSB SWITCH (designated S7).

The given markings "USB" and "LSB" for switch S7 are incorrect, and should be transposed. (e.g. The +12V supply is switched in to energise relays RLD1 and RLE1 when S7 is switched to the USB position).

The receiver circuitry is correct.

GENERAL CHANGES

935kHz LOOP MODULE : : R84 becomes 1K2.

MODEL EC958/7F

SUPPLEMENT TO EC958/7 INSTRUCTION MANUAL

INTRODUCTION

This receiver is a variant of the EC958/7 fitted with a Notch Filter Module LP3466. Changes are as detailed below and a modification circuit is bound at the rear of the manual.

General

The Notch Filter Module is fitted at the front of the RH side plate. It is wired in circuit between the 100kHz IF Filter Unit and the 100kHz IF Amplifier Module. The notch filter is tunable over the range 100kHz ± 300Hz by means of a front panel control which also serves to switch the filter into circuit, the insertion loss being approximately 7-10dB. The notch depth obtained is approximately 60dB down referred to the centre of the bandwidth with the notch filter out of circuit.

Operation

The notch filter control knob is concentric with the IF gain control and is distinguished by a red skirt. To bring the filter into operation the knob is moved out of the red sector at the extreme anti-clockwise end of its travel. Further rotation of the control knob enables the filter to be tuned over the prescribed range.

It should be noted that if the notch filter is used with bandwidths greater than 2kHz some limitation of the overall bandwidth will occur.

Circuit

The notch filter is a bridged 'T' type, tuned by MV1656 varicap diodes. The filter inductor (vinkor) is preset to give the required tuning range of at least ± 300Hz around 100kHz. A 100kΩ preset potentiometer controls the notch depth.

Another vinkor, which forms the tuned load for the filter, is preset to resonance at 100kHz.

Control voltage for the varicap diodes is derived directly from the notch filter control potentiometer on the front panel. This control voltage is also fed to a trigger circuit comprising a 741P operational amplifier and two BCY 71 transistors. As the control knob is moved from the extreme anti-clockwise position the control voltage rises to a level where the transistors are turned 'on' thus energising the associated relays which bring the filter into circuit. The switch 'on' point is determined by a 1kΩ preset potentiometer.

Component Types, Major Spares

Appendix 'B'

Page 124 Add to Location Code : Y: Notch Filter Module

Page 125-7 Add:-

Ref.	Type	Manufacturer	Circuit Function	Location
IC25	741P	Texas	Switching Detector	Y
TR70	BCY 71	Mullard	Relay Driver	Y
TR71	BCY 71	Mullard	Relay Driver	Y
D70	1N4004	ITT	Relay Diode	Y
D71	MV1656	Motorola	Varicap Diode	Y
D72	MV1656	Motorola	Varicap Diode	Y
D73	1N4004	ITT	Relay Diode	Y
D74	BZY88C10	Mullard	Zener Diode	Q

Appendix 'C'

Page 128 Add to Location Code : Y: Notch Filter Module

Page 136 Add:-

Ref.	Value	Type	Tolerance	Wkg. V	Location
C600	1μF	Tantalum	20%	35V	Y
C601	22pF	Polystyrene	+10%	125V	Y
C602	0.1μF	Polycarbonate	20%	100V	Y
C603	0.0056μF	Polystyrene	2%	125V	Y
C604	180pF	Polystyrene	2%	125V	Y
C605	0.1μF	Polycarbonate	20%	100V	Y
C606	0.0056μF	Polystyrene	2%	125V	Y
C607	180pF	Polystyrene	2%	125V	Y
C608	0.1μF	Polycarbonate	20%	100V	Y
C609	390pF	Polystyrene	2%	125V	Y
C610	1μF	Tantalum	20%	35V	Y
C611	1μF	Tantalum	20%	35V	Y
C612	220μF	Tubular Electrolytic	+50% - 10%	16V	Q

Page 139 Add:-

Ref.	Value	Tolerance	Rating	Location
R600	47Ω	5%	0.3W	Y
R601	47Ω	5%	0.3W	Y
R602	0.33MΩ	5%	0.3W	Y
R603	47Ω	5%	0.3W	Y
R604	33000Ω	5%	0.3W	Y
R605	0.33MΩ	5%	0.3W	Y
R606	47Ω	5%	0.3W	Y
R607	47000Ω	5%	0.3W	Y
R608	5600Ω	5%	0.3W	Y
R609	1000Ω	5%	0.3W	Y
R610	1000Ω	5%	0.3W	Y
R611	82000Ω	5%	0.3W	Y
R612	4700Ω	5%	0.3W	Y
R613	4700Ω	5%	0.3W	Y
R614	100Ω	5%	0.3W	Q
R615	270Ω	5%	0.3W	Q

Page 140 Add:-

Ref.	Value	Law	Type	Function	Location
RV30	0.1MΩ	LIN	Carbon preset	Notch Depth	Y
RV31	1000Ω	LIN	Carbon preset	Switching level	Y
RV32	1000Ω	LIN	Carbon	Notch frequency	Q

Appendix 'D'

Page 145 Add:-

Notch Filter Module LP3466
100kHz IF Amplifier Module LP3056/1

Delete:-

100kHz IF Amplifier Module LP3056

Page 147 Add:-

RV5/RV32 IF Gain/Notch Frequency 50,000Ω log + 1000Ω lin with concentric spindle — 9432P

Page 148 Add:-

IF Gain/Notch Frequency knob assembly — LP3462/3

Page 151 Add:-

Ref.	Description	Part No.
L90	Notch coil	D4976
L91	Output coil	D4977

Page 152 Add:-

Finger Plate (Model 958/7F) D4980

Delete:-

Finger Plate (Model 958/7) 8767P

October 1978

AMENDMENT NO. 5 MODEL 958/7

GENERAL CHANGES TO CIRCUIT DIAGRAM

10kHz CALIBRATOR UNIT LP3441 (AMENDMENT NO. 1 REFERS).

Add two diodes type 1S44 as follows:-

D1 across pins 2 and 5 of IC22. Cathode to pin 5.

D2 across pins 5 and 12 of IC22. Cathode to pin 5.

MASTER OSCILLATOR UNIT

Add capacitor 0.1μ polycarbonate 20% 100V Wkg (designated C122a). This capacitor is connected across circuit board terminal "I" and EARTH.

FSK MODULE (CAT 1533 ONLY).

Change value of Resistor R329 (original value 1K8) to 1K w.w 12W 5%. The resistor is connected from FSK circuit board terminal "84" to Pin 11 of the Ancillary Connector.

LIST OF CONTENTS

			Page
Section 1.	GENERAL DESCRIPTION AND TECHNICAL DATA	General Description	6
		General Specification	7
		Performance Summary	8
Section 2.	CIRCUIT DESCRIPTION	List of Contents	10
Section 3.	MECHANICAL CONSTRUCTION	Mounting styles	49
		Weight	49
		Internal Layout	49
		Tuning Drives and Frequency Display	51
		Component Location	55
Section 4.	INSTALLATION	Accessories	58
		Assembly instructions	59
		Mains voltage adjustment	60
		Operation from low-voltage d.c. supplies	61
		External connections	61
		Installation of dual-diversity terminal	64
		Synthesized operation on ranges 5-10	66
Section 5.	OPERATION	Introduction	68
		Control functions and basic operating procedures	69
		Tuning instructions	77
Section 6.	MAINTENANCE	General	80
		Fuse and lamp replacement	80
		Fault diagnosis	81
		Performance testing	88
		Re-alignment	90
		Removal of units, modules etc.	98

Note:– Pages 103-114 do not appear in this handbook and are reserved for future extension of Section 6.

ILLUSTRATIONS

		Page
	Model EC958/7 Receiver	I
	List of illustrations in Section 2	II
Fig. 3.1.	Dimensions of Receiver in all mounting styles	50
Fig. 3.2.	Main scale projection system	51
Fig. 3.3.	Plan view of Receiver with covers removed	52
Fig. 3.4.	Underside view of Receiver with covers removed	53
Fig. 3.5.	Side elevation with covers removed showing SSB Filter Assembly, Meter/Regulator Board and Rectifiers D43 and D44.	54
Fig. 3.6.	FSK Module LP3058	54
Fig. 4.1.	Mains Transformer voltage settings.	61
Fig. 4.2.	Rear view of Receiver showing location of input/output connectors	62
Fig. 4.3.	Internal connections to Ancillaries Connector PL/C (viewed on pins)	63
Fig. 4.4.	External connections to Ancillaries Connector SK/C (viewed on wiring side)	65
Fig. 4.5.	Interconnections for common oscillator working.	67
Fig. 5.1.	Front view of receiver showing panel controls.	70
	Main Circuit Diagram	Inside rear cover

APPENDICES

		Page
'A'	Voltage analysis	115
'B'	Semi-conductor complement	124
'C'	List of component types, tolerances and ratings:	
	Part 1 Main Receiver	128
	Part 2 Turret Disks	141
'D'	List of major spares	145
'E'	Circuit data, printed circuit board patterns and legends.	156

Section 1

GENERAL DESCRIPTION & TECHNICAL DATA

GENERAL DESCRIPTION

The EC958/7 receiver covers the frequency band 10kHz to 30MHz with reception facilities for all normal signal modes including FSK. Self-contained circuitry permits high-stability working at all frequencies from 1.6MHz up, and provision is made for connecting an external synthesizer on the lower frequency ranges. The receiver can be powered from any 40-60Hz AC supply and is available in basic form for rack-mounting, or complete with cabinet to suit bench installations. Current variants include Model EC958/9 which is a special version for ISB reception and has a 7" (178mm) panel.

The circuit configuration for frequencies below 1.6MHz employs either single-conversion with an IF of 100kHz, or double-conversion using an additional IF of 250kHz. An oven-controlled crystal oscillator provides 350kHz injection for the second conversion stage on those ranges where double-conversion is used.

The 1st Oscillator is continuously tunable for all frequencies from 10kHz to 1.6MHz and provides adequate stability for the types of signal normally encountered in this part of the spectrum. Frequency read-out is by means of a high-resolution optical projection system equipped with a polarised filter to maintain optimum readability in conditions of high ambient lighting. The scale markings are free from parallax and frequencies can be read to 1kHz.

At frequencies higher than 1.6MHz, the circuit changes to triple-conversion with a tunable 1st IF ahead of the two IF's used on the double-conversion ranges. The 1st Oscillator becomes part of a narrow-band drift-cancelling loop which can be locked at intervals of 100kHz by reference to an oven-controlled Master Oscillator to give an effective 1st Oscillator stability of $\pm$ 0.5 parts in 10^7. Adjustment of the 1st Oscillator to the appropriate 100kHz point is by use of the Main Tuning Control with frequency read-out provided by the optical projection system in the same manner as on the lower frequency ranges.

Interpolation between adjacent 100kHz points on the main scale is achieved by use of the tunable IF facility which is set by means of the Incremental Tuning Control. Calibration read-out is by a five-figure digital display which can be read to the nearest cycle of the tune frequency: overall accuracy is within 4Hz under all conditions of operation.

Provision is made for disabling the drift-cancelling loop to permit continuous search tuning over any selected HF range with the incremental facility still available for use as a fine frequency adjuster.

The receiver employs FET's and MOSFET's in almost all the front-end and IF stages, and utilises single, double or triple-conversion according to the frequency range in use. Input protection is included as a standard feature and desensitizing is provided by an internal relay which interrupts the aerial feeder and grounds the input to the RF Stage during periods of transmission. Three signal frequency circuits are used before the 1st Signal Mixer on all except the two lowest ranges where adequate selectivity is provided by two circuits.

The Master Oscillator, the Incremental Oscillator and the 350kHz crystal in the final conversion stage are all oven-controlled and provision is made for standardising the Master against an external frequency standard.

Bandwidth in the 1st and 2nd IF is limited to a maximum of the order 15kHz and selectivity is adjustable at the final IF where a 5-section L/C filter can be switched to provide bandwidths of 400Hz, 1.3kHz, 3kHz and 8kHz. Separate upper and lower sideband filters can be introduced for SSB reception with characteristics in accordance with CEPT Specifications. IF output is available at 100kHz for use with ancillary equipment.

double balanced mixer

The CW/SSB Detector employs a dual-gate MOSFET with carrier insertion derived from the Master Oscillator. A tunable BFO is used for CW signals, this having a coverage of ± 5kHz with a reduction tuning drive for ease of adjustment.

Audio outputs are provided for external loudspeaker, telephones and lines, the line output being fed from a totally independent amplifier with separate level control. A miniature monitor speaker fed from the main channel is fitted behind the front panel.

Other standard features include a meter which indicates carrier or line level (and also serves as a tuning monitor in receivers equipped with the optional FSK Module), provision for dual-diversity working (with or without common oscillator control) and an input for synthesized working at frequencies lower than 1.6MHz.

Mechanical and electrical design of the receiver have been closely integrated and it can be subjected to extremes of environmental conditions with only minor degradation in performance.

All front-end circuitry is built into a diecast aluminium-alloy frame to ensure optimum screening and maximum rigidity. The basic chassis is of Alocrom-protected aluminium which provides a strong light-weight assembly with good climatic protection. Most circuitry is housed in detachable modules or units to facilitate servicing and inspection.

TECHNICAL DATA

GENERAL SPECIFICATION

Application

High-grade professional-class receiver suitable for fixed, mobile or maritime use where wide frequency coverage and high-stability are of paramount importance.

Reception Modes

A1, A2 & A2H telegraphy (and F1 telegraphy when optional FSK Module Type LP3058 is fitted).

A3, A3A, A3H & A3J telephony with separate filters for upper, lower and double-sideband working.

Frequency Coverage

Continuously tunable 10kHz to 30MHz in ten ranges.

Ranges 1-4 : 1.6-30MHz with internal facilities for high-stability working and digital frequency read-out to 1Hz.

Ranges 5-10 : 10kHz-1650kHz with provision for use with external synthesizer if high-stability working is required.

Circuit Configuration

Ranges 1-4 : Triple-conversion with tunable 1st IF and drift-cancelling loop.

Ranges 5-10 : Single-conversion, or double-conversion with oven-controlled crystal in second conversion stage.

TECHNICAL DATA

Intermediate Frequencies

IF1 : 1235-1335kHz (Incremental Tuning).
IF2 : 250kHz (high-grade ceramic filter).
IF3 : 100kHz (L/C and crystal filters).
BFO : 100kHz ± 5kHz (reduction drive).

Aerial input

75Ω unbalanced (also 600Ω on Ranges 5-10).

Output Facilities

1. 100kHz IF Output (low-Z).
2. External Loudspeaker (3Ω).
3. Lines (600Ω, bal. or unbal.).
4. Headset (low/medium-Z).
5. FSK Relay (h/s mercury reed).
6. Diversity AGC.
7. Incremental Oscillator (550-650kHz) for common oscillator working.

Muting

Internal h/s reed relay controlled from associated transmitter interrupts aerial feeder and grounds input circuit during transmission.

Environmental

The receiver conforms generally to the climatic and shock/vibration requirements of DEF-133.

Operational Temperature Rating: -15°C to +55°C (+40°C, 95% relative humidity).

Power Supply

105/130V or 210/260V (40-60Hz) single-phase AC. Consumption of the order 80VA max.

DC/AC Converter can be supplied to special order to permit operation from 12V or 24V supply.

Cat No 979

Mounting Styles

Standard version is in rack-mounting form to suit 483mm (19in.) racking. Also available with cabinet (and shock mounts) for bench-mounting.

Dimensions and Weight

See Section 3.

Accessories

Plinth Loudspeaker Unit Cat. No. 989.
Cabinet Loudspeaker Unit Cat. No. 935.

PERFORMANCE SUMMARY

Not to be interpreted as a Test Specification

Sensitivity

AM	: $3\mu V$ for 10dB S+N/N ratio (3kHz B/W).
CW/SSB	: $1\mu V$ for 10dB S+N/N ratio (3kHz B/W).
CW (10-100kHz)	: $1\mu V$ for 20dB SINAD (1.3kHz B/W).

IF Selectivity

Four selectable bandwidths using switched L/C filter plus separate multi-pole crystal filters for upper and lower sideband.

Posn.	-6dB	-60dB
1	400Hz	2.4kHz
2	1.3kHz	4.5kHz
3	3kHz	12kHz
4	8kHz	18kHz

SSB Filters: 2.4kHz B/W at -3dB, 3.9kHz at -60dB assymmetrical, meeting CEPT Specification.

N.B. Maximum overall bandwidth is governed by front-end circuits when operating on low frequency ranges.

Image Rejection

10kHz–18MHz	: greater than 75dB
18MHz–30MHz	: greater than 60dB

IF Rejection

53kHz–126kHz	: greater than 85dB
280kHz–3MHz	: greater than 90dB
3MHz–30MHz	: greater than 100dB
Other freqs.	: greater than 60dB

Frequency Stability

1.6MHz–30MHz	: Tune frequency will remain within 4Hz of Master Osc. stability* for any 20°C change in the range 0°C to +60°C.
160kHz–1.6MHz	: Better than 1 part in 10^4 in any 5-min period with constant ambient.
10kHz–160kHz	: Better than 50Hz in any 5-min period with constant ambient.

(*) ± 0.5 parts in 10^7 over the range -10°C to +60°C.

Cross Modulation

With a wanted signal 60dBμV producing standard output, unwanted output will be at least 30dB below this level with an interfering signal 20kHz off-tune and of level 95dBμV (or 5% off-tune of level 110dBμV in the range 1.6-30MHz).

Blocking

With a wanted signal 60dBμV, output will be affected by less than 3dB with an interfering carrier 20kHz off-tune of level 100dBμV (or 3% off-tune of level 120dBμV in the range 1.6–30MHz).

Intermodulation

The level of third-order intermodulation products produced by two signals of equal strength lying at *carrier + 1kHz* and *carrier + 1.6kHz* will be at least 30dB below the level of either signal.

With a wanted signal 30dBμV producing standard output, two unwanted signals adjusted to produce a third-order intermodulation product at the wanted frequency, must each be of a level greater than 90dBμV to produce standard output (neither signal closer than 20kHz to the wanted frequency, or within 3% in the range 1.6–30MHz).

AGC Characteristic

Output is maintained within 6dB for a change in input of 90dB from 3μV reference level.

AGC Time Constant

Governed by Mode Switch. Of the order 40ms attack and 1 sec. decay at 'AM' & 'CW/SSB': increased to 200ms and 10 secs when switched to 'SSB HIGH-STAB'.

Audio Output

Ext Loudspeaker (3Ω):	1W at 5% distortion
Line (600Ω):	10mW max

Audio Response

Level within 3dB over the range 300Hz to 4kHz.

IF Output

20mV into 75Ω for 3μV at aerial input.

Radiation

Less than 400pW (typically 20pW).

Scale Resolution

10kHz–1650kHz	:	Readable to 1kHz
1.6MHz–30MHz	:	Readable to 1Hz

FSK Performance

Keying speeds up to 200 bauds with shifts of 85-850Hz can be accommodated when FSK Module Type LP3058 is fitted.

Section 2

CIRCUIT DESCRIPTION

LIST OF CONTENTS

		Page
INTRODUCTION	Frequency Conversion	12
	Intermediate Frequencies	12
	Conversion Oscillators	13
	Mixer Stages	13
THE RF SECTION	General	13
	Construction	14
	Printed Circuit Boards	14
	Turret Disks	15
	AERIAL ATTENUATOR UNIT LP3260/1	16
	The RF Amplifier and associated circuits	16
	The 1st Signal Mixer	17
	Signal frequency tuning	17
	Main-Tune Oscillator (MTO)	17
	1MHz CRYSTAL CALIBRATOR BOARD LP3059	18
THE TUNABLE IF	Introduction	18
	Frequency conversion in the Tunable IF	18
	Incremental Tuning	19
	Incremental Calibration	20
	Tunable IF Circuitry	20
	TUNABLE IF MODULE LP3057A/1	21
	The 2nd Signal Mixer	21
	The 2nd Loop Mixer	21
	INCREMENTAL OSCILLATOR UNIT LP3347	21
	Incremental Oscillator Board LP3362 & Oven Control Circuit	22
	Inc. Osc. Divider Board LP3363	22
HIGH STABILITY WORKING	Introduction	23
	DRIFT CANCELLING LOOP—Principle of Operation	23
	Bandwidth of drift-cancelling loop	25
	High-Stab/Continuous Tune Switching	26
	High-Stab Indicator	26
	Drift cancelling loop circuitry	26
	MASTER OSCILLATOR UNIT LP3346	26
	RF ASSEMBLY	27
	Harmonic Amplifier	27
	1st Loop Mixer & MTO Amplifier	27
	935kHz LOOP MODULE LP3055A/1	27
	935kHz Loop Amplifier	28
	935kHz Loop Limiter, Discriminator & AFC Controller	28
	High-Stab Indicator Circuit	28
	935kHz Crystal Oscillator	29

THE 250kHz IF	General	29
	IF Switching	29
	250kHz IF MODULE LP3345	29
THE 100kHz IF	General	30
	100kHz IF FILTER UNIT LP3047A	30
	SSB FILTER ASSEMBLY LP3374	30
	Sideband Reversal	30
	100kHz IF AMPLIFIER MODULE LP3056	31
	100kHz IF Amplifier	31
	AM Detector	31
	RF & IF AGC Circuits	31
	CW/SSB DETECTOR & BFO UNIT LP3348	31
THE AUDIO SECTION	General	32
	AUDIO AMPLIFIER MODULE LP3385	32
	Main Audio	32
	Line Audio	33
TELEPRINTER DRIVE CIRCUITS	General	33
	FSK MODULE LP3058	33
THE METER CIRCUITS	Metering Facilities	34
	METER/REGULATOR BOARD LP3373	34
	Meter Circuit	34
POWER SUPPLY SECTION	Input & Output Voltages	35
	Power Supply Circuits	35
	Standby Switching	35
	METER/REGULATOR BOARD LP3373	36
	Regulator Circuits	36
	Regulator Switching	36
DIGITAL COUNTER CIRCUIT	Introduction	36
	COUNTER & DISPLAY UNIT LP3343	40
	Counter Board LP3368	40
	Display Board LP3369	40
	TIMEBASE & CONTROL UNIT LP3344	40
	Timebase & Control Board	41
	DIGITAL COUNTER CIRCUIT—Principle of Operation	41
	Generation of counter timing & control information	41
	Operation of the counter circuits and numeric display	44
	Operation of LED Indicators	45

Illustrations

Fig. 2.1	RF Assembly showing location of printed circuit boards.	14
Fig. 2.2	Turret Disk 'A'.	15
Fig. 2.3	Block Diagram of RF Section.	16
Fig. 2.4	Block Diagram of Tunable IF Section.	19
Fig. 2.5	Block Diagram of drift-cancelling loop.	24
Fig. 2.6	Circuit of digital counter showing interconnections and switching.	38
Fig. 2.7	Circuit and truth table for AND-OR INVERT GATE.	41
Fig. 2.8	Block Diagram of digital counter.	42
Fig. 2.9	Pulse sequence generated by Timebase & Control Unit.	43
Fig. 2.10	Interconnection between counter decades and display.	45
Fig. 2.11	LED control circuits.	47
Fig. 2.12	Block Diagram of Complete Receiver.	Facing 48

INTRODUCTION

N.B. It is assumed that the reader has previously read the General Description which appears on page 6. A block diagram of the complete receiver is bound facing page 48.

Frequency Conversion

The receiver functions as a single, double or triple-conversion superhet depending on the frequency range in use: selection of the appropriate IF configuration is an auxiliary function of the range switching which is summarised in Table 2.1.

TABLE 2.1 RANGE SWITCHING

Range	Coverage	Conversion	1st IF	2nd IF	3rd IF
1	19.8 – 30.0MHz	Triple	Tunable 1235–1335kHz	250kHz	100kHz
2	9.8 – 20.1MHz				
3	4.0 – 10.0MHz				
4	1.6 – 4.1MHz				
5	680 – 1650kHz	Double	250kHz	100kHz	–
6	280 – 690kHz	Double	250kHz	100kHz	–
7	125 – 285kHz	Single	100kHz	–	–
8	53 – 126kHz	Double	250kHz	100kHz	–
9	24 – 55kHz	Single	100kHz	–	–
10	10 – 24.5kHz	Single	100kHz	–	–

Intermediate Frequencies

In order to avoid confusion in the text which follows, intermediate frequencies will be referred to as **"The Tunable IF"**, **"The 250kHz IF"** and **"The 100kHz IF"** – NOT as 1st IF, 2nd IF etc.

TABLE 2.2 INTERMEDIATE FREQUENCIES

INTERMEDIATE FREQ.	TRIPLE CONVERSION (Ranges 1-4)	DOUBLE CONVERSION (Ranges 5, 6, 8)	SINGLE CONVERSION (Ranges, 7, 9, 10)
The Tunable IF	1st IF	–	–
The 250kHz IF	2nd IF	1st IF	–
The 100kHz IF	3rd IF	2nd IF	1st IF

Conversion Oscillators

In similar fashion, the conversion oscillators will also be referred to by 'name' rather than as 1st Oscillator etc., since this avoids the complications which arise due to the number of actual frequency conversions being different on some ranges from others.

TABLE 2.3 CONVERSION OSCILLATORS

CONVERSION OSCILLATOR	TRIPLE CONVERSION (Ranges 1-4)	DOUBLE CONVERSION (Ranges 5, 6, 8)	SINGLE CONVERSION (Ranges 7, 9, 10)
Main Tune Osc.*	1st Osc.	1st Osc.	1st Osc.
Incremental Osc.	2nd Osc.	–	–
350kHz Osc.	3rd Osc.	2nd Osc.	–

(*) MTO

Mixer Stages

Mixer stages are referred to as "Signal Mixers" where their function is to convert the incoming signal frequency to IF (or 'signal' IF to the next IF), and as "Loop Mixers" where they form part of the drift-cancelling loop.

There are three Signal Mixers and two Loop Mixers, both the latter being used only on Ranges 1-4 (1.6 to 30MHz).

TABLE 2.4 MIXER STAGES

MIXER STAGE	TRIPLE CONVERSION (Ranges 1-4)	DOUBLE CONVERSION (Ranges 5, 6, 8)	SINGLE CONVERSION (Ranges 7, 9, 10)
1st Signal Mixer	1st Mixer	1st Mixer	1st Mixer
2nd Signal Mixer	2nd Mixer	–	–
3rd Signal Mixer	3rd Mixer	2nd Mixer	–
1st Loop Mixer	Operative in HIGH STAB mode only.	–	–
2nd Loop Mixer	Operative at HIGH STAB and CONT TUNE.	–	–

THE RF SECTION

General

The description of the RF Section which follows will ignore initially the provision made for high-stability operation and will deal first with the more conventional aspects of the front-end design. A full description of the action of the drift-cancelling loop will be found later in this Section.

CIRCUIT DESCRIPTION

Construction

The whole of the RF Section is built around a 10-position printed circuit coil turret which carries the full complement of inductors and associated trimmers etc., for each of the ten tuning ranges. The complete assembly employs a rugged die-cast frame which provides effective screening and also incorporates part of the circuitry for the drift-cancelling loop. Four 10-position switch wafers are ganged to the turret mechanism to perform several associated switching functions, the most important being selection of the appropriate IF configuration and activation of the drift-cancelling loop circuits for Ranges 1-4.

Printed Circuit Boards

RF Section transistors, IC's etc. are carried on five printed circuit boards which are attached directly to the turret assembly. Designations for the PCB's are given in Table 2.5 and their location can be determined from Fig. 2.1.

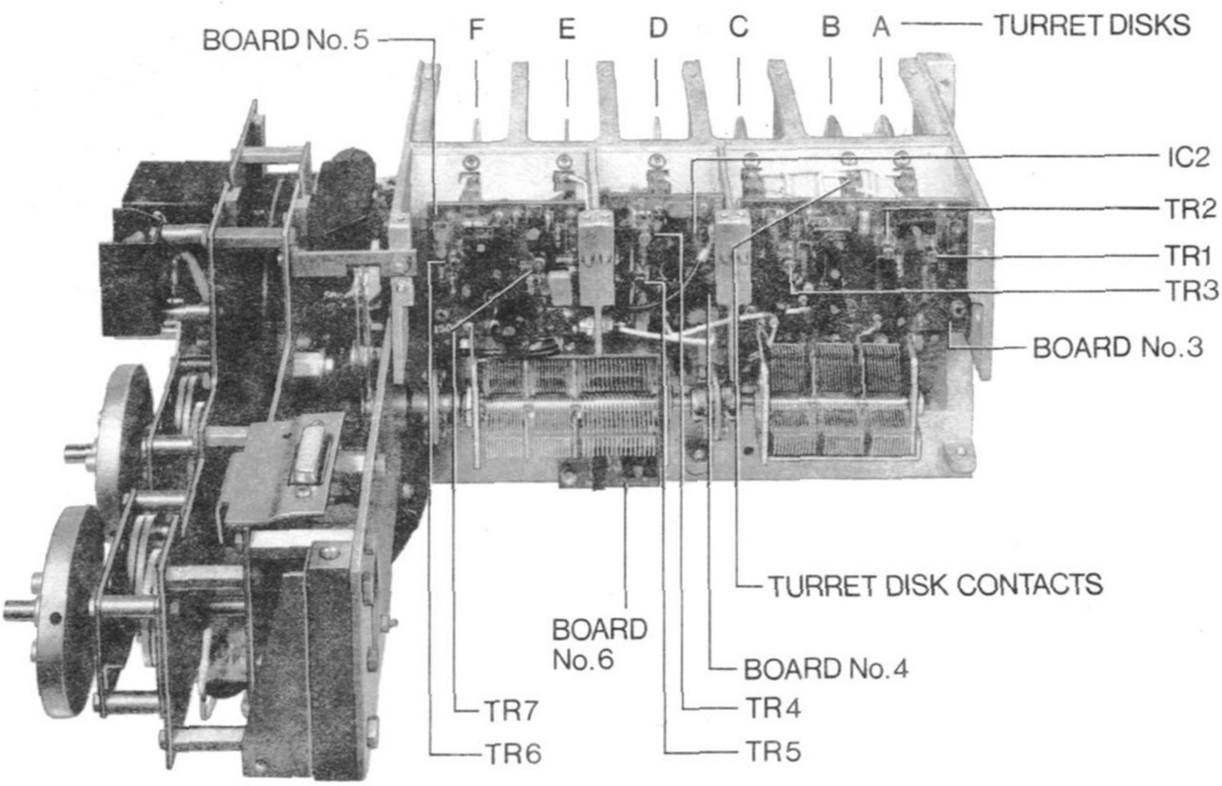


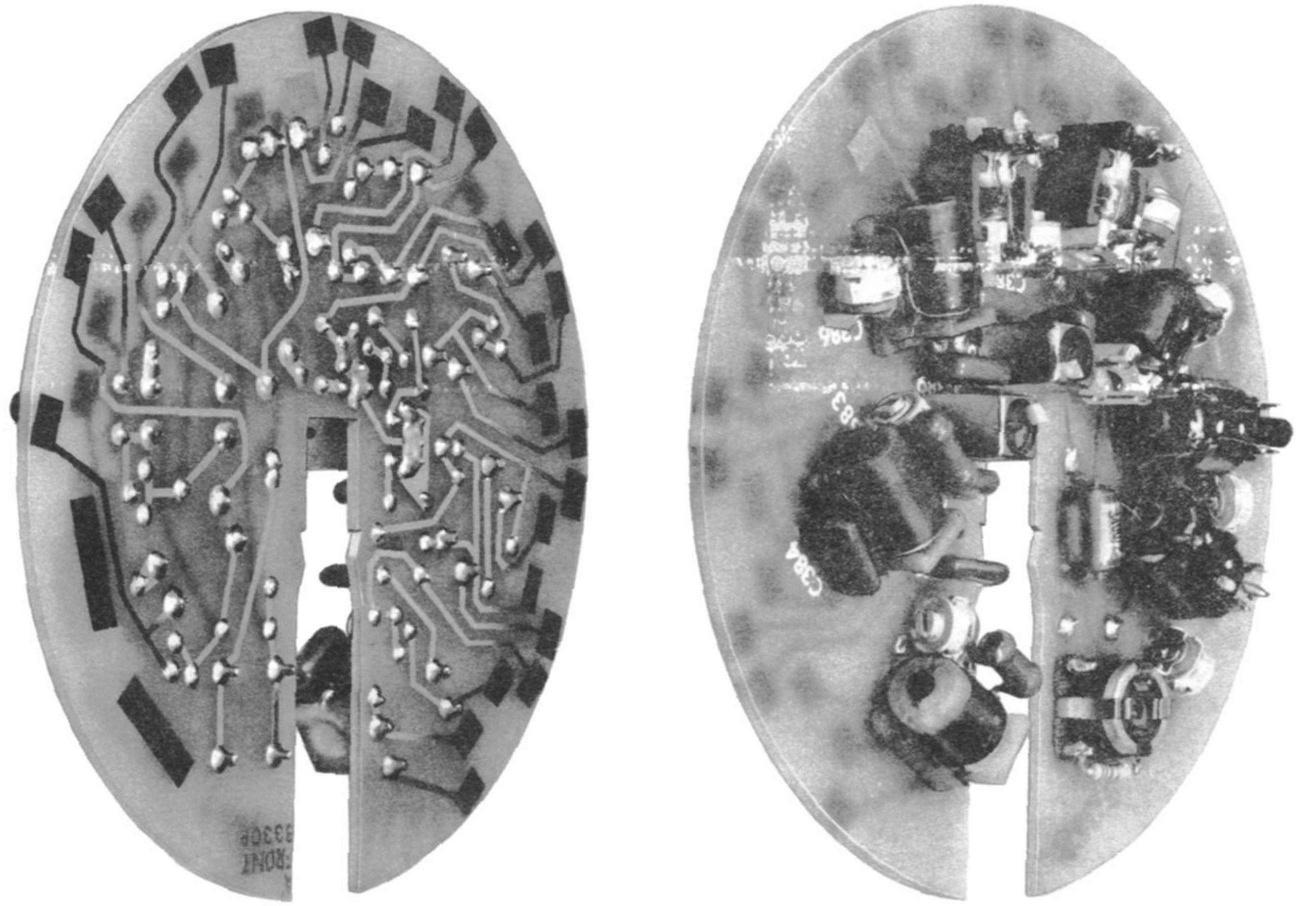
Fig. 2.1 RF Assembly showing location of printed circuit boards.

TABLE 2.5 RF SECTION PRINTED CIRCUIT BOARDS

Board No.	Designation	Remarks
1	1MHz Crystal Calibrator Board	IC1
2	–	Board No. not allocated
3	RF Amplifier Board	Also carries 1st Signal Mixer
4	Main Tune Osc. (MTO) Board	Also carries MTO Amplifier
5	Harmonic Amplifier Board	Also carries 1st Loop Mixer
6	MTO AFC Board	Part of drift-cancelling loop

Turret Disks

Six printed circuit "Turret Disks" carry the full complement of inductors etc. for range selection. Four of the disks are used in the RF Section proper and two in the drift-cancelling loop. Identities and designations are given in Table 2.6 and a typical disk is illustrated in Fig. 2.2.



FRONT REAR

Fig. 2.2 Turret Disk 'A'

TABLE 2.6 TURRET DISKS

Identity	Designation	Remarks
Disk 'A'	Aerial Disk	
Disk 'B'	RF Disk	
Disk 'C'	Signal Mixer Disk	All Disks are fabricated from double-sided glass-fibre board with gold-plated contacts.
Disk 'D'	Main Tune Osc. (MTO) Disk	
Disk 'E'	Loop Mixer Disk	
Disk 'F'	Harmonic Amplifier Disk	

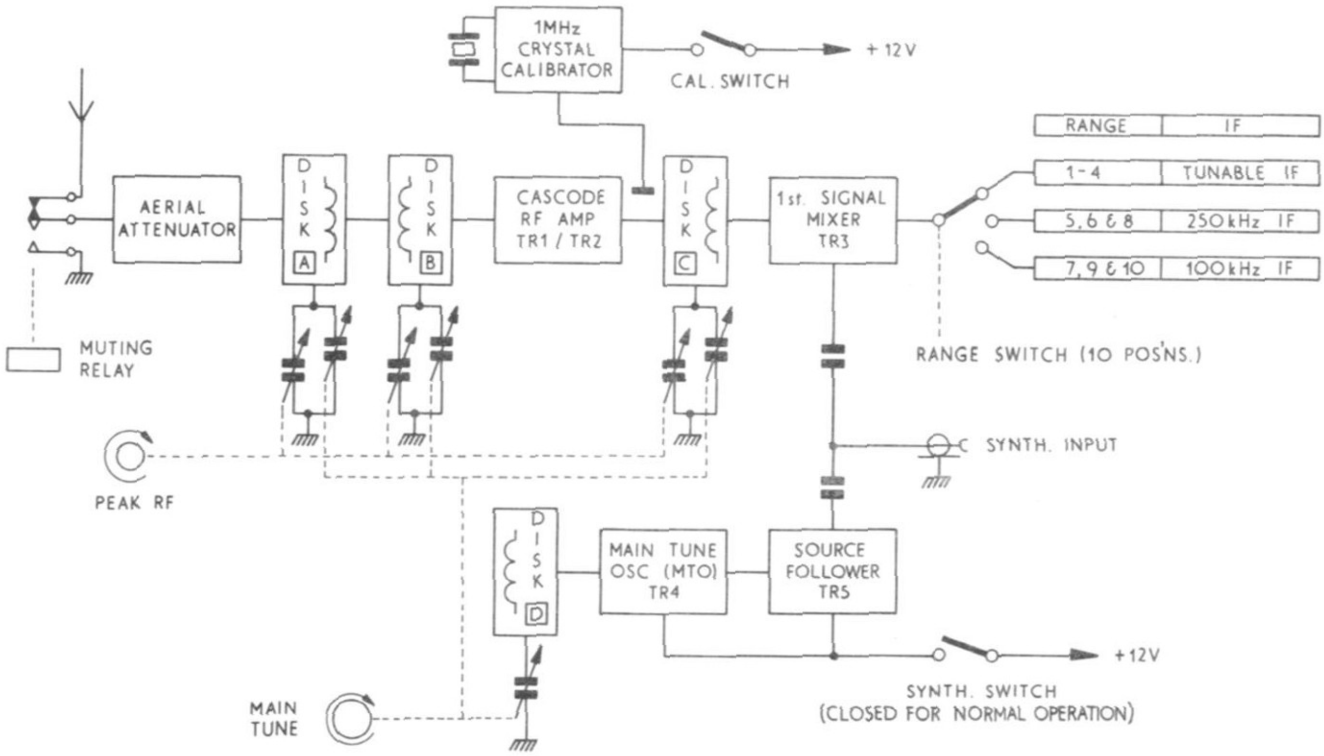


Fig. 2.3 Block Diagram of RF Section

AERIAL ATTENUATOR UNIT LP3260/1

This unit is associated with the front-end circuitry but does not form part of the RF Assembly: it is mounted immediately behind the front panel and contains the following items:–

1. Aerial Attenuator Switch S2A/S2B/S2C (3 positions : 0dB – 20dB – 40dB).
2. Aerial Relay (RLA/1).
3. Input Protection Circuit (PC1).
4. Balun Transformer T1 (600/75Ω).

More detailed information on the above will be found in the paragraphs below.

The RF Amplifier and associated circuits

The RF Amplifier utilises a junction-FET (TR1 : : UC734B) in conjunction with a single-gate MOSFET (TR2 : : 3N128) in a low-noise cascode circuit which provides extremely good two-signal performance throughout the entire tuning range. Manual gain control in its normal form is not applied directly to this stage but a 3-step attenuator with a maximum loss of 40dB is included in the aerial circuit. Delayed AGC derived from the 100kHz IF is permanently connected to the gate of TR2 and will be operative at very high signal levels even when using manual control of the later stages in the intermediate frequency section of the receiver.

Input protection diodes (PC1 : : 8 x 1N4148) are included in the *AERIAL ATTENUATOR UNIT* to guard the input circuits and first transistor from damage in the presence of a high locally induced voltage on the aerial.

The aerial input impedance is 75Ω (unbalanced) for all frequencies but balun transformer T1 provides alternative connections for high impedance feed (nominally 600Ω) at frequencies below 1.6MHz.

A relay is incorporated to open-circuit the aerial feeder and short down the input circuit when using the receiver in conjunction with an associated transmitter. The relay (RLA/1) can be operated from an external 12V or 24V send/receive changeover system through connections on the Ancillaries Connector at the rear: the relay also becomes energised when using the scale-check facility described on page 18.

Double-tuned bandpass input circuits are used on Ranges 1-8, and single-tuned circuits on Ranges 9 & 10. The appropriate coils etc. are carried on Disks 'A' and 'B', the bandpass primaries being on Disk 'A' and the secondaries on Disk 'B'. Coupling between the bandpass primaries and secondaries is by means of low-inductance link windings on the secondary coils except on Ranges 1 & 2 where coupling is effected by the earth return inductance present on the RF Disk. The single coils used on Ranges 9 & 10 are fitted on Disk 'B' and IF rejectors for Ranges 4 & 6 on Disk 'A'. The Range 4 rejector is a low-pass filter comprising L140/L141, while the Range 6 rejector is a simple parallel-tuned circuit tuned to 250kHz (L144).

The 1st Signal Mixer

Simple tuned-secondary transformer coupling is used between the RF Amplifier and the 1st Signal Mixer on all ranges except 7, 9 & 10. On these ranges, a form of resistance-capacity coupling is employed between the drain of TR2 and the tuned input circuit of the following stage. All inductors etc. are located on Disk 'C'.

A protected dual-gate n-channel MOSFET (TR3 : : 40673) serves as the 1st Signal Mixer with signal input to gate 1 and oscillator injection to gate 2. The drain of the Mixer is taken via coaxial interconnection "E" to the selector of S3C (part of RANGE SWITCH) and thence to the appropriate IF channel. Output will be at 100kHz on Ranges 7, 9 & 10; 250kHz on Ranges 5, 6 & 8; and in the band 1235–1335kHz on Ranges 1-4.

Signal-frequency tuning

The signal-frequency circuits on Disks 'A', 'B' & 'C' are gang-tuned by three sections of the six-gang tuning capacitor operated by the MAIN TUNING CONTROL. The appropriate sections are C30, C31 & C37, C30 being inoperative when not using bandpass input (i.e. Ranges 9 & 10).

A separate three-gang capacitor of much lower capacity (C20, C21, C22) is wired in parallel with the three signal frequency sections of the main tuning gang to provide an independent means of tuning the signal frequency circuits when using the incremental tuning facility which is available on Ranges 1-4.

This capacitor is adjusted by means of the PEAK-RF CONTROL and remains in circuit on Ranges 5-10 where it takes the place of the conventional 'aerial-trimmer' found on other receivers.

Main-Tune Oscillator (MTO)

This stage utilises a single-gate MOSFET (TR4 : : 3N128) in a tuned-gate oscillator circuit, with separate feedback winding in series with the feed to the drain electrode. Tuning is by means of a further section (C46) of the main tuning gang which has wider vane spacing and heavier vanes than those on the signal frequency sections. The ten oscillator inductors etc. are carried on Turret Disk 'D'. Diode D12 provides bias for the gate of the MOSFET.

Oscillator output is taken from the gate of TR4 to junction-FET TR5 (UC734B) which is wired as a source follower and serves as an isolating stage. Injection is taken from TR5 to the second gate of the 1st Signal Mixer via C54 and C43. The junction of these two capacitors is wired to a socket on the back plate to provide an input point for oscillator drive when using synthesizer control. The miniature toggle switch S4 allows the +12V supply to be removed from TR4 & TR5 when using the receiver in this manner.

The VVC diode D11 (BA110) forms part of the oscillator tuned circuit but is used only when operating the receiver in its high-stability mode on Ranges 1-4. Under all other conditions the diode is maintained at constant effective capacity by a fixed reverse-bias (derived from TR8).

The MTO runs on the 'high' side of the signal frequency on all ranges and also feeds the MTO Amplifier IC2 associated with the drift-cancelling loop (see later).

1MHz CRYSTAL CALIBRATOR BOARD LP3059

IC1 (CA3000/V1) provides crystal-controlled marker signals at 1MHz intervals for scale checking on the higher frequencies in the tuning range: its harmonic output is introduced into the RF circuitry by means of a short injection probe.

The scale check facility is brought into operation by pressing the CAL SWITCH (S1) to complete the +12V supply to IC1. S1 also energises the aerial relay (RLA/1) which grounds the input to the RF Amplifier to limit interference from other normally received signals when carrying out a calibration check. Scale correction is achieved mechanically by use of the CAL ADJ CONTROL which adjusts the position of the main scale cursor index line.

THE TUNABLE IF

Introduction

This portion of the receiver is used only on Ranges 1-4 (1.6-30MHz) where it provides an incremental tuning facility with a nominal coverage of 100kHz for interpolation between adjacent 100kHz points on the main tuning scale.

The Tunable IF stages are an integral part of the drift-cancelling circuitry used for high-stability working but remain in operation when the receiver is set for continuous tuning on Ranges 1-4 (i.e. with drift-cancelling circuit disabled). Their action will first be considered in this mode and a full description of the drift-cancelling loop will be deferred until page 23.

The various stages in the Tunable IF proper are shown in simplified form in Fig. 2.4.

Frequency conversion in the Tunable IF

IF output from the 1st Signal Mixer (TR3) is selected by a varactor-tuned IF filter which is tunable over the range **1235kHz to 1335kHz** by means of the INCREMENTAL TUNING CONTROL. Output from the IF filter feeds the 2nd Signal Mixer (TR15) which converts the selected frequency to the 250kHz IF.

Oscillator injection for the conversion process in TR15 is derived from the 2nd Loop Mixer (IC12) which mixes the tunable output from the *INCREMENTAL OSCILLATOR UNIT* (550-650kHz) with a 935kHz signal from Crystal Oscillator IC5. The actual injection frequency can be calculated from:–

$$f_{INJ} = f_{INC\ OSC} + 935\text{kHz}$$

and will therefore lie in the range **1485kHz to 1585kHz.** The appropriate frequency is selected by a varactor-tuned injection filter which is ganged to the IF filter mentioned above. Both filters are ganged to the Incremental Oscillator tuning.

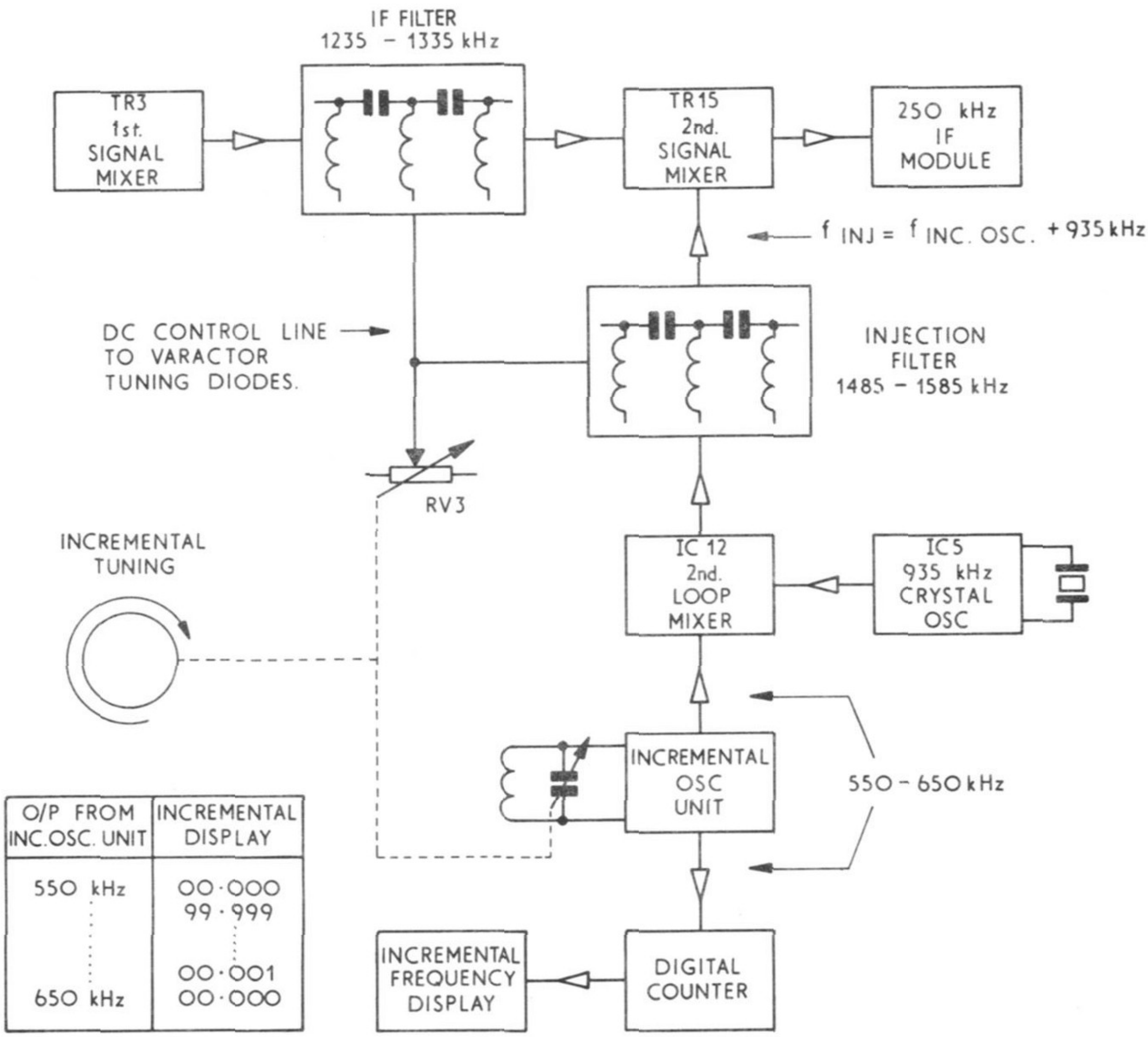


Fig. 2.4 Block diagram of Tunable IF Section

Incremental Tuning

Use of the Tunable IF as a means of interpolating between adjacent 100kHz points on the main tuning scale will now be described.

The MTO in the RF Section of the receiver is aligned during manufacture to track 1335kHz above the incoming signal frequency when switched to Ranges 1-4. It follows then, that the Tunable IF must be set to the highest frequency in its range for the main scale calibration to be correct. This frequency (1335kHz) is referred to as the 'nominal' setting of the Tunable IF.

Because the 1st Signal Mixer operates with its oscillator injection on the 'high' side of the signal frequency, it produces at its output a complete reversal of the signal spectrum present at its input. Thus, any signal frequency which is **higher** than the frequency to which the main scale is set will produce an intermediate frequency which is **lower** than the 'nominal' setting of the Tunable IF. It is essential therefore, that the **main scale** is always set to the 100kHz point at the low-frequency end of the actual 100kHz range which is to be tuned by means of the INCREMENTAL TUNING CONTROL. This is best understood by considering the example on the next page.

EXAMPLE

1. Assume that the receiver is to be tuned over the range 3500kHz to 3600kHz by use of the INCREMENTAL TUNING CONTROL.
2. Set MAIN TUNING CONTROL to lowest frequency in this range = **3500kHz.**
3. Main-Tune Oscillator tracks 1335kHz above main scale reading, so

   $f_{MTO} = f_{SIG} + 1335kHz = 3500kHz + 1335kHz =$ **4835kHz.**
4. The signal frequency selected by the Tunable IF will be

   $f_{SIG} = f_{MTO} - f_{IF}$ where f_{IF} is some value between 1235kHz and 1335kHz.
5. Substituting the **end** frequencies of the Tunable IF range,

   $f_{SIG} = 4835kHz - 1335kHz =$ **3500kHz.**

   $f_{SIG} = 4835kHz - 1235kHz =$ **3600kHz.**
6. At the 2nd Signal Mixer, the selected Tunable IF mixes with a frequency in the range 1485kHz to 1585kHz to produce the fixed 250kHz IF, viz:–

   1585kHz – 1335kHz = **250kHz.**
   1485kHz – 1235kHz = **250kHz.**

NB.1 Misalignment of the signal frequency circuits which occurs when the Tunable IF is set to any frequency below 1335kHz is corrected by adjusting the PEAK-RF CONTROL.

NB.2 Oscillator injection to the 2nd Signal Mixer is on the 'high' side of the Tunable IF and therefore results in a second reversal of the signal spectrum present at the aerial input. Thus, an upper sideband signal at the aerial input, although converted to a lower sideband signal at the Tunable IF, reverts to being an upper sideband signal at the input to the 3rd Signal Mixer.

Incremental Calibration

Frequency read-out for the Tunable IF is provided by a five-figure digital display derived from a counter driven by the *INCREMENTAL OSCILLATOR UNIT.*

The counter counts backwards to overcome the spectrum reversal due to the 1st Signal Mixer and is arranged to read 00.000kHz when the Tunable IF is set to its 'nominal' value of 1335kHz, i.e. when the output from the *INCREMENTAL OSCILLATOR UNIT* lies at 650kHz.

The actual frequency to which the receiver is tuned is determined by reading the incremental frequency display in conjunction with the main scale reading, e.g. if the main scale reads 3.5MHz (3500kHz) and the incremental read-out is 47.000kHz, then the tune frequency is 3547.000kHz.

The actual tuning range of the *INCREMENTAL OSCILLATOR UNIT* is slightly greater than 100kHz to provide overlaps of the order 4kHz at each end of the Tunable IF coverage. Ambiguity of the frequency read-out in the overlap sectors is overcome by means of a pair of LED's which provide visual indication that the Tunable IF is set below or above its basic range. The LED's flash when activated by the counter circuits.

Tunable IF Circuitry

The various stages which make up the Tunable IF proper are located in *TUNABLE IF MODULE LP3057A/1* and *INCREMENTAL OSCILLATOR UNIT LP3347* which are described below. The 935kHz Crystal Oscillator is part of the *935kHz LOOP MODULE LP3055A/1* a full description of which appears on page 27. The counter circuits etc. are covered in detail on pages 36 to 48.

TUNABLE IF MODULE LP3057A/1

This module houses the 2nd Signal Mixer and the 2nd Loop Mixer. Both stages are continuously operational on Ranges 1-4 but are disabled on Ranges 5-10.

The 2nd Signal Mixer (TR15)

This stage utilises a 40673 protected dual-gate MOSFET in a similar configuration to that employed in the 1st Signal Mixer circuit, i.e. signal (IF) input is fed to gate 1 and oscillator injection to gate 2.

IF input to gate 1 from the 1st Signal Mixer is selected by a 3-section varactor-tuned filter covering the range 1235kHz to 1335kHz. This has a bandwidth of the order 15kHz and is controlled by potentiometer RV3 which provides reverse bias for the six varactors D19/D19A, D20/D20A & D21/D21A. The potentiometer is gear-driven from the output spindle of the incremental tuning drive.

RV3 also controls six more varactors (D22/D22A, D23/D23A & D24/D24A) which tune a second 3-section filter connected between the output of the 2nd Loop Mixer and the 'oscillator' gate of the 2nd Signal Mixer. This filter covers the range 1485kHz to 1585kHz and selects the pre-mixed oscillator injection derived from IC12.

Alignment and tracking of the two filter circuits is carried out during manufacture by adjustment of the filter inductors (L10-L12 & L13-L15) and the two pre-set potentiometers RV4 & RV18.

IF output at the drain of TR15 is fed directly to the 250kHz IF filter in *250kHz IF MODULE LP3345.* CH17 provides a DC path for the drain of TR15 which derives its supply from the *250kHz IF MODULE.*

It should be noted that this supply is present on all ranges **except 7, 9 & 10** when it is interrupted by RANGE SWITCH wafer S3D, and also that the other supplies to the *TUNABLE IF MODULE* are present on **all** ranges. The fact that these supplies are present is of no consequence because the Tunable IF is disabled on Ranges 5-10 by RANGE SWITCH wafer S3C which interrupts the IF input feed (coaxial inter-connection 'J').

The 2nd Loop Mixer (IC12)

This is the final stage in the drift-cancelling loop but remains in operation when the loop is disabled to allow continuous tuning on Ranges 1-4. It employs a double-balanced mixer (SL641C) and produces the oscillator injection for TR15 by mixing the output from the *INCREMENTAL OSCILLATOR UNIT* with a 935kHz signal derived from Crystal Oscillator IC5 (or from the drift-cancelling loop when running the receiver in its high-stability mode).

Spurious outputs are kept to a low level by the 3-section varactor-tuned injection filter (L13-L15) which has a similar bandwidth to that of the IF filter L10-L12. Input levels are carefully adjusted during manufacture to keep intermodulation products to a minimum.

INCREMENTAL OSCILLATOR UNIT LP3347

This unit provides two separate 550-650kHz outputs, one to drive the 2nd Loop Mixer and the other for the counter which provides the incremental frequency display. Both outputs are derived from a 5.5-6.5MHz oscillator which feeds a decade divider to produce the drive frequency required. The 550-650kHz output can be arranged to provide common oscillator control for two receivers installed as a dual-diversity terminal.

The *Incremental Oscillator Unit LP3347* comprises:–

(1) Incremental Oscillator Board LP3362 (in oven-controlled housing).

(2) Incremental Oscillator Divider Board LP3363.

(3) Oven control circuits.

Incremental Oscillator Board LP3362 and Oven Control Circuit

The Incremental Oscillator board carries the basic Incremental Oscillator circuit which employs a single-gate MOSFET (TR53 : : BFR29). A tuned-gate oscillator configuration is used with positive feedback from the source electrode: series resistor R401 is included to stabilise the MOSFET parameters.

The oscillator covers a fundamental tuning range of 5.5-6.5MHz and is temperature-compensated by C502 and C503 which are individually selected during manufacture. The supply voltage is regulated by D58 and output from the oscillator is taken from a tap at the earthy end of the inductance L16.

The complete oscillator board, together with a temperature sensing circuit (TR54 : : BC107B), is mounted inside an oven enclosure which is heated by the three series-connected resistors R403, R404 & R405 (wire-wound type with integral heat sink, bolted directly to the inside surface of the oven enclosure which is fabricated from heavy gauge copper sheet).

The oven employs proportional temperature control, output from the sensor being fed to a 3-stage DC Amplifier external to the oven enclosure. The first two stages (TR55 : : BC107B and TR56 : : 2N3053) are located for convenience on the Inc. Osc. Divider Board while the final stage (TR37 : : 2N3055) which serves as the oven controller is mounted on a large heat sink attached to the outside of the *INCREMENTAL OSCILLATOR UNIT* proper.

The temperature at which the oven operates is set during manufacture by adjustment of RV25 and will be in the range 65°C to 70°C. The sensor operates from a regulated supply (D59/D60) but the DC Amplifier supply is unregulated (22V line).

Inc. Osc. Divider Board LP3363

Output from the Incremental Oscillator Board is fed via C509 to the Inc. Osc. Divider Board where the fundamental 5.5-6.5MHz drive is processed to give two separate 550-650kHz outputs.

The level of oscillator drive taken via C509 is extremely low so that loading on the oscillator is at a minimum. Further isolation is afforded by the two transistors TR58 and TR59 (2 x 2N4254) which provide some 30dB of gain and drive the pulse-shaping TTL Schmitt Trigger IC16 (SN5413). This in turn drives the TTL Decade Divider IC17 (SN5490) to give the 550-650kHz drive required.

The Decade Divider output is fed via low-pass filter L17, L17A, L18 to TR60 (BC107B) which serves as a splitter to provide the separate drive outlets required for the 2nd Loop Mixer and the counter. The low-pass filter restores a sinusoidal waveform and reduces the harmonic content fed to the splitter stage: L18A is a 2nd harmonic rejector.

Drive for the counter is taken from the collector of TR60 via coaxial socket 'Y', and drive for the 2nd Loop Mixer from the emitter. The latter output is fed to a pair of parallel-connected coaxial sockets ('N' & 'O') through a link located on the top of the *INCREMENTAL OSCILLATOR UNIT*. The link can be removed to interrupt the Inc. Osc. output when using the receiver as 'Slave' in a dual-diversity installation operating with common oscillator control (i.e. Inc. Osc. in 'Master' receiver is used to drive 2nd Loop Mixer in 'Slave'). Coaxial socket 'O' is used for interconnecting the two receivers.

HIGH STABILITY WORKING

Introduction

When using the receiver in its high-stability mode the 935kHz Crystal Oscillator IC5 is disabled and the 935kHz drive is derived instead from the drift-cancelling loop. Changeover from one mode of operation to the other is by means of the HIGH STAB/CONTINUOUS TUNE SWITCH (S5A – S5B – S5C) which connects the 12V supply to the appropriate stage(s).

A block diagram of the drift-cancelling loop appears in Fig. 2.5 which shows in heavier outline those stages which have already been described.

The description of the drift-cancelling loop which follows is written on the assumption that the reader has previously read the paragraphs dealing with the Tunable IF which precede this section.

THE DRIFT-CANCELLING LOOP – Principle of Operation

When using the receiver in its high-stability mode in the range 1.6-30MHz, the 935kHz drive for the 2nd Loop Mixer is present only at discrete 0.1MHz settings of the MAIN TUNING CONTROL; i.e. at 1.6MHz, 1.7MHz, 1.8MHz . . . etc.

This is due to the fact that the drive is generated by mixing the MTO frequency with a second frequency which lies within a spectrum of frequencies, all of which are multiples of 100kHz. These frequencies are derived from the *MASTER OSCILLATOR UNIT* and the mixing process occurs in the 1st Loop Mixer.

The particular harmonic for any given 0.1MHz setting of the MAIN TUNING CONTROL is selected by a pair of harmonic selector circuits ganged to the main tuning and aligned to track 400kHz higher than the indicated signal frequency. Harmonic drive to the 1st Loop Mixer therefore lies within the range 2.0-30.4MHz.

The example which follows shows first how the 935kHz loop signal is produced and assumes that the main tuning scale is set to 3500kHz.

EXAMPLE

1. The selected harmonic will lie 400kHz above the signal frequency, thus

   $f_{HARMONIC} = f_{SIG} + 400kHz = 3500kHz + 400kHz = \mathbf{3900kHz}$

2. The corresponding MTO frequency will be 1335kHz above the signal frequency, i.e.

   $f_{MTO} = f_{SIG} + 1335kHz = 3500kHz + 1335kHz = \mathbf{4835kHz}$

3. Frequencies in (1) and (2) will combine in the 1st Loop Mixer to produce the required loop frequency, viz:–

   $f_{LOOP} = f_{MTO} - f_{HARMONIC} = 4835kHz - 3900kHz = \mathbf{935kHz}$

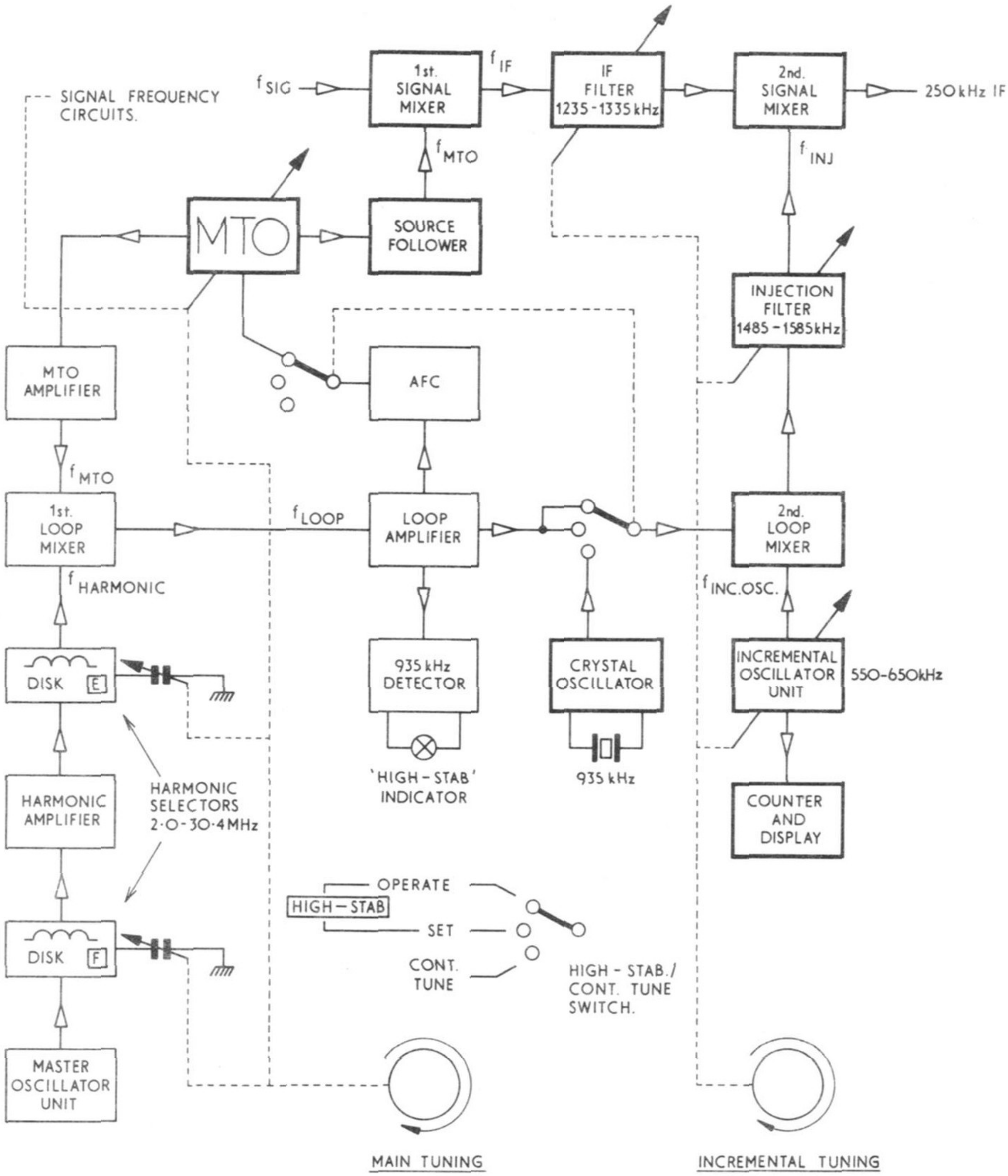


Fig. 2.5 Block diagram of drift-cancelling loop

The 935kHz drive applied to the 2nd Loop Mixer will combine with the drive from the *INCREMENTAL OSCILLATOR UNIT* to furnish injection for the 2nd Signal Mixer in exactly the same manner described when dealing with the Tunable IF. Continuing the example above therefore, and assuming that the INCREMENTAL TUNING CONTROL is set to its 'nominal' setting, we shall next consider the action in the Tunable IF:

4. $f_{IF} = f_{MTO} - f_{SIG} = 4835\text{kHz} - 3500\text{kHz} =$ **1335kHz.**

5. $f_{INJ} = f_{INC\ OSC} + 935\text{kHz} = 650\text{kHz} + 935\text{kHz} =$ **1585kHz.**

6. Frequencies in (4) and (5) combine in the 2nd Signal Mixer to produce the 250kHz IF, viz:—
   $f_{INJ} - f_{IF} = 1585\text{kHz} - 1335\text{kHz} =$ **250kHz.**

The action in the drift-cancelling loop will now be considered on the assumption that the MTO has drifted 2kHz higher than its original frequency.

7. The **new** MTO frequency $f_{MTO'} = 4835\text{kHz} + 2\text{kHz} =$ **4837kHz.**

8. The original assumed signal frequency of 3500kHz will therefore be converted to a **new** Tunable IF $f_{IF'} = 4837\text{kHz} - 3500\text{kHz} =$ **1337kHz**.

9. The assumed change in MTO frequency is also transmitted to the 1st Loop Mixer where it produces a **new** loop frequency $f_{LOOP'} = 4837\text{kHz} - 3900\text{kHz} =$ **937kHz.**

10. The **new** loop frequency is passed to the 2nd Loop Mixer where it combines with the original output from the *INCREMENTAL OSCILLATOR UNIT* to give a **new** 'oscillator' injection frequency $f_{INJ'}$ at the 2nd Signal Mixer.

    $f_{INJ'} = f_{INC\ OSC} + f_{LOOP'} = 650\text{kHz} + 937\text{kHz} =$ **1587kHz**

11. 250kHz IF output from the 2nd Signal Mixer will now result from $f_{IF'}$ and $f_{INJ'}$ mixing together, i.e.

    $f_{INJ'} - f_{IF'} = 1587\text{kHz} - 1337\text{kHz} =$ **250kHz**

12. It should be clear that since the **new** Tunable IF corresponds to the original assumed 3500kHz signal, drift occurring in the MTO has been cancelled by an equal shift in the injection frequency to the 2nd Signal Mixer. Automatic correction will occur at all settings of the Tunable IF.

Bandwidth of drift-cancelling loop

The maximum drift that can be accommodated by the loop system is dependent entirely on the bandwidth of the 935kHz circuits and amounts to roughly $\pm$ 5kHz. Drift in excess of this would result in severe reduction of the injection level to the 2nd Signal Mixer, so causing loss of conversion efficiency. This is overcome by including a simple AFC system to hold the MTO frequency after this has been set by initial adjustment of the MAIN TUNING CONTROL. Control for the AFC system is derived from a 935kHz Discriminator, the output of which is amplified and then fed to the VVC diode D11 in the MTO circuit.

High Stab/Continuous Tune Switching

Activation of the drift-cancelling loop, its associated AFC system and the 935kHz Crystal Oscillator IC5 is controlled by means of the HIGH STAB/CONT TUNE SWITCH (S5A – S5B – S5C). This is a 3-position control which performs the functions listed in Table 2.7.

TABLE 2.7 HIGH STAB/CONTINUOUS TUNE SWITCHING

Position	Function
'CONT TUNE'	Drift-cancelling loop and AFC disabled. 935kHz Crystal Oscillator activated.
'HIGH STAB SET'	935kHz Crystal Oscillator and AFC disabled. Drift-cancelling loop activated.
'HIGH STAB OPERATE'	935kHz Crystal Oscillator disabled. Drift-cancelling loop and AFC activated.

High-Stab Indicator

An illuminated legend is provided on the receiver front panel to facilitate adjustment of the MAIN TUNING CONTROL during high-stability working. This indicator will become illuminated whenever a 935kHz signal is present in the drift-cancelling loop, i.e. at each 0.1MHz setting of the MAIN TUNING CONTROL. The indicator is permanently extinguished with the HIGH STAB/CONT TUNE SWITCH set to 'CONT TUNE'.

Drift-cancelling loop circuitry

The various stages which make up the drift-cancelling loop and its associated circuits will now be described in detail. Some of the circuitry forms part of the RF Assembly and the remaining stages are located in the following units:–

MASTER OSCILLATOR UNIT LP3346

935kHz LOOP MODULE LP3055A/1

MASTER OSCILLATOR UNIT LP3346

This unit provides three independent outputs as follows:–

(1) 1MHz square-wave output.

(2) 100kHz sine-wave output.

(3) Differentiated spike output containing all multiples of 100kHz up to at least 30.4MHz.

All three outputs are derived from a self-contained oven-controlled crystal oscillator which generates a 1MHz square-wave. The oven employs proportional temperature control and operates from the regulated 12V supply: fine frequency adjustment is by means of potentiometer RV22 which allows the master frequency to be set exactly during alignment of the receiver. RV22 is easily accessible in case further adjustment is required in service.

The 1MHz square-wave is fed directly to the Decade Divider IC6 (SN6490) and also via coaxial interconnection 'Z' to the time base associated with the counter for the incremental frequency display. The Decade Divider provides a 100kHz square-wave drive for TR13 and TR14 both of which are wired as emitter followers.

TR13 (BC107B) is driven via the tuned circuit L35/C118 which converts the 100kHz square-wave to sine-wave for use as a carrier insertion signal in the CW/SSB Detector (see page 29). This output is taken via coaxial interconnection 'I' and is present only when the MODE SWITCH is set to 'SSB HIGH STAB' (12V supply completed to Terminal No. 74 on M.O. Unit).

TR14 (2N4254) is driven directly from the Decade Divider and can be considered as an harmonic generator which feeds all harmonics of 100kHz to the harmonic selector circuits in the RF Assembly (via coaxial interconnection 'G'). Output level is set during manufacture by adjustment of the pre-set potentiometer RV16.

The *MASTER OSCILLATOR UNIT* is housed in a double-screened box to prevent direct radiation of its fundamental or harmonics within the receiver. Double-screened coaxial cable is used to extend this protection on the output lead feeding the harmonic selector circuits in the RF Assembly: Single-screened coaxial cable is used for the other two outputs. All stages in the *MASTER OSCILLATOR UNIT* are powered continuously with the exception of TR13.

RF ASSEMBLY

The following stages in the drift-cancelling loop form part of the RF Assembly:—

(1) Harmonic Amplifier TR6.

(2) 1st Loop Mixer TR7.

(3) MTO Amplifier IC2.

Harmonic Amplifier TR6

This stage employs a UC734B junction-FET and serves to amplify the harmonic output from TR14 in the *MASTER OSCILLATOR UNIT.* Its input is tuned over the range 2.0MHz to 30.4MHz by a further section of the main tuning gang (C60), the appropriate inductors etc. being carried on Turret Disk 'F'. These circuits are tracked to tune 400kHz higher than the indicated main scale frequency and serve to discriminate against unwanted harmonic signals. Output from TR6 is fed to the 1st Loop Mixer.

1st Loop Mixer TR7 & MTO Amplifier IC2

Harmonic drive from TR6 passes to the 1st Loop Mixer TR7 through a further harmonic selector circuit which is tuned by C65. This circuit reinforces the rejection of unwanted harmonics afforded by the harmonic selector in the input of TR6: inductors etc. are located on Turret Disk 'E'.

The 1st Loop Mixer employs a 40673 protected dual-gate MOSFET with harmonic drive applied to gate 1. Gate 2 is driven from the MTO Amplifier IC2 (SA21) which serves as a wideband amplifier and gives good isolation for the MTO.

The difference between the two applied frequencies appears at the drain of TR7 in which the output load L1 is tuned to 935kHz. Output is available only at discrete 0.1MHz settings of the MAIN TUNING CONTROL and is taken from a tap on L1 via coaxial interconnection 'H' to the Loop Amplifier IC3 (see below).

935kHz LOOP MODULE LP3055A/1

This module contains the following stages:—

(1) 935kHz Loop Amplifier (IC3)

(2) 935kHz Loop Limiter (IC4).

(3) 935kHz Discriminator and AFC Controller (D13/D14 & TR8).

(4) High-Stab Indicator Circuit (TR9, D15 & TR10/TR11).

(5) 935kHz Crystal Oscillator (IC5).

CIRCUIT DESCRIPTION

935kHz Loop Amplifier (IC3)

The 935kHz tuned circuit L1 in the output of the 1st Loop Mixer (TR7) is actually the first element of a 3-section bandpass filter which includes two sections (L2 & L3) located in the *935kHz LOOP MODULE.* This filter feeds the 935kHz Loop Amplifier IC3 (CA3002), the output from which is connected via a second 3-section filter to restrict the overall 935kHz bandwidth to some 10—15kHz.

The amplified 935kHz signal which appears at the final circuit in the second filter is taken via coaxial interconnection 'M' to the 2nd Loop Mixer IC12 where it combines with the output from the *INCREMENTAL OSCILLATOR UNIT* to provide injection for the 2nd Signal Mixer TR15. D15A (IS44) serves as a clipper to limit the maximum signal voltage developed across L6.

IC3 runs continuously with the HIGH STAB/CONT TUNE SWITCH in either 'HIGH STAB. position but is disabled at 'CONT TUNE'.

935kHz Loop Limiter IC4, Discriminator D13/14 & AFC Controller TR8

These stages provide the controlling voltage for the MTO AFC varactor D11 when the receiver is working with the HIGH-STAB/CONT TUNE SWITCH set to 'HIGH-STAB OPERATE'. In the other tuning modes (and on Ranges 5-10), the AFC system is disabled and the reverse bias applied to D11 is held constant at +7.5V by TR8.

Drive for the AFC stages is taken from a tap on the final 935kHz tuned circuit (L6) which feeds the input terminal of the integrated circuit Loop Limiter IC4 (CA3012): IC4 is coupled in turn to the Loop Discriminator D13/14 (2 x IS44's) by L7/L8.

The discriminator load (R81/R82) is connected to the gate of the UC734B junction-FET used in the TR8 position. This stage serves as the AFC Controller and presents very light loading on the discriminator output: its drain is connected through suitable filtering to the MTO AFC varactor D11.

The circuit action is conventional in that with the receiver tuned correctly, drive into the discriminator will be at exactly 935kHz and its output will therefore be zero. TR8 drain will stand at +8V as set during manufacture by adjustment of the pre-set potentiometer RV2. Under off-tune conditions the discriminator will provide a +ve or —ve voltage at the gate of TR8 causing the effective capacity of D11 to change due to the change in voltage at the drain of TR8. This will correct the MTO frequency and so prevent the MTO drifting outside the bandwidth of the drift-cancelling loop.

IC4 is fed from the same supply rail as IC3 and though required to function only at 'HIGH-STAB OPERATE', also functions when the HIGH-STAB/CONT TUNE SWITCH is moved to 'HIGH-STAB SET'. This is of no consequence because the gate of TR8 is grounded except at 'OPERATE' and this effectively disables the entire AFC circuit.

High-Stab Indicator Circuit (TR9, D15 & TR10/11)

The amplified 935kHz signal from IC3, in addition to feeding the 2nd Loop Mixer and the AFC circuit described above, also feeds the High-Stab Indicator circuit via the Emitter Follower TR9 (2N4254).

935kHz output from TR9 is detected by D15 (IS44) which controls the Schmitt Trigger TR10/11 (UC734B/40309) to operate relay RLB/1. Closure of the RLB/1 contact completes the 12V supply to LP1 which illuminates the HIGH-STAB legend to indicate to the operator that the 935kHz signal is present in the loop (i.e. the appropriate 100kHz harmonic has been selected and passed to the 1st Loop Mixer).

The trigger circuit TR10/11 ensures snappy action of the relay when the level of 935kHz drive is sufficient for satisfactory mixing in IC12 (2nd Loop Mixer).

935kHz Crystal Oscillator (IC5)

This stage provides 935kHz drive for the 2nd Loop Mixer when the HIGH-STAB/CONT TUNE SWITCH is set to 'CONT TUNE' (i.e. when drift-cancelling loop is disabled). It utilises a CA3000 integrated circuit with close-tolerance crystal (XL2) running in series-mode. Output is taken via C103 and C91 to coaxial interconnection 'M' which feeds the *TUNABLE IF MODULE.*

THE 250kHz IF

General

This portion of the receiver is operative when using double-conversion and triple-conversion but is not used on Ranges 7, 9 & 10 which employ single-conversion direct to the 100kHz IF. The relevant circuitry includes the 250kHz IF Amplifier TR22, the 3rd Signal Mixer TR20 and the associated Crystal Oscillator TR21. All three stages are housed in the *250kHz IF MODULE.*

IF Switching

Input to the *250kHz IF MODULE* is derived from the drain of the 2nd Signal Mixer on Ranges 1-4, and from the drain of the 1st Signal Mixer on Ranges 5, 6 & 8. The changeover is effected by RANGE SWITCH wafer S3C which connects the output of the 1st Signal Mixer either to the input of the Tunable IF (Ranges 1-4), or to the input of the 250kHz IF (Ranges 5, 6 & 8).

The output connection from the 2nd Signal Mixer (Tunable IF) is wired permanently to the input of the 250kHz IF and is therefore effectively in parallel with the feed from the 1st Signal Mixer when using Ranges 5, 6 & 8. This method of connection is adopted to allow some simplifications of the switching, and is possible because although the supplies remain on the 2nd Signal Mixer on Ranges 5, 6 & 8, there will be no output from it on these ranges because its input is interrupted by S3C.

The 12V supply for the 250kHz IF Stages is fed via RANGE SWITCH wafer S3D and is absent on Ranges 7, 9 & 10 (single conversion ranges). S3D also controls the 935kHz loop supply, and since this is required only on Ranges 1-4, diode D31 (1N4004) is included to isolate the two switching lines.

250kHz IF MODULE LP3345

IF output from the appropriate Signal Mixer is fed to the 250kHz IF Amplifier (TR22 : : BC107B) via an eleven-element ceramic ladder filter which provides a bandwidth of the order 12kHz to limit cross modulation and intermodulation effects in this part of the circuit.

TR22 compensates for the insertion loss of the filter and employs tuned-choke coupling to feed the 3rd Signal Mixer TR20. This stage uses a 40673 dual-gate MOSFET in a similar circuit configuration to that used in the 1st and 2nd Signal Mixer stages. IF input is to gate 1 and oscillator drive to gate 2. 100kHz IF output developed in the drain circuit is fed via coaxial interconnection 'Q' to the *100kHz IF FILTER UNIT* (coaxial interconnection 'L' is wired in parallel with this lead and runs from RANGE SWITCH wafer S3C to permit connection of the 1st Signal Mixer directly to the *100kHz IF FILTER UNIT* when using single-conversion).

Oscillator injection for the 3rd Signal Mixer is derived from TR21 (40673) which functions as a 350kHz crystal oscillator. The crystal (XL4) is housed in a miniature oven located inside the *250kHz IF MODULE.* Proportional temperature control is employed and the oven is continuously powered via Module Termination No. 43 (12V supply).

THE 100kHz IF

General

The circuitry associated with this part of the receiver is divided between the following units:—

(1) *100kHz IF FILTER UNIT LP3047A*

(2) *SSB FILTER ASSEMBLY LP3374*

(3) *100kHz IF AMPLIFIER MODULE LP3056*

(4) *CW/SSB DETECTOR & BFO UNIT LP3348*

The 100kHz IF signal is fed initially to the *100kHz IF FILTER UNIT* and is derived from the 1st Signal Mixer on Ranges 7, 9 & 10, and from the 3rd Signal Mixer on all other ranges.

100kHz IF FILTER UNIT LP3047A

This unit houses a five-section L/C filter with its associated switching (S8A-G) and provides IF bandwidths of 400Hz, 1.3kHz, 3kHz and 8kHz.

Selection of the appropriate bandwidth is achieved by switching in different values of top-coupling capacitor, and, in the two widest positions, by introducing damping resistors in parallel with the inductors: the centre-frequency is corrected in the two narrow positions by switching additional capacitors across each circuit.

The SELECTIVITY SWITCH has five positions, only four of which are involved in switching of the L/C filter. The fifth position (actually switch position No. 3, and labelled 'SSB'), is arranged to route the IF Filter input and output leads (coaxial interconnections 'Q' & 'T') to the *SSB FILTER ASSEMBLY* via coaxial interconnections 'R' and 'S'. CH36 provides a DC path for the supply feeding the appropriate mixer when S8 is set to 'SSB'. The supply is fed via L24 at each of the other switch positions.

SSB FILTER ASSEMBLY LP3374

This assembly carries separate USB and LSB filters and is brought into circuit when the SELECTIVITY SWITCH is set to 'SSB'. Selection of the appropriate SSB filter is by means of relays RLD/1 and RLE/1 which are controlled from the USB/LSB SWITCH S7. Both relays are energised at 'LSB' and de-energised at 'USB'.

It is important to note that the USB filter is in circuit with S7 at 'LSB' and vice-versa (see below).

Sideband Reversal

The 3rd Signal Mixer operates with oscillator injection on the 'high' side of the 250kHz IF and therefore reverses the sideband of an SSB signal present at its input. This means that on Ranges 1-4, where two reversals have already occurred in the 1st and 2nd Signal Mixers, output from the 3rd Signal Mixer to the 100kHz IF will be a reversal of the signal present on the aerial input. This situation also obtains on Ranges 7, 9 & 10 where only **one** stage of conversion is involved.

Allowance is made for this by arranging S7 to introduce the opposite filter when selecting the sideband required.

Ranges 5, 6 & 8 employ double-conversion (i.e. two sideband reversals occur), and the signal presented to the 100kHz IF is therefore identical to that at the aerial input. This is opposite to the other ranges and operators must therefore remember to use the 'USB' position for lower sideband reception and vice-versa when switched to Ranges 5, 6 & 8.

100kHz IF AMPLIFIER MODULE LP3056

This module contains the 100kHz IF Amplifier, the AM Detector and two separate AGC circuits.

100kHz IF Amplifier

This employs four cascaded junction-FET amplifiers (TR23-TR26 : : 4 x UC734B) with broadly resonant choke coupling between each stage. The final FET feeds an emitter follower (TR27 : : 2N4254) which provides a low-impedance 100kHz output to drive the CW/SSB Detector and the *FSK MODULE:* this output is also brought out at the rear of the receiver to provide drive for external ancillary equipment.

Gain control is applied to the first three 100kHz amplifiers, either from the IF AGC line or from the manual IF GAIN CONTROL RV5. Both control lines provide a negative controlling voltage and are switched by means of the AGC SWITCH S9.

AM Detector

This stage uses an OA47 diode (D32) and is fed from the emitter follower TR27 via the tapped step-up transformer L29. Detected output is developed across R220 and passes to the 'AM' position of MODE SWITCH section S10A.

RF & IF AGC Circuits

Separate AGC lines are provided for controlling the RF Amplifier and the first three 100kHz IF Stages. The RF AGC is permanently connected and is derived from D33 (IS44). Divider R230/231 provides the initial gate bias for TR2 and also provides a delay for the AGC diode. A similar drive arrangement to that used with the AM Detector is employed to feed D33, utilising Emitter Follower TR29 (2N4254) and matching coil L30: TR28 (UC734B) provides the requisite amount of 100kHz amplification and is choke-coupled to the associated emitter follower.

An almost identical circuit is used in the IF AGC system, but whereas the RF AGC stages are fed directly from the output of the 100kHz IF filters, the IF system is driven from the final 100kHz IF Amplifier TR26. The IF AGC stages comprise TR30 (UC734B) as IF AGC Amplifier, TR31 (2N4254) as Emitter Follower and D34 (IS44) as IF AGC Rectifier. Delay is provided by R239/240.

IF AGC is brought out on the Ancillary Connector PL/C for use in dual-diversity working. The time constant is lengthened at 'SSB HIGH STAB' by switching C309 in place of C308 (S10B).

CW/SSB DETECTOR & BFO UNIT LP3348

This unit is brought into circuit for the reception of CW and SSB signals. It incorporates a product detector together with an associated BFO which is activated when the MODE SWITCH is set to 'CW/SSB'. The BFO is tunable and is primarily intended for CW reception: it is disabled with the MODE SWITCH set to 'SSB HIGH-STAB', in which position carrier insertion for SSB reception is derived from TR13 in the *MASTER OSCILLATOR UNIT* (via coaxial interconnection 'I').

The product detector employs a dual-gate MOSFET (TR33 : : 40673) with signal (100kHz IF) input applied to gate 1 via coaxial interconnection 'V'. Oscillator injection is to gate 2 and detected audio output is taken from the drain via a low-pass filter which feeds the 'CW/SSB' and 'SSB HIGH-STAB' positions of MODE SWITCH section S10A. Audio from S10A passes directly to the AF stages.

Selection of the BFO or MO carrier insertion is achieved by means of S10C which completes the +12V supply to either the BFO (TR32) or TR13 as appropriate. The supply is removed from both stages with S10C at 'AM'. Leakage of 100kHz carrier signal through TR13 in its turned-off condition is prevented by including two diodes D35 and D36 (2 x IS44) which are arranged as RF switches to complete the signal path correctly for the desired mode of operation.

With S10C at 'CW/SSB', D35 becomes forward-biased and passes the tunable BFO output from C314 to R252 and thence via C317 to gate 2 of the product detector. At the same time, D36 will be reverse-biased because of the voltage developed across R252. This effectively interrupts the signal path from coaxial interconnection 'I'.

Moving S10C to 'SSB HIGH-STAB' removes the +12V supply from D35, so causing the voltage across R252 to fall below the level at which D36 becomes forward-biased. Under this condition, D36 offers minimum opposition to the 100kHz carrier which passes unhindered to gate 2 of the detector.

The BFO (TR32) employs a UC734B junction-FET in tuned-gate configuration with separate feedback winding in the drain circuit. Its nominal frequency of 100kHz is adjustable over a range of ± 5kHz by means of C310/311.

NB: The 'CW/SSB' setting of the MODE SWITCH, although available for SSB reception, would normally be used for this mode, only when it is required to receive SSB signals without the 'hang' AGC characteristic which is present at 'SSB HIGH-STAB'.

THE AUDIO SECTION

General

The 'Audio Section' comprises two separate audio amplifiers both of which are housed in *AUDIO AMPLIFIER MODULE LP3385*. Independent gain controls are fitted for both amplifiers which provide outputs as follows:–

Main Audio Amplifier: High-level output for external loudspeaker and attenuated outputs for internal loudspeaker and headset.

Line Amplifier: Low-level output suitable for connection to 600Ω line circuits.

Both audio circuits are fed from MODE SWITCH section S10A.

AUDIO AMPLIFIER MODULE LP3385

Main Audio

Integrated circuit IC18 (SL414) provides the loudspeaker/headset output and is fed from the slider of the AF GAIN (RV7).

The IC incorporates its own pre-amplifier and is protected against accidental short-circuiting of its output. HF compensation is provided by R274/C331 while R275/C336 prevent parasitic oscillation at RF. The pre-set potentiometer RV26 is adjusted during manufacture to set the quiescent output voltage to equal half the supply voltage under which condition maximum undistorted output is obtained.

The output terminal of IC18 is wired via C339 to pin 9 of the Ancillaries Connector PL/C to feed the external loudspeaker circuit, and also to the panel for connection to the internal loudspeaker and the headset socket JK1. The two latter outputs are attenuated by series resistors (R299/R300) and a switch (S11) allows the **internal** loudspeaker to be muted when not required.

The earth return from the external loudspeaker circuit is not directly earthed but is routed via an auxiliary contact on JK1. This interrupts the earth return to mute the external loudspeaker when the headset is connected.

Line Audio

This circuit comprises TR34 (BCY71) and IC19 (MFC4000B) as pre-amplifier and output amplifier respectively: both stages operate from a regulated supply derived from D37A (BZY88 C9V1).

Input is taken from the slider of the LINE LEVEL CONTROL (RV6) which allows the output on this channel to be adjusted independently of the main channel output. The output transformer (T2) is electrostatically screened and has a centre-tapped secondary which can be arranged for balanced or unbalanced operation when feeding standard 600Ω line circuits.

The associated transistor TR35 (BC107B) amplifies the voltage across the primary of T2 to feed the Meter Rectifier D37 (OA47). Output from D37 drives the metering circuit when the METER SWITCH S12 is set to 'AF' (See page 34).

TELEPRINTER DRIVE CIRCUITS

General

Provision is made for fitting an optional module within the receiver when the installation requirements call for reception of FSK radio-teleprinter transmissions. The module is fitted to special order or can be supplied as an accessory to be fitted by the user.

FSK MODULE LP3058

This module is driven directly from the *100kHz IF AMPLIFIER MODULE* and provides a relay keyed output suitable for switching an external teleprinter supply.

100kHz input for the FSK stages is taken from Emitter Follower TR27 in the *100kHz IF AMPLIFIER MODULE* via coaxial interconnections 'U' and 'W'. The first stage (IC8 : : CA3012) functions as a single-ended limiting amplifier, providing a clipped 100kHz output to drive the FSK Discriminator D38/D39 (2 x 1S44). Mark/space pulses appearing across R314/R315 are DC-coupled to the Source Follower TR40 (UC734B) which maintains light loading on the Discriminator output.

The following stage is a P-N-P transistor (TR41 : : BCY34) which serves as a Driver Stage for IC9. Use of a P-N-P unit at this point is dictated by the fact that terminal 5 of IC9 must lie close to earth potential in the absence of signal input. RV13 provides a means of establishing this condition (corresponding to equal base currents in the two input emitter followers which form part of the IC). A metering point is provided to facilitate adjustment.

The CA3002 fitted in the IC9 position functions as a single-ended DC-coupled clipping amplifier. Its square-wave output is converted to a near-sine wave in the shaping filter R322/323-C362/363 to eliminate residual FM noise components before application to the final stage IC10. This is a further CA3002 in which the amplifier proper again clips the keying waveform. The last stage in IC10 is an emitter follower which drives a mercury-wetted contact reed relay RLC/1 to control the teleprinter circuit. A contact protection circuit comprising R329 and C368/369 is provided external to the module.

Pre-set potentiometer RV14 permits adjustment of the relay bias conditions to allow correct keying of the 'printer': access for adjustment is through an aperture in the rear of the receiver.

Pulse output is fed from the FSK Discriminator via R316 to the meter circuit to provide visual indication when tuning to FSK signals. Mark/space reversal is not provided and should therefore be arranged externally as shown in Section 4.

THE METER CIRCUITS

Metering Facilities

The built-in panel meter can be switched by means of the METER SWITCH S12A/B to provide the following metering facilities. The switch positions bear the legend 'RF' – 'CZ' – 'AF'.

'RF' : : Meter monitors IF AGC voltage to provide reading of relative carrier level (logarithmic reading with AGC 'ON', linear at 'OFF').

'CZ' : : Meter operates with centre zero and serves as FSK tuning indicator.

'AF' : : Meter monitors output from Meter Rectifier (D37) and indicates audio level (in mW) at 600Ω line output.

The meter has a 50-0-50μA movement and is driven from TR39 which is located on the *METER/REGULATOR BOARD LP3373.* Scaling is in arbitrary divisions 0-10 with additional CZ and 10mW marking.

METER/REGULATOR BOARD LP3373

This printed circuit board carries the following circuit items.

(1) Meter Amplifier TR39 together with associated pre-set controls etc.

(2) Pre-set potentiometers RV2 and RV4 (AFC and Tunable IF adjustments, located on this board for convenience of access).

(3) Two separate voltage regulator circuits (see page 36).

Meter Circuit

The S12A section of the METER SWITCH connects the appropriate metering line to the gate of junction-FET TR39 (UC734B) which serves as the Meter Amplifier. The meter has a basic centre-zero movement and is wired between the drain of TR39 and the slider of RV11 which forms part of a potential divider across the 15V supply. This constitutes a bridge circuit and RV11 is adjusted (with S12 at 'RF') so that the bridge is unbalanced by an amount just sufficient to cause the meter needle to lie at the left-hand end of its scale.

The drain load for TR39 is selected by S12B and at 'RF' will comprise R303 and the decoupling resistor R44 in series with the 15V feed to TR1/2 (RF Amplifier). TR39 gate is connected to the IF AGC line and will therefore go increasingly negative as signal level rises. The voltage at the drain of TR39 will rise towards +15V causing the meter needle to be deflected away from the left-hand zero.

Further increase in signal level will bring the RF AGC into operation and the voltage dropped across R44 will become less. TR39 drain therefore moves even closer to +15V to give a bigger deflection of the meter.

Shifting S12 to the 'CZ' position modifies the drain load which then becomes RV9. This is adjusted to produce zero voltage across the meter (i.e. so that the drain of TR39 lies at the same potential as that at the slider of RV11). The meter needle reverts to centre-zero and serves as a tuning indicator for reception of FSK signals.

At 'AF' the drain load will be RV10 which is set to bias the meter needle once again to a conventional left-hand zero. RV12 is adjusted so that the AF calibration mark (10mW) is correct with the line output terminated in 600Ω.

POWER SUPPLY SECTION

Input and output voltages

The power supply can be adjusted to accept all standard 40-60Hz AC inputs in the ranges 105/130V and 210/260V: the following outputs are provided to power the various receiver circuits:–

(1)	+22V DC	: :	Unregulated.
(2)	+15V DC	: :	Zener regulated.
(3)	+12V DC	: :	IC regulated.
(4)	+5V DC	: :	IC regulated.
(5)	–6V DC	: :	Zener regulated
(6)	6V AC	: :	Lamp supply for 'kHz'/'MHz' indicators and main scale projection.

NOTE: The 'High-Stab' indicator bulb is supplied from the 12V DC line via a series dropping resistor.

Power supply circuits

The mains transformer T3 has four secondary windings, three of which feed the bridge rectifiers D43, D44 and D45. Fuses are included in the earth returns of the two high-current circuits (D43/44) but D45 is unfused. The rectifiers provide the following outputs:–

D43	: :	+22V	: :	Feeds Inc. Osc. oven heater/control circuit, IC regulator IC15 (+12V supply). and zener regulator D41 (+15V supply).
D44	: :	+12V	: :	Feeds IC regulator IC14 (+5V supply).
D45	: :	–10V	: :	Feeds zener regulator D42 (–6V supply).

The remaining secondary on T3 supplies 6V AC for the bulbs LP2/LP3 & LP4. LP4 provides illumination for the main scale projection system and is adjustable in brilliance by means of the DIAL DIMMER RV15. LP2 and LP3 illuminate the 'kHz' and 'MHz' legends respectively and are switched by means of RANGE SWITCH wafer S3B. Calibration is in MHz on Ranges 1-4 and kHz on Range 5-10.

IC regulator circuits IC14/IC15 are part of the *METER/REGULATOR BOARD LP3373:* the remaining power supply circuitry is mainly located on the power unit chassis in the rear right-hand corner of the receiver.

The primary circuit of T3 is fused in both legs and incorporates a filter circuit C375-377/CH33, CH34 to provide protection against high voltage spikes riding on the mains input supply.

Standby switching

The receiver is not equipped with a conventional AC supply switch but can be switched to a 'standby' condition by means of the STANDBY SWITCH S13. This arrangement allows the supplies for the three oscillator ovens and their associated circuits to be retained when the receiver is not actually operational but must be available for immediate use. An LED indicator (D55) fed from the 12V supply rail shows when the AC supply is present within the receiver.

The actual stages disabled by S13 when set to 'STANDBY' vary according to the settings of the RANGE SWITCH and the HIGH-STAB/CONT TUNE SWITCH but always include those in the *100kHz IF AMPLIFIER MODULE.* The stages in the *250kHz IF MODULE* and certain stages in the *935kHz LOOP MODULE* will also be disabled under certain conditions of switching but may already be disabled by the two switches previously mentioned. Other stages – the 2nd Signal Mixer for example – may also be switched off but this is accidental rather than intentional and does not affect the desired switching action, i.e. muting of the *100kHz IF AMPLIFIER MODULE.*

The stages referred to in the previous paragraph are switched by means of S13A which interrupts the appropriate 12V supply lines, namely those fed via PL/B-6 and PL/B-7. S13A is also responsible (see later) for interruption of the 5V supply feeding the counter circuits etc. associated with the incremental frequency display which is therefore extinguished when switched to 'STANDBY'.

The other section of the STANDBY SWITCH (S13B) is arranged to interrupt the 6V AC supply to extinguish the main scale projection lamp and the 'kHz'/'MHz' indicators.

The 'High-Stab' indicator is also extinguished because it derives its supply from the *935kHz LOOP MODULE* which is switched off by S13A. This in fact is the sole reason for disabling this particular module.

METER/REGULATOR BOARD LP3373

Note: The metering circuit carried on this board is described on page 34.

Regulator circuits

This board carries two independent voltage regulator circuits which provide the +12V supply for the main receiver circuits and the +5V supply for the digital section. Both regulators employ fold-back current limiting and utilise external pass transistors (TR51/52 : : 2 x 2N3055) to extend the current capability of the LM723's which are used in both circuits (IC14/IC15).

Output voltages are set during manufacture by adjustment of RV23 (12V) and RV24 (5V).

Regulator switching

The 12V regulator runs continuously under all conditions of operation but the 5V circuit is disabled when using Ranges 5-10 (incremental read-out not required) and also when the receiver is switched to 'STANDBY'. Switching is accomplished indirectly by means of TR50 (BC107B) to avoid the need for direct switching of the 5V supply line which carries a current of some 3 Amps. TR50 is arranged to shut down IC14 when not required.

Control for TR50 is derived from either RANGE SWITCH wafer S3A or STANDBY SWITCH section S13A, both of which will apply +12V to the base of TR50 when set to the appropriate position(s). Diode D54 (1N4004) is included in the switching circuit to prevent activation of the *100kHz IF AMPLIFIER MODULE* etc. when switched to 'STANDBY' on Ranges 5-10.

DIGITAL COUNTER CIRCUIT

Introduction

The digital counter circuit provides the incremental frequency readout by counting the output frequency at one of the two 550-650kHz outputs supplied by the *INCREMENTAL OSCILLATOR UNIT.* It is pre-set so that the mid-frequency in the oscillator range (600kHz) is displayed as '50kHz' and is arranged to count backwards to compensate for the spectrum reversal resulting from the conversion process in the 1st Signal Mixer (i.e. 650kHz corresponds to an incremental setting of '0kHz').

The basic readout utilises five digits to provide a display which is readable to within 1Hz and is capable of displaying a maximum frequency of 99.999kHz. The display therefore reads 00.000kHz with the *INCREMENTAL OSCILLATOR UNIT* set to either 650.000kHz or 550.000kHz (corresponding to incremental settings of '0kHz' and '100kHz' respectively). This ambiguity in readout is resolved by including an LED indicator which is extinguished at 650.000kHz but flashes when the oscillator is set to 550.000kHz

The LED circuit is so arranged that the LED continues to flash if the *INCREMENTAL OSCILLATOR UNIT* is tuned into the overlap region **below** 550.000kHz, for this also gives rise to an ambiguity in the display which cannot differentiate between outputs of say 548.000kHz and 648.000kHz, both of which would appear as 02.000kHz.

A similar ambiguity will exist if the *INCREMENTAL OSCILLATOR UNIT* is tuned into the overlap coverage at the other end of its range and for this reason a second LED indicator is incorporated which will flash when the output frequency lies at 650.001kHz or above, e.g. to differentiate between outputs of say 652.000kHz and 552.000kHz, both of which give a readout of 98.000kHz.

The LED's are controlled from the counter circuit and carry legends to indicate to the operator that the setting of the MAIN TUNING CONTROL should really be altered to the next 0.1MHz calibration point higher or lower than the one to which the control is set.

TABLE 2.8 INC. OSC. READOUT AND LED DISPLAY

INC. OSC. O/P (kHz)	READOUT (kHz)	LED INDICATORS (LEGEND)	
		READ MAIN SCALE -100kHz	READ MAIN SCALE +100kHz
650.001	99.999	D64 flashes	Off
650.000	00.000	Off	Off
649.999	00.001	Off	Off
600.000	50.000	Off	Off
550.001	99.999	Off	Off
550.000	00.000	Off	D65 flashes
549.999	00.001	Off	D65 flashes

Readout of the incremental setting to an accuracy of 1Hz necessitates a count time of 1 second and results in too great an interval between successive updates of the counter readout for the display to be useful during initial tuning adjustments. Provision is therefore made for bypassing one decade in the counter (and in the timebase) so that frequencies can be displayed instead to within 10Hz. This cuts the count time to 100ms which is more compatible with the tuning rate obtained when using the INCREMENTAL TUNING CONTROL.

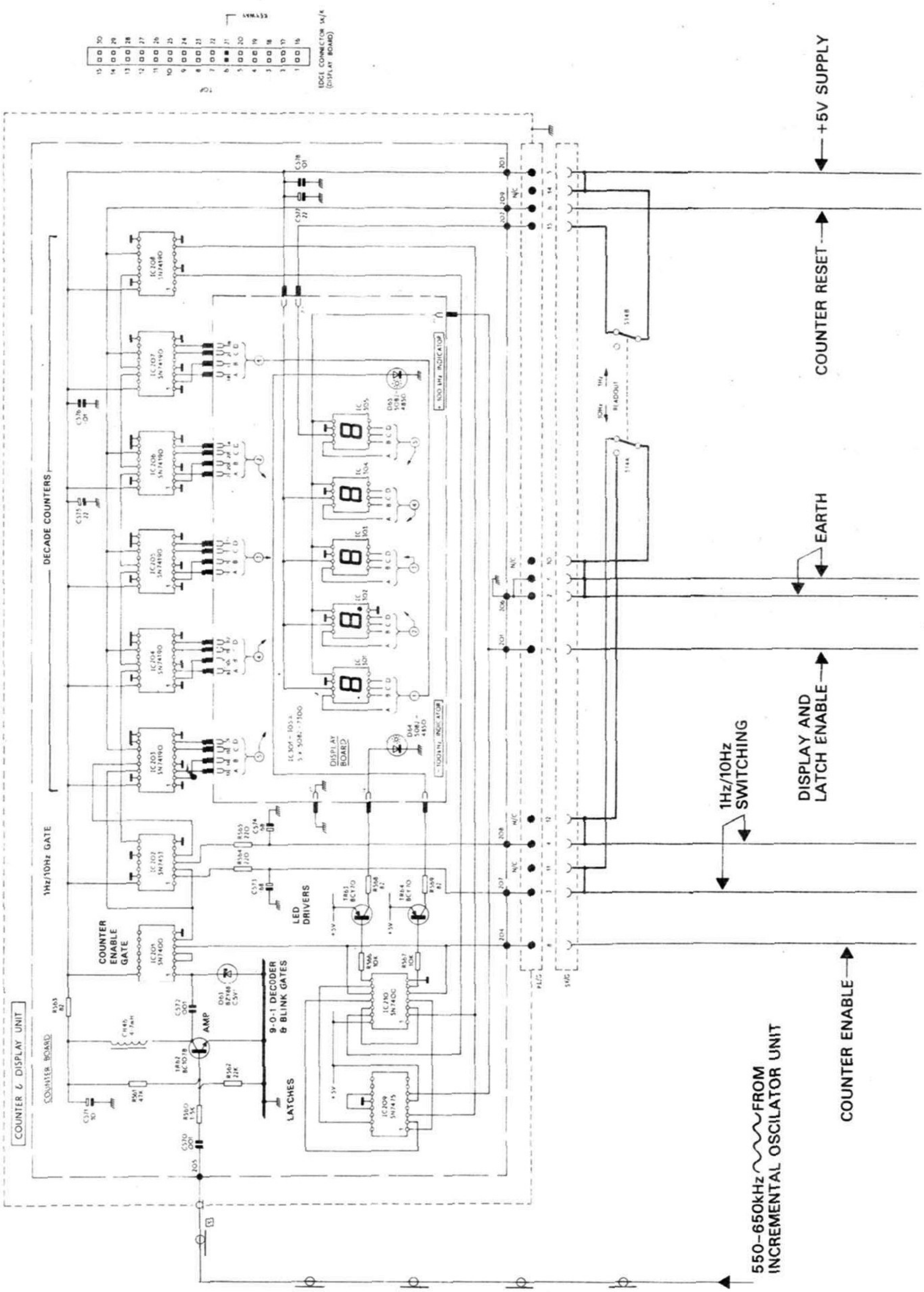
Changeover from a 1Hz to a 10Hz display is achieved by means of the 1Hz/10Hz READOUT SWITCH (S14A/B) which, in addition to bypassing the decades mentioned above, also extinguishes the 'Hz' digit when set to the '10Hz' position: the position of the decimal point remains unchanged when switching. The '1Hz' display is used only for precise frequency adjustment after carrying out initial adjustment in the '10Hz' position.

The counter and associated circuitry are housed in the following units both of which are powered from the +5V supply rail.

(1) *COUNTER & DISPLAY UNIT LP3343*

(2) *TIMEBASE & CONTROL UNIT LP3344*

The complete circuitry of LP3343 and LP3344 is shown in Fig. 2.6 and in block form in Fig. 2.8.



+5V SUPPLY
COUNTER RESET
EARTH
DISPLAY AND LATCH ENABLE
1Hz/10Hz SWITCHING
COUNTER ENABLE
550-650kHz FROM INCREMENTAL OSCILATOR UNIT
DECADE COUNTERS
1Hz/10Hz GATE
COUNTER ENABLE GATE
LED DRIVERS
9-0-1 DECODER & BLINK GATES
LATCHES
AMP
COUNTER & DISPLAY UNIT
COUNTER BOARD
DISPLAY BOARD

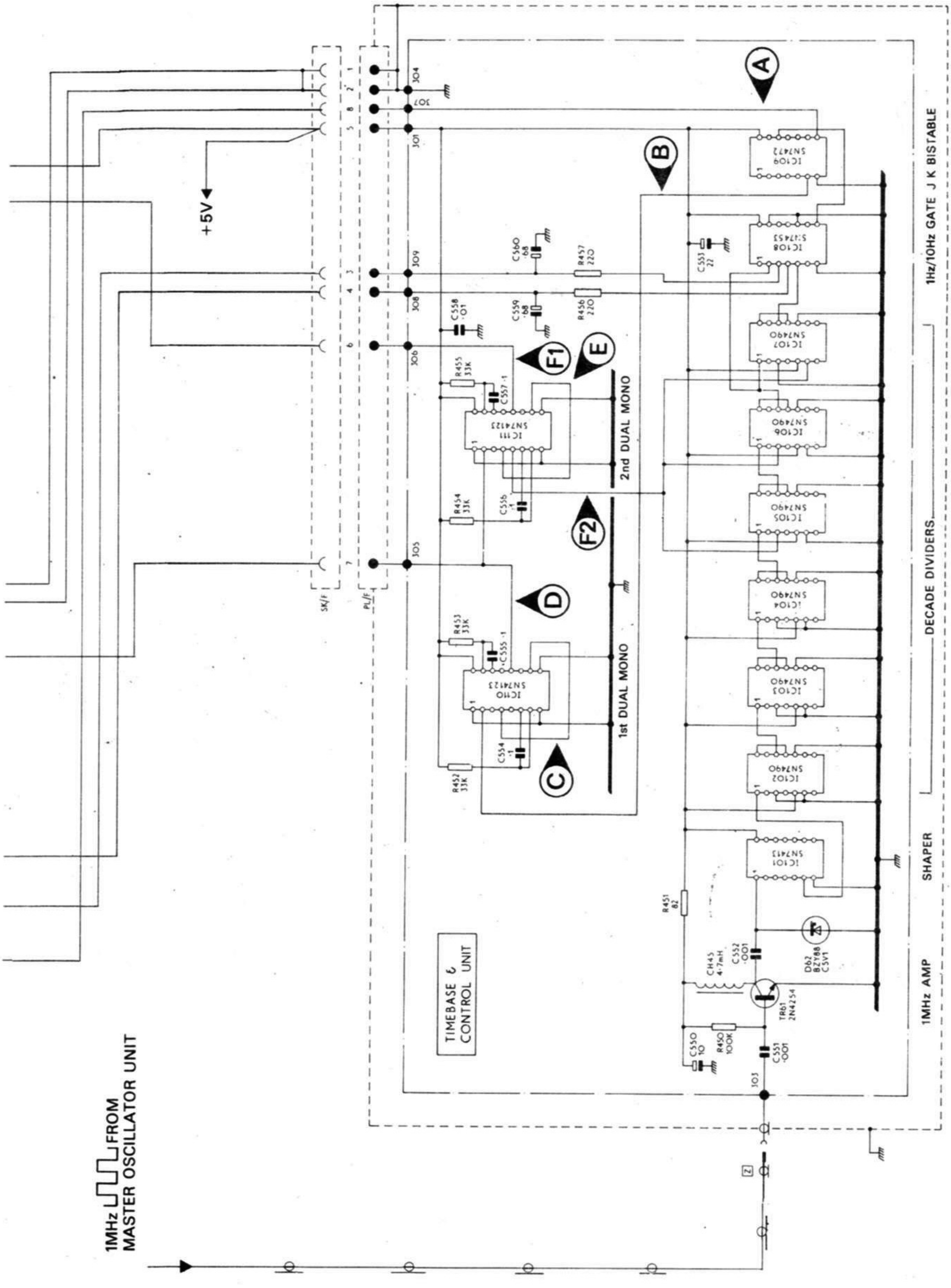


Fig. 2.6 Digital counter circuit

CIRCUIT DESCRIPTION

COUNTER & DISPLAY UNIT LP3343

This unit contains two printed circuit boards which are interconnected by means of an edge connector (SK/K). The boards are designated as follows:—

(1) *COUNTER BOARD LP3368*

(2) *DISPLAY BOARD LP3369*

Counter Board LP3368

This board carries the basic counter circuits and the circuits for operating the two LED indicators: it employs ten 7400 Series TTL IC's and three transistors in the following functions:—

(1) Amplifier/Shaper (TR62 : : BC107B).

(2) Counter Enable Gate (IC201 : : SN7400)

(3) 1Hz/10Hz Gate (AND-OR INVERT GATE) (IC202 : : SN7453).

(4) Six pre-set, reverse-counting decades (IC203-IC208 : : 6 x SN74190).

(5) 9-0-1 Decoder (½-IC210 : : SN7400).

(6) Blink Gates 1 & 2 (½-IC210 : : SN7400).

(7) Latches 1, 2 & 3 (¾-IC209 : : SN7473).

(8) LED Drivers 1 & 2 (TR63/TR64 : : 2 x BCY70).

Display Board LP3369

This board carries the five numeric display indicators (NDI's) IC301-IC305 which are LED devices with integral latch and decode facilities. (Hewlett Packard Type No. 5082-7300). The two flashing LED's are also mounted on this board and are suitably positioned to coincide with the panel legends which indicate their significance, viz:—

D64	: :	READ MAIN SCALE -100kHz	(Inc. Osc. at 650.001kHz or higher)
D65	: :	READ MAIN SCALE +100kHz	(Inc. Osc. at 550.000kHz or lower)

TIMEBASE & CONTROL UNIT LP3344

This unit is driven from the *MASTER OSCILLATOR UNIT* (via coaxial interconnection 'Z') and generates a sequence of timed control pulses to govern the circuit action in the *COUNTER & DISPLAY UNIT*. The following control information is provided:—

(1) Counter enable pulse.

(2) Display and latch enable pulse.

(3) Counter reset (or load) pulse.

(4) Timebase reset pulse.

Interconnections between this unit and the *COUNTER & DISPLAY UNIT* are carried by a multi-wire cable terminated in PL/SK-F and PL/SK-G which also convey the 5V supply and the leads to the 1Hz/10Hz READOUT SWITCH S14.

All stages in the *TIMEBASE & CONTROL UNIT* are carried on a single printed circuit board which is described on the following page.

Timebase & Control Board

The various stages on this board involve a total of eleven 7400 Series TTL IC's and one transistor: their functions are as follows:—

TR61	::	2N4254	::	1MHz Amplifier.
IC101	::	SN7413	::	1MHz Shaper (Schmitt Trigger).
IC102-107	::	6 x SN7490	::	6-decade Divider.
IC108	::	SN7453	::	1Hz/10Hz Gate (AND-OR INVERT GATE).
IC109	::	SN7472	::	JK Bistable Divide-by-Two.
IC110	::	SN74123	::	Dual Monostable Multivib.
IC111	::	SN74123	::	Dual Monostable Multivib.

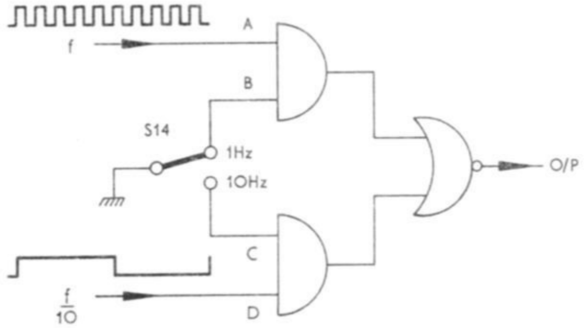
DIGITAL COUNTER CIRCUIT—Principle of Operation

Generation of counter timing and control information

1. The low-level 1MHz square-wave fed to the *TIMEBASE & CONTROL UNIT* from the *MASTER OSCILLATOR UNIT* (via coaxial interconnection 'Z') is amplified to the required level by transistor amplifier TR61.
2. This increase in amplitude is accomplished at the expense of some distortion in the original waveform so this is restored by feeding the signal to Schmitt Trigger IC101 which provides a good square-wave output to drive the following stages. Diode D62 serves as a limiter across its input.
3. The six IC's following IC101 (namely IC102-IC107) make up a six-decade divider which has a final output frequency of 1Hz. Output frequencies from the individual decades are as follows:—

IC102	::	100kHz	IC105	::	100Hz
IC103	::	10kHz	IC106	::	10Hz
IC104	::	1kHz	IC107	::	1Hz

4 Only the outputs available from the last two dividers are used in the operation of the counter control circuits, selection of the appropriate frequency being a function of the 1Hz/10Hz READ-OUT SWITCH S14. Switching is not direct but is accomplished by means of the AND-OR INVERT GATE IC108 which in effect by-passes the final decade (IC107) when S14 is set to the '10Hz' position. The action of this gate is summarised in Fig. 2.7 which shows the basic circuit configuration and corresponding truth table.



S14 POSN	INPUT				OUTPUT
	A	B	C	D	
'1Hz'	f	0	1	$\frac{f}{10}$	$\frac{f}{10}$
'10Hz'	f	1	0	$\frac{f}{10}$	f

Fig. 2.7 Circuit and truth table for AND-OR INVERT GATE

5. The 1Hz or 10Hz output selected by IC108 is passed to the JK BISTABLE DIVIDE-BY-TWO circuit IC109 which halves the input frequency to give output pulses of 1 second or 100ms duration according to the position of S14. IC109 has two separate outputs (pins 6 & 8) which provide simultaneous falling and rising pulses respectively. The rising pulse at pin 8 is used to open the Counter Enable Gate IC201 and is referred to as the *counter enable pulse.*

Both pulses are initiated by the falling edge of the 1Hz or 10Hz input pulse as shown in Fig. 2.9. The rising *counter enable pulse* is shown at 'A' and the falling pulse at 'B', this same identification being repeated in Figs. 2.6 and 2.8 which show the actual points in the circuit where the pulses appear.

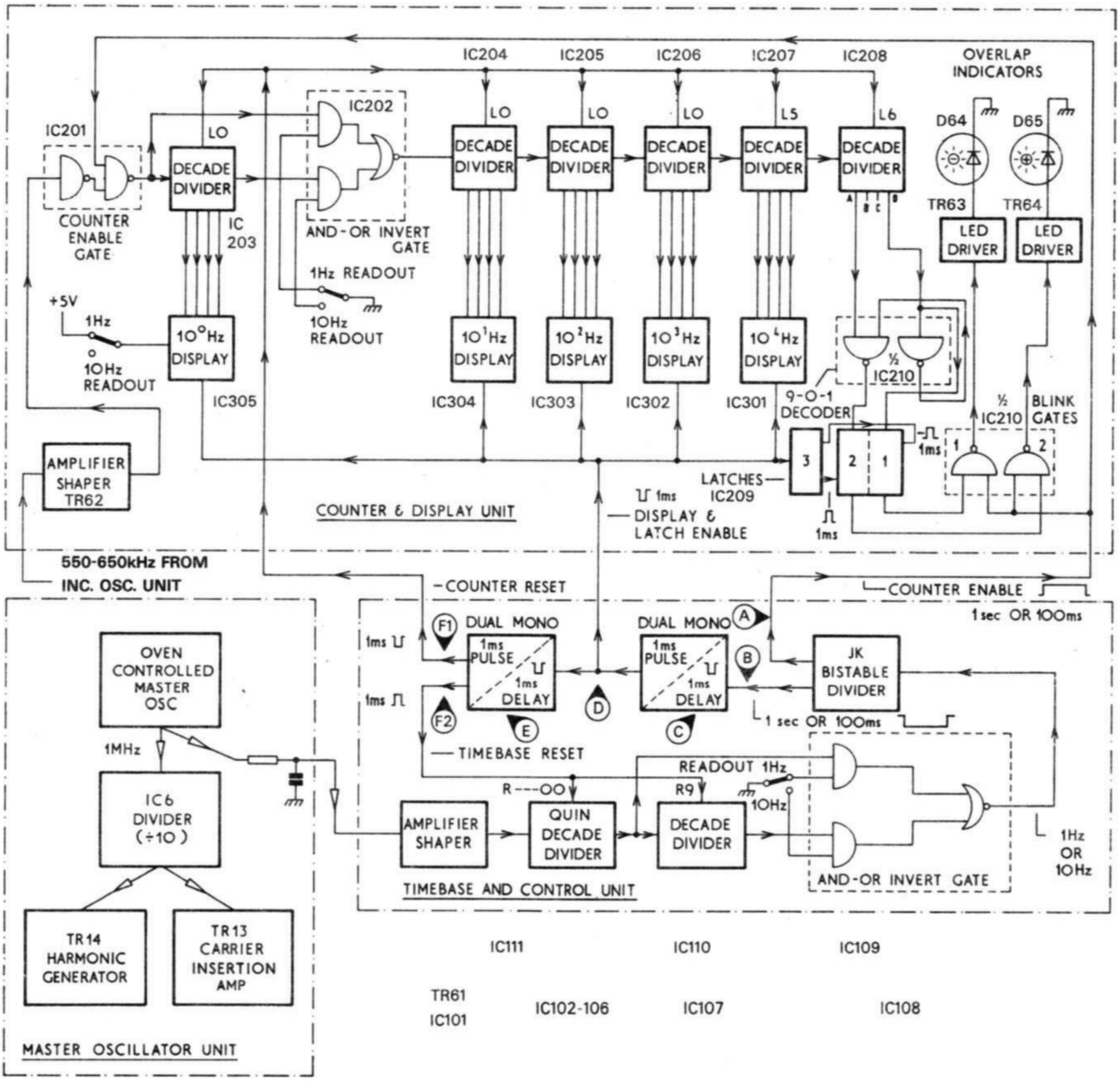


Fig. 2.8 Block Diagram of Digital Counter.

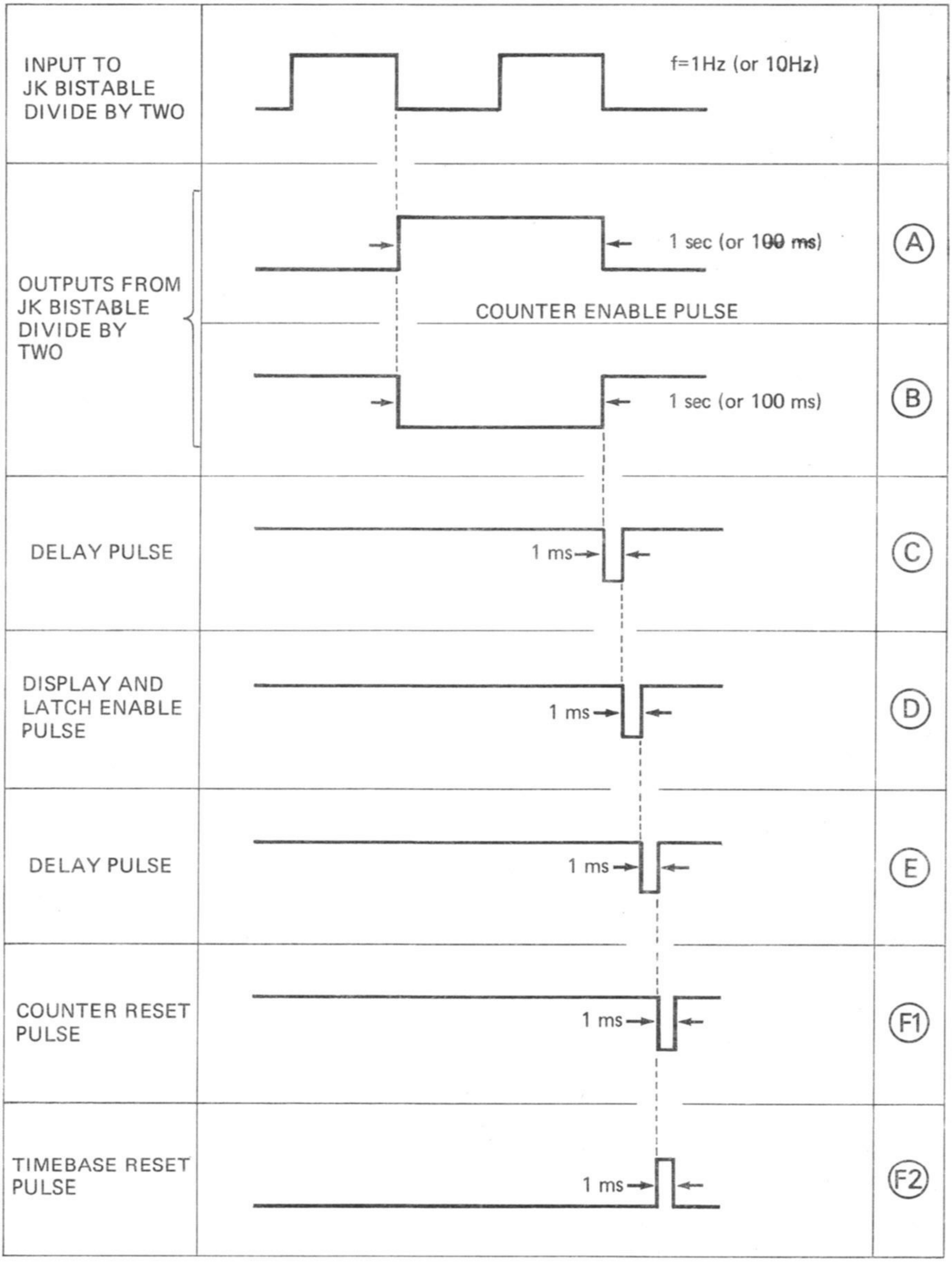


Fig. 2.9 Pulse sequence generated by Timebase & Control Unit.

6. The falling pulse 'B' in (5) above is applied to the Delayed Pulse Generator IC110 which comprises two monostable multivibs in cascade. The first monostable generates a 1ms delay pulse (C) which then initiates the 1ms output pulse 'D'. The latter is known as the *display and latch enable pulse* which is used to momentarily open the circuit between the counter and the display so that the count information can flow into the display circuit.

7. The *display and latch enable pulse* is also passed to IC111 which is a second Delayed Pulse Generator, identical to IC110 except that it provides two isolated outputs. The first monostable generates a 1ms delay pulse (E) as in the previous case and this then initiates the two output pulses which appear at pins 5 & 11. Both pulses are of 1ms duration, the one at pin 11 being a falling pulse (F1) which is known as the *counter reset* or *counter load pulse:* it is used to reset the counter decades preparatory to the next count.

8. The other 1ms pulse provided by IC111 is a rising pulse ('F2' : *timebase reset pulse)*. This is applied to the final three decades in the timebase divider to modify their resting states in readiness for generation of the next 1 second or 100ms *counter enable pulse.* This will start 500ms after the F2 pulse with S14 at '1Hz', or 100ms after with S14 at '10Hz'.

The complete pulse timing sequence is summarised in Table 2.9.

TABLE 2.9 COUNTER TIMING SEQUENCE

FUNCTION	DURATION OF PULSE	
	S14 AT '1Hz'	S14 AT '10Hz'
COUNTER ENABLE	1 sec	100ms
DELAY	1ms	1ms
DISPLAY & LATCH ENABLE	1ms	1ms
DELAY	1ms	1ms
COUNTER & TIMEBASE RESET	1ms	1ms

Operation of the counter circuits and numeric display

1. Sine-wave output from the *INCREMENTAL OSCILLATOR UNIT* lying in the range 550kHz to 650kHz is fed via coaxial interconnection 'Y' to TR62 in the *COUNTER & DISPLAY UNIT.* This stage functions as an amplifier and raises the amplitude of the oscillator signal above the clipping level of D63 which squares off the waveform fed to the Counter Enable Gate IC201.

2. IC201 is controlled by the 1 sec or 100ms *counter enable pulses* produced by IC109 in the *TIMEBASE & CONTROL UNIT:* it will open for the duration of each pulse to allow the count to take place.

3. The square-wave output from IC201 passes to the first counter decade (IC203) and also to one input (pin 3) of the AND-OR INVERT GATE IC202: the other input of IC202 (pin 5) is fed from the output of the first counter decade. IC202 functions in a similar manner to IC108 in the *TIMEBASE & CONTROL UNIT,* i.e. it bypasses the first counter decade when the 1Hz/10Hz READOUT SWITCH (S14) is set to '10Hz'.

4. The counter includes a total of six counter decades (IC203-208) of which only the first five are associated with the numeric display: the remaining decade (IC208) is concerned with the operation of the two LED indicators and will be discussed later.

The BCD outputs from each of the five decades in the counter proper are connected to the five Numeric Display Indicators IC301-IC305 which are equipped with integral latch and decode facilities. The decades are connected in the manner illustrated in Fig. 2.10, i.e. the first decade provides the 'Hz' figure and so on.

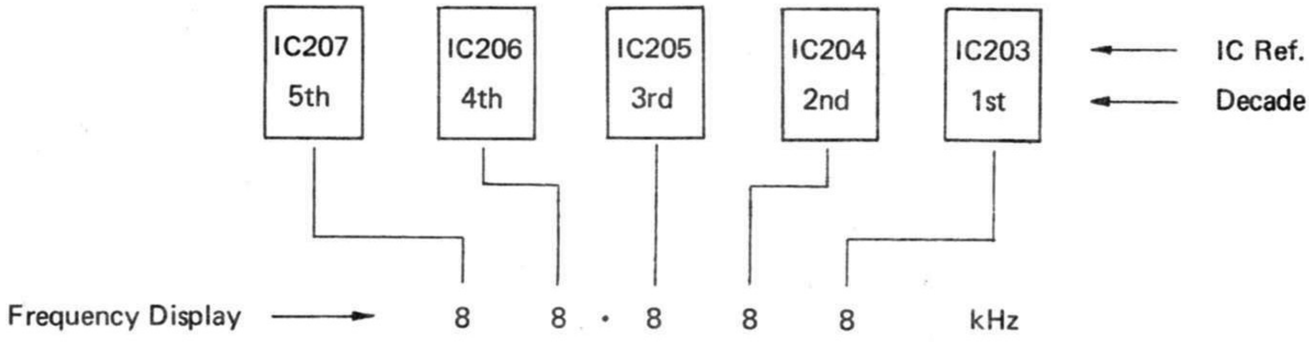


Fig. 2.10 Interconnection between counter decades and display.

The integral latches in the NDI's will open in the presence of the *display and latch enable pulses* produced by IC110 in the *TIMEBASE & CONTROL UNIT.* These pulses are of 1ms duration and occur 1ms after the completion of the count. With the latches 'open', BCD information from the counter decades passes into the NDI decoders which provide outputs to illuminate the appropriate segments of the LED matrices.

The frequency display will be updated at intervals of 1.5 seconds if the 1Hz/10Hz READOUT SWITCH is set to '1Hz', or every 200ms with the switch at '10Hz'. S14B removes the 5V supply from the final digit to extinguish it when the 10Hz readout is selected.

5. The *counter reset pulse* produced by IC111 in the *TIMEBASE & CONTROL UNIT* resets the first four counter decades to 'O' and the final decade (IC207) to '5'. This pulse is of 1ms duration and occurs 1ms after the *display and latch enable pulse.*

   The final decade is reset to '5' so that the digital readout will show 50.000kHz when the output from the *INCREMENTAL OSCILLATOR UNIT* lies at 600kHz, i.e. the mid frequency in its range.

Operation of the LED Indicators D64/D65

1. Information for controlling the operation of the two LED's (D64/D65) is derived initially from the 'carry pulse' output provided by the fifth counter decade (IC207).

   The number of carry pulses generated by this stage depends on the frequency setting of the *INCREMENTAL OSCILLATOR UNIT* and will be either 5, 6 or 7 as indicated in Table 2.10. One of the two LED's is arranged to flash if there are five pulses, the other if there are seven and neither if there are six.

TABLE 2.10 CARRY PULSE OUTPUT FROM FIFTH COUNTER DECADE

INC. OSC. FREQ.	≤550.000kHz	550.001–650.000kHz	> 650.000kHz
NUMBER OF CARRY PULSES (IC207)	5	6	7
LED OPERATION	D65 flashes	Both LED's extinguished	D64 flashes

2. The carry pulses generated in IC207 cannot be used directly to operate the two LED's and they are therefore passed to a sixth counter decade (IC208) which generates a more readily usable BCD output. IC208 is reset to '6' and will count downwards on receipt of the carry pulses from IC207 to give the reverse counts and corresponding BCD outputs listed in Table 2.11.

TABLE 2.11 BCD OUTPUTS GENERATED BY SIXTH COUNTER DECADE

NUMBER OF CARRY PULSES FROM IC207	REVERSE COUNT OCCURRING IN IC208	EQUIVALENT BCD OUTPUT PRODUCED BY IC208			
		D	C	B	A
5	5–4–3–2–1	0	0	0	1
6	5–4–3–2–1–0	0	0	0	0
7	5–4–3–2–1–0–9	1	0	0	1

3. It can be seen from Table 2.11 that the final output count in IC208 will always be either 1, 0 or 9 (other states could exist but these lie outside the tuning range of the *INCREMENTAL OSCILLATOR UNIT).*

It is also evident that although the outputs on the 'D' and 'A' lines are different in each case (01, 00, 11), those on the 'C' and 'B' lines are always the same (00). The 'C' and 'B' outputs are therefore ignored (not connected) and output for the following stages is taken from the 'D' and 'A' lines only. This information is directly related to the frequency setting of the *INCREMENTAL OSCILLATOR UNIT* as shown in Table 2.12.

TABLE 2.12 RELATIONSHIP BETWEEN BCD OUTPUT OF IC208 AND LED OPERATION

INC. OSC. FREQ.	≤550.000kHz	550.001–650.000kHz	> 650.000kHz
FINAL COUNT IN IC208	1	0	9
'D' O/P (IC208)	0	0	1
'A' O/P (IC208)	1	0	1
LED OPERATION	D65 flashes	Both LED's extinguished	D64 flashes

4. Close examination of Table 2.12 shows that the 'D' output of IC208 becomes state '1' **only when the output from the INCREMENTAL OSCILLATOR UNIT** lies **at 650.001kHz or higher.** This output can therefore be used directly to activate the controlling stages which are responsible for flashing LED D64.

The 'A' output on the other hand, is not directly usable because its output state rests at '1' for both conditions where the LED's must flash. This output will be dealt with later after first considering the action of the various stages associated with D64. These stages are shown in heavier outline in Fig. 2.11 which shows the remaining circuit elements used to operate both LED's.

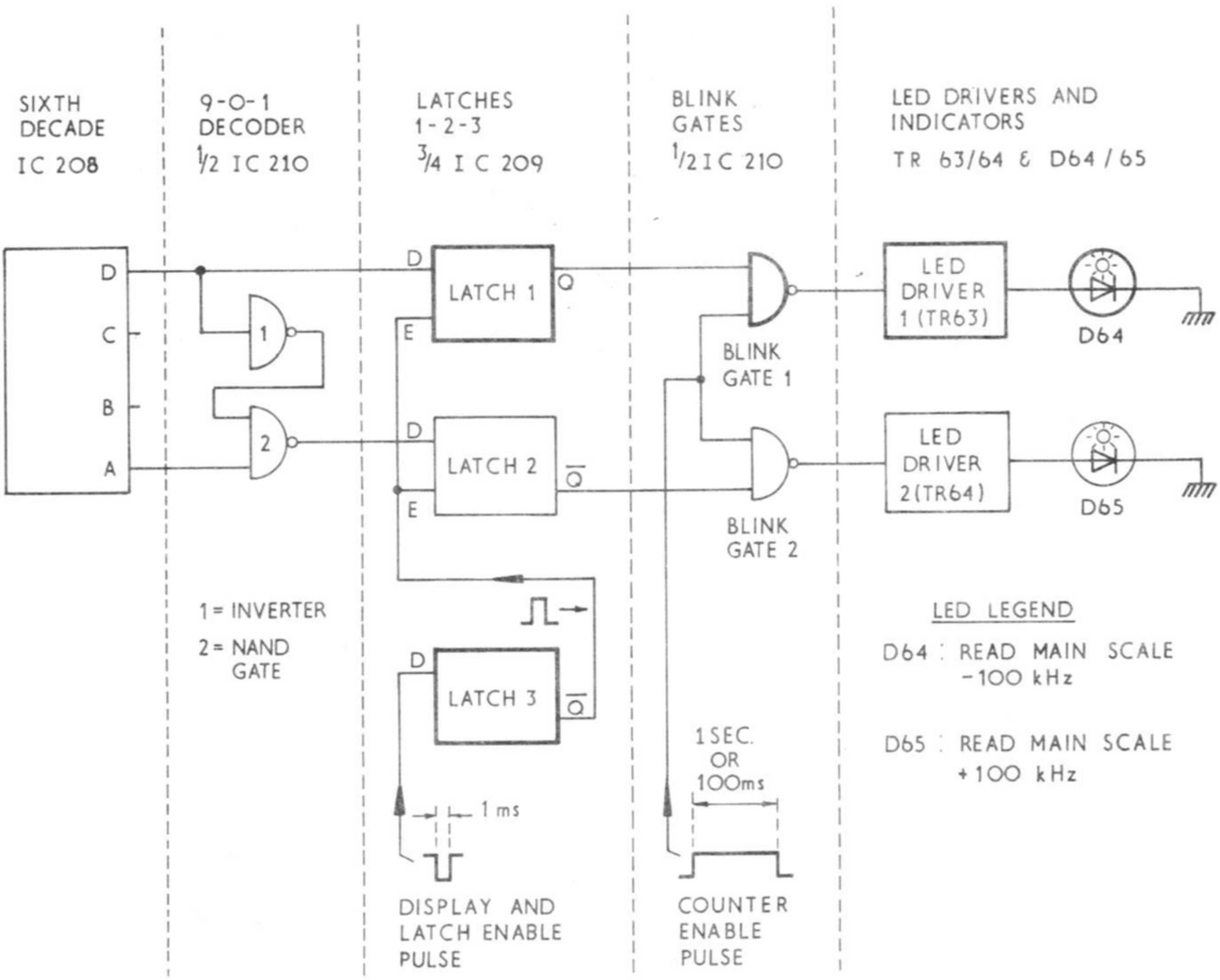


Fig. 2.11 LED control circuits.

5. The 'D' output of IC208 is connected to the 'Data' input (D) of LATCH 1 which forms part of the IC209 package (IC209 houses four separate latches, only three of which are used). LATCH 1 functions in a similar manner to the integral latches in the NDI's and is used to convey the final output state of IC208 to BLINK GATE 1 in the short period of time before IC208 is reset by the *counter reset pulse.*

   Control for LATCH 1 is derived from the *display and latch enable pulse* after this has been inverted by passing it through LATCH 3. The inverted pulse is applied to the 'Enable' input (E) of LATCH 1 and will be a rising pulse of 1ms duration. Circuit action is as follows:–

   If the 'D' input of LATCH 1 is at state '1' when the 'E' input becomes state '1' due to the inverted *display and latch enable pulse,* its 'Q' output will change state from '0' to '1' and will remain at '1' until such time as the 'D' input becomes '0', i.e. if f becomes 650.000kHz or lower. The 'Q' output would then change to '0' in the presence of the next *display and latch enable pulse.*

6. The 'Q' output of LATCH 1 is connected to one input of BLINK GATE 1, the other input of which is returned to the counter enable line. BLINK GATE 1 is a NAND gate and therefore produces a '0' output when both its inputs are '1'. Its output will be '1' for all other input states, under which condition the p-n-p transistor TR63 will be turned off and D64 extinguished.

   With f = 650.001kHz or higher, both inputs will be '1' during the period of the *counter enable pulses,* so turning on TR63 each time a pulse occurs. Thus D64 will flash in sympathy with the on/off transitions in TR63, the flashing rate being a function of the setting of S14 which governs the duration of the *counter enable pulses.*

7. The method whereby the 'A' output of IC208 is adapted to initiate the flashing action of the other LED (D65) will now be considered (see Fig. 2.11).

   The 'A' output is ambiguous in that it changes to state '1', not only when D65 is required to flash, but also when D64 is flashing due to the action initiated by the 'D' output of IC208.

   This ambiguity is overcome by feeding the 'A' output to one input of a NAND gate, the other input of which is fed from the 'D' output via a second NAND gate operating as an inverter. Both gates are contained in IC210, the circuit arrangement being referred to as a '9-0-1 DECODER'.

   The output states of the inverter stage will be the opposite of those quoted for the 'D' output in Table 2.12, i.e. 1-1-0 respectively for the three incremental ranges under consideration. The corresponding states derived from the 'A' output are 1-0-1.

   Output from the NAND gate will be '0' when both inputs are '1', or '1' when either input is '1' and the other is '0'. It follows then, that the output states passed to the following stage will be 0-1-1 and will be '0' only when the incremental frequency is at 550.000kHz or below.

8. The remaining circuitry is exactly the same as that on the D64 'channel' except that output from LATCH 2 is taken from the $\overline{Q}$ output instead of from the Q output. This is necessary because the NAND gate in (7) above produces a '0' output when D65 is required to flash.

ERRATUM:
Pages 26, 39 & 41: 1MHz output from MASTER OSCILLATOR UNIT via coaxial outlet 'Z' has a triangular waveshape and not square-wave as stated in text.

Section 3

MECHANICAL CONSTRUCTION

MOUNTING STYLES

The basic receiver is supplied in rack-mounting form complete with top and bottom covers and occupies a height of 133mm (5.25in) in standard 483mm (19in) racking. Intrusion into the rack amounts to 411mm (16.2in).

A matching cabinet can be supplied as an accessory (see Table 4.2 in Section 4) for use when the receiver is required to be bench-mounted. Shock-absorbent mountings and a plinth loudspeaker unit are also available.

Dimensions of the receiver are given for all mounting styles in Fig. 3.1.

WEIGHT

The overall weights of the receiver in its various forms are as follows:—

Rack-mounting version complete with covers	19.6kg	43.5lb
Bench-mounting version complete with cabinet	22.7kg	50.0lb
Ditto with Cat. No. 989 Plinth Loudspeaker	23.7kg	52.25lb
Ditto with Shock-Absorbent Mounting LP2817/1	23.7kg	52.25lb

INTERNAL LAYOUT

General

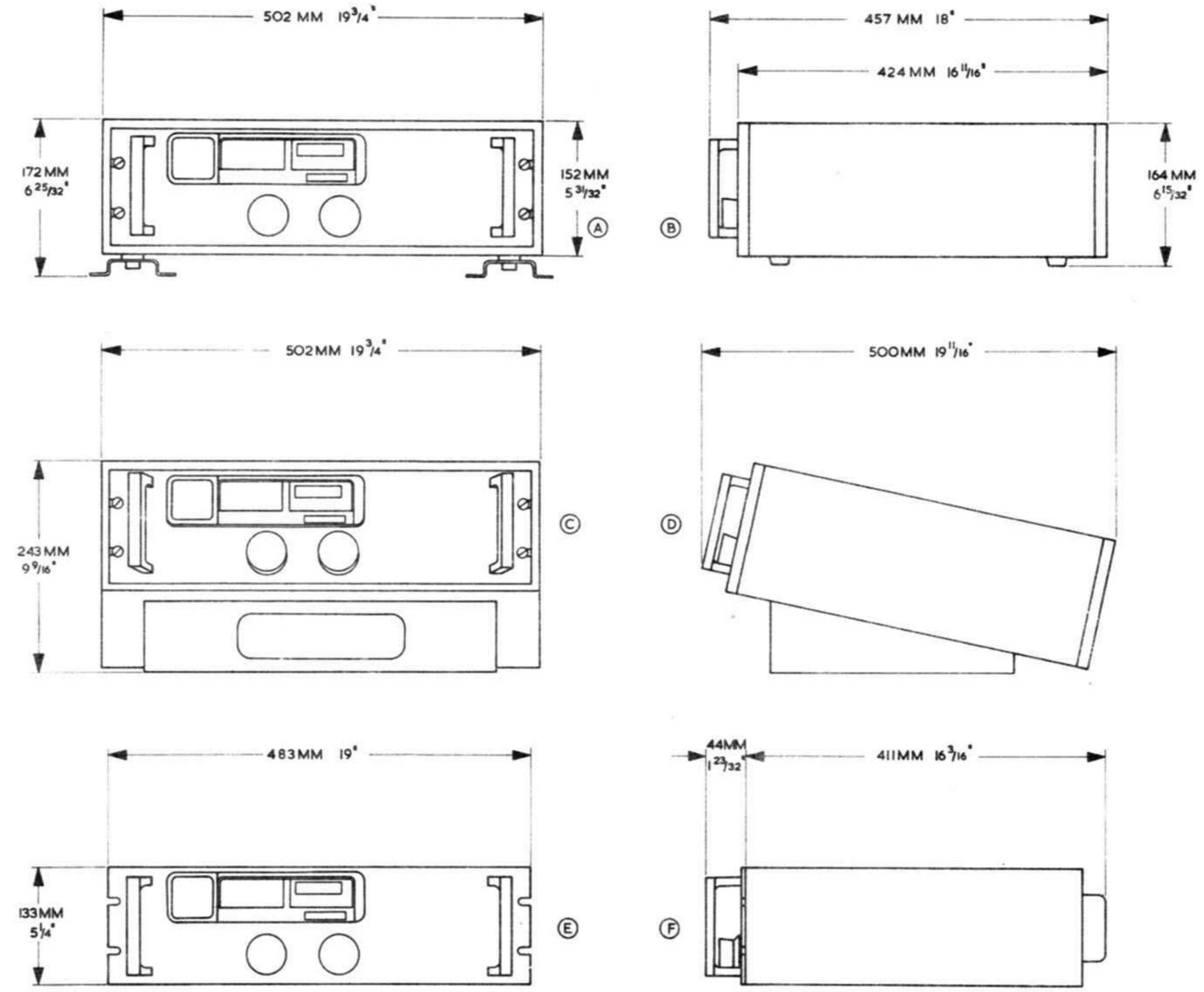
The receiver can be broken down into two main sub-assemblies which are independently attached to the front panel. Tie-points exist between the sub-assemblies so that the receiver exhibits complete rigidity when fully assembled.

The larger of the two sub-assemblies comprises three flanged plates of different shape and size which are attached to each other to form a flat chassis which is fixed to the back-plate and the right-hand side-plate. This chassis carries the major power supply components and also supports the greater part of the receiver circuitry which is housed in detachable modules and units: a typical module is illustrated in Fig. 3.6. Printed circuit techniques are used throughout and the chassis, module covers etc. are fabricated from Alocrom-protected aluminium.

The other major sub assembly comprises the *RF ASSEMBLY* and the *INCREMENTAL OSCILLATOR UNIT*, together with the dual tuning mechanism on which they are both mounted. The *RF ASSEMBLY* is built on a die cast aluminium alloy frame and is illustrated in Fig. 2.1 (Page 14). The tuning mechanisms are also visible in this illustration which shows the heavy gauge steel plates to which the circuit housings are attached.

The front panel is fabricated from heavy-gauge steel plate and contributes considerable strength to the complete chassis assembly. The cabinet is of rust-proofed steel and is equipped with fixing points for feet, shock-absorbent mountings and plinth loudspeaker unit.

MECHANICAL CONSTRUCTION



A — Frontal dimensions of Receiver in Cabinet 8866P mounted on Shock-Absorbent Mountings LP2817/1.

B — Side elevation of Receiver in Cabinet 8866P fitted with standard mounting feet.

C & D — Receiver in Cabinet 8866P on Plinth Loudspeaker Unit Cat. No. 989.

E & F — Standard Rack-Mounting Receiver.

Fig. 3.1 Dimensions of Receiver in all mounting styles

Access for servicing

The method of construction described in the foregoing paragraphs facilitates direct access for most minor servicing and also permits easy breakdown of the complete assembly in the event of major fault rectification being required. The modular form of construction which is utilised for the greater part of the receiver circuitry is ideally suited to servicing by substitution and to this end a full range of major spares can be supplied to order (see Section 6 and Appendix 'D').

Individual units and modules are interconnected by means of simple pin and socket connectors to allow removal without need for use of a soldering tool: miniature coaxial plugs and sockets or coaxial line connectors are used where screened leads are employed. Interconnections between the main chassis assembly and the panel controls are carried by multi-way plug and socket connectors.

TUNING DRIVES AND FREQUENCY DISPLAY

Tuning Drives

Two identical geared mechanisms are employed for the main tuning and incremental controls. Reduction ratios are of the order 100:1, the drives being flywheel-loaded to permit rapid change in frequency setting. Backlash is almost totally non-existent and re-setting accuracy is of a very high order.

Drive output for the main tuning capacitors is taken via a linearising arm which is arranged to alter the speed of gang travel at the high frequency end of the tuning sweep. The calibration display is driven prior to the linearising arm to achieve a more linear scale.

Main Frequency Display

Scale presentation is by means of a light projection system in which a beam of light is projected through transparent markings on an otherwise opaque calibration disk as shown in Fig. 3.2. After passing through the disk, the light is transmitted through a twin-lens magnifier and falls upon a translucent screen. A polaroid filter and hooded escutcheon ensure a clear display in conditions of high ambient lighting. The position (height) of the light source is altered automatically to suit the range selected.

Calibration is arranged so that there is no confusion in reading frequencies from the limited portion of the individual range calibration visible at any setting of the tuning knob. Illuminated legends indicate whether calibration is in kHz or MHz.

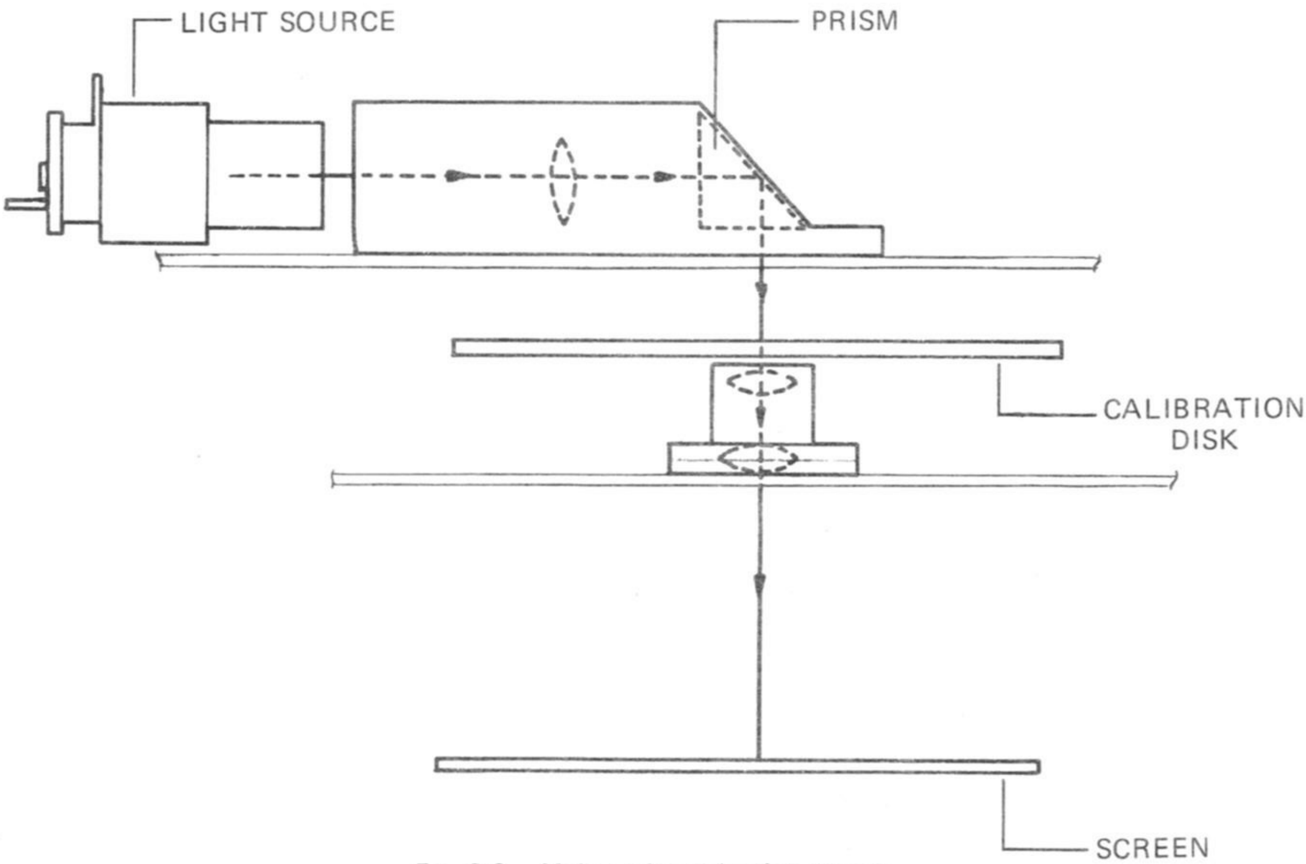


Fig. 3.2 Main scale projection system

Incremental Frequency Display

This display is provided by five LED Numeric Display Indicators which are located at the right-hand side of the main scale display. The digital read-out is extinguished when using Ranges 5-10.

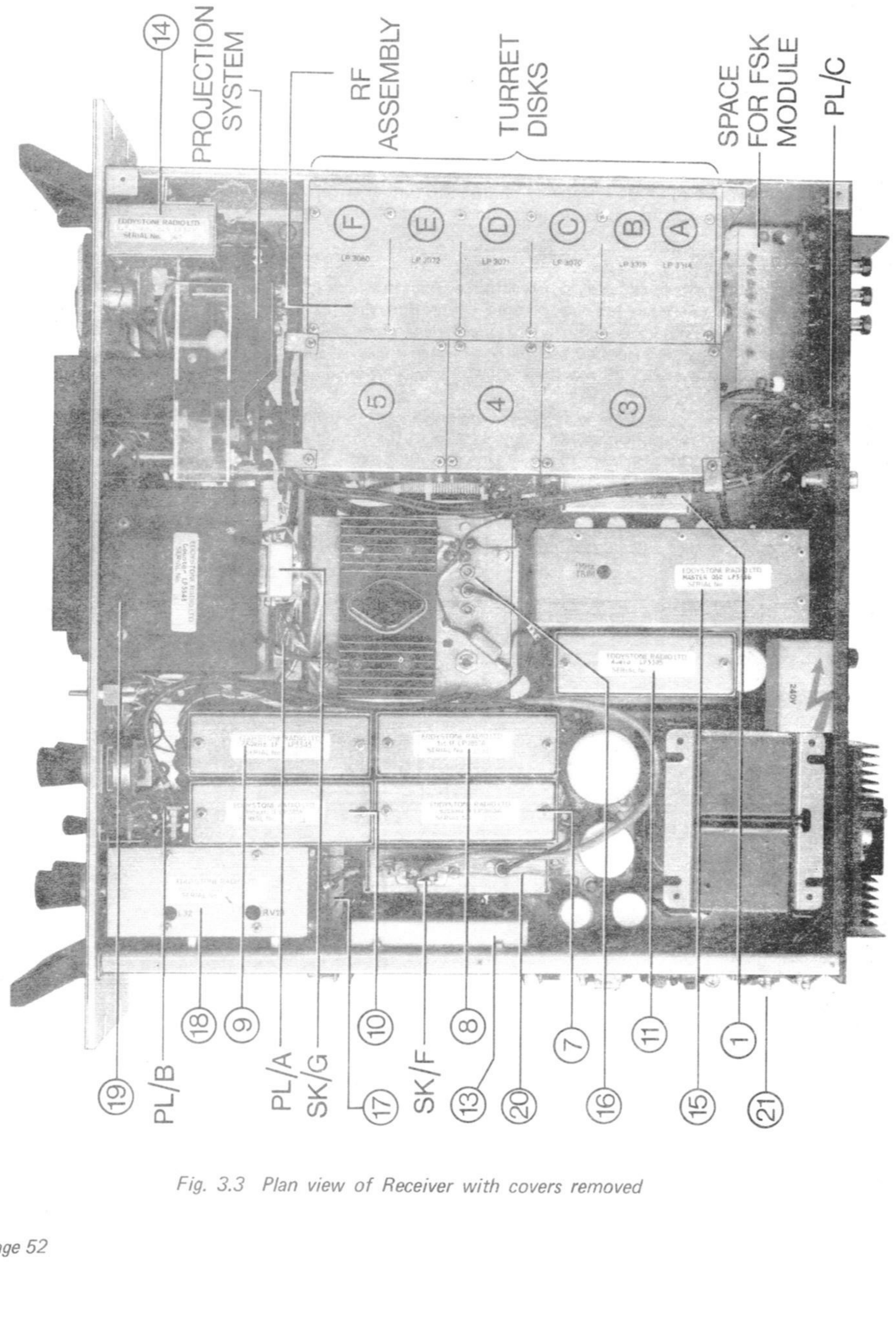
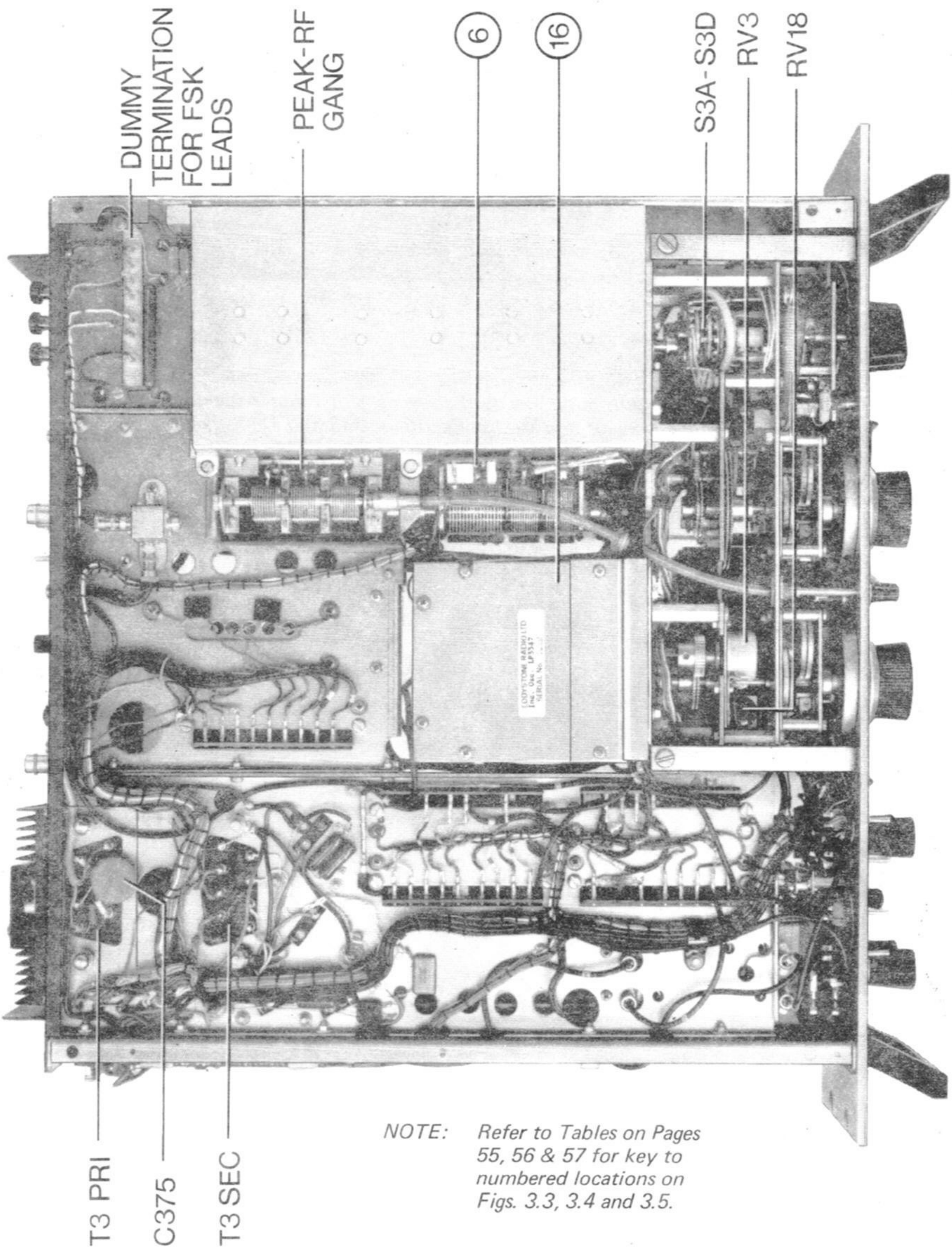


Fig. 3.3 Plan view of Receiver with covers removed



NOTE: Refer to Tables on Pages 55, 56 & 57 for key to numbered locations on Figs. 3.3, 3.4 and 3.5.

Fig. 3.4 Underside view of Receiver with covers removed

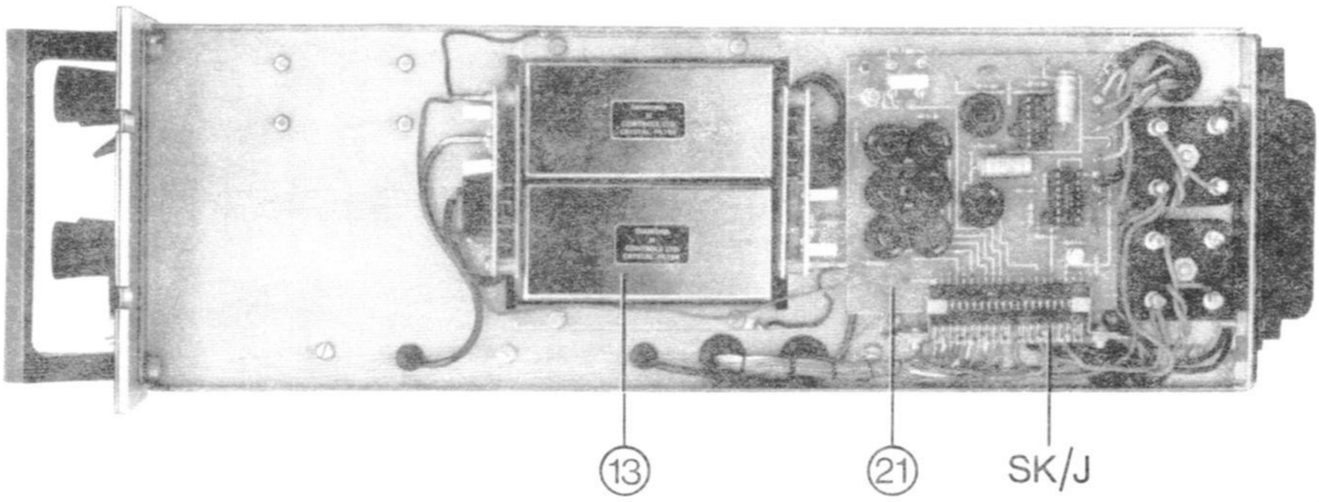


Fig. 3.5 Side elevation with cover removed showing SSB Filter Assembly, Meter/ Regulator Board and Bridge Rectifiers D43 and D44.

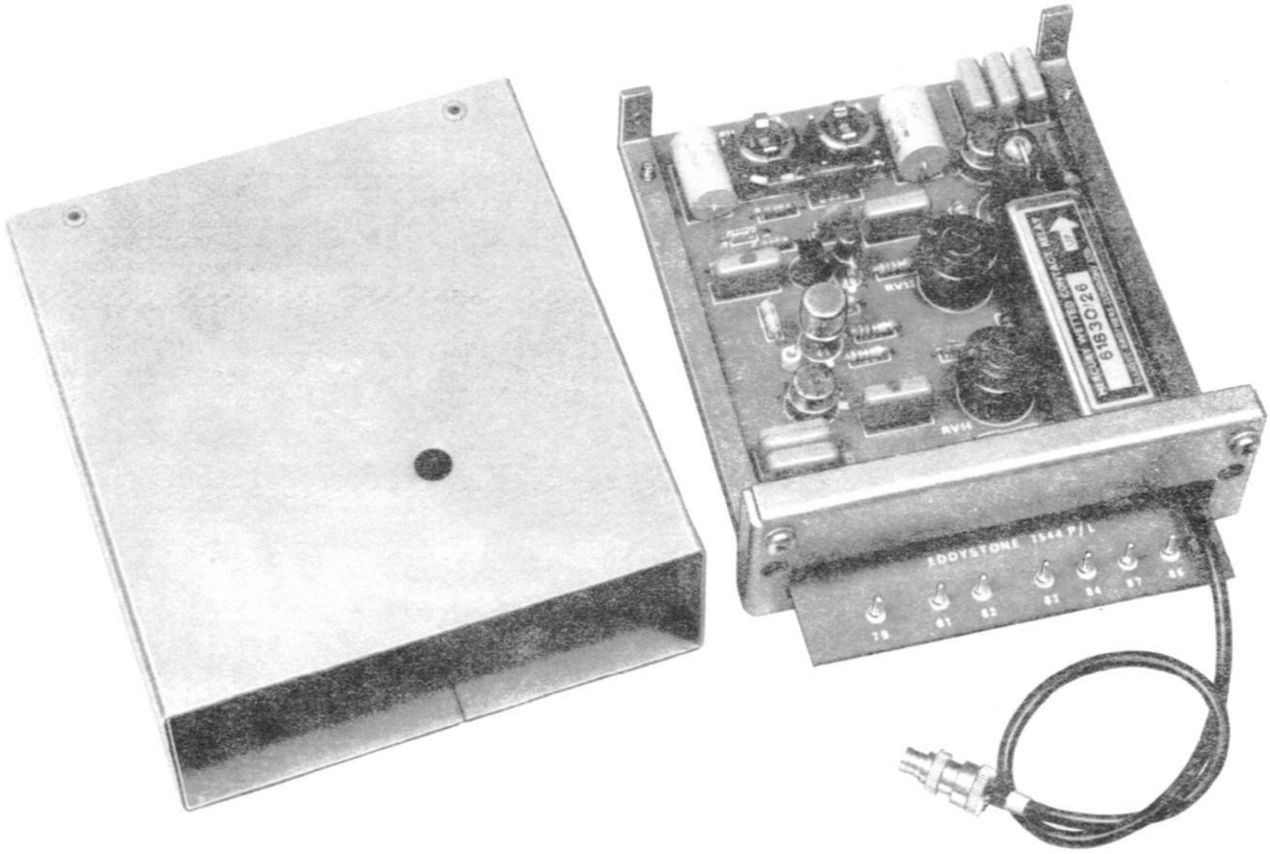


Fig. 3.6 FSK Module LP3058

COMPONENT LOCATION

The Tables which follow provide a key to the location of all units, modules, p.c.b's etc. shown on Figs. 2.1, 3.3, 3.4 and 3.5. Each individual item is allocated a reference number which is repeated on the appropriate illustration. These numbers must *not* be used for spares ordering (Note: the number '2' has not been allocated). Turret Disks are identified 'A' – 'F' as on the Circuit Diagram at the rear.

Each Table includes a full list of the major components associated with the various sub-assemblies.

RF Assembly

The RF Assembly carries the printed circuit boards listed in Table 3.1 and the Turret Disks listed in Table 3.2. All p.c.b's with the exception of the 1MHz Crystal Calibrator are mounted directly on the turret casting: the calibrator is attached to one of the outer screening plates. An illustration of Turret Disk 'A' appears on page 15: all other Disks have inductors etc. mounted on both sides (see Appendix 'E').

TABLE 3.1 RF ASSEMBLY PRINTED CIRCUIT BOARDS

Ref	Designation	Part No.	Semiconductors	Resistors	Capacitors	Misc.
1	1MHz Crystal Calibrator Board	LP3059	IC1	R1-4	C1	XL1
3	RF Amplifier Board	LP3062	TR1-3	R40-50	C32-43 excluding C37	CH1
4	MTO Board	LP3063	TR4-5, IC2, D12	R55-60	C44-59 excluding C45, 46 48 & 49	CH2-3
5	Harmonic Amplifier Board	LP3064	TR6-7	R61-70	C62-74 excluding C65-66	CH4, L1
6	MTO AFC Board	LP3081	D11	R53-54	C48-49	–

TABLE 3.2 RF ASSEMBLY TURRET DISKS

Ref	Designation	Part No.	Inductors	Capacitors	Resistors
'A'	Aerial Disk	LP3314	L136-146	C380-396	R350-352
'B'	RF Disk	LP3315	L44-53	C400-412	R360-361
'C'	Signal Mixer Disk	LP3070	L54-63	C420-438	R370-377
'D'	MTO Disk	LP3071	L64-73	C450-476	–
'E'	Loop Mixer Disk	LP3072	L74-77	C480-487	–
'F'	Harmonic Amp. Disk	LP3080	L78-81	C490-497	R380

MECHANICAL CONSTRUCTION

Main Chassis, Panel etc.

The bulk of the remaining circuitry is mainly located in detachable modules/units, most of which are fitted on the main chassis. These sub-assemblies are all listed in Table 3.3 which also includes the plug-in printed circuit board mounted on the right-hand side-plate (Meter/Regulator Board).

Reference numbers are allocated as before to facilitate location of the various units on the appropriate illustrations. (Nos. 1-6 appear in Table 3.1.)

TABLE 3.3 MODULES, UNITS ETC.

Ref	Designation & Part No.	Semiconductors	Capacitors	Resistors	Misc.
7	935kHz Loop Module LP3055A/1	TR8-11, IC3-5, D13-15A	C80-108	R80-95	L2-9, CH5-8, RLB/1
8	Tunable IF Module LP3057A/1	TR15, IC12, D19-24A	C140-168 excluding C147, 150, 164 & 167	R120-138 excluding R131-133	L10-15
9	250kHz IF Module LP3345	TR20-22	C190-212	R160-178	CH15-17A, XL4
10	100kHz IF Amplifier Module LP3056	TR23-31, D32-34	C260-300	R200-244 excluding R224	L29-31, CH18-27
11	Audio Amplifier Module LP3385	TR34-35, IC18, IC19, D37 & 37A	C330-348	R270-287 RV26	T2
12	FSK Module LP3058	TR40-41, IC8-10, D38-40	C350-365	R310-326, RV13, RV14	L33, L34, CH32, RLC/1
13	SSB Filter Assembly LP3374	–	C213-216	R194-199	RLD/1, RLE/1, USB & LSB Filters
14	Aerial Attenuator Unit LP3260/1	PC1 (8 diodes)	C10	R11-16	T1, RLA/1
15	Master Oscillator Unit LP3346	TR13-14, IC6, D16	C110-132 excluding C123-127	R104-114 RV16 RV22	L35, CH9-12
16	Incremental Oscillator Unit LP3347	TR53-60, IC16, IC17, D58-61	C500-529 excluding C506-508	R400-431 RV25	L16-18A
17	100kHz IF Filter Unit LP3047A	–	C217-259 excluding C219	R180-190 excluding R187	L24-28, CH36

TABLE 3.3 (contd.)

Ref	Designation & Part No.	Semiconductors	Capacitors	Resistors	Misc.
18	CW/SSB Detector & BFO Unit LP3348	TR32, TR33 D35, D36	C310-324	R251-263 excluding R260. RV21	L32, CH28-31
19	Counter & Display Unit LP3343	TR62-64, IC201-210, IC301-305 D63-65	C570-578	R560-569	–
20	Timebase & Control Unit LP3344	TR61, IC101-111 D62	C550-560	R450-457	–
21	Meter/Regulator Board LP3373	TR39, TR50 IC14, IC15	C301-306, C349	R301-307 excluding R303. R340-349 RV2, RV4, RV9-12, RV23, RV24	–

Section 4

INSTALLATION

N.B. It is important to check that the NORMAL/SYNTH SWITCH on the back-plate is set to 'NORMAL' position when the receiver is installed for any application other than one in which it is used in conjunction with a frequency synthesizer.

ACCESSORIES

The Tables which follow list the accessories supplied with the receiver and also those additional items which are available to special order. The contents of the Accessories Kit should be checked against Table 4.1 when removing the receiver from its packaging.

TABLE 4.1 CONTENTS OF ACCESSORIES KIT SUPPLIED WITH RECEIVER III

QTY.	DESCRIPTION	PART No.
4	*Cabinet Mounting Feet (complete with 4 x 2BA screws)	7132P
3	BNC bayonet-lock: coaxial plugs (for Aerial Input etc.)	8012P
1	AC Supply Connector (complete with 3-core cable)	D2311/1
1	Ancillaries Connector (15-way complete with cover)	7771P
1	Telephone Plug	6567P
1	Test Lead (coaxial with male connector)	D4146
1	Test Lead (coaxial with female connector)	D4147
1	Allen Key (to fit control knob screws)	8449P
1	Screwdriver	7612P
1	Disk Insertion Tool	7857P
1	Trimming Tool (Neosid T.T.1.)	8451P
3	Spare Bulbs – 6V 0.2A MES 13.5mm round	8542P
2	Spare Bulbs – 6V 60mA LES	6659P
4	Spare Fuses – 5A miniature glass cartridge	7814P
2	Spare Fuses – 3A miniature glass cartridge	6709P
2	Spare Fuses – 1.5A miniature glass cartridge	9025P
	NOTE: Receivers dispatched adjusted for 105/130V working are supplied with 4 x 3A fuses.	
	(*) Not supplied with rack-mounting receiver.	

TABLE 4.2 LIST OF ADDITIONAL ACCESSORIES AVAILABLE TO ORDER

DESCRIPTION	PART No.
Anti-vibration Mounting Kit (supplied unassembled)	LP2817/1
Plinth Loudspeaker Unit	Cat. 989
Cabinet Loudspeaker Unit	Cat. 935
Telephone Headset	LP3242
Telephone Headset	LP3301
FSK Module	LP3058
DC/AC Converter Unit (12V INPUT)	–
DC/AC Converter Unit (24V INPUT)	–
Standard Receiver Cabinet (for converting rack-mounting receiver to bench-mounting style)	8866P
Dust Cover – Top (for use when converting cabinet receiver to rack-mounting style)	8952P
Dust Cover – Bottom	8958P
Spares Kit (list of selected items on request)	–

ASSEMBLY INSTRUCTIONS

Mounting Style

Receivers can be supplied for bench or rack-mounting, the latter being designated by suffix '/RM' after the Model/Type No. Receivers supplied to '/RM' specification are fitted with protective dust covers which are absent on versions in cabinet style for bench-mounted installations. The equipment can easily be converted from one form of mounting to the other, accessories for this purpose being listed on the facing page.

NOTE: DUST COVERS MUST BE REMOVED WHEN FITTING A STANDARD RACK-MOUNTING RECEIVER INTO CABINET 8866P.

Rack-mounting Receivers

Rack-mounting versions can be installed directly in 483mm (19in) racks, using four ¼in. BSF chromium-plated screws Eddystone Ref. 40A-330. Plain washers Ref. 27E-57 should be used to prevent damage to the panel finish. FIxing slots conform to standard with centre-spacing of 57.2mm (2.25in).

Bench-mounting Receivers

Eight hank-bushes are provided in the underside of the cabinets used on bench-mounting receivers. These provide fixing points for (1) normal mounting feet, (2) Plinth Loudspeaker Unit Cat. No. 989, and (3) Anti-vibration Mounting Type LP2817/1.

The mounting feet should be attached using the four 2BA screws supplied, the correct fixing points being those nearest to the corners of the cabinet. These hank-bushes are also used when fitting the Anti-vibration Mountings, whereas the Plinth Loudspeaker Unit is screwed to the inner group of fixing points.

Instructions for fitting Anti-vibration Mountings LP2817/1

1. Invert receiver.
2. Place the large neoprene washers over the fixing holes provided in the underside of the cabinet with stepped face uppermost.
3. Lower the channel-shaped mountings onto the washers, keeping the fixing flanges towards the outside of the receiver, and at the same time making sure that the step on the washers locates with the holes in the mountings.
4. Place the smaller neoprene washers on the inside of the channel-shaped pieces and pass the 2BA screws (with brass washers) through both neoprene washers.
5. Attach channel-shaped mountings to bench top with suitable screws: mountings should be bonded to bench if this is of metal construction.

MAINS VOLTAGE ADJUSTMENT

NB: Unless otherwise specified at the time of ordering, receivers are dispatched from the factory with transformer taps set for 240V operation. Receivers set to other voltages are identified by a label attached to the rear which indicates the voltage to be used.

The following procedure should be adopted if alteration of the mains transformer setting is necessary to suit the local mains supply: a soldering tool is required.

1. Remove cabinet (or bottom dust cover in the case of rack-mounting version).
2. Locate mains transformer primary connections (see Fig. 3.4 on page 53). Remove transparent safety cover.
3. Refer to Fig. 4.1 for connections applicable to each voltage range.
4. Unsolder supply lead filter choke from PRI 2 connection and also the filter capacitor C375 which is soldered to the same termination. Remove link(s) between PRI 1 and PRI 2.
5. Re-fit link(s), supply lead filter choke and C375 to suit required voltage setting, viz:—
   115V : : for voltages in the range 105/117V
   125V : : for voltages in the range 117/130V
   230V : : for voltages in the range 210/235V
   240V : : for voltages in the range 235/245V
   250V : : for voltages in the range 245/260V
6. Re-fit bottom dust cover or cabinet as appropriate.

Mains fuse ratings

The ratings of the mains fuses should be checked before connecting to the supply. Ratings should be as follows:—

105/130V : : 3 Amps 210/260V : : 1.5 Amps.

Spare fuses of both types will be found in the Accessories Kit.

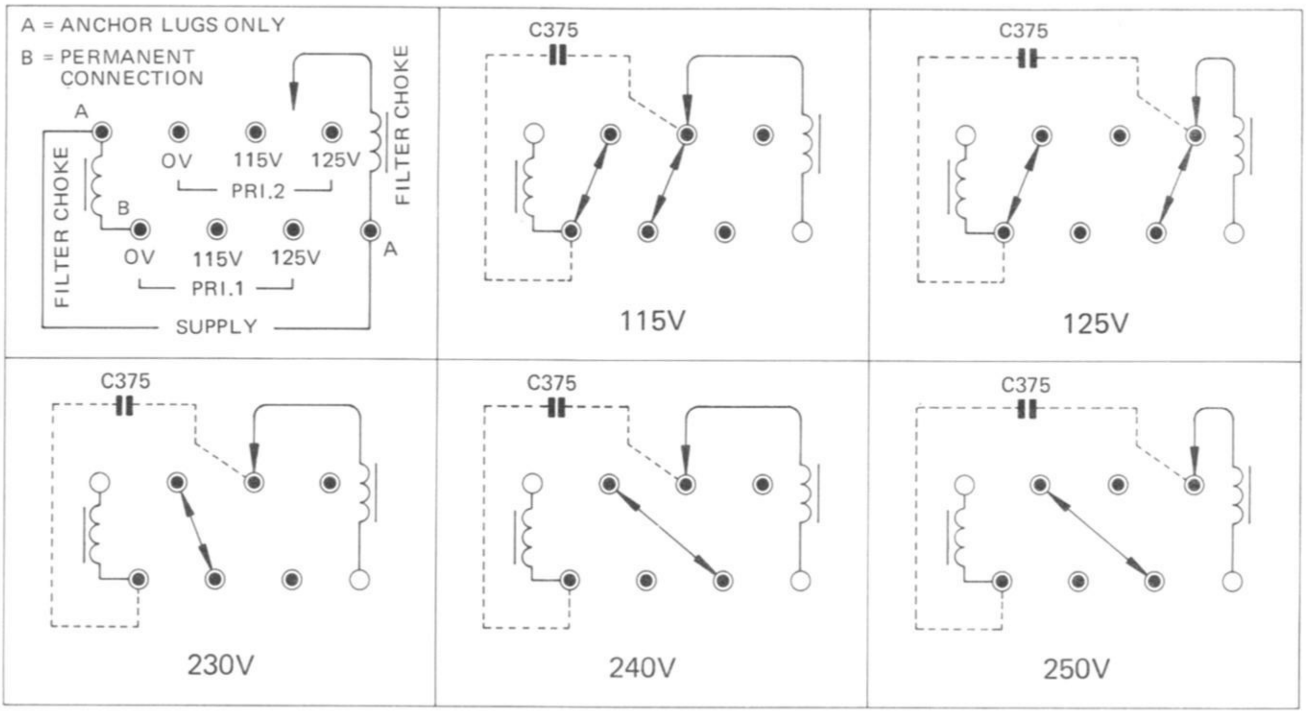


Fig. 4.1 Mains transformer voltage settings

OPERATION FROM LOW VOLTAGE DC SUPPLIES

The equipment can be powered from low voltage DC supplies by using an external DC/AC Converter Unit of 100VA minimum rating. Suitable units can be ordered from the Manufacturer, or any adequately rated unit capable of an AC output within the range of adjustment afforded by the mains transformer tappings can be used.

EXTERNAL CONNECTIONS

General

All external connections (except telephone headset) are made at the rear of the receiver. The appropriate connectors are included in the Accessories Kit.

Mains Input

The AC Supply Connector is fitted with 2000mm (approximately 6-feet) of 3-core cable and is colour-coded in accordance with the current European Standard, viz:—

LIVE : : BROWN NEUTRAL : : BLUE EARTH : : GREEN/YELLOW

NB: No provision is made for switching the AC supply within the receiver and this facility should therefore be arranged externally at the supply source.

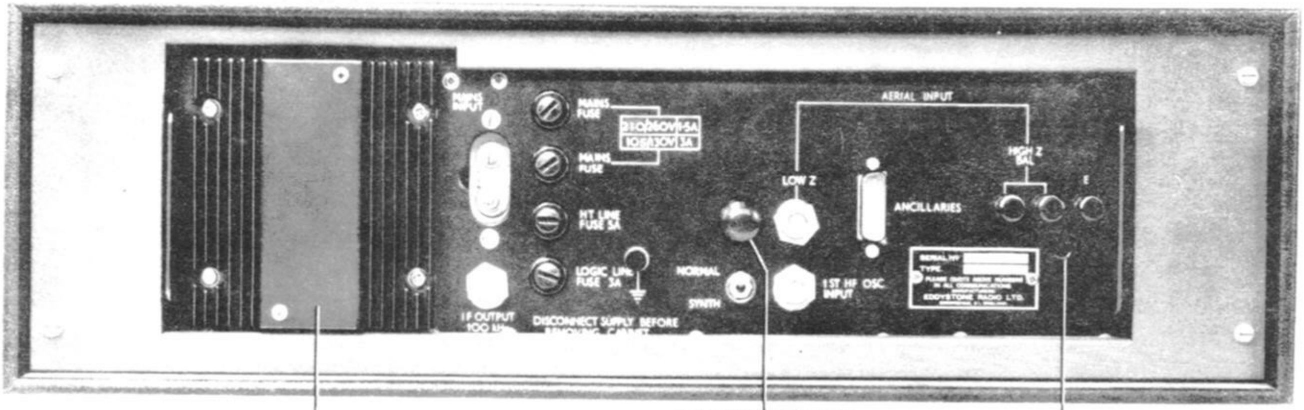


Fig. 4.2 Rear view of Receiver showing location of input/output connectors

Aerial Input

Two separate aerial inputs are available:—

LOW-Z INPUT : : nominally 75Ω unbalanced and usable at all frequencies 10kHz-30MHz.

HIGH-Z INPUT : : nominally 600Ω balanced feed for use only at frequencies below 1.6MHz.

Connections are to a BNC bayonet-lock coaxial socket for LOW-Z inputs and to spring-loaded terminals for HIGH-Z inputs. The latter can be unbalanced by fitting a shorting strap between the right-hand terminal and the adjacent earth terminal (E).

Earth Terminal

This terminal (located immediately to the left of the NORMAL/SYNTH SWITCH) should be bonded to the frame of the rack when the receiver is installed as a rack-mounted equipment. In bench installations (cabinet receivers), connect to supply earth. Additional earthing (e.g. to reduce noise pick-up on the low frequencies) should be connected to the earth terminal 'E' adjacent to the HIGH-Z INPUT terminals.

IF Output

This output provides a low-level signal at the final intermediate frequency (100kHz) suitable for driving external ancillary equipment such as panoramic display units etc. Output level is of the order 20mV in 75Ω for 3μV at the aerial input. Bandwidth is governed by the setting of the SELECTIVITY SWITCH and is adjustable up to a maximum of 8kHz (except on lowest signal frequencies where bandwidth is restricted by the selectivity of the front-end tuning circuits). Connection is by means of a BNC bayonet-lock coaxial connector.

1st HF Oscillator Input

This socket is used for synthesized operation only. Refer to 'SYNTHESIZED OPERATION ON RANGES 5-10' which appears on page 66.

Common Oscillator Working

The plastic bung adjacent to the LOW-Z INPUT socket can be removed to allow direct cable access to the *INCREMENTAL OSCILLATOR UNIT* when using the receiver with common oscillator control in a diversity installation. Further information will be found under 'INSTALLATION OF DUAL DIVERSITY TERMINAL' on page 64.

Telephone Headset

Connect to PHONES socket at front of receiver using standard jack plug. This output is primarily intended for use with low/medium-impedance communications headsets but will provide satisfactory results with impedances of 2,000Ω or higher.

The socket is arranged so that insertion of the plug will automatically mute an external loudspeaker if one is connected: the internal loudspeaker is switched by means of a panel control and can therefore be 'on' or 'off' when using the headset.

Ancillaries Connector (PL/C)

This is a miniature 15-way connector providing terminations for the following ancillary circuits:–

1. External Loudspeaker
2. Line
3. Muting
4. Teleprinter
5. Diversity AGC

Internal connections to the fixed male member of this connector are illustrated in Fig. 4.3 and the appropriate external connections to the free female portion appear in Figs. 4.4.1 through 4.4.5. Each of the services routed through the Ancillaries Connector is dealt with separately in the paragraphs which follow.

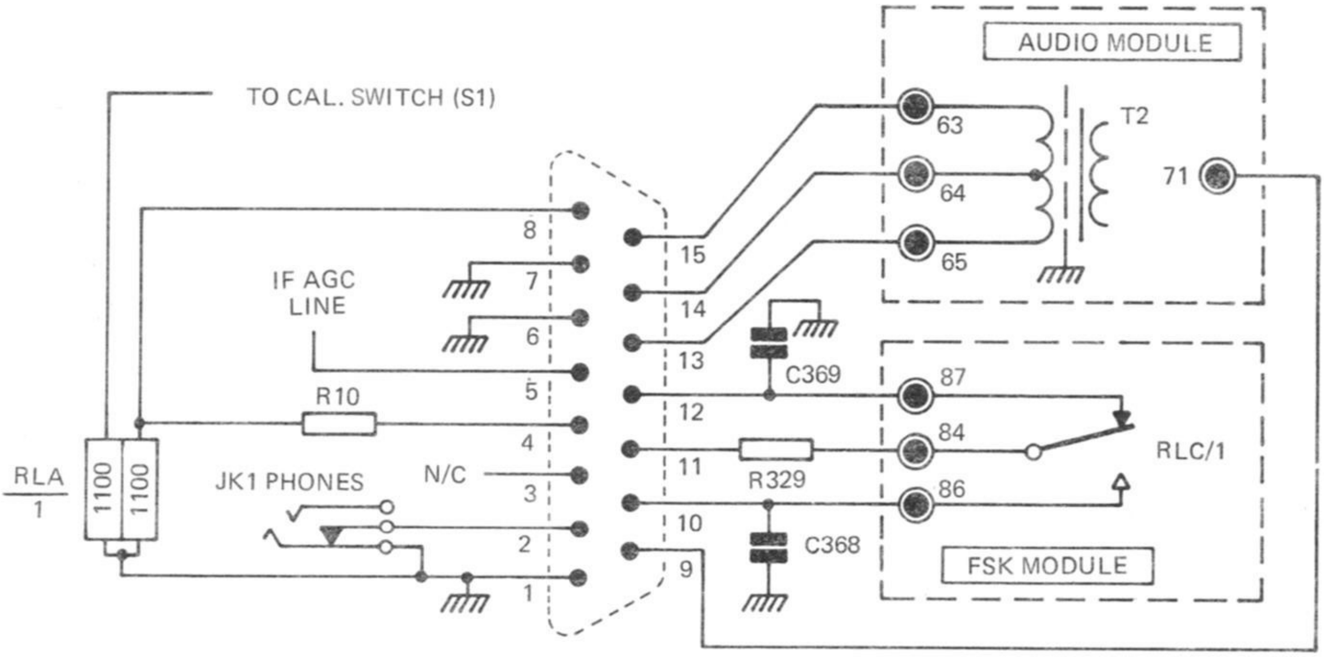


Fig. 4.3 Internal connections to Ancillaries Connector PL/C (viewed on pins)

External Loudspeaker (Fig. 4.4.1)

Connect to SK/C-9 and SK/C-2 (earthy). Rated output power (1 watt at 5% dis.) will be obtained when using an external loudspeaker of 3Ω impedance (e.g. Cat. Nos. 935 and 989). Higher loudspeaker impedances can be used if a reduction in output level is tolerable.

The audio circuit incorporates safeguards to protect the output stage from damage in the event of accidental short-circuiting of the connections to SK/C-9 and SK/C-2. Total shut-down of the output IC will occur in the presence of a short-circuit: **normal operation is restored by interrupting the AC supply for a period of 5-10 seconds.**

The earthy connection (via SK/C-2) returns to earth via an auxilliary contact on the PHONES socket which interrupts the external speaker when the headset is in use.

Line Output (Fig. 4.4.2)

Connect line to SK/C-13 and SK/C-15. Output is matched to 600Ω and provision is made for operation as a balanced source with the centre-tap of the transformer secondary connected to ground (link SK/C-14 to SK/C-7).

The output transformer incorporates an electrostatic screen which is grounded within the receiver.

Muting (Fig. 4.4.3)

High-speed reed relay RLA (in the *AERIAL ATTENUATOR UNIT*) can be used to interrupt the aerial feeder and ground the input to the attenuator when the receiver is used in conjunction with an associated transmitter.

Separate relay control lines are brought out on the Ancillaries Connector to suit external supplies of 12V (SK/C-8) and 24V (SK/C-4). Current drain is of the order 10mA and the relay must be energised to mute: either pole of the supply can be grounded via the common earth connection SK/C-1.

Teleprinter Output (Fig. 4.4.4)

This facility is available only on receivers which carry the optional FSK MODULE LP3058.

Keying of the teleprinter is by means of a high-speed mercury-wetted-contact reed relay (RLC) which has a single-pole changeover action. The contacts are wired to SK/C-10, SK/C-11 and SK/C-12 as shown in Fig. 4.3. A contact protection circuit is incorporated within the receiver but provision for Mark/Space reversal, line current monitoring and line rheostat must be made externally.

Polar Working: External connections should be as shown in Fig. 4.4.4.

Single-current Working: Connect to SK/C-11 and either SK/C-10 or SK/C-12 depending on whether a make or break circuit is required. Either 80V line can be keyed as necessary.

Diversity AGC (Fig. 4.4.5)

See 'IF AGC' on page 66.

INSTALLATION OF DUAL DIVERSITY TERMINAL

Two receivers can be installed with independent aerials to operate as a versatile Dual Diversity Terminal. Interconnections between the Master Receiver and Slave should be as follows:—

IF Output

The IF Output socket on the Master Receiver should be linked to the IF Output socket on the Slave using a short length of coaxial cable terminated with standard BNC bayonet-lock connectors. This arrangement gives equal drive to the detector circuits in both receivers and obviates the need for the more usual technique of interconnecting the audio outputs by use of a combining transformer.

Audio outputs from the Master and Slave will be identical so that either equipment can be used to feed the line and monitoring facilities required. In the case of a Dual Diversity FSK Terminal, only one of the receivers need be equipped with *FSK MODULE LP3058.*

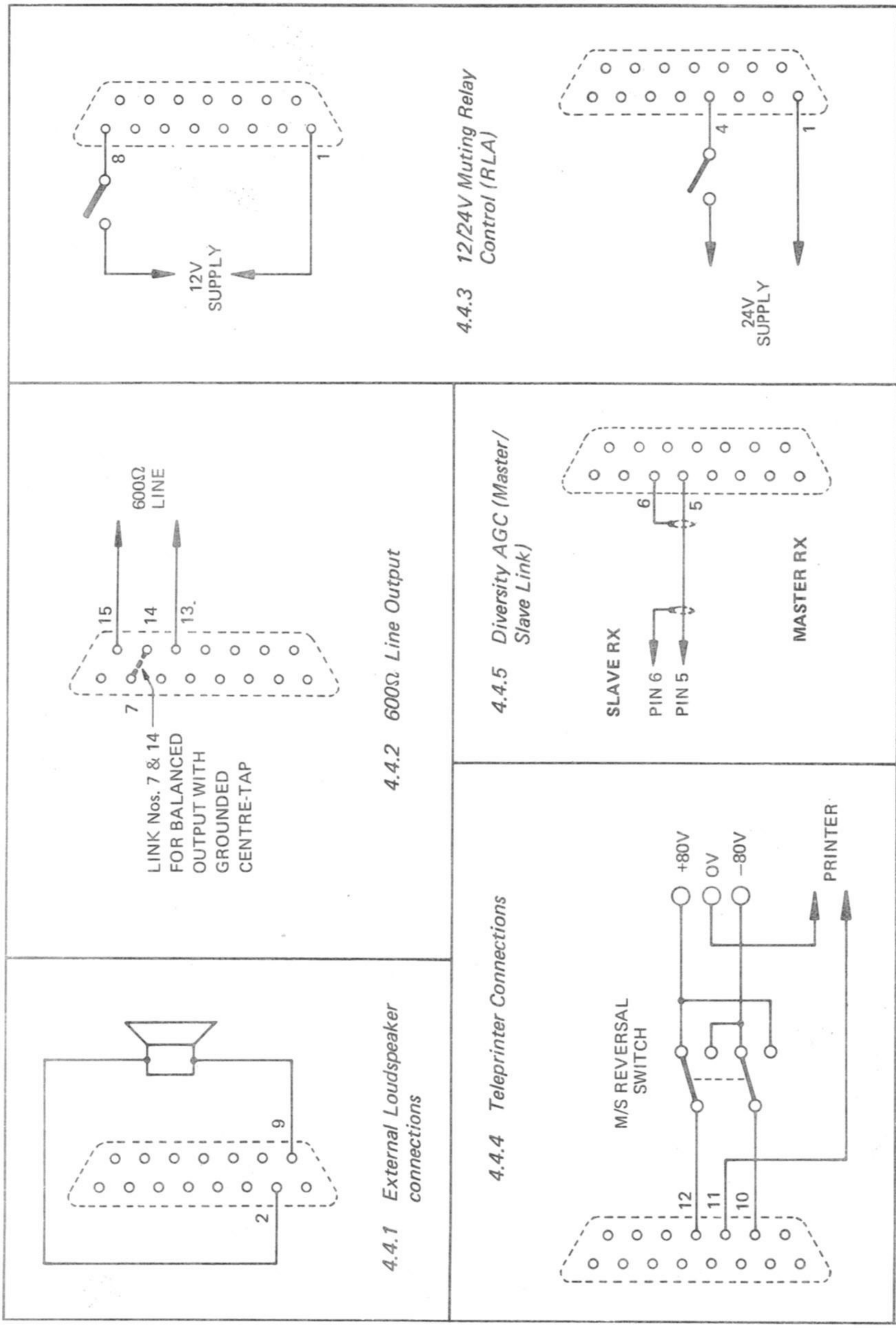


Fig. 4.4 External connections to Ancillaries Connector SK/C (viewed on wiring side)

IF AGC

The IF AGC lines are commoned in the usual manner by interconnecting Pins 5 of the Ancillaries Connectors as shown in Fig. 4.4.5. Screened cable should be used with the braid earthed to the adjacent pin (SK/C-6). The RF AGC lines operate independently of one another.

Common Oscillator Working

Receivers operated as a Dual Diversity Terminal in the range 1.6-30MHz can be inter-connected so that the INCREMENTAL OSCILLATOR UNIT in the Master Receiver governs the incremental frequency of the Slave equipment. This arrangement leads to greater convenience in setting up and simplifies any re-tuning which may be required.

Interconnection for this mode of working necessitates removal of both receivers from their cabinets (or removal of the top dust covers in the case of rack-mounted receivers). Proceed as follows using Fig. 4.5 for guidance.

MASTER RECEIVER

1. Make up a coaxial lead terminated at both ends with miniature free coaxial plugs (B/Lee L1465). A lead length of the order 1.2 metres (47in) will be adequate for two rack-mounted receivers installed one directly above the other.

2. Remove the plastic bung from the cable access hole adjacent to the NORMAL/SYNTH SWITCH located on the back-plate.

3. Feed one end of the cable through the access hole and connect to socket 'O' on the *INCREMENTAL OSCILLATOR UNIT.*

SLAVE RECEIVER

1. Carry out operations 1-3 as for Master Receiver but fit a free socket to one end of the cable to allow mating with the lead from the Master Receiver.

2. Unsolder and remove the link which is located adjacent to socket 'N' on the INCREMENTAL OSCILLATOR UNIT. This interrupts the output feed and prevents interference from the Slave oscillator when the INCREMENTAL TUNING CONTROL is adjusted to align the Tunable IF circuits.

3. Mate Slave line connector with Master Receiver.

NB: The link removed in (2) above must be replaced if the receiver is returned to normal service. The coaxial interconnecting lead can be left in-situ with the plug stowed in the spare socket 'O'.

Refer to Section 5 (Diversity Operation) for further information on this mode of working.

SYNTHESIZED OPERATION ON RANGES 5-10

Applications calling for a high order of stability at frequencies below 1.6MHz can be satisfied by using the receiver in conjunction with an external synthesizer. This should be connected to the socket labelled '1ST HF OSC INPUT' at the rear. The internal oscillator can be disabled by setting the NORMAL/SYNTH SWITCH to 'SYNTH'.

When installing a receiver for this mode of operation, it is necessary to fit a link on the RF Amplifier board within the equipment. The link completes the circuit between the '1ST HF OSC INPUT' socket and the oscillator injection point (gate 2) of the 1st Signal Mixer. Proceed as follows:–

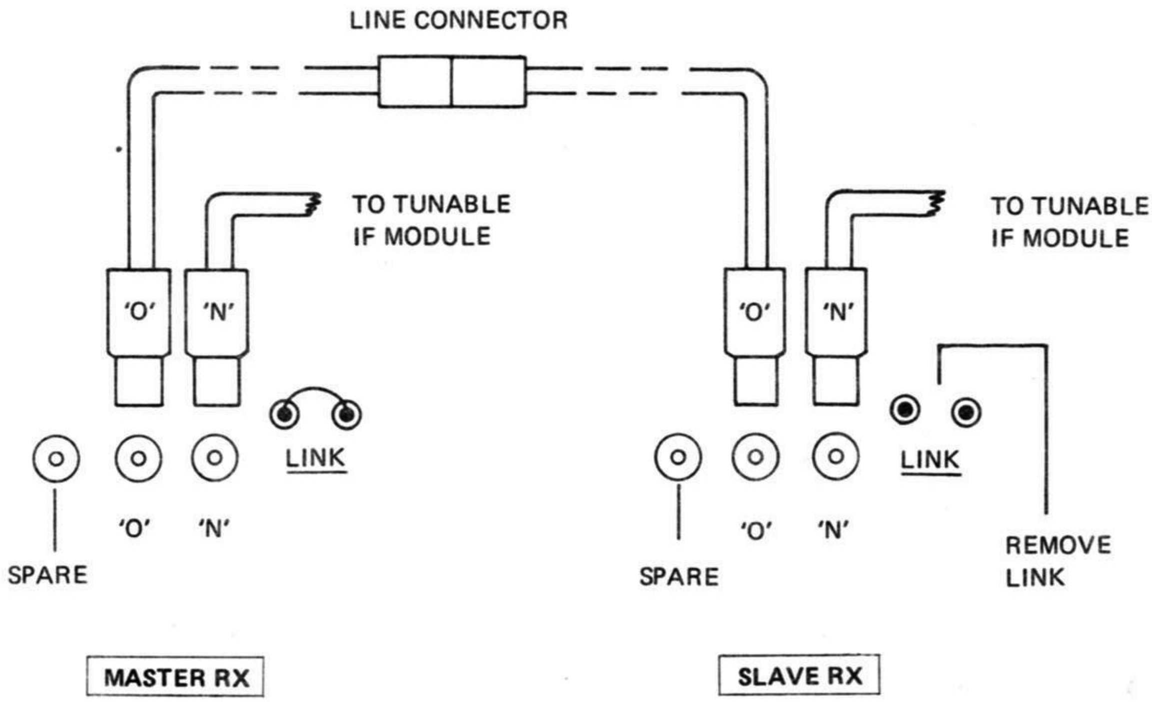


Fig. 4.5 Interconnections for common oscillator working

Synthesized Operation (contd.)

1. Remove receiver from cabinet (or take off top dust cover in the case of a rack-mounted equipment).
2. Remove rear cover screen from RF Assembly.
3. Locate 'synth link' connections on RF Amplifier Board (shown dotted on PCB layout drawing in Appendix 'E').
4. Solder link in position.
5. Replace covers etc.

NB: Link should be removed to limit oscillator radiation if receiver is returned to normal service.

Drive level from the synthesizer should be of the order 1V.

Refer to Section 5 (Synth Working) for further information including calculation of synthesizer frequency.

Section 5

OPERATION

INTRODUCTION

IMPORTANT: The attention of all personnel is drawn to the introductory paragraphs below. Their content should be noted before consulting the remainder of this Section.

SUPPLY SWITCH

This control provides a 'standby' switching function only. It does not interrupt the AC supply which will normally be controlled externally in a manner suited to the particular installation arrangements, e.g. a switched wall socket.

NORMAL/SYNTH SWITCH

This control is located at the rear of the receiver and must always be set to the 'NORMAL' position except when using the receiver in conjunction with an external synthesizer (see page 79). The Main-Tune Oscillator is shut down with the switch set to 'SYNTH' thus completely disabling the receiver unless the synthesizer drive is present.

IF GAIN CONTROL

This control is taken out of circuit when the AGC SWITCH is set to 'ON'.

EXTERNAL LOUDSPEAKER

The integrated circuit which drives the external loudspeaker has an in-built protection facility as a safeguard against damage to the IC in the event of accidental short-circuiting of the loudspeaker leads wired to the Ancillaries Connector at the rear. A short-circuit will cause the IC to shutdown and audio output will cease until the short has been removed and the recovery procedure has been effected. This merely requires that the *AC supply* to the receiver is interrupted for a period of 5 to 10 seconds. See SUPPLY SWITCH above.

CONTROL ABNORMALITIES ON RANGES 5-10

Certain controls are rendered inoperative or function in a slightly different manner on some or all ranges covering the low frequency band 10kHz to 1650kHz. These abnormalities are summarised below:-

HIGH STAB/CONT TUNE SWITCH & INCREMENTAL TUNING CONTROL: These controls are functional only when the receiver operates as a triple-conversion superhet, i.e. when using Ranges 1-4.

The digital frequency display associated with the INCREMENTAL TUNING CONTROL is extinguished on Ranges 5-10 and this serves as a reminder that neither of the controls above is available for use on these ranges.

CALIBRATOR SWITCH: Only one scale-check marker is available on Range 5-10 (at 1MHz on Range 5).

USB/LSB SWITCH: The panel legend associated with this control is correct for all ranges except Ranges 5, 6 & 8. On these ranges (which employ double-conversion), select 'USB' position to receive lower sideband transmissions, 'LSB' for upper sideband reception.

SELECTIVITY SWITCH: The bandwidths marked on the panel legend are limited on Ranges 9 & 10 by the selectivity of the front-end circuits. On these ranges, operators should use only the '400Hz' and possibly '1.3kHz' positions. If use is made of the latter position, the setting of the AF GAIN should be reduced to limit the level of internally generated whistles which result from the low frequencies involved.

CONTROL FUNCTIONS AND BASIC OPERATING PROCEDURES

The paragraphs below describe in detail the functions of the various receiver controls and should be used for reference when following the tuning sequences given later in this Section. The actual legend marked on the panel for each control is shown in italics.

RANGE SWITCH *(RANGE)*

This is a heavy-duty ten-position selector which performs the following operations to select the required tuning range: continuous rotation is prevented by mechanical stops adjacent to Ranges 1 and 10.

1. Rotates Turret Assembly to select the correct inductors for the range in use.
2. Selects the appropriate intermediate frequency configuration as follows:–

   Ranges 1-4 : : Triple-conversion (with incremental facility).
   Ranges 5, 6 & 8 : : Double-conversion.
   Ranges 7, 9 & 10 : : Single-conversion.
3. Disables the HIGH STAB/CONT TUNE SWITCH when set to Ranges 5-10.
4. Activates the digital counter and INCREMENTAL frequency display when set to Ranges 1-4.
5. Raises or lowers the light source associated with the optical projection system to display the correct MAIN TUNE frequency scale.
6. Changes over the illuminated 'kHz' and 'MHz' scale indicators (see Fig. 5.1) to show which unit is applicable to the displayed MAIN TUNE frequency scale.

   Ranges 1-4 : : 'MHz' indicator illuminated.
   Ranges 5-10 : : 'kHz' indicator illuminated.

TUNING CONTROLS

The receiver is equipped with two separate tuning controls as follows:–

MAIN TUNING CONTROL *(MAIN TUNE)*

INCREMENTAL TUNING CONTROL *(INCREMENTAL)*

Both controls operate geared 100:1 reduction drives and are flywheel-loaded to permit rapid change of frequency setting.

MAIN TUNING CONTROL *(MAIN TUNE)*

This control tunes the front-end signal circuits, the Main-Tune Oscillator and the harmonic selector circuits associated with the drift-cancelling loop which is activated for high-stability working.

The tuning drive has a secondary output spindle which drives a calibration disk that forms part of the optical projection system used to display the MAIN TUNE frequency setting. The display appears to the left of the 'kHz'/'MHz' scale indicators and is so arranged that only the *tune* frequency and those frequencies immediately adjacent are visible. Calibration marks etc. are repeated at such intervals that there can be no confusion in reading the MAIN TUNE frequency at any setting of the control (see Table 5.1). Tuning rate varies according to the range selected, typical figures at 200kHz and 20MHz being 3kHz and 125kHz per rev. respectively.

Use of the Main Tuning Control on Ranges 5-10

The INCREMENTAL control is inoperative of Ranges 5-10 and in consequence all tuning adjustments are performed by means of the MAIN TUNING CONTROL alone. The HIGH STAB/CONT TUNE SWITCH is also inoperative on these ranges and the receiver will function in the **continuous-tune mode** *irrespective of the switch setting. It is recommended however, that only the 'CONT TUNE' position is used for Ranges 5-10, since this avoids the possibility of confusion when changing rapidly to a frequency on Ranges 1-4.*

See also PEAK-RF CONTROL (page 74)

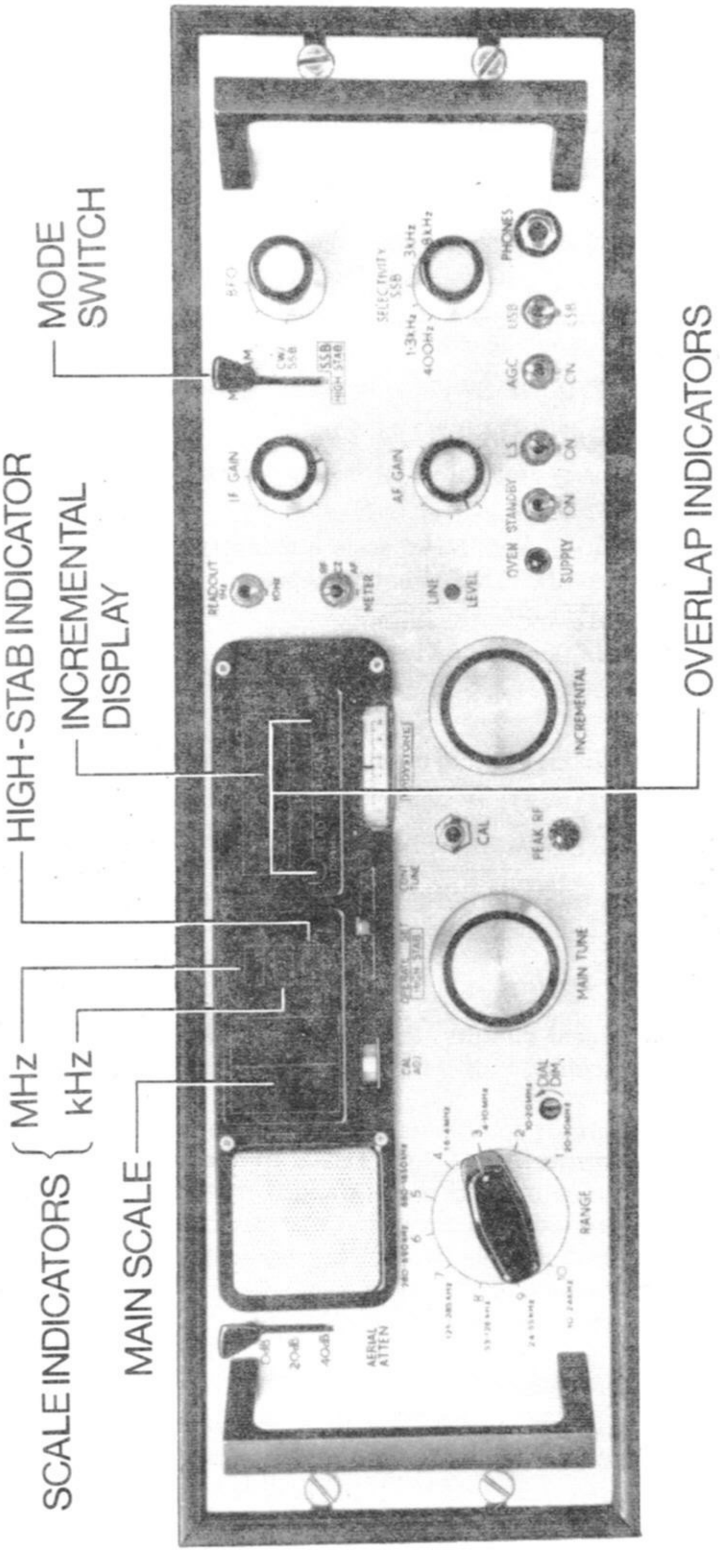


Fig. 5.1 Front view of receiver showing panel controls

TABLE 5.1 MAIN SCALE CALIBRATION MARKING

RANGE	COVERAGE	CALIBRATION INTERVAL	FREQUENCY INTERVAL
1	19.8 – 30.0MHz	100kHz	100kHz
2	9.8 – 20.1MHz	100kHz	100kHz
3	4.0 – 10.0MHz	50kHz	100kHz
4	1.6 – 4.1MHz	50kHz	50kHz
5	680 – 1650kHz	10kHz	20kHz
6	280 – 690kHz	5kHz	10kHz
7	125 – 285kHz	1kHz	5kHz
8	53 – 126kHz	1kHz	1kHz
9	24 – 55kHz	0.5kHz	1kHz
10	10 – 24.5kHz	0.5kHz	0.5kHz

Use of the Main Tuning Control on Ranges 1-4

The manner in which the MAIN TUNING CONTROL is used on Ranges 1-4 is governed by the setting of the HIGH STAB/CONT TUNE SWITCH (S5) as described below.

S5 at 'CONT TUNE': The MAIN TUNING CONTROL provides continuous tuning over the selected range in the manner described for Ranges 5-10 on the previous page. The INCREMENTAL TUNING CONTROL will also be functional and can be used in the role of 'fine frequency adjuster' if so desired. If use of the INCREMENTAL control is not required, it should be set to 'zero' to preserve the accuracy of the MAIN TUNE frequency scale (see INCREMENTAL TUNING CONTROL below).

S5 at 'HIGH STAB' settings: The drift-cancelling loop is activated and receiver is tuned by combined use of both tuning controls. The INCREMENTAL control provides continuous tuning over any 100kHz sub-band selected by the MAIN TUNING CONTROL. The procedure to be adopted in setting the MAIN TUNING CONTROL to the nearest 100kHz setting is described under 'Use of the HIGH STAB/CONT TUNE SWITCH in high-stability working' (page 73).

See also PEAK-RF CONTROL (page 74).

INCREMENTAL TUNING CONTROL *(INCREMENTAL)*

This control is functional on Ranges 1-4 only. It tunes the Incremental Oscillator and Tunable IF circuits to provide a means of interpolating between adjacent 0.1MHz calibration points on the MAIN TUNE frequency scale when operating the receiver in its high-stability mode. Coverage is slightly in excess of 100kHz to provide overlaps at the HF and LF ends of the incremental range.

A secondary function of the INCREMENTAL TUNING CONTROL is that it can be used as a 'fine frequency adjuster' when using the receiver in the continuous-tune mode on Ranges 1-4. In this application, the reduced tuning rate will be found extremely useful in resolving single sideband transmissions especially on Ranges 1 and 2.

NB: The INCREMENTAL TUNING CONTROL should always be set to 'zero' when the MAIN TUNING CONTROL is used alone for general search tuning. Non-compliance with this rule will cause the MAIN TUNE frequency scale to be in error by the number of kHz indicated on the INCREMENTAL frequency display.

See also PEAK-RF CONTROL (page 74).

Incremental Frequency Display

The setting of the INCREMENTAL TUNING CONTROL is indicated by an LED numeric display derived from a frequency counter driven by the Incremental Oscillator. Frequency can be read to within 1Hz or 10Hz depending on the setting of the 1Hz/10Hz READOUT SWITCH (S14). The final digit is extinguished with S14 set to the '10Hz' position (see page 73).

Incremental Frequency Display *(continued)*

The LED numeric display has only two figures ahead of the decimal point and is therefore limited to a maximum display frequency of 99.999kHz. An incremental setting of '100kHz' cannot be displayed directly and will produce exactly the same display as the 'zero' incremental setting, i.e. 00.000kHz. Differentiation between the 'zero' and '100kHz' displays is provided by inculding an LED indicator which will flash when the display corresponds to an incremental setting of '100kHz'.

The indicator will continue to flash if the INCREMENTAL TUNING CONTROL is tuned into the HF overlap region which extends some 4kHz above the '100kHz' setting. Flashing of the indicator precludes the possibility of ambiguity in reading the actual tune frequency since settings of '2kHz' and '102kHz', for example, would produce an identical display, i.e. 02.000kHz.

A similar ambiguity will occur when the INCREMENTAL TUNING CONTROL is tuned into the LF overlap region which extends some 4kHz *below* the 'zero' setting; e.g. an incremental setting 1kHz below 'zero' would produce exactly the same readout as when set 1kHz below '100kHz', i.e. 99.000kHz. This ambiguity is resolved by including a second LED indicator which will flash at all settings lower than 'zero'

The two indicators are shown in Fig. 5.1 and carry the following legends:–

READ MAIN SCALE +100kHz : : Flashes at '100kHz' and settings above '100kHz'.
READ MAIN SCALE –100kHz : : Flashes at settings below '0kHz'.

The flashing rate is governed by the counter timebase and therefore increases when the 1Hz/10Hz READOUT SWITCH is set to '10Hz'. The significance of the legends is explained in the paragraphs which follow (see Examples 3 and 5).

READING MAIN TUNE AND INCREMENTAL FREQUENCIES

Ranges 5-10
The tune frequency is read directly from the MAIN TUNE frequency scale and will be in 'kHz'. The The INCREMENTAL frequency display (including LED indicators) is extinguished.

Ranges 1-4 (S5 at 'CONT TUNE')
The tune frequency is read directly from the MAIN TUNE frequency scale and will be in 'MHz'. The INCREMENTAL TUNING CONTROL should be set to 'zero' to preserve the accuracy of the MAIN TUNE calibration.

Ranges 1-4 (S5 at 'HIGH STAB OPERATE')*
The tune frequency is obtained by combining the reading on the MAIN TUNE scale with that from the INCREMENTAL frequency display. See Examples 1-5 below.

Example 1
Reading from MAIN TUNE frequency scale 14.2MHz
Reading from INCREMENTAL frequency display 50.000kHz
The MAIN TUNE reading is to the nearest 100kHz, i.e. 14,200kHz. The INCREMENTAL display shows that the receiver is actually tuned 50kHz higher so the real tune frequency is therefore 14,250kHz (or 14.25MHz).

Example 2
Reading from MAIN TUNE frequency scale 14.2MHz
Reading from INCREMENTAL frequency display 02.00kHz
It is assumed that neither of the LED indicators is flashing so the real tune frequency is therefore 14,202kHz (or 14.202MHz).

Example 3
As Example 2 but with +100kHz LED indicator flashing. This shows that the actual incremental setting is really '102kHz' so the tune frequency in this case will be 14,302kHz (or 14.302MHz), i.e. 102kHz higher than the indicated MAIN TUNE frequency. The legend 'READ MAIN SCALE +100kHz' is interpreted as meaning 'ADD 100kHz TO THE INDICATED MAIN SCALE READING'.

(*) 'HIGH STAB SET' position is used for initial adjustment only.

Example 4

Reading from MAIN TUNE frequency scale	*14.2MHz*
Reading from INCREMENTAL frequency display	*98.000kHz*

It is assumed that neither of the LED indicators is flashing so the real tune frequency is therefore 14,298kHz (or 14.298MHz).

Example 5

As Example 4 but with –100kHz LED indicator flashing. This shows that the actual incremental setting is really 2kHz lower than 'zero' so the tune frequency in this case will be 14,198kHz (or 14.198MHz). The legend 'READ MAIN SCALE –100kHz' is interpreted as meaning 'DEDUCT 100kHz FROM THE INDICATED MAIN SCALE READING'.

1Hz/10Hz READOUT SWITCH *(READOUT : 1Hz – 10Hz)*

Readout of the incremental setting to an accuracy of 1Hz necessitates a count time of 1 second and results in too great an interval between successive updates of the counter readout for the display to be useful during initial tuning adjustments. The 1Hz/10Hz READOUT SWITCH is provided so that operators can select readout to the nearest 10Hz when making such adjustments. This reduces the count time to 100ms which is more compatible with the tuning rate obtained when using the INCREMENTAL TUNING CONTROL. It should be noted that the flashing rate of the two LED indicators is affected when the READOUT SWITCH is moved from one position to the other. The final display digit is extinguished when set to '10Hz'.

HIGH STABILITY/CONTINUOUS TUNE SWITCH

('CONT TUNE' – 'HIGH STAB SET' – 'HIGH STAB OPERATE')

This control is functional on Ranges 1-4 only. Its basic functions are as follows:-

'CONT TUNE'	Drift-cancelling loop is disabled to allow receiver to be tuned continuously over the selected range by use of the MAIN TUNING CONTROL alone. INCREMENTAL TUNING CONTROL can be used as 'fine frequency adjuster'.
'HIGH STAB SET'	Drift-cancelling loop activated. This position is used only for initial adjustment of the MAIN TUNING CONTROL when changing over to high-stability working.
'HIGH STAB OPERATE'	AFC system brought into circuit to maintain frequency of Main-Tune Oscillator after this has been adjusted with switch at 'HIGH STAB SET'.

Use of the HIGH STAB/CONT TUNE SWITCH in high-stability working

The following procedure should be adopted when it is required to operate the receiver in the high-stability mode on Ranges 1-4

NB1 The INCREMENTAL TUNING CONTROL can be at any setting for operations Nos 1-4.

NB2 It is recommended that the accuracy of the MAIN TUNE frequency scale is first checked by use of the 1MHz Calibrator if the wanted frequency lies on Ranges 1 or 2. This step is not usually necessary on Ranges 3 or 4 (see page 76).

1. *Select 'HIGH STAB SET' position.*
2. *Adjust MAIN TUNING CONTROL until MAIN TUNE frequency scale is set to the nearest calibration mark (100kHz point) on the low frequency side of the wanted signal frequency; e.g. for a wanted frequency of 10.620MHz, set scale to 10.6MHz.*

   The HIGH STAB INDICATOR (see Fig. 5.1) should now be illuminated. If not, alter setting of MAIN TUNING CONTROL by small increments until the illuminated legend 'HIGH STAB' appears in the appropriate window.
3. *Note the arc of rotation over which illumination of the legend is maintained and then set MAIN TUNING CONTROL to the centre of this arc.*

4. *Maintain setting of MAIN TUNING CONTROL obtained in (3) above and lock the frequency of the Main-Tune Oscillator by moving the HIGH STAB/CONT TUNE SWITCH to 'HIGH STAB OPERATE'.*
5. *All subsequent tuning is carried out by means of the INCREMENTAL TUNING CONTROL which, continuing the example in (2) above, should be set to 20.000kHz to obtain the wanted frequency of 10.620MHz.*

Retaining a particular signal when changing from 'CONT TUNE' to 'HIGH STAB'

Either of the following procedures can be adopted as appropriate when it is required to change to high-stability working while still retaining the particular signal to which the receiver is tuned.

1. **With INCREMENTAL TUNING CONTROL set to 'zero'**
   (a) Estimate the approximate tune frequency from the MAIN TUNE calibration.
   (b) Set MAIN TUNING CONTROL to 100kHz point at low frequency end of 100kHz segment in which required frequency lies.
   (c) Change over to high-stability working as previously described, setting INCREMENTAL TUNING CONTROL to 'kHz' figure estimated in (a) above.
2. **With INCREMENTAL TUNING CONTROL at random setting**
   (a) Remain at 'CONT TUNE' and adjust MAIN TUNING CONTROL and INCREMENTAL TUNING CONTROL simultaneously in small steps such that the required signal is held in tune and eventually occurs with the MAIN TUNING CONTROL set to the 100kHz point at the low frequency end of the 100kHz segment in which the wanted frequency lies.
   (b) Change over to high-stability working as previously described.
   (c) Re-adjust INCREMENTAL TUNING CONTROL slightly, if necessary, to accurately tune to wanted signal.

PEAK-RF CONTROL *(PEAK RF)*

This control takes the place of the more usual 'aerial trimmer' found on other communication receivers. It differs from this control in that it tunes *all* the signal frequency circuits rather than just the aerial circuit alone.

The PEAK-RF CONTROL must always be adjusted for maximum signal strength after tuning adjustments have been made by use of the RANGE, MAIN TUNE or INCREMENTAL controls. This is especially important when using the INCREMENTAL TUNING CONTROL on Ranges 1-4 because this control introduces inevitable misalignment of the front-end signal frequency circuits. On Ranges 5-10, use of the PEAK-RF CONTROL is analagous to the 'aerial trimmer' mentioned previously.

AERIAL ATTENUATOR *(AERIAL ATTEN : 0dB – 20dB – 40dB)*

The AERIAL ATTENUATOR is provided in lieu of a conventional RF gain control. It will usually be set to '0dB' position except when experiencing cross modulation or blocking effects in the presence of strong adjacent channel signal(s). In this event, select '20dB' or '40dB' position as appropriate to the interference conditions prevailing.

MODE SWITCH *(MODE : AM – CW/SSB – SSB HIGH STAB)*

This control selects audio output from the appropriate detector to suit the transmission mode of the received signal : it also performs a number of auxiliary functions which are summarised below:-

'AM'	:	Audio output taken from AM Detector. Carrier insertion and BFO disabled. FSK (if fitted) inoperative.
'CW/SSB' (FSK)	:	Audio output taken from CW/SSB Detector using tunable BFO. FSK Module (if fitted) operative.
'SSB HIGH STAB'	:	Audio output taken from CW/SSB Detector using carrier insertion signal derived from crystal standard in Master Oscillator Unit. FSK (if fitted) inoperative. AGC time constant lengthened to 10 secs to provide a 'hang' characteristic.

AM Reception

No special procedures are applicable to this mode of reception. The excellent single-sideband filters fitted in this receiver allow AM signals to be converted very satisfactorily into SSB to give improved reception in conditions of strong adjacent channel interference.

CW Reception

Telegraphy signals should normally be received with the MODE SWITCH set to 'CW/SSB' using the tunable beat oscillator. Such signals can also be received at 'SSB HIGH STAB' using the Master Oscillator as a fixed frequency beat generator. In this event, either of the two SSB filters can be used and operators should note that the frequency display will be in error by the offset used to obtain the desired beat frequency.

SSB Reception

Single-sideband signals can be received with the MODE SWITCH at either 'CW/SSB' or 'SSB HIGH STAB'. The latter position should be used on all occasions except when the hang type AGC characteristic is inconvenient. If this should prove to be the case, select 'CW/SSB' and set the BFO CONTROL to 'mid-setting' to obtain the required carrier insertion frequency.

FSK Reception

The 'CW/SSB' setting of the MODE SWITCH must be selected to activate the FSK Module when this is fitted to the receiver.

SELECTIVITY SWITCH (SELECTIVITY : 400Hz – 1.3kHz – SSB – 3kHz – 8kHz)

All selectivity settings are derived from a block L/C filter with the exception of that marked 'SSB'. Selection of this position gives the operator a choice of upper or lower sideband reception by operation of the separate USB/LSB SWITCH which introduces an appropriate crystal filter in each position.

The SELECTIVITY SWITCH should always be set to suit the transmission mode of the received signal. Recommended bandwidths for each mode are as follows:–

CW : : 400Hz and 1.3kHz.
FSK : : 1.3kHz (400Hz for known narrow-shift signals only)
AM : : 8kHz (3kHz under interference conditions)

NB: Maximum bandwidth is limited by front-end selectivity on Ranges 9 & 10. *See note at foot of page 68.*

USB/LSB SWITCH *(USB – LSB)*

The SELECTIVITY SWITCH must be set to 'SSB' for the USB/LSB SWITCH to function.

This control actuates a relay switching circuit to select one or other of the two single-sideband filters which provide a 3dB bandwidth of 2.4kHz. Switch to 'USB' for upper sideband reception, 'LSB' for lower sideband reception except when using Ranges 5, 6 or 8. On these ranges the receiver functions with double-conversion and the 'USB' position provides lower sideband reception and the 'LSB' position is used for upper side band signals.

BFO CONTROL *(BFO)*

The MODE SWITCH must be set to 'CW/SSB' for the BFO CONTROL to function.

The BFO CONTROL provides adjustment of pitch for CW reception and is set to mid-travel (100kHz) if the 'CW/SSB' position is utilised for receiving single sideband signals. A tuning range of ± 5kHz is provided and the control has a slow-motion reduction-drive for ease of adjustment.

IF GAIN CONTROL *(IF GAIN)*

The AGC SWITCH must be set to 'off' for the IF GAIN CONTROL to function.

The IF GAIN CONTROL is utilised to adjust the amplification in the 100kHz IF strip when not using AGC. The setting of this control should be maintained below the level at which detector overload occurs.

AF GAIN CONTROL *(AF GAIN)*

Provides continuous adjustment of the audio level to the internal loudspeaker, external loudspeaker and telephone headset.

LINE LEVEL CONTROL *(LINE LEVEL)*

Pre-set control with screwdriver adjustment through aperture in front panel to allow independent setting of the audio level at the 600Ω line output. The output can be monitored with the METER SWITCH set to 'AF'.

METER SWITCH *(METER : RF – CZ – AF)*

The function of the panel meter in each position is as follows:–

'RF' : : Meter reads carrier-level, the scale being calibrated in arbitrary steps 0-10 for relative measurement of signal strength. Scaling is essentially linear with AGC 'OFF', logarithmic with AGC 'ON'.

'CZ' : : Meter serves as a centre-zero monitor to assist accurate tuning of FSK signals on receivers equipped with FSK Module LP3058. This position is non-functional on receivers not fitted with the FSK Module (meter will rest permanently at centre-zero).

'AF' : : Meter serves as line output level indicator and is calibrated at 10mW for 600Ω line loading.

AGC SWITCH *(AGC : ON)*

Permits selection of manual or automatic gain control in the IF part of the receiver circuit. The manual IF GAIN CONTROL is functional only when the switch is set to 'OFF' (up position).

AGC time constants are fixed except when the MODE SWITCH is set to 'SSB HIGH STAB'. At this setting, a long decay is provided to give a 'hang' characteristic suited to single-sideband reception.

The RF AGC is continuously connected but is operative only on very strong signals.

CALIBRATOR SWITCH *(CAL)*

Press to activate internal Crystal Calibrator for scale checking on Ranges 1-5. Markers are available at all 1MHz points: aerial circuit is interrupted to limit interference from outside signals when performing scale checks (see below).

CALIBRATION ADJUSTER *(CAL ADJ)*

Mechanical control which allows one of the two cursor lines to be shifted laterally when performing a scale check on Ranges 1-5. Variable cursor should be set coincident with fixed cursor line for operation on Ranges 6-10 (calibration accuracy is of the order 1kHz on these ranges and provision is not therefore made for scale checking).

Procedure for scale checking on Ranges 1-5

NB: This procedure, though applicable to Ranges 1-5, will normally be required only on Ranges 1 and 2 where there is a possibility of confusion in identifying a particular 100kHz calibration mark.

1. *Select 'SSB HIGH STAB' and '3kHz' selectivity position.*
2. *Set MAIN TUNE scale to 'MHz' calibration point nearest to required working frequency. On Ranges 1-4 only, check that INCREMENTAL TUNING CONTROL is set to 'zero'.*
3. *Press CALIBRATOR SWITCH and adjust MAIN TUNING CONTROL as necessary to locate marker signal. Tune to zero-beat.*
4. *Release CALIBRATOR SWITCH and slide CALIBRATION ADJUSTER to set variable cursor coincident with MHz mark on MAIN TUNE scale.*
5. *Tune to required working frequency.*

SPEAKER SWITCH *(LS : ON)*

Set to 'ON' to activate miniature panel loudspeaker. This speaker continues to operate when a telephone headset is connected but the external loudspeaker is muted by an auxiliary contact on the headset socket.

DIAL DIMMER *(DIAL DIM)*

Controls brilliancy of MAIN TUNE frequency scale and allows this to be set to suit ambient lighting conditions. Adjust with small screwdriver.

SUPPLY SWITCH *(STANDBY : ON)*

This control performs a 'standby' switching function only: it does not interrupt the AC supply to the receiver, but must be set to the 'ON' position for the receiver to operate.

In the 'up' position (STANDBY), the 12V DC supply is removed from the 100kHz IF AMPLIFIER MODULE to effectively mute the receiver. Other internal supplies are also interrupted including those to the INCREMENTAL frequency display, the MAIN TUNE projection lamp and the lamps behind the 'kHz'. 'MHz' and 'HIGH STAB' legends. The miniature light emitting diode adjacent to the SUPPLY SWITCH will continue to glow to show the presence of the AC supply when the switch is set in the 'up' position.

FSK ADJUSTMENT *(RV14)*

This control forms part of FSK Module LP3058 and is therefore absent when this unit is not fitted. Access for adjustment is via an aperture in the back-plate just below the HIGH-Z input terminals (see Fig. 4.2 on page 62). The control is pre-set and is adjustable by means of a small screwdriver: adjust for correct operation of teleprinter relay.

NORMAL/SYNTH SWITCH *(NORMAL – SYNTH)*

The NORMAL/SYNTH SWITCH is located on the back-plate and must be set to 'NORMAL' except when using the receiver in conjunction with an external synthesizer.
Refer to 'SYNTHESIZED OPERATION ON RANGES 5-10' (page 79).

METER-ZERO CONTROLS *(RV9, 10, 11 & 12)*

See page 79.

TUNING INSTRUCTIONS

Operation in continuous-tune mode on any range

1. Apply power to receiver from external AC supply or switch on DC/AC Converter if operating from 12/24 DC supply.
2. Put SUPPLY SWITCH to 'ON' to complete DC supply circuits within receiver.
3. Switch on the panel loudspeaker, plug headset into PHONES socket or use the external loudspeaker if fitted.
4. Set the following controls as indicated:–

AERIAL ATTENUATOR	: :	'0dB'
METER SWITCH	: :	'RF'
HIGH STAB/CONT TUNE	: :	'CONT TUNE'
CALIBRATION ADJUSTER	: :	Normal position
INCREMENTAL TUNING	: :	'Zero' (Ranges 1-4 only)
DIAL DIMMER	: :	As required
PEAK-RF CONTROL	: :	For maximum signal strength or noise
1Hz/10Hz READOUT SWITCH	: :	'10Hz' (non-functional on Ranges 5-10)

5. Select desired signal mode and appropriate selectivity (pages 74 and 75).
6. Set BFO CONTROL and/or USB/LSB SWITCH as required (page 75).
7. Adjust IF GAIN and AF GAIN for suitable output with AGC SWITCH to 'OFF' if use of the IF GAIN is required, or to 'ON' if manual control is not needed (pages 75 and 76).
8. Select required range and tune to wanted frequency with MAIN TUNING CONTROL (pages 69, 71, 72 and 73 – also page 76 for scale checking procedure if this is required).
9. Check that PEAK-RF CONTROL is set for maximum signal (page 74) and then re-adjust IF GAIN and/or AF GAIN as necessary.
10. If using Ranges 1-4, carry out fine tuning on INCREMENTAL TUNING CONTROL, remembering that re-adjustment of PEAK-RF CONTROL will be required for major tuning excursions.

Operation in high-stability mode on Ranges 1-4

1. Carry out operations 1-7 as for continuous-tune mode (see above).
2. Select required range and, if required frequency lies on Ranges 1 or 2, carry out scale-check procedure (page 76).
3. Operate HIGH STAB/CONT TUNE SWITCH and tune to required frequency in manner described on page 73 (Use of the HIGH STAB/CONT TUNE SWITCH in high-stability working).
4. Check that PEAK-RF CONTROL is set for maximum signal (page 74) and then re-adjust IF GAIN and/or AF GAIN as necessary.
5. To revert to continuous-tune mode, set HIGH STAB/CONT TUNE SWITCH to 'CONT TUNE' and INCREMENTAL to 'zero'.
6. For continued high-stability working in another 100kHz segment, set HIGH STAB/CONT TUNE SWITCH to 'HIGH STAB SET' and re-tune for illumination of the HIGH STAB INDICATOR in the normal manner.

Diversity Operation

Two receivers running in diversity and wired as per the instructions given on page 64 should be operated in the manner described below.

NB: It should be borne in mind that commoning the IF AGC lines of the two receivers causes the individual carrier-level meters to show identical readings at all times. It is therefore necessary to disable one receiver while the other is being tuned, this being achieved by moving the SUPPLY SWITCH to the up position ('standby'). Both meters will continue to operate with identical readings as before, but will now be actuated only by the receiver which has not been disabled.

Operation on Ranges 5-10: The two receivers should be tuned individually to the required working frequency, disabling the Slave Receiver while tuning the Master Receiver and vice-versa. All functional controls should be adjusted to similar settings to suit the transmission mode and prevailing conditions.

Operation on Ranges 1-4: Both receivers should be operated in the high-stability mode, preferably with common oscillator control (see page 66).

In this mode of operation, the adjustment procedure is similar to that for Ranges 5-10 except that only the receiver allocated as Master will control the exact tune frequency. It should be noted however, that the INCREMENTAL TUNING CONTROL on the Slave Receiver must be set to the same reading as that of the Master Receiver in order that the Tunable IF circuits are correctly aligned at the required frequency.

If the receivers are operated without common oscillator control, they should be tuned separately in the same manner as for Ranges 5-10, except that tuning will be by use of the two incremental controls after first setting up for high-stability working.

Synthesized working on Ranges 5-10

A receiver installed for this type of operation should be tuned in the normal manner except that the NORMAL/SYNTH SWITCH at the rear should be set to 'SYNTH'. Installation instructions for synthesized working appear on page 66.

The correct 'oscillator' injection frequency required from the synthesizer should be calculated as follows:—

Ranges 5, 6 & 8 : : : Signal frequency + 250kHz

Ranges 7, 9 & 10 : : Signal frequency + 100kHz

FSK Operation

Receivers equipped with internal FSK Module LP3058 provide direct keying connection for operating a teleprinter. Normal tuning procedures apply with the addition of the following extra operations.

1. MODE SWITCH must be set to 'CW/SSB' position to complete 12V supply to FSK Module.
2. METER SWITCH should be set to 'CZ' so that meter functions as centre-zero tuning monitor.
3. FSK ADJUSTMENT (Relay Bias Control) must be set for correct operation of teleprinter relay (accessible through aperture at rear of set (see Fig. 4.2 on page 62).
4. SELECTIVITY SWITCH should normally be set to '1.3kHz' position, though '400Hz' can be used when taking signal with narrow shift.
5. BFO CONTROL setting does not affect teleprinter operation because keying signal is derived directly from 100kHz IF signal and not from audio output.

Adjustment of pre-set Meter-Zero controls

Four pre-set controls are provided for adjustment of the metering circuits. They are located beneath the cover fitted on the right-hand side-plate of the receiver: their functions are as follows:—

RV9	: :	FSK CZ SET	RV11	: :	RF ZERO SET
RV10	: :	AF ZERO SET	RV12	: :	AF CALIB ADJ.

Adjustment will be required at infrequent intervals only and should be carried out as follows:—

1. Remove cover and identify each control by reference to the legend printed on the cover.
2. Set METER SWITCH to 'RF', AGC SWITCH to 'OFF' and IF GAIN to minimum.
3. Adjust RV11 to set meter needle coincident with 'O' on carrier-level scale.
4. Change METER SWITCH to 'CZ'.
5. Adjust RV9 so that meter needle lies on mid-scale marking.
6. Change METER SWITCH to 'AF' and set LINE LEVEL to minimum.
7. Adjust RV10 so that meter needle lies as in (3) above.
8. Terminate line output connections (PL/C-13 & PL/C-15) in 600Ω (either with a standard power o/p meter or a dummy load resistor).
9. Obtain signal for adjustment purposes by tuning to any 1MHz calibrator harmonic such that an audible output of the order 1kHz is available.
10. Set LINE LEVEL at roughly 3/4 of maximum setting, and adjust IF GAIN until external o/p meter registers an output of 10mW (2.45V on electronic voltmeter patched across 600Ω load).
11. Adjust RV12 so that meter needle lies on 10mW scale marking.
12. Replace cover and return receiver to normal service.

Section 6

MAINTENANCE

GENERAL

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

The receiver can be returned to the Manufacturer at any time should major servicing become necessary. The Ser. No. should be quoted in all communications, and extreme care should be taken to ensure that the receiver is well protected against possible damage during transit.

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

This Section is devoted primarily to minor servicing and will be found useful if it becomes necessary to replace fuses, lamps, etc. Simple procedures for fault diagnosis are covered in some detail, together with instructions for fitting all major replacement items (modules, units etc). Re-alignment instructions are included for guidance of technicians called upon to carry out major servicing tasks.

FUSE AND LAMP REPLACEMENT

Fuses

Separate fuses are fitted in both live AC supply lines, the main 22V DC secondary circuit, and the 12V DC supply circuit to the logic circuitry voltage supply regulator. Fuse holders are located at the rear of the receiver and require fuses rated as follows:—

AC Fuse	: :	105/130V supply	:	3-Amp
	: :	210/260V supply	:	1.5-Amp
DC Fuse	: :	5-Amp		
Logic Line Fuse	: :	3-Amp		

Fuses are standard 20mm x 5mm glass cartridge types: spare items of each value are included in the Accessories Kit. (Part Nos. 1.5A:6373P. 3A:6709P. 5A:7814P.)

Legend Lamps

In the event of lamp failure, proceed as follows:—

1. Pull off dolly from HIGH-STAB/CONT TUNE SWITCH.
2. Remove the four Philips type countersunk screws retaining the dial escutcheon.
3. Lift escutcheon clear of panel.
4. Release bulb carrier by unscrewing two captive screws.
5. Withdraw carrier, unscrew appropriate bulb and fit replacement. (Remove holder from grommet to simplify this operation.)
6. Re-fit carrier, escutcheon etc. by reversing procedure above.

Two spare bulbs are supplied with each receiver. (Standard L.E.S. type, rated 6V @ 60mA, Part No. 6659P.)

Projection Lamp

In the event of lamp failure, proceed as follows:—

1. Remove cabinet (or top dust cover in case of rack-mounted unit) and place receiver in normal operating position to prevent dirt etc. falling into lens unit when lamp carrier is removed.
2. Set RANGE SWITCH to Range 1 position to raise light unit to highest position for ease of access.
3. Pull lamp carrier out of light unit (friction fit).
4. Grip lamp holder tags with pliers and pull gently to remove lamp holder from carrier.
5. Unscrew faulty bulb from holder and fit replacement.
6. Check that bulb is free from finger grease and then push holder back into carrier (holder will click into position).
7. Check that limit ring is pushed home against step on body of lamp carrier and then slide carrier into light unit (friction fit). DO NOT PUSH CARRIER FULLY HOME — INSERTION TO A DEPTH OF ¼" (6.35mm) IS SUFFICIENT.
8. Apply power to the receiver and focus the scale display by rotating the lamp carrier and adjusting laterally as required.

Three spare bulbs are supplied with each receiver (M.E.S. Cap, 13.5mm round type rated 6V @ 0.2A, Part No. 8542P).

Oven Supply Lamp

In the event of lamp failure, proceed as follows:—

1. Remove cabinet.
2. Unsolder lead and resistor from rear tags of oven supply lamp.
3. Remove lamp by gently pushing from the front and fit replacement by inserting from the rear of the panel and pushing until it clicks home in its collar (note cathode lead is marked with orange spot).
4. Reconnect lead and resistor ensuring that the resistor is reconnected to the cathode.

Overlap Indicators and Digital Display

It is not recommended that these are replaced in the field and it would be preferred that the COUNTER AND DISPLAY UNIT LP3343 be returned to the manufacturer for replacement of these items.

FAULT DIAGNOSIS

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

Such an approach is totally unnecessary, for faults which may occur on the receiver can usually be localised quite rapidly by observing whether performance is affected on all ranges or only on certain ranges. The Tables which follow are self-explanatory and will enable faults to be cleared quickly, even by engineers or technicians who may not be completely familiar with the equipment.

NB: Two miniature coaxial connectors (one male, one female) are provided with the receiver, to permit connection to inter-module circuits. Each is supplied ready crimped to a suitable length of coaxial cable.

TABLE 6.1 FAULT LOCATION CHART : : MAIN RECEIVER CIRCUITS

RANGES OPERATIVE	NONE
RANGES INOPERATIVE	ALL

LIKELY FAULT AREA AND SUGGESTED TREATMENT

POWER SUPPLY

Check availability of main supply voltages:–

+22V : : Pink Leads
+15V : : Orange Leads
+12V : : Red Leads
+5V : : Blue Leads
–6V : : White Leads

AUDIO MODULE

Check availability of +12V supply at Module Pin 69.
Check security of other module connections.

NB: There are two separate audio channels in this module, and it would be most unlikely that both would fail simultaneously. Thus, if monitor output is absent, check for output on Line Channel by setting METER SWITCH to 'AF' and, with IF GAIN and LINE LEVEL well advanced, tune over a known busy frequency band looking for fluctuation on meter. If meter does indicate presence of signal on line channel a check should be made that the automatic overload cut-out on the 3Ω channel is not operative. This can be checked and automatically reset by removing the AC supply to the receiver for 5-10 seconds (after first ensuring that the cause of the overload e.g. a short circuit in the 3Ω output lines, has been eliminated).

If meter shows no evidence of signals on Line Channel, fault is most likely in some other part of receiver (i.e. Audio Module is serviceable).

100kHz IF AMPLIFIER MODULE

Check availability of +12V supply at Module Pin 53. If absent check line continuity via PLB/–6, S13A (at 'ON') and PLB/–3 through to Power Unit.

Check voltage at Module Pin 48 (IF gain control line). Voltage should swing within the limits 0 to –4V for full traverse of IF GAIN (AGC SWITCH 'OFF').
Check security of other module connections.

Check whether IF output is available at IF Output socket on back plate.
Check whether meter indicates presence of signals when METER SWITCH is at 'RF'.

NB: Internally generated signal for testing this module can be derived from the Master Oscillator Unit (100kHz carrier insertion output). Disconnect coaxial lead 'I' at CW/SSB Detector and patch to coaxial lead 'T' entering 100kHz IF Amp. Meter should indicate carrier when MODE SWITCH is set to 'SSB HIGH-STAB'. Sensitivity check can be carried out as detailed under 'Performance Testing'.

RANGES OPERATIVE	NONE
RANGES INOPERATIVE	ALL

LIKELY FAULT AREA AND SUGGESTED TREATMENT – contd.

100kHz IF FILTER

Check security of all coaxial connections.
Check availability of +12V supply at Pin 56 (should be present on all ranges).

RF ASSEMBLY

Check availability of +15V supply at RF Amplifier Board (Termination No. 3).
Check availability of +12V supply at MTO Board (Termination No. 5).
If +12V supply is absent, check line continuity back to NORMAL/SYNTH SWITCH (S4 – lead 98) and then via lead 97 to Power Unit. S4 must be at 'NORMAL' position to complete circuit.

Check whether receiver is operative from Tunable IF onwards. Select Ranges 1–4, connect aerial to coaxial lead 'J' (Tunable IF Input) via 100pF blocking capacitor.
Tune INCREMENTAL TUNING CONTROL for medium-wave broadcast signals falling in the range 1235–1335kHz (RANGE SWITCH at 1, 2, 3 or 4).

Check whether Main-Tune Oscillator is operative. Select Ranges 1–4, tuning in HIGH-STAB mode for normal illumination of HIGH-STAB INDICATOR at 100kHz points.

If MTO is working, and all previous checks have indicated normal operation of the remaining stages, fault must be located in the RF or 1st Signal Mixer Stage (or associated wiring/switching). Tests can proceed using normal signal tracing technique and detailed voltage analysis. The Aerial Attenuator Unit should not be overlooked when a fault has been localised to the RF Section.

RANGES OPERATIVE	RANGES 7, 9 & 10
RANGES INOPERATIVE	RANGES 1–6 & 8

LIKELY FAULT AREA AND SUGGESTED TREATMENT

250kHz IF MODULE

Check availability of +12V supply at Module Pins 42 (+12V oven supply should also be present on pin 43).
If absent, check line continuity via PL/A-4, S3D and PL/A-2, PL/B-7, S13A (at 'ON') and PL/B-3 through to Power Unit.

Check for possible s/c on coaxial leads 'K' & 'P'.

Check 250kHz IF Module (see 'Performance Testing').

RANGES OPERATIVE	RANGES 5–10
RANGES INOPERATIVE	RANGES 1–4 (At all settings of HIGH-STAB/CONT TUNE SWITCH)

LIKELY FAULT AREA AND SUGGESTED TREATMENT

TUNABLE IF MODULE

Check availability of +15V supply at Module Pin 22.
If absent, check line continuity through to Power Unit.

Check for possible s/c or o/c on coaxial leads 'J', 'M', 'N' & 'P'.

Check S3C.

Check Tunable IF Module (see 'Performance Testing').

NB: If low gain only on Ranges 1–4, check voltage on control line to Module Pin 23 (VVC Tuning from RV3 via PL/A-14).

INCREMENTAL OSCILLATOR UNIT

Check availability of +12V supply at Pin 19. Ensure that 650 to 550kHz is being generated by observing that the counter operates normally as the incremental is tuned. If it does operate correctly check for a s/c or o/c on lead 'N'.

Check Incremental Oscillator Unit (see 'Performance Testing'). 22V oven supply should also be present on Pin 18.

RANGES OPERATIVE	RANGES 5–10
RANGES INOPERATIVE	RANGES 1–4 (At 'CONT TUNE' only)

LIKELY FAULT AREA AND SUGGESTED TREATMENT

935kHz CRYSTAL OSCILLATOR (Part of 935kHz LOOP MODULE)

Check availability of +12V supply at Module Pin 32.
If absent, check line continuity via PL/B-12, S5B (at 'CONT TUNE'). PL/B-11, PL/A-5, S3D (at Ranges 1–4), PL/A-2, PL/B-7, S13A (at 'ON') and PL/B-3 through to Power Unit.

Check availability of –6V supply to Module Pin 29.
If absent, check line continuity through to Power Unit.

Check for possible s/c or o/c on coaxial lead 'M'.

Check IC5 and associated circuitry within Loop Module.

RANGES OPERATIVE	RANGES 5–10
RANGES INOPERATIVE	RANGES 1–4 (At 'HIGH-STAB' only)

LIKELY FAULT AREA AND SUGGESTED TREATMENT

935kHz LOOP MODULE

Check availability of +12V supply at Module Pin 28.
If absent, check line continuity via PL/B-9, S5B (at 'HIGH-STAB'). PL/B-11, PL/A-5, S3D (at Ranges 1–4), PL/A-2, PL/B-7, S13A (at 'ON') and PL/B-3 through to Power Unit.

Check for possible s/c or o/c on coaxial leads 'H' & 'M'.

Check loop circuitry within 935kHz Loop Module (see 'Performance Testing').

MASTER OSCILLATOR UNIT

Check availability of +12V supply at Unit Pin 77 (+12V oven supply should also be present on Pin 78).
If absent, check line continuity through to Power Unit.

Check for possible s/c or o/c on coaxial lead 'G' (double-screened lead).

Check Master Oscillator Unit (see 'Performance Testing').

NB: Normal operation of Master Oscillator Unit is likely if 'SSB HIGH-STAB' is operative on Ranges 5–10.

MTO AMPLIFIER, HARMONIC AMPLIFIER & 1st LOOP MIXER (RF ASSEMBLY)

Check availability of +15V supply at Pin 7 (RF Assembly).
If absent, check line continuity via PL/B-8, S5A (at 'HIGH-STAB'). PL/B-2 and through to Power Unit.

Check availability of –6V supply at Pin 8 (RF Assembly).
If absent, check line continuity through to Power Unit.

Check for possible s/c or o/c on coaxial leads 'G' or 'H'.

Carry out detailed voltage analysis on MTO Amp., Harmonic Amp. and 1st Loop Mixer.

FAULT DIAGNOSIS : : DIGITAL CIRCUITS

Equipment required: AVO 8 Mk III Multi-range Testset
Logic Probe Incorporating Pulse Stretcher
(SAUNDERS TYPE TTL/DTL)
RF Millvoltmeter

(*) For other types of probe refer to manufacturers instructions.

Before carrying out any fault diagnosis on either unit the supply voltage for the digital circuits should be checked as follows:–

1. Set RANGE SWITCH to Range 3
2. Set 1Hz/10Hz READOUT SWITCH to '1Hz' position
3. Measure voltage at 5V take-off point on chassis adjacent to TIMEBASE & CONTROL UNIT
4. Adjust RV24 as necessary so that supply is between 4.75V–5.25V.

The logic probe can be conveniently powered from this point.

The following samples of malfunction as indicated by the digital display listed in Table 6.2 likely causes will assist in fault location.

TABLE 6.2 FAULT LOCATION CHART – DIGITAL CIRCUITS

SYMPTON	CHECK
No reading – display extinguished (1Hz/10Hz READOUT SWITCH at either position, INCREMENTAL TUNING CONTROL at any setting). Display reads 50.00 in '10Hz' position and 50.000 in '1Hz' position. (INCREMENTAL TUNING CONTROL at any setting).	5V HT at Pins 203 and 301. Earth return through timebase to chassis. Insufficient or no drive from INCREMENTAL OSCILLATOR UNIT (pin 503). This may be checked by logic probe on Pin 1 of IC201. Probe should glow dimly. No drive will be shown as High '1' state and the probe will light brightly. Level at coaxial socket 'Y' $\nless$ 500mV (RV Millivoltmeter).
Display reads a fixed random figure Switching from '10Hz' to '1Hz' does not cause a miscount. INCREMENTAL TUNING CONTROL does not alter display.	Insufficient or no drive from MASTER OSCILLATOR UNIT. Check for count enable pulses at Pin 204 and display enable pulses at Pin 201. Level at Pin 303 $\nless$ 30mV (RF Millivoltmeter).

SYMPTOM	CHECK
Display reads a fixed random figure Switching from '10Hz' to '1Hz' **does** cause a miscount. INCREMENTAL TUNING CONTROL does not alter display.	Coupler between INCREMENTAL TUNING CONTROL and tuning capacitor is loose.
5 digit of display illuminated when '10Hz' position is selected and 2 least significant digit indicate in parallel.	1Hz/10Hz READOUT SWITCH not extinguishing display in 10Hz position. Check 5V supply at pin 202 back to S14B.
Display indicates a fixed frequency error which may be accompanied by flashing of the '+100kHz' indicator. Display is altered by INCREMENTAL TUNING CONTROL in normal manner. Counter updated at 1 sec or 0.1 sec rate only regardless of setting of 1Hz/10Hz READOUT SWITCH.	Check switch lines from S14A to IC202 and IC108. A break in either line may cause counter/display set to '1Hz' to be updated by timebase set to 0.1 sec or vice-versa.
Display appears random regardless of setting of 1Hz/10Hz READOUT SWITCH.	Check for load pulses at pin 209 with logic probe – a short pulse every second or 0.1 second dependent on display setting – Low '0'.
Display functions 'real time' indicating a 'square 8' and displays a random frequency every second.	Check for display enable pulses at pin 201 with logic probe – a short pulse every second or 0.1 second dependent on display setting – Low '0'.

Correct operation may be checked as follows:– Coverage approx. 96.000kHz (–100kHz Indicator flashing) to 04.000kHz (+100kHz Indicator flashing). This is equivalent to a frequency range of 654-546kHz. The 100kHz indicators flash at the count enable rate i.e. display switch set to 1Hz, count enable 1 second.

PERFORMANCE TESTING

NB: The +12V and +5V lines should be checked for accuracy before carrying out any performance checks. If slight re-adjustment of the voltage on these lines is required, then RV23 (+12V) and RV24 (+5V) voltage setting controls should be used.

These are situated on the METER/REGULATOR BOARD beneath the ventilated cover on the right hand side of the receiver.

Overall Performance

If substandard performance is suspected, the receiver should be withdrawn from service and subjected initially to an overall performance check at the mid-frequency in each of the ten frequency ranges. An accurately calibrated signal generator matched to 75Ω should be employed, having a reliable attenuator and low signal leakage. Output readings can be taken using the integral receiver meter with the METER SWITCH at 'AF'. The line output terminations should be wired to a 600Ω load (PL/C-13, PL/C-15).

Sensitivity readings should be taken for 10dB s/n ratio at 10mW output with the receiver controls set as indicated below. Further checks should be made at mid-band 100kHz points on Ranges 1-4 with receiver running in high-stability mode.

HIGH-STAB/CONT TUNE	: : 'CONT TUNE'	AERIAL ATTENUATOR	: : 0dB
INCREMENTAL TUNING	: : 'Ø' (R1-4)	METER SWITCH	: : 'AF' (0-10mW) As required for monitoring;
MODE SWITCH	: : 'AM'		
SELECTIVITY SWITCH	: : '3kHz'		
AGC SWITCH	: : 'OFF'	IF GAIN*	: : ¾ of maximum setting
		LINE LEVEL	: : Adjust for 10mW

(*) Use IF GAIN for fine adjustment of output level.

Sensitivity on all ranges should be equal to or better than 3uV for 10dB s/n ratio. In the event of sensitivity being lower than this figure on one or more ranges, but not on all ten (**), investigation should be restricted to the RF Assembly, checking alignment and carrying out detailed voltage analysis. If sensitivity is generally low on ALL ranges, testing can proceed as detailed on the following pages.

Audio Section

Repeat overall sensitivity check (on any range) for 10dB s/n, but using 3Ω channel to determine whether fault lies in 600Ω line channel. Test should be carried out with AF GAIN set for reading of 50mW on external Power Output Meter wired to PL/C-2 and PL/C-9 (meter matched to 3Ω). If sensitivity is still found to be lower than normal the fault does not lie in the Audio Module.

Direct audio sensitivity figures for the Audio Module alone, using 1000Hz test signal are as follows:-

Monitor Channel (3Ω)

Audio in at Module Pin 68 (existing lead disconnected) should show a sensitivity of 20mV for 100mW output on external meter. (AF GAIN is inoperative.)

Line Channel (600Ω)

Audio in at Module Pin 67 (existing lead disconnected) should show a sensitivity of 20mV for 10mW output on panel meter. (LINE LEVEL is inoperative.)

(**) Excluding special cases of low gain on all except 7, 9 & 10, or all except 5-10.

IF Sensitivity

IF sensitivity can be checked by introducing a modulated test signal (30% at 400Hz), at the signal gate of the 1st Signal Mixer (via C38 with lead to disk contact disconnected). The fundamental circuit configuration permits checking the 100kHz IF alone, the 100kHz and 250kHz IF's together, or all three IF channels simultaneously by setting the RANGE SWITCH to ranges employing single, double or triple conversion respectively. Appropriate ranges and test frequencies are as follows:–

TABLE 6.3 IF SENSITIVITY CHECKS

RANGE	IF's OPERATIVE	TEST FREQUENCY	INPUT FOR 10dB s/n AT 10mW ON LINE METER
7	100kHz only	100kHz	20uV ± 6dB
5	100kHz and 250kHz	250kHz	15uV ± 6dB
4	100kHz, 250kHz and Tunable IF	1335kHz	less than 10uV

Control settings should be as for the overall performance check, but with the IF GAIN at maximum. 10mW output level should be set by use of LINE LEVEL control. The INCREMENTAL TUNING CONTROL must be set to 'Ø' when carrying out the test on Range 4.

Miscellaneous

The following additional performance figures are included here to assist service engineers carrying out more advanced fault-finding.

CW/SSB Detector & BFO Unit

An unmodulated input of 30mV at 100kHz into coaxial socket 'V' should produce an output of 10mW on the integral meter with LINE LEVEL set to maximum.

Tunable IF Module

If low drive levels are suspected to the 2nd Loop Mixer via coaxial leads 'M' or 'N', substitute signals can be fed into the module from an external source. Drive levels necessary to produce normal operation (as determined by overall performance checks, or an IF sensitivity check on Range 4) are as follows:-

Coaxial lead 'M' : : 300mV at 935kHz

Coaxial lead 'N' : : 150mV in the range 550-650kHz*

*INCREMENTAL TUNING CONTROL must be adjusted to peak Tunable IF circuits to suit signal generator frequency. Remember that direction of tuning is reversed, i.e. 'Ø' setting corresponds to highest intermediate frequency (1335kHz).

Incremental Oscillator Unit

Level of output at 550/650kHz OSC IN/OUT socket '0' (on top of unit) should lie in the range 150mV to 250mV. A substitute testing signal can be derived from a second receiver if available.

935kHz Loop Module

Normal operation of the Loop Amplifier (IC3) can be verified by introducing an external unmodulated 935kHz signal at gate 1 of the 1st Loop Mixer (via C67 with lead to disk contact disconnected). The HIGH-STAB INDICATOR should light up when the input level exceeds 0.7mV.

An alternative check in the event of a fault existing in the legend lamp circuit, is to feed a 1mV 935kHz signal via C67, while monitoring the output on coaxial lead 'M'. An output of the order 300mV should be obtained.

AFC operation can be checked by offsetting the signal introduced via C67 and reading voltage at Module Pin 34 with an electronic voltmeter. Readings should be of the order:—

935kHz	: :	+7.5V
935kHz + 3kHz	: :	+8.5V
935kHz – 3kHz	: :	+6.5V

Master Oscillator Unit

Output level measured on coaxial lead 'I' using an electronic voltmeter should be of the order 2V (MODE SWITCH set to 'SSB HIGH-STAB').

Output level measured on coaxial lead 'G' should be of the order 2.5V to 3V p-p measured on an oscilloscope of approximately 70MHz bandwidth. Output level measured on coaxial lead 'Z' should be 60mV-100mV measured on an electronic voltmeter.

FSK Module

Normal operation of the FSK Discriminator can be checked by introducing an unmodulated 100kHz signal via coaxial lead 'W'. Input level should be 15mV, and the voltage at Module Pin 81 will reach the following voltages for offsets of ±425Hz:—

100kHz	: :	0V
100kHz + 425Hz	: :	+3.3V
100kHz – 425Hz	: :	–3.3V

An electronic voltmeter should be used for measurement of the voltage at Module Pin 81.

RE-ALIGNMENT

General

All Modules and Units employed in the receiver are pre-aligned on factory test jigs before they are fitted to the main chassis assembly. Further adjustment of the module/unit circuits is not normally required. Replacement Modules and Units supplied for user-servicing are also pre-aligned in this way and can be installed without major adjustment. Instructions for carrying out any minor adjustments which may be required in some cases, will be furnished with the replacement item.

Turret Disks are also treated in a similar manner, but are subjected to further minor adjustment after installation in the receiver. The initial in-situ factory alignment should hold for a long period of time, and re-alignment should only be contemplated if there is a clear indication that this course of action is in fact necessary.

This same procedure should be adopted in the event of Turret Disks being changed when fault-finding on receivers in operational service. Alignment should be restricted to the replacement disk(s), taking care to avoid excessive trimmer/core shifts in view of the very minor adjustment which will be required.

Re-alignment should be carried out only by skilled technicians having a sound knowledge of the procedures involved. High-grade test instruments should be employed. All pre-set adjustment — trimmers, cores etc. — are self-locking, and should not be sealed with wax or other similar compounds.

The +12V and +5V voltage lines should also be checked and set if necessary, as described at the start of the section 'Performance Testing'.

Re-alignment of the RF Assembly (Coil Turret)

The paragraphs which follow, cover the entire alignment procedure applicable to the Turret Assembly. Relevant data can be extracted as necessary when re-alignment of specific disks only is required. Disks will have been pre-aligned before despatch so major adjustments will not be necessary. Instructions for removal and replacement of disks will be found in later sections 'Turret Disks (Removal)' and 'Turret Disks (Replacement)'.

Access to Trimming Adjustments

All trimming adjustments are accessible after removal of the long top cover plate which carries the disk identification (12 screws). All trimmers and cores are adjacent to each other in pairs (one trimmer – one core), and are adjusted from the top of the turret with the trimming tool angled at approximately 60°. The correct coils and trimmers for the selected range are easily identifiable by their proximity to the contact blocks.

Main-Tune Oscillator (Turret Disk 'D')

Alignment should commence with adjustment of Turret Disk 'D' (MTO). An accurate frequency standard must be available to provide marker signals throughout the entire coverage of the receiver (10kHz-30MHz). On the lower frequencies it will be found advantageous to utilise a standard signal generator, which itself can be standardised against the frequency standard employed. The latter should provide harmonic output at 10kHz and 100kHz points for greatest convenience in carrying out the necessary adjustments (the integral calibrator can be used to permit positive identification of the MHz settings). Marker signals should be introduced at the LOW-Z aerial input socket, with the receiver controls set as follows:–

RANGE SWITCH	: :	See Table 6.4 for alignment frequencies etc.
MAIN TUNING	: :	
INCREMENTAL TUNING	: :	'Ø' (for Ranges 1-4)
HIGH-STAB/CONT TUNE	: :	'CONT TUNE'
PEAK-RF	: :	As required for maximum signal
AERIAL ATTENUATOR	: :	'0dB'
IF & AF GAINS	: :	To provide required level of output
MODE SWITCH	: :	'SSB HIGH-STAB'
SELECTIVITY	: :	'3kHz'
AGC SWITCH	: :	'OFF'
CAL ADJ	: :	Mid-position (co-incident with fixed index)

Before commencing alignment, check that RV2 (AFC ADJ) is set correctly. With the control settings indicated above, RV2 should be adjusted for approximately +7.5V at Module Pin 34 (AFC outlet from 935kHz Loop Module).

Select each range in turn, tuning to marker signal by adjustment of appropriate trimmer or core, after setting main dial to marker frequency. Adopt normal alignment procedure, tuning trimmers at HF end of range and cores at LF end. Repeat each adjustment several times to achieve correct calibration at both ends of each range simultaneously. All adjustments should be made for zero-beat on the low ranges, but on the higher frequencies, where this adjustment becomes more difficult, setting for an audible output will suffice. Check scale accuracy at main intermediate calibration marks after completion of alignment.

It may be found convenient on the HF ranges, to take advantage of the high-stability facilities when carrying out MTO alignment. This eliminates the need for an external frequency standard; the correct procedure to adopt is as follows:–

1. Set dial to required alignment point (from Table).
2. Select 'SET' position of HIGH-STAB/CONT TUNE SWITCH.
3. Adjust trimmer or core (as appropriate) for illuminiation of HIGH-STAB LEGEND.
4. Revert to 'CONT TUNE'.
5. Check that correct 100kHz point has been selected by counting from nearest 1MHz marker supplied by integral calibrator.

Signal-frequency Circuits (Turret Disks 'A', 'B' & 'C')

Disconnect frequency standard and connect standard signal generator to LOW-Z aerial input socket. Generator must be matched to 75Ω and modulated 30% at either 400Hz or 1kHz. Transfer MODE SWITCH to 'AM' position.

The signal-frequency circuits are located on Disks 'A', 'B' & 'C'. Those on Disk 'A' are for Ranges 1-8 only (i.e. where bandpass input circuits are employed). In addition, this same disk also carries IF rejection filters for Ranges 4, 5, 6, 7 & 8, but further adjustment of these will not normally be required after initial factory alignment.

Adjustments should be carried out at each of the alignment points indicated in Table 6.4, tuning the appropriate trimmer or core for maximum output. The integral meter can be used as output indicator (METER SWITCH at 'AF'). No special procedures are involved, other than correct setting of the PEAK-RF CONTROL to suit the range in use (see Table 6.5).

TABLE 6.4 ALIGNMENT FREQUENCIES AND ADJUSTMENTS

RANGE	ALIGNMENT FREQS.		ALIGNMENT ADJUSTMENTS					
	TRIMMER	CORE	DISK 'A'	DISK 'B'	DISK 'C'	DISK 'D'	DISK 'E'	DISK 'F'
1	29.0MHz	20.1MHz	C380 L136	C400 L44	C420 L54	C451 L64	C480 L74	C490 L78
2	19.0MHz	10.0MHz	C383 L137	C404 L45	C424 L55	C453 L65	C484 L75	C494 L79
3	9.6MHz	4.1MHz	C386 L138	C405 L46	C425 L56	C456 L66	C485 L76	C495 L80
4	3.9MHz	1.62MHz*	C387 L139	C406 L47	C426 L57	C457 L67	C487 L77	C497 L81
5	1580kHz	700kHz	C392 L142	C407 L48	C427 L58	C461 L68	**Main Tuning at 1.6MHz and Incremental set to 20kHz.*	
6	660kHz	300kHz	C393 **L143	C408 **L49	C428 **L59	C462 L69	***Inductance with core on 'inner peak'*	
7	275kHz	130kHz	C395 L145	C409 L50	C429 L60	C467 L70	– –	– –
8	125kHz	55kHz	C396 L146	C410 L51	C432 L61	C468 L71	– –	– –
9	54kHz	26kHz		C411 L52	C433 L62	C472 L72	– –	– –
10	23kHz	10.5kHz		C412 L53	C438 L63	C473 L73	– –	– –

TABLE 6.5 PEAK RF GANG ALIGNMENT POINTS

Expressed as percentage meshing of peak RF gang
– typical figures only.

RANGE	ALIGNMENT POINTS	POSITION OF INCREMENTAL TUNING		
		'0'	'50'	'100'
1	LF End	30%	25%	15%
	Arithmetic Mid-range	30%	30%	30%
	HF End	30%	30%	30%
2	LF End	45%	40%	35%
	Arithmetic Mid-range	30%	30%	30%
	HF End	30%	30%	30%
3	LF End	90%	70%	60%
	Arithmetic Mid-range	50%	45%	45%
	HF End	35%	35%	35%
4	LF End	100%	40%	15%
	Arithmetic Mid-range	40%	30%	15%
	HF End	40%	35%	30%
5	LF End	25%		
	Arithmetic Mid-range	15%		
	HF End	25%		
6	LF End	20%		
	Arithmetic Mid-range	15%		
	HF End	20%		
7	LF End	25%		
	Arithmetic Mid-range	25%		
	HF End	25%		
8	LF End	20%		
	Arithmetic Mid-range	5%		
	HF End	0%		
9	LF End	15%		
	Arithmetic Mid-range	0%		
	HF End	15%		
10	LF End	45%		
	Arithmetic Mid-range	25%		
	HF End	15%		

Harmonic Selector Circuits (Turret Disks 'E' & 'F')

These two disks are operative only when using the receiver in its high-stability mode on Ranges 1-4. The four tuned circuits on each of the disks are aligned to track 400kHz higher in frequency than the indicated frequency on the main tuning scale. Mis-alignment will cause a reduction in the level of selected harmonic drive to the 1st Loop Mixer (TR7), so reducing conversion gain at the 2nd Signal Mixer (TR15). A clear indication of mis-alignment is failure of the HIGH-STAB INDICATOR to light at all 100kHz settings in a given range. Very severe mis-alignment at the high end of Range 1 could result in selection of the loop image frequency, producing errors in dial setting. It can be seen therefore that accurate alignment of the two selector circuits is vital to proper working of the loop system.

Initial factory alignment is carried out by introducing at coaxial entry 'G' (harmonic drive feed to Disk 'F'), a substitute signal derived from a generator tuned 400kHz higher than the indicated tune frequency. Signal level is adjusted to be of the order 250uV.

This procedure is not necessary in subsequent re-alignment, except where excessive mistuning has occurred. In the normal case, the relevant circuits will be so close to their correct tuning points that it will be possible to utilise the harmonic drive available from the Master Oscillator Unit. An external generator is totally unnecessary.

Visual indication of correct alignment is achieved by patching an electronic voltmeter into coaxial lead 'M' (935kHz drive to 2nd Loop Mixer). This monitoring arrangement is preferred to other methods which could be used because of the very sharp indication of tuning which it provides. Other arrangements will give the impression of very flat tuning due to the sensibly constant conversion which obtains in the 2nd Loop Mixer for wide variation in injection level.

Access to the required metering point can be obtained by connecting in series, the two coaxial test leads supplied with the receiver, using these to form a link between the two halves of coaxial connector 'M'. Some reduction in overall receiver sensitivity will be apparent due to the increased attenuation caused by the greater length of coaxial interconnection 'M'. This however, is of little consequence, since the prime object is to provide a clear indication of tuning without the need for performance checks of any kind.

The receiver should be tuned to each of the alignment points indicated in Table 6.4, using the HIGH-STAB INDICATOR as a check on correct tuning. The appropriate trimmers and cores are tuned for maximum reading on the voltmeter, adjustments being repeated several times to ensure accurate alignment. A careful check should be made on completion of the adjustments on each range, to determine that correct tracking of the selector circuits is achieved at all intermediate 100kHz points.

Re-alignment of L1

On completion of re-alignment of Disks 'E' and 'F', a check can be made on correct setting of the core in L1. The receiver should be operated in the high-stability mode, tuned to any 100kHz point for illumination of the HIGH-STAB INDICATOR. With the HIGH-STAB/CONT TUNE SWITCH moved into the 'OPERATE' position, trim the core in L1 for maximum reading on the electronic voltmeter connected as for alignment of Disks 'E' and 'F'.

NB: Access to L1 is by removal of the cover over the front section of the Turret Assembly.

Re-alignment of Modules

If re-alignment of 935kHz Loop, Tunable IF and FSK Discriminator is necessary, the appropriate unit should be removed from receiver and reconnected beneath chassis so that coils can be adjusted with receiver and unit operating.

Re-alignment of 935kHz Loop Module

1. Inject a 1mV, 935kHz unmodulated test signal into gate 1 of the 1st loop Mixer (via C67 with lead to disk contact block disconnected).
2. Use an electronic voltmeter to measure the 935kHz output level on a 'T' test connector inserted in lead 'M' at the junction of the two miniature coaxial connectors.(See note on access to 'M' lead included in a previous section 'Harmonic Selector Circuits'.)
3. Tune inductors L2, L3, L4, L5 and L6 for maximum output on lead 'M'. The 1mV input signal should produce at least 300mV on lead 'M'.
4. L9 should also be tuned by progressively decreasing the input signal lead and tuning L9 so that the High-Stab Indicator is kept illuminated. The input level at which the High-Stab Indicator will just switch on should not be greater than 3dB below the input level required to give 300mV output on lead 'M'.
5. The electronic valve voltmeter, set to a DC range, should now be connected to Pin 37 of the module and L8 tuned for OV output with the 935kHz input signal. With an approximately 938kHz input signal the DC output should be peaked by tuning L7. The tuning of L8 then L7 should be repeated to ensure the accuracy of alignment of this part of the circuit. The 935kHz loop specification is given under 'Performance Testing' and can now be checked. Note that RV2 is used to set the AFC output at Pin 34 to +7.5V approximately with Pin 37 earthed (i.e. S5 at CONT TUNE or HIGH-STAB SET).

Re-alignment of the Tunable IF Module

1. Oscillator filter coils L13, L14 and L15:— Connect RF electronic voltmeter to junction of R126 and R125 and with the incremental oscillator tuned to give a display of approximately 20.000 on the incremental readout, tune L13, L14 and L15 for maximum output on the voltmeter (approximately 800mV).

NB: After alignment of signal circuit in this module check that voltage at this point does not fall below 600mV over the whole incremental range.

2. Signal filter coils L10, L11 and L12:— Set the receiver controls as follows:—

AGC SWITCH	: :	'OFF'
NORMAL/SYNTH SWITCH	: :	'SYNTH'
IF/AF GAINS	: :	Adjust as necessary
MODE SWITCH	: :	'AM'
SELECTIVITY SWITCH	: :	'3kHz'
RANGE SWITCH	: :	'Range 4'

Inject test signal at 1315kHz, 30% mod, 400Hz at gate 1 of the first mixer (via C38 with lead to disk contact block disconnected).

Tune incremental to give readout at approximately 20,000 (i.e. 1315kHz is tuned inband). Adjust L10, L11 and L12 for maximum audio output. Now with the aid of fine IF Trim potentiometers RV18 and IF Trim potentiometer RV4 track the signal circuits so that the sensitivity of the unit is sufficient to give an overall signal to noise ratio of at least 10dB for an 10μV signal over the whole 1335 to 1235kHz range input to the 1st Mixer.

NB: (a) RV4 is used to peak the output for a 1235kHz input (i.e. incremental at 99.999) and can be found on the METER/REGULATOR BOARD.

(b) RV18 is used to peak the output for a 1285kHz input (i.e. incremental at 50.000) and can be found beneath the receiver adjacent to the incremental drive mechanism.

Re-alignment of the 100kHz Filter Unit

1. Set receiver controls as follows:–

RANGE SWITCH	: :	'Range 5'
MODE SWITCH	: :	'AM'
AGC SWITCH	: :	'OFF'
IF/AF GAINS	: :	As required
NORMAL/SYNTH SWITCH	: :	'SYNTH'
SELECTIVITY	: :	'400Hz'

Connect a 75Ω terminated RF electronic voltmeter to the 100kHz IF output socket (rear panel) and inject a 250kHz unmodulated signal into gate 1 of the 1st mixer (via C38 with lead to disk contact block disconnected). Adjust generator level to give approximately 100mV output into voltmeter and adjust coils L24, L25, L26, L27 and L28 for maximum output. These coils are vinkor types and can be reached on underside of chassis adjacent to SELECTIVITY SWITCH.

CW/SSB Detector & BFO adjustments

1. BFO frequency

Set receiver controls as follows:–

MODE SWITCH	: :	'CW/SSB'
AF GAIN	: :	As required
BFO	: :	Mid-position

Inject a 100kHz, 10mV signal into socket 'V' of the unit and tune L32 for a zero beat audio output.

2. Product Detector gain

This is set by adjustment of RV21 to equalise the audio output produced by a signal modulated 30% at 1kHz (received in AM mode) and a 1kHz beat output from an unmodulated signal (received in SSB mode, signal offset from tuned frequency by 1kHz). This is best done with the test signal introduced at the aerial socket at any convenient frequency in Range 4 with AGC 'OFF' and IF gain as required.

NB: L32 and RV21 are accessible via holes in the lid of the module.

Re-alignment of the FSK Discriminator

Inject a 100kHz unmodulated signal of 50mV into the module lead 'W'. Disconnect Pin 81 and connect a DC electronic voltmeter to this pin, adjust L34 for zero voltage output. Offset the input frequency to obtain a DC output and adjust L33 for a maximum reading. Repeat these two adjustments.

Now reconnect the DC electronic voltmeter to the test point on the collector of TR41 and with the 100kHz input signal adjust RV13 for zero voltage at this point.

REMOVAL OF UNITS, MODULES ETC.

Standard Modules (250kHz IF, 935kHz Loop etc.)

1. Stand receiver chassis on left-hand side.
2. Remove leads from appropriate module pins.
3. Locate coaxial interconnectors on any associated coaxial leads. Unplug connectors after making careful note of cable dressing etc.
4. Remove the two retaining screws on underside of chassis, complete with shakeproof washers, taking care to note any earth tag which may be retained by these screws. The module should be supported as screws are removed.
5. Lift module free of chassis.
6. Fit replacement module by reversing procedure detailed above, taking care to re-fit solder tag earths etc.

FSK Module (Not fitted unless specified at time of order)

1. Stand receiver on right-hand side plate.
2. Free the seven module leads from the dummy termination strip (Nos. 79, 81, 82, 83, 84, 87 & 86).
3. Take out two 4BA retaining screws and remove termination strip.
4. Place FSK Module in position and replace the two 4BA retaining screws with shakeproof washers (and earth tag to lead No. 79). Check that screws are secure.
5. Connect seven leads to module, using number sequence stamped on chassis.
6. Connect coaxial lead 'W' to spare socket on FSK side of 4-way (or 3-way) junction box (100kHz input to FSK Module).

Aerial Attenuator Unit

1. Disconnect two-way polarised connector PL/SK-D.
2. Unsolder leads 'B' and 'C' from HIGH-Z input terminals, and lead 'D' from turret contacts.
3. Unscrew and release BNC socket (LOW-Z input).
4. Pull dolly off AERIAL ATTENUATOR SWITCH.
5. Free unit by removing two screws holding bracket to flat strip between panel handle screws.
6. Fit replacement unit by reversing procedure detailed above.

Master Oscillator Unit

1. Disconnect four leads (Nos. 74, 76, 77 & 78).
2. Remove two 4BA screws to free earth lead on pin 76 and capacitors C138 and C139.
3. Remove coaxial plug 'I' at CW/SSB DETECTOR & BFO UNIT, and coaxial plug 'Z' at TIMEBASE AND CONTROL UNIT.
4. Remove cover over front section of Turret Assembly to gain access to unsolder the double-screened coaxial lead 'G'.
5. Remove four 6BA screws retaining unit, supporting with free hand. Note that three of the screws also retain cable clips, and that all screws are fitted with washers.
6. Fit replacement unit by reversing procedure detailed above, remembering to re-fit the solder tag from Pin 76 and the capacitor earthing tag. Note that coaxial lead 'G' has its **outer** screen connected directly to the turret casting.

Incremental Oscillator Unit

1. Disconnect two leads Nos. 18 & 19.
2. Disconnect coaxial plugs 'N' (and 'O' if present).
3. Remove PL/A from SK/A.
4. Remove SKA complete with its bracket (held by two 4BA bolts).
5. Slacken the four screws in the flexible coupler (access from below) and push forward on shaft towards the front of receiver.
6. Use open-ended spanner to remove the four 4BA hex-headed screws holding unit to rear drive plate (support unit at this stage).
7. Slide unit to rear to disengage spindle from flexible coupler. Lift clear in downward direction.
8. Fit replacement unit by reversing procedure detailed above.
9. Set incremental drive fully anticlockwise and turn shaft of unit to give minimum reading, on digital display, with the −100kHz light flashing.
10. Lock coupler screws.

CW/SSB Detector and BFO Unit

1. Remove BFO control knob and skirt (separate item).
2. Disconnect lead Nos. 57, 58, 59, 61 & 62.
3. Disconnect coaxial plugs 'I' & 'V'.
4. Remove cover from 100kHz IF Module (two screws on top).
5. Remove the four 6BA screws with shakeproof washers which retain the unit on right-side plate. Slide unit to rear and upward to remove.
6. Fit replacement unit by reversing procedure detailed above. Take care when re-fitting skirt to check that this is attached so that index registers against panel marking.

100kHz IF Filter Unit

1. Remove CW/SSB DETECTOR & BFO UNIT. (See previous instructions.)
2. Disconnect lead No. 56, and coaxial leads 'Q', 'R', 'S' & 'T'.
3. Remove SELECTIVITY control knob.
4. Remove the two 6BA screws with shakeproof washers located adjacent to coaxial sockets 'S' & 'T'.
5. Remove $\frac{3}{8}$" panel nut (SELECTIVITY SWITCH), and slide unit towards rear of set. Take care not to lose the large shakeproof washer which is located behind panel, concentric with control spindle bush.
6. Fit replacement unit by reversing procedure detailed above. Remember to re-fit the large washer removed in (5) above. Replace CW/SSB DETECTOR & BFO Unit.

SSB Filter Assembly

1. Remove side-cover over this module and METER/REGULATOR board (held by 4 6BA screws).
2. Disconnect leads R, S and both B18 leads.
3. Remove module (held by four 4BA screws) taking care to retain earthing leads and solder tags.
4. To replace, reverse above procedure taking care to fit earthing leads correctly.

Meter/Regulator Board

1. Remove side-cover over this board and SSB FILTER ASSEMBLY (held by four 6BA screws).
2. Remove four screws holding board.
3. Unsolder leads A, B, C, D, E, F, G & H from side of board.
4. Withdraw board from socket.
5. To replace, reverse above procedure taking care to reconnect leads A, B, C, D, E, F, G & H correctly.

Timebase & Control Module

1. Disconnect lead 'Z', plug and socket SKF/PLF and blue +5V lead from chassis pin.
2. Remove module (held by two 4BA screws, accessible from below chassis).
3. To replace, reverse above procedure.

Counter & Display Unit

1. Disconnect plug and socket PLG/SKG and lead 'Y' (at incremental oscillator socket).
2. Remove escutcheon from front panel (see Fuse and Lamp Replacement).
3. Remove module (held by two 6BA countersunk screws, accessible from front of receiver behind the removed escutcheon).
4. To replace, reverse above procedure.

Turret Disks (Removal)

1. Remove cover plate from left-hand side of turret assembly, and top cover plate which carries the disk identification.
2. Select Range 1 (20-30MHz).
3. Stand receiver on right-hand side plate.
4. Grip edge of disk firmly between finger and thumb, pulling vertically upwards so that slot in disk slides smoothly across spindle.

Turret Disks (Replacement)

1. Check that disk clip (on spindle) is correctly aligned with contact assembly, and guide at bottom of turret. Slide along spindle if necessary for correct position.
2. Orientate disk so that the side marked "FRONT" is towards panel.
3. Insert Disk Insertion Tool to open contact fingers.
4. Position disk so that its slot lines up with the spindle clip.
5. Push disk gently downwards to enter Disk Insertion Tool.
6. Withdraw Disk Insertion Tool.
7. Check for accurate positioning of disk and smooth operation of turret.
8. Check electrical alignment as described in 'Re-alignment' section.
9. Replace turret covers.

Front Panel Assembly

1. Place receiver on right-hand side plate for operations 2, 3 & 4 below. Invert to rest on left-hand side for remaining operations. It will be found most convenient to allow the panel to protrude over the edge of the work bench.

2. Remove Aerial Attenuator Unit (see in 'Removal and Installation of Modules' section, but ignore operations 2 and 3 since total removal is unnecessary).

3. Remove the following control knobs, etc.

   MAIN TUNING
   INCREMENTAL TUNING
   RANGE SWITCH
   BFO*
   SELECTIVITY**

   **Also remove control knob skirt which is separate from knob proper.*

   ***Also remove $\frac{3}{8}$" panel nut concentric with spindle bush. Note that there is a large shakeproof washer on this bush at the reverse side of the panel. This should be removed and stored in a safe place after taking off the panel.*

4. Remove *COUNTER & DISPLAY UNIT* as previously described in this section.

5. Remove panel nut to free 1Hz/10Hz READOUT switch.

6. Remove two screws holding panel to right-hand side plate, i.e. screws retaining the panel handle.

7. Remove the four screws which attach the two panel brackets to the drive mounting points (two at left-hand side just in front of turret, two near centre of panel).

8. Pull panel clear, at same time releasing PL/B from SK/B (towards right-hand end of panel assembly at left of MODE SWITCH) and two pin connector E (at edge of chassis).

9. Replace panel by reversing procedure detailed above. Take care to replace the larger washer on the SELECTIVITY SWITCH spindle bush.

Tuning Drive Assembly

1. Remove panel as described above.

2. Remove *INCREMENTAL OSCILLATOR UNIT* (as previously described).

3. Slacken the four screws in rear component of flexible coupler in turret drive.

4. Slacken the four screws in rear component of flexible coupler in main tuning gang drive.

5. Disconnect both coaxial interconnectors coded 'H', and those coded 'E', 'J', 'K' & 'L'.

6. Remove 250kHz IF MODULE (as previously described). This allows access to one fixing screw which secures drive assembly to main chassis. Remove this screw (below chassis on flange).

7. Remove the four screws which retain drive assembly to turret casting. One of these screws is fitted from inside of turret – gain access by removing left-hand turret cover and Disk 'F'.

8. Fit replacement drive assembly by reversing procedure detailed above. Flexible coupler to main tuning gang should be locked to spindle with capacitor set to maximum capacity and tuning drive at LF end stop (line marked on scale).

NB: All drive bearings and other mechanical items are lubricated with molybdenum disulphide during initial assembly. Further lubrication should normally not be required but can be carried out if felt necessary after the receiver has been in use for a number of years.

Turret Assembly

1. Remove turret covers and unsolder coaxial leads 'D', 'F' & 'G'. Leave cable clips for leads 'A', 'B', 'C' and 'D' floating free.
2. Uncouple flexible shaft to peak RF gang by loosening the two screws in the coupling collar and pulling the coupler forward towards the front of the receiver.
3. Disconnect leads Nos. 2, 3, 4, 5, 6, 7* and 8. *(Unsolder lead marked*.)*
4. Remove Panel Assembly (as previously described).
5. Remove Drive Assembly (as previously described). *INCREMENTAL OSCILLATOR UNIT* can be left in position.
6. Remove three screws retaining rear left-hand corner of turret casting.
7. Remove two screws retaining right-hand side of turret casting (access from below).
8. Turret is now free and can be lifted clear.
9. Fit replacement turret by reversing procedure detailed above.

Switch Assembly S3A-D

1. Set RANGE SWITCH to Range 4.
2. Slacken rear screw in switch spindle coupler.
3. Slacken the two hex-headed screws retaining switch assembly mounting plate.
4. Rotate plate slightly so that screw heads lie in wide part of keyhole cut-out.
5. Pull gently to rear to free spindle from coupler.
6. For total removal, disconnect coaxial interconnectors 'E', 'H' (2), 'J', 'K' & 'L', and fixed socket SK/A.
7. Replace assembly by reversing procedure detailed above. Check that switch wiper is aligned correctly and operates in sympathy with motion of RANGE SWITCH.

APPENDIX 'A'

VOLTAGE ANALYSIS

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

Voltages quoted in both Tables were taken with a standard 20,000 ohms/volt multi-range testset or an electronic Voltmeter and a supply voltage of 240V AC. A tolerance of 10% should be allowed on all readings to cover zener and semiconductor spreads.

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

RANGE SWITCH	::	Range 1
MAIN TUNING	::	20MHz
INCREMENTAL	::	00.000kHz
HIGH-STAB / CONT TUNE	::	'OPERATE' (*)
MODE SWITCH	::	'CW/SSB'
USB/LSB SWITCH	::	'USB'
IF GAIN	::	Maximum
METER SWITCH	::	'RF'
AGC SWITCH	::	'ON'
CALIBRATOR SWITCH	::	'OFF'

(*)Receiver tuned to illuminate 'HIGH-STAB' legend.

VOLTAGE TABLE 1 – MODULE SUPPLIES ETC.

MODULE/ UNIT ETC.	PIN	SERVICE	VOLTAGE/REMARKS
RF Assembly	1	ICI supply	+12V with CALIBRATOR SWITCH pressed.
	2	Metering connection	+14.2V with METER SWITCH at 'RF'. +14.3V with METER SWITCH at 'CZ' or 'AF'.
	3	TR1-TR3 supply	+15V under all conditions of switching.
	4	RF AGC	+1.3V under no-signal conditions.
	5	TR4-TR5 supply	+12V under all conditions of switching except when NORMAL/SYNTH SWITCH is set to 'SYNTH' position (0V).
	6	AFC line to D11	+7.5V with HIGH-STAB/CONT TUNE SWITCH at 'CONT TUNE' or 'SET' positions.
	7	TR6, TR7 & IC2 supply	+15V except when HIGH-STAB/CONT TUNE SWITCH is set to 'CONT TUNE' position.
	8	IC2 supply	-6V under all conditions of switching.

APPENDIX 'A'

MODULE/ UNIT ETC.	PIN	SERVICE	VOLTAGE/REMARKS
	9–11		Not allocated
Aerial Attenuator Unit	12	Muting Relay control line . . (external) Ditto . . (internal)	+12V derived from external source via ANCILLARIES connector. +12V with CAL button pressed
	14–17		Not allocated
Incremental Oscillator Unit	18	Oven supply	+22V under all conditions of switching
	19	Regulated supply to Inc. Osc. Board and Inc. Osc. Divider Board	+12V under all conditions of switching
	20–26		Not allocated
Tunable IF Module	21	Earth	
	22	TR15 & IC12 supply	+15V under all conditions of switching
	23	Control voltage to D19/24 & D19A/24A	Dependent on setting of INCREMENTAL TUNING CONTROL:– Fully clockwise : +15V Set to '100' : 5V
	24	Earth	
Relay Switching Boards (SSB Filter Assembly)	30	Supply to RLD	+12V with USB/LSB switch set to 'LSB'
	31 32	Filter input switching	
	33	Supply to RLE	+12V with USB/LSB SWITCH set to 'LSB'
	34 35	Filter output switching	
935kHz Loop Module	27	'HIGH-STAB' lamp	+12V (Derived from supply to Pin 28). Available only in 'HIGH-STAB' positions of HIGH-STAB/CONT TUNE SWITCH with Rec. tuned to 0.1MHz point on Ranges 1–4.

MODULE/ UNIT ETC.	PIN	SERVICE	VOLTAGE/REMARKS
935kHz Loop Module	28	Supply to TR9-11 & IC3-4	+12V. Available only on Ranges 1–4 with HIGH-STAB/CONT TUNE SWITCH in 'HIGH-STAB' positions.
	29	Supply to IC5	–6V under all conditions of switching
	31	Earth	
	32	Supply to IC5	+12V. Available only on Ranges 1–4 with HIGH-STAB/CONT TUNE SWITCH at 'CONT TUNE'.
	33	Supply to TR8	+12V under all conditions of switching
	34	AFC	(see Pin 6)
	36	AFC Adjuster (RV2)	Dependent on setting of RV2. Of the order +2V.
	37	Discriminator o/p	Earthed with HIGH-STAB/CONT TUNE SWITCH at 'CONT TUNE' and 'SET'.
	38–40		Not allocated
250kHz IF Module	41	Earth	
	42	Supply to TR20, 21 & 22	+12V except on Ranges 7, 9 & 10
	43	Supply to XL4 Oven	+12V under all conditions of operation
	44	Earth	
	45–50		Not allocated
100kHz IF Amplifier Module	48	IF AGC	Varies between 0V and –3V for full travel of IF GAIN CONTROL (with AGC 'OFF')
	49	Earth	
	51	Audio output	From AM Detector
	52	IF AGC	Output from IF AGC Rectifier
	53	Supply to TR23–31	+12V under all conditions of switching
	54	Earth	
	55	RF AGC	Output from RF AGC Rectifier (1.3V under no-signal conditions).

APPENDIX 'A'

MODULE/ UNIT ETC.	PIN	SERVICE	VOLTAGE/REMARKS
100kHz IF Filter Unit	56	Supply to TR3 or TR20 drain	+12V under all conditions of switching
	60		Not allocated
CW/SSB Detector & BFO Unit	57	Supply to TR32	Available with MODE SWITCH at 'CW/SSB' position only. (+12V)
	58	Earth	
	59	Audio output	From CW/SSB Detector
	61	Supply to TR33	+12V under all conditions of switching
	62	Earth	
	70		Not allocated
Audio Amplifier Module	63	600Ω output	
	64	600Ω centre-tap	
	65	600Ω output	
	66	Meter Rectifier o/p	Approximately –3V for 10mW noise on panel meter
	67	Audio input from RV6	
	68	Audio input from RV7	
	69	Supply to IC18 and TR35 (internal zener feeds TR34 & IC19)	+12V under all conditions of switching
	71	Audio output from IC18	
	72	Earth	
	73–75		Not allocated
Master Oscillator Unit	74	Supply to TR13	+12V. Available only with MODE SWITCH at 'SSB HIGH-STAB' position
	76	Earth	
	77	Supply to 1MHz Crystal Osc., IC6 and TR14	+12V under all conditions of switching
	78	Supply to oven	+12V under all conditions of switching

MODULE/ UNIT ETC.	PIN	SERVICE	VOLTAGE/REMARKS
	80–85		Not allocated
FSK Module	79	Earth	
	81	Discriminator o/p	Feed to meter circuit ('CZ' position)
	82	Supply to IC9 & IC10	–6V under all conditions of switching
	83	Supply to all FSK Stages	+12V. Available only with MODE SWITCH at 'CW/SSB' setting.
	84	FSK Relay contacts	
	86	FSK Relay contacts	
	87	FSK Relay contacts	
	88–96		Not allocated
S4	97	Supply to S4	+12V
	98	Supply via S4 to TR4 & TR5	+12V with S4 at 'NORMAL'
	99		Not allocated
Meter/ Regulator Board (Edge-connector SK/J)	P1	Earth	Earthing of meter circuit, RV2 & RV4
	P2	RV4 (IF Trim)	Alignment potentiometer for Tunable IF
	P3	RV2 (AFC Adjuster)	See Pin 36
	P4	RV12 (AF Calib Adj)	DC output from Meter Rectifier on 600Ω channel
	P5	RV12 (AF Calib Adj)	DC output from Meter Rectifier on 600Ω channel
	P6	RV10 (AF Zero Adj)	
	P7	RV9 (Cz Adj)	FSK Monitor
	P8	Supply to TR39	+15V under all conditions of switching
	P9	RV11 slider (RF Zero Adjuster)	+14V (nominal)
	P10	Drain of TR39	
	P11	Gate of TR39	Input from S12A
	P12	No connection	
	P13	IC15 input	+22V (nominal)
	P14	No connection	
	P15	Earth	Earthing of +12V Regulator (IC15)
	P16	IC15 output	+12V regulated
	P17	IC14 output	+5V regulated
	P18	No connection	
	P19	IC14 input	+12V (nominal)
	P20	Earth	Earthing of +5V Regulator (IC14)
	P21	IC14 inhibit control (TR50)	

VOLTAGE TABLE 2 – STAGE VOLTAGES

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

TRANSISTORS

TR12, TR16–TR19, TR36–TR38, TR42–TR49 : : References not allocated.

REF	EMITTER/ SOURCE	BASE/GATE/ GATE 1	GATE 2	COLLECTOR/ DRAIN	NOTES
TR1	0.75V*	0V	–	2.3V**	Note 1
TR2	2.3V**	1.7V†	–	13.5V	Note 1
TR3	0.55V*	0V	0.9V†	11.5V	Note 13
TR4	0.65V*	0V	–	11.5V	Note 2
TR5	4.85V**	3.2V†	–	11.55V	Note 2
TR6	1.3V*	0V	–	13.5V	Note 3
TR7	0.68V*	0V	0.62V*	14V	Note 3
TR8	2.1V**	0V	–	7.1V**	Note 3
TR9	0V	0.72V*	–	11.5V	Note 3
TR10	0.66V*	–2.55V†	–	10.25V	Note 3
TR11	0.66V*	1.36V*	–	0.85V	Note 3
TR13	0.3V*	1V*	–	11.4V	Note 5
TR14	1.4V*	2.1V	–	11.4V	Note 5
TR15	3V**	0V	0.7V†	11V	Note 6
TR20	0.55V*	0V	1V	11.5V	Note 16
TR21	5V**	4.3V**	7.5V	12V	Note 16
TR22	2.1V**	3V**	–	11.8V	Note 16
TR23	1.58V*	0V	–	10.9V	Note 8
TR24	1.38V*	0V	–	11.0V	Note 8
TR25	1.55V*	0V	–	11.0V	Note 8
TR26	1.58V*	0V	–	10.9V	
TR27	0V	0.73V*	–	10.2V	
TR28	1.54V*	0V	–	9.4V	
TR29	0V	0.75V*	–	8V	
TR30	1.56V*	0V	–	8.2V	
TR31	0V	0.75V*	–	7.4V	
TR32	0V	–5V†	–	12V	Note 9
TR33	0.6V*	0V	0.97V*	5.5V**	
TR34	4.1V**	3.2V**	–	0.8V*	
TR35	1.2V*	1.8V**	–	7.5V**	
TR39	1.7V*	0V	–	12.6V	Note 10

Voltages taken on 25V range except where indicated

(*) 2.5V range
(**) 10V range
(†) Electronic Voltmeter

REF	EMITTER/ SOURCE	BASE/GATE/ GATE 1	GATE 2	COLLECTOR/ DRAIN	NOTES
TR40	0.6V*	0V	–	6.2V**	Note 9
TR41	0.4V*	1V	–	–0.2V*	Note 9
TR50	0V	0V	–	9.4V**	
TR51	7.5V**	8.1V**	–	12.2V	
TR52	12.6V	13V	–	24V	
TR53	0.6V*	0V	–	9V**	
TR54–TR57	–	–	–	–	Note 19
TR58	1V*	1.6V	–	5.9V**	
TR59	5.3V**	5.9V**	–	11.1V	
TR60	1.4V*	2V**	–	10.6V	Note 17
TR61	0V	0.9V	–	4.50V**	
TR62	0V	0.7V*	–	3.7V**	
TR63	5V**	4.1V**	–	1.5V	Note 18
TR64	5V**	4.1V**	–	1.5V	Note 18

Voltages taken on 25V range except where indicated

(*) 2.5V range
(**) *10V range*
(†) Electronic Voltmeter

INTEGRATED CIRCUITS

Ref	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Notes
IC1	12V	8V	0V	6V	2.4V	2V	0V	6.3V	6.3V	8.2V	–	–	–	–	11
IC2	0.5V	3.2V	3.8V	15V	0V	0V	–.3V	0V	0V	–6V	–5.2V	–9.5V	0V	0V	3
IC3	0V	–6V	–6V	–6V	0V	1.5V	0V	1.5V	6V	0V	–	–	–	–	4
IC4	1.7V	1.7V	1.7V	1.7V	5.4V	0V	0V	0V	0V	5.4V	–	–	–	–	4
IC5	0V	0V	–6V	–4V	–3.7V	0V	0V	4V	8.4V	4.1V	–	–	–	–	12
IC6	3.1V	0V	0V	0V	5.8V	0V	0V	2V	2V	0V	1V	2.2V	0V	1V	–
IC8	1.7V	1.7V	1.7V	1.7V	5.4V	0V	0V	0V	0V	5.4V	–	–	–	–	9
IC9	0V	–6V	–6V	–6V	0V	1.5V	0V	1.5V	6V	0V	–	–	–	–	9
IC10	0V	–6V	–6V	–6V	0V	1.5V	0V	1.5V	6V	0V	–	–	–	–	9
IC12	0V	2.4V	2.4V	5.5V	5.5V	0V	2.3V	0V	–	–	–	–	–	–	–
IC14	–	4.7V	5V	5V	5V	7.2V	0V	–	–	8.1V	12.2V	12.2V	9.3V	–	–
IC15	–	11.5V	12V	12V	7V	7V	0V	–	–	13V	24V	24V	14.2V	–	1
IC16	–	–	–	–	–	–	0V	4V	–	1.2V	–	–	–	5.2V	16
IC17	4V	–	0V	–	5.2V	0V	–	–	–	0V	–	4V	–	–	16
IC18	0V	2.1V	0V	2.1V	2.1V	1V	9.1V	11.4V	12V	6V	–	–	–	–	17
IC19	0V	.8V	9.3V	4.5V	–	–	–	–	–	–	–	–	–	–	–

VOLTAGE TABLE 2 – NOTES

NOTE 1	Figures quoted are for all ranges except Ranges 7, 9 and 10. On these three ranges, voltages are modified as follows:– TR1 Drain : : 3.5V TR2 Source : : 3.5V Drain : : 5.5V
NOTE 2	NORMAL/SYNTH SWITCH set to 'NORMAL' position
NOTE 3	HIGH-STAB/CONT TUNE SWITCH in 'SET' position and receiver tuned to light the 'HIGH-STAB' legend
NOTE 4	Voltages present on Ranges 1–4 only, with HIGH-STAB/CONT TUNE SWITCH at 'SET' or 'OPERATE'
NOTE 5	MODE SWITCH set to 'SSB HIGH-STAB' position
NOTE 6	Drain voltage removed on Ranges 7, 9 and 10
NOTE 7	NORMAL/SLAVE SWITCH set to 'NORMAL' position
NOTE 8	MANUAL/AGC SWITCH at 'MANUAL' and IF GAIN at maximum setting
NOTE 9	MODE SWITCH at 'CW/SSB' position
NOTE 10	Readings recorded after setting meter adjustments for correct zero, RF position, etc.
NOTE 11	CALIBRATOR SWITCH pressed
NOTE 12	Check on Ranges 1–4 with HIGH-STAB/CONT TUNE SWITCH at 'CONT TUNE' setting
NOTE 13	NORMAL/SYNTH SWITCH set to 'NORMAL' position. Voltage on TR3 drain will be lower on Ranges 5–10 (fed from +12V in lieu of +15V line). Additional drop across R119 on Ranges 9 and 10 only.
NOTE 14	+12V removed from all 250kHz Stages when switched to Ranges 7, 9 and 10. Drain voltage remains on TR20
NOTE 15	Pin 501 Disconnected
NOTE 16	No Input
NOTE 17	With Pin 10 set to ½Vcc by RV26
NOTE 18	Counter set at 50·000 (no drive)
NOTE 19	Voltages dependent on setting of RV25

APPENDIX 'B'

SEMICONDUCTOR COMPLEMENT

Location Code

Each component in the Table which follows is allocated a reference letter which will assist in location. Coding is as follows:–

A : 1MHz Calibrator Board
B : Aerial Attenuator Unit
C : Not allocated
D : RF Assembly
E : 935kHz Loop Module
F : Master Osc. Unit
G : Tunable IF Module
H : Incremental Osc. Unit
I : 250kHz IF Module
J : 100kHz IF Filter Unit
K : 100kHz IF Amplifier
L : CW/SSB Detector & BFO
M : Audio Module
N : FSK Module
O : Power Unit Chassis
P : Meter/Regulator Board
Q : Panel Assembly
R : Drive Assembly
S : Back Plate
T : Main Chassis
U : Counter & Display Unit
V : Timebase & Control Unit
W : SSB Filter Assembly
X : Right Hand Side Plate

REF	TYPE	MANUFACTURER	CIRCUIT FUNCTION	LOC
TR1	UC734B	Solidev	Cascode RF Amplifier	D
TR2	3N128	RCA		D
TR3	40673	RCA	1st Signal Mixer	D
TR4	3N128	RCA	Main Tune Oscillator (OSC1)	D
TR5	UC734B	Solidev	Source Follower (MTO Buffer)	D
TR6	UC734B	Solidev	Harmonic Amplifier	D
TR7	40673	RCA	1st Loop Mixer	D
TR8	UC734B	Solidev	AFC Control Amplifier	E
TR9	2N4254	Texas	Emitter Follower	E
TR10	UC734B	Solidev	Schmitt Trigger (HIGH STAB Relay)	E
TR11	40309	RCA		E
TR12	–	–	Reference not allocated	–
TR13	BC107B	Mullard	100kHz Emitter Follower (Carrier Insertion)	F
TR14	2N4254	Texas	Emitter Follower (Harmonic Generator)	F
TR15	40673	RCA	2nd Signal Mixer	G
TR16-TR19	–	–	References not allocated	–
TR20	40673	RCA	3rd Signal Mixer	I
TR21	40673	RCA	350kHz Crystal Oscillator (OSC 3)	I
TR22	BC107B	Mullard	250kHz IF Amplifier	I
TR23	UC734B	Solidev	1st 100kHz IF Amplifier	K
TR24	UC734B	Solidev	2nd 100kHz IF Amplifier	K
TR25	UC734B	Solidev	3rd 100kHz IF Amplifier	K
TR26	UC734B	Solidev	4th 100kHz IF Amplifier	K
TR27	2N4254	Texas	Emitter Follower (100kHz)	K
TR28	UC734B	Solidev	RF AGC Amplifier	K
TR29	2N4254	Texas	Emitter Follower (RF AGC Rect. Driver)	K

REF	TYPE	MANUFACTURER	CIRCUIT FUNCTION	LOC
TR30	UC734B	Solidev	IF AGC Amplifier	K
TR31	2N4254	Texas	Emitter Follower (IF AGC Rect. Driver)	K
TR32	UC734B	Solidev	Beat Oscillator	L
TR33	40673	RCA	CW/SSB Detector	L
TR34	BCY71	Mullard	AF Amplifier (600Ω Line Pre-Amp)	M
TR35	BC107B	Mullard	AF Amplifier (Meter Rect. Driver)	M
TR36-TR38	–	–	References not allocated	–
TR39	UC734B	Solidev	Meter Control Amplifier	P
TR40	UC734B	Solidev	Source Follower (FSK Module)	N
TR41	BCY34	Mullard	DC Amplifier (FSK Module)	N
TR42-TR49	–	–	References not allocated	–
TR50	BC107B	Mullard	5V Regulator Inhibit Controller	P
TR51	2N3055	RCA	5V Regulator (Pass Transistor)	S
TR52	2N3055	RCA	12V Regulator (Pass Transistor)	S
TR53	BFR29	Mullard	Incremental Oscillator (OSC 2)	H
TR54	BC107B	Mullard	Inc. Osc. Oven Sensor	H
TR55	BC107B	Mullard	DC Amp (Oven Control)	H
TR56	2N3053	RCA	DC Amp (Oven Control)	H
TR57	2N3055	RCA	Inc. Osc. Oven Controller	H
TR58	2N4254	Texas	Inc. Osc. Amplifier	H
TR59	2N4254	Texas	Emitter Follower	H
TR60	BC107B	Mullard	550-650kHz Splitter Amplifier	H
TR61	2N4254	Texas	1MHz Amplifier (Timebase)	V
TR62	BC107B	Mullard	Inc. Osc. Amplifier (Counter)	U
TR63	BCY70	Mullard	LED Driver 1 (–100kHz)	U
TR64	BCY70	Mullard	LED Driver 2 (+100kHz)	U
PC1	8 x 1N4148	Newmarket	Input Protection (Diode Package)	B
D1-D10	–	–	References not allocated	–
D11	BA110	ITT	AFC VVC	D
D12	1S44	Texas	Bias Diode (MTO)	D
D13-D14	2 x 1S44	Texas	935kHz Discriminator	E
D14A	BZY88C10	Mullard	Zener Regulator	E
D15	1S44	Texas	High Stab Lamp Detector	E
D15A	1S44	Texas	935kHz Peak Clipper	E
D16	BZY88C5V1	Mullard	Zener Regulator	F
D17-D18	–	–	References not allocated	–
D19-D21 & D19A-D21A	6 x MV1656	Motorola	Tunable IF Filter VVC's	G
D22-D24 & D22A-D24A	6 x MV1656	Motorola	Injection Filter VVC's	G
D25-D30	–	–	References not allocated	–

APPENDIX 'B'

REF	TYPE	MANUFACTURER	CIRCUIT FUNCTION	LOC
D31	1N4004	ITT	12V Switch	R
D32	OA47	Mullard	AM Detector	K
D33	1S44	Texas	RF AGC Rectifier	K
D34	1S44	Texas	IF AGC Rectifier	K
D35	1S44	Texas	BFO Switch	L
D36	1S44	Texas	Carrier Insertion Switch	L
D37	OA47	Mullard	Meter Rectifier (600Ω O/P)	M
D37A	BZY88C9V1	Mullard	Zener Regulator	M
D38-D39	2 x 1S44	Texas	FSK Discriminator (100kHz)	N
D40	BZY88C6V2	Mullard	Zener Regulator	N
D41	BZY93C15	Mullard	Zener Regulator	O
D42	1S50 06A	Texas	Zener Regulator	O
D43	PL12BA	AEI	Bridge Rect.	X
D44	PL12BA	AEI	Bridge Rect.	X
D45	OSH01-A100	Mullard	Bridge Rect.	O
D46-D53	–	–	References not allocated	–
D54	1N4004	ITT	12V Switch	R
D55	5082-4850	H. Packard	Oven Supply Indicator (LED)	Q
D56	–	–	Reference not allocated	–
D57	–	–	Reference not allocated	–
D58	BZY88C9V1	Mullard	Zener Regulator	H
D59	BZY88C3V9	Mullard	Zener Regulator	H
D60	BZX91	Mullard	Zener Regulator	H
D61	BZY88C4V7	Mullard	Zener Regulator	H
D62	BZY88C5V1	Mullard	Peak Limiter	V
D63	BZY88C5V1	Mullard	Peak Limiter	U
D64	5082-4850	H. Packard	–100kHz Indicator (LED)	U
D65	5082-4850	H. Packard	+100kHz Indicator (LED)	U
IC1	CA3000/V1	RCA	1MHz Crystal Calibrator	A
IC2	SA21	Sylvania	MTO Amplifier	D
IC3	CA3002/V1	RCA	Loop Amplifier (935kHz)	E
IC4	CA3012/V1	RCA	Loop Limiter (935kHz)	E
IC5	CA3000/V1	RCA	935kHz Crystal Oscillator	E
IC6	SN6490	Texas	Decade Divider (1MHz/100kHz)	F
IC7	–	–	Reference not allocated	–
IC8	CA3012/V1	RCA	FSK Limiter (100kHz)	N
IC9	CA3002/V1	RCA	FSK Limiter	N
IC10	CA3002/V1	RCA	FSK Relay Driver	N
IC11	–	–	Reference not allocated	–
IC12	SL641C	Plessey	2nd Loop Mixer	G
IC13	–	–	Reference not allocated	–
IC14	723C	Fairchild	5V Regulator	P
IC15	723C	Fairchild	12V Regulator	P
IC16	SN5413	Texas	Shaper (Schmitt Trigger)	H
IC17	SN5490	Texas	Decade Divider (5.5-6.5MHz/ 550-650kHz)	H
IC18	SL414	Plessey	Main Audio Amplifier	M
IC19	MFC4000B	Motorola	Line Audio Amplifier	M

REF.	TYPE	MANUFACTURER	CIRCUIT FUNCTION	LOC
IC101	SN7413	Texas	1MHz Shaper (Schmitt Trigger)	V
IC102	SN7490	Texas	Decade Divider	V
IC103	SN7490	Texas	Decade Divider	V
IC104	SN7490	Texas	Decade Divider	V
IC105	SN7490	Texas	Decade Divider	V
IC106	SN7490	Texas	Decade Divider	V
IC107	SN7490	Texas	Decade Divider	V
IC108	SN7453	Texas	1Hz/10Hz Gate (AND-OR INVERT GATE)	V
IC109	SN7472	Texas	JK Bistable Divide-by-Two	V
IC110	SN74123	Texas	Delayed Pulse Generator (Dual Mono)	V
IC111	SN74123	Texas	Delayed Pulse Generator (Dual Mono)	V
IC201	SN7400	Texas	Counter Enable Gate (Quad NAND GATE)	U
IC202	SN7453	Texas	1Hz/10Hz Gate (AND-OR INVERT GATE)	U
IC203	SN74190	Texas	Presetable Reverse Decade Counter	U
IC204	SN74190	Texas	Presetable Reverse Decade Counter	U
IC205	SN74190	Texas	Presetable Reverse Decade Counter	U
IC206	SN74190	Texas	Presetable Reverse Decade Counter	U
IC207	SN74190	Texas	Presetable Reverse Decade Counter	U
IC208	SN74190	Texas	Presetable Reverse Decade Counter	U
IC209	SN7475	Texas	Latches 1, 2 & 3 (4 bit latch)	U
IC210	SN7400	Texas	9-0-1 Decoder and Blink Gates 1 & 2	U
IC301	5082-7300	H. Packard	LED Numeric Display Indicator	U
IC302	5082-7300	H. Packard	LED Numeric Display Indicator	U
IC303	5082-7300	H. Packard	LED Numeric Display Indicator	U
IC304	5082-7300	H. Packard	LED Numeric Display Indicator	U
IC305	5082-7300	H. Packard	LED Numeric Display Indicator	U

APPENDIX 'C'

LIST OF COMPONENT TYPES, TOLERANCES AND RATINGS

PART 1 : : MAIN RECEIVER
PART 2 : : TURRET DISKS (Page 141)

MAIN RECEIVER

Location Code

Each component in the Table which follows is allocated a reference letter which will assist in location. Coding is as follows:—

A : 1MHz Calibrator Board
B : Aerial Attenuator Unit
C : Not Allocated
D : RF Assembly
E : 935kHz Loop Module
F : Master Osc. Unit
G : Tunable IF Module
H : Incremental Osc. Unit
I : 250kHz IF Module
J : 100kHz IF Filter Unit
K : 100kHz IF Amplifier
L : CW/SSB Detector & BFO
M : Audio Module
N : FSK Module
O : Power Unit Chassis
P : Meter/Regulator Board
Q : Panel Assembly
R : Drive Assembly
S : Back Plate
T : Main Chassis
U : Counter & Display Unit
V : Timebase & Control Unit
W : SSB Filter Assembly
X : Right Hand Side Plate

Capacitors

Ref.	Value	Type	Tolerance	Wkg. V	Loc.
C1	0.1μF	Polycarbonate	20%	100V	A
C2-C7	—	References not allocated	—	—	—
C8	0.1μF	Polycarbonate	20%	100V	R
C9	0.1μF	Polycarbonate	20%	100V	R
C10	0.1μF	Polycarbonate	20%	100V	B
C11-C19	—	References not allocated	—	—	—
C20	10-70pF	Air-spaced variable	—	—	D
C21	10-70pF	Air-spaced variable	—	—	D
C22	10-70pF	Air-spaced variable	—	—	D
C23-C29	—	References not allocated	—	—	—
C30	12-358pF	Air-spaced variable	—	—	D
C31	12-358pF	Air-spaced variable	—	—	D
C32	60pF	Tubular Ceramic	10%	750V	D
C33	0.1μF	Polycarbonate	20%	100V	D
C34	0.1μF	Polycarbonate	20%	100V	D
C35	0.1μF	Polycarbonate	20%	100V	D
C36	0.1μF	Polycarbonate	20%	100V	D
C37	12-358pF	Air-spaced variable	—	—	D
C38	20pF	Tubular Ceramic	10%	750V	D
C39	0.1μF	Polycarbonate	20%	100V	D

Ref.	Value	Type	Tolerance	Wkg. V	Loc.
C40	0.1μF	Polycarbonate	20%	100V	D
C41	0.1μF	Polycarbonate	20%	100V	D
C42	0.1μF	Polycarbonate	20%	100V	D
C43	150pF	Silvered Mica	5%	350V	D
C44	6pF	Tubular Ceramic	10%	750V	D
C45	0.1μF	Polycarbonate	20%	100V	D
C46	18-364pF	Air-spaced variable	–	–	D
C47	100pF	Silvered Mica	5%	350V	D
C48	0.1μF	Polycarbonate	20%	100V	D
C49	0.1μF	Polycarbonate	20%	100V	D
C50	0.047μF	Polycarbonate	20%	100V	D
C51	100pF	Silvered Mica	5%	350V	D
C52	0.047μF	Polycarbonate	20%	100V	D
C53	0.1μF	Polycarbonate	20%	100V	D
C54	0.01μF	Metallised Paper	20%	200V	D
C55	0.1μF	Polycarbonate	20%	100V	D
C56	3pF	Tubular Ceramic	0.5pF	200V	D
C57	0.1μF	Polycarbonate	20%	100V	D
C58	0.047μF	Polycarbonate	20%	100V	D
C59	0.047μF	Polycarbonate	20%	100V	D
C60	12-358pF	Air-spaced variable	–	–	D
C61	20pF	Tubular Ceramic	10%	750V	D
C62	20pF	Tubular Ceramic	10%	750V	D
C63	0.047μF	Polycarbonate	20%	100V	D
C64	0.1μF	Polycarbonate	20%	100V	D
C65	12-358pF	Air-spaced variable	–	–	D
C66	20pF	Tubular Ceramic	10%	750V	D
C67	25pF	Tubular Ceramic	10%	750V	D
C68	50pF	Tubular Ceramic	10%	750V	D
C69	0.1μF	Polycarbonate	20%	100V	D
C70	0.001μF	Silvered Mica	5%	350V	D
C71	0.047μF	Polycarbonate	20%	100V	D
C72	0.047μF	Polycarbonate	20%	100V	D
C73	150pF	Silvered Mica	5%	350V	D
C74	0.1μF	Polycarbonate	20%	100V	D
C75-C76	–	References not allocated	–	–	–
C77	0.047μF	Polycarbonate	20%	100V	D
C78	6pF	Tubular Ceramic (N750)	10%	750V	D
C79	0.1μF	Polycarbonate	20%	100V	D
C80	0.001μF	Silvered Mica	5%	350V	E
C81	15pF	Tubular Ceramic	10%	100V	E
C82	0.001μF	Silvered Mica	5%	350V	E
C83	0.1μF	Polycarbonate	20%	100V	E
C84	0.1μF	Polycarbonate	20%	100V	E
C85	0.1μF	Polycarbonate	20%	100V	E
C86	0.0015μF	Tubular Ceramic	10%	750V	E
C87	0.001μF	Silvered Mica	5%	350V	E
C88	15pF	Tubular Ceramic	10%	100V	E
C89	0.001μF	Silvered Mica	5%	350V	E

APPENDIX 'C'

Ref.	Value	Type	Tolerance	Wkg. V	Loc.
C90	40pF	Tubular Ceramic	10%	750V	E
C91	22pF	Tubular Ceramic	10%	100V	E
C92	0.047μF	Polycarbonate	20%	100V	E
C93	0.001μF	Silvered Mica	5%	350V	E
C94	0.047μF	Polycarbonate	20%	100V	E
C95	0.047μF	Polycarbonate	20%	100V	E
C96	0.1μF	Polycarbonate	20%	100V	E
C97	0.001μF	Silvered Mica	5%	350V	E
C98	100pF	Silvered Mica	5%	350V	E
C99	0.001μF	Silvered Mica	5%	350V	E
C100	0.01μF	Polycarbonate	20%	100V	E
C101	0.1μF	Polycarbonate	20%	100V	E
C102	0.1μF	Polycarbonate	20%	100V	E
C103	8.2pF	Tubular Ceramic	10%	100V	E
C104	0.1μF	Polycarbonate	20%	100V	E
C105	0.001μF	Silvered Mica	5%	350V	E
C106	0.001μF	Tubular Ceramic	10%	750V	E
C107	0.1μF	Polycarbonate	20%	100V	E
C108	0.1μF	Polycarbonate	20%	100V	E
C109	—	Reference not allocated	—	—	—
C110	0.1μF	Polycarbonate	20%	100V	F
C111	0.01μF	Polycarbonate	20%	100V	F
C112	0.1μF	Polycarbonate	20%	100V	F
C113	0.1μF	Polycarbonate	20%	100V	F
C114	0.01μF	Polycarbonate	20%	100V	F
C115	0.047μF	Polycarbonate	20%	100V	F
C116	0.01μF	Polycarbonate	20%	100V	F
C117	0.01μF	Polycarbonate	20%	100V	F
C118	0.002μF	Silvered Mica	5%	350V	F
C119	0.001μF	Disk Ceramic	20%	500V	F
C120	0.1μF	Polycarbonate	20%	100V	F
C121	0.1μF	Polycarbonate	20%	100V	F
C122	0.01μF	Polycarbonate	20%	100V	F
C123-C127	—	References not allocated	—	—	—
C128	390pF	Silvered Mica	5%	350V	F
C129	47pF	Tubular Ceramic	10%	750V	F
C130	0.047μF	Polycarbonate	20%	100V	F
C131	0.001μF	Disk Ceramic	20%	500V	F
C132	0.047μF	Polycarbonate	20%	100V	F
C133-C137	—	References not allocated	—	—	—
C138	0.01μF	Polycarbonate	20%	100V	T
C139	0.01μF	Polycarbonate	20%	100V	T
C140	10μF	Tubular Electrolytic	+50% -10%	16V	G
C141	110pF	Silvered Mica	5%	350V	G
C142	0.047μF	Polycarbonate	20%	100V	G
C143	2pF	Tubular Ceramic	0.25pF	750V	G
C144	0.001μF	Disk Ceramic	20%	500V	G
C145	110pF	Silvered Mica	5%	350V	G
C146	2pF	Tubular Ceramic	0.25pF	750V	G
C147	—	Reference not allocated	—	—	—
C148	110pF	Silvered Mica	5%	350V	G

Ref.	Value	Type	Tolerance	Wkg. V	Loc.
C149	0.1μF	Polycarbonate	20%	100V	G
C150	–	Reference not allocated	–	–	–
C151	0.047μF	Polycarbonate	20%	100V	G
C152	0.1μF	Polycarbonate	20%	100V	G
C153	0.047μF	Polycarbonate	20%	100V	G
C154	10-40pF	Disk Ceramic Trimmer	–	–	G
C155*	100pF	Polystyrene	5%	125V	G
C155A	250pF	Polystyrene	5%	125V	G
C156	0.1μF	Polycarbonate	20%	100V	G
C157*	680pF	Polystyrene	2%	125V	G
C158	0.1μF	Polycarbonate	20%	100V	G
C159	150pF	Silvered Mica	5%	350V	G
C160	6pF	Tubular Ceramic	10%	750V	G
C161	0.001μF	Disk Ceramic	20%	500V	G
C162	150pF	Silvered Mica	5%	350V	G
C163	6pF	Tubular Ceramic	10%	750V	G
C164	–	Reference not allocated	–	–	–
C165	0.1μF	Polycarbonate	20%	100V	G
C166	150pF	Silvered Mica	5%	350V	G
C167	–	Reference not allocated	–	–	–
C168	0.047μF	Polycarbonate	20%	100V	G
C169	–	Reference not allocated	–	–	–
C170-C179	–	References not allocated	–	–	–
C180-C189	–	References not allocated	–	–	–
C190	10μF	Tantalum	20%	20V	I
C191	0.0012μF	Polystyrene	2%	63V	I
C192	0.1μF	Polycarbonate	20%	100V	I
C193	0.1μF	Polycarbonate	20%	100V	I
C194	10μF	Tantalum	20%	20V	I
C195	0.002μF	Polystyrene	2%	63V	I
C196	10μF	Tantalum	20%	20V	I
C197	0.1μF	Polycarbonate	20%	100V	I
C198	0.001μF	Disk Ceramic	20%	500V	I
C199	0.1μF	Polycarbonate	20%	100V	I
C200	0.1μF	Polycarbonate	20%	100V	I
C201	0.1μF	Polycarbonate	20%	100V	I
C202	10μF	Tantalum	20%	20V	I
C203	25/30pF	Combination of Silvered	–	–	I
C204		Mica and Ceramic	–	–	I
C205	3-14.5pF		–	–	I
C206	0.1μF	Polycarbonate	20%	100V	I
C207	390pF	Silvered Mica	5%	350V	I
C208	0.0012μF	Silvered Mica	5%	350V	I
C209	0.001μF	Disk Ceramic	20%	500V	I
C210	330pF	Polystyrene	2%	63V	I
C211	0.1μF	Polycarbonate	20%	100V	I
C212	0.001μF	Disk Ceramic	20%	500V	I
C213	0.1μF	Polycarbonate	20%	100V	W
C214	0.1μF	Polycarbonate	20%	100V	W

*Adjusted on test

APPENDIX 'C'

Ref.	Value	Type	Tolerance	Wkg. V	Loc.
C215	0.1μF	Polycarbonate	20%	100V	W
C216	0.1μF	Polycarbonate	20%	100V	W
C217	350pF	Silvered Mica	5%	350V	J
C218	250pF	Silvered Mica	5%	350V	J
C219	0.047μF	Polycarbonate	20%	100V	R
C220	0.047μF	Polycarbonate	20%	100V	J
C221	70pF	Tubular Ceramic	10%	750V	J
C222	300pF	Silvered Mica	5%	350V	J
C223	0.0044μF	Polystyrene	2%	30V	J
C224	400pF	Silvered Mica	5%	350V	J
C225	0.1μF	Polycarbonate	20%	100V	J
C226	15pF	Tubular Ceramic	10%	750V	J
C227	370pF	Silvered Mica	5%	350V	J
C228	300pF	Silvered Mica	5%	350V	J
C229	70pF	Tubular Ceramic	10%	750V	J
C230	30pF	Tubular Ceramic	10%	750V	J
C231	0.0044μF	Polystyrene	2%	30V	J
C232	400pF	Silvered Mica	5%	350V	J
C233	350pF	Silvered Mica	5%	350V	J
C234	15pF	Tubular Ceramic	10%	750V	J
C235	250pF	Silvered Mica	5%	350V	J
C236	70pF	Tubular Ceramic	10%	750V	J
C237	300pF	Silvered Mica	5%	350V	J
C238	30pF	Tubular Ceramic	10%	750V	J
C239	0.0044μF	Polystyrene	2%	30V	J
C240	400pF	Silvered Mica	5%	350V	J
C241	390pF	Silvered Mica	5%	350V	J
C242	15pF	Tubular Ceramic	10%	750V	J
C243	100pF	Silvered Mica	5%	350V	J
C244	300pF	Silvered Mica	5%	350V	J
C245	20pF	Tubular Ceramic	10%	750V	J
C246	0.0044μF	Polystyrene	2%	30V	J
C247	400pF	Silvered Mica	5%	350V	J
C248	370pF	Silvered Mica	5%	350V	J
C249	15pF	Tubular Ceramic	10%	750V	J
C250	250pF	Silvered Mica	5%	350V	J
C251	30pF	Tubular Ceramic	10%	750V	J
C252	0.0044μF	Polystyrene	2%	30V	J
C253	400pF	Silvered Mica	5%	350V	J
C254	350pF	Silvered Mica	5%	350V	J
C255	10pF	Tubular Ceramic	10%	750V	J
C256	12pF	Tubular Ceramic	10%	750V	J
C257	250pF	Silvered Mica	5%	350V	J
C258	50pF	Tubular Ceramic	10%	750V	J
C259	300pF	Silvered Mica	5%	350V	J
C260	0.001μF	Disk Ceramic	20%	500V	K
C261	0.1μF	Polycarbonate	20%	100V	K
C262	0.047μF	Polycarbonate	20%	100V	K
C263	0.1μF	Polycarbonate	20%	100V	K
C264	0.1μF	Polycarbonate	20%	100V	K
C265	0.001μF	Disk Ceramic	20%	500V	K

Ref.	Value	Type	Tolerance	Wkg. V	Loc.
C266	0.047μF	Polycarbonate	20%	100V	K
C267	0.1μF	Polycarbonate	20%	100V	K
C268	0.1μF	Polycarbonate	20%	100V	K
C269	0.001μF	Disk Ceramic	20%	500V	K
C270	0.047μF	Polycarbonate	20%	100V	K
C271	0.1μF	Polycarbonate	20%	100V	K
C272	0.001μF	Disk Ceramic	20%	500V	K
C273	540pF	Silvered Mica	5%	350V	K
C274	0.047μF	Polycarbonate	20%	100V	K
C275	0.1μF	Polycarbonate	20%	100V	K
C276	0.001μF	Disk Ceramic	20%	500V	K
C277	0.1μF	Polycarbonate	20%	100V	K
C278	0.1μF	Polycarbonate	20%	100V	K
C279	0.002μF	Silvered Mica	5%	350V	K
C280	0.001μF	Disk Ceramic	20%	500V	K
C281	0.001μF	Disk Ceramic	20%	500V	K
C282	100pF	Silvered Mica	5%	350V	K
C283	0.1μF	Polycarbonate	20%	100V	K
C284	0.001μF	Disk Ceramic	20%	500V	K
C285	0.1μF	Polycarbonate	20%	100V	K
C286	0.002μF	Silvered Mica	5%	350V	K
C287	0.001μF	Disk Ceramic	20%	500V	K
C288	10μF	Tubular Electrolytic	+50% -10%	16V	K
C289	0.1μF	Polycarbonate	20%	100V	K
C290	0.1μF	Polycarbonate	20%	100V	K
C291	0.1μF	Polycarbonate	20%	100V	K
C292	0.001μF	Tubular Ceramic	20%	750V	K
C293	0.047μF	Polycarbonate	20%	100V	K
C294	0.001μF	Disk Ceramic	20%	500V	K
C295	0.1μF	Polycarbonate	20%	100V	K
C296	0.1μF	Polycarbonate	20%	100V	K
C297	0.1μF	Polycarbonate	20%	100V	K
C298	0.001μF	Disk Ceramic	20%	500V	K
C299	0.002μF	Silvered Mica	5%	350V	K
C300	10μF	Tubular Electrolytic	+50% -10%	16V	K
*C301	125μF	Tubular Electrolytic	+50% -10%	16V	P
C302	10μF	Tantalum	20%	20V	P
C303	0.001μF	Disk Ceramic	20%	500V	P
*C304	125μF	Tubular Electrolytic	+50% -10%	16V	P
C305	10μF	Tantalum	20%	20V	P
C306	0.001μF	Disk Ceramic	20%	500V	P
C308	10μF	Tantalum	20%	35V	Q
C309	1μF	Tantalum	20%	35V	Q
C310	8.5-126.5pF	Air-spaced variable	—	—	L
C311	8.5-126.5pF	Air-spaced variable	—	—	L
C312	790pF	Silvered Mica	5%	350V	L
C313	47pF	Silvered Mica	5%	350V	L
C314	0.005μF	Metallised Paper	20%	250V	L
C315	0.1μF	Polycarbonate	20%	100V	L
C316	0.1μF	Polycarbonate	20%	100V	L
C317	0.1μF	Polycarbonate	20%	100V	L

N.B: C307 : Reference not allocated

(*) May be 150μF

Ref.	Value	Type	Tolerance	Wkg. V	Loc.
C318	0.001μF	Tubular Ceramic	10%	750V	L
C319	10μF	Tubular Electrolytic	+50% -10%	16V	L
C320	0.1μF	Polycarbonate	20%	100V	L
C321	0.005μF	Metallised Paper	20%	250V	L
C322	0.001μF	Disk Ceramic	20%	500V	L
C323	0.001μF	Disk Ceramic	20%	500V	L
C324	10μF	Tubular Electrolytic	+50% -10%	16V	L
C325-329	–	References not allocated	–	–	–
C330	0.01μF	Polycarbonate	20%	100V	M
C331	0.0022μF	Polystyrene	5%	63V	M
C332	0.1μF	Polycarbonate	20%	100V	M
C333	680pF	Polystyrene	5%	63V	M
C334	22μF	Tantalum	20%	16V	M
C335	100μF	Tubular Electrolytic	+50% -10%	16V	M
C336	0.047μF	Polycarbonate	20%	100V	M
C337	0.1μF	Polycarbonate	20%	100V	M
C338	1000μF	Tubular Electrolytic	+50% -10%	16V	M
C339	1000μF	Tubular Electrolytic	+50% -10%	16V	M
C340	68μF	Tantalum	20%	20V	M
C341	10μF	Tantalum	20%	20V	M
C342	0.01μF	Polycarbonate	20%	100V	M
C343	10μF	Tantalum	20%	20V	M
C343A	0.001μF	Disk Ceramic	20%	500V	M
C344	100μF	Tubular Electrolytic	+50% -10%	16V	M
C345	1μF	Tantalum	20%	35V	M
C346	1μF	Tantalum	20%	35V	M
C347	4.7μF	Tantalum	20%	25V	M
C348	100μF	Tubular Electrolytic	+50% -10%	16V	M
C349	0.1μF	Polycarbonate	20%	100V	P
C350	80μF	Tubular Electrolytic	+50% -10%	25V	N
C351	0.047μF	Polycarbonate	20%	100V	N
C352	0.1μF	Polycarbonate	20%	100V	N
C353	0.1μF	Polycarbonate	20%	100V	N
C354	0.1μF	Polycarbonate	20%	100V	N
C355	0.01μF	Polystyrene	1%	125V	N
C356	0.001μF	Silvered Mica	5%	350V	N
C357	0.0047μF	Polystyrene	1%	125V	N
C358	0.001μF	Disk Ceramic	20%	500V	N
C359	0.047μF	Polycarbonate	20%	100V	N
C360	0.047μF	Polycarbonate	20%	100V	N
C361	0.1μF	Polycarbonate	20%	100V	N
C362	0.1μF	Polycarbonate	20%	100V	N
C363	0.1μF	Polycarbonate	20%	100V	N
C364	0.1μF	Polycarbonate	20%	100V	N
C365	0.1μF	Polycarbonate	20%	100V	N
C366-367	–	References not allocated	–	–	–
C368	0.1μF	Polycarbonate	20%	100V	T
C369	0.1μF	Polycarbonate	20%	100V	T
C370	7,500μF	Tubular Electrolytic	+50% -10%	25V	O
C371	7,500μF	Tubular Electrolytic	+50% -10%	25V	O
C372	10,000μF	Tubular Electrolytic	+50% -10%	16V	O

Ref.	Value	Type	Tolerance	Wkg. V	Loc.
*C373	2,200μF	Tubular Electrolytic	+50% -10%	25V	O
*C374	2,200μF	Tubular Electrolytic	+50% -10%	25V	O
C375	0.005μF	Disk Ceramic	+80% -20%	3,000V	O
C376	0.047μF	Paper	10%	400V	S
C377	0.047μF	Paper	10%	400V	S
C378-379	–	References not allocated	–	–	–
C380-497	–	References allocated to Turret Disks (see page 141)	–	–	–
C498-499	–	References not allocated	–	–	–
C500	6-62pF	Air-spaced variable	–	–	H
C501	4-29pF	Air-spaced Trimmer	–	–	H
C502 }	Total 90pF	Combination of Silvered	–	–	H
C503 }		Mica and Ceramic	–	–	H
C504	0.001μF	Silvered Mica	5%	350V	H
C505	0.01μF	Polycarbonate	20%	100V	H
C506	–	Reference not allocated	–	–	–
C507	–	Reference not allocated	–	–	–
C508	–	Reference not allocated	–	–	–
C509	0.001μF	Silvered Mica	5%	350V	H
C510	0.001μF	Disk Ceramic	20%	500V	H
C511	0.1μF	Polycarbonate	20%	100V	H
C512	0.01μF	Disk Ceramic	+80% -20%	25V	H
C513	0.001μF	Disk Ceramic	20%	500V	H
C514	0.001μF	Disk Ceramic	20%	500V	H
C515	0.001μF	Disk Ceramic	20%	500V	H
C516	0.01μF	Disk Ceramic	+80% -20%	25V	H
C517	0.01μF	Disk Ceramic	+80% -20%	25V	H
C517A	0.01μF	Disk Ceramic	+80% -20%	25V	H
C518	220pF	Polystyrene	5%	63V	H
C519	330pF	Polystyrene	5%	63V	H
C520	82pF	Polystyrene	5%	63V	H
C521	0.01μF	Disk Ceramic	+80% -20%	25V	H
C522	0.01μF	Disk Ceramic	+80% -20%	25V	H
C523	0.01μF	Disk Ceramic	+80% -20%	25V	H
C524	220pF	Polystyrene	5%	63V	H
C525	0.001μF	Silvered Mica	5%	350V	H
C526	0.047μF	Polycarbonate	20%	100V	H
C527	0.01μF	Polycarbonate	20%	100V	H
C528	0.47μF	Polycarbonate	20%	100V	H
C529	0.68μF	Polycarbonate	20%	100V	H
C530-C549	–	References not allocated	–	–	–
C550	10μF	Tantalum	20%	20V	V
C551	0.001μF	Disk Ceramic	20%	500V	V
C552	0.001μF	Disk Ceramic	20%	500V	V
C553	22μF	Tantalum	20%	25V	V
C554	0.1μF	Polycarbonate	20%	100V	V
C555	0.1μF	Polycarbonate	20%	100V	V
C556	0.1μF	Polycarbonate	20%	100V	V
C557	0.1μF	Polycarbonate	20%	100V	V

(*) May be 3,300μF

APPENDIX 'C'

Ref.	Value	Type	Tolerance	Wkg. V	Loc.
C558	0.01μF	Disk Ceramic	+80% -20%	25V	V
C559	0.68μF	Tantalum	20%	35V	V
C560	0.68μF	Tantalum	20%	35V	V
C561-569	–	References not allocated	–	–	–
C570	0.001μF	Disk Ceramic	20%	500V	U
C571	10μF	Tantalum	20%	20V	U
C572	0.001μF	Disk Ceramic	20%	500V	U
C573	0.68pF	Tantalum	20%	35V	U
C574	0.68μF	Tantalum	20%	35V	U
C575	22μF	Tantalum	20%	20V	U
C576	0.01μF	Disk Ceramic	+80% -20%	25V	U
C577	22μF	Tantalum	20%	20V	U
C578	0.01μF	Disk Ceramic	+80% -20%	25V	U

Resistors

Ref.	Value	Tol.	Rtg.	Loc.
R1	1,000Ω	5%	0.3W	A
R2	1,000Ω	5%	0.3W	A
R3	1,500Ω	5%	0.3W	A
R4	1,800Ω	5%	0.3W	A
R5- R9	Not allocated	–	–	–
R10	1,000Ω	5%	0.5W	S
R11	68Ω	5%	0.3W	B
R12	68Ω	5%	0.3W	B
R13	18Ω	5%	0.3W	B
R14	68Ω	5%	0.3W	B
R15	68Ω	5%	0.3W	B
R16	18Ω	5%	0.3W	B
R17- R19	Not allocated	–	–	–
R20- R29	Not allocated	–	–	–
R30- R39	Not allocated	–	–	–
R40	1.8MΩ	10%	0.05W	D
R41	270Ω	5%	0.3W	D
R42	0.1MΩ	5%	0.3W	D
R43	22Ω	5%	0.3W	D
R44	180Ω	5%	0.3W	D
R45	1MΩ	5%	0.3W	D
R46	33,000Ω	5%	0.3W	D
R47	270Ω	5%	0.3W	D
R48	0.47MΩ	5%	0.3W	D
R49	4,700Ω	5%	0.3W	D

Ref.	Value	Tol.	Rtg.	Loc.
R50	22Ω	5%	0.3W	D
R51	220Ω	5%	0.3W	D
R52	22Ω	5%	0.3W	D
R53	0.22MΩ	5%	0.3W	D
R54	0.22MΩ	5%	0.3W	D
R55	0.1MΩ	5%	0.3W	D
R56	330Ω	5%	0.3W	D
R57	0.22MΩ	5%	0.3W	D
R58	100Ω	5%	0.3W	D
R59	270Ω	5%	0.3W	D
R60	820Ω	5%	0.3W	D
R61	0.1MΩ	5%	0.3W	D
R62	330Ω	5%	0.3W	D
R63	22Ω	5%	0.3W	D
R64	220Ω	5%	0.3W	D
R65	0.1MΩ	5%	0.3W	D
R66	470Ω	5%	0.3W	D
R67	470 ohms	5%	0.3W	D
R68	10,000Ω	5%	0.3W	D
R69	150Ω	5%	0.3W	D
R70	22Ω	5%	0.3W	D
R71- R78	Not allocated	–	–	–
R79	47Ω	5%	0.3W	D
R80	220Ω	5%	0.3W	E
R81	47,000Ω	5%	0.3W	E
R82	47,000Ω	5%	0.3W	E
R83	0.1MΩ	5%	0.3W	E
R84	1,800Ω	5%	0.3W	E

Ref.	Value	Tol.	Rtg.	Loc.
R84A	33Ω	5%	0.3W	E
R85	4,700Ω	5%	0.3W	E
R86	1,200Ω	5%	0.3W	E
R87	1,000Ω	5%	0.3W	E
R88	1,000Ω	5%	0.3W	E
R89	100Ω	5%	0.3W	E
R90	68,000Ω	5%	0.3W	E
R91	0.12MΩ	5%	0.3W	E
R92	68,000Ω	5%	0.3W	E
R93	3,900Ω	5%	0.3W	E
R94	22,000Ω	5%	0.3W	E
R95	22Ω	5%	0.3W	E
R96-R98	Not allocated	–	–	–
R99	150Ω	10%	0.5W	R
R100-R103	Not allocated	–	–	–
R104	100Ω W.W.	5%	6W	F
R105	10,000Ω	5%	0.3W	F
R106	3,300Ω	5%	0.3W	F
R107	0.22MΩ	5%	0.3W	F
R108	0.12MΩ	5%	0.3W	F
R109	150Ω	5%	0.3W	F
R110	150Ω	5%	0.3W	F
R111	47,000Ω	5%	0.3W	F
R112	3,900Ω	5%	0.3W	F
R113	330Ω	5%	0.3W	F
R114	100Ω	5%	0.3W	F
R115-R118	Not allocated	–	–	–
R119*	680Ω	5%	0.3W	R
R120	220Ω	5%	0.3W	G
R120A	0.27MΩ	5%	0.3W	G
R121	0.39MΩ	5%	0.3W	G
R122	0.39MΩ	5%	0.3W	G
R123	0.39MΩ	5%	0.3W	G
R124	0.47MΩ	5%	0.3W	G
R125	47,000Ω	5%	0.3W	G
R126	0.68MΩ	5%	0.3W	G
R127	2,700Ω	5%	0.3W	G
R128	470Ω	5%	0.3W	G
R129	220Ω	5%	0.3W	G
R130	680Ω	5%	0.3W	G
R131-R133	Not allocated	–	–	–
R134	0.39MΩ	5%	0.3W	G
R134A	0.27MΩ	5%	0.3W	G
R135	0.39MΩ	5%	0.3W	G
R136	0.39MΩ	5%	0.3W	G
R137	10,000Ω	5%	0.3W	G
R138	10,000Ω	5%	0.3W	G

(*) Subject to adjustment on test

Ref.	Value	Tol.	Rtg.	Loc.
R139	4,700Ω	5%	0.3W	R
R140-R149	Not allocated	–	–	–
R150-R159	Not allocated	–	–	–
R160	220Ω	5%	0.3W	I
R161	2,200Ω	5%	0.3W	I
R162	1,000Ω	5%	0.3W	I
R163	1,000Ω	5%	0.3W	I
R164	39,000Ω	5%	0.3W	I
R164A	22,000Ω	5%	0.3W	I
R165	220Ω	5%	0.3W	I
R166	1,200Ω	5%	0.3W	I
R167	150Ω	5%	0.3W	I
R167A	1,000Ω	5%	0.3W	I
R168	1,000Ω	5%	0.3W	I
R168A	39,000Ω	5%	0.3W	I
R169	12,000Ω	5%	0.3W	I
R170	10,000Ω	5%	0.3W	I
R170A	1,000Ω	5%	0.3W	I
R171	56,000Ω	5%	0.3W	I
R172	39,000Ω	5%	0.3W	I
R172A	22,000Ω	5%	0.3W	I
R173	3,300Ω	5%	0.3W	I
R174	5,600Ω	5%	0.3W	I
R175	22Ω	5%	0.3W	I
R176	1,200Ω	5%	0.3W	I
R177	12,000Ω	5%	0.3W	I
R178	22Ω	5%	0.3W	I
R179	Not allocated	–	–	–
R180	82,000Ω	5%	0.3W	J
R181	22,000Ω	5%	0.3W	J
R182	220Ω	5%	0.3W	J
R183	82,000Ω	5%	0.3W	J
R184	10,000Ω	5%	0.3W	J
R185	82,000Ω	5%	0.3W	J
R186	10,000Ω	5%	0.3W	J
R187	Not allocated	–	–	–
R188	22,000Ω	5%	0.3W	J
R189	82,000Ω	5%	0.3W	J
R190	10,000Ω	5%	0.3W	J
R191-R193	Not allocated	–	–	–
R194	33Ω	5%	0.3W	W
R195	33Ω	5%	0.3W	W
R196	1,000Ω	5%	0.3W	W
R197	1,000Ω	5%	0.3W	W
R198	1,000Ω	5%	0.3W	W
R199	1,000Ω	5%	0.3W	W

Ref.	Value	Tol.	Rtg.	Loc.
R200	0.27MΩ	5%	0.3W	K
R201	1,000Ω	5%	0.3W	K
R202	5,600Ω	5%	0.3W	K
R203	330Ω	5%	0.3W	K
R204	0.27MΩ	5%	0.3W	K
R205	1,000Ω	5%	0.3W	K
R206	1,200Ω	5%	0.3W	K
R207	330Ω	5%	0.3W	K
R208	0,27MΩ	5%	0.3W	K
R209	1,000Ω	5%	0.3W	K
R210	5,600Ω	5%	0.3W	K
R211	330Ω	5%	0.3W	K
R212	0.1MΩ	5%	0.3W	K
R213	1,000Ω	5%	0.3W	K
R214	8,200Ω	5%	0.3W	K
R215	330Ω	5%	0.3W	K
R216	47,000Ω	5%	0.3W	K
R217	22,000Ω	5%	0.3W	K
R218	100Ω	5%	0.3W	K
R219	22,000Ω	5%	0.3W	K
R220	33,000Ω	5%	0.3W	K
R221	47Ω	5%	0.3W	K
R222	270Ω	5%	0.3W	K
R223	0.47MΩ	5%	0.3W	K
R224	Not allocated	–	–	–
R225	1,000Ω	5%	0.3W	K
R226	47,000Ω	5%	0.3W	K
R227	22,000Ω	5%	0.3W	K
R228	100Ω	5%	0.3W	K
R229	0.27MΩ	5%	0.3W	K
R230	10,000Ω	5%	0.3W	K
R231	2,200Ω	5%	0.3W	K
R232	47,000Ω	5%	0.3W	K
R233	0.27MΩ	5%	0.3W	K
R234	1,000Ω	5%	0.3W	K
R235	1,500Ω	5%	0.3W	K
R236	47,000Ω	5%	0.3W	K
R237	22,000Ω	5%	0.3W	K
R238	100Ω	5%	0.3W	K
R239	10,000Ω	5%	0.3W	K
R240	3,300Ω	5%	0.3W	K
R241	1MΩ	5%	0.3W	K
R242	22,000Ω	5%	0.3W	K
R243	330Ω	5%	0.3W	K
R244	150Ω	5%	0.3W	K
R245-R247	Not allocated	–	–	–
R248	47,000Ω	5%	0.3W	Q
R249	0.1MΩ	5%	0.3W	Q
R250	Not allocated	–	–	–
R251	0.27MΩ	5%	0.3W	L

Ref.	Value	Tol.	Rtg.	Loc.
R252	10,000Ω	5%	0.3W	L
R253*	2,200Ω	5%	0.3W	L
R254	2,200Ω	5%	0.3W	L
R255	6,800Ω	5%	0.3W	L
R256	22,000Ω	5%	0.3W	L
R257	2,200Ω	5%	0.3W	L
R258	1,000Ω	5%	0.3W	L
R259*	4,700Ω	5%	0.3W	L
R260	Not allocated	–	–	–
R261	33,000Ω	5%	0.3W	L
R262*	1,800Ω	5%	0.3W	L
R263	100Ω	5%	0.3W	L
R264-R269	Not allocated	–	–	–
R270	39,000Ω	5%	0.3W	M
R271	8,200Ω	5%	0.3W	M
R272	1MΩ	5%	0.3W	M
R273	0.22MΩ	5%	0.3W	M
R274	22Ω	5%	0.3W	M
R275	22Ω	5%	0.3W	M
R276	100Ω	5%	0.3W	M
R277	0.18MΩ	5%	0.3W	M
R278	0.1MΩ	5%	0.3W	M
R279	220Ω	5%	0.3W	M
R280	10,000Ω	5%	0.3W	M
R281	1,000Ω	5%	0.3W	M
R282	22,000Ω	5%	0.3W	M
R283	3,900Ω	5%	0.3W	M
R284	1,200Ω	5%	0.3W	M
R285	330Ω	5%	0.3W	M
R286	10,000Ω	5%	0.3W	M
R287	0.1MΩ	5%	0.3W	M
R288-R289	Not allocated	–	–	–
R290-R298	Not allocated	–	–	–
R299	12Ω	10%	0.5W	Q
R300	3,300Ω	5%	0.3W	Q
R301	1MΩ	5%	0.3W	P
R302	1,000Ω	5%	0.3W	P
R303	1,000Ω	5%	0.3W	Q
R304	100Ω	5%	0.3W	P
R305	560Ω	5%	0.3W	P
R306	8,200Ω	5%	0.3W	P
R307	0,33MΩ	5%	0.3W	P
R308	Not allocated	–	–	–
R309	2.2MΩ	10%	0.05W	Q
R310	100Ω	5%	0.5W	N
R311	68Ω	5%	0.3W	N
R312	68Ω	5%	0.3W	N

(*) Value may be adjusted on test

Ref.	Value	Tol.	Rtg.	Loc.
R313	33,000Ω	5%	0.3W	N
R314	33,000Ω	5%	0.3W	N
R315	33,000Ω	5%	0.3W	N
R316	0.47MΩ	5%	0.3W	N
R317	2,200Ω	5%	0.3W	N
R318	15,000Ω	5%	0.3W	N
R319	1,000Ω	5%	0.3W	N
R320	1,200Ω	5%	0.3W	N
R321	4,700Ω	5%	0.3W	N
R322	6,800Ω	5%	0.3W	N
R323	6,800Ω	5%	0.3W	N
R324	4,700Ω	5%	0.3W	N
R325	10,000Ω	5%	0.3W	N
R326	10,000Ω	5%	0.3W	N
R327-R328	Not allocated	–	–	–
R329	1,800Ω	5%	12W	T
R331	68Ω w.w.	5%	6W	O
R332	100Ω w.w.	5%	6W	O
R333	1.2Ω w.w.	10%	1W	Q
R334-R335	Not allocated	–	–	–
R336	3,300Ω	5%	0.3W	Q
R337	680Ω	5%	0.3W	Q
R338	0.68Ω w.w.	5%	10W	S
R339	2.2Ω w.w.	5%	10W	S
R340	2,200Ω	5%	0.3W	P
R341	3,300Ω	5%	0.3W	P
R342	560Ω	5%	0.3W	P
R343	6,800Ω	5%	0.3W	P
R344	1,800Ω	5%	0.3W	P
R345	3,300Ω	5%	0.3W	P
R346	680Ω	5%	0.3W	P
R347	2,200Ω	5%	0.3W	P
R348	2,200Ω	5%	0.3W	P
R349	0.22MΩ	5%	0.3W	P
R350-R380	References allocated to Turret Disks (see page 144)	–	–	–
R381-R389	Not allocated	–	–	–
R390-R399	Not allocated	–	–	–
R400	0.27MΩ	5%	0.3W	H
R401	270Ω	5%	0.3W	H
R402	120Ω	5%	0.3W	H
R403	4.7Ω w.w	5%	10W	H
R404	4.7Ω w.w	5%	10W	H

N.B: R330 : Reference not allocated

Ref.	Value	Tol.	Rtg.	Loc.
R405	4.7Ω w.w	5%	10W	H
R406	1,200Ω	5%	0.3W	H
R407	68Ω	5%	0.3W	H
R408	10,000Ω	5%	0.3W	H
R409	22Ω	5%	0.3W	H
R410	47Ω	5%	0.3W	H
R411	100Ω	5%	0.3W	H
R412	0.1MΩ	5%	0.3W	H
R413	18,000Ω	5%	0.3W	H
R414	1,000Ω	5%	0.3W	H
R415	120Ω	5%	0.3W	H
R416	5,600Ω	5%	0.3W	H
R417	680Ω	5%	0.3W	H
R418	1,500Ω	5%	0.3W	H
R419	100Ω	5%	0.3W	H
R420	68Ω w.w	5%	1W	H
R421	2,200Ω	5%	0.3W	H
R422	2,200Ω	5%	0.3W	H
R423	330Ω	5%	0.3W	H
R424	47Ω	5%	0.3W	H
R425	3,900Ω	5%	0.3W	H
R426	820Ω	5%	0.3W	H
R427	470Ω	5%	0.3W	H
R428	330Ω	5%	0.3W	H
R429	330Ω	5%	0.3W	H
R430	100Ω	5%	0.3W	H
R431	0.5Ω w.w.	5%	6W	H
R432-R449	Not allocated	–	–	–
R450	0.1MΩ	5%	0.3W	V
R451	82Ω	5%	0.3W	V
R452	33,000Ω	5%	0.3W	V
R453	33,000Ω	5%	0.3W	V
R454	33,000Ω	5%	0.3W	V
R455	33,000Ω	5%	0.3W	V
R456	220Ω	5%	0.3W	V
R457	220Ω	5%	0.3W	V
R458-R559	Not allocated	–	–	–
R560	1,500Ω	5%	0.3W	U
R561	47,000Ω	5%	0.3W	U
R562	22,000Ω	5%	0.3W	U
R563	82Ω	5%	0.3W	U
R564	220Ω	5%	0.3W	U
R565	220Ω	5%	0.3W	U
R566	10,000Ω	5%	0.3W	U
R567	10,000Ω	5%	0.3W	U
R568	82Ω	5%	0.3W	U
R569	82Ω	5%	0.3W	U

APPENDIX 'C'

Potentiometers

Ref.	Value	Law	Type	Function	Loc.
RV1	–	–	–	Not allocated	–
RV2	1,000Ω	Lin	Carbon pre-set	AFC Adjuster	P
RV3	10,000Ω	Lin	Carbon	VVC Control (Tunable IF)	R
RV4	4,700Ω	Lin	Carbon pre-set	VVC Tracker (Tunable IF)	P
RV5	50,000Ω	Log	Carbon	IF Gain	Q
RV6	0.47MΩ	Lin	Carbon pre-set	Line Level	Q
RV7	0.5MΩ	Log	Carbon	AF Gain	Q
RV8	–	–	–	Not allocated	–
RV9	3,300Ω	Lin	Carbon pre-set	FSK CZ Set	P
RV10	4,700Ω	Lin	Carbon pre-set	AF Zero Set	P
RV11	1,000Ω	Lin	Carbon pre-set	RF Zero Set	P
RV12	0.47MΩ	Lin	Carbon pre-set	AF Calib. Adj	P
RV13	2,700Ω	Lin	Carbon pre-set	FSK	N
RV14	10,000Ω	Lin	Carbon pre-set	FSK Relay Bias Adj	N
RV15	10Ω	Lin	Wirewound	Dial Dimmer	Q
RV16	1,000Ω	Lin	Carbon pre-set	Harmonic Drive Adj	F
RV17	–	–	–	Not allocated	–
RV18	47,000Ω	Lin	Carbon pre-set	Fine IF Trim	R
RV19/20	–	–	–	Not allocated	–
RV21	560Ω	Lin	Carbon pre-set	CW/SSB Level Adj	L
RV22	1,000Ω	Lin		Fine Freq Adj (Master Osc)	F
RV23	1,000Ω	Lin	Carbon pre-set	+12V Adj	P
RV24	560Ω	Lin	Carbon pre-set	+5V Adj	P
RV25	100Ω	Lin	Helical pre-set	Inc Osc Oven Adj	H
RV26	0.1MΩ	Lin	Carbon pre-set	IC18 Adj	M

APPENDIX 'C'

LIST OF COMPONENT TYPES, TOLERANCES AND RATINGS

PART 2 : : TURRET DISKS

Capacitors

Turret Disk "A' (Aerial)

Ref.	Value	Type	Tolerance	Wkg. V	Range
C380	4.5-20pF	Ceramic Trimmer	–	–	1
C381	250pF	Silvered Mica	1%	350V	1
C382	70pF	Tubular Ceramic	10%	750V	1
C383	4.5-20pF	Ceramic Trimmer	–	–	2
C384	800pF	Silvered Mica	1%	350V	2
C385	20pF	Tubular Ceramic	10%	750V	2
C386	4.5-20pF	Ceramic Trimmer	–	–	3
C387	4.5-20pF	Ceramic Trimmer	–	–	4
C388	0.0016uF	Silvered Mica	5%	350V	4
C389	0.0019uF	Silvered Mica	5%	350V	4
C390	0.0024uF	Silvered Mica	5%	350V	4
C391	0.0017uF	Silvered Mica	5%	350V	4
C392	6-30pF	Ceramic Trimmer	–	–	5
C393	6-30pF	Ceramic Trimmer	–	–	6
C394	0.0034uF	Polystyrene	2%	125V	6
C395	4.5-20pF	Ceramic Trimmer	–	–	7
C396	4.5-20pF	Ceramic Trimmer	–	–	8
C397-399	–	References not allocated	–	–	–

Turret Disk "B" (RF)

Ref.	Value	Type	Tolerance	Wkg. V	Range
C400	6-30pF	Ceramic Trimmer	–	–	1
C401	50pF	Tubular Ceramic	10%	750V	1
C402	250pF	Silvered Mica	1%	350V	1
C403	800pF	Silvered Mica	1%	350V	2
C404	6-30pF	Ceramic Trimmer	–	–	2
C405	4.5-20pF	Ceramic Trimmer	–	–	3
C406	4.5-20pF	Ceramic Trimmer	–	–	4
C407	6-30pF	Ceramic Trimmer	–	–	5
C408	6-30pF	Ceramic Trimmer	–	–	6
C409	6-30pF	Ceramic Trimmer	–	–	7
C410	6-30pF	Ceramic Trimmer	–	–	8
C411	6-30pF	Ceramic Trimmer	–	–	9
C412	6-30pF	Ceramic Trimmer	–	–	10
C413-419	–	References not allocated	–	–	–

APPENDIX 'C'

Turret Disk "C" (Signal Mixer)

Ref.	Value	Type	Tolerance	Wkg. V	Range
C420	6-30pF	Ceramic Trimmer	–	–	1
C421	50pF	Tubular Ceramic	10%	750V	1
C422	250pF	Silvered Mica	1%	350V	1
C423	800pF	Silvered Mica	1%	350V	2
C424	6-30pF	Ceramic Trimmer	–	–	2
C425	4.5-20pF	Ceramic Trimmer	–	–	3
C426	4.5-20pF	Ceramic Trimmer	–	–	4
C427	6-30pF	Ceramic Trimmer	–	–	5
C428	6-30pF	Ceramic Trimmer	–	–	6
C429	6-30pF	Ceramic Trimmer	–	–	7
C430	0.01uF	Polycarbonate	20%	100V	7
C431	0.001uF	Disk Ceramic	20%	500V	7
C432	6-30pF	Ceramic Trimmer	–	–	8
C433	6-30pF	Ceramic Trimmer	–	–	9
C434	0.01uF	Polycarbonate	20%	100V	9
C435	0.001uF	Disk Ceramic	20%	500V	9
C436	0.01uF	Metallised Paper	20%	200V	10
C437	0.047uF	Polycarbonate	20%	100V	10
C438	6-30pF	Ceramic Trimmer	–	–	10
C439-C449	–	References not allocated			

Turret Disk "D" (Main Tune Oscillator)

Ref.	Value	Type	Tolerance	Wkg. V	Range
C450	40pF	Tubular Ceramic	10%	750V	1
C451	4.5-20pF	Ceramic Trimmer	–	–	1
C452	225pF	Silvered Mica	1%	350V	1
C453	4.5-20pF	Ceramic Trimmer	–	–	2
C454	600pF	Silvered Mica	1%	350V	2
C455	0.0012uF	Silvered Mica	1%	350V	3
C456	4.5-20pF	Ceramic Trimmer	–	–	3
C457	4.5-20pF	Ceramic Trimmer	–	–	4
C458	540pF	Silvered Mica	1%	350V	4
C459	15pF	Tubular Ceramic	10%	750V	5
C460	0.0016uF	Silvered Mica	1%	350V	5
C461	4.5-20pF	Ceramic Trimmer	–	–	5
C462	4.5-20pF	Ceramic Trimmer	–	–	6
C463	680pF	Silvered Mica	1%	350V	6
C464	20pF	Tubular Ceramic	10%	750V	6
C465	20pF	Tubular Ceramic	10%	750V	7
C466	470pF	Silvered Mica	1%	350V	7
C467	4.5-20pF	Ceramic Trimmer	–	–	7
C468	4.5-20pF	Ceramic Trimmer	–	–	8
C469	100pF	Silvered Mica	1%	350V	8

Turret Disk "D" (contd.)

Ref.	Value	Type	Tolerance	Wkg. V	Range
C470	30pF	Tubular Ceramic	10%	750V	8
C471	170pF	Silvered Mica	1%	350V	9
C472	4.5-20pF	Ceramic Trimmer	–	–	9
C473	4.5-20pF	Ceramic Trimmer	–	–	10
C474	100pF	Silvered Mica	1%	350V	10
C475	50pF	Tubular Ceramic	10%	750V	10
C476	30pF	Tubular Ceramic	10%	750V	9
C477-C479	–	References not allocated			

Turret Disk "E" (Loop Mixer)

Ref.	Value	Type	Tolerance	Wkg. V	Range
C480	6-30pF	Ceramic Trimmer	–	–	1
C481	50pF	Tubular Ceramic	10%	750V	1
C482	240pF	Silvered Mica	1%	350V	1
C483	800pF	Silvered Mica	1%	350V	2
C484	6-30pF	Ceramic Trimmer	–	–	2
C485	6-30pF	Ceramic Trimmer	–	–	3
C486	0.0032uF	Silvered Mica	1%	200V	4
C487	6-30pF	Ceramic Trimmer	–	–	4
C488-C489	–	References not allocated			

Turret Disk "F" (Harmonic Amplifier)

Ref.	Value	Type	Tolerance	Wkg. V	Range
C490	6-30pF	Ceramic Trimmer	–	–	1
C491	50pF	Tubular Ceramic	10%	750V	1
C492	240pF	Silvered Mica	1%	350V	1
C493	800pF	Silvered Mica	1%	350V	2
C494	6-30pF	Ceramic Trimmer	–	–	2
C495	6-30pF	Ceramic Trimmer	–	–	3
C496	0.0032uF	Silvered Mica	1%	200V	4
C497	6-30pF	Ceramic Trimmer	–	–	4

APPENDIX 'C'

Resistors

Turret Disk "A" (Aerial)

Ref.	Value	Tol.	Rtg.	Range
R350	0.1MΩ	5%	0.3W	1
R351	0.1MΩ	5%	0.3W	2
R352 -R359	Not allocated			

Turret Disk "C" (Signal Mixer)

Ref.	Value	Tol.	Rtg.	Range
R370	0.1MΩ	5%	0.3W	1
R371	0.1MΩ	5%	0.3W	2
R372	0.1MΩ	5%	0.3W	7
R373	2,200Ω	5%	0.3W	7
R374	0.1MΩ	5%	0.3W	9
R375	2,200Ω	5%	0.3W	9
R376	2,200Ω	5%	0.3W	10
R377	0.1MΩ	5%	0.3W	10
R378	Not allocated	–	–	–
R379	Not allocated	–	–	–

Turret Disk "B" (RF)

Ref.	Value	Tol.	Rtg.	Range
R360	0.1MΩ	5%	0.3W	1
R361	0.1MΩ	5%	0.3W	2
R362 -R369	Not allocated			

Turret Disk "F" (Harmonic Amplifier)

Ref.	Value	Tol.	Rtg.	Range
R380	1,000Ω	5%	0.3W	3

APPENDIX 'D'

LIST OF MAJOR SPARES

The following list details all major spares for the EC958/7 receiver. Items should be ordered by quoting the Circuit Ref. (where applicable), the written description given in the list and the Part No. in the right-hand column. All orders and enquiries should be directed to the address below, quoting the Serial No. of the receiver in all communications.

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

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

REF	DESCRIPTION	PART No.
	MODULES, UNITS AND ASSEMBLIES	
	Aerial Attenuator Unit	LP3260/1
	RF Assembly (less Crystal Calibrator, Peak RF gang, AFC Board and Turret Disks)	D4833
	935kHz Loop Amplifier Module	LP3055A/1
	Master Oscillator Unit (complete)	LP3346
	1MHz Crystal Oscillator (SEI Type QC1311D)	8787P
	Tunable IF Module	LP3057A
	Incremental Oscillator Unit	LP3347
	250kHz IF Module	LP3345
	100kHz IF Filter Unit	LP3047A
	SSB Filter Assembly (complete)	LP3374
	100kHz IF Amplifier Module	LP3056
	CW/SSB Detector and BFO Unit	LP3348
	FSK Module (fitted only on request)	LP3058
	Audio Amplifier Module	LP3385
	Counter and Display Unit	LP3343
	Timebase and Control Unit	LP3344
	PRINTED CIRCUIT BOARDS	
	1MHz Crystal Calibrator Board	LP3059
	RF Amplifier Board	LP3062
	Main-Tune Oscillator (MTO) Board	LP3063
	Harmonic Amplifier Board	LP3064
	AFC Board	LP3081
	Meter/Regulator Board	LP3373
	TURRET DISKS AND CONTACT BLOCKS	
"A"	Aerial Disk	LP3314
"B"	RF Disk	LP3315
"C"	1st Signal Mixer Disk	LP3070
"D"	Main-Tune Oscillator Disk	LP3071
"E"	1st Loop Mixer Disk	LP3072
"F"	Harmonic Amplifier Disk	LP3080
	Contact Blocks (4-contact type)	D4082
	(5-contact type)	D4083

REF	DESCRIPTION	PART No.
	IF FILTERS	
	250kHz IF Filter	8331P
	NB: The filter descriptions given below relate to the filters proper. Sideband reversal occurs in the conversion processes such that the USB Filter is used for LSB reception and vice versa.	
	LSB SEI Type QC1329F	9048P
	USB SEI Type QC1329G	9047P
	LSB Diamond H Controls Type 135	8819P
	USB Diamond H Controls Type 144	8818P
	LSB Vernitron Type SK-NP937-LSB	9050P
	USB Vernitron Type SK-NP937-USB	9049P
	Both USB and LSB filters should form a pair from a particular manufacturer	
	CRYSTALS	
XL1	1MHz (Crystal Calibrator)	7547P
XL2	935kHz	7537P
XL3	Reference not allocated	–
XL4	350kHz	8811P
	SWITCHES	
S1	CALIBRATOR SWITCH Miniature push-button	6726P
S2	AERIAL ATTENUATOR SWITCH 3-pole, 3-position miniature lever switch	7491P
S3	RANGE SWITCH (wafers S3A-S3D) 4 x 10-posn wafers supplied as complete assembly	D4832
S4	NORMAL/SYNTH SWITCH. Miniature toggle	7352P
S5	HIGH-STAB/CONT TUNE SWITCH. 3-pole, 3-position miniature lever switch – special dolly	7490P
S6	Reference not allocated	–
S7	USB/LSB SWITCH. Miniature toggle	7352P
S8	SELECTIVITY SWITCH. Part of 100kHz IF Filter Unit	
	Wafers S8A/B & S8E (2-pole 5-way)	8537P
	Wafers S8C/D & S8F/G (2-pole 5-way)	8538P
	Clicker mechanism for S8	8536P
S9	AGC SWITCH. Miniature toggle	7352P
S10	MODE SWITCH. 3-pole, 3-position miniature lever switch	7491P
S11	SPEAKER SWITCH. Miniature toggle	7352P
S12	METER SWITCH. 4-pole ON-ON-ON miniature toggle	8828P
S13	STANDBY SWITCH. Miniature toggle	7352P
S14	READOUT SWITCH. Miniature toggle	7352P

REF	DESCRIPTION	PART No.
	POTENTIOMETERS	
RV1	Reference not allocated	–
RV2	AFC ADJ 1000Ω carbon pre-set, linear law	9033P
RV3	TUNABLE IF TUNE. 10,000Ω carbon, linear law	7762P
RV4	TUNABLE IF TRIM. 4,700Ω carbon pre-set, linear law	9031P
RV5	IF GAIN. 50,000Ω carbon, logarithmic law	4103/1P
RV6	LINE LEVEL. 0.47MΩ carbon pre-set, linear law	6077P
RV7	AF GAIN. 0.5MΩ carbon logarithmic law	4103P
RV8	Reference not allocated	–
RV9	FSK CZ SET. 3,300Ω carbon pre-set, linear law	9032P
RV10	AF ZERO SET. 4,700Ω carbon pre-set, linear law	9031P
RV11	RF ZERO SET. 1,000Ω carbon pre-set, linear law	9033P
RV12	AF CALIB. 0.47MΩ carbon pre-set, linear law	9030P
RV13	FSK ADJ. 2,700Ω carbon pre-set, linear law	6841P
RV14	FSK RELAY BIAS ADJ. 10,000Ω carbon pre-set, linear law	6840P
RV15	DIAL DIMMER. 10Ω wire-wound pre-set, linear law	7763P
RV16	HARM DRIVE ADJ. 1,000Ω carbon pre-set, linear law	6076P
RV17	Reference not allocated	–
RV18	FINE IF TRIM. 47,000Ω carbon pre-set, linear law	6488P
RV21	BFO LEVEL. 560Ω carbon pre-set, linear law	9034P
RV22	MO FINE FREQUENCY ADJUSTER. 1,000Ω trimpot linear law	9035P
RV23	12V ADJ. 1,000Ω carbon pre-set, linear law	9033P
RV24	5V ADJ. 560Ω carbon pre-set, linear law	9034P
RV25	INC. OSC. TEMPERATURE ADJ. 100Ω trimpot, linear law	9036P
	VARIABLE CAPACITORS AND TRIMMERS	
C30/31/37	Gang Assembly. 3 x 12 – 358pF	7379P
C46/60/65	Gang Assembly. 2 x 12 – 358pF + 1 x 18 – 364pF	7357P
C176	Trimmer. 4 – 29pF Concentric	6597P
C310/311	Gang Assembly. 2 x 8.5 – 126.5pF	D3363D
C20/21/22	Gang Assembly. 3 x 10.5 – 65pF	LP3371
C500	Gang Assembly. 1 x 6 – 62pF	8771P
	PLUGS AND SOCKETS etc.	
	Inter-Unit Coaxial Connectors as fitted on coaxial leads coded "E", "H1", "H2", "J", "K", "L", "M", "P" and "U".	
	Male Component	7768P
	Female Component	7769P
	NB: Specify cable letter code so that connector can be supplied ready crimped to suitable length of lead.	
	Standard BNC bayonet-lock coaxial sockets (as used for Aerial Input (Low-Z), IF Out etc.	7225P
	Ditto – plugs (free component)	8012P

REF	DESCRIPTION	PART No.
	PLUGS AND SOCKETS etc. (continued)	
PL/A	15-way Drive Assembly Connector (male – free)	7772P
PL/B	37-way Panel Connector (male – free)	7774P
PL/C	15-way Ancillaries Connector (male – fixed)	7772P
PL/F	15-way Timebase Connector (male – fixed)	7772P
PL/G	15-way Counter Connector (male – fixed)	7772P
PL/SK-D	2-way Polarised Connector (RLA supply)	7245P
PL/SK-E	2-way Polarised Connector (panel earthing)	7245P
PL/SK-H	2-way Polarised Connector (meter)	7245P
SK/A	15-way Drive Assembly Connector (female – fixed)	7770P
SK/B	37-way Panel Connector (female – fixed)	7773P
SK/C	15-way Ancillaries Connector (female – free)	7771P
SK/F	15-way Timebase Connector (female – free)	7771P
SK/G	15-way Counter Connector (female – free)	7771P
SK/J	Edge Connector (Meter/Regulator Board) 21-way	8838P
	"Amp" pin – fixed (as used for module connections etc)	7775P
	"Amp" socket – free (as used for module connections etc)	7776P
	Miniature B/L coaxial plug*	7293P
	Miniature B/L coaxial socket*	7292P
	(*) As used for connections to 100kHz Filter etc.	
	Mains input connector (chassis-mounted component)	D2310/1
	Mains input connector (with 2000mm of 3-core lead)	D2311/1
	Telephone plug	6567P
	Standard push-terminals as used for High-Z Aerial Input	6102P
	Earth terminal	6371P
JK1	Telephone socket	6660P
	KNOBS etc.	
	Main Tuning, Incremental Tuning (less skirt)	D3613/3
	Skirt for Main Tuning and Incremental Tuning	7089/1P
	IF Gain, AF Gain, Selectivity (complete with skirt)	D3614/–**
	BFO (less skirt)	D3957/–**
	Skirt for BFO	D3958
	Range Switch (bar knob)	D4012
	Skirt for Range Knob	7777P
	Dolly for Mode, Aerial Attenuator	7778P
	Dolly for High-Stab/Cont Tune Switch	7703P
	Collet Knob (black) for Peak RF Control	8487P
	Cap for 8487P Collet Knob	8532P
	(**) Add suffix "/Black"	

REF	DESCRIPTION		PART No.
	INDUCTORS		
	NB: All inductors employed in the EC958 Receiver are of miniature construction. Great care should be exercised if replacement is necessary, the task being considerably simplified if proper de-soldering equipment is available. In many cases it will be found best to return the faulty module etc. to the factory so that the fault can be rectified under ideal conditions by personnel who are familiar with the intricate construction used. Items returned for servicing of this nature should carry a cover note giving the Receiver Serial No. and the Reference of the particular component(s) suspected.		
L1	935kHz Coil No. 1	RF Assembly	D3891A
L2	935kHz Coil No. 2	935kHz Loop Module	D3859A
L3	935kHz Coil No. 3	935kHz Loop Module	D3860A
L4	935kHz Coil No. 4	935kHz Loop Module	D3861A
L5	935kHz Coil No. 5	935kHz Loop Module	D3862A
L6	935kHz Coil No. 6	935kHz Loop Module	D3998A
L7	935kHz Coil No. 7	935kHz Loop Module	D3863B
L8	935kHz Coil No. 8	935kHz Loop Module	D3864A
L9	935kHz Coil No. 9	935kHz Loop Module	D3865A
L10	1235-1335kHz Coil No. 1	Tunable IF Module	D3881B
L11	1235-1335kHz Coil No. 2	Tunable IF Module	D3882B
L12	1235-1335kHz Coil No. 3	Tunable IF Module	D3883B
L13	1485-1585kHz Coil No. 1	Tunable IF Module	D3884B
L14	1485-1585kHz Coil No. 2	Tunable IF Module	D3885B
L15	1485-1585kHz Coil No. 3	Tunable IF Module	D3886B
L16	Incremental Oscillator Coil		D4715
L17	Low-pass Filter Coil No. 1	100 microhenries	9039P
L17A	Low-pass Filter Coil No. 2	330 microhenries	9038P
L18	Low-pass Filter Coil No. 3	220 microhenries	9037P
L18A	Rejector Coil		D4722
L19-23	References not allocated		–
L24	100kHz Coil No. 2	100kHz IF Filter Unit	D3840A
L25	100kHz Coil No. 3	100kHz IF Filter Unit	D3841A
L26	100kHz Coil No. 4	100kHz IF Filter Unit	D3841A
L27	100kHz Coil No. 5	100kHz IF Filter Unit	D3841A
L28	100kHz Coil No. 6	100kHz IF Filter Unit	D3841A
L29	100kHz Coil No. 7	100kHz IF Amplifier Module	D3871A
L30	100kHz Coil No. 8	100kHz IF Amplifier Module	D3869A
L31	100kHz Coil No. 9	100kHz IF Amplifier Module	D3870A
L32	BFO Coil	CW & SSB Detector/BFO Unit	D4738

REF	DESCRIPTION		PART No.
	INDUCTORS (continued)		
L136	Range 1 Aerial Coil	Turret Disk "A"	D3892B
L137	Range 2 Aerial Coil	Turret Disk "A"	D3893B
L138	Range 3 Aerial Coil	Turret Disk "A"	D3894A
L139	Range 4 Aerial Coil	Turret Disk "A"	D3895A
L140	High-pass Filter Coil No. 2	Turret Disk "A"	D3898A
L141	High-pass Filter Coil No. 1	Turret Disk "A"	D3899A
L142	Range 5 Aerial Coil	Turret Disk "A"	D4555
L143	Range 6 Aerial Coil	Turret Disk "A"	D4556
L144	250kHz IF Rejector Coil	Turret Disk "A"	D3896/1C
L145	Range 7 Aerial Coil	Turret Disk "A"	D4557
L146	Range 8 Aerial Coil	Turret Disk "A"	D4558
L44	Range 1 RF Coil	Turret Disk "B"	D3900A
L45	Range 2 RF Coil	Turret Disk "B"	D3901A
L46	Range 3 RF Coil	Turret Disk "B"	D3902A
L47	Range 4 RF Coil	Turret Disk "B"	D3903A
L48	Range 5 RF Aerial Coil	Turret Disk "B"	D4573
L49	Range 6 RF Aerial Coil	Turret Disk "B"	D4574
L50	Range 7 RF Aerial Coil	Turret Disk "B"	D4575
L51	Range 8 RF Aerial Coil	Turret Disk "B"	D4441
L52	Range 9 RF Aerial Coil	Turret Disk "B"	D3908
L53	Range 10 RF Aerial Coil	Turret Disk "B"	D3909A
L54	Range 1 Mixer Coil	Turret Disk "C"	D3910
L55	Range 2 Mixer Coil	Turret Disk "C"	D3911A
L56	Range 3 Mixer Coil	Turret Disk "C"	D3912
L57	Range 4 Mixer Coil	Turret Disk "C"	D3913
L58	Range 5 Mixer Coil	Turret Disk "C"	D3914
L59	Range 6 Mixer Coil	Turret Disk "C"	D3915
L60	Range 7 Mixer Coil	Turret Disk "C"	D3916
L61	Range 8 Mixer Coil	Turret Disk "C"	D3917A
L62	Range 9 Mixer Coil	Turret Disk "C"	D3918
L63	Range 10 Mixer Coil	Turret Disk "C"	D3919
L64	Range 1 Oscillator Coil	Turret Disk "D"	D3921
L65	Range 2 Oscillator Coil	Turret Disk "D"	D3922
L66	Range 3 Oscillator Coil	Turret Disk "D"	D3923
L67	Range 4 Oscillator Coil	Turret Disk "D"	D3924
L68	Range 5 Oscillator Coil	Turret Disk "D"	D3925
L69	Range 6 Oscillator Coil	Turret Disk "D"	D3926
L70	Range 7 Oscillator Coil	Turret Disk "D"	D3927
L71	Range 8 Oscillator Coil	Turret Disk "D"	D3928
L72	Range 9 Oscillator Coil	Turret Disk "D"	D3930
L73	Range 10 Oscillator Coil	Turret Disk "D"	D3931
L74	Range 1 Loop Mixer Coil	Turret Disk "E"	D3932B
L75	Range 2 Loop Mixer Coil	Turret Disk "E"	D3933B
L76	Range 3 Loop Mixer Coil	Turret Disk "E"	D3934B
L77	Range 4 Loop Mixer Coil	Turret Disk "E"	D3935

REF	DESCRIPTION		PART No.
	INDUCTORS (continued)		
L78	Range 1 Harmonic Amplifier Coil	Turret Disk "F"	D3979E
L79	Range 2 Harmonic Amplifier Coil		D3933B
L80	Range 3 Harmonic Amplifier Coil		D4405
L81	Range 4 Harmonic Amplifier Coil		D3935
	CHOKES		
CH1	47 microhenries	RF Assembly	7753P
CH2	10 microhenries		7752P
CH3	10 microhenries		7752P
CH4	47 microhenries		7753P
CH5	4.7 millihenries	935kHz Loop Module	7472P
CH6	4.7 millihenries		7472P
CH7	4.7 millihenries		7472P
CH8	4.7 millihenries		7472P
CH9	27.5 microhenries	Master Oscillator Unit	D2413
CH10	1 millihenry		7754P
CH11	100 millihenries		7350P
CH12	68 millihenries		7759P
CH15	3 microhenries	250kHz IF Module	D2854/1
CH16	560 microhenries		8042P
CH17	330 microhenries		8400P
CH17A	220 microhenries		8401P
CH18	68 millihenries	100kHz IF Amp. Module	7759P
CH19	68 millihenries		7759P
CH20	68 millihenries		7759P
CH21	68 millihenries		7759P
CH22	100 millihenries		7350P
CH23	100 millihenries		7350P
CH24	4.7 millihenries		7472P
CH25	68 millihenries		7759P
CH26	1 millihenry		7754P
CH27	100 millihenries		7350P
CH28	1 millihenry	CW/SSB Detector & BFO	7754P
CH29	68 millihenries		7759P
CH30	4.7 millihenries		7472P
CH31	100 millihenries		7350P
CH32	100 millihenries	FSK Module	7350P
CH33	3 microhenries	Mains Input Filter	D2854/1C
CH34	3 microhenries		D2854/1C

REF	DESCRIPTION		PART No.
	CHOKES (continued)		
CH36	4.7 millihenries	100kHz IF Filter	7472P
CH45	4.7 millihenries	Timebase	9040P
CH46	4.7 millihenries	Counter/Display	9040P
	TRANSFORMERS		
T1	600/75-ohm Balun Transformer		D3850A
T2	600-ohm Line Output Transformer		8641P
T5	Power Transformer		8831P
	BULBS AND FUSES		
LP1-3	Standard L.E.S. 6V 60mA (Legend lamps)		6659P
LP4	Projection Bulb (6V, 0.2A, MES CAP 13.5mm round)		8542P
D55	Oven Lamp (LED 5082-4850)		8797P
	Standard 20mm x 5mm Glass Cartridge Rated 5A		7814P
	Standard 20mm x 5mm Glass Cartridge Rated 3A		6709P
	Standard 20mm x 5mm Glass Cartridge Rated 1.5A		6373P
	Fuseholder		6372P
	Lampholder (L.E.S.)		6600P
	Holder/Carrier for Projection Bulb		D4564
	DRIVE ASSEMBLY		
	Special jigs are required for assembly of this unit. Receiver should be returned to our factory for repair, or special arrangements can be made to supply a complete replacement mechanism on receipt of faulty unit.		
	OPTICS – SCALE DISPLAY		
	Light Unit – Main Tune (complete assembly)		D3975
	Lens Block (Main Display)		D3974
	Calibration Disk (Main Display)		7571PB
	MISCELLANEOUS		
	Panel Handles		8523P
	Meter (50-0-50μA with special scaling)		8865P
	Panel Speaker		6101P
	Grille for Panel Speaker		6976P
	Dial Escutcheon		8764P
	Finger Plate (Model 958/7)		8767P
	Finger Plate (Model H2311)		8677/1P
	Flexible Coupler		7327P
	Module Box (as used for Tunable IF etc)		7521PA
	Screwdriver		7612P
	Trimming Tool (Neosid Type T.T.I.)		8451P
	Disk Insertion Tool		7857P
	Dust Cover (top)		8952P
	Dust Cover (bottom)		8958P
	Flexible Coupler (for tuning gangs)		D4537
	Flexible Coupler (for Peak-RF gang)		8829P

REF	DESCRIPTION	PART No.
	ADDITIONAL ITEMS	

REF	DESCRIPTION	PART No.
	ADDITIONAL ITEMS (continued)	

REF	DESCRIPTION	PART No.
	ADDITIONAL ITEMS (continued)	

APPENDIX 'E'

CIRCUIT DATA

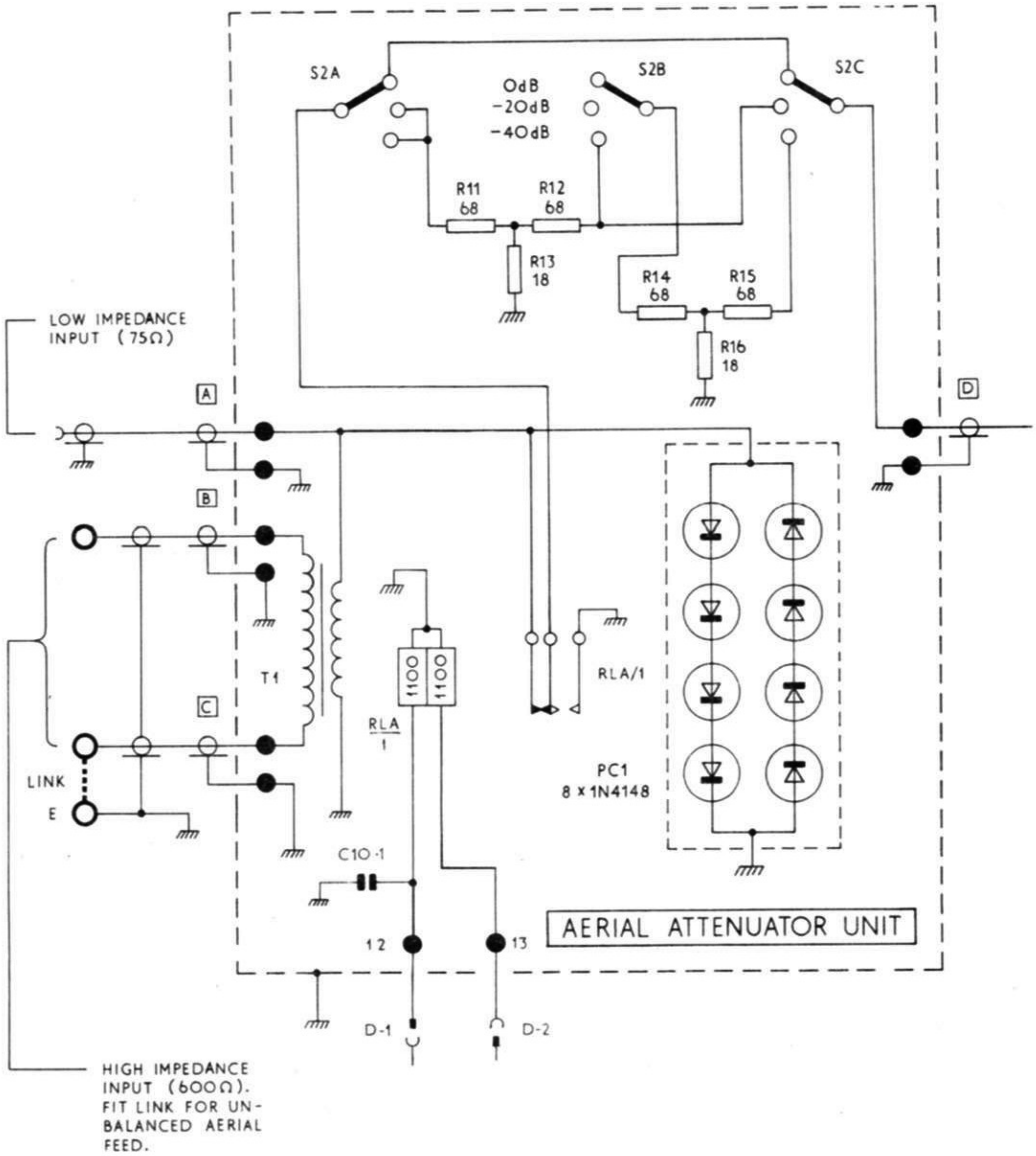
All boards – including turret disks – are shown viewed from legend side (i.e. copper side is seen through the laminate). Two views are provided for all double-sided boards. It should be noted that there is no legend on the front of Disk 'A', but that the identification 'A' Front 8330P is etched in the copper and therefore appears in reverse on the rear view. All six turret disks are double-sided. All illustrations are slightly less than actual size.

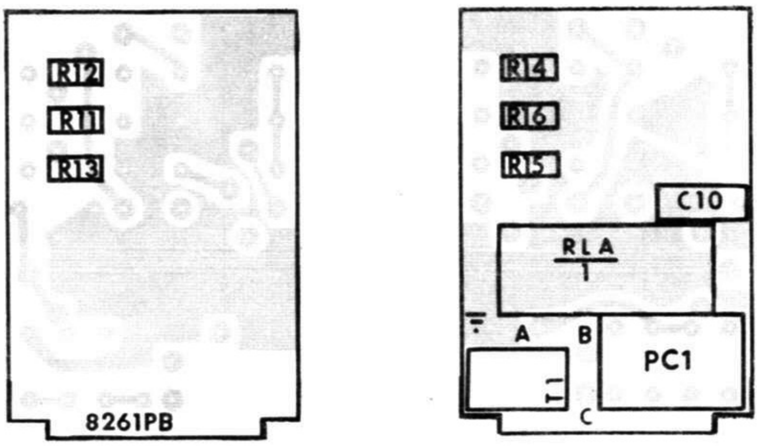
LIST OF CONTENTS

	Page
Aerial Attenuator Unit	157
RF Assembly	158
Turret Disk 'A' – Aerial	160
Turret Disk 'B' – RF	162
Turret Disk 'C' – Signal Mixer	164
Turret Disk 'D' – Main-tune Oscillator	166
Turret Disk 'E' – Loop Mixer	168
Turret Disk 'F' – Harmonic Amplifier	170
935 kHz Loop Module	172
Master Oscillator Unit	174
100 kHz IF Filter Unit	175
Tunable IF Module	176
Incremental Oscillator Unit	178
250 kHz IF Module	180
100 kHz IF Amplifier Module	182
CW/SSB Detector and BFO Unit	184
SSB Filter Assembly (including Relay boards)	185
Audio Amplifier Module	186
FSK Module	187
Meter/Regulator Unit	188
Counter and Display Unit	190
Timebase and Control Unit	192
Panel Wiring	194
Drive Assembly Wiring	195
Chassis Interconnections (left hand side)	196
Chassis Interconnections (right hand side)	197
Linear Integrated Circuits and Transistor Boxes	198
Digital Integrated Circuits	199

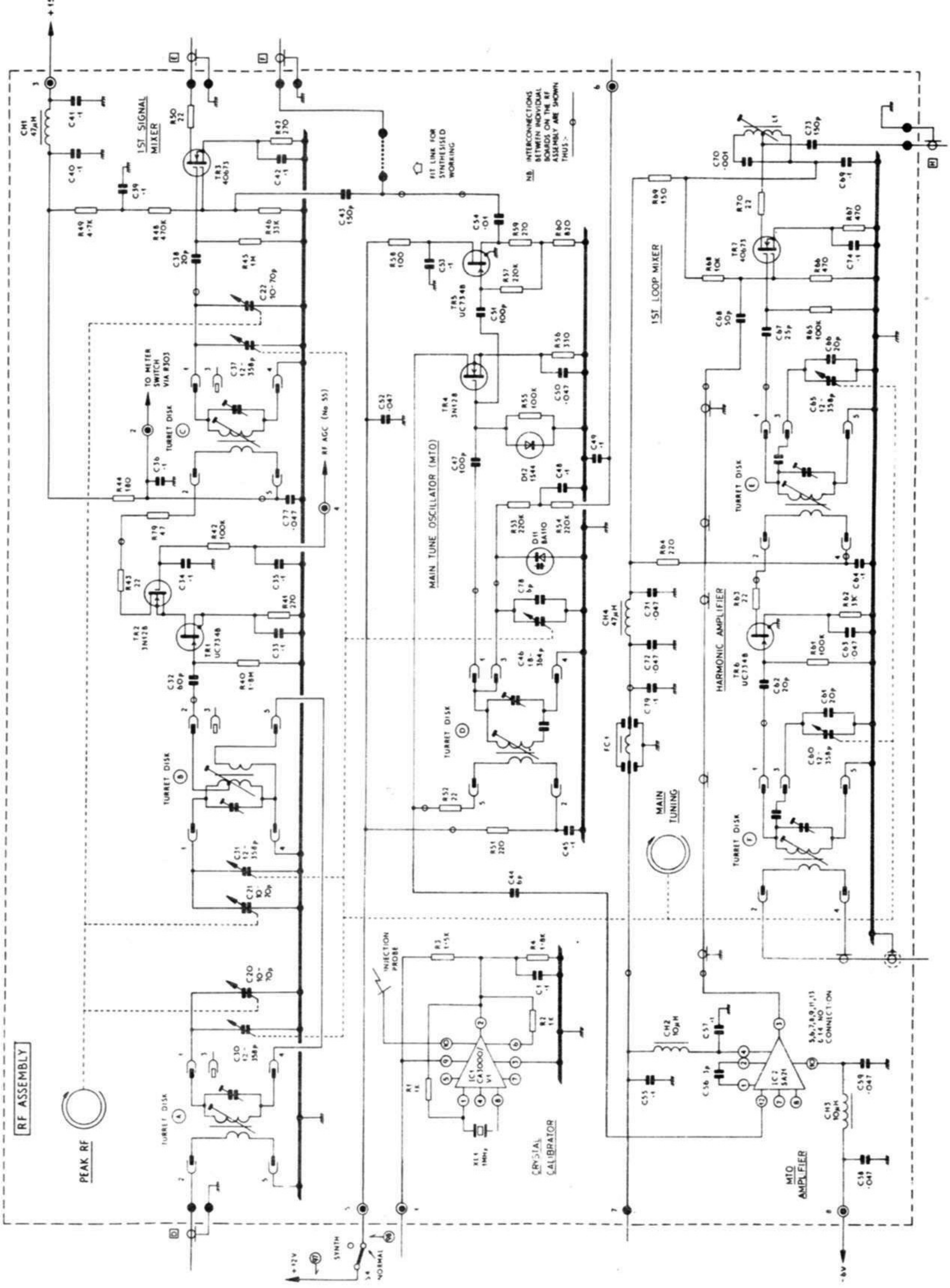
NB1: *Main Circuit Diagram is bound at the rear of the manual.*

NB2: Block Diagram is bound facing page 48.





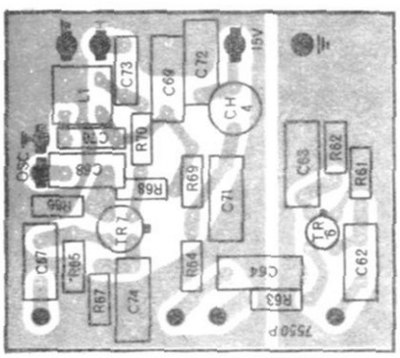
Aerial Attentuation Unit



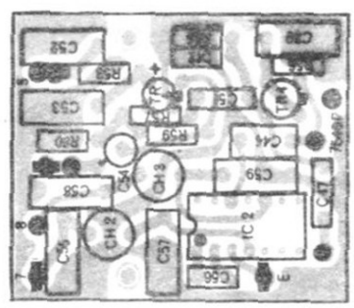
RF Assembly circuit (including 1 MHz Calibrator)

The components shown below are in the RF Assembly:–

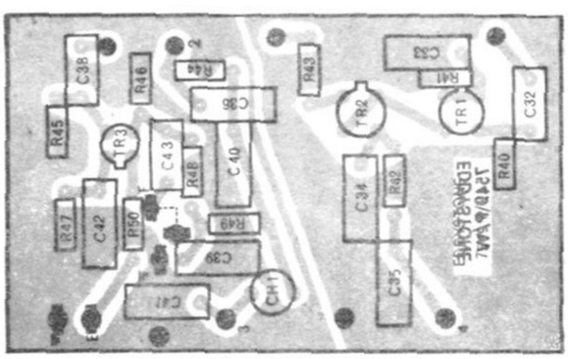
R1 – R4	Calibrator	TR1 – TR2	RF
R53 – R54	AFC	TR3	1st Signal Mixer
R55 – R60	MTO	TR4 – TR5	MTO
R61 – R70	Harmonic Amplifier	TR6	Harmonic Amplifier
C1	Calibrator	TR7	1st Loop Mixer
C32 – C36	RF	IC1	Calibrator
C38 – C43	1st Signal Mixer	IC2	MTO Amplifier
C44, C45 and C47	MTO	CH1	RF
C48 – C49	AFC	CH2 – CH3	MTO Amplifier
C50 – C59	MTO	CH4	Harmonic Amplifier
C62 – C64	Harmonic Amplifier	L1	1st Loop Mixer
C67 – C74	1st Loop Mixer	D11	AFC
C77	RF	D12	MTO
C79	Harmonic Amplifier	XL1	Calibrator



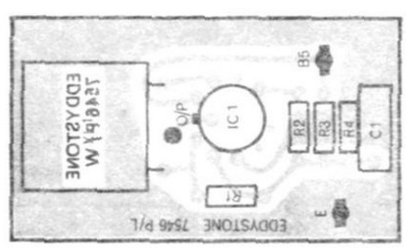
Harmonic Amplifier board



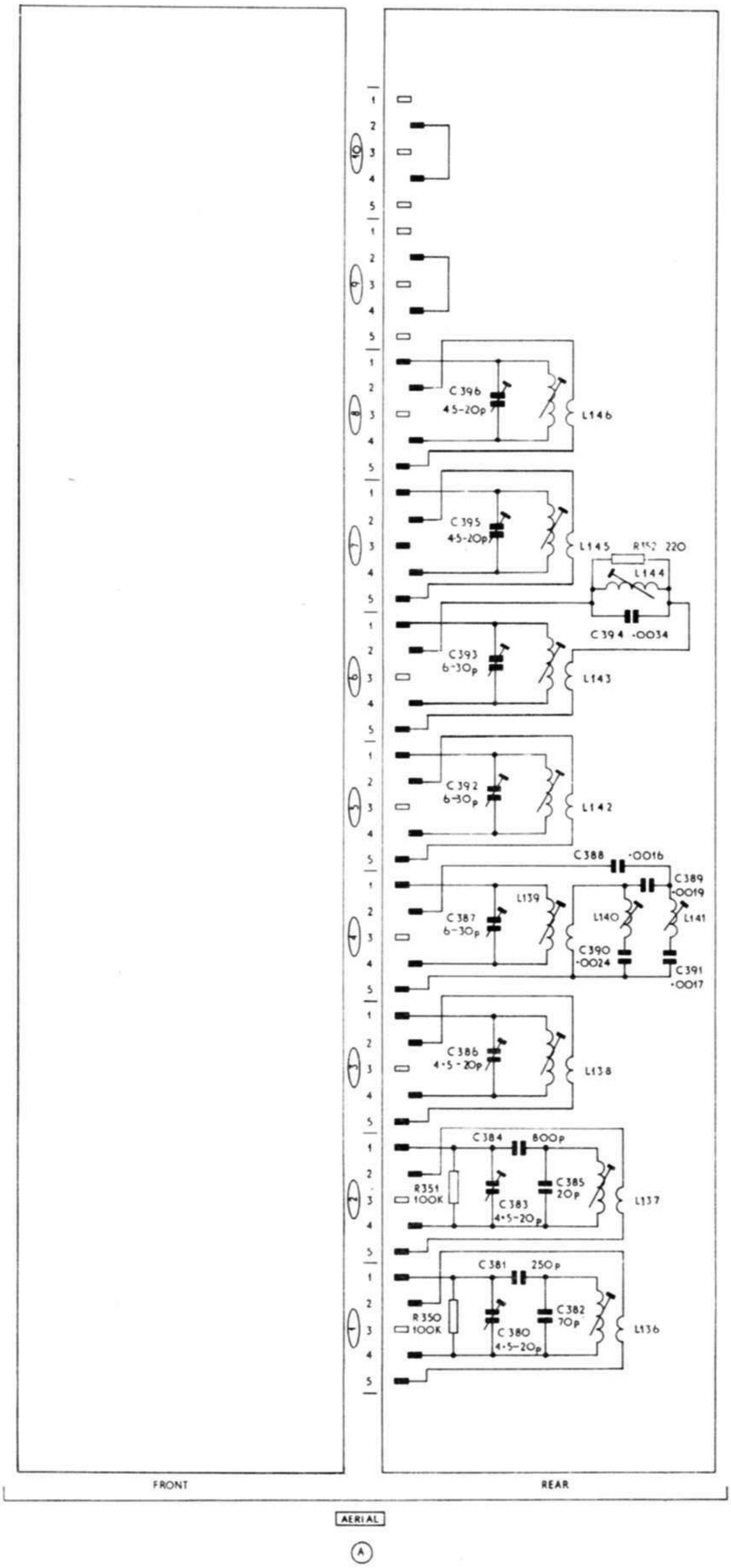
MTO Amplifier board



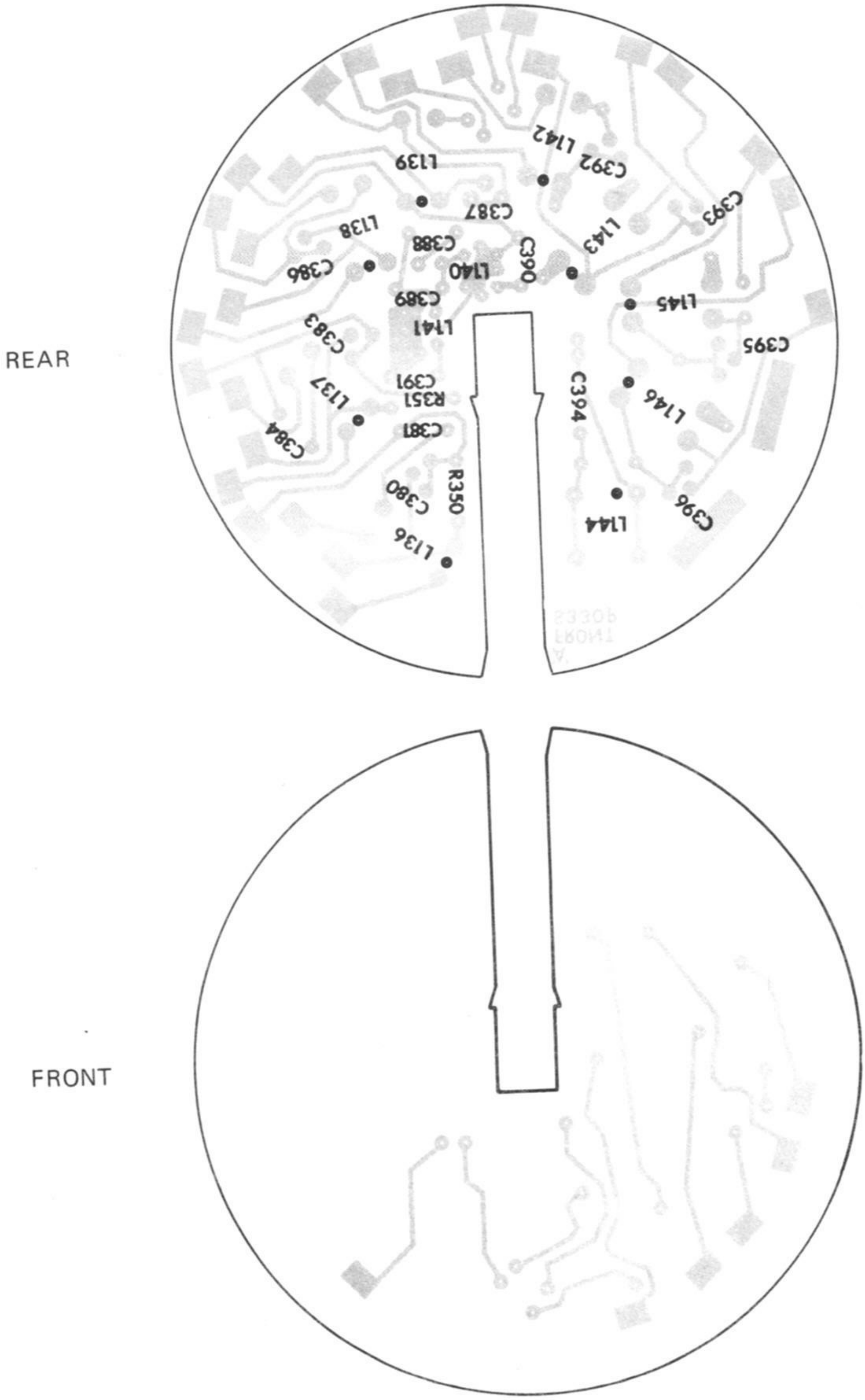
RF Assembly board



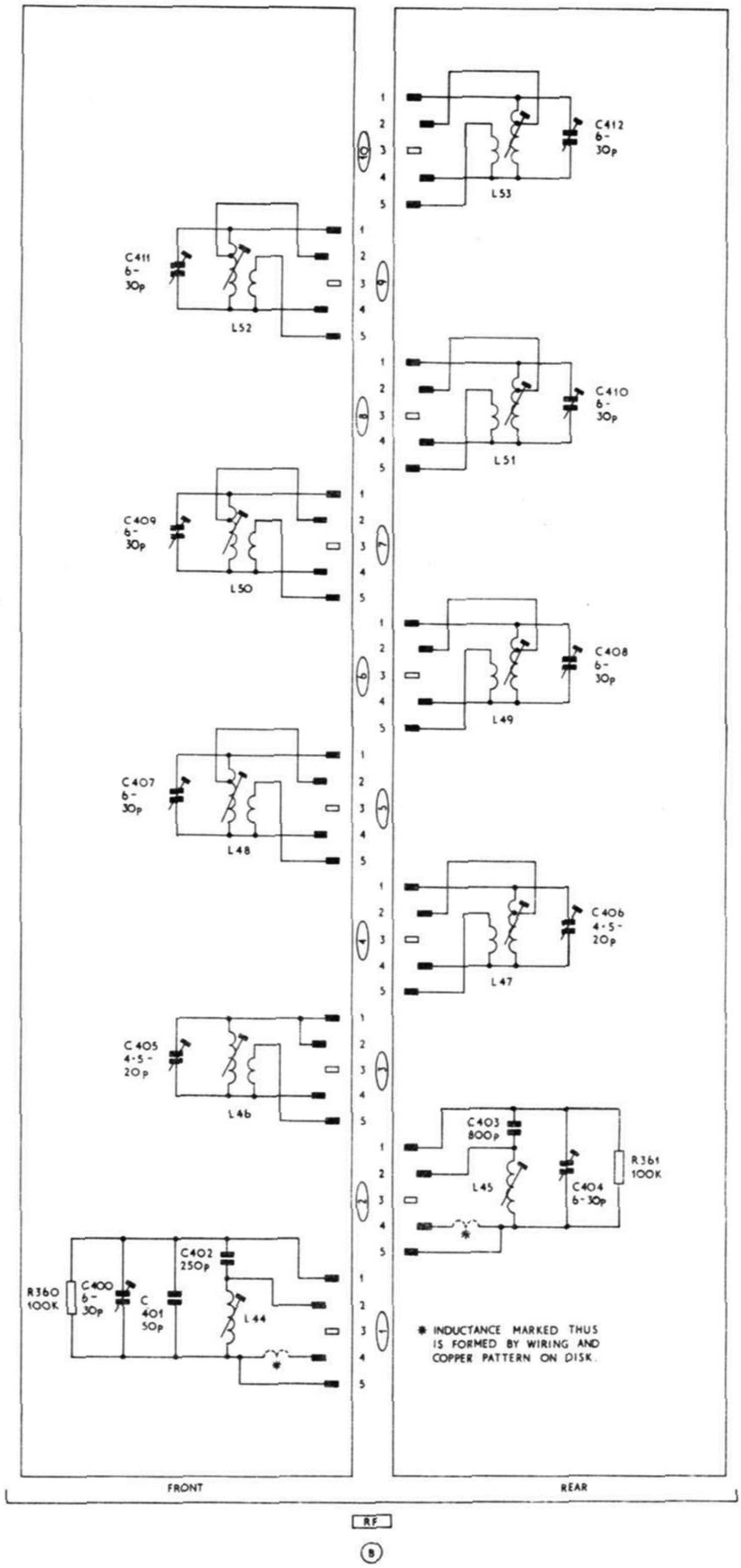
Calibration board



Turret Disk 'A' – Aerial circuit

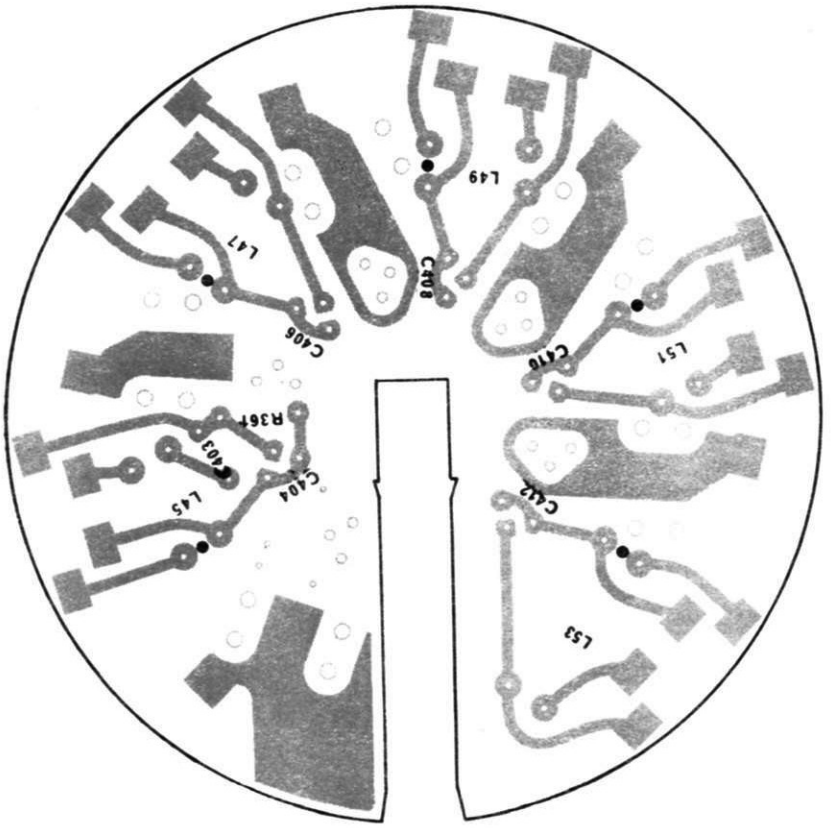


Turret Disk 'A' — Aerial board

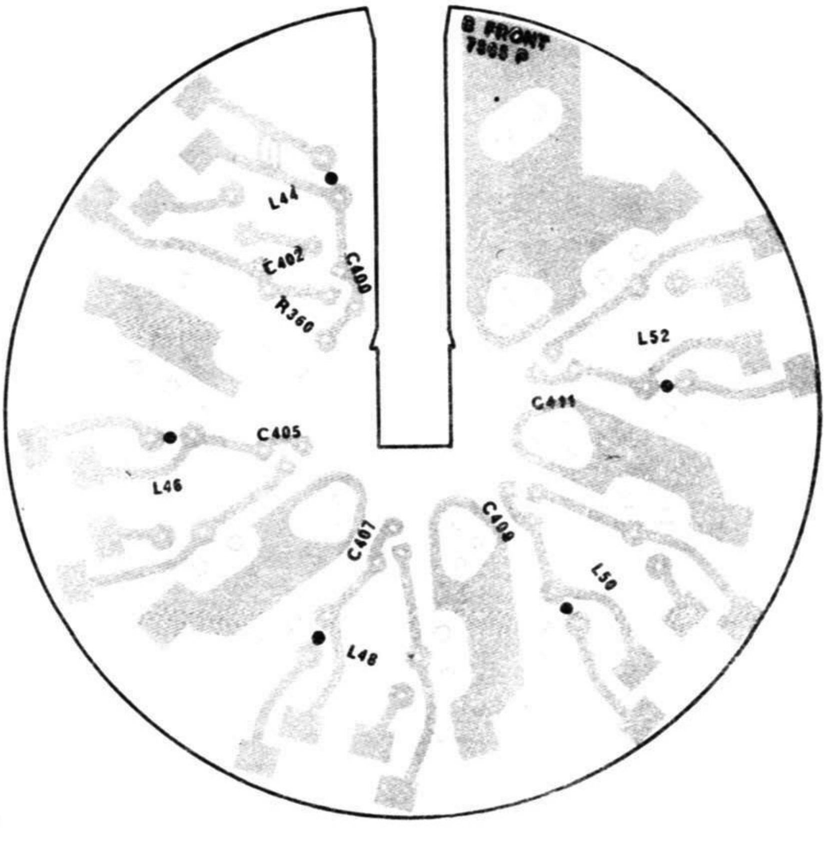


Turret Disk 'B' – RF circuit

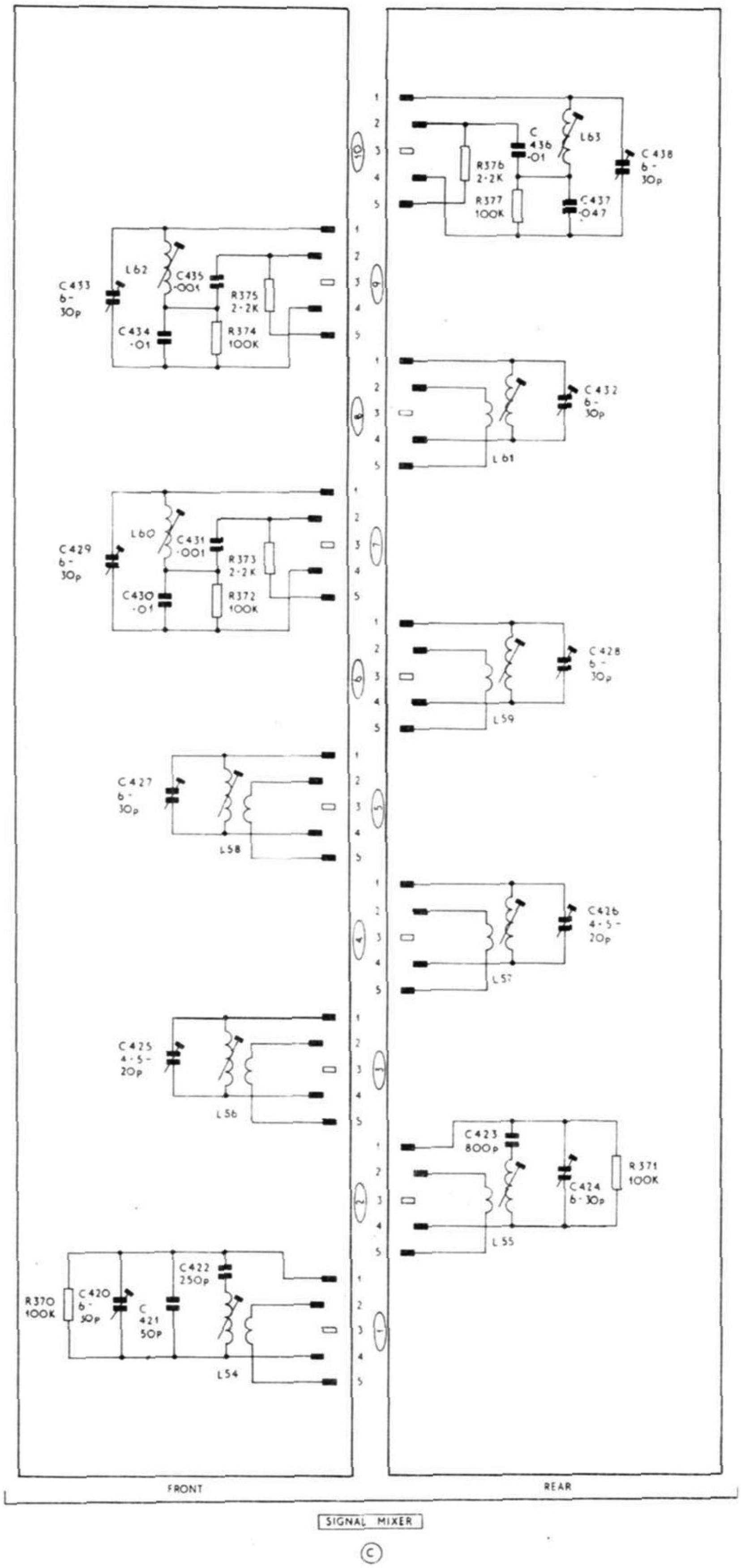
REAR



FRONT

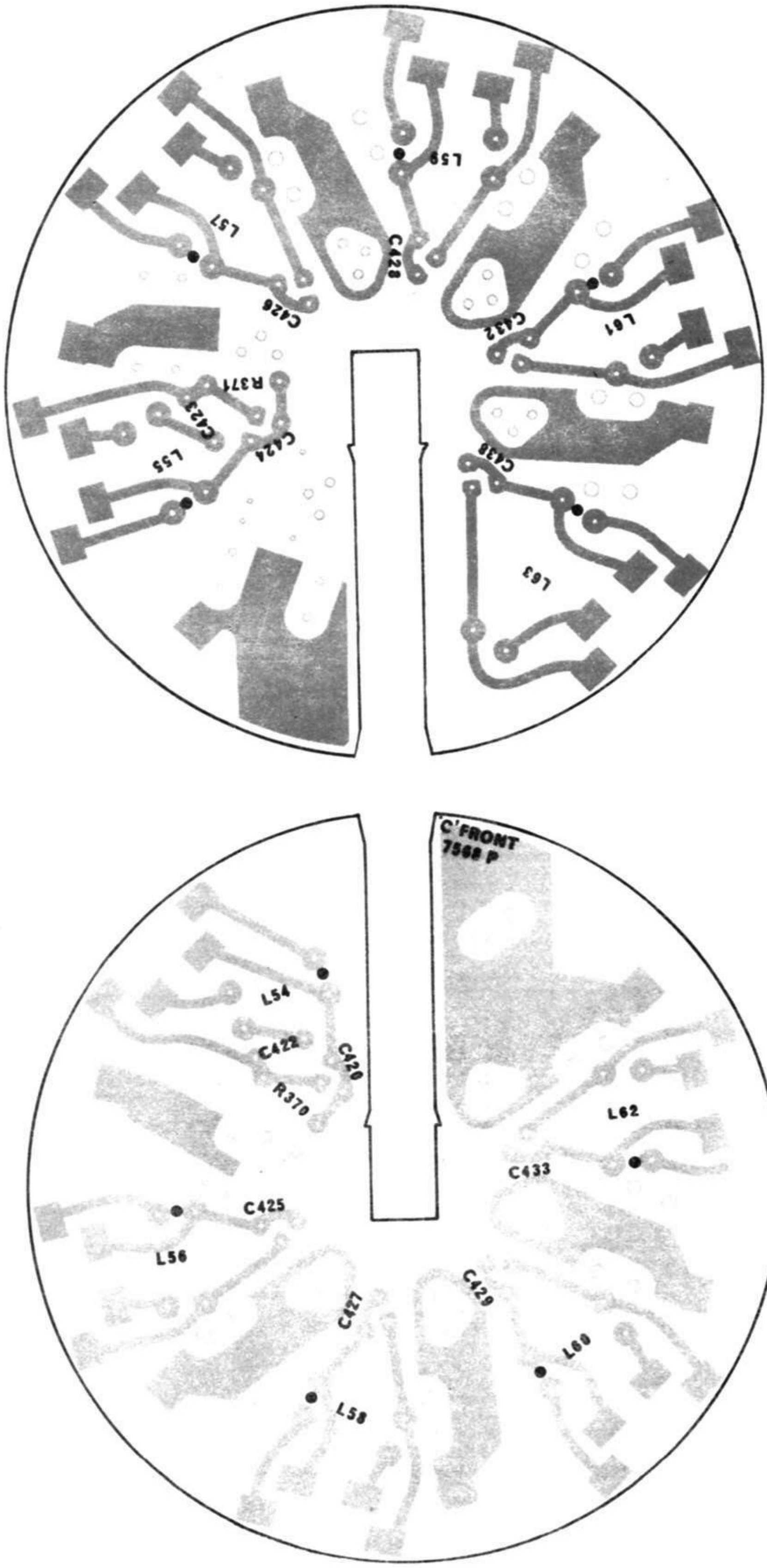


Turret Disk 'B' – RF board



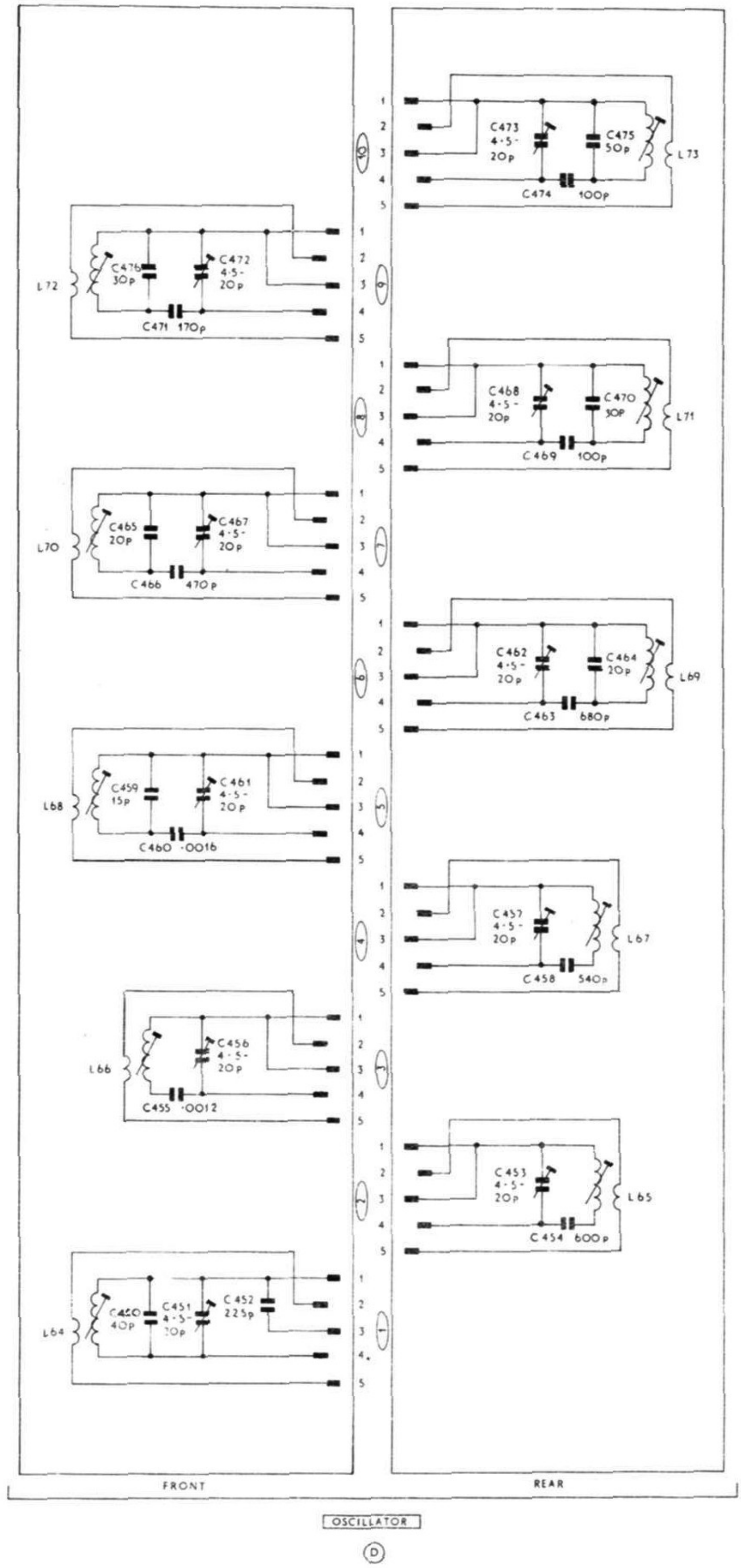
Turret Disk 'C' – Signal Mixer circuit

REAR



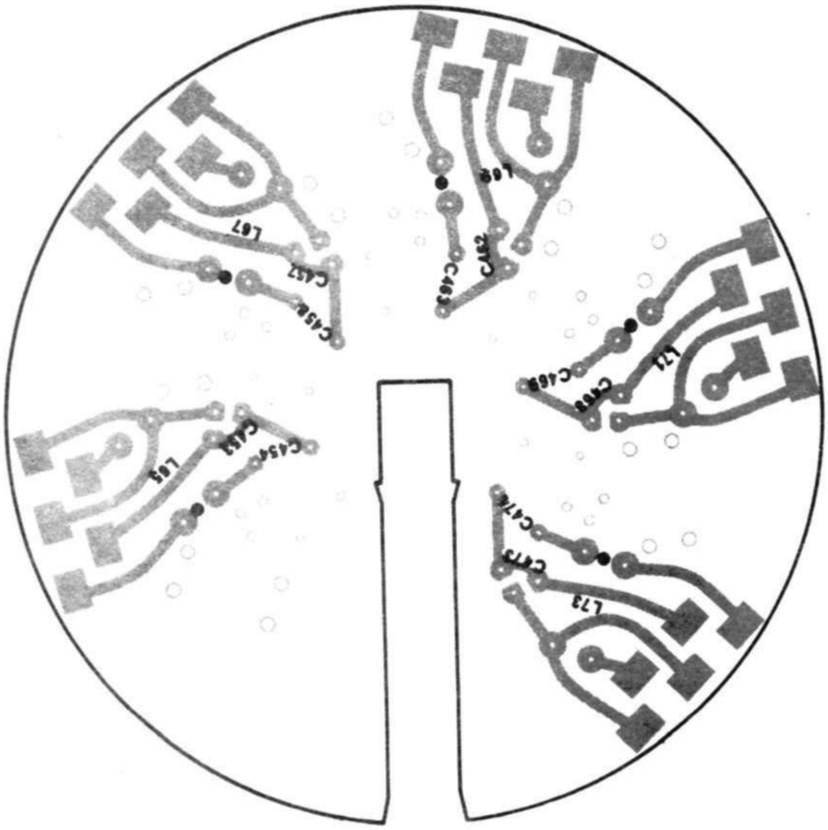
FRONT

Turret Disk 'C' – Signal Mixer board

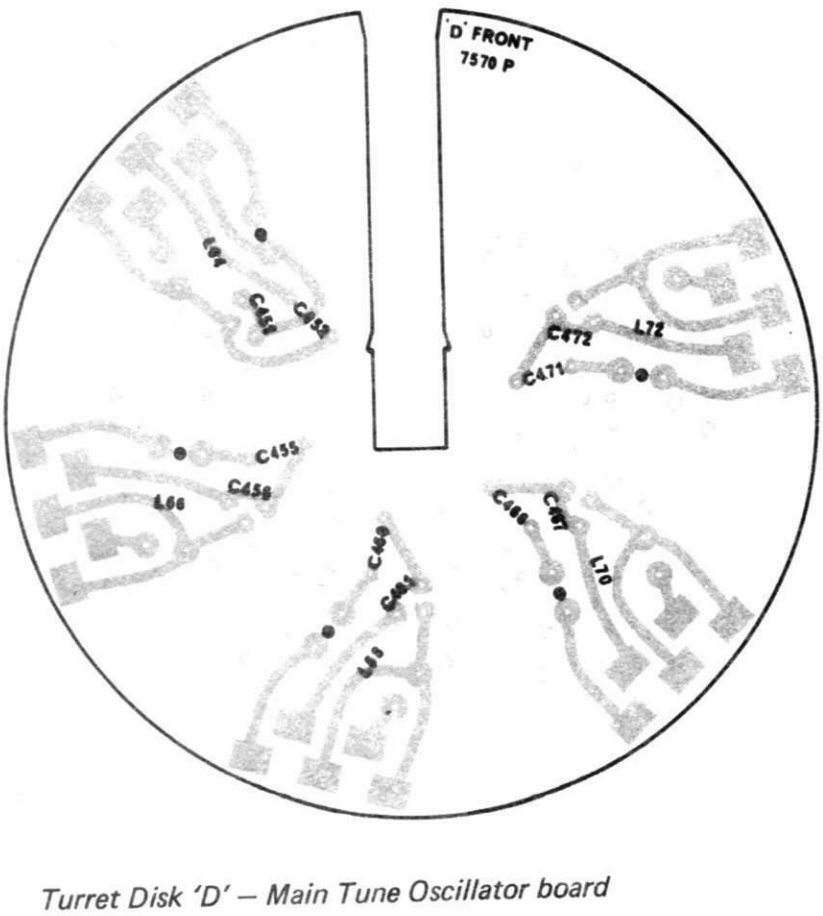


Turret Disk 'D' – Main Tune Oscillator circuit

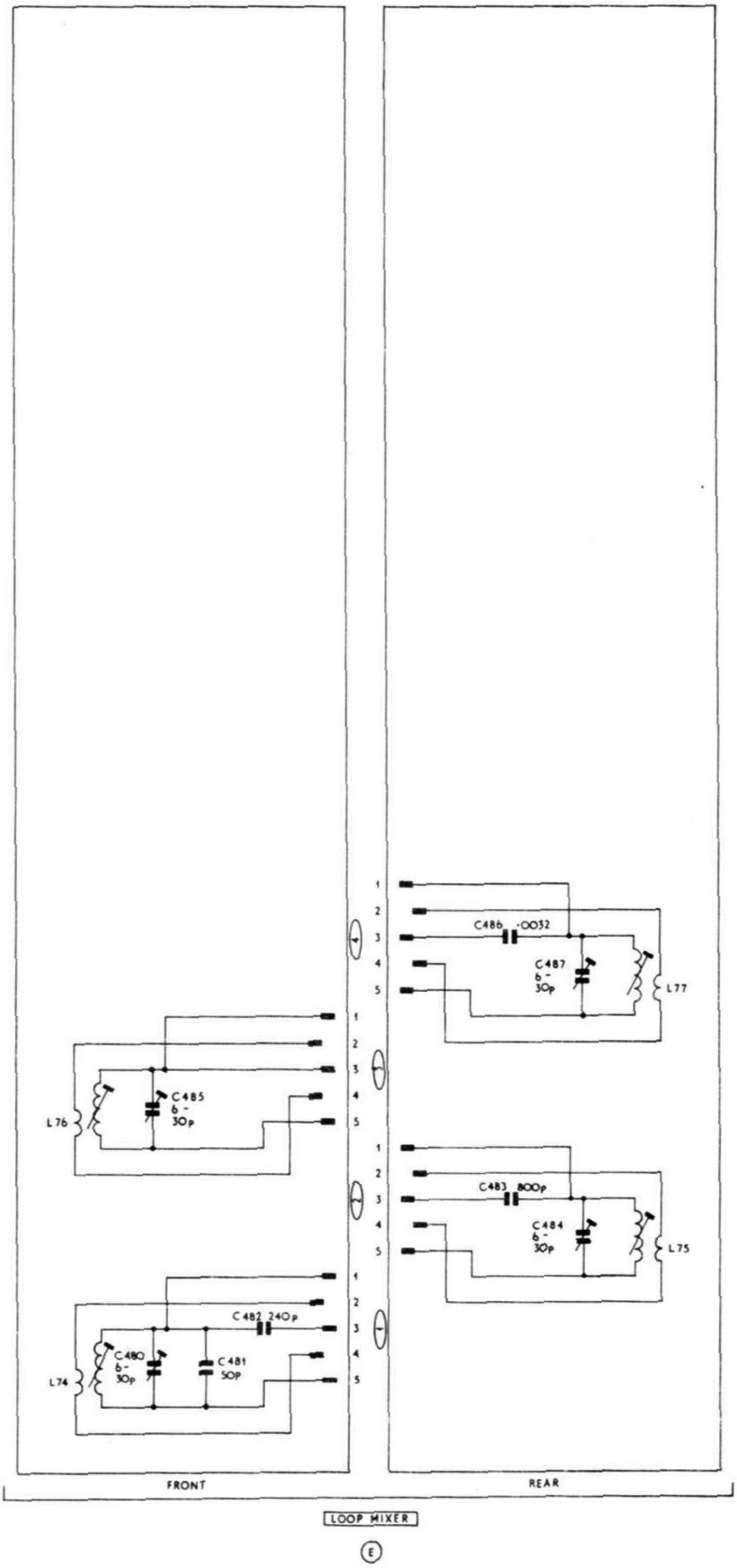
REAR



FRONT

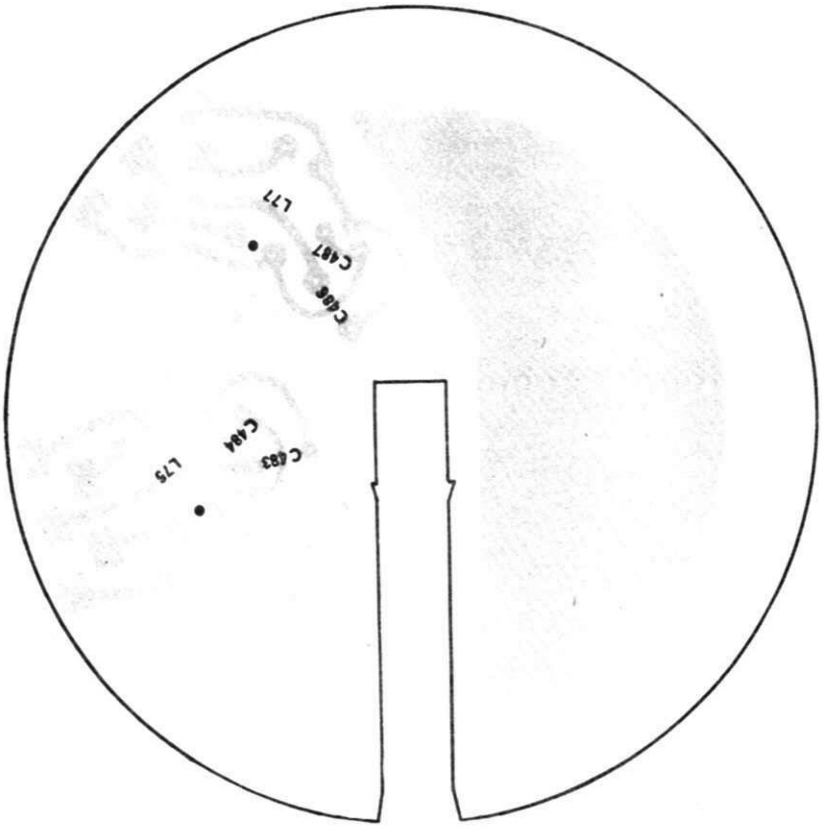


Turret Disk 'D' – Main Tune Oscillator board

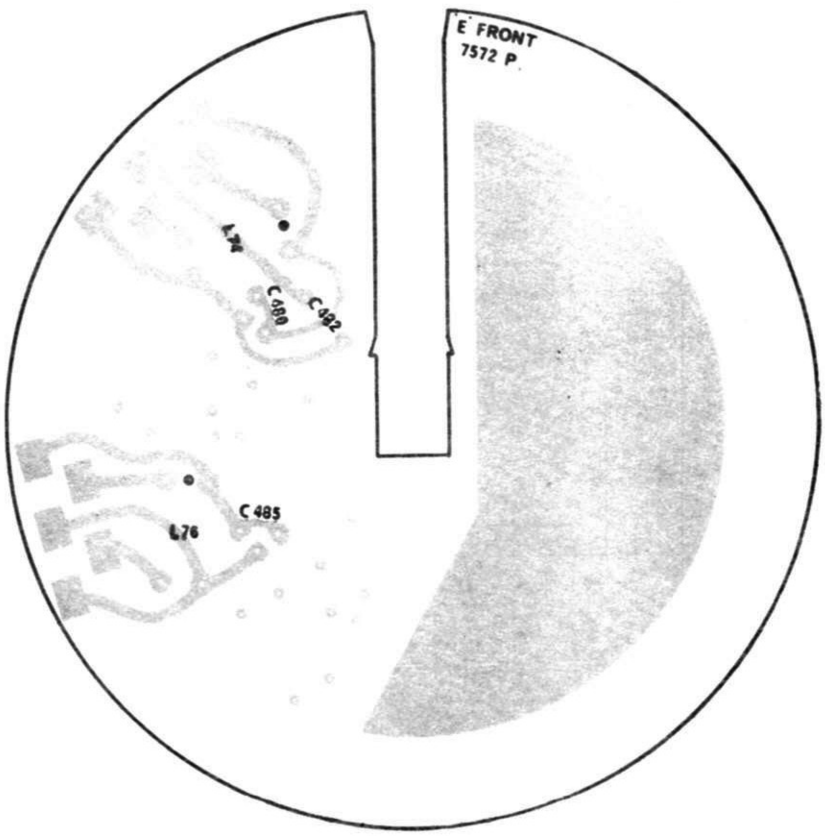


Turret Disk 'E' – Loop Mixer circuit

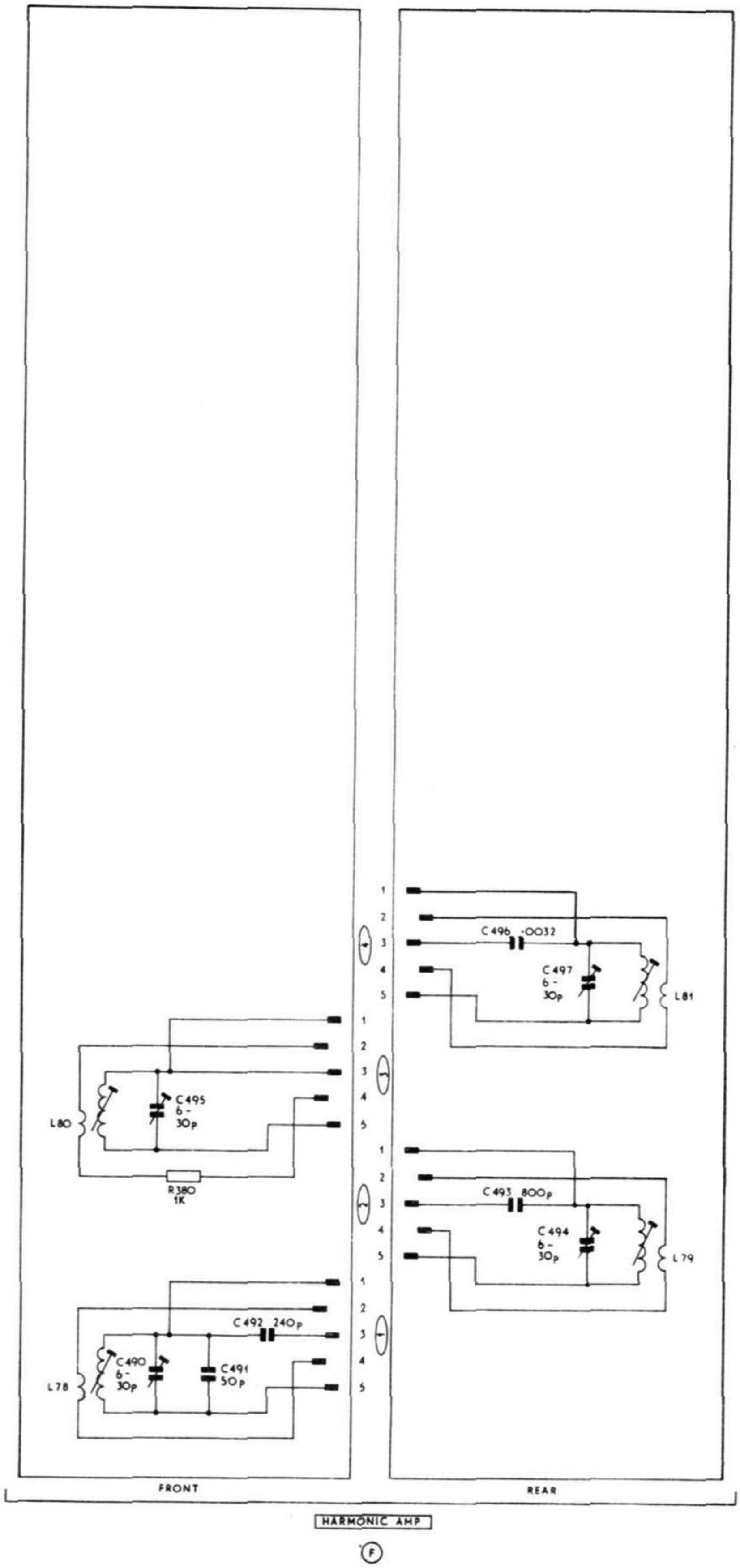
REAR



FRONT

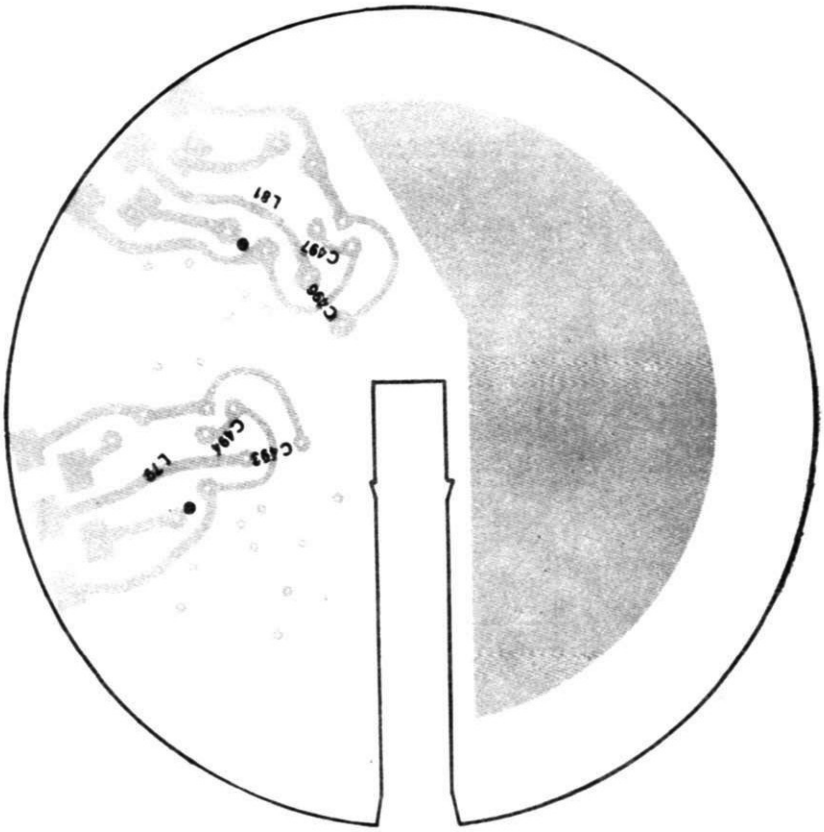


Turret Disk 'E' – Loop Mixer board

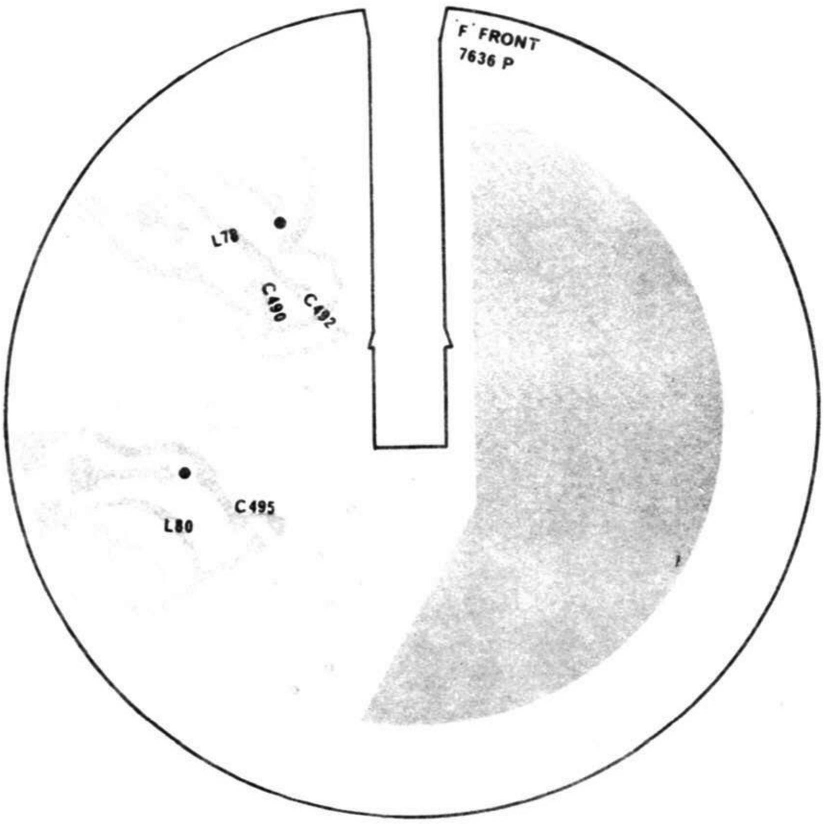


Turret Disk 'F' – Harmonic Amplifier circuit

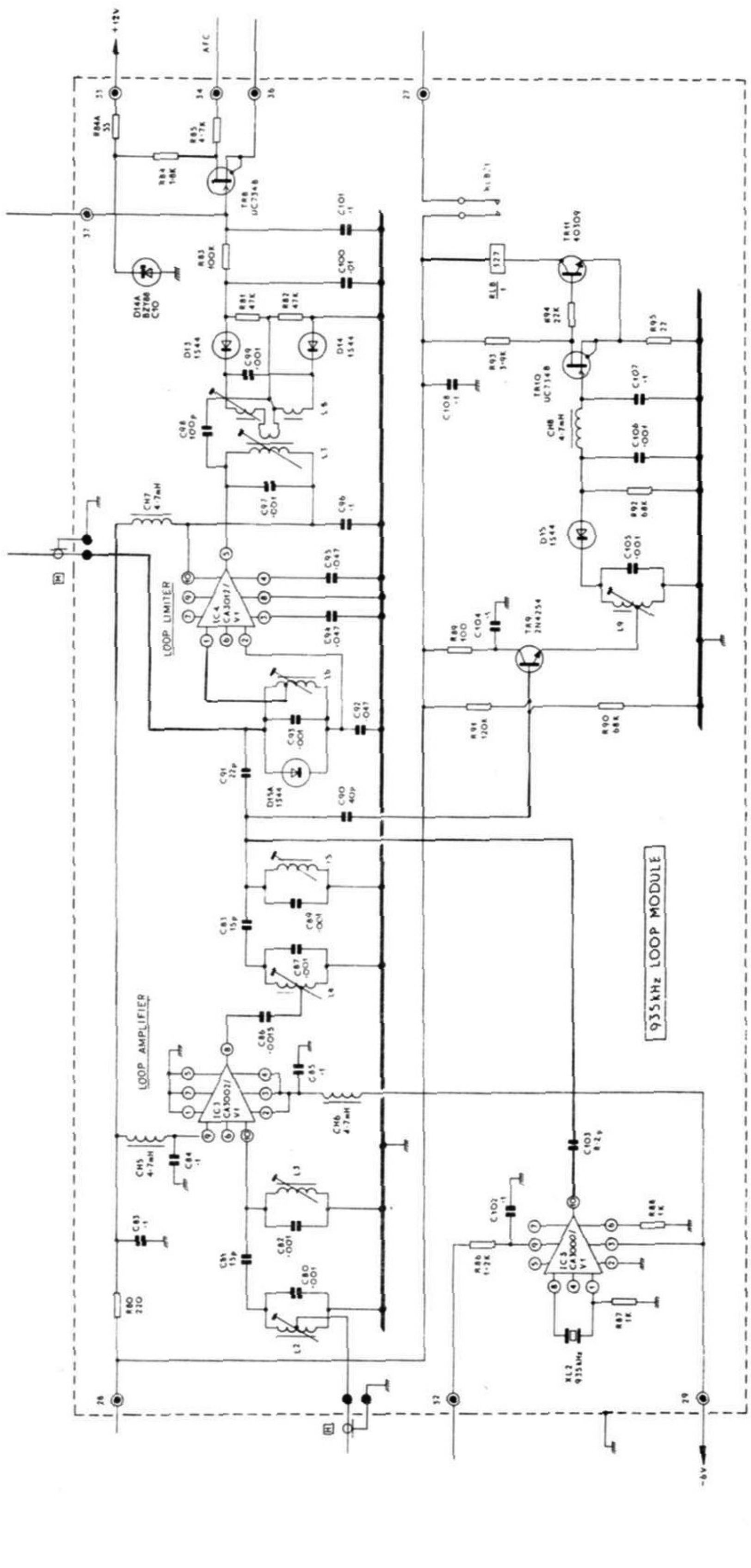
REAR



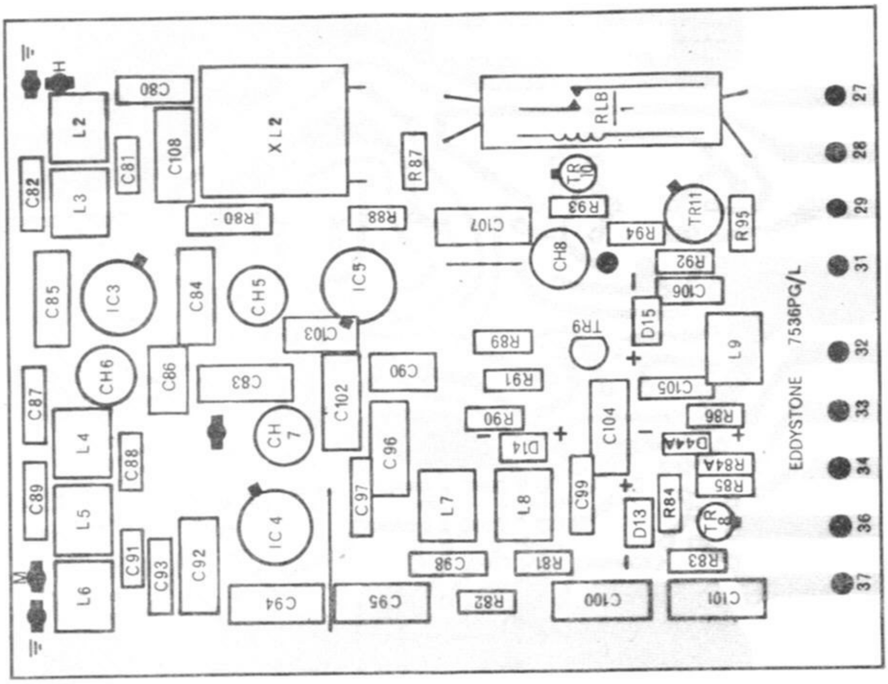
FRONT



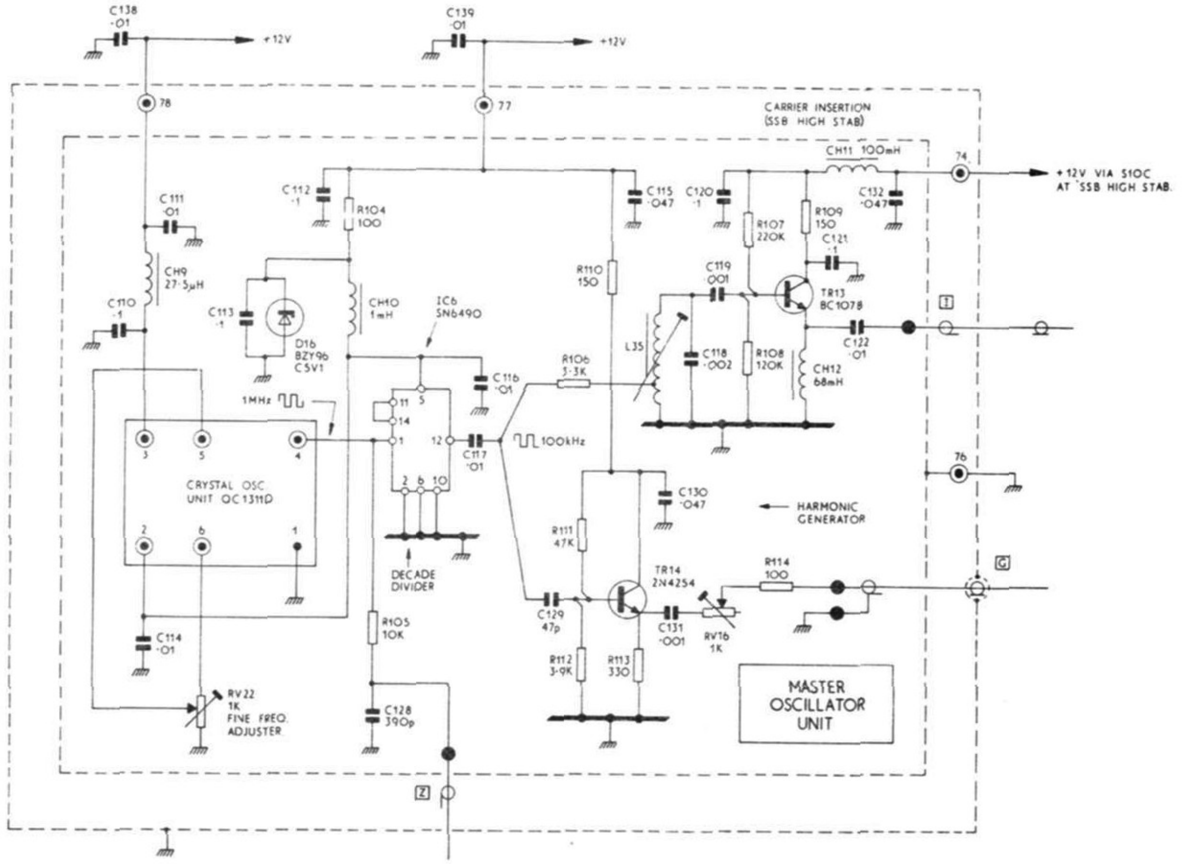
Turret Disk 'F' – Harmonic Amplifier board

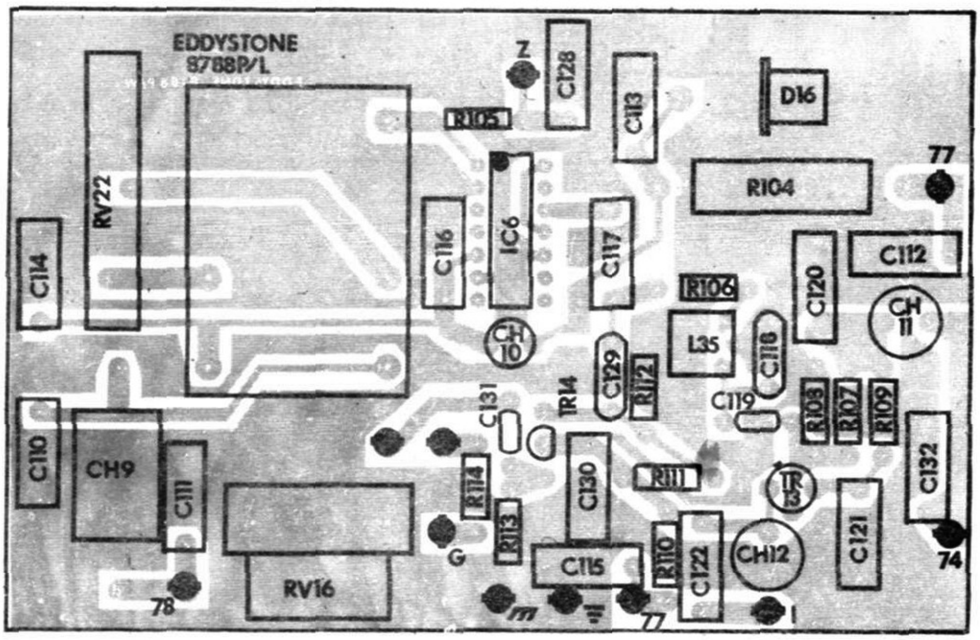


935kHz Loop Module circuit

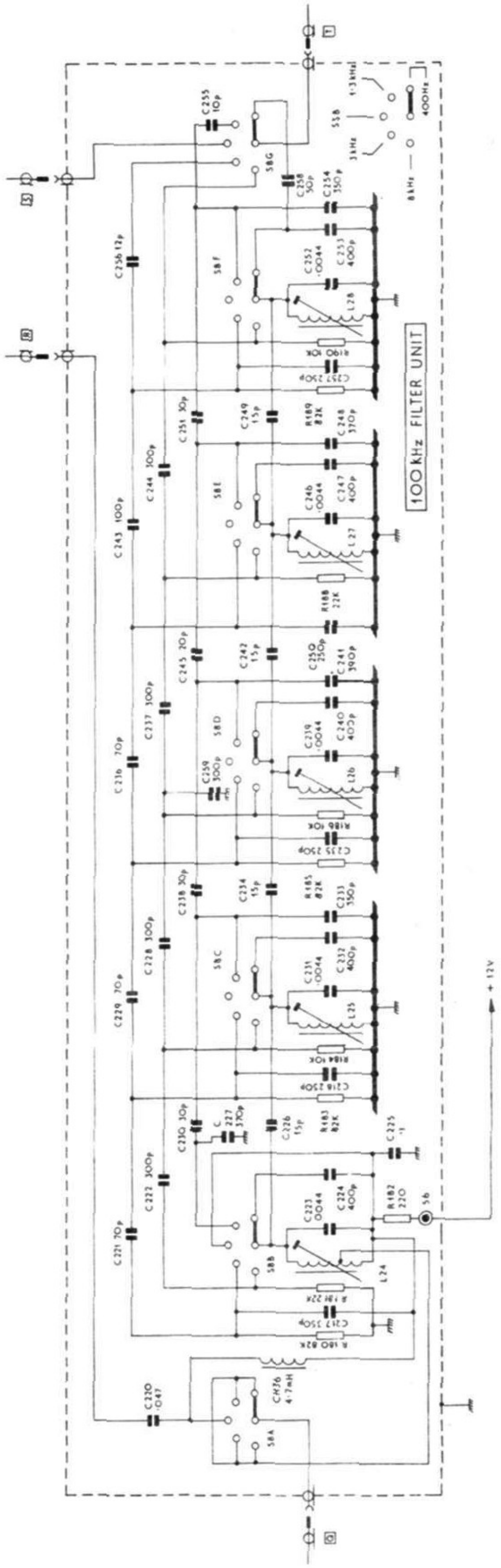


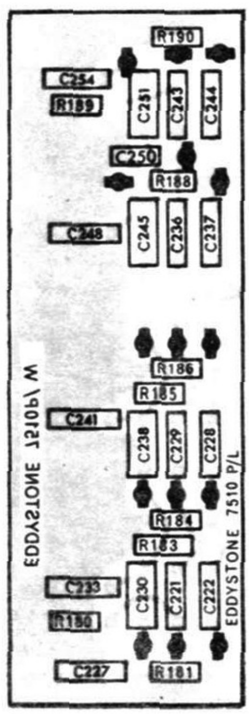
935kHz Loop Module board



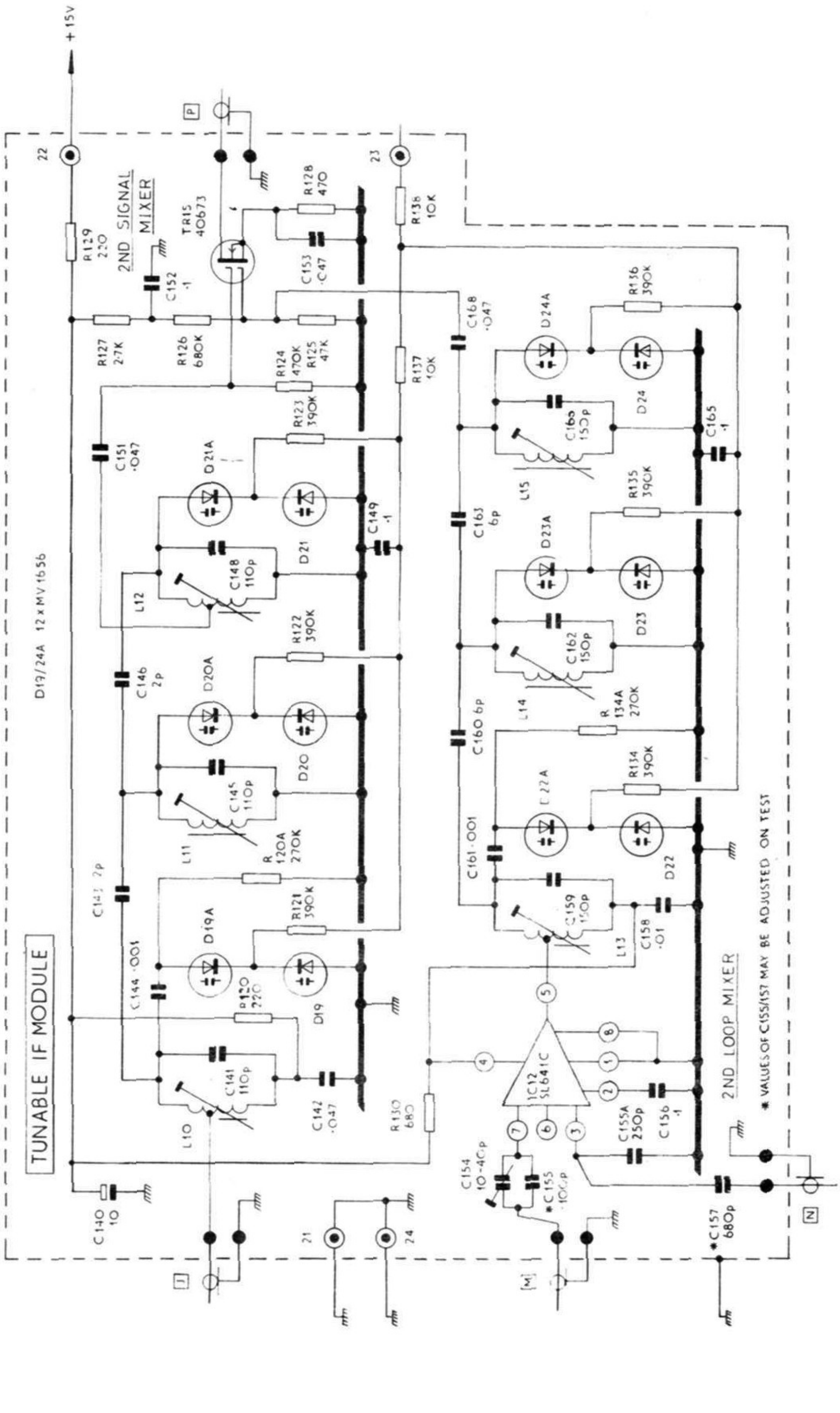


Master Oscillator Unit

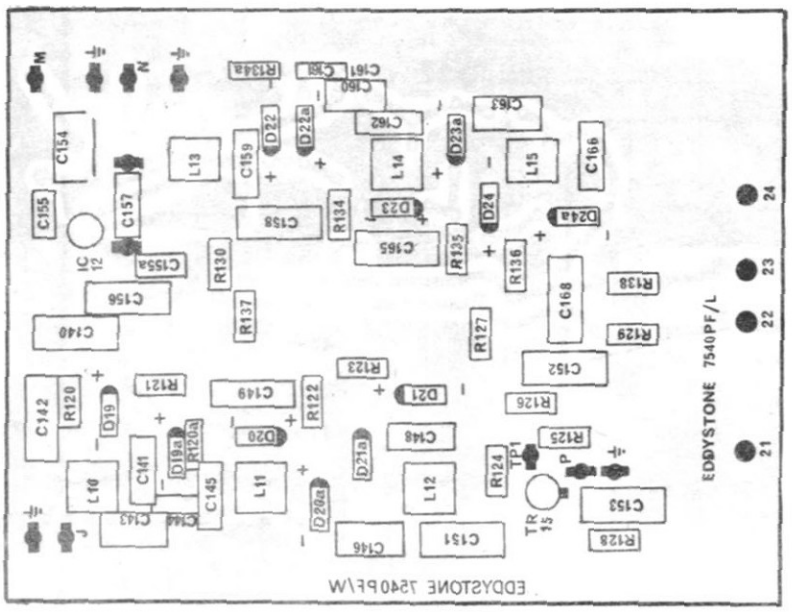




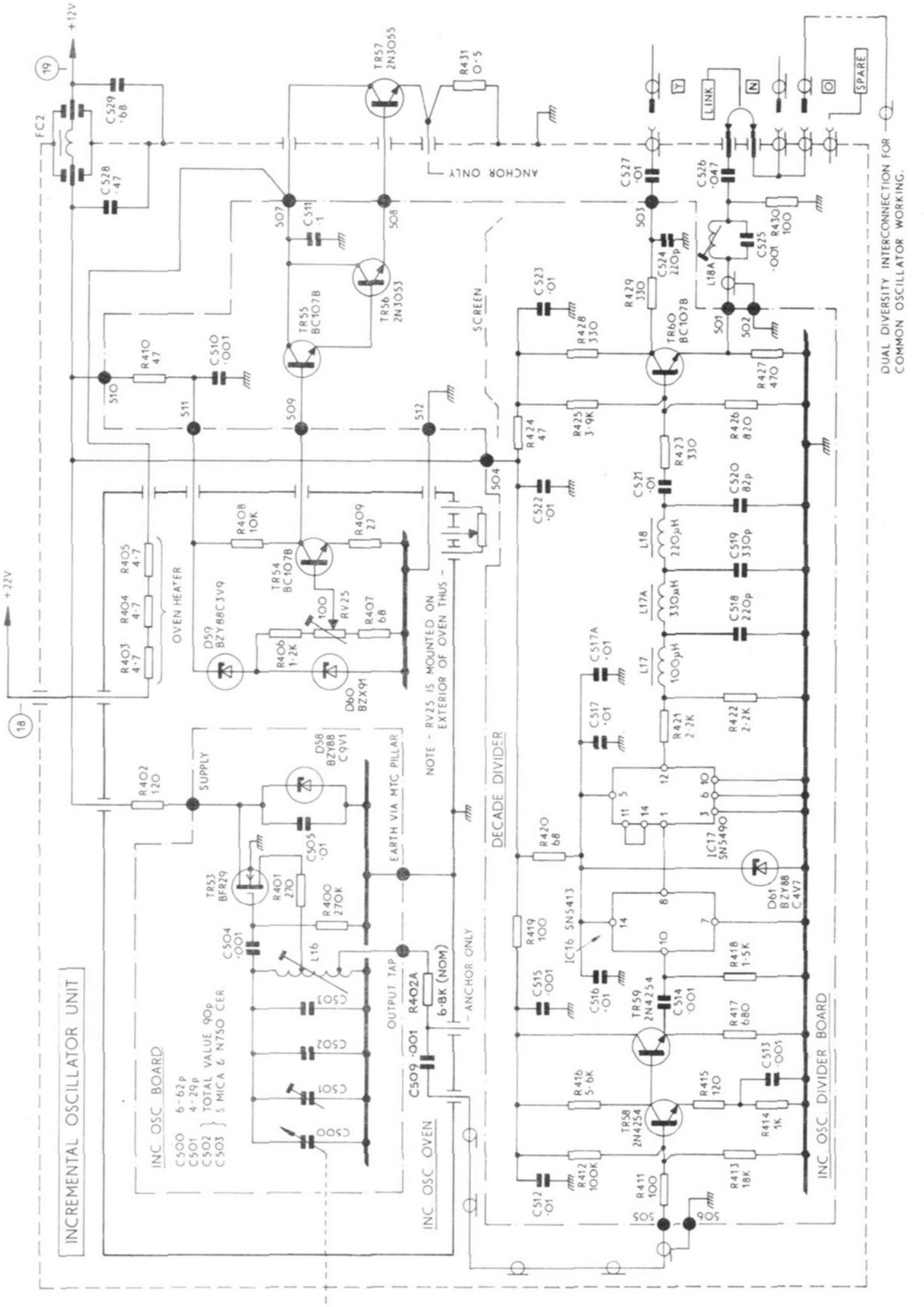
100kHz IF Filter Unit



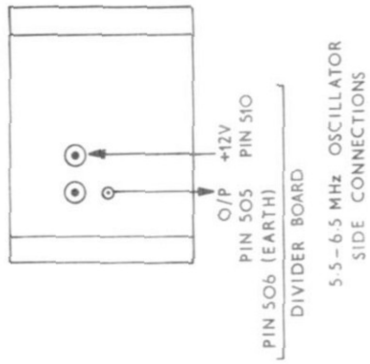
Tunable IF Module circuit

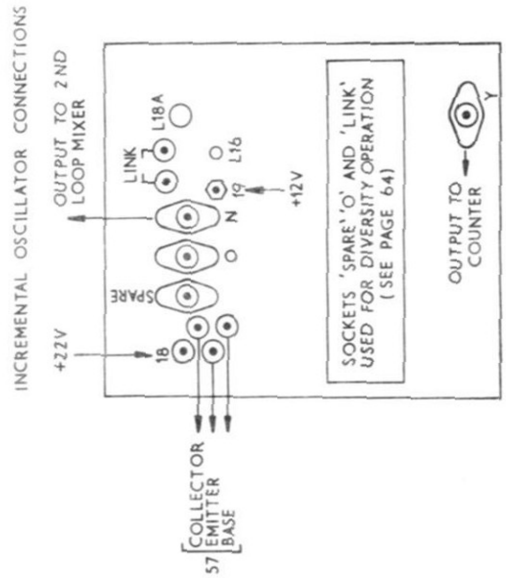


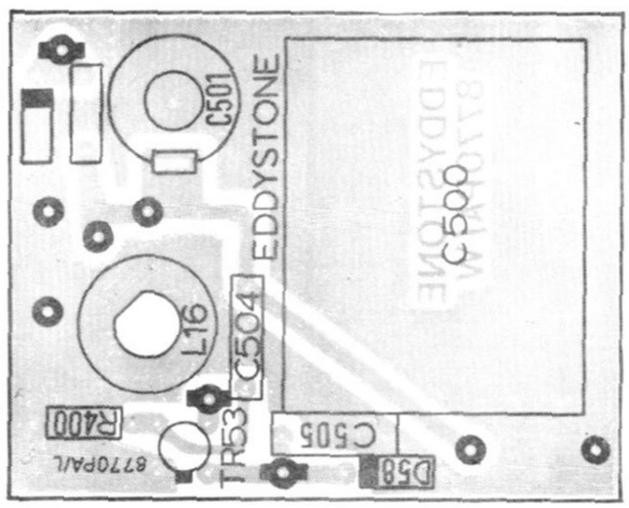
Tunable I F Module board



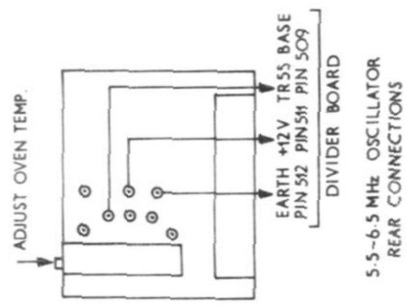
Incremental Oscillator Unit circuit

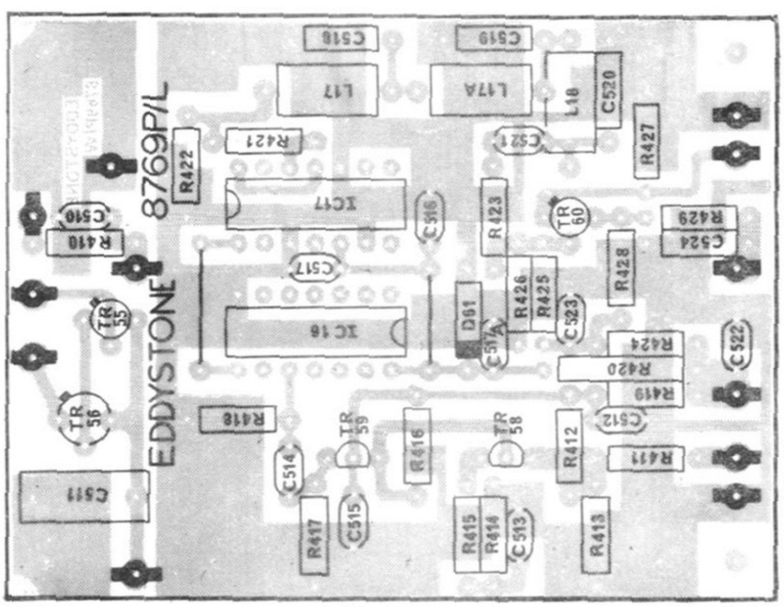




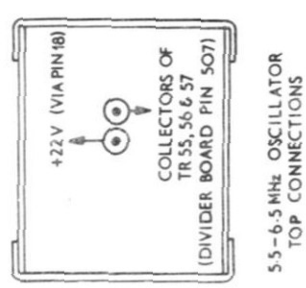


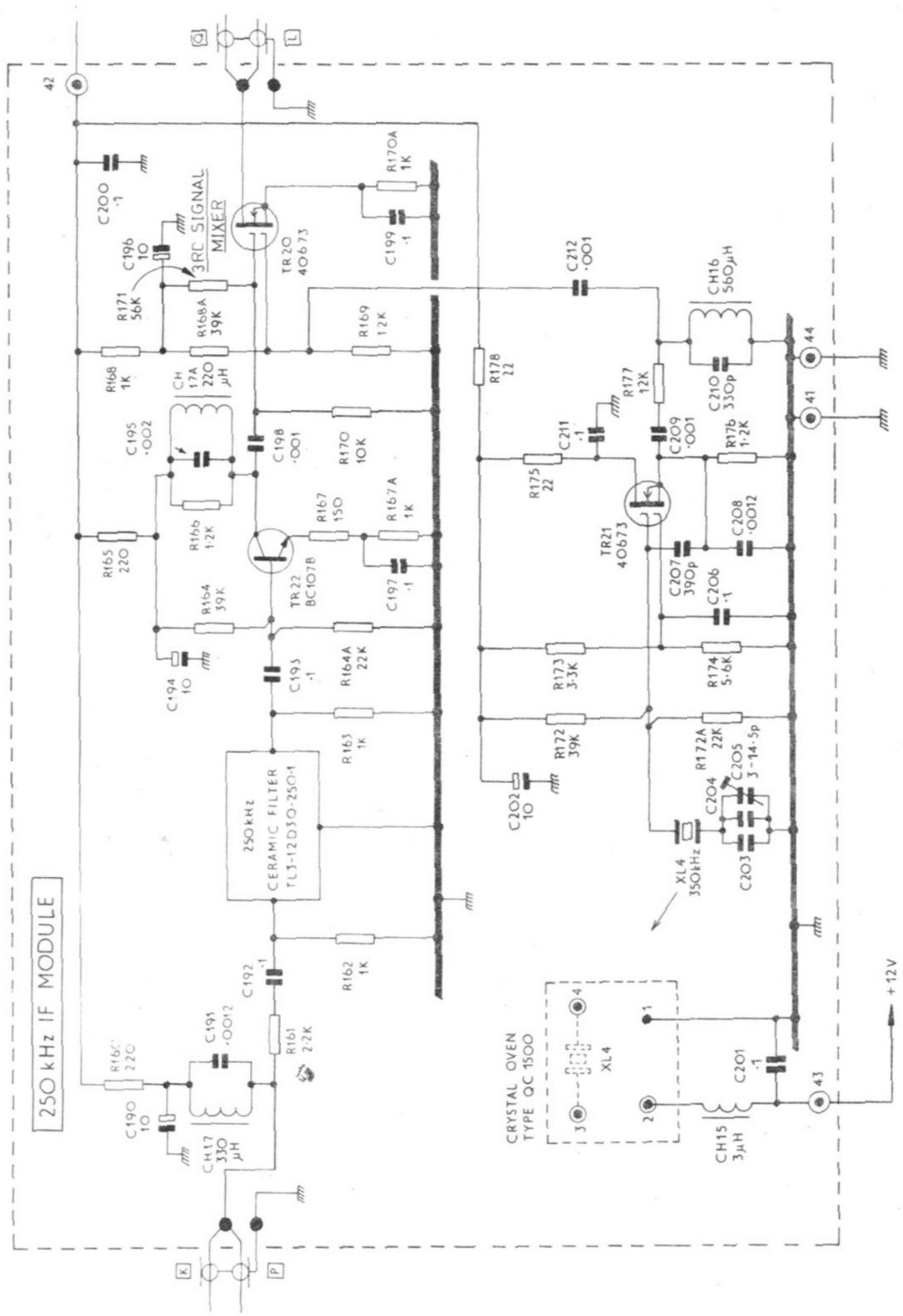
Incremental Oscillator board



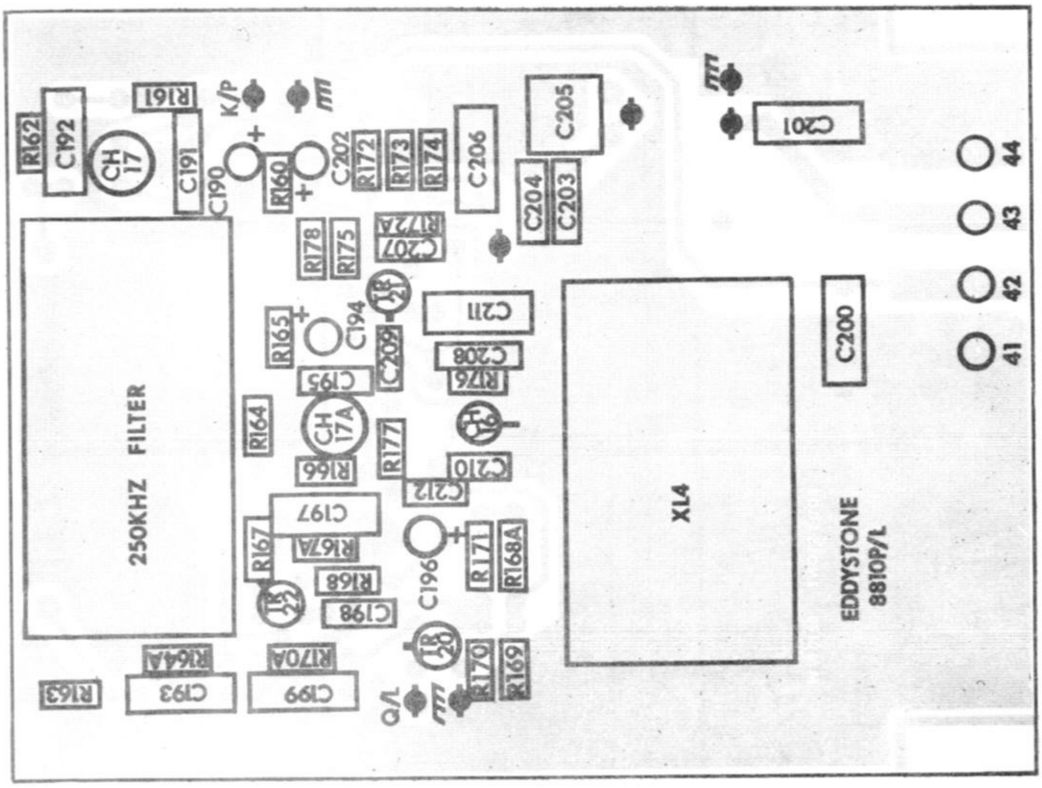


Incremental Oscillator Divider board

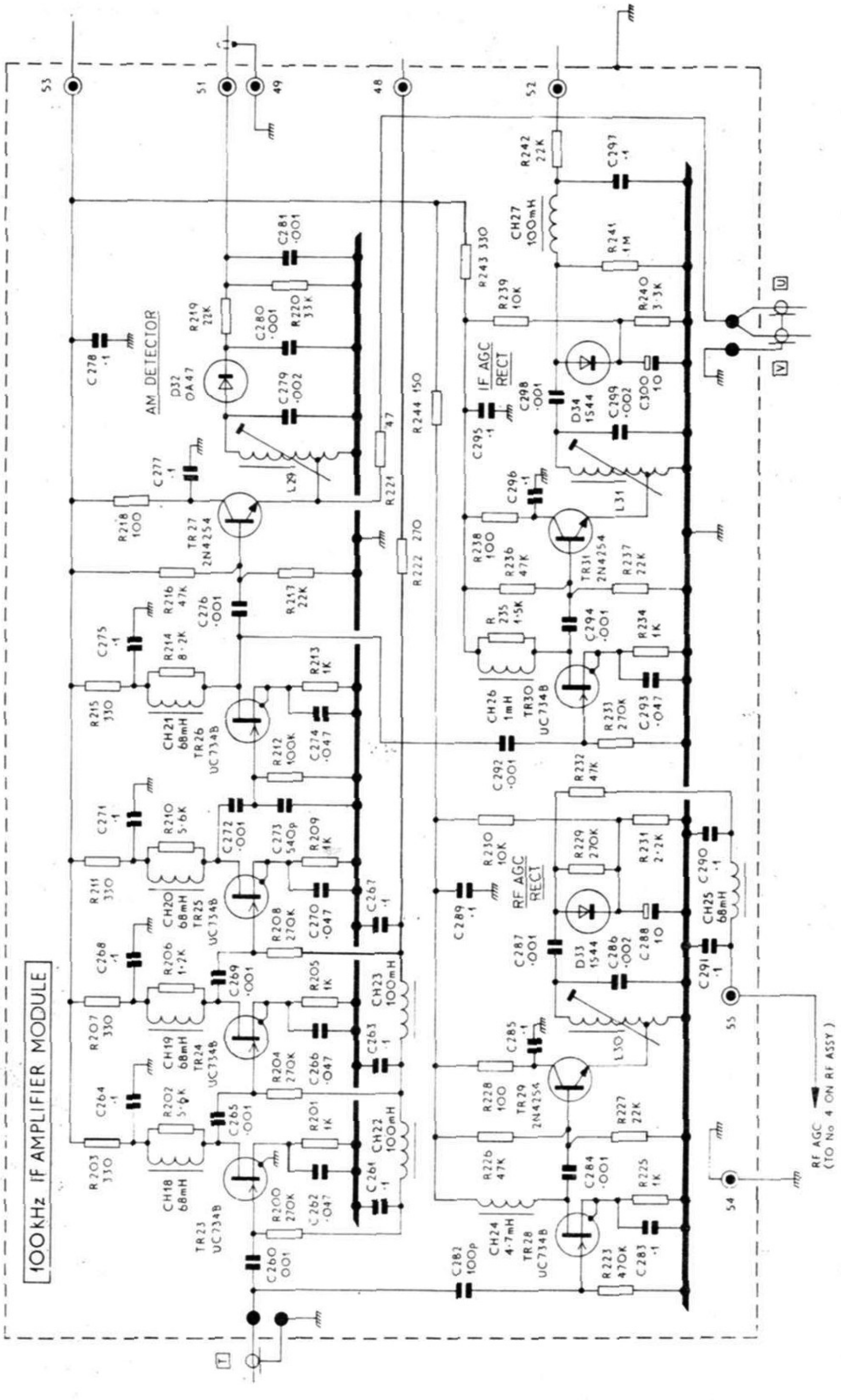




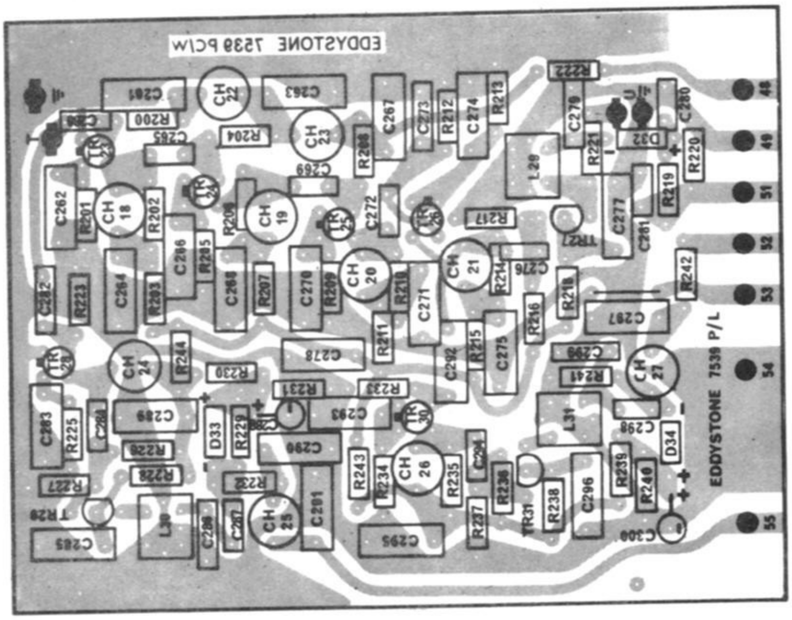
250kHz IF Module circuit



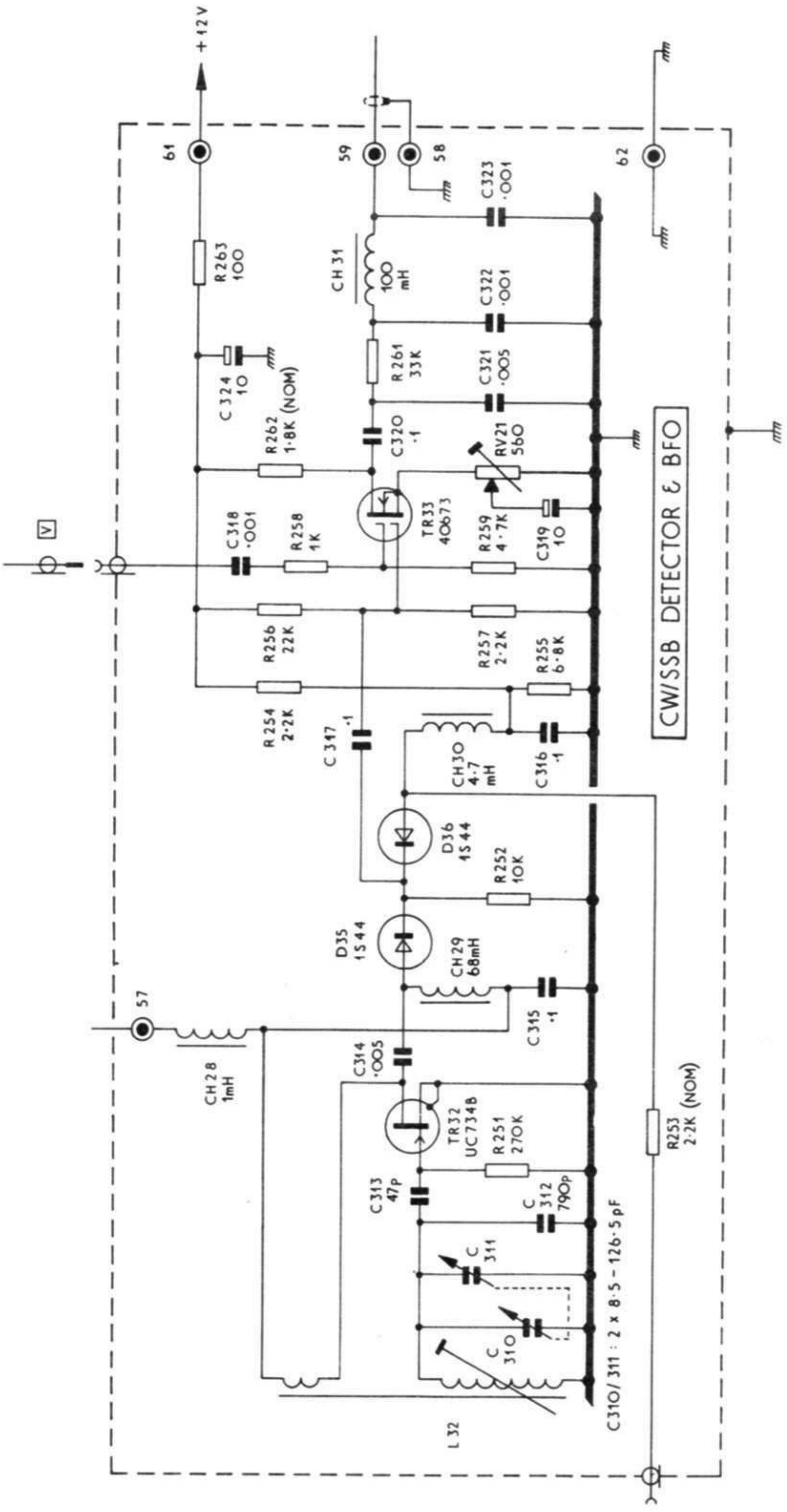
250kHz IF Module board

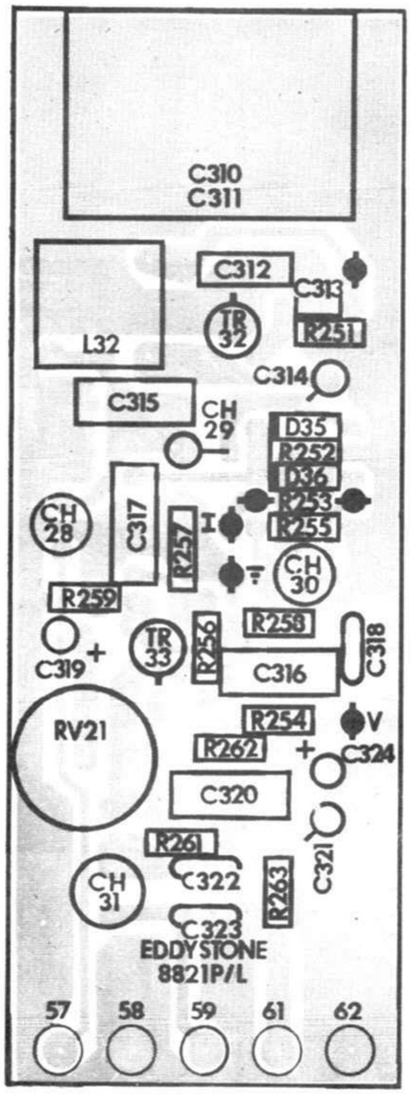


100kHz IF Amplifier circuit

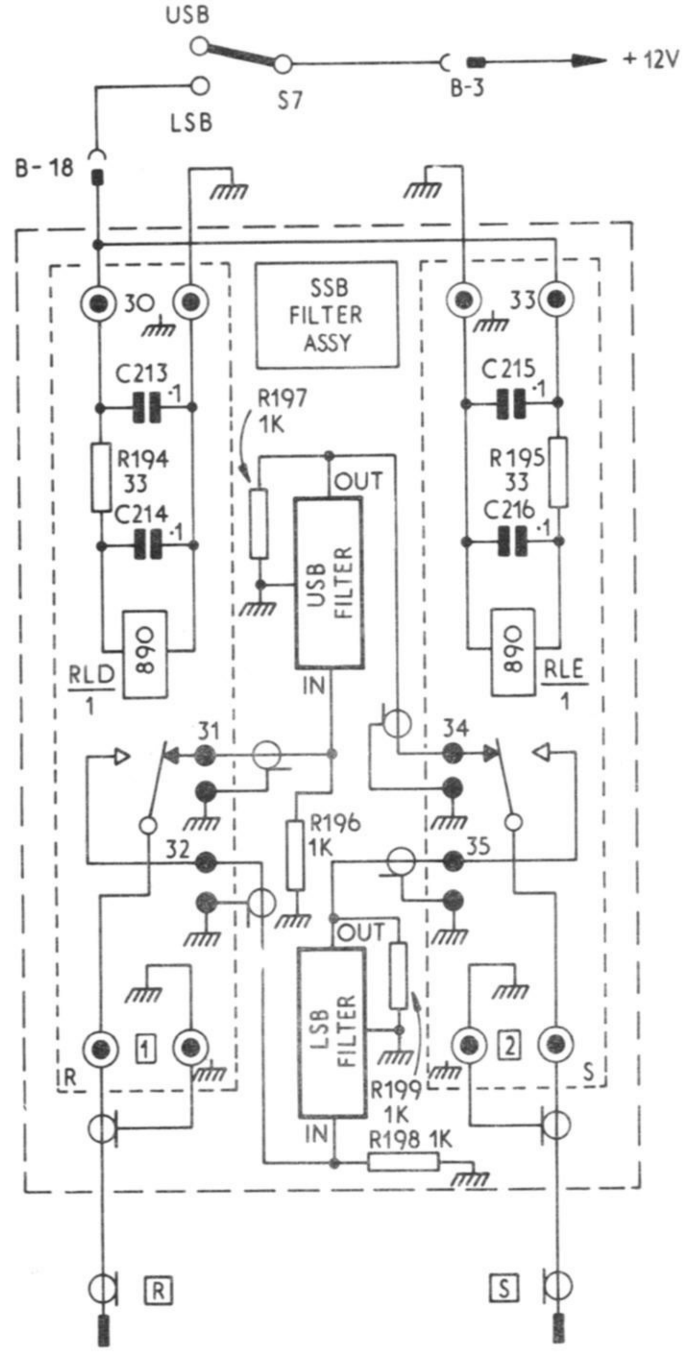


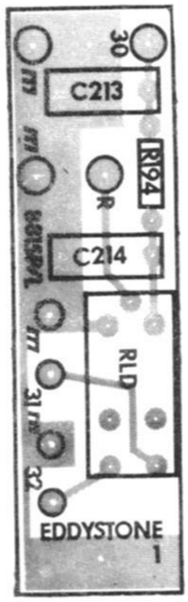
100kHz IF Amplifier board

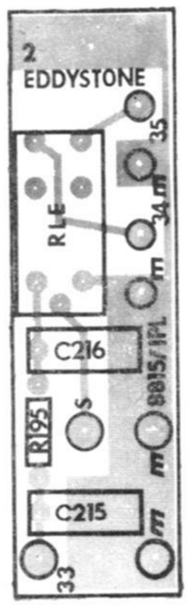




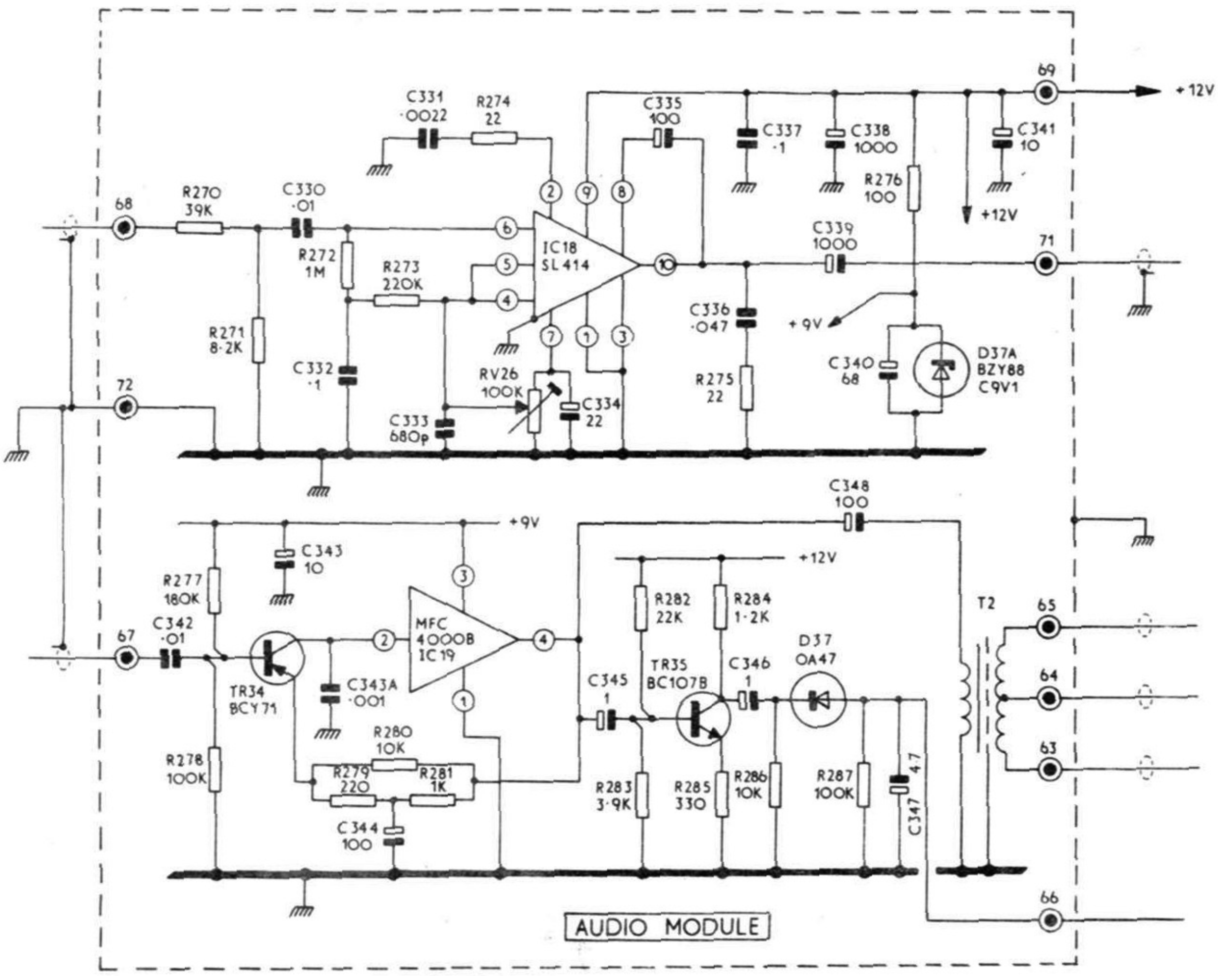
CW/SSB Detector and BFO unit

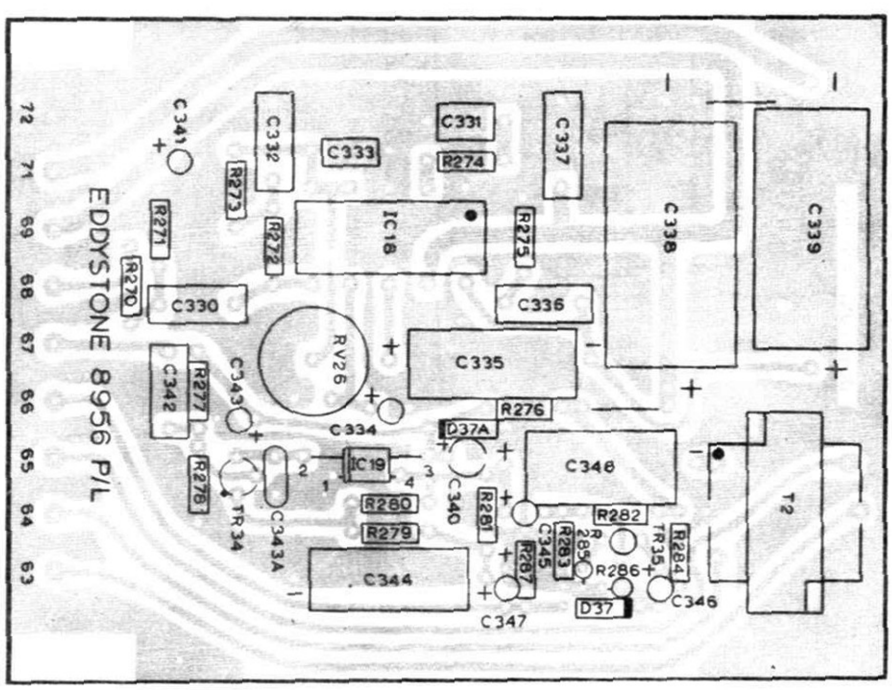




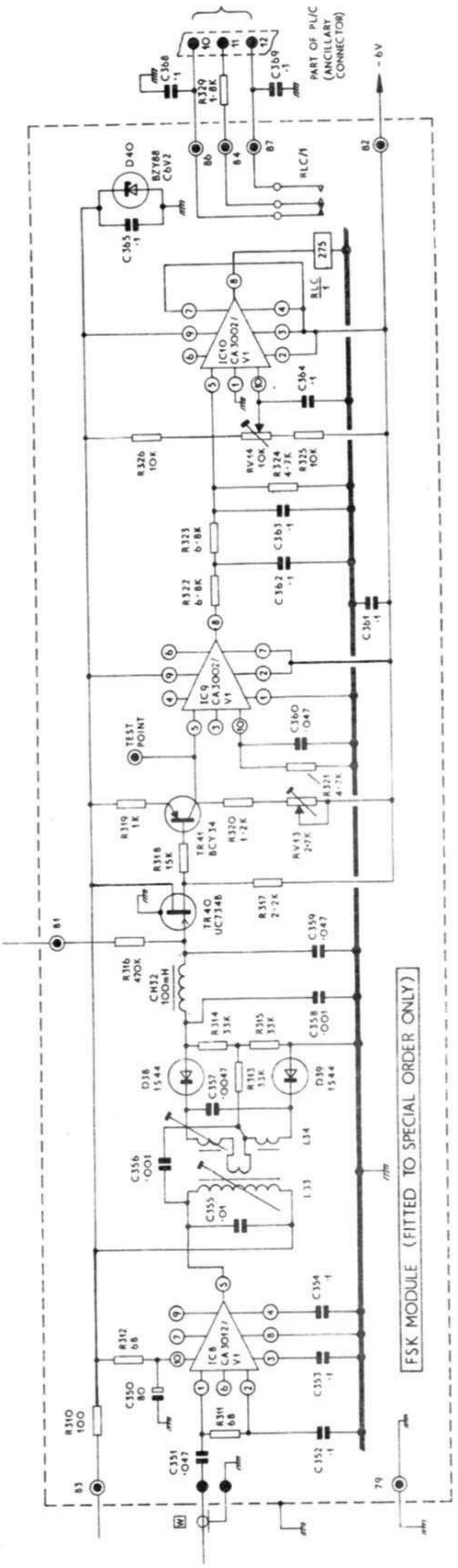


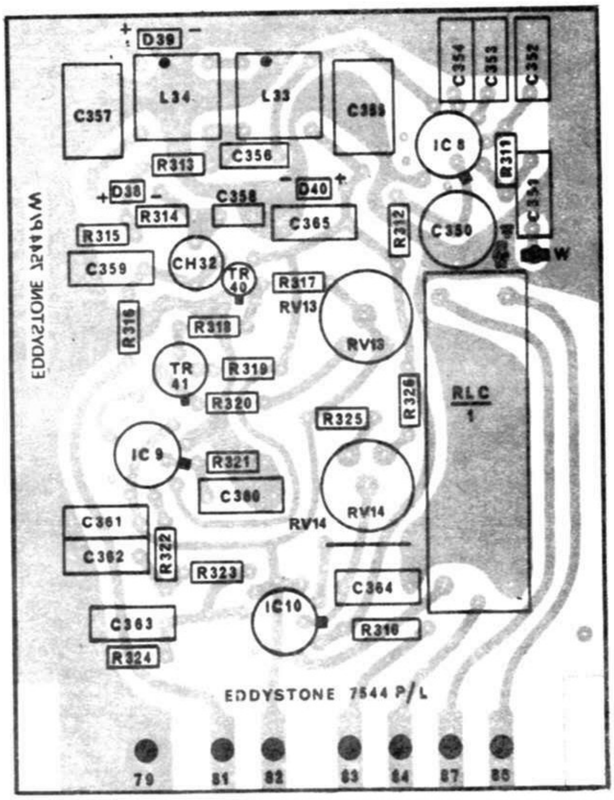
SSB Filter Assembly (including Relay boards)



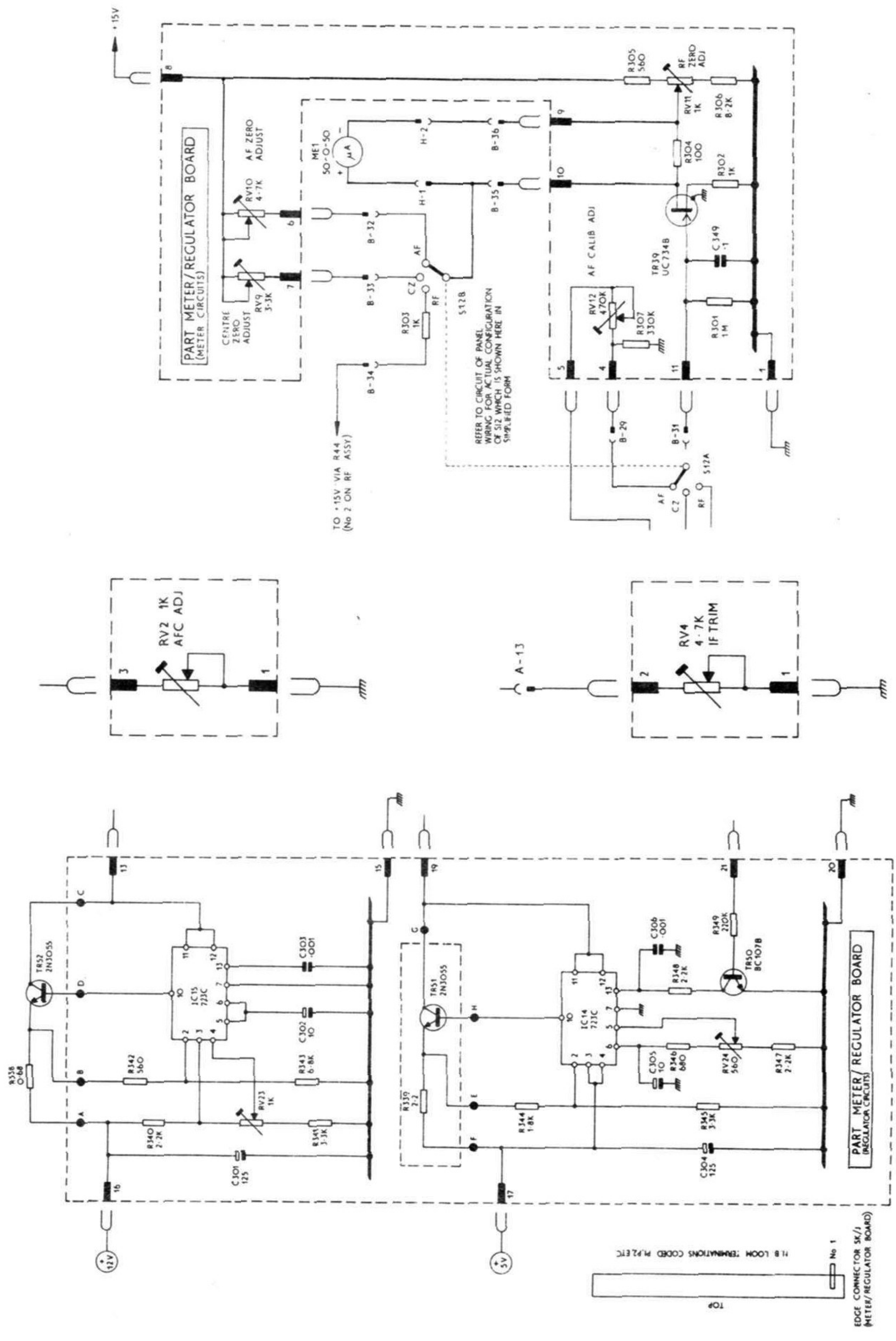


Audio Amplifier Module


FSK MODULE (FITTED TO SPECIAL ORDER ONLY)
PART OF PL/C (ANCILLARY CONNECTOR)
TEST POINT

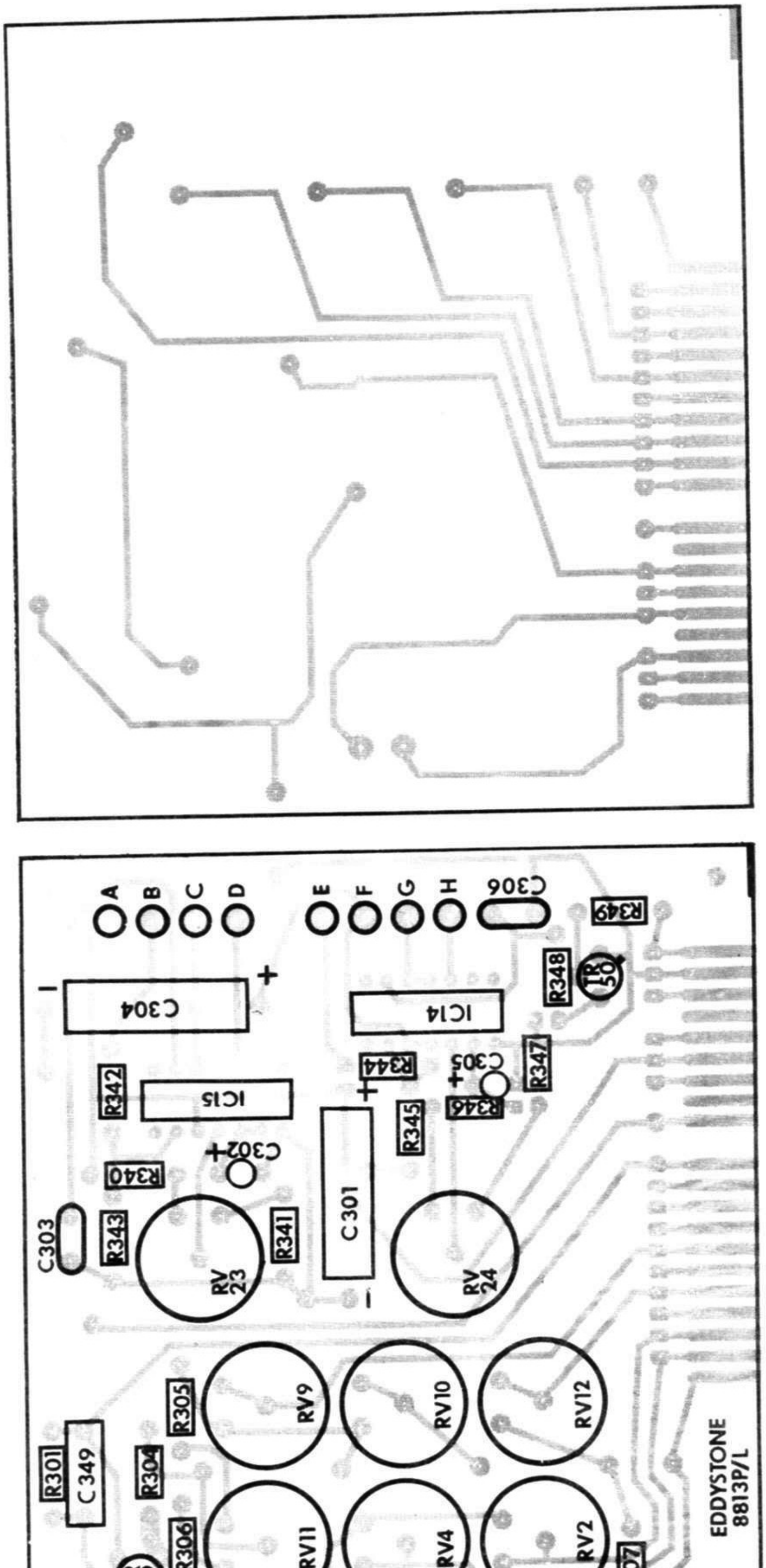

EDDYSTONE 7544 P/L
RLC 1

FSK Module

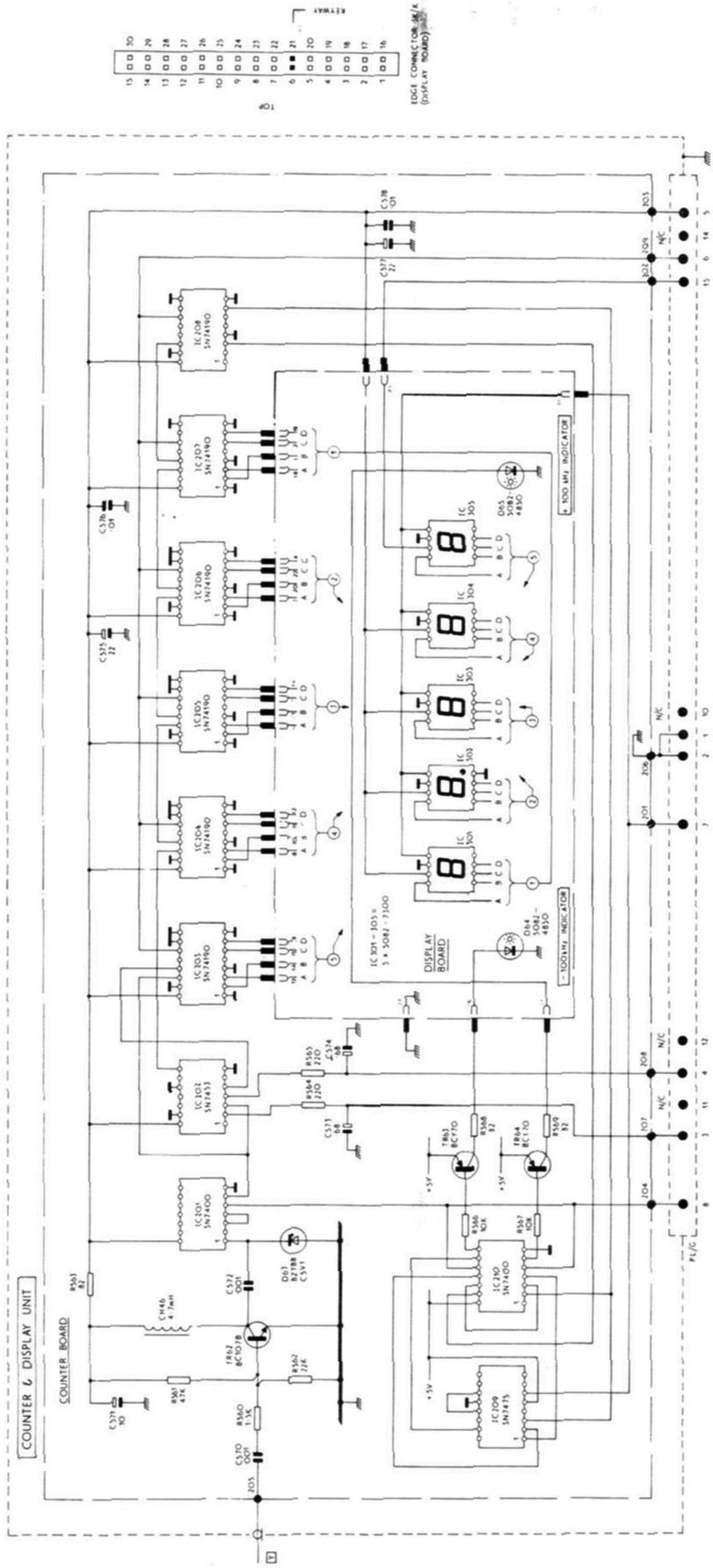


Meter Regulator circuits

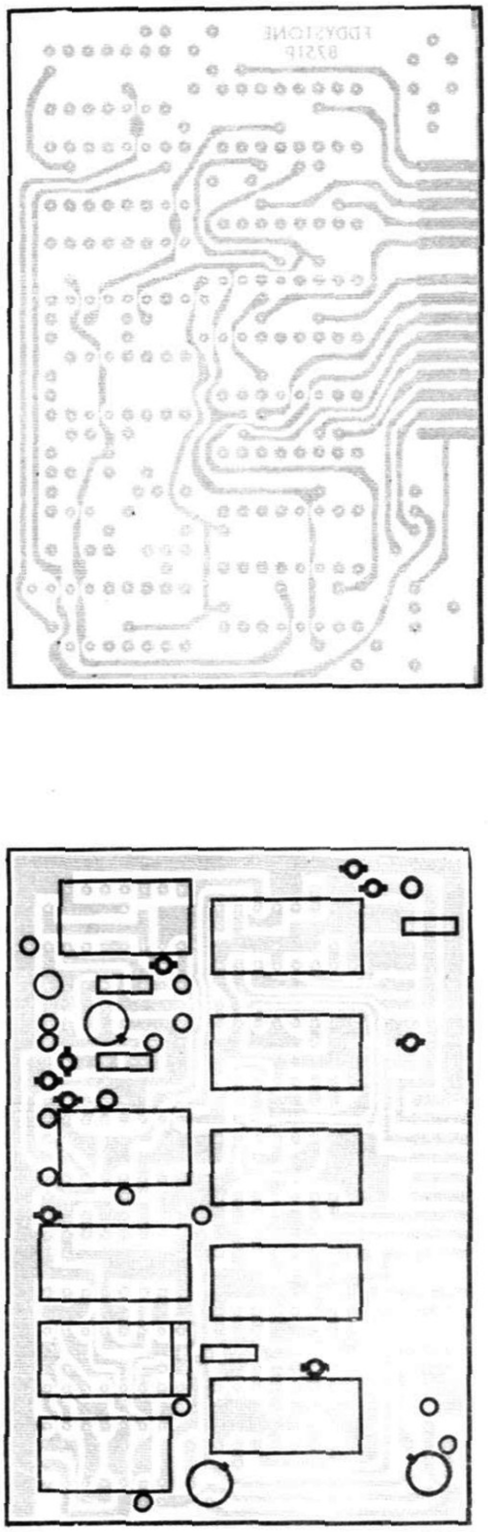
Note: All components shown inside dotted lines appear on the Meter/Regulator boards.



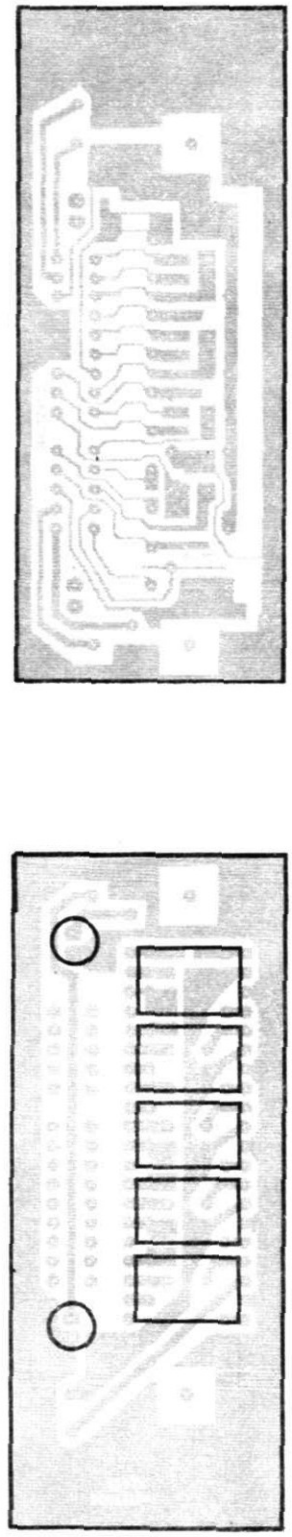
Meter/Regulator board



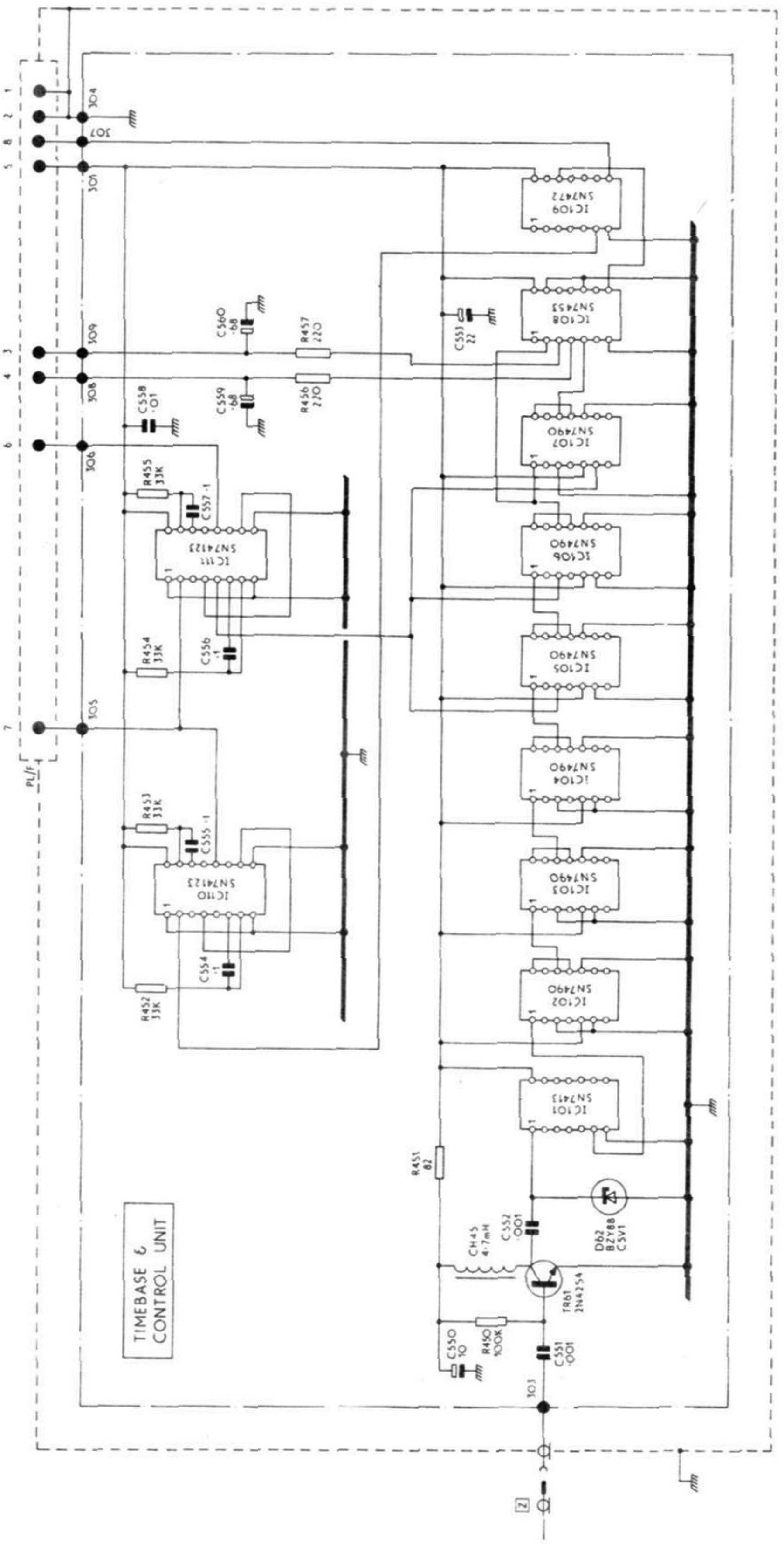
Counter and Display Unit circuit



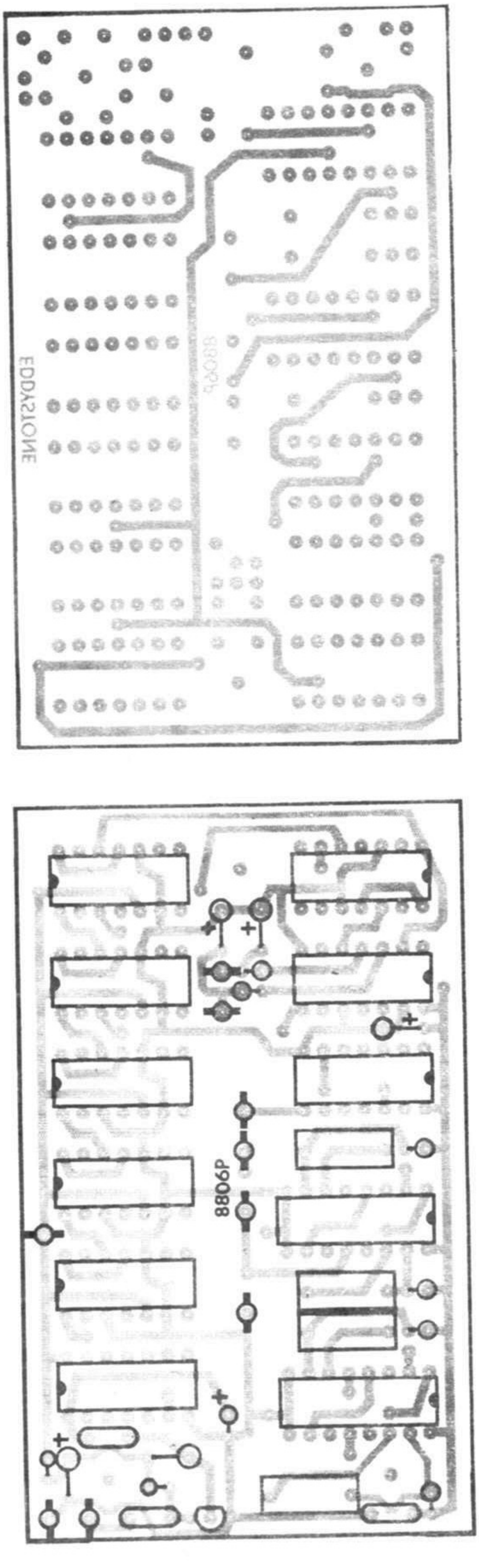
Counter board



Display board

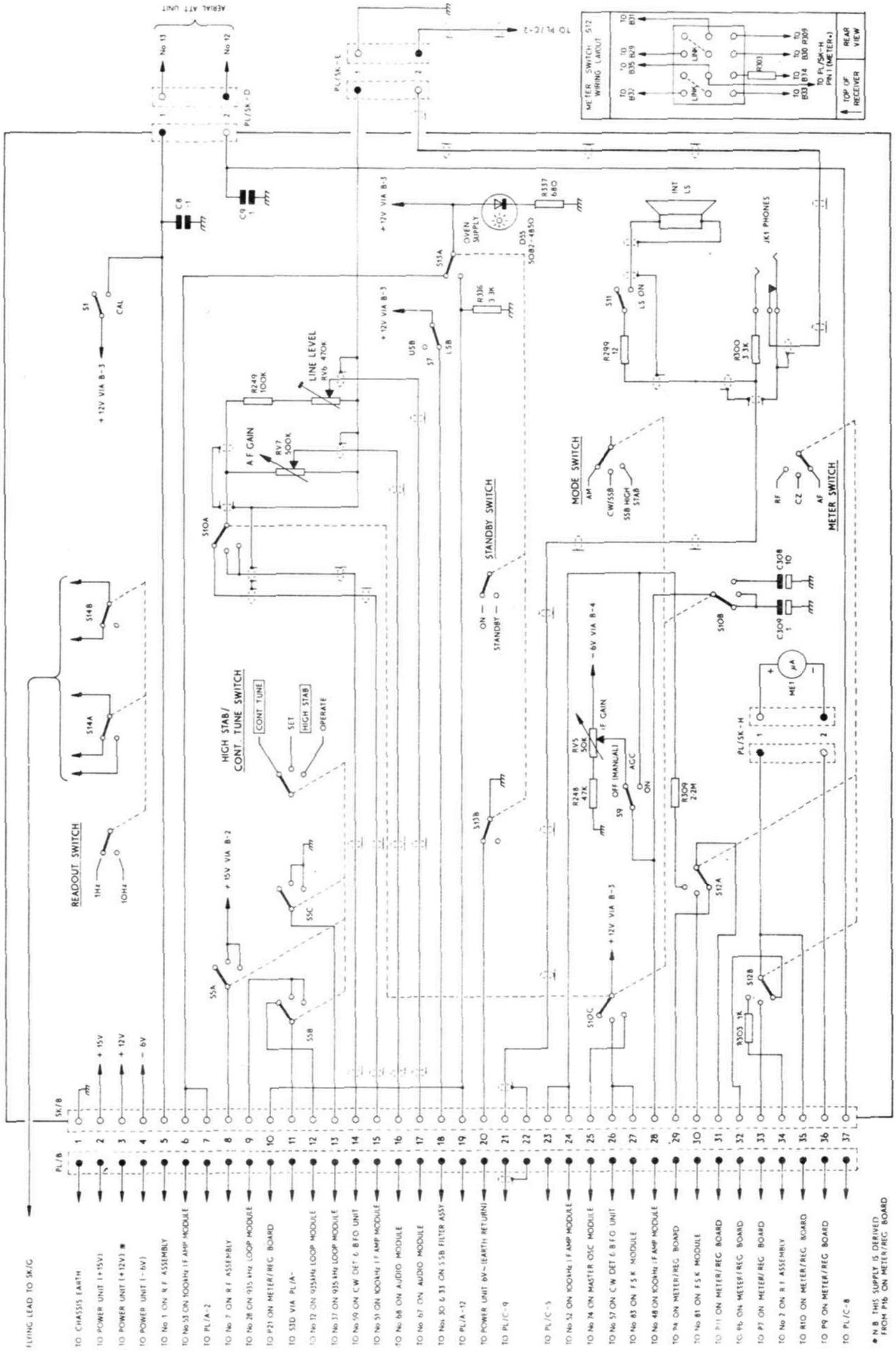


Timebase and Control Unit circuit

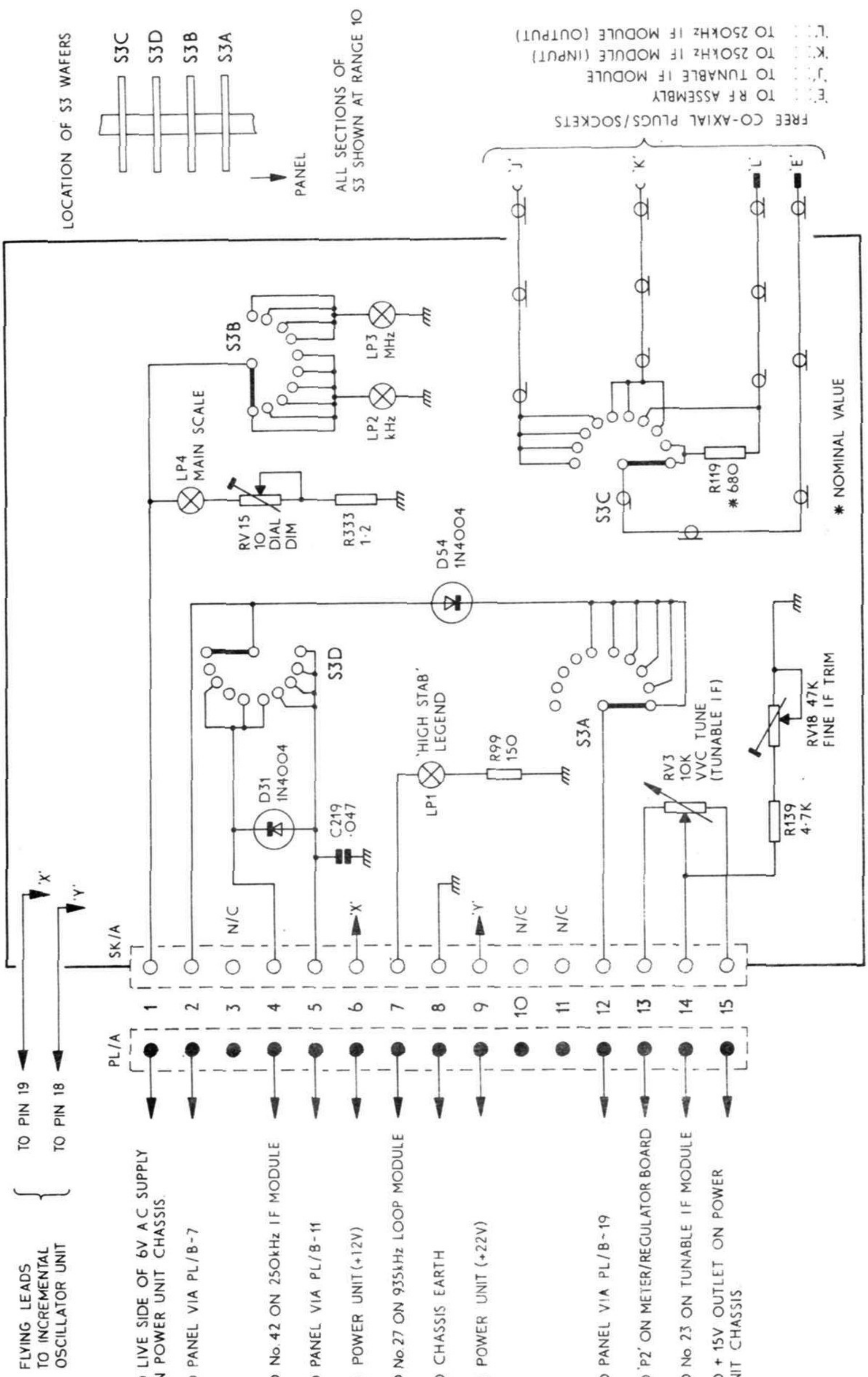


Timebase and Control Unit board

APPENDIX 'E'

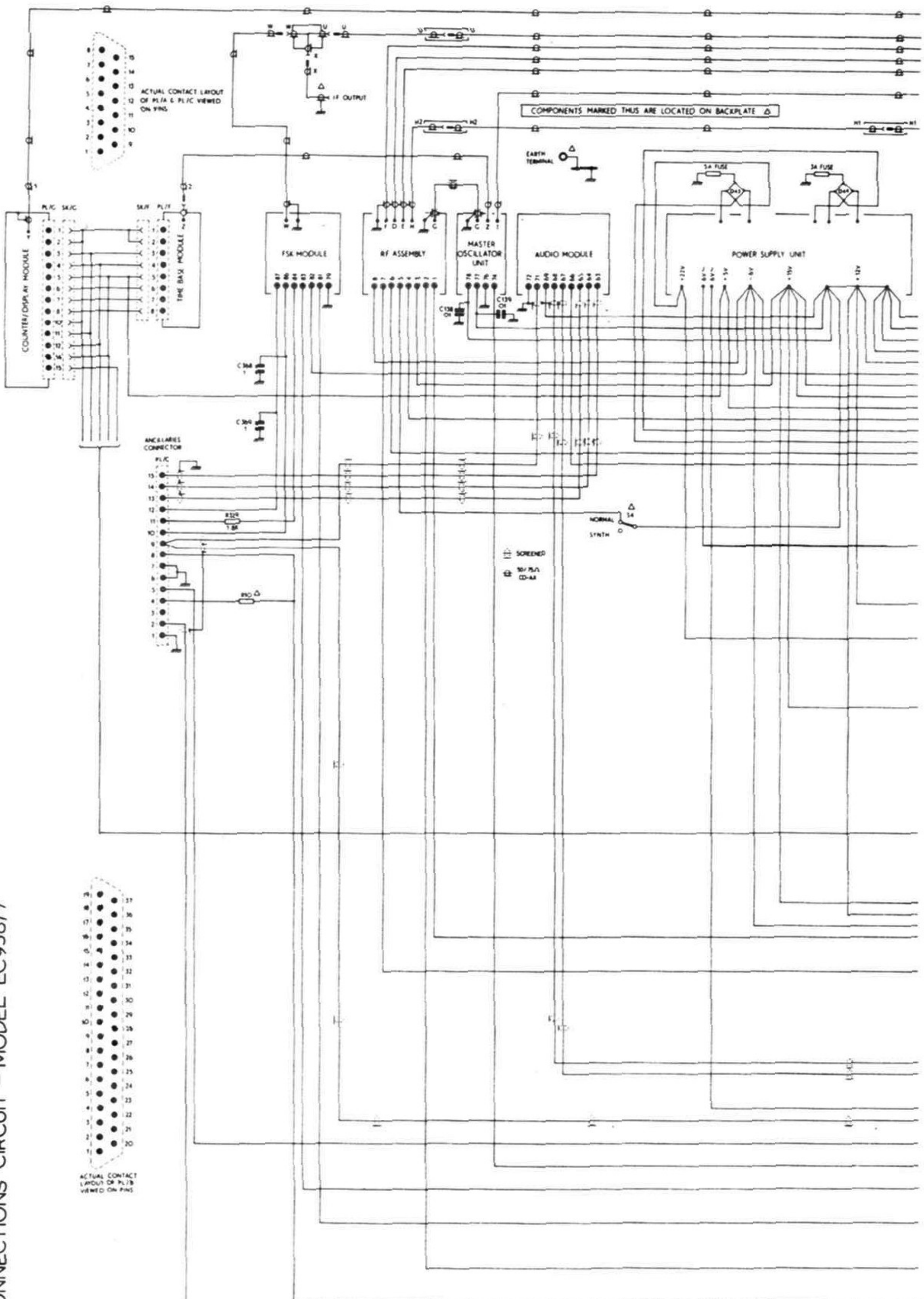


Panel wiring

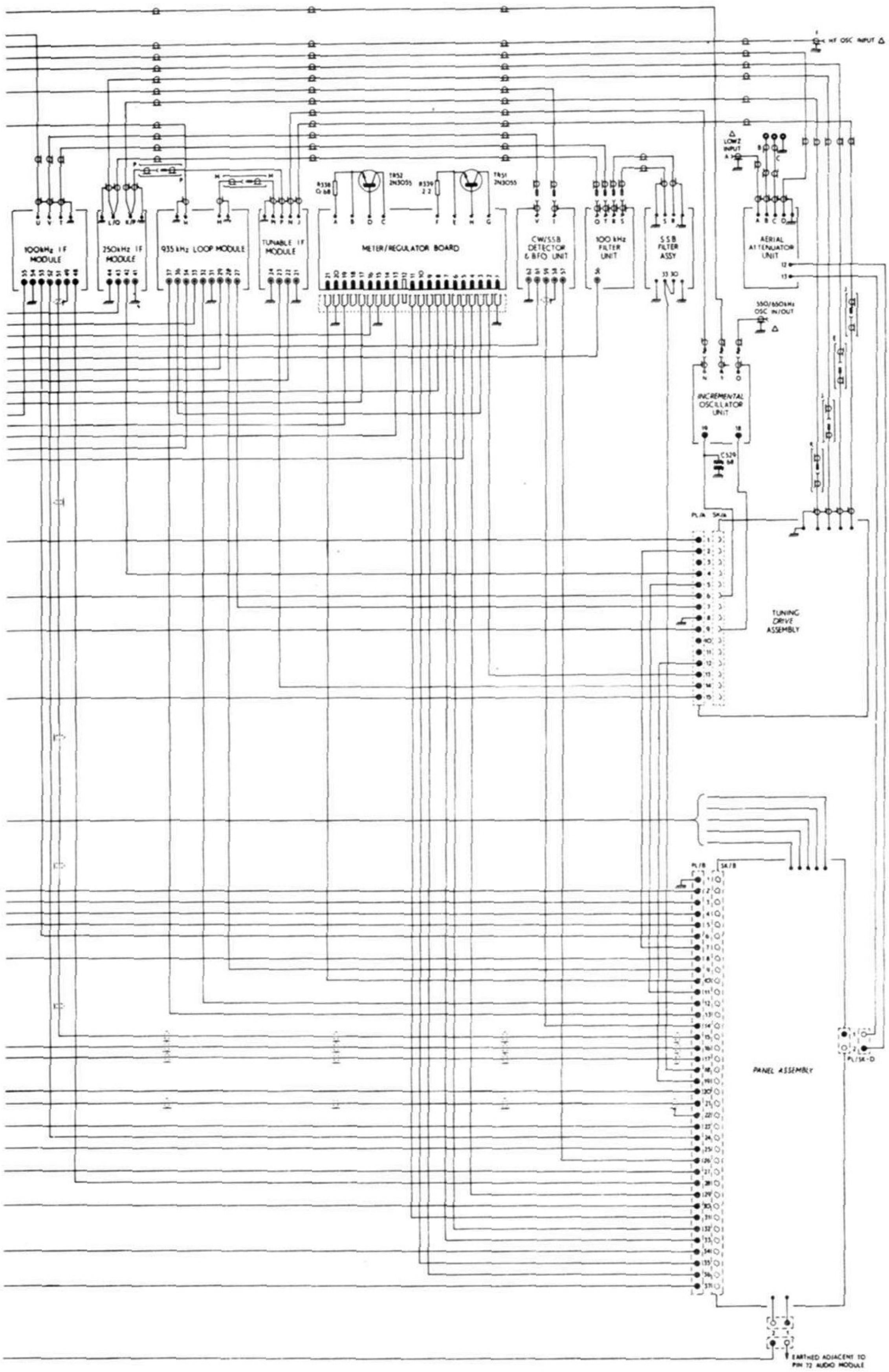


Drive Assembly wiring

INTERCONNECTIONS CIRCUIT – MODEL EC958/7

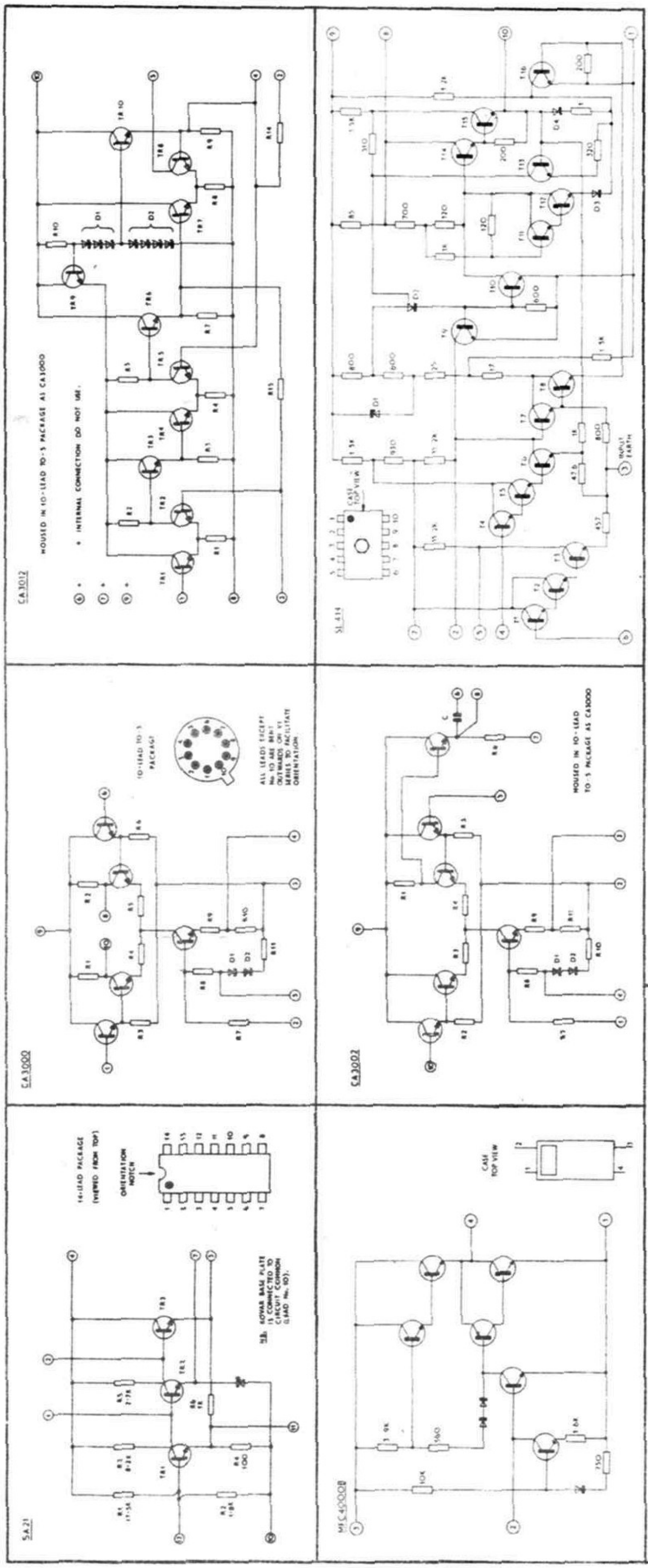


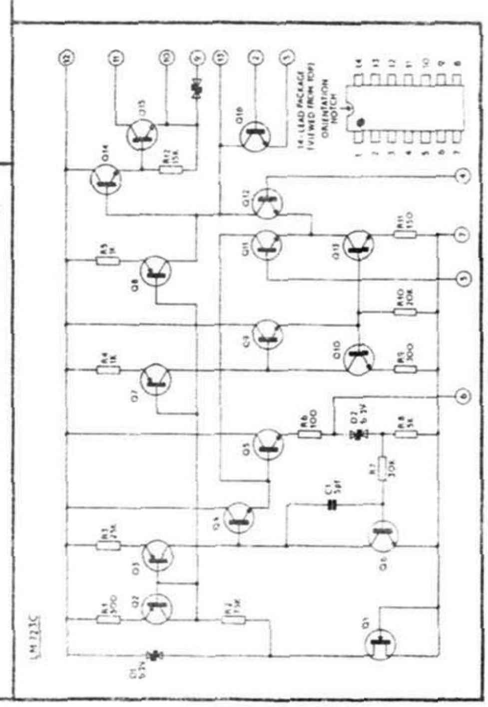
Chassis interconnections (left hand side)



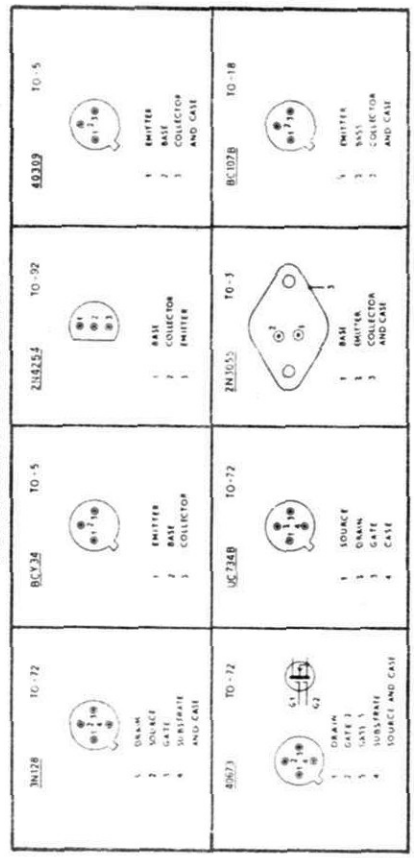
Chassis interconnections (right hand side)

LINEAR INTEGRATED CIRCUITS



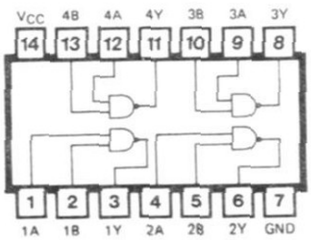


TRANSISTOR BASES

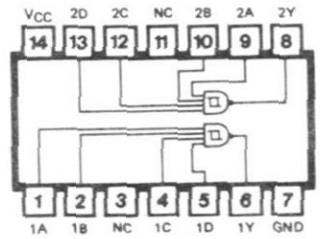


DIGITAL INTEGRATED CIRCUITS

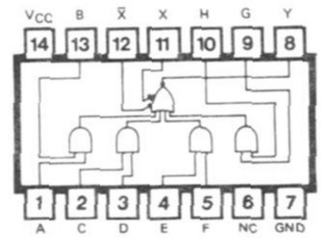
SN7400



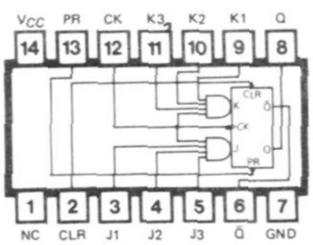
SN7413*



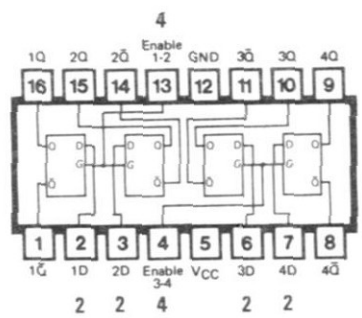
SN7453



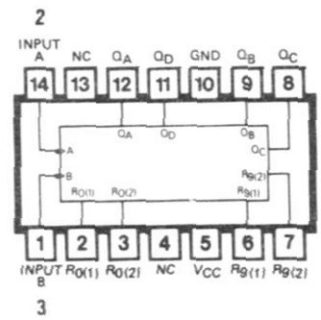
SN7472



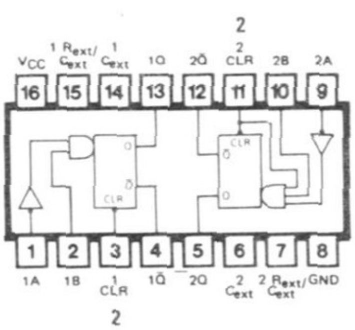
SN7475



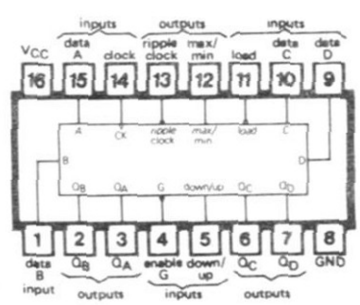
SN7490**



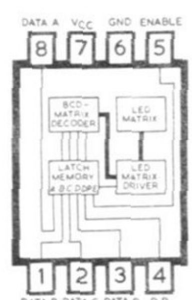
SN74123



SN74190



5082 – 7300



** Similar layout for SN6490 and SN5490

* Similar layout for SN6413 and SN5413

COMPONENT CHANGES AND ADDITIONS FOR 1MHz MASTER OSCILLATOR LP 3496

Except where stated, the components in LP3496 are the same as in LP3346. The additional components are numbered in the '900' series.

Changes

R104 is changed from 100Ω to 140Ω 1 Watt (a 6 Watt type may be fitted).

D16 is changed from BZY 96 C5V1 to BZY 88 C4V7.

Additions

C901	10μF	Tantalum	20%	25V
C902	0.01μF	Disc ceramic	20%	25V
C903	10μF	Tantalum	20%	25V
C904	0.01μF	Disc ceramic	20%	25V
C905	0.1 μF	Polycarbonate	20%	100V
C906	0.1 μF	Polycarbonate	20%	100V
C907	0.1 μF	Polycarbonate	20%	100V
C908	0.1 μF	Polycarbonate	20%	100V
C909	0.1 μF	Polycarbonate	20%	100V
C910	0.1 μF	Polycarbonate	20%	100V
C911	10μF	Tantalum	20%	25V
C912	0.01μF	Disc ceramic	20%	25V
C913	0.1 μF	Polycarbonate	20%	100V

R901	180Ω	10%	$\frac{1}{2}$W
R902	33Ω	5%	$\frac{1}{3}$W
R903	2200Ω	5%	$\frac{1}{3}$W
R904	2200Ω	5%	$\frac{1}{3}$W
R905	4700Ω	5%	$\frac{1}{3}$W
R906	47Ω	5%	$\frac{1}{3}$W
R907	1000Ω	5%	$\frac{1}{3}$W
R908	1000Ω	5%	$\frac{1}{3}$W
R909	22Ω	5%	$\frac{1}{3}$W
R910	22Ω	5%	$\frac{1}{3}$W
R911	220Ω	5%	$\frac{1}{3}$W
R912	220Ω	5%	$\frac{1}{3}$W
R913	120Ω	5%	$\frac{1}{3}$W
R914	100Ω	5%	$\frac{1}{3}$W
R915	180Ω	10%	$\frac{1}{2}$W

D901	Zener Regulator	BZY88 C4V7	(Mullard)
D902	Zener Regulator	BZY88 C10	(Mullard)
D903	Zener Regulator	BZY88 C4V7	(Mullard
IC901	Schmidt trigger	SN5413	(Texas)

Additions (cont.)

TR901	Current Source		BCY 71	(Mullard)
TR902	Diff. Amp.		BCY 71	(Mullard)
TR903	Diff. Amp		BCY 71	(Mullard)
CH901	1mH	Sigma SC60		
CH902	1mH	Sigma SC60		
CH903	1mH	Sigma SC60		
CH904	1mH	Sigma SC60		
FC901	1500pF	Erie Filtercon 1270-009		
FC902	1500pF	Erie Filtercon 1270-009		
RL901	National	RS-12V		
S901	1p 2w miniature toggle			

1MHz input socket: Greenpar GE35039 C63 specially modified to suit double screened cable used.

This Amendment inserted in 6 manuals only (in normal place)

High Stability Communication Receiver

AMENDMENT FOR EC958/7X SERIAL NO. 2139

This receiver differs from the standard EC958/7 in that provision is made for an external frequency standard to be used as well as internal 1MHz master oscillator. The master oscillator unit type LP3346 is replaced by a modified unit type LP3496, an additional BNC socket for the 1MHz standard frequency input is fitted to the rear panel together with a switch to select internal or external frequency standard.

CIRCUIT DESCRIPTION FOR MASTER OSCILLATOR UNIT LP3496

This unit provides three independent outputs as follows:-

1. 1MHz output
2. 100kHz output
3. Differentiated spike output containing all multiples of 100kHz up to at least 30.4MHz.

All three outputs are derived from the same source which may be either the external standard frequency or the internal crystal oscillator. The external input is fed to the differential amplifier and limiter TR902, TR903 and then to a Schmidt trigger IC901 which provides a TTL compatible output for the decade divider. TR901 is a constant current source for the differential amplifier. The internal crystal oscillator also produces a TTL output, fine frequency adjustment is provided by RV22 which is made easily accessible so that adjustment is possible without removing the receiver from service. The crystal is contained within an oven which has a proportional temperature control which is continuously maintained even when the external input is in use. Oven heaters are powered from the 12V regulated supply. Selection of the source of the 1MHz frequency is by the rear panel switch which supplies power to either the internal oscillator or to the 1MHz input amplifier. When the 1MHz input amplifier is powered, the relay changes the 1MHz input to the decade divider from the crystal oscillator to the output of the 1MHz input amplifier.

The selected 1MHz square-wave is fed to the Decade Divider IC6 (SN5490) and also via coaxial interconnection 'Z' to the time base associated with the counter for the incremental frequency display. The Decade Divider provides a 100kHz square-wave drive for TR13 and TR14 both of which are wired as emitter followers.

TR13 (BC107B) is driven via the tuned circuit L35/C118 which converts the 100kHz square-wave to sine-wave for use as a carrier insertion signal in the CW/SSB Detector (see page 29). This output is taken via coaxial interconnection 'I' and is present only when the MODE SWITCH is set to 'SSB HIGH STAB' (12V supply completed to Terminal No. 74 on M.O. Unit).

TR14 (2N4254) is driven directly from the Decade Divider and can be considered as an harmonic generator which feeds all harmonics of 100kHz to the harmonic selector circuits in the RF Assembly (via coaxial interconnection 'G'). Output level is set during manufacture by adjustment of the pre-set potentiometer RV16.

The MASTER OSCILLATOR UNIT is housed in a double-screened box to prevent direct radiation of its fundamental or harmonics within the receiver. Double-screened coaxial cable is used to extend this protection on the output lead feeding the harmonic selector circuits in the RF Assembly and on the 1MHz input lead. Single-screened coaxial cable is used for the other two outputs. All stages in the MASTER OSCILLATOR UNIT are powered continuously with the exception of TR13.

MECHANICAL CONSTRUCTION

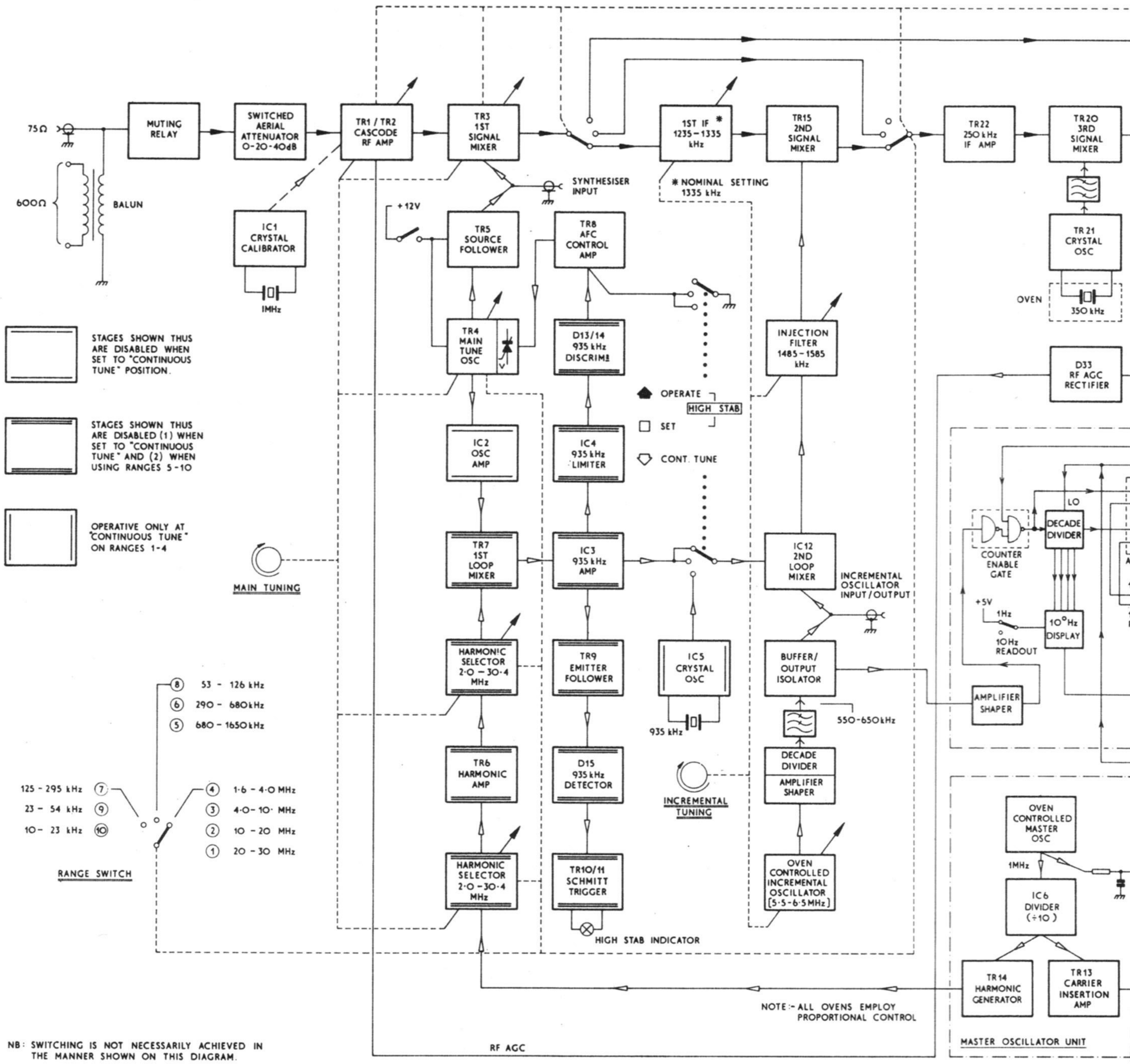
The Master Oscillator Unit LP3496 is externally similar to LP3346 which it replaces. The 1MHz input is taken to the module from a specially modified BNC socket on the rear panel by a double-screened coaxial cable. The outer screen is terminated to the outer screen of the module only and the inner screen is connected to the socket (which is floating from chassis) and to the amplifier earth circuit. Internally the amplifier printed circuit is mounted on spacers above the main board.

EXTERNAL 1MHz INPUT CONNECTION

The 1MHz input socket on the rear panel will accept a standard 50Ω BNC Connector. The terminating impedance is 50Ω at 1MHz and the signal voltages developed across this impedance should be within the range 250mV - 2.5V rms (this being equivalent to an open-circuit voltage of 500mV - 5V rms from a 50Ω source). The screen connection in this connector is isolated from chassis earth and connected only to the amplifier earth within the Master Oscillator Unit.

OPERATION

To use the external standard, the lead carrying the standard signal should be plugged into the 1MHz input and the switch set in the down "ON" position. To use the internal standard the switch should be in the up "OFF" position. It may be found in this case that, although the external 1MHz input is isolated within the receiver, spurious responses at low level may arise when the external signal is connected to the receiver. If these are found to be troublesome they can be reduced by disconnecting the external 1MHz input at the rear panel socket.



NB: SWITCHING IS NOT NECESSARILY ACHIEVED IN THE MANNER SHOWN ON THIS DIAGRAM.

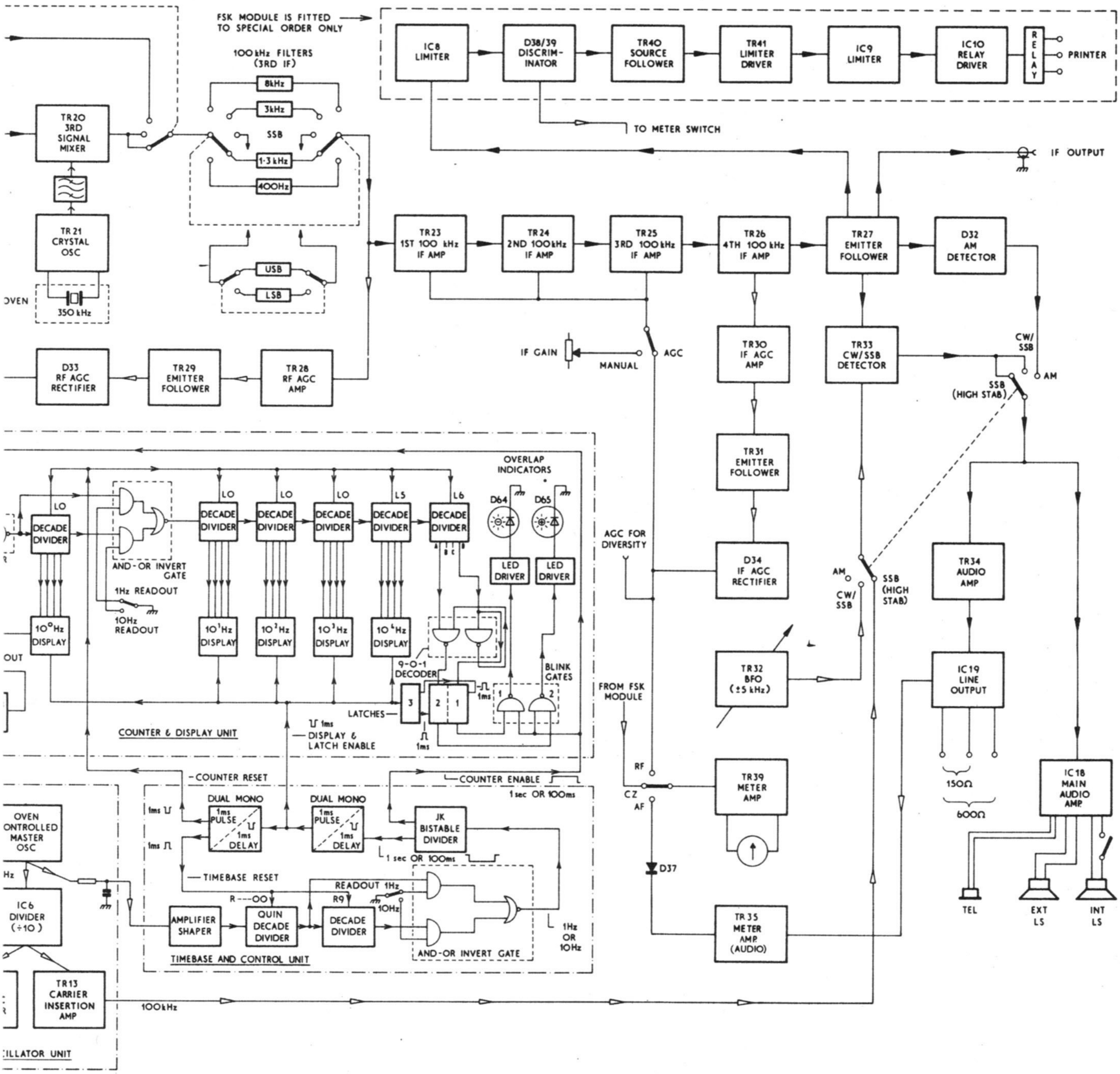


Fig. 2.12 Block Diagram of Complete Receiver

CORRECTIONS

Incremental Oscillator Unit

R402A and C509 are transposed: R402A is connected to tap.

The supply feeds to Nos. 18 & 19 (+22V and +12V) are routed through PL/A-9 & PL/A-6 respectively—see Interconnection Circuit in Appendix 'E'.

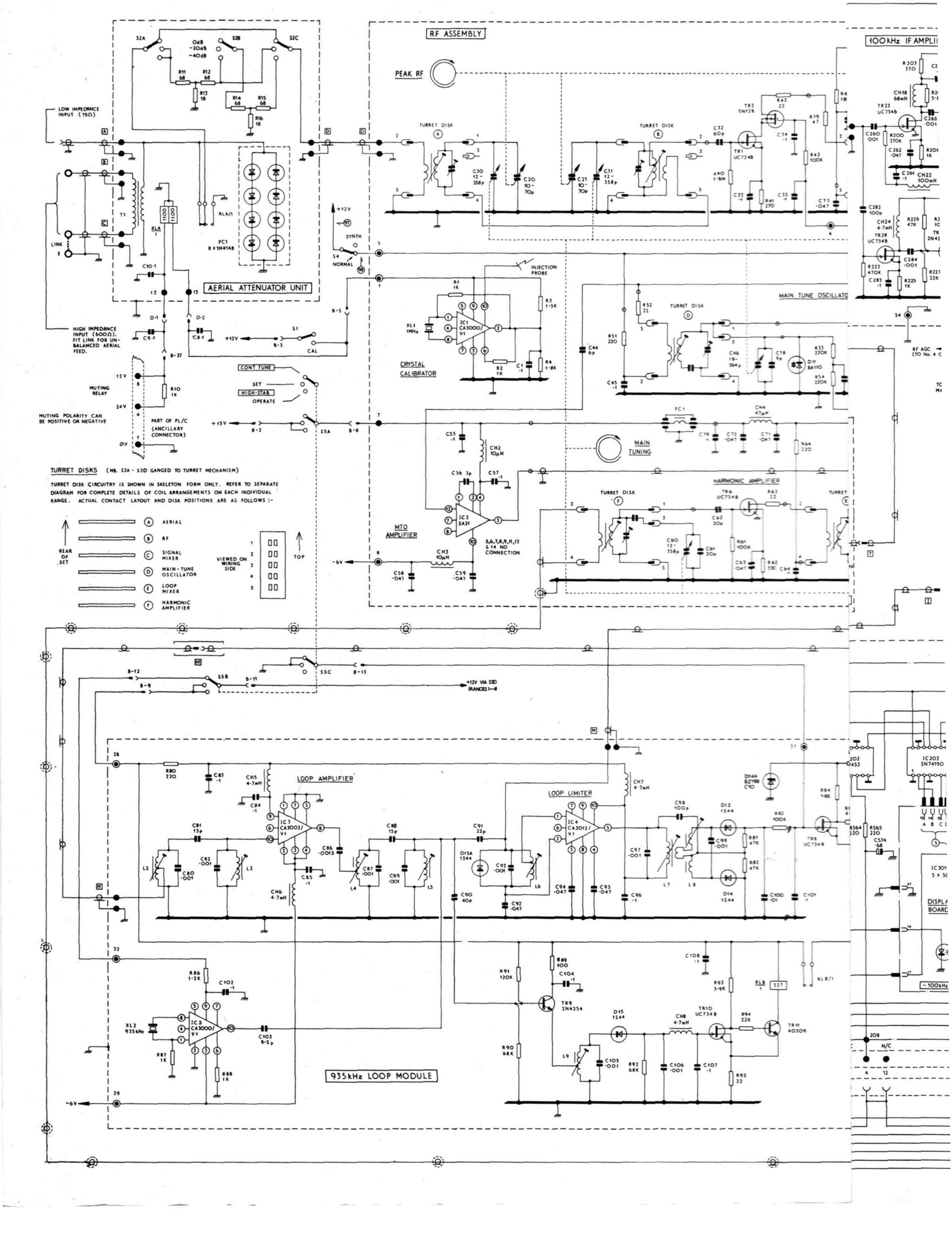
AC Fuse Ratings

The footnote in the bottom right-hand corner should read:-

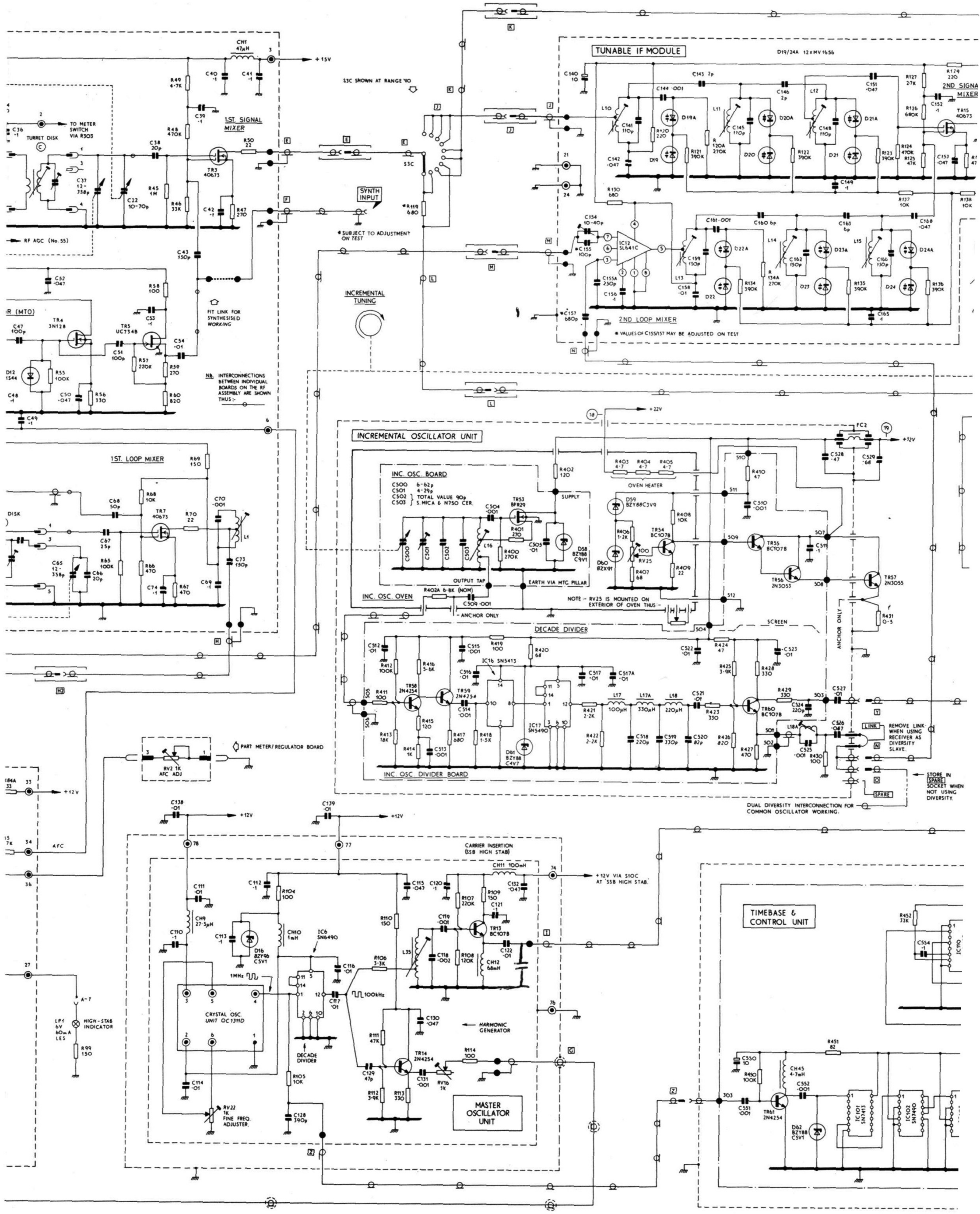
105/130V : : 3A.
210/260V : : 1.5A.

A 3,300 Ω resistor (R336) should be shown from the "STANDBY" contact of S13A to earth.

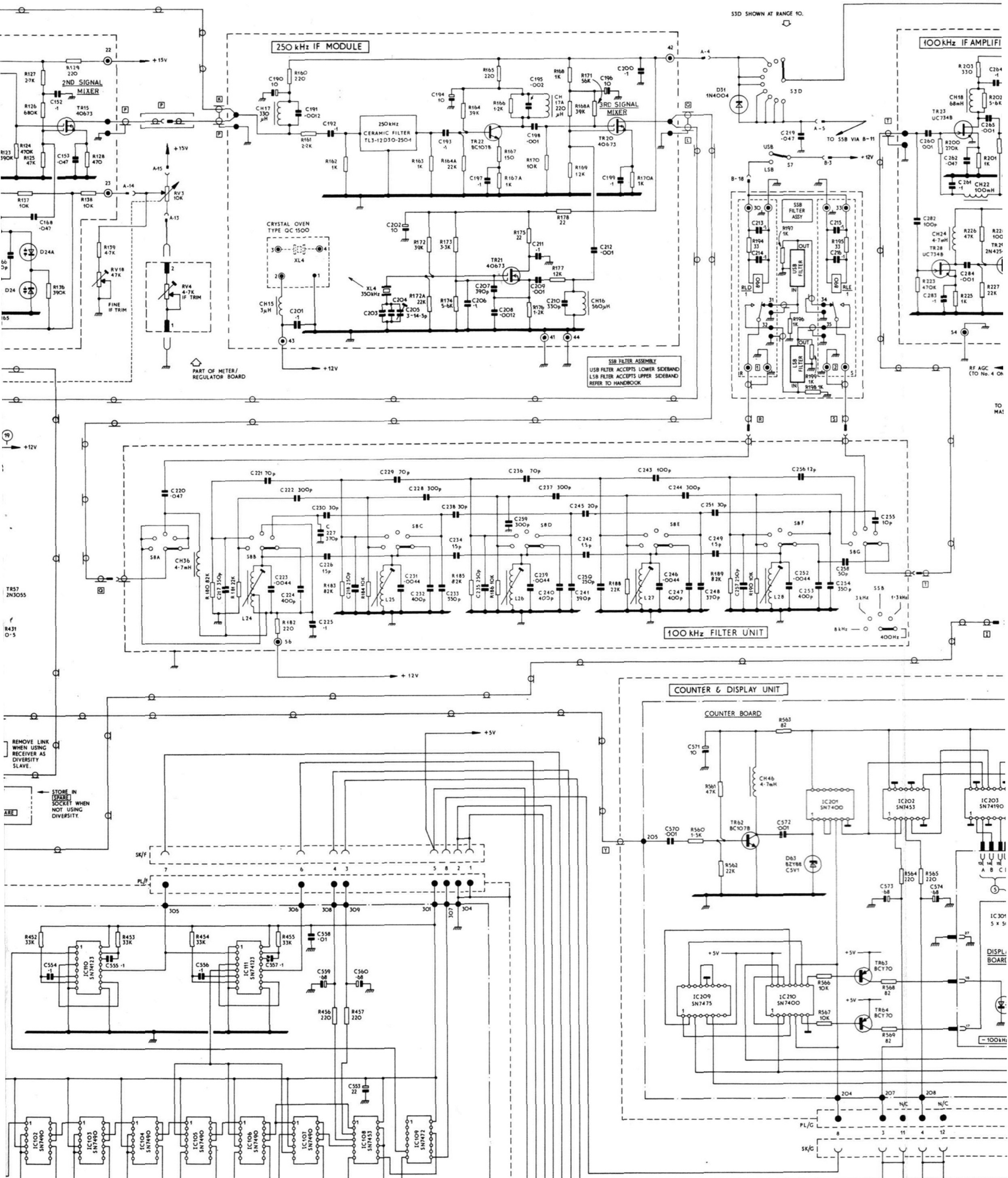
MAIN CIRCUIT DIAGRAM – MODEL EC958/7

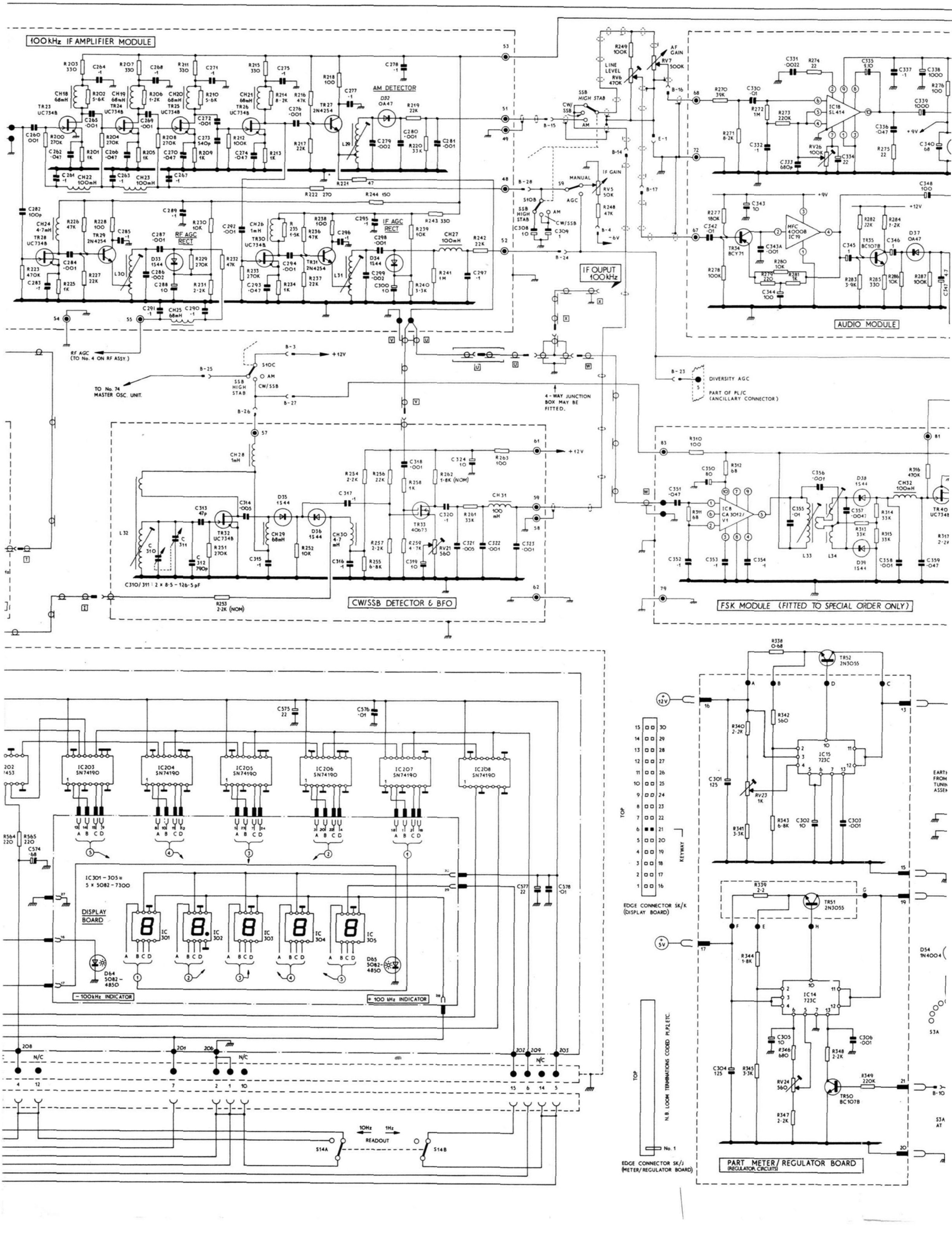


AERIAL ATTENUATOR UNIT
RF ASSEMBLY
PEAK RF
100kHz IF AMPLI
LOW IMPEDANCE INPUT (75Ω)
HIGH IMPEDANCE INPUT (600Ω). FIT LINK FOR UN-BALANCED AERIAL FEED.
LINK
MUTING RELAY
MUTING POLARITY CAN BE POSITIVE OR NEGATIVE
PART OF PL/C (ANCILLARY CONNECTOR)
CONT TUNE
SET
HIGH-STAB
OPERATE
SYNTH
NORMAL
CAL
INJECTION PROBE
CRYSTAL CALIBRATOR
MTO AMPLIFIER
MAIN TUNING
MAIN TUNE OSCILLATO
HARMONIC AMPLIFIER
TURRET DISK
RF AGC (TO No. 4 C
5,6,7,8,9,11,13 & 14 NO CONNECTION
TURRET DISKS (NB. S3A - S3D GANGED TO TURRET MECHANISM)
TURRET DISK CIRCUITRY IS SHOWN IN SKELETON FORM ONLY. REFER TO SEPARATE DIAGRAM FOR COMPLETE DETAILS OF COIL ARRANGEMENTS ON EACH INDIVIDUAL RANGE. ACTUAL CONTACT LAYOUT AND DISK POSITIONS ARE AS FOLLOWS :-
REAR OF SET
A AERIAL
B RF
C SIGNAL MIXER
D MAIN-TUNE OSCILLATOR
E LOOP MIXER
F HARMONIC AMPLIFIER
VIEWED ON WIRING SIDE
TOP
+12V VIA S3D (RANGES 1-4)
LOOP AMPLIFIER
LOOP LIMITER
935kHz LOOP MODULE
DISPLA BOARD
IC203 SN74190

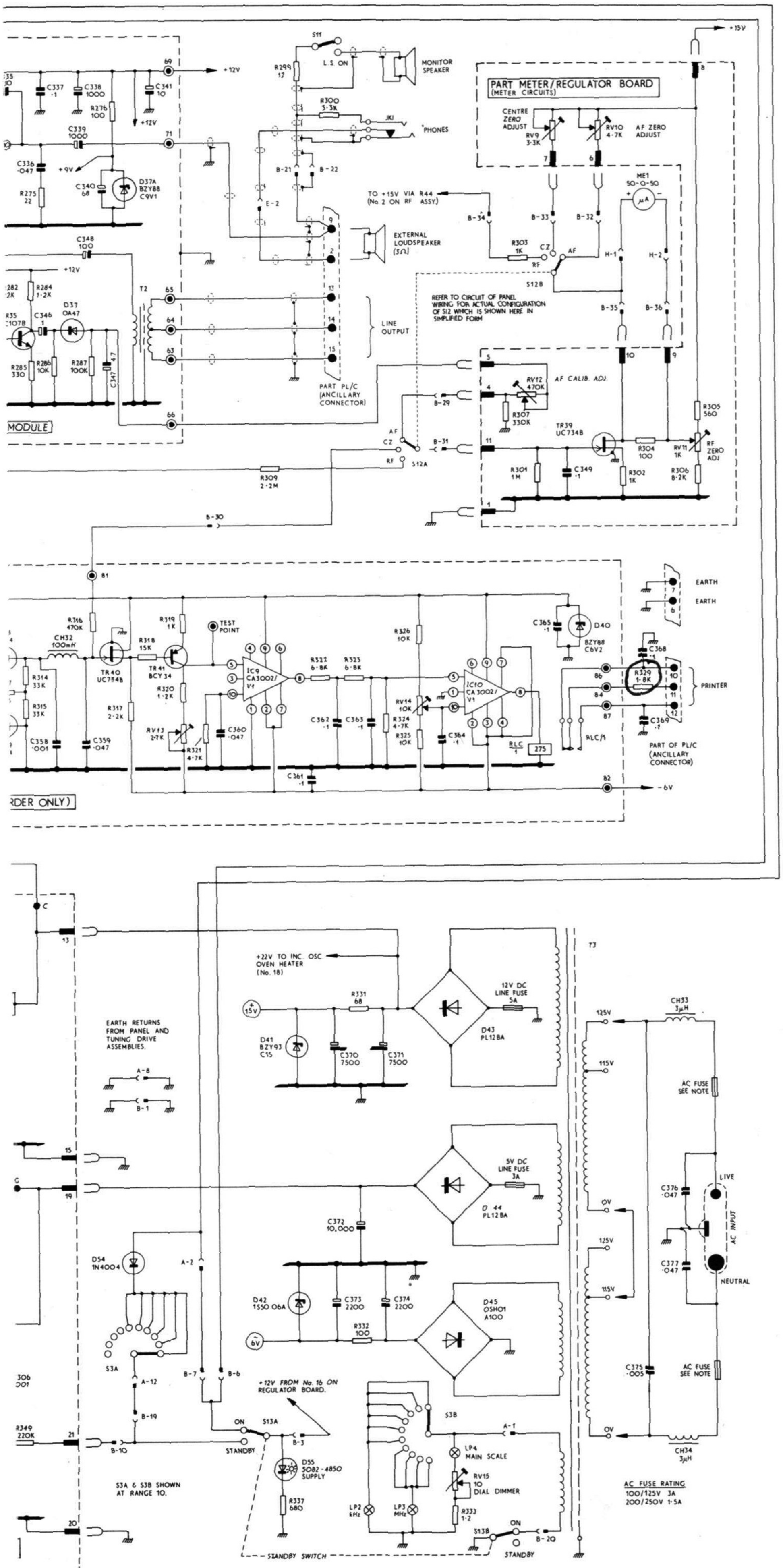


TUNABLE IF MODULE
D19/24A 12 x MV 1656
2ND SIGNAL MIXER
1ST. SIGNAL MIXER
S3C SHOWN AT RANGE 10
SYNTH INPUT
* SUBJECT TO ADJUSTMENT ON TEST
TURRET DISK
TO METER SWITCH VIA R303
RF AGC (No. 55)
FIT LINK FOR SYNTHESISED WORKING
NB. INTERCONNECTIONS BETWEEN INDIVIDUAL BOARDS ON THE RF ASSEMBLY ARE SHOWN THUS:-
2ND LOOP MIXER
* VALUES OF C155/157 MAY BE ADJUSTED ON TEST
INCREMENTAL TUNING
1ST. LOOP MIXER
INCREMENTAL OSCILLATOR UNIT
INC. OSC. BOARD
C500 6-62p
C501 4-29p
C502 C503 TOTAL VALUE 90p S.MICA & N750 CER.
SUPPLY
OVEN HEATER
OUTPUT TAP
EARTH VIA MTG. PILLAR
INC. OSC. OVEN
ANCHOR ONLY
NOTE:- RV25 IS MOUNTED ON EXTERIOR OF OVEN THUS:-
DECADE DIVIDER
SCREEN
INC. OSC. DIVIDER BOARD
REMOVE LINK WHEN USING RECEIVER AS DIVERSITY SLAVE.
STORE IN SPARE SOCKET WHEN NOT USING DIVERSITY.
DUAL DIVERSITY INTERCONNECTION FOR COMMON OSCILLATOR WORKING.
PART METER/REGULATOR BOARD
RV2 1K AFC ADJ
CARRIER INSERTION (SSB HIGH STAB)
+12V VIA S10C AT 'SSB HIGH STAB.'
CRYSTAL OSC. UNIT OC1311D
1MHz
100kHz
DECADE DIVIDER
HARMONIC GENERATOR
MASTER OSCILLATOR UNIT
RV22 1K FINE FREQ. ADJUSTER.
HIGH-STAB INDICATOR
TIMEBASE & CONTROL UNIT
+15V
+12V
+22V

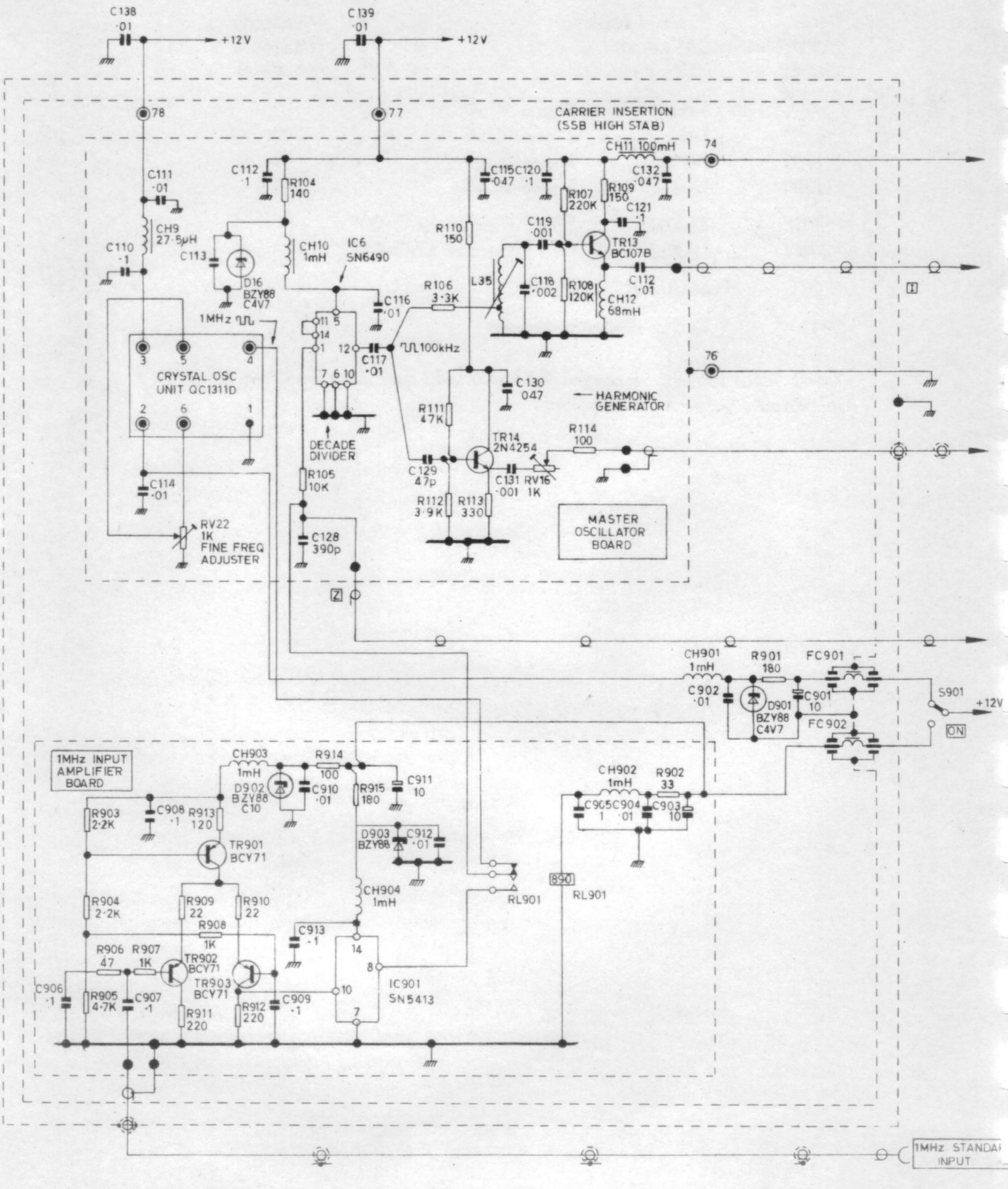

S3D SHOWN AT RANGE 10.
250 kHz IF MODULE
2ND SIGNAL MIXER
3RD SIGNAL MIXER
100 kHz IF AMPLIFI
250 kHz CERAMIC FILTER TL3-12D30-2504
CRYSTAL OVEN TYPE QC 1500
XL4 350kHz
RV3 10K
RV4 4·7K IF TRIM
RV18 47K FINE IF TRIM
PART OF METER/ REGULATOR BOARD
SSB FILTER ASSEMBLY
USB FILTER ACCEPTS LOWER SIDEBAND
LSB FILTER ACCEPTS UPPER SIDEBAND
REFER TO HANDBOOK
SSB FILTER ASSY
USB FILTER
LSB FILTER
TO S5B VIA B-11
RF AGC (TO No. 4 ON
100 kHz FILTER UNIT
COUNTER & DISPLAY UNIT
COUNTER BOARD
REMOVE LINK WHEN USING RECEIVER AS DIVERSITY SLAVE.
STORE IN SPARE SOCKET WHEN NOT USING DIVERSITY.
IC201 SN7400
IC202 SN7453
IC203 SN74190
IC209 SN7475
IC210 SN7400
IC110 SN74123
IC111 SN74123
IC102 SN7490
IC103 SN7490
IC104 SN7490
IC105 SN7490
IC106 SN7490
IC107 SN7490
IC108 SN7453
IC109 SN7472
DISPLAY BOARD
SK/F
PL/F
PL/G
SK/G



100kHz IF AMPLIFIER MODULE
AM DETECTOR
RF AGC RECT
IF AGC RECT
AF GAIN
LINE LEVEL
SSB HIGH STAB
IF GAIN
MANUAL
AGC
AUDIO MODULE
IF OUPUT 100kHz
RF AGC (TO No. 4 ON RF ASSY.)
TO No. 74 MASTER OSC. UNIT.
4-WAY JUNCTION BOX MAY BE FITTED.
DIVERSITY AGC
PART OF PL/C (ANCILLARY CONNECTOR)
CW/SSB DETECTOR & BFO
C310/311 : 2 x 8·5 - 126·5 pF
FSK MODULE (FITTED TO SPECIAL ORDER ONLY)
IC301 - 305 = 5 x 5082-7300
DISPLAY BOARD
- 100kHz INDICATOR
+ 100 kHz INDICATOR
READOUT
EDGE CONNECTOR SK/K (DISPLAY BOARD)
KEYWAY
N.B LOOM TERMINATIONS CODED PL/P2 ETC.
EDGE CONNECTOR SK/J (METER/REGULATOR BOARD)
PART METER/REGULATOR BOARD (REGULATOR CIRCUITS)

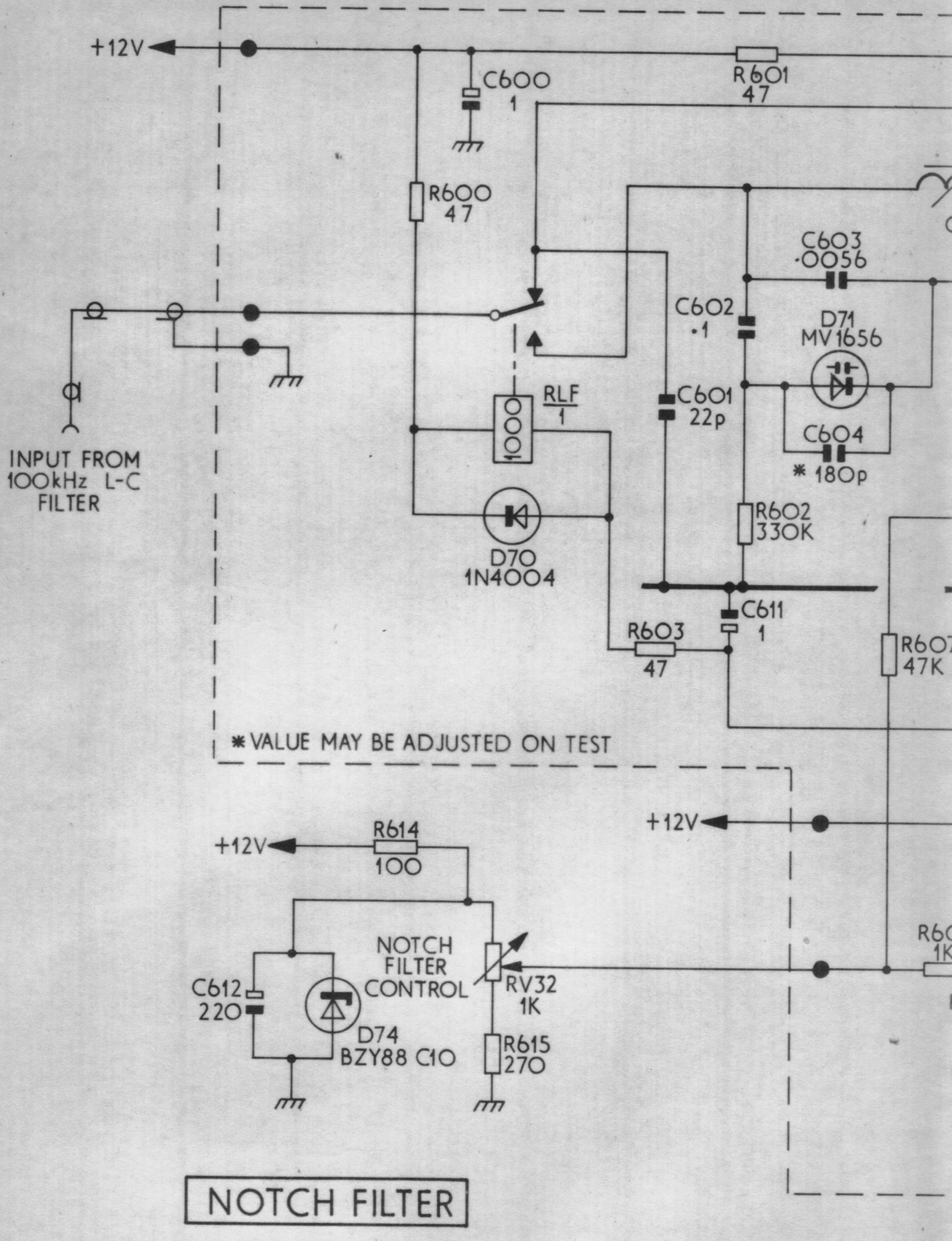


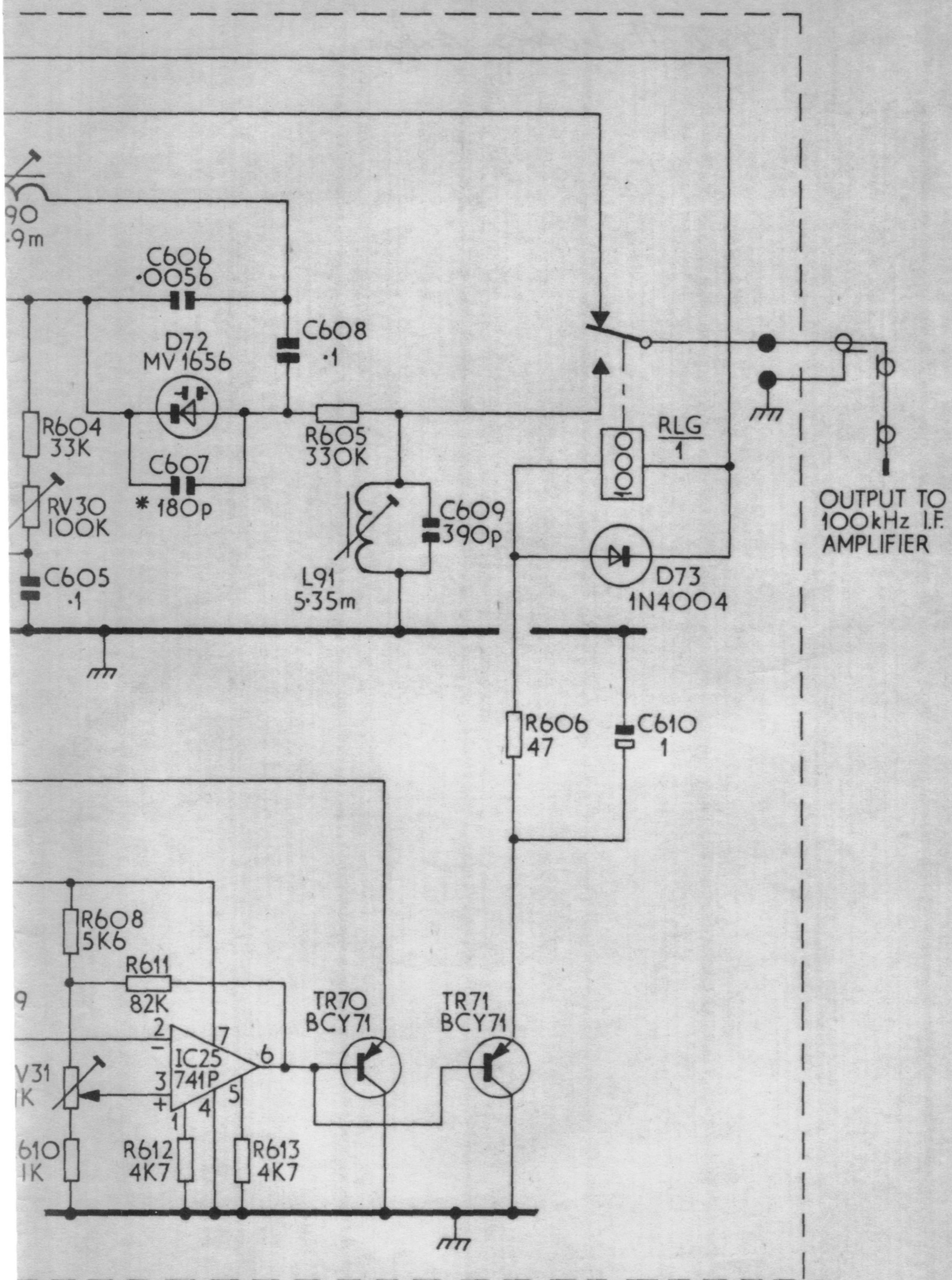
+12V
+15V
S11
L.S. ON
MONITOR SPEAKER
R299 12
R300 3·3K
JK1
PHONES
C337 ·1
C338 1000
C341 10
R276 100
C339 1000
+9V
C336 ·047
R275 22
C340 68
D37A BZY88 C9V1
PART METER/REGULATOR BOARD
(METER CIRCUITS)
CENTRE ZERO ADJUST
RV9 3·3K
RV10 4·7K
AF ZERO ADJUST
ME1 50-0-50
B-21
B-22
E-2
TO +15V VIA R44 (No. 2 ON RF ASSY)
B-34
B-33
B-32
EXTERNAL LOUDSPEAKER (3Ω)
R303 1K
CZ
AF
RF
H-1
H-2
C348 100
S12B
R284 1·2K
T2
R282 2K
C346
D37 OA47
REFER TO CIRCUIT OF PANEL WIRING FOR ACTUAL CONFIGURATION OF S12 WHICH IS SHOWN HERE IN SIMPLIFIED FORM
B-35
B-36
LINE OUTPUT
R285 330
R286 10K
R287 100K
C347 4·7
PART PL/C (ANCILLARY CONNECTOR)
RV12 470K
AF CALIB ADJ
B-29
R307 330K
MODULE
B-31
TR39 UC734B
R305 560
R304 100
RV11 1K
RF ZERO ADJ
S12A
R301 1M
C349 ·1
R302 1K
R306 8·2K
R309 2·2M
B-30
EARTH
EARTH
R316 470K
CH32 100mH
R319 1K
TEST POINT
R326 10K
C365 ·1
D40 BZY88 C6V2
C368
R318 15K
TR41 BCY34
IC9 CA3002/V1
R322 6·8K
R323 6·8K
IC10 CA3002/V1
R329 1·8K
PRINTER
R314 33K
TR40 UC734B
R320 1·2K
RV14 10K
R315 33K
R317 2·2K
RV13 2·7K
C360 ·047
C362 ·1
C363 ·1
R324 4·7K
R325 10K
C364 ·1
RLC
RLC/1
C369 ·1
PART OF PL/C (ANCILLARY CONNECTOR)
C358 ·001
C359 ·047
R321 4·7K
C361 ·1
-6V
RDER ONLY)
+22V TO INC. OSC OVEN HEATER (No. 18)
T3
R331 68
12V DC LINE FUSE 5A
CH33 3μH
125V
D43 PL12BA
115V
D41 BZY93 C15
C370 7500
C371 7500
EARTH RETURNS FROM PANEL AND TUNING DRIVE ASSEMBLIES.
A-8
B-1
AC FUSE SEE NOTE
5V DC LINE FUSE 3A
LIVE
D 44 PL12BA
0V
C376 ·047
AC INPUT
C372 10,000
D54 1N4004
A-2
C377 ·047
NEUTRAL
D42 1S50 06A
C373 2200
C374 2200
D45 OSH01 A100
R332 100
S3A
C375 ·005
AC FUSE SEE NOTE
A-12
B-7
B-6
+12V FROM No. 16 ON REGULATOR BOARD.
S3B
A-1
B-19
ON
S13A
LP4 MAIN SCALE
R349 220K
B-10
STANDBY
B-3
D55 5082-4850 SUPPLY
RV15 10 DIAL DIMMER
CH34 3μH
S3A & S3B SHOWN AT RANGE 10.
R337 680
LP2 kHz
LP3 MHz
R333 1·2
AC FUSE RATING
100/125V 3A
200/250V 1·5A
S13B
B-20
STANDBY SWITCH



1MHz MASTER OSCILLATOR UNIT 958/7X

LP3496


+12V
C600
1
R601
47
R600
47
C603
·0056
C602
·1
D71
MV1656
RLF
1
C601
22p
C604
* 180p
INPUT FROM
100kHz L-C
FILTER
R602
330K
D70
1N4004
C611
1
R603
47
R607
47K
* VALUE MAY BE ADJUSTED ON TEST
+12V
+12V
R614
100
NOTCH
FILTER
CONTROL
RV32
1K
C612
220
D74
BZY88 C10
R615
270
NOTCH FILTER



For 958/7F only

BP1348