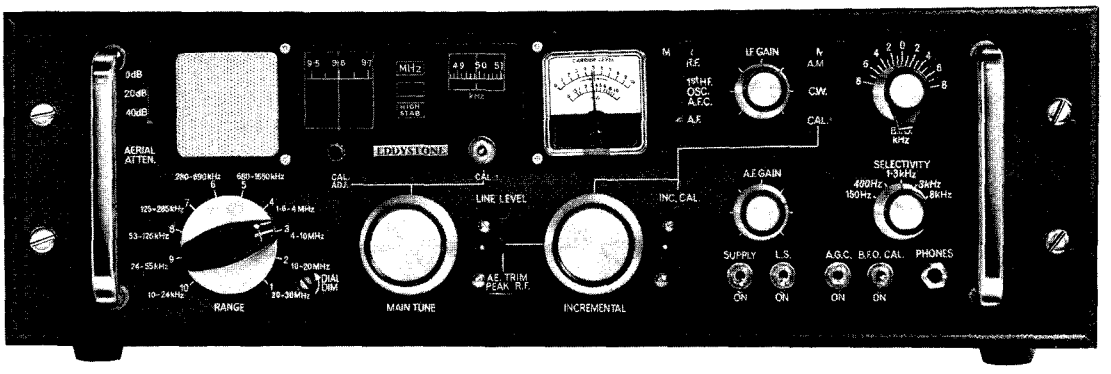
Eddystone

SOLID-STATE HIGH-STABILITY GENERAL COVERAGE RECEIVER

MODEL EC958/3 – CAN



10kHz-30MHz

Manufactured in England by

EDDYSTONE RADIO LIMITED

MEMBER OF MARCONI COMMUNICATIONS SYSTEMS LTD.

ALVECHURCH ROAD, BIRMINGHAM B31 3PP

Telephone: 021–475 2231 Telex: 337081

ISSUE NUMBER 1, APRIL 1972

PRINTED IN ENGLAND

LIST OF CONTENTS

Eddystone Radio Limited
Member of Marconi Communication Systems Limited
Alvechurch Road, Birmingham B31 3PP, England
Telephone: 021-475 2231
Cables: Eddystone Birmingham Telex: 337081

EC958 VARIANTS

EC958 Standard general-purpose version with optional internal FSK facility. Three versions of this model are produced to meet special German and Swedish requirements.

EC958/1 Developed primarily for use in conjunction with Lincompex equipment using A3A transmission. Features carrier-controlled AGC and beat meter to facilitate accurate adjustment. Internal FSK facilities are not available but can be arranged externally.

EC958/2 Special version of EC958 developed for specialised network monitoring and surveillance. Major differences include:-

Continuous high-stability operation on Ranges 1-4 (free-running continuous tune facility is not provided).

Visual indication of AFC in drift-cancelling loop to facilitate operation in high-stability mode.

10kHz markers for checking incremental calibration on Ranges 1-4.

150Hz bandwidth dual-crystal filter for CW working (SSB filter omitted).

Low-level BFO output for connection to counter circuit.

Internal FSK not available but can be arranged externally.

EC958/3 Variant of EC958/2 with internal optional FSK facility and 10kHz scale-checking facility for use on Ranges 5-10 (main scale). Bandpass input on Ranges 5-8.

EC958/4 Special version of EC958 intended for marine and military use only.

EC958/5 Modified EC958 meeting the requirements of B.P.O. Specifications TSC87, TSC102 and TSC105, plus M.P.T. Specifications 1201 and 1208.

Features many general improvements including bandpass input on Ranges 5-8 to satisfy the approval tests listed above.

Includes 10kHz main scale calibrator for Ranges 5-10, and optional internal FSK facility as on basic receiver. Sidetone facility provided.

EC958/6 Similar to EC958/5 but less sidetone facility and with modified supply switching.

EC958/7 Special version with greater stability and digital read-out. Refer to Supplement No. 5 for design variations.

EC958/8 Variant of standard EC958 with supply switching modified to customer requirement (Netherlands).

EC958/9 Variant of Model EC958/7 with provision for ISB working.

LIST OF CONTENTS

AMENDMENT RECORD

Amend No.	Content	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. Amendment Sheets will be incorporated where necessary at date of issue.

CIRCUIT MODIFICATION SHEET

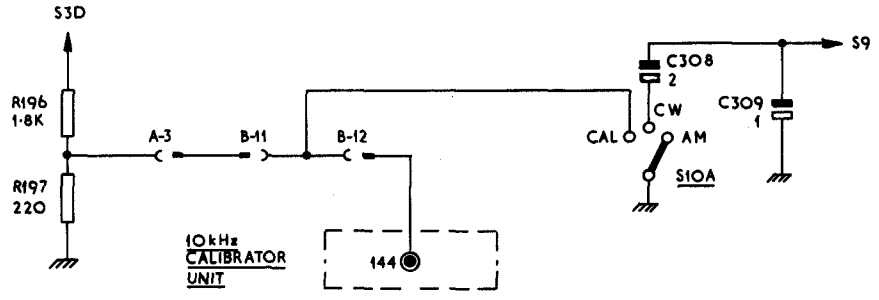
The following changes apply to the Main Circuit Diagram bound at the rear of this Handbook. Changes Nos 3 and 4 apply also to the Interconnection Circuit.

1. The value of RV4 should be shown as 10K (adjacent to Tunable IF Module).
2. The values of C333 and C343 should both be shown as 0.002μF (Audio Amp Module).
3. A 4.7Ω resistor (R98) should be shown in series with the lead from T5 secondary to Pin 78 of the Master Oscillator Unit (oven supply).

   A note should be added to the effect that R98 must be shorted out when the receiver is equipped with 1MHz Crystal Oven Type 8473P. Current receivers are fitted with 1MHz Crystal Oven Type 7503P which requires that the resistor is in circuit. A modification note will be included if replacement ovens 8473P are supplied.

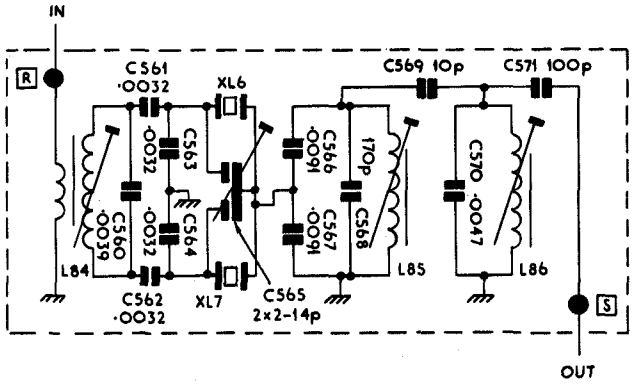
4. MODE SWITCH WAFER S10A

   The wiring of S10A has been modified so that this wafer serves the additional function of AGC time constant switching. The modified arrangement is shown below:-



5. 100kHz CRYSTAL FILTER

   The circuitry of the 100kHz Crystal Filter Unit used on current EC958/3 receivers differs from that of the earlier filter shown on the Main Circuit Diagram. The modified filter circuit is as follows:-



C O R R I G E N D A

Page 7 — AGC Characteristic and Time Constant

Amend second line to read:-

Attack/decay time constants :: AM : 20ms/0.5sec. CW : 60ms/1.5sec.

Pages 41 & 43 — Add note to the effect that MAIN TUNING and INCREMENTAL TUNING controls are fitted with brakes which must be released before tuning the receiver.

Page 45 — Manual/AGC Switch

Add at end of first paragraph:-

Time constants are increased at 'CW' setting of MODE SWITCH.

Page 46 — Amend 4. (a) (iv) to read:- ....lever below control knob.

Page 67 — Front Panel Assembly

Amend Item 4 to read:- Remove panel nut to free SUPPLY SWITCH.

Delete reference to PL/SK-E.

Page XVIII — Add:- C308 2µF Tantalum 20% 35V Loc Q

Page XXVII — Add after R453:- R454 330 ohms 5% 0.1-watt Loc U

Page XXVIII — MODULES UNITS & ASSEMBLIES

Add:-

RF Amplifier Board	LP3062
MTO Board	LP3063
Harmonic Amplifier Board	LP3064

TURRET DISKS AND CONTACTS

Add:-

Disk Retainer Clips	7382P
Contact Holder	7401P
Contacts - short	7582P
Contacts - long	7583P

Page XXXII — Add after L81:-

L82/83	References not allocated	
L84	150Hz Filter Input Coil	D4553
L85	150Hz Filter Intermediate Coil	D4554
L86	150Hz Filter Output Coil	D4554

AMENDMENT SHEET NO. 1

Page 27	RF ASSEMBLY :: TURRET DISKS Disk 'C', Res. col. to read:- R370-377.
Pages 41 & 43	Delete handwritten note (ex-Corrigenda Sheet, April 1972). Brakes are not fitted to late production models of EC958/3-CAN.
Page XIV	Add:- C138 0.1µF Polycarbonate 20% 100V Loc. T.
Page XV	Change C155A to read:- 250pF (Tol. 5%). C157 to read:- 680pF (2%).
Page XIX	Change C373 & C374 to read:- +100% -20%.
Page XXIII	RV2 should read:- 2,200Ω. Page XXVI C475 should read:- 50pF.
Page XXVII	Delete R378 and add in list below Table (not allocated).
Page XXVIII	MODULES UNITS AND ASSEMBLIES Change Master Oscillator Unit to read:- Master Oscillator Unit (complete) . . LP3045A
Page XXIX	SWITCHES - S8 SELECTIVITY SWITCH - Amend to read:- Wafers S8A/B & S8E (2-pole 5-way) . . 8537P Wafers S8C/D & S8F/G (2-pole 5-way) . . 8538P Clicker mechanism for S8 . . 8536P POTENTIOMETERS - RV2 - Amend to read:- 2,200Ω (Part No. 8701P).
Page XXXI	Add suffix 'A' to Part Nos for:- L1-L6, L8, L9, L17/18, L29-31, L35. Add suffix 'B' to Part Nos for:- L7, L10-L15, L16.
Page XXXII	Add suffix 'A' to Part Nos for:- L58, L59, L63, L65, L67, L68, L69, L70, L77, L81. Add suffix 'B' to Part Nos for:- L138, L44, L45, L46, L55, L56, L57, L61, L71. Add suffix 'C' to Part Nos for:- L136, L137, L73, L74, L75, L76, L79. Add suffix 'D' to Part No. for:- L54.
Page XXXIII	Change Part No. for T1 to read:- D3850A.
Page XXXIV	Change Part Nos as follows:- Module Box :: 7521PA Trimming Tool :: 8451P Dust Cover (bottom) :: 8408PC.
Main Circuit	Add C138 (0.1µF) from Pin 78 of Master Oscillator Unit to earth. Change Type No. for 1MHz Crystal Oscillator to read:- QC.1013YX. Change C155A to read:- 250pF. Change C157 to read:- 680pF. Change RV2 to read:- 2.2K.
Interconnection Circuit	Add C138 (0.1µF) from Pin 78 of Master Oscillator Unit to earth. Change C376 & C377 to read:- 0.047µF.
Disk Circuits	Disk 'C' :: Delete R378. Disk 'D' :: Change C475 to read:- 50pF Disk 'F' :: Change C491 to read:- 50pF.

Issued by:- EDDYSTONE RADIO LIMITED, ALVECHURCH ROAD, BIRMINGHAM B31 3PP, ENGLAND
Tel. 021-475 2231 : Cables Eddystone Birmingham : Telex 337081

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.

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 $\geq$ 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 $\pm$ 6V, $\pm$ 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

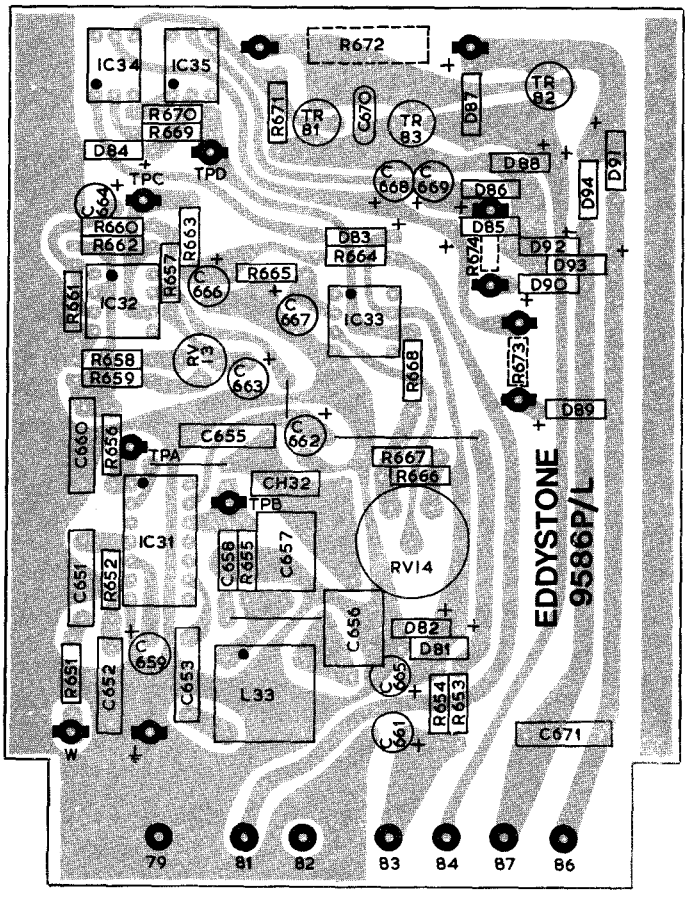
R651	390
R652	220
R653	100
R654	120
R655	22k
R656	6.8k
R657	1k
R658	1k
R659	6.8k
R660	6.8k
R661	6.8k

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

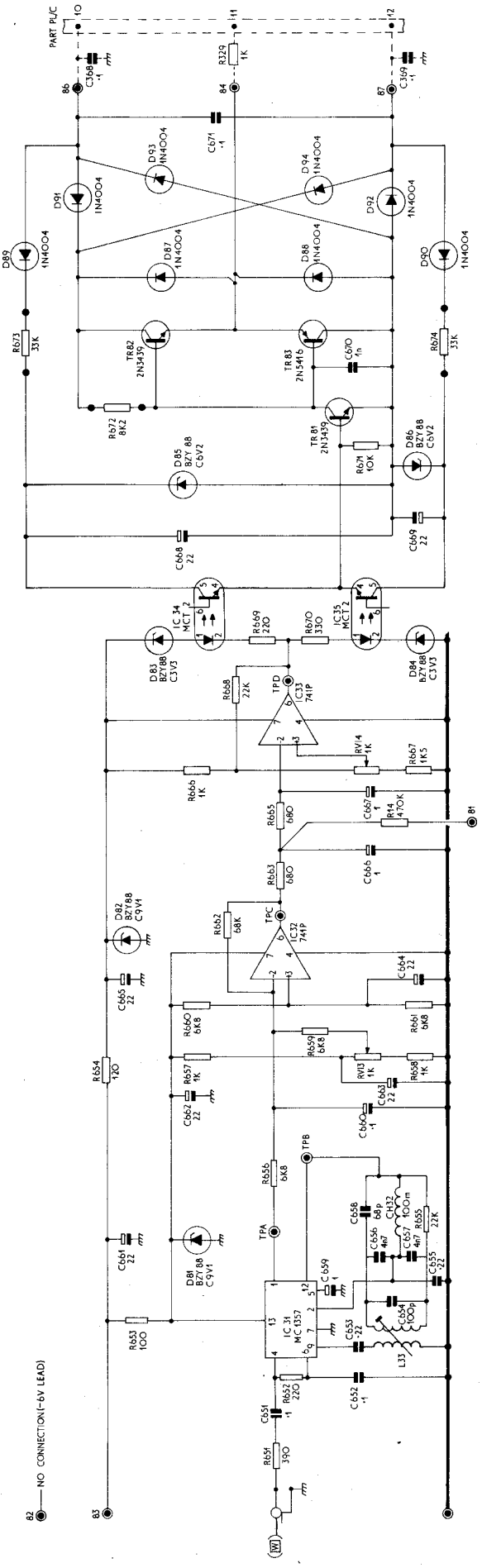
All the above are 5%, 1/3 W carbon film.
for the values and rating of R672, R673, R674 and R329 see table. 5% tolerance is adequate.

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

GENERAL DESCRIPTION

Eddystone Model EC958/3 is a solid-state communication receiver covering the frequency band 10kHz to 30MHz with reception facilities for CW, MCW and AM signals. No special provision is made for SSB, but transmissions in this mode can be resolved if necessary by using the CW Detector with an appropriate setting of the IF bandwidth. FSK (F1) teletype signals can also be received when the receiver is equipped with an optional module which provides a relay keyed output. An internal power unit allows direct operation from all standard 40-60Hz AC supplies and external DC/AC Converter Units can be provided to special order for 12V or 24V battery working.

The receiver is fitted with a standard 483mm (19in) panel to suit normal racking and is also available with cabinet for use in bench-mounted installations. Shock-mounts can be fitted for mobile use and other accessories include plinth and cabinet loudspeaker units in matching style.

Basic circuit configuration is fairly conventional on the six low frequency ranges which employ either single-conversion, or double-conversion with crystal-controlled oscillator injection in the second stage of conversion. Continuous tuning is available throughout this part of the range which covers the band 10kHz to 1.6MHz.

Frequencies above 1.6MHz are covered in four ranges using triple-conversion with the 1st Oscillator tuned in steps of 100kHz by reference to an oven-controlled Master Oscillator. This forms part of a drift-cancelling loop which gives an effective 1st Oscillator stability of the order 1 part in 10^7. Bandwidth within the loop is much less than that used in other similar equipment and an AFC system is therefore incorporated to maintain the 1st Oscillator frequency after selection of the appropriate 100kHz setting. The narrower loop bandwidth gives greater immunity to two-signal interference due to noise in the oscillator system.

Interpolation between adjacent 100 kHz points in the high frequency band is achieved by using a tunable 1st IF arrangement which employs a variable low frequency oscillator with appropriate tuning coverage and a long-term stability of the order 20Hz. The oscillator and intermediate frequency circuits are tuned by an 'incremental' control which uses a gear-driven mechanism similar to that used for tuning the 1st Oscillator and signal frequency circuits: the latter can be tuned independently to prevent misalignment when using the incremental facility.

Frequency read-out for both tuning controls is displayed on a translucent screen by two separate light projection systems which incorporate integral magnifiers. The display is totally non-ambiguous and easily read, only those portions of the tuning scales in the immediate vicinity of the tune frequency actually appearing on the screen. The incremental calibration for the tunable IF is marked at 1 kHz intervals with graduation marks every 200Hz: it can be easily resolved to better than 50Hz for precise frequency setting and is extinguished when tuning frequencies below 1.6MHz. Main scale calibration is in kHz or MHz depending on frequency, the appropriate unit being indicated by illuminated legends adjacent to the display.

FET's, protected MOSFET's and integrated circuits are used extensively in all parts of the receiver which is essentially modular in construction. All normal communications facilities are provided and these include variable selectivity (with crystal filter for narrow-band CW), separate RF and IF AGC systems, aerial attenuator, tunable calibrated BFO, scale-check markers, metering and provision for diversity working and remote tuning. An output is available from the final IF for connection to ancillary equipment and audio outputs are provided for loudspeaker, headset and line: a low-level BFO output is also available.

TECHNICAL DATA

GENERAL

Frequency Coverage

10kHz to 30MHz in ten overlapping ranges. The receiver is continuously tunable at frequencies below 1.6MHz and is tuned in bands of 100kHz width from 1.6MHz up.

Range 1	::	19.8MHz	- 30.0MHz	Range 6	::	280kHz	- 690kHz
Range 2	::	9.8MHz	- 20.1MHz	Range 7	::	125kHz	- 285kHz
Range 3	::	4.0MHz	- 10.0MHz	Range 8	::	53kHz	- 126kHz
Range 4	::	1.6MHz	- 4.1MHz	Range 9	::	24kHz	- 55kHz
Range 5	::	680kHz	- 1650kHz	Range 10	::	10kHz	- 24.5kHz

Intermediate Frequencies

1st IF* :: 1335kHz nom. (tunable 1235-1335kHz to provide incremental facility).

2nd IF** :: 250kHz (ceramic ladder filter).

3rd IF :: 100kHz (variable selectivity).

(*) Used on Ranges 1-4 only. (**) Used on Ranges 1-6 and Range 8 only.

Reception Modes

A1, A2 and A2H telegraphy. F1 telegraphy also available when optional module is fitted internally on receiver chassis.

A3 telephony. Single-sideband signals can be copied satisfactorily with receiver operating in CW (A1) mode with suitable adjustment of BFO and IF selectivity.

Power Supplies

Single-phase AC mains 100/125V and 200/250V (40-60Hz), or low voltage DC (12/24V) using external DC/AC Converter Type 978/12 or 978/24. Consumption of the order 35 watts AC, or 45 watts DC.

Input and Output Impedances

Aerial Input	::	Ranges 1-4 : 75 ohms. Ranges 5-10 : 75 or 600 ohms.	
Inc. Osc. IN/OUT	::	Low-impedance (to provide common oscillator facility for diversity working above 1.6MHz).	
IF Output (100kHz)	::	Low-impedance (to drive external ancillaries, e.g. Panoramic Display Unit Type EP961A).	
BFO Output (100kHz)	::	Low-impedance (to drive external counter etc.).	
Audio Output	::	Loudspeaker	: 3Ω. (interrupted when using headset)
		Lines	: 600Ω balanced or unbalanced (also usable as 150Ω unbalanced output).
		Headset	: Low/medium-Z.

Semiconductor Complement

The entire circuit including the optional FSK Module makes use of 44 transistors, 58 diodes and 13 integrated circuits. The reader is referred to Appendix "C" for a complete list of types and circuit functions.

PERFORMANCE SPECIFICATION

Sensitivity

3μV AM and 1μV CW for 10dB S+N/N ratio.
Taken with 3kHz IF B/W for standard 50mW output (AM mode : modulation 30% at 400Hz).

IF Selectivity

Variable selectivity is provided at the 100kHz IF giving five switched bandwidths as follows:-

Position	-6dB B/W	-60dB B/W	Filter
1	150Hz	1.5kHz	Crystal
2	400Hz	2.4kHz	L/C
3	1.3kHz	4.5kHz	L/C
4	3kHz	12kHz	L/C
5	8kHz	21kHz	L/C

NB: Maximum overall B/W is governed by the front-end circuits on the low frequency ranges.

Image and IF Rejection

Frequency Band	Image Rejection	IF Rejection
10kHz - 1.6MHz	60dB	greater than 60dB
1.6MHz - 15MHz	70dB	greater than 85dB
15MHz - 30MHz	50dB	greater than 85dB

Cross Modulation

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

Blocking

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

Intermodulation

All in-band intermodulation products due to two signals of equal strength lying at carrier + 1kHz and carrier + 1.6kHz will be at least 26dB below the level of either signal.

The output produced by two unwanted signals of equal level 80dB above 1μV, whose sum or difference frequency is equal to that of any specified test frequency (s.t.f.) in the tuning range of the receiver will not exceed standard output, provided that (1) neither signal is closer than 35kHz to the s.t.f., (2) neither produces an output greater than 20dB below standard output when applied alone, and (3) the receiver has been previously adjusted for standard output with a reference signal 30dB above 1μV at the s.t.f., this signal being removed during the test.

AGC Characteristic and Time Constant

Output is maintained within 6dB for a change in input of 86dB from 3μV reference level. Attack time constant is of the order 40ms and decay 1 second.

Frequency Stability

Figures quoted below apply after 30-minute warm-up period.

Drift with constant ambient

1.6MHz - 30MHz	::	less than 20Hz (long-term).
160kHz - 1.6MHz	::	less than 1 part in 10^4 in any five minute period.
10kHz - 160kHz	::	less than 50Hz in any five minute period.

Drift with 5°C change in ambient

1.6MHz - 30MHz	::	less than 20Hz.
160kHz - 1.6MHz	::	less than 5 parts in 10^4.
10kHz - 160kHz	::	less than 150Hz.

Drift for supply voltage change of ± 5%

1.6MHz - 30MHz	::	less than 2Hz.
10kHz - 1.6MHz	::	less than 3 parts in 10^5.

Audio Output

External loudspeaker (3Ω)	::	1W at less than 5% distortion.
Headset (600Ω)	::	2mW at less than 5% distortion.
Line (600Ω)	::	10mW at less than 5% distortion.

Audio Response

Level within 3dB over the range 300Hz to 6kHz.

IF Output (100kHz)

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

BFO Output (100kHz ± 8kHz)

250mV into 75Ω.

Radiation

Typically 20pW, and not greater than 400pW at any frequency. Field less than 0.1μV/metre at 2km.

Calibration Accuracy

1.6 - 30MHz	::	better than 50Hz)	using internal scale-check
10kHz - 1.6MHz	::	better than 1kHz)	facility.

Tuning Mechanisms

High-grade gear drives permit signals to be continuously resolved to within 10Hz.

Remote Fine Tuning

100Hz above and below local tune frequency (Ranges 1-4 only).

Temperature Rating

Operational : -15°C to +55°C. Storage : -40°C to +70°C.

Vibration

At any table frequency in the range 0-50Hz, at a force of 1g for 10-minutes, with the receiver adjusted for standard output at 1000Hz, degradation of performance is limited to a variation in oscillator frequency of less than 10Hz.

FSK Capability

Available with optional module fitted. Keying speeds from 50 to 200 bauds and shifts of 80 to 850Hz can be accommodated.

CIRCUIT DESCRIPTION

INTRODUCTION

The EC958/3 Receiver functions as a single or double-conversion superhet on the low frequency ranges and changes to triple-conversion at frequencies higher than 1.6MHz. Selection of the appropriate IF configuration is an auxiliary function of the range switching and reference should be made to the Table below for details of the actual intermediate frequencies used on each of the ten ranges. It should be noted that although intermediate frequencies are identified as "IF1" etc. in the Table, the text which follows will use the nomenclature "The Tunable IF", "The 250kHz IF" and "The 100kHz IF" to limit the possibility of confusion when considering the various modes of operation.

Each conversion oscillator will also be referred to by "name" rather than as "1st Oscillator", "2nd Oscillator" etc., since this avoids the complications which arise due to the number of actual frequency conversions being different on some ranges from others. The term "Main-Tune Oscillator" refers to the tunable oscillator associated with the first stage of conversion (1st HF Oscillator). The other oscillators are "The Incremental Oscillator" and "The 150kHz Crystal Oscillator".

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.

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 drift-cancelling loop will be found later on page 14.

A fold-out Block Diagram of the receiver is included at the rear of the Handbook and reference to this is recommended before studying the actual circuit in detail.

FREQUENCY CONVERSION ARRANGEMENTS ON EACH RANGE

Range	Coverage	Conversion	IF1	IF2	IF3
1	19.8 - 30.0MHz	)			
2	9.8 - 20.1MHz	)			
3	4.0 - 10.0MHz	) Triple	Tunable 1235-1335kHz	250kHz	100kHz
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	-	-

THE RF SECTION

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 is contained in a rugged die-cast housing which provides effective screening and also includes part of the circuitry for the drift-cancelling loop. Five standard switch wafers are ganged to the turret mechanism to perform several associated switching functions, the most important of which is selection of the appropriate IF configuration to suit the range in use.

The basic circuitry of the RF Section is carried on six separate printed circuit boards, designations for which are given below. The Board "Numbers" quoted in this list are repeated in Fig. 2 (page 25) for location of the individual boards.

1. Crystal Calibrator Board (1MHz).
2. Peak-RF Board.
3. RF Amplifier Board.
4. Main-Tune Oscillator Board
5. Harmonic Amplifier Board.
6. MTO AFC Board.

A total of six printed circuit "Turret Disks" carry the various inductors etc. for range selection: their identities are as follows:-

Disk 'A' : Aerial Disk.
Disk 'B' : RF Disk.
Disk 'C' : Signal Mixer Disk.
Disk 'D' : Main-Tune Oscillator Disk.
Disk 'E' : Loop Mixer Disk.
Disk 'F' : Harmonic Amplifier Disk.

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.

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 send/receive changeover system through terminals on the ancillaries block at the rear: it also becomes energised when using the scale-check facility as described on page 17.

Aerial 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 high induced voltage on the aerial.

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 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 TUNABLE IF

Introduction

This portion of the receiver provides the incremental tuning facility used on Ranges 1 to 4 (1.6 - 30MHz) and forms part of the drift-cancelling loop system. A full description of the latter will be deferred at this point and the text which follows will consider only those stages which are directly involved in the Tunable IF proper. A sound understanding of the functions performed by these particular stages will be found of great value when considering the operation of the loop system as a whole.

The Tunable IF Section has a tuning range of 100kHz and covers the band 1235kHz to 1335kHz. Its input is derived from the drain of the 1st Signal Mixer (TR3) and the selected intermediate frequency is passed directly to the 2nd Signal Mixer (TR15) for conversion to the 250kHz IF.

Oscillator injection for this conversion process is obtained from the 2nd Loop Mixer (IC12) which mixes the output from the Incremental Oscillator (550 - 650kHz) with a 935 kHz output provided by the drift-cancelling loop: injection will lie at an appropriate frequency in the band 1485 to 1585kHz, i.e.:-

$$f_{inj} = f_{inc\ osc} + 935kHz.$$

The IF spectrum present at the input of the 2nd Signal Mixer is a mirror image of the signal spectrum at the aerial input (due to the Main-Tune Oscillator being on the high side of the signal and therefore causing inversion to occur). In consequence, the Tunable IF is calibrated in reverse, 'Ø' on the scale corresponding to a Tunable IF of 1335kHz, and '100' corresponding to 1235kHz. The signal frequency and MTO circuits are aligned to give correct main scale calibration with the Tunable IF set to 'Ø': 1335kHz is therefore referred to as the 'nominal' setting of the Tunable IF.

The actual function of the Tunable IF as an incremental tuning facility will now be examined, taking as an example the case where the main tuning has been set to give an incremental coverage of 3.5 - 3.6MHz.

1. As mentioned in a previous paragraph, the Main-Tune Oscillator is aligned to track 1335kHz above the indicated signal frequency on the main tuning scale. It follows then, that for a main scale setting of 3500kHz, the MTO will be tuned to 4835kHz.

2. The 1335kHz IF produced by the conversion process in (1) above is passed to the 2nd Signal Mixer and will be converted to the 250kHz IF by oscillator injection at 1585kHz, viz:- 1585kHz - 1335kHz = 250kHz.

3. This condition is met when the incremental control is adjusted to display '0kHz' on the incremental scale. The oscillator injection results from a 650kHz Incremental Oscillator output which is mixed with a 935kHz signal from the drift-cancelling loop, i.e. 650kHz + 935kHz = 1585kHz.

4. If the original MTO setting of 4835kHz is maintained, setting the incremental scale to '100kHz' will cause the Tunable IF to become 1235kHz and the receiver tune frequency is then 3600kHz, i.e. 4835kHz - 1235kHz = 3600kHz.

5. With the incremental scale at '100kHz', the Incremental Oscillator frequency becomes 550kHz which gives injection to the 2nd Signal Mixer at 550kHz + 935kHz = 1485kHz. This mixes with the 1235kHz input to produce the 250kHz IF.

The various stages referred to above will now be considered in greater detail.

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 (L60, L62 & L63 - See Disk Circuit Part 1).

A protected dual-gate n-channel MOSFET (40673) is used 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

All signal-frequency circuits are gang-tuned by the MAIN TUNING CONTROL, one section of the tuning capacitor becoming idle on Ranges 9 & 10 when bandpass input tuning is not employed. Six voltage-variable-capacitance diodes (D5-D10 :: 6 x BA111) are wired back-to-back in pairs across each of the three gang sections to permit independent adjustment of the signal frequency circuits when using the incremental tuning facility. Only two of the diodes (D5 & D6) are operative on Ranges 5-8, functioning as a conventional aerial trimmer control in parallel with the aerial section of the main tuning gang (C30). ALL DIODES ARE INOPERATIVE ON RANGES 9 & 10.

The VVC-diodes are reverse-biased from RV1 (PEAK-RF CONTROL) and the circuit is so arranged that the effective capacity swing is modified to suit the tuning range in use, (S3A). On Ranges 1 & 2, the DC return for the VVC's is completed by 0.1MΩ resistors (R350 etc.) located on the Aerial, RF and Signal Mixer Turret Disks. These are necessary because of the inclusion of series tracking capacitors (C381 etc.).

Main-Tune Oscillator (1st HF Oscillator)

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. It is tuned by a further section of the main tuning gang (C46) which has wider spacing and heavier vanes than the signal frequency sections. A gate resistor and biasing diode are used in conjunction with a source resistor to determine the operating point. Output is taken by capacitive coupling from the gate to a junction-FET (TR5 :: UC734B) which is wired as a source follower and serves as an isolating stage. Injection voltage is coupled to gate 2 of the 1st Signal Mixer via C54 and C43.

VVC diode D11 (BA110) forms part of the oscillator tuned circuit and is maintained at constant effective capacity except when using the receiver in its high-stability mode on Ranges 1-4: its function will be covered later in this Section.

Scale-check facility

1MHz markers are available for checking the accuracy of the main scale on Ranges 1-4 and 10kHz markers on Ranges 5-10. Changeover from 1MHz to 10kHz is an auxiliary function of the RANGE SWITCH (wafer S3D), and is performed automatically.

The 1MHz markers are derived directly from a 1MHz crystal oscillator IC1 (CA3000) which has its output connected to an injection probe positioned close to the circuitry of the RF Amplifier. 10kHz markers for Ranges 5-10 are obtained by modulating the 12V supply to the crystal oscillator with a 10kHz output from the 10kHz Calibrator Unit (see page 17).

The scale-check facility is brought into use by closing the CAL SWITCH S1A/S1B and scale correction is by mechanical movement of the cursor index line (CAL ADJ CONTROL). The aerial relay RLA/1 is energised during calibration checks to limit interference from normally received signals.

2nd Signal Mixer (TR15)

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

A three - circuit voltage-variable-capacitance tuned IF filter is included between the drain of the 1st Signal Mixer and the signal (IF) gate of the 2nd Signal Mixer. This has a bandwidth of the order 15kHz and is tuned over the range 1235 - 1335kHz by the potentiometer RV3 which provides a controlling voltage for the six VVC's D19/19A, D20/20A and D21/21A (6 x MV1656). The potentiometer is driven from one outlet of the incremental tuning drive.

Six more diodes (D22-D24A :: 6 x MV1656) are controlled by RV3 to tune a further three-section filter which is connected between the output of the 2nd Loop Mixer and the 'oscillator' gate of the 2nd Signal Mixer. This filter covers the range 1485 to 1585kHz, its function being to eliminate spurious products generated in the oscillator mixing process.

Pre - set potentiometers RV4 and RV18 are included in the RV3 circuit to provide a means of alignment when tracking the two filter circuits during initial testing.

Output from the drain of TR15 is fed directly to the 250kHz IF filter via the coaxial interconnecting lead "P". CH17 provides a DC path to the drain electrode.

2nd Loop Mixer (IC12)

This is the final stage in the drift-cancelling loop. It employs an integrated circuit double-balanced mixer (SL641C) and produces the oscillator injection required in the 2nd Signal Mixer. Drive from the Incremental Oscillator is fed to input '3' via coaxial lead "N", and drive at 935kHz from the drift-cancelling loop is fed to input '7' via coaxial lead "M". Spurious products are kept to a minimum by using this type of mixer in this position: input levels are set by adjustment of C154, C155 & C157.

Incremental Oscillator Unit (TR17, TR18 & TR19)

TR17 (UC734B junction-FET): This is a high-stability, temperature-compensated oscillator with a long-term stability of the order 20Hz. It covers the nominal range of 550-650kHz with an actual coverage of 548-652kHz to provide a 2kHz overlap for convenience when tuning adjacent 100kHz segments with the INCREMENTAL TUNING CONTROL. A precision-built ceramic-insulated variable capacitor is employed for tuning.

A VVC-diode (D46 :: BA111) is included in the oscillator circuit to provide (1) a means of correcting long-term ageing of the oscillator components, and (2) a remote fine tuning facility with a coverage of ± 100Hz. Scale correction is provided by adjustment of the INC CAL CONTROL (RV17) and connections for remote tuning are on the ancillaries block at the rear of the set. RV17 is taken out of circuit when using the remote fine tuning facility.

TR18 (2N4254): Serves as an isolating stage (emitter follower) giving low-impedance oscillator drive to the 2nd Loop Mixer via a low-pass filter. A parallel-connected socket at the rear (fed via coaxial lead "O") allows two receivers to be operated in dual-diversity with common oscillator control. The unused oscillator can be shut down by opening the NORMAL/SLAVE SWITCH (S6).

TR19 (2N4254): This is another emitter follower which provides an isolated incremental oscillator output to the 10kHz Calibrator Unit for scale checking. Reference should be made to page 17 for details of this facility.

Power Supply: Extensive zener regulation is employed for the oscillator supply which operates at a final voltage of 8.2V. The supply is maintained on all ranges to preserve the highest possible order of oscillator stability.

HIGH-STABILITY OPERATION ON RANGES 1-4 (1.6-30MHz)

In the description of the Tunable IF Section on page 12, reference was made to a 935kHz signal derived from the drift-cancelling loop. This signal is obtained by mixing the Main-Tune Oscillator frequency with a selected harmonic delivered by an oven-controlled Master Oscillator. The harmonic will be a multiple of 100kHz and will lie in the range 2.0 - 30.4MHz.

Selection of the appropriate harmonic is a function of two harmonic selector circuits which are ganged to the MAIN TUNING CONTROL and tracked to tune 400kHz higher than the signal frequency circuits, e.g. with the main scale set to 3.5MHz, the harmonic selected will be the one at 3900kHz.

SELECTED HARMONIC = SIGNAL FREQUENCY + 400kHz (3500kHz + 400kHz = 3900kHz) (1)

The MTO frequency for a main scale setting of 3.5MHz will be 1335kHz higher than the signal frequency (1335kHz = 'nominal' setting of Tunable IF).

MTO FREQUENCY = SIGNAL FREQUENCY + 1335kHz (3500kHz + 1335kHz = 4835kHz) (2)

This frequency will mix with the selected harmonic to provide the 935kHz loop signal.

LOOP FREQUENCY = MTO FREQUENCY - SELECTED HARMONIC (4835kHz - 3900kHz = 935kHz) (3)

The 935kHz output will be present only at discrete settings of the MAIN TUNING CONTROL, i.e. when set to each 0.1MHz calibration point in the range 1.6 - 30MHz. An indication of correct setting is obtained by rectifying the 935kHz signal and using the DC to control a lamp fitted on the receiver panel.

The operation of the drift-cancelling loop will now be considered by continuing the example above and assuming that the MTO has drifted 2kHz higher in frequency.

NEW MTO FREQUENCY = 4835kHz + 2kHz = 4837kHz (4)

This frequency will mix with the incoming signal at 3500kHz to give an input to the Tunable IF of 1337kHz.

NEW TUNABLE IF = 4837kHz - 3500kHz = 1337kHz. (5)

The change in MTO frequency is also transmitted to the 1st Loop Mixer where it produces a new loop frequency of 937kHz.

NEW LOOP FREQUENCY = 4837kHz - 3900kHz = 937kHz. (6)

This signal is passed to the 2nd Loop Mixer where it mixes with the Incremental Oscillator frequency to give an 'oscillator' injection frequency to the 2nd Signal Mixer of 1587kHz (Incremental Osc. freq. will be 650kHz at 'nominal' setting of Tunable IF).

NEW INJECTION FREQUENCY TO 2nd SIGNAL MIXER = 937kHz + 650kHz = 1587kHz. (7)

The new injection frequency to the 2nd Signal Mixer changes the effective Tunable IF frequency to 1337kHz which coincides with the figure obtained in (5) above. The shift in MTO frequency has therefore been nullified by an equal change in the Tunable IF and output from the 2nd Signal Mixer is maintained at 250kHz.

NEW TUNABLE IF = 1587 - 250 = 1337kHz. (8)

The maximum drift that can be accommodated by the loop system is dependent on the bandwidth of the 935kHz circuits and amounts to roughly ± 5kHz. Drift in excess of this would result in severe reduction of 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 Main-Tune Oscillator frequency after this has been set during initial tuning adjustment. Control for the AFC system is derived from a 935kHz Discriminator, the output of which can be displayed on the panel meter to allow precise setting of the MAIN TUNING CONTROL to the required 0.1MHz calibration point.

The various stages concerned in the drift-cancelling system will now be considered in greater detail:-

The Master Oscillator Unit

This unit provides two independent outputs as follows:-

(1) A differentiated spike output containing all harmonics of 100kHz up to at least 30.4MHz.

(2) A 100kHz sine-wave output.

Both outputs are derived from a 1MHz oven-controlled crystal oscillator provided with an easily accessible trimmer to permit precise frequency setting during initial test and alignment. Output from this oscillator is fed to the base of TR12 (2N4254) which increases the level of the 1MHz signal and drives the integrated circuit IC6 (FJJ141). This stage functions as a decade divider giving output at 100kHz: its input is limited by zener diode D17 (BZY88 C4V7) to prevent overdriving.

The square-wave output at 100kHz is fed to the bases of TR13 (BC107B) and TR14 (2N4254) which are both wired as emitter followers. TR13 has a tuned input circuit and therefore gives a good sine-wave output at 100kHz via coaxial outlet "I". This signal is used as a master reference when carrying out certain scale-check functions. Further details will be found on pages 17 and 20.

The other emitter follower (TR14), is driven directly from the decade divider and can be considered as an harmonic generator which feeds all harmonics of 100kHz to the tuned harmonic selector circuits referred to in the description on the previous page.

All stages in the Master Oscillator Unit run continuously with the exception of the emitter follower TR13. This stage is brought into use only when performing calibration checks, switching being by S1B, S10B or S7A as appropriate.

The Master Oscillator Unit is housed in a double-screened box to prevent direct radiation of its fundamental or harmonic output within the receiver. Double-screened coaxial cable is used to extend this protection on the main output which is fed to the first harmonic selector circuit in the RF Section of the receiver (via coaxial interconnection "G"). Normal coaxial cable is used on coaxial lead "I" which runs directly to socket "I-1" on the 10kHz Calibrator Unit. Socket "I-2" is strapped directly to "I-1" to provide 100kHz drive to the CW Detector when calibrating the BFO.

Harmonic Amplifier (TR6)

The output derived from TR14 in the Master Oscillator Unit contains components of all 100kHz harmonics and is fed to an FET amplifier stage (TR6 :: UC734B) which forms part of the RF Assembly. The FET input is tuned over the range 2.0 - 30.4MHz by a further section of the main tuning gang (C60), the appropriate inductors being carried on Turret Disk "F". These circuits are tracked to tune 400kHz higher than the indicated frequency on the main tuning scale and their main function is to discriminate against unwanted harmonic signals. TR6 is coupled to a second selector circuit which reinforces the attenuation of unwanted harmonics afforded by the first circuit. All inductors etc. for the second circuit are carried on Turret Disk "E".

1st Loop Mixer and MTO Amplifier (TR7 & IC2)

The second harmonic selector circuit referred to at the foot of the previous page is wired to gate 1 of the 40673 protected dual-gate MOSFET which serves as the 1st Loop Mixer. Gate 2 is fed from the drain of the Main-Tune Oscillator via a wide-band amplifier (IC2 :: SA21), which is referred to as the MTO Amplifier.

The difference between the two applied frequencies appears at the drain of TR7 in which the load comprises L1/C70 tuned to 935kHz. Output is available only at discrete settings of the MAIN TUNING CONTROL and is taken from a tap on L1 via coaxial interconnecting lead "H" to the Loop Amplifier IC3.

The 935kHz Loop Stages (IC3, IC4, TR8 - TR11)

Output from the 1st Loop Mixer (TR7) is coupled to a double-tuned bandpass circuit (L2/L3) aligned at 935kHz and feeding the integrated circuit IC3 (CA3002). This stage functions as the main loop amplifier, its output feeding the emitter follower TR9 (2N4254) via a second 935kHz double-tuned bandpass circuit. The emitter follower drives a detector (D15 :: 1S44) which serves to control the Schmitt Trigger TR10/11 (UC734B/40309) to operate relay RLB/1. The relay operates to close contact RLB/1 whenever 935kHz drive is available from the 1st Loop Mixer. Closure of the relay contact applies +12C to LP1 which illuminates the "HIGH-STAB" legend on the panel to indicate to the operator that the MAIN TUNING CONTROL has been set to accept the appropriate 100kHz harmonic in the harmonic selector circuits associated with TR6 & TR7. The trigger circuit ensures snappy operation of the relay as soon as the drive exceeds the minimum level required for satisfactory mixing.

A further 935kHz tuned circuit (L6/C93) is coupled to the bandpass pair in the output of IC3. Coupling is by C91 and it is from this point in the circuit that 935kHz drive is extracted to feed the 2nd Loop Mixer IC12. The feed is taken via coaxial interconnection "M". Diode D15A (1S44) serves as a clipper to limit the maximum voltage developed across L6.

The integrated circuit IC4 (CA3012) is fed from a tap on L6 and functions as a limiter to drive the AFC Discriminator D13/D14 (2 x 1S44). The DC voltage appearing across the load resistors (R81/82) under off-tune conditions is applied via R83 to the gate of TR8 (UC734B). This stage maintains light loading on the discriminator and is used to control the AFC diode D11 in the Main-Tune Oscillator circuit (page 11).

Initial operating conditions in the AFC control transistor TR8 are set by adjustment of the pre-set potentiometer RV2. This fixes the standing reverse bias on D11 which remains in circuit on all tuning ranges.

Output from the discriminator is also applied to the receiver metering circuit via S12A to provide visual indication of the conditions within the drift-cancelling loop. In normal operation on Ranges 1-4, the MAIN TUNING CONTROL is first adjusted to illuminate the "HIGH-STAB" legend lamp, after which the control is adjusted more carefully until the meter indicates centre-zero (METER SWITCH at '1ST HF OSC AFC').

All stages in the loop system except TR8 are switched off on Ranges 5-10. The switching function is performed by RANGE SWITCH wafer S3D.

935kHz Crystal Oscillator (IC5)

This stage is not required for normal operation in the EC958/3 version but is used in the standard receiver which has facilities for continuous tuning over each of the four high frequency ranges. The 935kHz crystal then provides a substitute signal which takes the place of the loop drive used in high-stability working. The 935kHz oscillator components are retained in the EC958/3, but there is no connection to its supply line (Module Pin 32). The stage is retained for possible use in testing and is activated by transferring the lead from Pin 28 to Pin 32.

10kHz CALIBRATOR UNIT

The following main scale and incremental scale calibration checking facilities are provided on the EC958/3 Receiver:-

MAIN SCALE	::	Ranges 1-4 : 1MHz markers)	Scale correction mechanically by
		Ranges 5-10 : 10kHz markers)	use of adjustable cursor.
INCREMENTAL	::	10kHz markers.	Scale correction by use of INC CAL CONTROL (RV17).

NB: Provision is also made for checking the 100kHz setting of the BFO PITCH CONTROL.

Line-up

The 10kHz Calibrator Unit comprises the following stages and is used when checking main scale calibration on Ranges 5-10 and incremental calibration on Ranges 1-4.

TR47	(2N4254) ;:	Divider Driver.	TR48	(2N4254) ::	Mixer.
IC11	(SN7490) ::	Decade Divider.	TR49	(2N4254) ::	Beat Amplifier.

Operation of 10kHz Calibrator Unit and associated stages

Main scale function: Only two of the stages listed above are used for this function. These are TR47 and IC11: the other two stages are energised but provide no output.

The main scale checking facility is activated by CAL SWITCH S1B which applies +12V directly to Pin 141 of the 10kHz Calibrator Unit, and +12V via D53 to Pin 74 of the Master Oscillator Unit. Relay RLD/1 is energised to provide +12V for the 1MHz Crystal Calibrator which is fed from Pin 142.

The +12V feed to Pin 74 brings TR13 into operation and provides 100kHz drive to the Divider Driver Stage TR47 via coaxial interconnection "I-1". The Decade Divider IC11 produces a 10kHz square-wave output which is developed across CH41 so modulating the +12V feed via relay contact RLD/1 to the 1MHz Crystal Calibrator.

On Ranges 1-4, where 1MHz markers only are required, the Decade Divider is shut down by RANGE SWITCH wafer S3D. The voltage developed at R196/197 provides the inhibit control which is applied to pin 2 of the IC.

The other section of the CAL SWITCH (S1A) is arranged to disable the AFC to permit free tuning when calibrating on Ranges 1-4.

The aerial relay RLA/1 is automatically energised via S1B and D53 to limit interference from normally received signals when performing a calibration check.

Incremental scale function: All four stages in the 10kHz Calibrator Unit are utilised in this mode of operation. Output from the Incremental Oscillator is mixed with a 10kHz spectrum to provide beat outputs which are fed directly to the Audio Section of the receiver after amplification in the Beat Amplifier Stage TR49.

TR13, TR47 and IC11 function as before to provide a square-wave 10kHz output at pin 12 of the IC, but switching in this case is by means of MODE SWITCH wafer S10B which completes the +12V feed to Pins 141 and 74 when set to 'CAL'.

10kHz drive is applied to the Mixer Stage TR48 along with drive from the Incremental Oscillator which enters the unit from TR19 via coaxial interconnection "Y". Audible beats are developed at the collector of TR48 and pass to the Audio Section via TR49 and MODE SWITCH wafer S10C.
The IC11 inhibit line is routed via S10C which allows the inhibit control to be overridden when the MODE SWITCH is set to the 'CAL' position. The 1MHz Crystal Calibrator and the aerial relay are energised as when carrying out a main scale check: this is of no consequence since output is taken directly from TR49 and not via the 100kHz IF.

THE 250kHz IF

This portion of the receiver is operative on all ranges except Ranges 7, 9 and 10 which utilise single-conversion direct to the 100kHz IF. All the 250kHz circuitry is housed in one module which contains a single-stage IF Amplifier, the 3rd Signal Mixer and its associated local oscillator system.

Input to the 250kHz IF is derived from the drain of the 2nd Signal Mixer on Ranges 1-4, and from the drain of the 1st Signal Mixer when using double-conversion on Ranges 5, 6 and 8. The changeover is effected by RANGE SWITCH wafer S3C which connects the output of the 1st Signal Mixer to the Tunable IF on Ranges 1-4, and to the 250kHz IF on Ranges 5, 6 and 8. The output of the 2nd Signal Mixer is not switched but is permanently connected to the input of the 250kHz IF via coaxial interconnection "P". This simplifies the IF switching, and though supplies remain on the 2nd Signal Mixer when using Ranges 5, 6 and 8, no output is obtained from it because the input to the Tunable IF has been interrupted at S3C.

The 12V supply for the 250kHz IF is fed via RANGE SWITCH wafer S3D and is absent on Ranges 7, 9 and 10 when single-conversion is being used. 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.

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 effects in this part of the circuit.

Tuned-choke coupling is employed between TR22 and the 3rd Signal Mixer (TR20) which uses another 40673 dual-gate MOSFET in the same type of circuit as the 1st and 2nd Signal Mixers. IF input is to gate 1 and oscillator drive to gate 2. 100kHz output is developed in the drain circuit and 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 directly to the filter when using Ranges 7, 9 and 10 (single-conversion mode).

Standard EC958 Receivers employ a dual-frequency local oscillator arrangement at this point in the circuit to provide a means of USB/LSB switching for single-sideband reception. This facility is not required on the EC958/3 which has no special provision for this mode of working. Connections to the 250kHz IF Module are therefore arranged so that single-frequency injection only is provided.

The local oscillator system comprises a Crystal Oscillator (IC7 :: CA3000) and an Oscillator Amplifier (TR21 :: UC734B junction-FET): tuned-choke coupling is used between TR21 and the oscillator gate of TR20. The Crystal Oscillator is arranged for dual-frequency working as on the standard receiver but the wiring associated with the USB/LSB switching is permanently connected so that only the 150kHz crystal oscillates. The 350kHz crystal is omitted in 250kHz IF Module Type LP3061/1 which is the module normally fitted to the EC958/3. Module Type LP3061 which includes the 350kHz crystal can be used as a direct replacement without affecting operation in any way.

THE 100kHz IF

The 100kHz IF circuitry comprises the following:-

1. A switched L/C filter providing four different IF bandwidths.
2. A dual-crystal telegraphy filter with a bandwidth of 150Hz.
3. A 100kHz IF Amplifier Module which incorporates the AM Detector and two separate AGC circuits.
4. A separate CW Detector and BFO Unit.

100kHz IF Filters

Two separate IF filters are provided at the 100kHz IF - a switched L/C filter which gives bandwidths of 400Hz, 1.3kHz 3kHz and 8kHz, and a crystal filter which has a bandwidth of 150Hz. Switching is by means of the SELECTIVITY SWITCH S8 which forms part of the L/C filter.

The L/C filter employs five high-Q vinkor assemblies tuned by close-tolerance silvered mica and polystyrene capacitors. Each of the five sections is top-coupled to the adjacent section, the value of capacitor being switched to obtain the desired bandwidth. Damping resistors are introduced for the two wide selectivity positions and the centre-frequency is corrected in the two narrow positions by adding extra values of capacity across each circuit.

Selecting the 150Hz selectivity position takes the L/C filter out of circuit, the drain feed to the appropriate Signal Mixer being maintained by CH36 which is switched into circuit by wafer S8A. The input coil of the L/C filter is short-circuited by S8B to prevent leakage through the L/C filter when the crystal filter is in use.

The 150Hz filter uses a pair of crystals in a semi-conventional bandpass arrangement with pre-set phasing adjustment. Skirt selectivity is of the order 1.5kHz at -60dB down.

Output from the appropriate filter is selected by switch wafer S8G and is routed to the 100kHz IF Amplifier Module via interconnecting coaxial lead "T".

100kHz IF Amplifier Module (TR23-TR31)

This module contains the 100kHz IF Amplifier, the AM Detector and separate RF & IF 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 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 wafer S10C.

RF & IF AGC Systems: 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 (1S44). Divider R230/231 provides a delay for the diode and preserves full gain in the RF Amplifier except when handling extremely strong signals. A similar drive arrangement to that used with the AM Detector is employed to feed the AGC Rectifier, 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 (1S44) IF AGC Rectifier. Delay is provided by R239/240: time constants are lengthened with MODE at 'CW' (C308).

IF AGC is brought out on the ancillaries block at the rear of the receiver for use in dual-diversity working.

CW Detector & BFO Unit

This unit comprises the following stages:-

CW Detector (TR33 :: 40673)
Beat Frequency Oscillator (TR32 :: UC734B)
Emitter Follower (TR32A :: BC107B)
100kHz Gate (IC13 :: SN7420N)

CW Detector: An n-channel dual-gate protected MOSFET is employed in this position functioning as a product detector with signal (IF) input to gate 1 and beat oscillator injection to gate 2. Output is taken from the drain circuit via a low-pass filter to the 'CW' position of MODE SWITCH wafer S10C.

Beat Oscillator: This is a junction-FET circuit using a similar configuration to that used in the Incremental Oscillator Stage. Temperature-compensation is applied and the two-gang variable capacitor C310/311 provides a tuning range of 100kHz ± 8kHz. The 12V supply to this stage (and to TR32A) is completed at 'CW' by MODE SWITCH wafer S10B.

Emitter Follower: This stage provides a low-level low-impedance BFO output via coaxial interconnection "Z" to the BFO OUT socket at the rear of the set. Sufficient output is available to drive a counter to display the BFO frequency.

100kHz Gate: Provision is made for introducing a 100kHz reference signal at the signal input of the CW Detector to permit accurate setting of the BFO scale calibration. The reference signal is obtained from TR13 in the Master Oscillator Unit via coaxial interconnection "I". (TR13 also provides drive for the 10kHz Calibrator Unit as already described: the feed to TR33 is taken via sockets "I-1" and "I-2" on that unit.)

IC13 is included in the CW Detector & BFO Unit to provide a means of interrupting the 100kHz feed from TR13 when the latter is energised during main scale calibration checks. The 100kHz Gate is switched by part of the BFO CAL SWITCH (S7B) which breaks the inhibit line when set to the 'ON' position.

The other section of the BFO CAL SWITCH (S7A) completes the +12V supply to TR13, and at the same time energises the aerial relay to prevent interference from normal signals while the BFO scale check is carried out.

The calibration adjustment merely involves tuning of the BFO control knob for zero-beat against the 100kHz reference signal, after which the skirt of the control is set to coincide with the 'Ø' calibration mark by use of the lever provided.

THE AUDIO SECTION

This Section of the receiver comprises two independent audio channels involving a total of five transistors. Each channel has its own gain control (RV6 & RV7), these being fed in parallel from the selector of MODE SWITCH wafer S10C. This wafer selects audio from the AM Detector at 'AM', from the CW Detector at 'CW' and from the 10kHz Calibrator Unit (Beat Amplifier) when set to 'CAL'. One audio channel provides outputs for telephone headset and internal/external loudspeakers while the other is a low-level output for connection to 600Ω line circuits.

High-level Audio Channel (TR36-TR38)

The line-up on this channel comprises TR36(BC107B), TR37 (40309) and TR38 (2N3054). Resistance-capacity coupling is used between the first two stages and transformer coupling to the output transistor TR38. Headset output is taken from this transformer, the circuit being arranged so that drive to the output stage is interrupted when the headset is connected.

The output transistor runs in Class "A", its initial operating conditions being set by precise adjustment of RV8 during factory test. The output transformer has a 3Ω secondary which is brought out directly to the ancillaries block at the rear: 1-watt of audio output is available at 5% distortion. The built-in monitor speaker is also fed from the same winding (via S11 and the attenuating resistor R299).

The Low-Level Audio Channel (TR34/TR35)

This channel utilises a straightforward resistance-capacity coupled circuit using two BC107B transistors. The output transformer is electrostatically screened and provides a centre-tapped 600Ω output for connection to remote line circuits. Diode D37 (1S44) serves as a rectifier to operate the built-in meter when checking line level.

FREQUENCY-SHIFT KEYING STAGES

The FSK Module employs three linear integrated circuits and two transistors. It is an optional unit and is fitted only if specified at the time of ordering the receiver. Circuit information is included here for the sake of completeness.

100kHz input for the FSK Stages is taken from Emitter Follower TR27 (100kHz IF Amplifier Module) via coaxial interconnections "U" & "W". IC8 (CA3012) functions as a single-ended limiting amplifier, providing a clipped 100kHz output to drive the FSK Discriminator D38/39 (2 x 1S44). Mark/space pulses appearing across R314/315 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). The pre-set adjustment accommodates transistor spread: a metering point is provided on the printed board.

The CA3002 used 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 is provided (external to the module): this comprises R329 and C368/369.

RV14 permits adjustment of the relay bias conditions to achieve correct keying of the 'printer: access for adjustment is through a suitably positioned hole in the rear of the set.

T H E M E T E R C I R C U I T S

The built-in meter can be switched to indicate (1) carrier-level, (2) line-level and (3) the AFC voltage to the AFC Control Stage. Selection of the desired indication is by means of the METER SWITCH S12A/S12B.

S12A selects the appropriate controlling voltage which is taken from the IF AGC line when reading carrier-level, from the meter rectifier D37 for line-level and from the 935kHz Discriminator D13/14 for AFC. The selected line is applied to the gate of the junction-FET TR39 which serves as the Meter Amplifier: the meter is connected in its drain circuit.

S12B modifies the drain load in each of its three positions, pre-set controls being introduced automatically for correct setting of the electrical meter zero. Initial operating conditions in the meter circuit are established by RV11 which is adjusted to position the meter needle coincident with 'Ø' on the arbitrary carrier-level scale with METER SWITCH at 'RF'.

The drain load of the Meter Amplifier in this position is fixed and comprises R303 and R44. The latter is part of the drain circuit of the RF Amplifier and this arrangement extends control of the meter circuit to the RF AGC line when taking extremely strong signals. The 'RF' position of S12 remains operational with the AGC SWITCH set to 'OFF' but the calibration then becomes essentially linear rather than logarithmic as it is when AGC is in use.

TR39 drain load in the 'AF' position is the pre-set potentiometer RV10 which is adjusted to zero the meter needle to 'Ø' on the mW scale. A second potentiometer (RV12) is adjusted during factory test to calibrate the meter scale for accurate mW readings with line output terminated in 600 ohms.

The meter is biased to centre-zero with S12 set to '1ST HF OSC AFC'. The appropriate pre-set adjustment is RV9 which is set to give zero voltage across the meter when the output from the AFC Discriminator is zero.

POWER SUPPLY SECTION

The receiver can be operated directly from any AC supply in the voltage ranges 100/125V and 200/250V (40-60Hz), or from 12/24V DC supplies by using an external DC/AC Converter Unit (Eddystone Types 978/12 & 978/24).

Operating voltages are obtained from a high-grade potted transformer (T5) which has four separate secondary windings providing AC outputs of 18V @ 1A, 12V @ 0.1A, 12.6V @ 0.75A and 6V @ 0.6A. The 18V and 12V outputs are rectified by silicon bridge rectifiers D43 & D44 to provide independent positive and negative outputs. The positive supply feeds two zener diodes (D41 & D42) which regulate separate 12V and 15V supply lines. The negative output is regulated by D44 to provide a -6.2V supply rail. Resistance-capacity smoothing is employed on all three outputs.

The remaining secondary supplies are not rectified, the 12.6V output being used solely for the Master Oscillator oven, and the 6V line for all scale lamps except the 'HIGH-STAB' indicator (this runs from the 12V DC line via a series dropping resistor). RV15 allows control of the intensity of the incremental and main scale markings to suit ambient lighting conditions. S3E (part of RANGE SWITCH) switches off the incremental projection system when not required (Ranges 5-10) and also changes the MHz/kHz indicators when switching between Ranges 1-4 and Ranges 5-10.

Separate fuses are incorporated in the AC input (FS2) and the negative return from the main positive supply rectifier (FS1). C375, 376 and 377, together with CH33/34 provide protection against high voltage spikes riding on the mains input supply.

MECHANICAL CONSTRUCTION

GENERAL

Dimensions

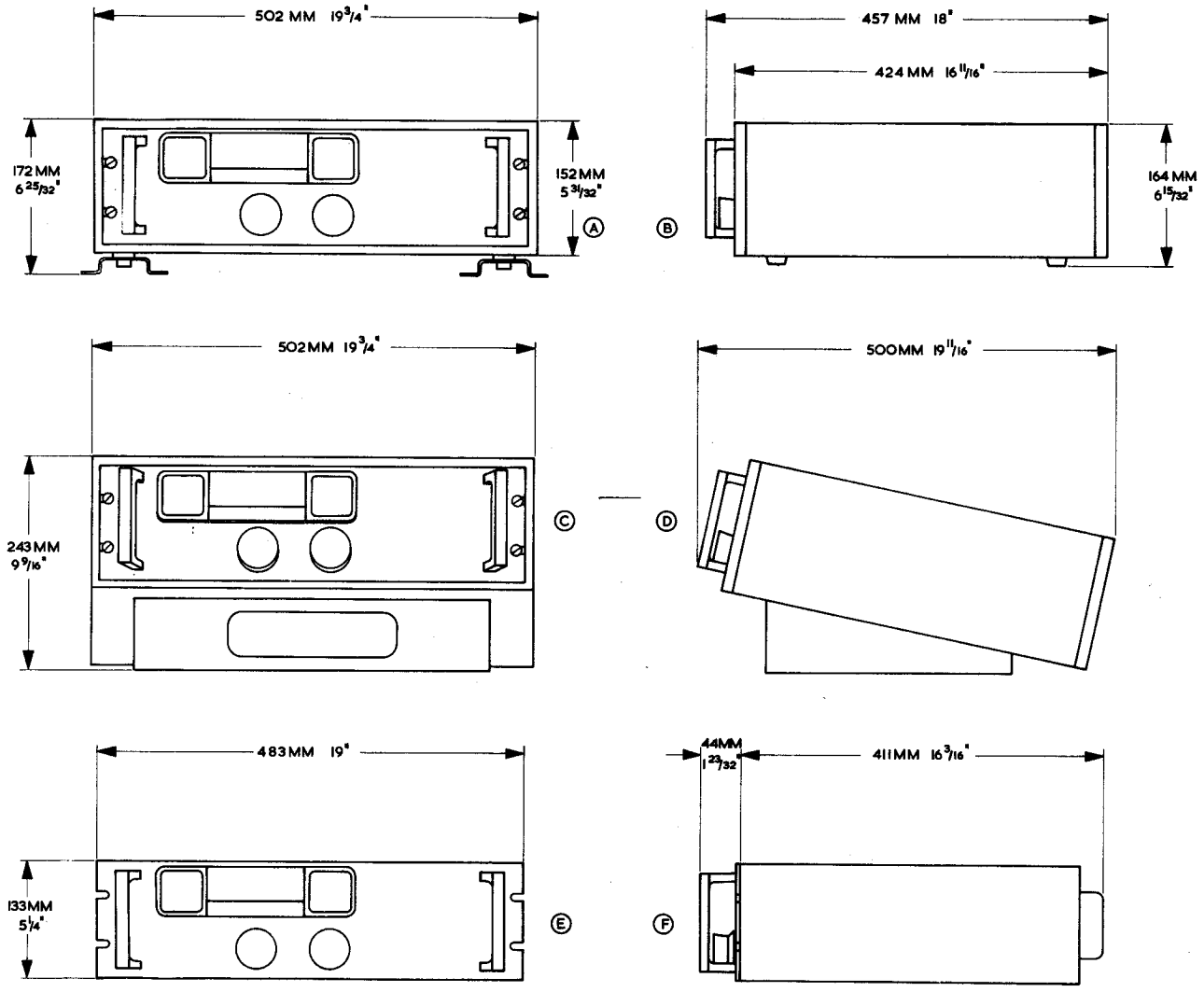


Fig. 1 Dimensions of EC958 in all mounting styles.

A	Frontal dimensions of EC958 in Cabinet 8256/1P mounted on Shock-Absorbent Mountings LP2817/1.
B	Side elevation of EC958 in Cabinet 8256/1P fitted with standard mounting feet.
C & D	EC958 in Cabinet 8256/1P mounted on Plinth Speaker Cat. No. 989.
E & F	EC958 in standard rack-mounting form.

Weight

Bench-mounting receiver (complete with cabinet)	22.7kg.	50lb.
Ditto with Cat No. 989 OR LP2817/1	23.7kg.	52.25lb.
Rack-mounting version (with covers)	19.6kg.	43.5lb.

Internal Layout

The receiver proper, (i.e. excluding cabinet) can be broken down into two main sub-assemblies which are independently attached to the front panel. Tie-points exist between the sub-assemblies to ensure complete rigidity when fully assembled.

The largest sub-assembly comprises three separate chassis plates, having flanges for direct attachment to each other and also to the receiver back-plate. The larger of the three plates is also fixed to the side-plate at the right-hand side of the receiver. This assembly carries the power supply section and all circuitry except the RF Unit and Incremental Oscillator. These two latter items are mounted on the rear of the dual tuning mechanism to form the other main sub-assembly. Additional anchorage is provided to the back-plate (l.h.s.), but construction is such that a side-plate of the type used on the right-hand side of the receiver is not required.

Alocrom-protected aluminium is used extensively in the construction of the receiver to keep overall weight to a minimum. The RF Unit is built on a rugged aluminium alloy die-casting which ensures an extremely high degree of mechanical stability in this vital section of the receiver. Heavy steel plates support the combined tuning mechanisms and the projection system used for the dial display. The front panel is a steel plate which contributes additional strength to the whole assembly: an anodised finger plate carries the panel legend. The cabinet is of rust-proofed steel.

Most circuitry, apart from the power supply, is housed in detachable modules or units, almost all of which are mounted on the main chassis assembly. Reference to the plan view of the receiver will help the user become familiar with the positioning of the major units, while the text which follows will give a clear indication of the location of the various circuit components, transistors etc. Printed circuit techniques are employed almost exclusively.

The RF Assembly

Comprises six separate printed boards together with six printed circuit turret disks which carry the full complement of inductors etc. in the turret proper. The boards are numbered 1-6 to assist location in Figs. 2 & 3. It should be noted that Circuit Board No. 2 is not mounted on the RF Assembly proper, but on the chassis immediately below it. Circuit Board No. 1 is attached to the side of the rear-most top cover adjacent to Circuit Board No. 3.

The six Turret Disks are identified by a letter code and run in sequence from the rear of the turret. Five contact positions are available on each contact block, but only four contacts are used on Disks "A", "B" and "C".

RF ASSEMBLY :: CIRCUIT BOARDS

NB Circuit Board No. 7 is included in this list purely for convenience. It does not form part of the RF Assembly, but is the only other board in the whole receiver which is not part of a major assembly. Board No. 7 is mounted on the right-hand side-plate and in addition to the metering circuits also carries RV2 and RV4.

Board No.	Designation	Semiconductors	Resistors	Capacitors	Inductors
1	Crystal Calibrator	IC1	R1-4	C1	-
2	Peak-RF	D5-10	R30-36	C20-24	-

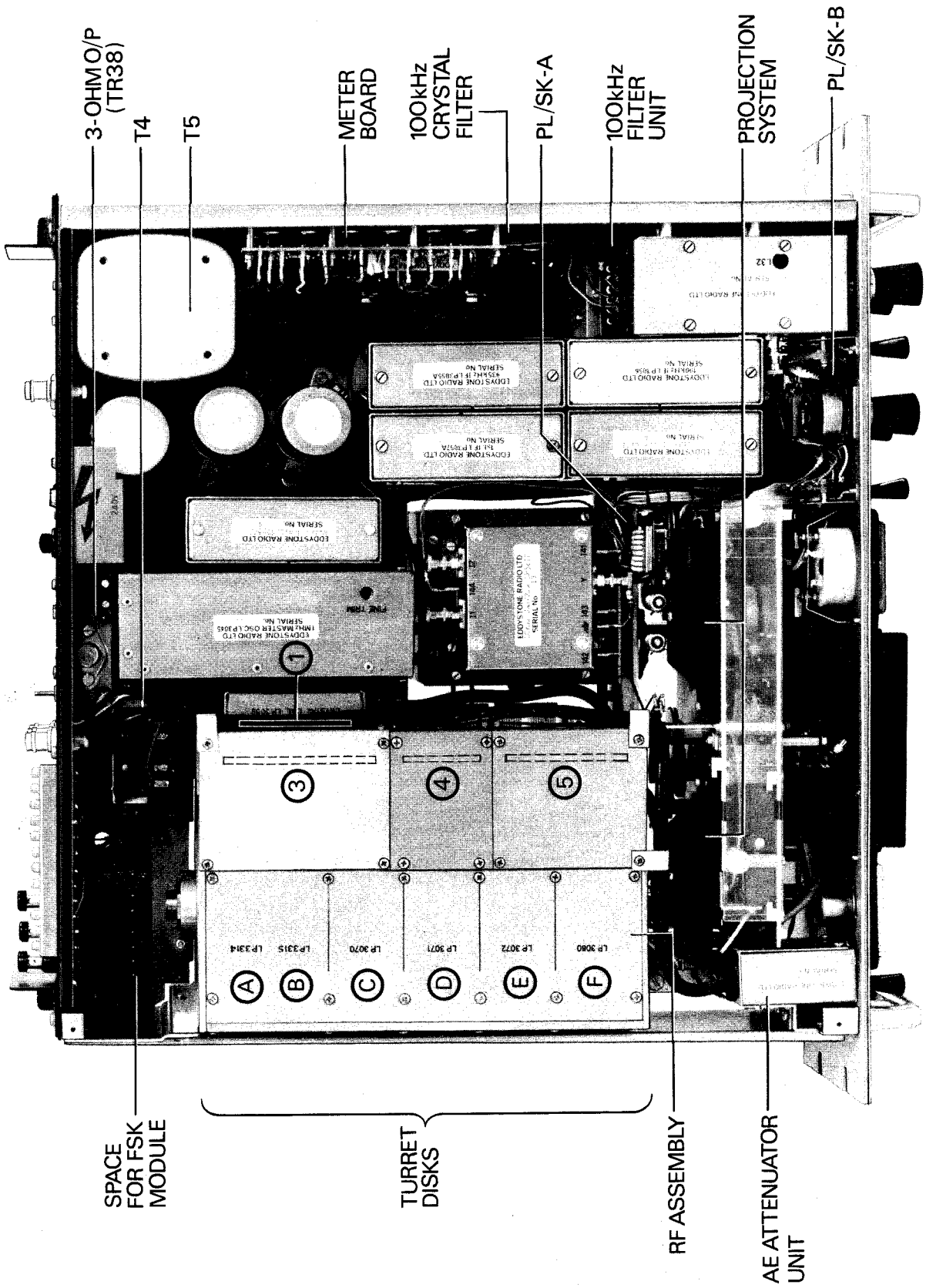


Fig. 2. Plan View of EC958/3 Receiver.

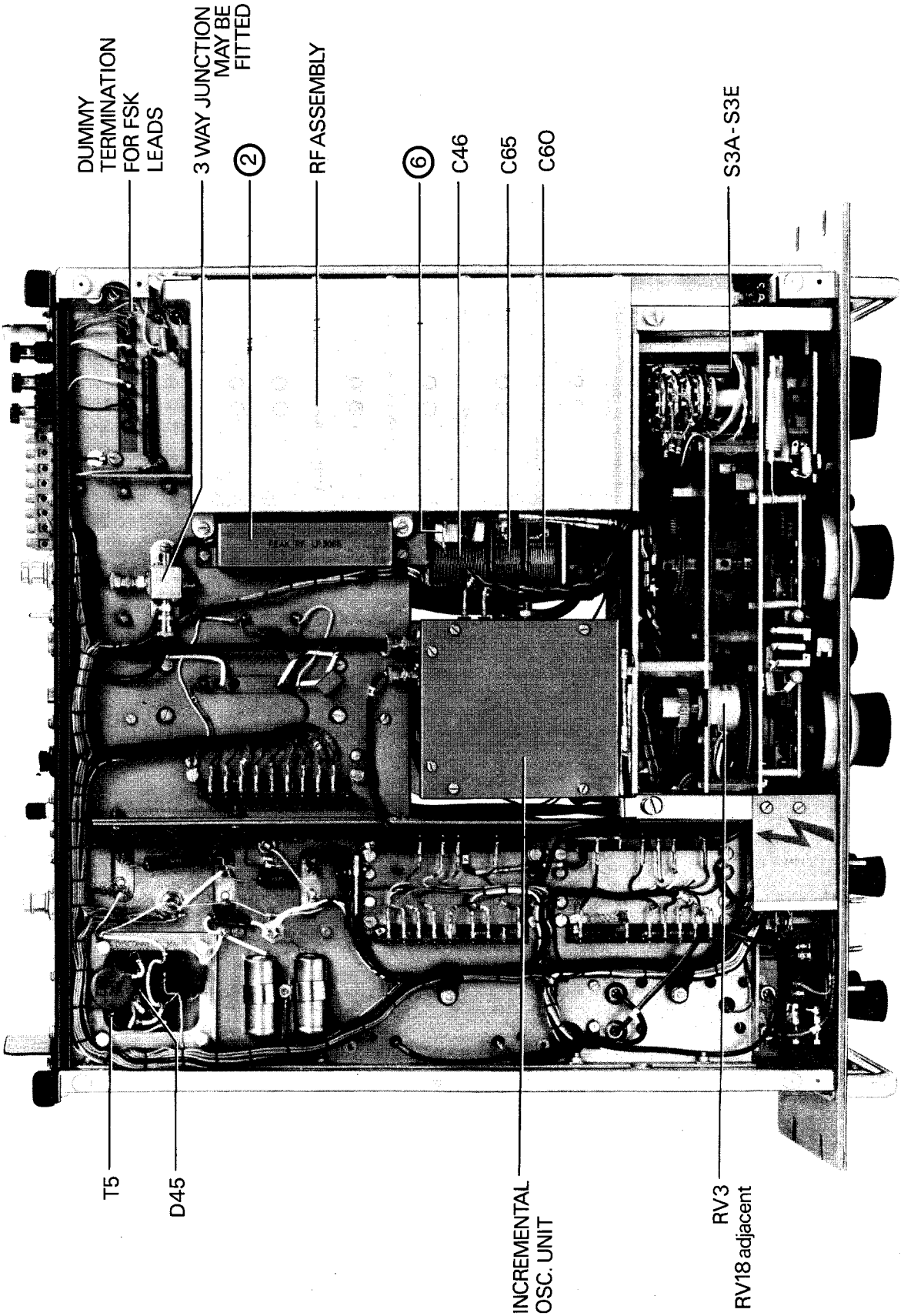


Fig. 3. Underside View of EC958/3 Receiver.

Board No.	Designation	Semiconductors	Resistors	Capacitors	Inductors
3	RF Amp.	TR1-3	R40-50	C32-43 excluding C37	CH1
4	Main-Tune Oscillator	TR4-5, IC2, D12	R55-60	C44-59 excluding C45-46 & C48-49	CH2-3
5	Harmonic Amp.	TR6-7	R61-70	C62-74 excluding C65-66	CH4, L1
6	Main-Tune Osc. AFC	D11	R53-54	C48-49	-
7	Meter	TR39	R301-306 excluding R303. RV2, RV4 & RV9-12.	C349	-

RF ASSEMBLY :: TURRET DISKS

Disk Ref	Designation	Inductors	Capacitors	Resistors
"A"	Aerial Disk	L136-146	C380-396	R350-352
"B"	RF Disk	L44-53	C400-412	R360-361
"C"	Signal Mixer Disk	L54-63	C420-438	R370-378
"D"	Main-Tune Oscillator Disk	L64-73	C450-476	-
"E"	Loop Mixer Disk	L74-77	C480-487	-
"F"	Harmonic Amplifier Disk	L78-81	C490-497	R380

Modules and Units

Six standard-size modules, together with six other units of various dimensions, make up the remainder of the receiver. Their positions are shown in Fig. 2, and main component distribution is listed in the Tables which follow.

MAIN ASSEMBLY :: MODULES

Module No.	Designation	Semiconductors	Inductors etc.	Capacitors	Resistors
1	935kHz Loop Amplifier	TR8-11, IC3-5, D13-15 & 15A.	L2-9, CH5-8 RLB/1	C80-108	R80-95
2	Tunable IF	TR15 &IC12, D19-24A	L10-15	C140-168(1)	R120-138 (2)
3	250kHz IF	TR20-22, IC7, D27-29	CH15-CH17 CH15A & CH17A	C190-216(3)	R160-178 (4)
4	100kHz IF Amplifier	TR23-31, D32-34	L29-31, CH18-27	C260-300	R200-244 excluding R224
5	Audio Amplifiers	TR34-37, D37 NB TR38 is mounted separately on sub-chassis attached to back-plate.	T2, T3	C330-347	R270-294
6	FSK (Optional)	TR40-41, IC8-10, D38-40	L33, L34, CH32, RLC/1	C350-365	R310-326 RV13, RV14

(1) Excluding C147, 150, 164 & 167.
(2) Including R120A & 134A, excluding R131-133.
(3) Including C206A, excluding C200, 201, 211 & 215.
(4) Including R164A, 167A, 168A, 170A, 171A & 172A.

MAIN ASSEMBLY :: UNITS

Unit No.	Designation	Semiconductors	Inductors etc.	Capacitors	Resistors
1	Ae. Atten.	PC1 (8 diodes)	RLA/1	C10	R11-16
2	Master Oscillator	TR12-14, IC6, D16-18	L35, CH9-13	C110-132	R100-114, RV16
3	Incremental Oscillator	TR17-19, D25, D26, D46	L16-18, CH35	C170-189	R140-155
4	100kHz IF Filter	NB: 150Hz Crystal Filter is separate from main filter.	L24-28, CH36	C217-259 excluding C219	R180-190 excluding R187
5	CW Detector & BFO	TR32, TR32A, TR33, IC13 & D52	L32 CH28 & 31	C310-324	R251-263
6	10kHz Calibrator	TR47, TR48, TR49, IC11, D50 & D51	CH41-44 RLD/1	C540-555 excldg C541	R440-454 incldg R440A

Access for Servicing

The basic constructional practice used in the EC958 Receiver is such that direct access is available for all minor servicing, plus easy breakdown of the complete assembly in the event of major servicing becoming necessary. Modular and unitised construction makes for ease of servicing by substitution and simplifies spares holding for establishments using a number of receivers of the same type. Extensive use of miniature coaxial inter-connectors, together with simple pin and socket connectors for unscreened wiring, facilitates removal of the various sub-units without need for use of a soldering iron. Multi-way connectors are used for connection between the main chassis and panel controls.

THE TUNING DRIVES AND SCALE DISPLAY

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 of a very high order.

Drive output for the main tuning capacitors is taken via a linearising arm which is arranged to reduce the speed of gang travel at the high frequency end of the tuning sweep. The calibration display is not retarded in this way and a more linear tuning rate is therefore achieved.

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. Both main and incremental displays employ the same technique, except that in the case of the main display, the position of the light-source is changed automatically as the appropriate range is selected. 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 when the receiver is used in conditions of high ambient lighting.

The calibration marks and figures are arranged in such a manner that there can be no confusion in reading frequencies from the limited portion of the individual range calibration visible at any setting of either control. Illuminated legends are included in the display to indicate whether the calibration figures are in MHz or kHz, and a further legend gives positive indication that the receiver is operating in its high-stability mode. The incremental scale is extinguished when using Ranges 5-10.

NB: On Model EC958/3, scale calibration is projected with black figures on a light background.

REVERSE BLANK

INSTALLATION

GENERAL

LIST OF ACCESSORIES & SPARES SUPPLIED WITH EC958/3 RECEIVER

Qty	Description	Part No.
4	*Cabinet Mounting Feet (complete with 4 x 2BA screws)	7132P
4	BNC bayonet-lock coaxial plugs (for Aerial Input etc.)	8012P
1	Telephone Plug	6567P
1	Test Lead with male connector	D4146
1	Test Lead 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
1	Trimming Tool - Mullard (Vinkor Adjuster)	-
2	Spare Bulbs - 6V 60mA LEGEND LAMPS	6659P
4	**Spare Bulbs - 6V 0.2A PROJECTION LAMPS	8542P
4	Spare Fuses - 2 @ 1 Amp miniature glass cartridge	7173P
	2 @ 2 Amp miniature glass cartridge	6704P
	NOTE: Receivers dispatched adjusted for 100/125V working are supplied with 4 x 2 Amp fuses.	
	(*) Not supplied with rack-mounting receiver.	
	(**) Two additional bulbs are retained in clip on Incremental light unit within receiver.	

LIST OF ADDITIONAL ACCESSORIES AVAILABLE TO ORDER

Description	Part No.
Shock-absorbent 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)	978/12
DC/AC Converter Unit (24V INPUT)	978/24
Standard Receiver Cabinet (for converting rack-mounting receiver to bench-mounting style)	8256/1P
Dust Cover - Top (for use when converting cabinet	8408/1PB
Dust Cover - Bottom receiver to rack-mounting style)	8408P
Spares Kit (list of selected items on request)	-

ASSEMBLY INSTRUCTIONS

Mounting Style

EC958/3 Receivers are available for bench-mounting or rack-mounting, the latter being designated EC958/3/RM. Receivers supplied to /RM specification are fitted with protective dust covers which are absent on versions in cabinet style for bench-mounted installations. Receivers can be easily converted from one form of mounting to the other, accessories for this purpose being listed on the previous page.

NOTE: DUST COVERS MUST BE REMOVED WHEN FITTING A BASIC EC958/3/RM RECEIVER INTO THE STANDARD CABINET.

Rack-mounting Receivers

Rack-mounting versions of the EC958/3 can be installed directly in 483mm (19in) racks, using four $\frac{1}{4}$in. 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 standard 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

Transformer Input Tappings: 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. Three voltage tappings are provided as follows:-

240V : for 230/250V. 220V : for 200/230V. 110V : for 100/125V.

Location of the appropriate tapping can be determined from the legend printed on the transparent cover fitted to the underside of the transformer. A soldering iron is required and care should be taken to transfer C375 (0.005 μF) to the new tap connection.

EXTERNAL CONNECTIONS

Mains Input

The AC supply lead is permanently attached to the receiver and should be terminated with a plug suitable for connection to the local supply. Colour-coding of the three wires is as follows:-

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

Aerial Inputs

Two separate aerial inputs are provided:-

LOW-Z INPUT :: nominally 75Ω unbalanced, usable at all frequencies.

HIGH-Z INPUT :: nominally 600Ω balanced for use only 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. A BNC coaxial plug is supplied with the receiver.

IF Output

Provides a low-level, low-impedance output at the final intermediate frequency (100kHz) for driving external ancillary equipment. An output of 20mV in 75Ω is available for 3μV carrier at the aerial input. Bandwidth is determined by the setting of the SELECTIVITY SWITCH and is adjustable to a maximum of 8kHz except on the lowest signal frequencies where the bandwidth is restricted by the selectivity of the front-end circuits.

A BNC bayonet-lock coaxial plug is provided for connection.

Telephones

The telephone output is suitable for use with low/medium impedance headsets and the circuit is arranged so that both the internal and external loudspeaker outputs are interrupted automatically when telephones are in use.

Earth Terminal

Located near mains input cable. Bond to frame of rack when receiver is installed as a rack-mounted equipment; otherwise connect directly to supply earth or a suitable earth stake. A separate 'RF' earth can be connected to the terminal adjacent to the HIGH-Z AERIAL INPUT terminals.

550-650kHz Osc. In/Out

This socket is used for common oscillator working in diversity operation. Refer to page 36.

IMPORTANT: THE NORMAL/SLAVE SWITCH ADJACENT TO THIS SOCKET MUST BE SET TO THE 'NORMAL' POSITION WHEN THIS FACILITY IS NOT IN USE. THE RECEIVER WILL BE DISABLED ON RANGES 1-4 IF THE SWITCH IS SET TO 'SLAVE'.

BFO Output

A low-level output (of the order 250mV in 75Ω) is available at this socket for connection to ancillary equipment (e.g. counter for precise measurement of the beat oscillator frequency). The output is available with MODE SWITCH set to 'CW' position only and connection is by means of a BNC coaxial plug.

Ancillaries Terminal Block (See Fig. 4.)

This is a 12-way terminal block which carries the following circuits:-

1. External loudspeaker.
2. Line output.
3. Teleprinter output.
4. Muting.
5. Diversity AGC.
6. Remote tuning.

External Loudspeaker: The loudspeaker output is suitable for use with any 3Ω loudspeaker unit. Matching loudspeakers in the Eddystone range are listed in the Table on page 31. The speaker should be connected across Terminals Nos 1 and 6, Terminal 1 being an earth connection. The output will be interrupted when telephones are connected.

Line Output: The secondary winding of the line output transformer is wired to Terminals Nos 7 and 9, with the centre-tap connected to Terminal No. 8. Output impedance is 600Ω and the output can be operated with grounded centre-tap by linking Nos 1 and 8 on the terminal block. A 150Ω output can be taken from Nos 7 and 8.

Refer to page 36 for details of interconnection of 600Ω outputs in diversity working.

Teleprinter Output: This facility is available only in receivers which carry the optional FSK Module Type LP3058.

Keying is by means of a high-speed mercury-wetted-contact reed relay with single-pole changeover circuit. The relay contact terminations are brought out at Nos 10, 11 and 12 on the terminal block. Line current monitoring, line rheostat and mark/space reversal switching should be provided externally in the normal manner.

Polar working: Connect to Nos 10, 11 and 12.

Single-current working: Connect to No. 11 and either No. 10 or No. 12 depending on whether make or break circuit is required.

Muting: An internal high-speed reed relay is available for muting if the receiver is operated in close proximity to an associated transmitter. The relay has a single-pole changeover contact which is arranged to open the aerial input circuit, while at the same time grounding the input to the Aerial Attenuator.

One side of the relay coil is directly grounded and the other is brought out to Terminal No. 4. An external 12V supply is required to operate the relay and polarity can be +ve or -ve w.r.t. earth: the control circuit should be wired as shown in Fig. 4. Current drain is of the order 10mA.

Diversity AGC: The IF AGC line is brought out to Terminal No. 5. AGC terminals should be linked when operating receivers in diversity, the interconnecting lead being screened with braid earthed to Terminals No. 1.

Remote Tuning: On Ranges 1-4, provision is made for shifting the frequency of the Incremental Oscillator over a range of ± 100Hz to provide a remote tuning facility. Control is achieved by means of a 10,000Ω variable resistor (linear law) wired between Terminals Nos 1 and 2, Terminal No. 1 being an earth connection. The variable resistor forms part of a potential divider which determines the reverse-bias applied to the VVC-diode D46 in the oscillator tuned circuit. A variation of the order 0 to 5V is available for full travel of the 10,000Ω variable resistor. Line resistance must not exceed 1,000Ω.

TERMINALS 2 & 3 MUST BE LINKED TOGETHER IF THE REMOTE TUNING FACILITY IS NOT IN USE. CALIBRATION ACCURACY WILL BE AFFECTED IF THE LINK IS OMITTED.

INSTALLATION PROCEDURE

(SUMMARY)

1. Adjust mains transformer primary taps to suit local supply voltage (page 32).
2. Terminate mains lead with plug for connection to local supply (LIVE : Brown, NEUTRAL : Light Blue, EARTH : Green/Yellow).
3. Connect external circuits to Ancillaries Terminal Block: Ext. Loudspeaker - 600Ω Line - Teleprinter - Muting - Diversity AGC - Remote Tuning.

   IMPORTANT: CHECK THAT TERMINALS NOS 2 & 3 ARE LINKED WITH A WIRE STRAP IF THE REMOTE TUNING FACILITY IS NOT REQUIRED. THIS STRAP IS FITTED WHEN RECEIVER IS DISPATCHED FROM FACTORY.
4. Connect aerial feeder to appropriate input (page 33).
5. Connect an effective earth to the EARTH terminal.
6. CHECK THAT NORMAL/SLAVE SWITCH IS SET TO 'NORMAL' POSITION. 'SLAVE' POSITION IS USED IN DIVERSITY WORKING ONLY (DISABLES INCREMENTAL OSCILLATOR).
7. Connect IF OUTPUT and BFO OUTPUT to external equipment if required.
8. Check that fuse complement is correct:- DC FUSE : 2 Amps, AC FUSE : 1 Amp for 200/250V operation or 2 Amps for 100/125V operation.
9. Plug into supply, apply power and check the receiver for normal operation as per pages 41-49.

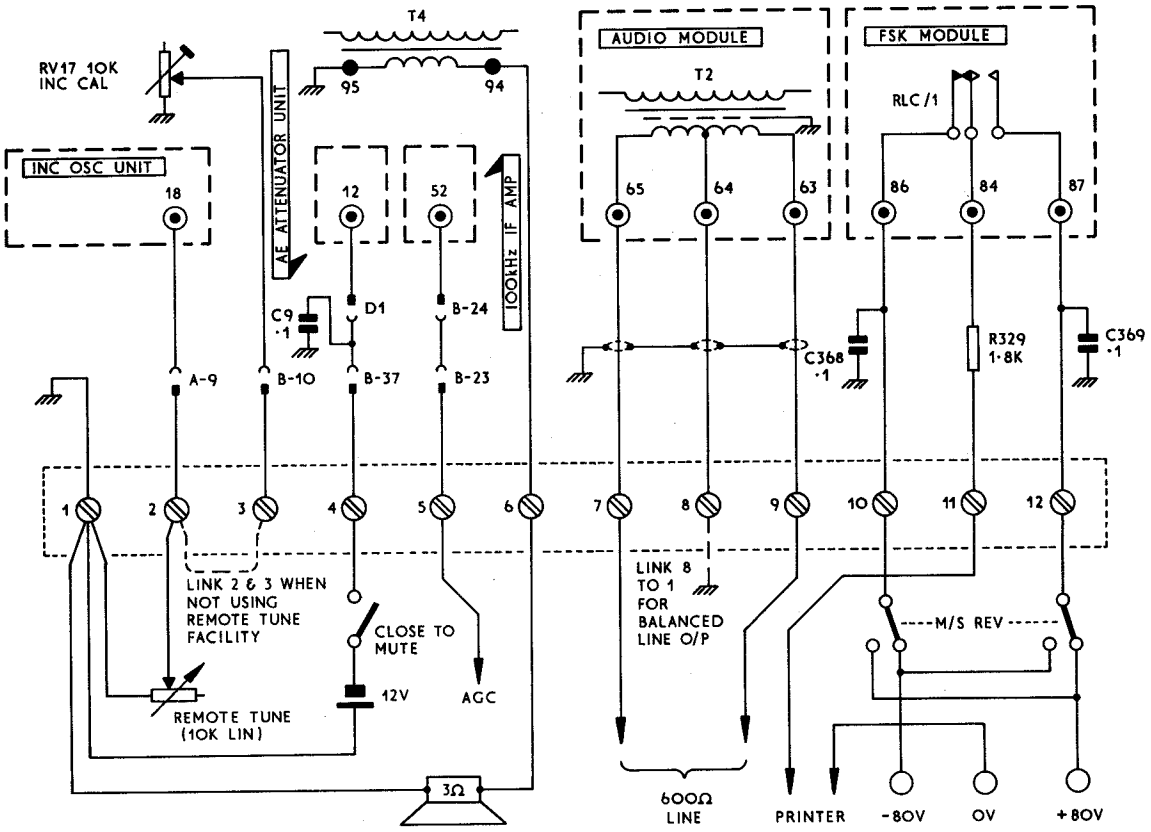


Fig. 4. Connections to Ancillaries Terminal Block.

DIVERSITY OPERATION

Two EC958 Receivers can be operated in diversity by linking their IF AGC lines and combining their audio output on the 600-ohm line channel. Separate aerials should be used in the normal manner.

AGC lines are commoned by linking together Ancillary Terminals No. 5 on the two receivers. The interconnecting lead should be screened with braid earthed to Terminals No. 1. Audio outputs can be combined as shown in Fig. 5, or by using an outboard transformer with three separate 600Ω windings.

Operation with common oscillator control is possible on Ranges 1-4 when the receiver is running in its high-stability mode. This arrangement leads to greater convenience in setting up the equipment and also simplifies remote tuning of the installation where this is required.

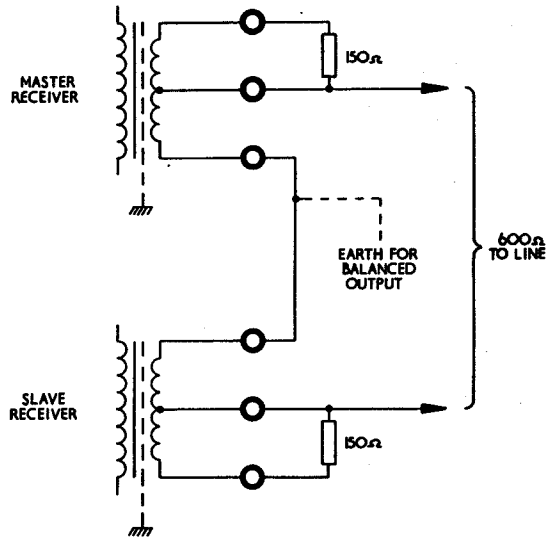


Fig. 5 Combined 600-ohm output wiring

The only accessory required for conversion to common oscillator working is a coaxial lead terminated at both ends with BNC bayonet-lock connectors. This is used to link the two coaxial sockets labelled '550-650kHz OSC IN/OUT' at the rear of the sets. One of the two Incremental Oscillators can be disabled by setting the NORMAL/SLAVE SWITCH (adjacent to coaxial output socket) to the 'SLAVE' position. This removes the supply voltage from all stages in the Incremental Oscillator Unit. The switch on the Master Receiver is left in the 'NORMAL' position to maintain the +12V supply to its Incremental Oscillator.

In operation, it must be remembered that the INCREMENTAL TUNING CONTROL on the Slave Receiver has to be set to the required frequency, not to tune the receiver in the normal sense, but to align the Tunable IF circuits to the appropriate intermediate frequency.

Diversity operation can also be arranged by operating the two receivers with their IF OUTPUT sockets linked together. Audio output can be taken from either receiver without the need for interconnection as in Fig. 5 above.

It should be noted that this method of connection is essential in the case of FSK Diversity working. Keying output can be taken from either receiver.

Reference should be made to the Section on 'Operation' for further information on diversity working.

NOTE: Pages 38, 39 & 40 are omitted in EC958/3 version of Handbook.

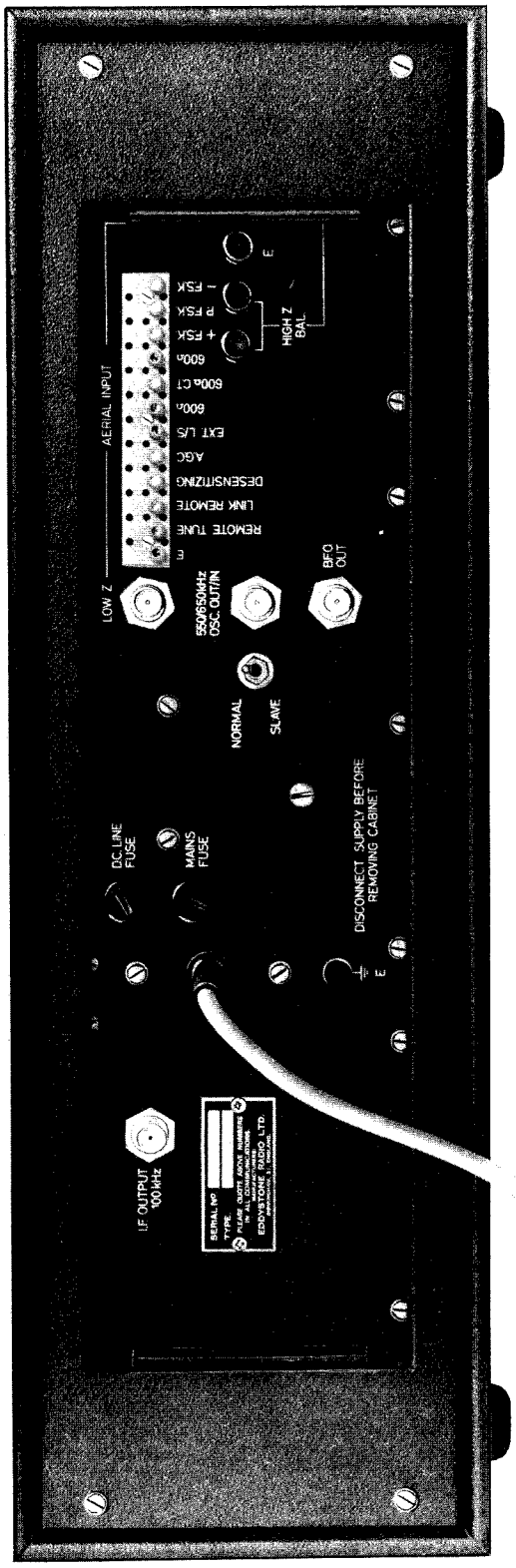


Fig. 6. Rear View of EC958/3 Receiver showing external connections.

OPERATION

CONTROL FUNCTIONS

Range Switch

Ten-position selector driving turret disks, carrier for light-source in main scale projection system, and auxiliary switching to select the appropriate scale display and intermediate frequency for the range in use. The only calibration visible is that applicable to the range selected. Illuminated legends indicate whether the calibration is in MHz (Ranges 1-4) or kHz (Ranges 5-10). The incremental scale projection system is extinguished automatically when using Ranges 5-10. The control has a bar knob to allow easy range selection and has stops adjacent to Ranges 1 and 10. A further auxiliary function on the "/3" version is to switch the calibrator to give 1MHz marker on Ranges 1-4, 10kHz markers on Ranges 5-10.

Main Tuning

High-grade geared reduction drive (Ratio 100:1) driving the six-gang tuning capacitor and the calibration disk forming part of the main scale projection system. Tuning rate varies with the range selected, typical figures being 3kHz per rev. at 200kHz and 125kHz per rev. at 20MHz. The main tuning scale appears at the left-hand side of the dial aperture and is arranged to display only those frequencies adjacent to the channel to which the receiver is tuned. Calibration marks and frequencies are repeated at such intervals that there can be no ambiguity or confusion in reading the scale at any setting. Marking of the individual ranges is detailed in the Table below.

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	1kHz	20kHz
6	280 - 690kHz	0.5kHz	10kHz
7	125 - 285kHz	0.5kHz	5kHz
8	53 - 126kHz	0.2kHz	1kHz
9	24 - 55kHz	0.2kHz	1kHz
10	10 - 24.5kHz	0.1kHz	0.5kHz

The MAIN TUNING CONTROL functions in a conventional manner on Ranges 5-10 and allows the receiver to be continuously tuned within the selected range. On Ranges 1-4, however, the control is tuned in steps of 100kHz by reference to the 'HIGH-STAB INDICATOR', and more precisely by observing the panel meter for a centre-zero indication (METER SWITCH at '1ST HF OSC AFC'). Interpolation between adjacent 100kHz points is achieved by use of the INCREMENTAL TUNING CONTROL as described on the following page.

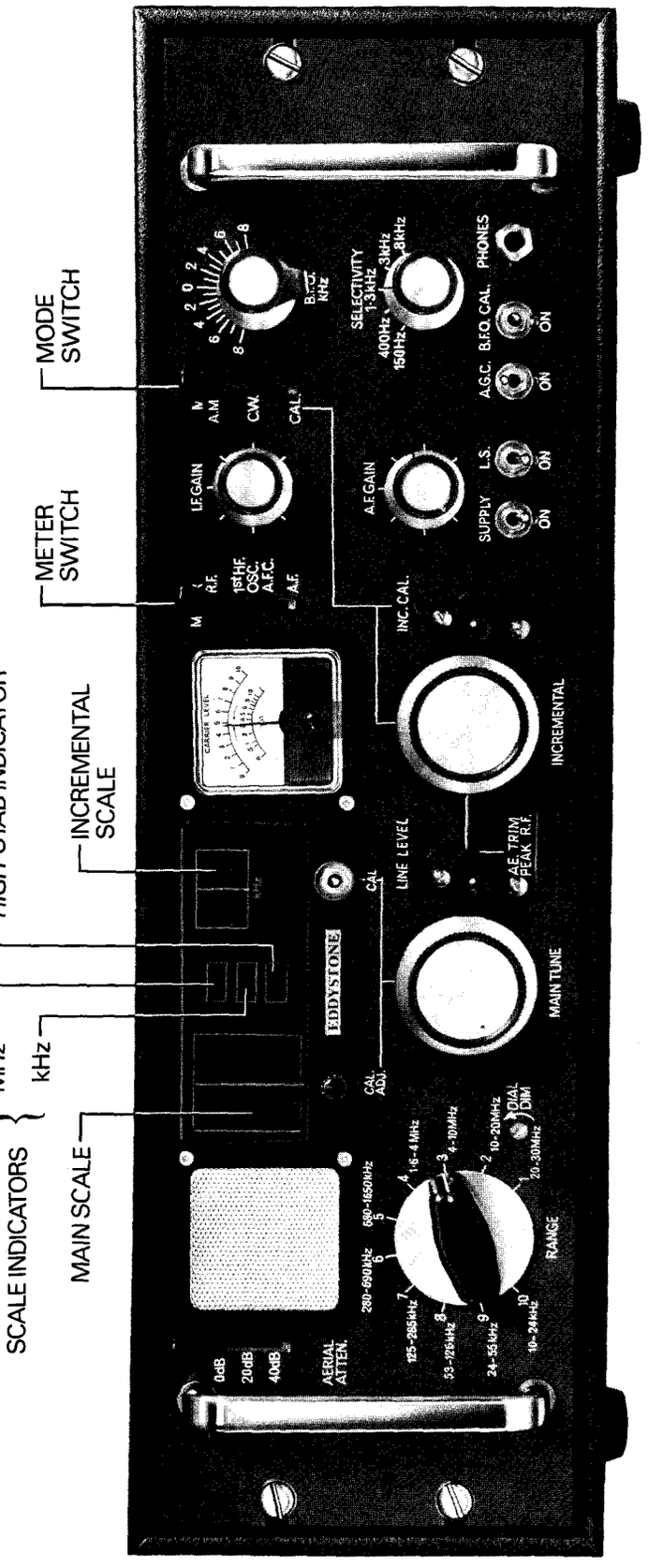


Fig. 7. Frontal View of EC958/3 Receiver showing controls.

Incremental Tuning

This control is operative only when the receiver is running in its high-stability mode on Ranges 1-4 (1.6-30MHz). It tunes the Incremental Oscillator and 1st IF circuits which form an essential part of the drift-cancelling loop associated with the 1st (Main-Tune) Oscillator. Total tuning range amounts to 104kHz, so giving a 2kHz overlap at each end of the 100kHz band for convenience when tuning adjacent 100kHz segments selected by the MAIN TUNING CONTROL.

Tuning rate is sensibly constant (2.5kHz/rev. at mid-band), and the scale is projected at the right-hand side of the main scale display when using Ranges 1 - 4. Calibration is marked at each 1kHz point and graduations at 200Hz intervals allow visual interpolation to an accuracy better than 50Hz.

The incremental scale reading must be added to the main scale reading to determine the actual frequency to which the receiver is tuned. The only exception to this rule is that when the display appears with light figures against a dark background, the incremental reading must be subtracted. This applies in the 2kHz overlap extension at the low end of the range.

The INCREMENTAL TUNING CONTROL is inoperative on Ranges 5-10 and its scale display is therefore interlocked with the range switching so that the display is extinguished when not required. The Incremental Oscillator is not disabled, but runs continuously on all ranges to maintain the highest possible stability. A weak carrier due to its fundamental may be detected on Range 6 when tuning over the 550 - 650kHz region. Any interference which may be caused can be eliminated by off-setting the INCREMENTAL TUNING CONTROL to clear the tune frequency.

Aerial Trimmer/Peak-RF Control

Functions as a conventional aerial trimmer on Ranges 5 - 8, and as a Peak-RF control on Ranges 1-4. In the latter case, it provides independent tuning of all signal frequency circuits to allow compensation for the inevitable misalignment which occurs when using the INCREMENTAL TUNING CONTROL. The control is inoperative on Ranges 9 and 10.

The control is a potentiometer which provides adjustable reverse-bias to a group of voltage-variable-capacitors included in the signal frequency circuits. It should always be set for maximum signal on completion of normal tuning adjustments, irrespective of the mode of operation or tuning range in use (except Ranges 9 & 10).

Aerial Attenuator

This control takes the place of the more usual RF gain control and will usually be set to the 0dB position. The 20dB or 40dB settings can be used to reduce signal input level when cross modulation or blocking effects are noticed in the presence of extremely strong adjacent channel signals.

Selectivity Switch

Five positions of selectivity are provided as follows :-

150Hz	::	'CW NARROW'	3kHz	::	'AM NARROW' **
400Hz	::	'CW INTERMEDIATE' *	8kHz	::	'AM WIDE'
1.3kHz	::	'CW WIDE' *			

(*) Also use for FSK. (**) Also use for SSB.

Use of the 3kHz and 8kHz positions is not recommended on Ranges 9 & 10. The 1.3kHz position can be used but with a reduction in the AF GAIN setting to limit internally generated whistles which appear on these low frequencies.

Signal Mode Switch ('AM' - 'CW' - 'CAL')

Selects appropriate circuits for reception of AM or CW signals, and in the third position activates the 10kHz Calibrator Unit to provide the incremental scale check facility on Ranges 1-4. (See 'Inc. Cal Control' below).

Switching functions are as follows:-

'AM' :: Audio output taken from AM Detector, BFO disabled.

'CW' * :: Audio output taken from CW Detector, BFO operational.

'CAL' :: Audio output taken from Beat Amplifier in 10kHz Calibrator Unit. BFO disabled (audio beat produced by mixing Inc. Osc. output with 10kHz harmonics derived from 1MHz Master). All stages in 10kHz Calibrator Unit operational.

(*) This position also activates the internal FSK Module in receivers equipped for this mode of working.

Inc. Cal Control

This control is provided primarily for correcting minor frequency errors in incremental calibration resulting from long-term ageing of the oscillator components: it will require infrequent adjustment only.

The control takes the form of a potentiometer which adjusts the reverse-bias to a VVC-diode in the oscillator tuned circuit. Adjustment is by means of a screwdriver through an aperture in the front panel. The control is inoperative when the remote tuning facility is in use.

10kHz markers for checking the accuracy of the incremental scale are available when the SIGNAL MODE SWITCH is set to the 'CAL' position. The procedure for checking incremental scale calibration is detailed on page 46.

BFO Pitch Control

Provides ± 8kHz adjustment of Beat Oscillator frequency. Direct calibration (in kHz) is provided and the skirt of the control knob is independently adjustable to permit error correction. A reference signal for this purpose is available from the Master Oscillator Unit when the BFO CAL SWITCH is set to 'ON' (see below). A reduction drive is fitted for ease of adjustment.

If single-sideband reception is required, the BFO should be set to +1.5kHz or -1.5kHz to suit the transmitted sideband: IF selectivity should be at 3kHz.

BFO Cal Switch

This switch is set to 'ON' to allow the operator to check and adjust the BFO scale calibration by reference to a 100kHz signal derived from the Master Oscillator Unit. Functions performed in the 'ON' position are as follows:-

(1) The aerial relay is energised to limit interference from outside signals.

(2) An emitter follower in the Master Oscillator Unit is brought into operation to provide the necessary 100kHz output.

(3) A signal switching gate is placed in the 'ON' condition to allow passage of the 100kHz reference to the CW Detector. (The gate is necessary to prevent the signal appearing when the emitter follower is activated in other calibrating functions.)

The procedure for carrying out the BFO calibration check is detailed on page 46. The SIGNAL MODE SWITCH must be at 'CW' when carrying out this check.

* IF Gain

Controls gain of the 100kHz IF strip when the MANUAL/AGC SWITCH is set to 'MANUAL'. Control is inoperative when set to 'AGC' in which case gain is at maximum in the absence of a received signal.

IF gain should be reduced as necessary to prevent detector overload when using manual control.

AF Gain

Provides adjustment of audio gain on the speaker/telephone output only.

Line Level

Pre-set control providing independent adjustment of audio gain on the line output channel only. The control can be adjusted with a small screwdriver and metering facilities are available to simplify adjustment when feeding output over a remote line circuit.

Meter Switch

Three-position lever switch marked as follows:- 'RF' - '1ST HF OSC AFC' - 'AF'. Functions carried out by this control are listed below.

'RF' :: :: **Meter reads carrier level, the scale being calibrated in arbitrary steps 0-10 for relative measurement of signal strength. Meter indication is logarithmic at 'AGC' and linear at 'MANUAL'.**

'AFC' :: :: Meter serves as a centre-zero monitor to permit precise selection of 100kHz steps when adjusting the MAIN TUNING CONTROL on Ranges 1-4. This meter facility is non-functional when carrying out a main scale calibration check (AFC disabled in this condition).

'AF' :: :: **Meter serves as line output level indicator and is calibrated 0-10mW for 600-ohm line loading.**

* Manual/AGC Switch

Two-position miniature toggle switch to select desired system of gain control in the IF section of receiver. The manual IF GAIN CONTROL is functional only when the MANUAL/AGC SWITCH is set to the 'MANUAL' position. Selecting 'AGC' takes the manual control out of circuit and causes the IF gain to rise to maximum in the absence of a received signal.

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

Calibrator Switch and Cal Adjuster (Main scale)

Calibrator Switch: This is a biased toggle of the same type used for BFO CAL. The 1MHz Crystal Calibrator is activated when the switch is depressed and the AFC is disabled if Ranges 1-4 are selected. Markers are provided at 1MHz intervals on these ranges, but on Ranges 5-10 the 1MHz oscillator is modulated by the 10kHz Calibrator Unit to give markers every 10kHz: changeover from 1MHz to 10kHz is an auxiliary function of the range switching. The aerial relay is automatically energised when carrying out a main scale calibration check.

Calibration Adjuster: Provides lateral movement of the cursor index line to permit correction for errors in main scale calibration. Index should be set coincident with fixed centre line when not using scale check facility.

(*) Panel legend reads AGC OFF/AGC ON, not MANUAL/AGC as implied in text.

Speaker Switch

This control switches the miniature panel loudspeaker only. No switching is provided for the external loudspeaker, but both loudspeakers will be muted when telephones are connected at the panel socket. Output to the external loudspeaker falls very slightly when the internal loudspeaker is in use.

Dial Dimmer

Pre-set, screwdriver-adjusted control. Controls brilliancy of scale illumination and allows this to be set to suit ambient lighting conditions.

Supply Switch

Completes both poles of the supply when set to 'ON'. Separate external switching must be arranged for the low voltage supply when using an external DC/AC converter.

Relay Bias Control

This control forms part of the FSK Module 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. The control is pre-set and is adjustable using a small screwdriver. Adjust for correct operation of teleprinter relay.

TUNING INSTRUCTIONS

1. Switch on SUPPLY. Illumination of scale display indicates availability of power to receiver. Brilliance can be set with DIAL DIM potentiometer to suit ambient lighting.

2. Switch on panel speaker, connect telephone headset or use external speaker as required.

3. Adjust AF GAIN for suitable output.

4. Carry out a full calibration check by following the sequence detailed below.

   (a) Beat Frequency Oscillator

   (i) MODE SWITCH to 'CW'.

   (ii) AGC to 'OFF' and IF GAIN to minimum.

   (iii) Switch BFO CAL to 'ON' and zero-beat BFO against 100kHz reference.

   (iv) Set BFO cursor (skirt) to coincide with 'Ø' using lever at right-hand side of control.

   (v) BFO is now calibrated. Set BFO CAL switch to 'OFF' position.

   (b) Incremental Oscillator

   NB: Ranges 1-4 only. Incremental facility is disabled on Ranges 5-10.

   (i) MODE SWITCH to 'CAL'.

   (ii) SELECTIVITY to '3kHz' position.

   (iii) Set INCREMENTAL TUNING CONTROL so that 00 marking coincides with cursor index line.

   (iv) Adjust INC CAL potentiometer for zero-beat (screwdriver adj.).

   (v) Incremental scale is now calibrated. Set MODE SWITCH to 'CW'.

4. (contd.)

(c) Main Tune Oscillator (RANGES 1-4)

(i) BFO must be at zero-beat as per 4(a) above.

(ii) MODE SWITCH to 'CW'.

(iii) SELECTIVITY to '3kHz' position.

(iv) AGC to 'OFF' and IF GAIN at maximum.

(v) Offset INCREMENTAL TUNING CONTROL by 400Hz (2 scale divs.).

(vi) Depress CAL SWITCH (below dial display).

(vii) Tune to 1MHz calibration point closest to wanted frequency. An audible beat will be heard whose tone will vary within the limits 400Hz at 2.0MHz to 3kHz at 30MHz. Note that this check serves only to verify that the selected frequency is in fact a MHz point. Its actual accuracy is governed by the oven-controlled Master.

(viii) Set CAL ADJ to align cursor with 1MHz calibration mark.

(ix) Main scale is now calibrated. Tune to required 100kHz point and adjust INCREMENTAL to wanted frequency.

(d) Main Tune Oscillator (RANGES 5-10)

(i)-(v) As in 4(c) above.

(vi) Tune to 10kHz calibration point closest to wanted frequency.

(vii) Adjust MAIN TUNING CONTROL for zero-beat with marker signal.

(viii) Set CAL ADJ to align cursor with 10kHz calibration mark.

(ix) Main scale is now calibrated. Tune to wanted frequency.

5. Select MODE and SELECTIVITY to suit type of signal to be received.

6. Tuning adjustments:-

(a) RANGES 5-10.

Tune with MAIN TUNING CONTROL only. INCREMENTAL CONTROL is inoperative on these ranges. Adjust PEAK-RF CONTROL for max. signal (except on Ranges 9 & 10 where this control is inoperative).

(b) RANGES 1-4.

(i) Adjust MAIN TUNING CONTROL to 100kHz point at low frequency end of segment in which wanted frequency lies.

(ii) Adjust control further to illuminated HIGH-STAB legend, and then more carefully by reference to panel meter (METER SWITCH to '1ST HF OSC AFC' position). Tune for centre-zero reading.

(iii) Tune INCREMENTAL TUNING CONTROL to required frequency and adjust PEAK-RF CONTROL for maximum signal.

NB: INCREMENTAL can be at any setting for operations (i) and (ii).

7. Adjust IF/AF GAINS, AERIAL ATTENUATOR and AGC SWITCH to suit signal level and circuit conditions. (IF GAIN is inoperative with AGC 'ON')

8. For SSB reception, use 'CW' position of MODE SWITCH, '3kHz' SELECTIVITY and offset BFO ± 1.5kHz to suit transmitted sideband.

Diversity Working

Two EC958 Receivers running in diversity and wired as per the instructions given on page 36 should be tuned in the manner described below :-

NB It should be borne in mind that commoning the AGC lines results in the individual carrier level meters showing identical readings at all times. It is therefore necessary to disable one receiver while the other is tuned. To achieve this, the receiver to be disabled should have its MANUAL/AGC SWITCH set to 'MANUAL' and its IF GAIN reduced to minimum. Additional gain reduction can be introduced if required by setting the AERIAL ATTENUATOR to 20/40dB. 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.

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 type of signal and conditions prevailing.

Each receiver must be disabled in turn when adjusting the LINE LEVEL CONTROLS since output on one channel will interfere with the meter reading on the other channel. In this case the meter common to the receiver being adjusted should be used as in normal operation.

Ranges 1-4. On these ranges, both receivers should be operated in the high-stability mode, preferably with common oscillator control.

Adjustment is similar to that employed on Ranges 5-10, except that only the receiver allocated as Master will control the exact tune frequency. The INCREMENTAL TUNING CONTROL on the Slave Receiver must be set to roughly the same setting as that of the Master Receiver in order that the Tunable IF circuits are correctly aligned at the required frequency. In common oscillator working, the NORMAL/SLAVE SWITCHES at the rear should be set as follows :- Master Rec. : NORMAL. Slave Rec. : SLAVE.

If common oscillator control is not employed, receivers 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 setting up for high-stability operation.

FSK Operation

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

1. SIGNAL MODE SWITCH must be set to the 'CW' position to apply +12V supply to the internal FSK Module.
2. Not applicable to Model EC958/3.
3. RELAY BIAS CONTROL (accessible at rear of set through aperture just below High-Z input terminals) should be set for correct operation of teleprinter relay.
4. Not applicable to Model EC958/3.
5. SELECTIVITY will normally be set to '1.3kHz', but '400Hz' position can be used when taking a signal with narrow shift.
6. BFO setting does not affect teleprinter operation because keying signal is derived directly from the 100kHz IF signal and not from audio output.

Incorporate opposite page 41 ('Operation' Section)

Inoperative Controls - Ranges 5-10

Certain controls on the EC958 receiver are rendered inoperative when using it at frequencies below 1.6MHz (Ranges 5-10). The following Table indicates which controls are affected in this way and will assist operators during familiarisation on the equipment.

INCREMENTAL TUNING	Inoperative on all ranges below 1.6MHz due to receiver functioning as a single or double-conversion superhet.
HIGH STAB/ CONT TUNE SWITCH	Inoperative on all ranges below 1.6MHz. Continuous tune mode only is available in this band.
USB/LSB SWITCH	Inoperative on Ranges 7, 9 & 10 due to receiver functioning as a single-conversion superhet.
SELECTIVITY SWITCH	It is recommended that operators use only the 400Hz and possibly 1.3kHz positions when tuning on Ranges 9 & 10. If use of the 1.3kHz or wider band-width positions is demanded by operational requirements, the AF GAIN setting should be reduced to limit internally generated whistles resulting from the low signal frequencies involved.
CALIBRATOR SWITCH	Only one calibration marker is available below 1.6MHz, this appearing at 1MHz on Range 5.

The attention of all operators is also drawn to the following:-

AE TRIM/PEAK RF CONTROL

Functions as PEAK RF on Ranges 1-4 and AE TRIM on Ranges 5-10.

IF GAIN CONTROL

Rendered inoperative when MANUAL/AGC SWITCH is set to 'AGC' position.

NORMAL/SYNTH and NORMAL/SLAVE SWITCHES

These two controls are located at the rear of the receiver and must be set to 'NORMAL' except when receivers are used in diversity installations or with external synthesised oscillator drive. The receiver will be disabled under normal circumstances if the switches are set to 'SYNTH' or 'SLAVE'. Refer to pages 38/39 for more detailed information.

'INC CAL' CONTROL

A pre-set variable resistor is now fitted to permit correction for minor errors in incremental calibration caused by long-term ageing of the oscillator components. The control is marked 'INC CAL' and is accessible through a small hole in the panel. A screwdriver is required for adjustment following the procedure detailed below:-

1. Set INCREMENTAL to 'Ø', SELECTIVITY to '3kHz', MODE to 'SSB HIGH-STAB'.
2. Select appropriate range and tune with MAIN TUNING CONTROL to any convenient frequency standard transmission (2.5, 5, 10, 15 or 20MHz - MSF, WWV etc.).
3. Switch to 'HIGH-STAB OPERATE' and check that the HIGH-STAB INDICATOR becomes illuminated.
4. Adjust INC CAL control for zero-beat.

If a suitable frequency standard transmisison is not available due to propagation conditions, INC CAL can be set by monitoring the output from the oscillator on a frequency counter connected to the 550-650kHz OSC IN/OUT socket at the rear of the set. Frequency should be 650.00kHz when the INCREMENTAL TUNING CONTROL is set to 'Ø'.

METER ADJUSTMENT

There are four pre-set controls associated with the meter circuit. These are located on the right-hand side-plate and are accessible after removal of the cabinet. Their functions are as follows :-

RV9	.. ..	CENTRE-ZERO SET.*	RV11	.. ..	RF ZERO SET.
RV10	.. ..	AF ZERO SET.	RV12	.. ..	AF CALIB.

Adjustment will be required at infrequent intervals only as detailed below :-

RV11 RF ZERO SET. **This control must be adjusted before any of the others. Set METER SWITCH to 'RF', MANUAL/AGC SWITCH to 'MANUAL' and, with IF GAIN at minimum, adjust RV11 to set meter needle coincident with 'Ø' on the arbitrary carrier level scale.**

RV9 CENTRE-ZERO SET. Set METER SWITCH to '1ST HF OSC AFC', RANGE SWITCH to Ranges 5-10 (to disable AFC). Adjust RV9 so that meter needle lies on red line at centre of meter scale.

RV10 AF ZERO SET. **This control must be adjusted before RV12. Set METER SWITCH to 'AF' and with LINE LEVEL at minimum, adjust RV10 so that meter needle lies coincident with 'Ø' on the 0-10mW scale.**

RV12 AF CALIB. **Adjust RV12 with METER SWITCH at 'AF' after adjusting RV10. Line o/p** (Ancillaries 7 & 9) **must be terminated in 600-ohms, either with a standard power o/p meter or a dummy load resistor. Signal for adjustment can be obtained by utilising the built-in Crystal Calibrator with BFO switched on and adjusted for beat of about 1kHz. With LINE LEVEL CONTROL at roughly 3/4 of maximum, adjust the IF GAIN until external meter registers an output of 10mW (2.45V on valve voltmeter patched across 600-ohm load). Adjust RV12 for reading of 10mW on panel meter.**

(*) This control is marked 'FSK' as on standard receiver.

REVERSE BLANK

MAINTENANCE

GENERAL

The EC958 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.

As with all Eddystone receivers, the EC958 can be returned to the Manufacturer at any time should major servicing become necessary. In this event, the receiver should normally be returned via one of the many Eddystone Agents, but can be sent direct provided prior arrangements are made with Eddystone Radio Ltd. The Ser. No. of the set should be quoted in all communications, and extreme care should be taken to ensure that the receiver is well protected against possible damage during transit.

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

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 the live AC supply line and the main 18V DC secondary circuit. Fuseholders are located at the rear of the receiver and require fuses rated as follows:-

AC :: 1 Amp for 200/250V, 2 Amp for 100/125V.
DC :: 2 Amp.

Fuses are standard 5/8" x 3/16" glass cartridge type and appropriate spares are supplied with the receiver. Relevant Part Nos are Eddystone 7173P :: 1Amp, 6704P :: 2 Amp.

Legend Lamps

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

1. Pull off dolly from HIGH-STAB/CONT TUNE SWITCH. (Not applicable EC958/3)
2. Remove the four Phillips type countersunk screws retaining the dial escutcheon.
3. Lift escutcheon clear of panel, taking care to avoid excessive movement which could break leads to CALIBRATOR SWITCH.
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. Eddystone Part No. 6659P.)

Projection Lamps

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

1. Remove cabinet 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 if failure is on main scale projection system (raises 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. Slide carrier back into light unit.
8. Focus scale display by rotating lamp carrier and adjusting laterally as necessary.

Four spare bulbs are supplied with each receiver plus two in clips at the rear of the Incremental light unit. Bulbs are rated 6V @ 0.2A and carry Eddystone Part No. 8542P.

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 access points which are readily available for signal tracing etc., tend to simplify rather than complicate logical progression through the circuit. The service engineer should resist any temptation to carry out haphazard module/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 EC958 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.**

RANGES OPERATIVE	NONE
RANGES NOT OPERATIVE	ALL

LIKELY FAULT AREA AND SUGGESTED TREATMENT

POWER SUPPLY

Check availability of main supply voltages:-

+15V :: Orange leads.
+12V :: Red leads.
-6V :: White leads.

AUDIO MODULE

Check availability of +15V 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 signals on Line Channel, fault could be in Audio Module, but may be in 3-ohm Output Stage (on rear plate). Investigate 3-ohm Output Stage before testing or replacing Audio Module. (See page 57)

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.
Check voltage at Module Pin 48 (IF gain control line). Voltage should swing within the limits 0 - 4V for full traverse of IF GAIN (AGC SWITCH at '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 drive to 10kHz Calibrator Unit). Patch coaxial lead "T" to the "I-2" socket on 10kHz Calibrator Unit, depress 1MHz CAL SWITCH and check that meter indicates presence of carrier. Sensitivity check can be performed as detailed on page 58.

100kHz IF FILTER

Check security of all coaxial connections.

Check availability of +12V supply at Pin 56 (present on all ranges)
Main Filter Unit is isolated in '150Hz' position.

RANGES OPERATIVE	NONE
RANGES INOPERATIVE	ALL

(contd.)

RF ASSEMBLY

Check availability of +15V supply at RF Amp Board (Termination No. 3).
If absent, check line continuity through to Power Unit (Termination No. 126).

Check availability of +12V supply at MTO Board (Termination No. 5).
If absent, check continuity through to Power Unit (Termination No. 128).

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 Pin 38.
If absent, check line continuity via PL/A-4, S3D and PL/A-2 through to Power Unit (Termination 118).

Check availability of -6V supply at Module Pin 42.

Check availability of -2.7V supply at Module Pin 41. (-6V line via R179)

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

(contd.)

If -6V and/or -2.7V supplies are absent, check line continuity through to Power Unit (Termination No. 120) via PL/B-5 (Pin 41), PL/B-18 (Pin 42), and PL/B-4.

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

Check 250kHz IF Module (see page 58).

RANGES OPERATIVE	RANGES 5-10
RANGES INOPERATIVE	RANGES 1-4

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 (Termination No. 115).

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

Check S3C. (Second wafer from rear of bank).

Check Tunable IF Module (see page 58).

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 Unit Pin 19.
If absent, check line continuity via PL/A-6, S6 (set to 'NORMAL'), through to Power Unit (Termination No. 128).

Check for possible s/c or o/c on coaxial leads "N" & "O".

NB The Incremental Oscillator can usually be assumed to be working normally if 10kHz beats of normal level are available when carrying out the INC CAL check. See page 58.

RANGES OPERATIVE	RANGES 5-10
RANGES INOPERATIVE	RANGES 1-4

(contd.)

935kHz LOOP MODULE

Check availability of +12V supply at Module Pin 28.
If absent, check line continuity via PL/A-5, S3D (at Ranges 1-4), PL/A-2 through to Power Unit (Termination No. 118).

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

Check loop circuitry within 935kHz Loop Module **(see page 59).**

NB: A substitute 935kHz signal for test purposes can be obtained by transferring the +12V supply lead from Module Pin 28 to Module Pin 32. This activates the 935kHz Crystal Oscillator IC5 and at the same time disables the normal loop stages including the MTO AFC. The receiver can be continuously tuned by use of the MAIN TUNING CONTROL when operating in this manner: the HIGH-STAB indicator and AFC metering are disabled.

MASTER OSCILLATOR UNIT

Check availability of +12V supply at Unit Pin 77.
If absent, check line continuity through to Power Unit (No. 130).

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

Check Master Oscillator Unit (see page 58).

NB: Normal operation of the Master Oscillator Unit can usually be assumed if the BFO calibration facility functions in the usual manner.

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

Check availability of +15V supply at Pin 7 (RF Assy.)
If absent, check line continuity through to Power Unit (Termination No. 132).

Check availability of -6V supply at Pin 8 (RF Assy.)
If absent, check line continuity through to Power Unit (Termination No. 125).

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.

PERFORMANCE TESTING

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 75-ohms 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 600-ohm load.

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.

AGC SWITCH	:: 'OFF'	AERIAL ATTENUATOR	:: 0dB
INCREMENTAL TUNING	:: 'Ø' (R1-4)	METER SWITCH	:: 'AF' (0-10mW)
MODE SWITCH	:: 'AM'	AF GAIN	:: As required for monitoring
SELECTIVITY SWITCH	:: '3kHz'		
		IF GAIN*	:: 3/4 of maximum setting
*Use IF GAIN for fine adjustment of output level.		LINE LEVEL	:: Adjust for 10 mW

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 below.

Audio Section

Repeat overall sensitivity check (on any range) for 10dB s/n, but using 3-ohm channel to determine whether fault lies in 600-ohm line channel. Test should be carried out with AF GAIN set for reading of 50mW on external Power Output Meter wired to Ancillaries 1 and 6 (meter matched to 3-ohms). 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 (3-ohm)

Audio in at Module Pin 68 (existing lead disconnected) should show sensitivity of 20mV for 100mW output on external meter. (AF GAIN is inoperative)

Line Channel (600-ohm)

Audio in at Module Pin 67 (existing lead disconnected) should show sensitivity of 15mV for 10mW output on panel meter. (LINE LEVEL is inoperative)

3-ohm Output Stage

This stage can be checked independently if a fault is suspected on the Monitor Channel. Connection is most easily made by disconnecting Pin 71 on the Audio Module. The audio generator is fed into the free lead which terminates at No. 91 on 3-ohm Output Stage.

An input of 400mV should produce 100mW on external meter connected to 3-ohm output.

*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:-

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 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" :: 550mV 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 (at rear) should lie in the range 300mV to 600mV. A substitute testing signal can be derived from a second EC958 if available.

Master Oscillator Unit

Output level measured on coaxial lead "I" using a valve voltmeter should be of the order 2.8V (MODE SWITCH set to 'CAL').

Output level measured on coaxial lead "G" should be of the order 3V p-p measured on an oscilloscope.

(*) BFO set for 1kHz beat.

935kHz Loop Module

Normal operation of the Loop Amplifier (IC3) can be verified by introducing an external unmodulated 935kHz signal via coaxial lead "H". 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 coaxial lead "H", 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 coaxial lead "H", and reading voltage at Module Pin 34 with a valve voltmeter. Readings should be of the order:-

935kHz	::	+8V
935kHz + 3kHz	::	+9V
935kHz - 3kHz	::	+7V

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

A valve voltmeter should be used for measurement of the voltage at Module Pin 81.

RE-ALIGNMENT

General

All Modules and Units employed in the EC958 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. This 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 adjustments - trimmers, cores etc. - are self-locking, and should not be sealed with wax or other similar compounds.

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 on page 66.

Access to Trimming Adjustments

All trimming adjustments are accessible after removal of the long top cover plate which carries the disk identification (12 screws). 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 cores and trimmers for the selected range are easily identified by their proximity to the contact blocks.

The two IF rejection filters located on Disk "A" are pre-aligned before being fitted to the receiver and are not accessible after installation. It is most unlikely that further adjustment would be required.

Main-Tune Oscillator (Turret Disk "D")

Re-alignment of the MTO circuits should be carried out if errors in main scale calibration exceed the correction afforded by the adjustable cursor. In full re-alignment, the MTO circuits must be adjusted before tuning the signal frequency circuits on Disks "A"-"C", and the loop circuits on Disks "E" & "F".

It will be found most convenient to disable the high-stab facility when aligning Ranges 1 - 4. This is done by transferring the lead from Pin 28 of the 935kHz Loop Module to Pin 32 so that the 935kHz Crystal Oscillator is brought into operation to provide constant 935kHz drive to the 2nd Loop Mixer. In this mode of operation the receiver can be continuously tuned over the selected range and the incremental facility (though still operative) is set to 'Ø' to provide a fixed 1st IF of 1335kHz.

IMPORTANT: BEFORE COMMENCING ALIGNMENT, SET RV2 (AFC ADJ) FOR +8V AT MODULE PIN 34 (AFC OUTLET FROM 935kHz LOOP MODULE). THIS ADJUSTMENT MUST BE PERFORMED AFTER DISABLING THE DRIFT CANCELLING LOOP.

The most convenient signal source for alignment is a standard signal generator with integral 1MHz and/or 100kHz crystal reference. This should be operated in the CW mode with output connected directly to the aerial input socket of the receiver. Control settings should be as follows:-

RANGE SWITCH MAIN TUNING	::	See Table on Page 62 for alignment frequencies etc.
INCREMENTAL TUNING	::	'Ø' (for Ranges 1-4)
PEAK-RF CONTROL	::	As required for maximum signal.
AERIAL ATTENUATOR	::	'0dB'
IF & AF GAINS	::	To provide required level of output
MODE SWITCH	::	'CW'
SELECTIVITY SWITCH	::	'3kHz' (use narrower b/w on low ranges)
AGC SWITCH	::	'OFF'
CAL ADJ	::	Mid-position (coincident with fixed index)
BFO PITCH	::	100kHz ('Ø').

Procedure: Select each range in turn, set main scale to appropriate alignment frequency and tune to marker by adjustment of correct trimmer or core. Normal alignment technique should be adopted, tuning trimmers at HF end of range and cores at LF end. Each adjustment should be repeated several times to cancel the interaction between trimmer and core.

On the low-frequency ranges, adjustment should be made for zero-beat, but at the higher frequencies where this adjustment becomes more critical it is sufficient to tune the trimmer or core for an audible output.

Once the end frequencies are correct, tune over the complete range and check that any minor tracking errors are well within the coverage of the adjustable cursor.

THE 935kHz LOOP MODULE SHOULD BE RE-CONNECTED FOR NORMAL OPERATION ON COMPLETION OF ALIGNMENT ON THE MTO CIRCUITS.

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 75-ohms, 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 & 6, 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 the Table on the following page, 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. On Ranges 5-8, this control should be set permanently to mid-travel. On Ranges 1-4, settings should be as follows:-

When making adjustments at HF ends of ranges :: mid-travel.
When making adjustments at LF ends of ranges :: anti-clockwise to end stop.

TABLE OF 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	- -	- -
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	- -	- -

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. Misalignment 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 misalignment is failure of the HIGH-STAB INDICATOR to light at all 100kHz settings in a given range. Very severe misalignment 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 a valve 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 the Table on the opposite page, using the HIGH-STAB INDICATOR as a check on correct tuning. The appropriate trimmers and cores are tuned for maximum reading on the valve 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 the first 935kHz circuit L1.

Tune the receiver to any 100kHz calibration point by reference to HIGH-STAB indicator and meter (METER SWITCH at '1ST HF OSC AFC'). Connect valve voltmeter as for alignment of Disks "E" & "F" (i.e. patched into coaxial lead "M"), and trim L1 for maximum meter deflection.

NB Access to L1 is by removal of the cover plate over the front section of the Turret Assembly.

REMOVAL AND INSTALLATION OF MODULES, UNITS 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 six module leads from the dummy termination strip (Nos 79, 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 shake-proof 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 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 0.1uF capacitor C139.
3. Remove coaxial plug "I-1" at 10kHz Calibrator 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 0.1uF capacitor earthing tag. Note that coaxial lead "G" has its outer screen connected directly to the turret casting.

Incremental Oscillator Unit

1. Remove 10kHz Calibrator Unit (see page 68).
2. Disconnect two leads Nos. 18 & 19 and coaxial plugs "N", "O" and "Y".
3. Remove PL/A from SK/A (for ease of access to fixing screws).
4. Slacken the two screws in rear component of flexible coupler (access from below).
5. Use open-ended spanner to remove the four 4BA hex-headed screws holding unit to rear drive plate (support unit at this stage).
6. Slide unit to rear to disengage spindle from flexible coupler. Lift clear in downward direction.
7. Fit replacement unit by reversing procedure detailed above.
8. Set dial to HF end-stop (line marked on scale). Remove bottom cover from unit and set capacitor to maximum capacity setting.
9. Lock coupler screws, replace bottom cover and verify scale accuracy.

CW Detector & BFO Unit

1. Remove BFO control knob and skirt (separate item).
2. Disconnect leads Nos. 57, 58, 59, 60, 61 & 62.
3. Disconnect coaxial plugs "V" & "Z", and "I-2" at 10kHz Calibrator Unit.
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.

3-ohm Output Stage

1. Disconnect leads Nos. 92 & 93.
2. Remove the two 4BA screws retaining unit.
3. Lift clear to permit unsoldering lead No. 91 and associated screening braid.
4. Fit replacement unit by reversing procedure detailed above.

100kHz IF Filter Unit

1. Remove CW Detector & BFO Unit. (See previous page).
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 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 Detector & BFO Unit.

Crystal Filter Unit

1. Disconnect coaxial leads "R" & "S" under Filter Unit below chassis.
2. Remove four screws which retain unit to right-hand side-plate.
3. Slide filter inwards and then upwards to remove.
4. Fit replacement filter by reversing procedure detailed above.

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 on pages 60-63.
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 page 64, 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 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 panel nut to free STANDBY SWITCH. Push switch through panel and leave floating free. Disconnect PL/SK-E. (Note: All other panel leads are routed through the 37-way connector PL/SK-B).
5. Remove two screws holding panel to right-hand side plate, i.e. screws retaining the panel handle.
6. 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).
7. Pull panel clear, at same time releasing PL/B from SK/B (towards right-hand end of panel assembly at left of MODE SWITCH).
8. Replace panel by reversing procedure detailed above. Take care to replace the large washer on the SELECTIVITY SWITCH spindle bush.

Tuning Drive Assembly (See note on page XXXIV)

1. Remove panel as described above.
2. Remove Incremental Oscillator Unit (see page 65).
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. Remove PL/A from SK/A.
6. Disconnect both coaxial interconnectors coded "H", and those coded "E", "J", "K" & "L".
7. Remove 250kHz IF Module (see page 64). This allows access to one fixing screw which secures drive assembly to main chassis. Remove this screw (below chassis on flange).
8. 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".
9. 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" and "G". Leave cable clips for leads "A" and "D" floating free.
2. Disconnect leads linking Peak-RF Board to main RF Unit.
3. Disconnect leads Nos. 2, 3, 4, 5, 6, 7* and 8. (Unsolder lead marked *)
4. Remove Panel Assembly (see page 67).
5. Remove Drive Assembly (see page 67). 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-E

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.

10kHz Calibrator Unit

1. Disconnect leads Nos. 141, 142, 144, 143 and Earth.
2. Disconnect coax plugs "I-1" and "I-2".
3. Remove four screws in corners of unit and lift clear.
4. Replace by reversing procedure detailed above.

APPENDIX "A"

OPERATING THE EC958 RECEIVER FROM LOW-VOLTAGE DC SUPPLIES

General

The EC958 Receiver can be installed with a DC/AC Converter Unit for operation from low voltage DC supplies. The units available provide conversion efficiencies of the order 80% and are designated as follows:-

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

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

Input

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

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

Switching

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

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

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

Fusing

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

Earthing

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

Output

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

Maximum output rating 50 watts.

Case Dimensions

Approximately 8 in x 6in x 4in.

APPENDIX "B"

VOLTAGE ANALYSIS

In the event of the receiver failing to operate normally, initial voltage checks should be carried out at all appropriate module terminations etc. to determine whether the fault lies in the circuit wiring or in one of the modules 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 and an applied supply voltage of 240V AC (using 230/250V tapping). A tolerance of 10% should be allowed on all readings to cover zener and semiconductor spreads; greater variation should be allowed if readings are taken with a less sensitive meter than that specified.

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

RANGE SWITCH	::	Range 1
*MAIN TUNING	::	20MHz
INCREMENTAL	::	'∅'
PEAK-RF	::	Fully clockwise
SIGNAL MODE	::	'CW'
IF GAIN	::	Maximum
METER SWITCH	::	'RF'
AGC SWITCH	::	'OFF'
CAL SWITCH	::	'OFF'
BFO CAL SWITCH	::	'OFF'

(*) Receiver tuned to illuminate the 'HIGH-STAB' legend.

VOLTAGE TABLE 1 - MODULE SUPPLIES ETC.

Module/ Unit etc.	Pin	Service	Voltage/Remarks
RF Assembly	1	IC1 supply	+12V with CAL SWITCH 'ON'.*
	2	Metering connection	+14.2V with METER SWITCH at 'RF'. +14.3V in other two positions.
	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
	6	AFC line to D11	+8V (measured on Ranges 5-10)
	7	TR6, TR7 & IC2 supply	+15V under all conditions of switching.
	8	IC2 supply	-6V under all conditions of switching.

(*) +12V also present with MODE SWITCH at 'CAL'.

Module/ Unit etc.	Pin	Service	Voltage/Remarks
RF Assembly	9	Control voltage to D5/6	Dependent on Range in use and setting of PEAK-RF :- Range 1 8.5-15V. Range 4 0.2-15V. Range 2 3.5-15V. Ranges 5-10 Range 3 1.5-15V. 3.5-15V.
	9/10	Control voltage to D7/8 & D9/10	Ranges 1-4 identical to pin 9 above. Ranges 5-10 fixed at 15V.
	11	Fixed control voltage to D7/8 & D9/10	+15V.
Aerial Attenuator Unit	12	Muting Relay control line (external)	+12V derived from external source.
	13	Ditto (internal)	+12V with CAL SWITCH at 'ON', MODE SWITCH at 'CAL' or BFO CAL 'ON'.
	14-17		Not allocated.
Incremental Oscillator Unit	18	Control voltage to D46	+1.5V with link fitted between Ancillary Terminals 2 & 3 0-+5V with external 10,000 ohm control
	19	TR17-19 supply	+12V under all conditions of switching except when NORMAL/SLAVE SWITCH is set to 'SLAVE' position (0V).
	20 25 26		Not allocated.
Tunable IF Module	21	Earth	
	22	TR15 & IC12 supply	+15V under all conditions of switching.
	23	Control voltage to D19/24	Dependent on setting of INCREMENTAL TUNING CONTROL:- INC. Fully Anti clock 15V INC. '100' 5V
	24	Earth	
	30-35		Not allocated.
935kHz Loop Module	27	'HIGH-STAB' lamp supply	+12V (Derived from supply to Pin 28). Available only on Ranges 1-4 when MAIN TUNING CONTROL is set to each 0.1MHz calibration point.

Module/ Unit etc.	Pin	Service	Voltage/Remarks
935kHz Loop Module	28	Supply to TR9-11 & IC3-4	+12V. Available only on Ranges 1-4
	29	Supply to IC5	-6V under all conditions of switching.
	31	Earth	
	32	Supply to IC5	There is no connection to this Pin. Transfer lead from Pin 28 to Pin 32 to activate IC5 for test purposes.
	33	Supply to TR8	+12V under all conditions of switching.
	34	AFC	(see Pin 6).
	36	AFC Adjuster	Dependent on setting of RV2. Of the order +1V.
	37	Discriminator o/p	Earthed with CAL SWITCH 'ON'
	39 40		Not allocated.
250kHz IF Module	38	Supply to TR20, TR21, TR22 & IC7.	+12V except on Ranges 7, 9 & 10.
	41	Supply to IC7	-2.7V under all conditions of switching
	42	Control voltage to D28	-6V under all conditions of switching.
	43	Earth	
	44	Control voltage to D27	There is no connection to this Pin.
	45	Earth	
	46 47 50		Not allocated.
100kHz IF Amplifier Module	48	IF AGC	Varies between 0V and -3V for full travel of IF GAIN CONTROL (with AGC SWITCH set to '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).

Module/ Unit etc.	Pin	Service	Voltage/Remarks
100kHz IF Filter Unit	56	Supply to TR3 or TR20 drain	+12V under all conditions of switching.
CW Detector & BFO Unit	57	Supply to TR32 & TR32A	Available with MODE SWITCH at 'CW' position only (+12V).
	58	Audio output	From CW Detector.
	59	Earth	
	60	Supply to TR33 & IC13	+12V under all conditions of switching.
	61	Inhibit line to IC13	Earthed with BFO CAL 'OFF'.
	62	Earth	
	70		Not allocated.
Audio Amplifier Module	63	600 ohm output	
	64	600 ohm centre-tap	
	65	600 ohm 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 TR34-37	+15V under all conditions of switching.
	71	Audio output from driver transformer	Via auxiliary contact on Telephone socket to Pin 91 of 3Ω Output Stage.
	72	Earth	
	73 75		Not allocated.
Master Oscillator Unit	74	Supply to TR13	+12V with CAL SWITCH at 'ON', MODE SWITCH at 'CAL' or BFO CAL 'ON'.
	76	Earth	
	77	Supply to 1MHz Crystal Oscillator, TR12, TR14 & IC6	+12V under all conditions of switching.
	78	Supply to Oven	12.6V AC available continuously.
	80 85		Not allocated.

Module/Unit etc.	Pin	Service	Voltage/Remarks
FSK Module	79	Earth	
	81	Discriminator o/p	No connection on Model EC958/3.
	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' setting.
	84		
	86	FSK Relay contacts	
	87		
	88-90		Not allocated.
3-ohm Output Stage	91	Audio drive	
	92	Supply to TR38	+15V under all conditions of switching
	93	Collector of TR38	+14.5V.
	94	3-ohm secondary	
	95	3-ohm secondary	Earthy side.
	96 & 100		Not allocated.
S6 etc.	97	Supply to S6	+12V
	98	Supply to TR4/5	+12V
	99	Supply via S6 to TR17-19	+12V with S6 at 'NORMAL'.
Meter Board	101	RV12	) DC output from meter rectifier on
	102	RV12	) 600-ohm channel.
	103	RV4	Alignment potentiometer for Tunable IF
	104	RV2	See Pin 36.
	105	Earth	
	106	Gate of TR39	
	107	Drain of TR39	
	108	RV11 slider	+14V nominal.
	109	RV10	AF ZERO SET.
	110	RV9	AFC CENTRE-ZERO SET
	111	Supply to TR39	+15V under all conditions of switching.
Power Unit	112-132	+12V +15V and -6V supplies	See Interconnection circuit.
	133-140		Not allocated.
10kHz Calibrator Unit	141	Supply to TR47-49/IC11	+12V with CAL SWITCH at 'ON' or MODE SWITCH at 'CAL'.
	142	Supply out to 1MHz Crystal Calibrator	As above - modulated at 10kHz on Ranges 5 to 10.
	143	Audio output	From Beat Amplifier.
	144	IC11 inhibit line	+1.2V on Ranges 1-4.

VOLTAGE TABLE 2 - STAGE VOLTAGES

NB **Control settings should be as detailed on page II, 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

Ref	Emitter / Source	Base / Gate / Gate 1	Gate 2	Collector / Drain	Notes
TR1	1.1V	0V	-	3V	NOTE 1
TR2	3V	1.3V	-	14.2V	NOTE 1
TR3	0.7V	0V	0.8V	13V	NOTE 14
TR4	1V	-1.5V	-	12V	NOTE 2
TR5	4V	3.5V	-	11.2V	NOTE 2
TR6	0.8V	0V	-	14.4V	NOTE 3
TR7	0.8V	0V	0.8V	14.7V	NOTE 3
TR8	1V	0V	-	7.9V	NOTE 3
TR9	0V	0.6V	-	11.3V	NOTE 3
TR10	0.1V	-2V	-	3V	NOTE 3
TR11	0.1V	0.7V	-	1.2V	NOTE 3
TR12	1.7V	2.2V	-	9.6V	-
TR13	0.3V	1V	-	11.4V	NOTE 5
TR14	1.4V	2.1V	-	11.4V	-
TR15	0.65V	0V	1.5V	11.4V	NOTE 6
TR16*	-	-	-	-	-
TR17	1.9V	0V	-	8V	NOTE 7
TR18	3.1V	3.4V	-	10V	NOTE 7
TR19	3.5V	3.4V	-	10V	NOTE 7
TR20	0.55V	0V	1.0V	11.9V	NOTE 15
TR21	2.5V	0V	-	12V	NOTE 15
TR22	2.1V	3V	-	11.8V	NOTE 15
TR23	2.3V	0V	-	10.2V	NOTE 8
TR24	2.3V	0V	-	10.2V	NOTE 8
TR25	2.3V	0V	-	10.2V	NOTE 8
TR26	2.3V	0V	-	10.2V	-
TR27	0V	0.6V	-	10.7V	-
TR28	2.3V	0V	-	10.1V	-
TR29	0V	0.8V	-	9.4V	-

(*) Reference not allocated.

Ref	Emitter / Source	Base / Gate / Gate 1	Gate 2	Collector / Drain	Notes
TR30	2.3V	0.6V	-	10.7V	-
TR31	0V	0.75V	-	8.2V	-
TR32	0V	-0.1V	-	10V	NOTE 9
TR33	1V	0V	1.1V	10V	-
TR34	0.85V	0.5V	-	6V	-
TR35	1.62V	1.95V	-	14.5V	-
TR36	0.45V	0.7V	-	7.1V	-
TR37	1.2V	1.8V	-	14.5V	-
TR38	0.6V	1.3V	-	14.5V	-
TR39	1.1V	0V	-	13.8V	NOTE 10
TR40	0.6V	0V	-	6.2V	NOTE 9
TR41	0.4V	1V	-	-0.2V	NOTE 9

REFER TO OPPOSITE PAGE FOR TR32A, TR47, TR48 & TR49.

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	-5.2	-9.5	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	-3.7	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	-
IC7	0V	0V	-2.9	0.2V	-1.2	0V	0V	4.5V	6.4V	4.5V	-	-	-	-	13
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
IC 12	0V	2.4V	2.4V	5.5V	5.5V	0V	2.3V	0V	-	-	-	-	-	-	-

REFER TO OPPOSITE PAGE FOR IC11 & IC13.

1MHz MASTER OSCILLATOR

1	2	3	4	5	6	7	8
12.6V AC	6.2V	-	-	0V	-	0V	0V

STAGE VOLTAGES (Contd.)

Ref	Emitter /Source	Base Gate/Gate 1	Gate 2	Collector / Drain	Notes
TR32A	2V	2.6V	-	12V	NOTE 9
TR47	3.4V	2.6V	-	11.8V	NOTE 16
TR48	1.4V	2V	-	9V	NOTE 16
TR49	2.8V	3.3V	-	7.5V	NOTE 16

Ref	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Notes
IC11	2.5V	OV	-	-	5.6V	-	-	-	-	OV	OV	OV	-	OV	16
IC13	-	1.5V	-	-	3V	1.2V	OV	-	-	1.2V	-	-	-	4.8V	17

VOLTAGE TABLE 2 - NOTES

NOTE 1. Figures quoted are for all ranges except Ranges 7, 9 & 10. On these three ranges, voltages are modified as follows:-

TR1 Drain :: 3.5V TR2 Source :: 3.5V
Drain :: 5.5V

NOTE 2. Not applicable to Model EC958/3.

NOTE 3. Receiver tuned to illuminate 'HIGH-STAB' legend.

NOTE 4. Voltages present on Ranges 1-4 only.

NOTE 5. Voltages present with CAL SWITCH 'ON', MODE SWITCH at 'CAL' or with BFO CAL SWITCH 'ON'.

NOTE 6. Drain voltage removed on Ranges 7, 9 & 10.

NOTE 7. NORMAL/SLAVE SWITCH to 'NORMAL' position.

NOTE 8. AGC SWITCH at 'OFF' and IF GAIN at maximum setting.

NOTE 9. MODE SWITCH at 'CW' position.

NOTE 10. Readings recorded after setting meter adjustments for correct zero etc.

NOTE 11. CAL SWITCH at 'ON'.

NOTE 12. Transfer +12V supply lead from Pin 28 to Pin 32 to check voltages on the 935kHz Crystal Oscillator (IC5).

NOTE 13. Not applicable to Model EC958/3.

NOTE 14. Voltage on TR3 drain will be lower on Ranges 5-10 (fed from +12V in lieu of +15V line). Additional drop occurs across R119 on Ranges 9 & 10 only.

NOTE 15. +12V removed from all 250kHz Stages when switched to Ranges 7, 9 & 10. Drain voltage remains on TR20.

NOTE 16. Taken on Ranges 5-10 with CAL SWITCH at 'ON'.

NOTE 17. Taken with BFO CAL SWITCH at 'ON'.

APPENDIX "C"

SEMICONDUCTOR COMPLEMENT

Ref	Type	Manufacturer	Circuit Function
TR1	UC734B	Union Carbide	) Cascode RF Amplifier
TR2	3N128	RCA	)
TR3	40673	RCA	1st Signal Mixer
TR4	3N128	RCA	Main Tune Oscillator (OSC 1)
TR5	UC734B	Union Carbide	Source Follower (Oscillator Buffer)
TR6	UC734B	Union Carbide	Harmonic Amplifier
TR7	40673	RCA	1st Loop Mixer
TR8	UC734B	Union Carbide	AFC Control Amplifier
TR9	2N4254	Texas	Emitter Follower
TR10	UC734B	Union Carbide	) Schmitt Trigger (HIGH-STAB RELAY)
TR11	40309	RCA	)
TR12	2N4254	Texas	1MHz Amplifier (Divider Driver)
TR13	BC107B	Mullard	100kHz Emitter Follower
TR14	2N4254	Texas	Emitter Follower (Harmonic Generator)
TR15	40673	RCA	2nd Signal Mixer
TR16			Reference not allocated
TR17	UC734B	Union Carbide	Incremental Oscillator (OSC 2)
TR18	2N4254	Texas	Emitter Follower (Oscillator Buffer)
TR19	2N4254	Texas	Emitter Follower (output to 10kHz
TR20	40673	RCA	3rd Signal Mixer Cal. Unit)
TR21	UC734B	Union Carbide	150kHz Oscillator Amplifier
TR22	BC107B	Mullard	250kHz IF Amplifier
TR23	UC734B	Union Carbide	1st 100kHz IF Amplifier
TR24	UC734B	Union Carbide	2nd 100kHz IF Amplifier
TR25	UC734B	Union Carbide	3rd 100kHz IF Amplifier
TR26	UC734B	Union Carbide	4th 100kHz IF Amplifier
TR27	2N4254	Texas	Emitter Follower (100kHz)
TR28	UC734B	Union Carbide	RF AGC Amplifier
TR29	2N4254	Texas	Emitter Follower (RF AGC Rect. Driver)
TR30	UC734B	Union Carbide	IF AGC Amplifier
TR31	2N4254	Texas	Emitter Follower (IF AGC Rect. Driver)
TR32	UC734B	Union Carbide	Beat Oscillator
TR33	40673	RCA	CW Detector
TR34	BC107B	Mullard	AF Amplifier) Low-level Audio
TR35	BC107B	Mullard	AF Output)
TR36	BC107B	Mullard	AF Amplifier)
TR37	40309	RCA	AF Driver) High-level Audio
TR38	2N3054	RCA	AF Output)
TR39	UC734B	Union Carbide	Meter Control Amplifier
TR40	UC734B	Union Carbide	Source Follower (FSK Module)
TR41	BCY34	Mullard	DC Amplifier (FSK Module)
TR42-46	-	-	References not allocated
TR47	2N4254	Texas	Divider Driver (10kHz Calib.)
TR48	2N4254	Texas	Calibrator Mixer (Inc. Cal.)
TR49	2N4254	Texas	Beat Amplifier (Inc. Cal.)
TR32A	2N4254	Texas	BFO Emitter Follower

Ref	Type	Manufacturer	Circuit Function
D1-D4	-	-	Replaced by PC1 (see below)
D5-D10	6 x BA111	STC	Peak RF/Ae Trim VVC's
D11	BA110	STC	AFC VVC
D12	1S44	Texas	Bias Diode (Main-Tune Osc.)
D13-D14	2 x 1S44	Texas	935kHz Discriminator
D15	1S44	Texas	HIGH-STAB Lamp Detector
D15A	1S44	Texas	935kHz Peak Clipper
D16	BZY88C5V6	Mullard	Zener Regulator
D17	BZY88C4V7	Mullard	Zener Regulator (1MHz Peak Clipper)
D18	BZY88C6V2	Mullard	Zener Regulator
D19-21A	6 x MV1656	Motorola	1st IF VVC's
D22-24A	6 x MV1656	Motorola	2nd Oscillator VVC's (Injection
D25	BZY88C8V2	Mullard	Zener Regulator Tuning)
D26	OAZ228	Mullard	Zener Regulator
D27	1S44	Texas	150kHz Oscillator Switch
D28	1S44	Texas	350kHz Oscillator Switch
D29	BZY88C6V2	Mullard	Zener Regulator
D30	-	-	Reference not allocated
D31	1N4004	ITT	12V Switch
D32	OA47	Mullard	AM Detector
D33	1S44	Texas	RF AGC Rectifier
D34	1S44	Texas	IF AGC Rectifier
D35	-	-	Reference not allocated
D36	-	-	Reference not allocated
D37	1S44	Texas	Meter Rectifier (600Ω output)
D38-D39	2 x 1S44	Texas	FSK Discriminator (100kHz)
D40	BZY88C6V2	Mullard	Zener Regulator
D41	OAZ230	Mullard	Zener Regulator
D42	OAZ232	Mullard	Zener Regulator
D43	S1PB2	West'house	Positive Supply Rectifier (Bridge)
D44	OAZ223	Mullard	Zener Regulator
D45	OSH01	Mullard	Negative Supply Rectifier (Bridge)
D46	BA111	STC	Remote Tune VVC
D47-49	-	-	References not allocated
D50	BZY88C4V7	Mullard	100kHz Peak Clipper
D51	BZY88C5V6	Mullard	Zener Regulator
D52	BZY88C4V7	Mullard	Zener Regulator
D53	1N4004	ITT	12V Switch
PC1	8 x 1N4148	Newm'kt	Aerial Protection
IC1	CA3000/V1	RCA	1MHz Crystal Calibrator
IC2	SA21	Sylvania	Main-Tune Osc. Amplifier
IC3	CA3002/V1	RCA	Loop Amplifier (935kHz)
IC4	CA3012/V1	RCA	Loop Limiter (935kHz)
IC5	CA3000/V1	RCA	935kHz Crystal Osc. (for test only)
IC6	FJJ141	Mullard	1MHz/100kHz Divider
IC7	CA3000/V1	RCA	150kHz Crystal Oscillator (OSC 3)
IC8	CA3012/V1	RCA	FSK Limiter (100kHz)
IC9	CA3002/V1	RCA	FSK Limiter
IC10	CA3002/V1	RCA	FSK Relay Driver
IC11	SN7490	Texas	100kHz/10kHz Divider
IC12	SL641C	Plessey	2nd Loop Mixer
IC13	SN7420N	Texas	100kHz Gate (BFO Cal)

NB: EQUIVALENTS WILL BE FITTED IF SPECIFIED TYPES ARE NOT AVAILABLE

APPENDIX "D"

LIST OF COMPONENT VALUES, TOLERANCES AND RATINGS

PART 1 :: MAIN RECEIVER

PART 2 :: TURRET DISKS (Page XXIV)

MAIN RECEIVER

Location Code

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

A : 1MHz Calibrator
B : Aerial Attenuator Box
C : Peak-RF Board
D : RF Assembly
E : 935kHz Loop Module
F : Master Osc. Unit
G : Tunable IF Module
H : Incremental Osc.
I : 250kHz IF Module
J : 100kHz IF Filter
K : 100kHz IF Amplifier
L : CW/SSB Detector & BFO
M : Audio Module
N : FSK Module
O : Power Unit Chassis
P : Meter Board
Q : Panel Assembly
R : Drive Assembly
S : Back Plate
T : Main Chassis
U : 10kHz Calibrator Unit
V : 100kHz Crystal Filter Unit

Capacitors

Ref	Value	Type	Tolerance	Wkg. V.	Loc
C1	0.1uF	Polycarbonate	20%	100V	A
C2-C5	-	References not allocated	-	-	-
C6-C7*	0.047uF	Polycarbonate	20%	100V	Q
C8-C9	0.1uF	Polycarbonate	20%	100V	R
C10	0.1uF	Polycarbonate	20%	100V	B
C11-C18	-	References not allocated	-	-	-
C19	0.047uF	Polycarbonate	20%	100V	R
C20	0.1uF	Polycarbonate	20%	100V	C
C21	0.1uF	Polycarbonate	20%	100V	C
C22	0.047uF	Polycarbonate	20%	100V	C
C23	0.047uF	Polycarbonate	20%	100V	C
C24	0.1uF	Polycarbonate	20%	100V	C
C25-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	0.1uF	Polycarbonate	20%	100V	D
C34	0.1uF	Polycarbonate	20%	100V	D
C35	0.1uF	Polycarbonate	20%	100V	D
C36	0.1uF	Polycarbonate	20%	100V	D
C37	12-358pF	Air-spaced variable	-	-	D
C38	20pF	Tubular Ceramic	10%	750V	D
C39	0.1uF	Polycarbonate	20%	100V	D

(*) omitted when not required.

Ref	Value	Type	Tolerance	Wkg. V.	Loc
C40	0.1uF	Polycarbonate	20%	100V	D
C41	0.1uF	Polycarbonate	20%	100V	D
C42	0.1uF	Polycarbonate	20%	100V	D
C43	150pF	Silvered Mica	5%	350V	D
C44	6pF	Tubular Ceramic	10%	750V	D
C45	0.1uF	Polycarbonate	20%	100V	D
C46	18-364pF	Air-spaced variable	-	-	D
C47	100pF	Silvered Mica	5%	350V	D
C48	0.1uF	Polycarbonate	20%	100V	D
C49	0.1uF	Polycarbonate	20%	100V	D
C50	0.047uF	Polycarbonate	20%	100V	D
C51	100pF	Silvered Mica	5%	350V	D
C52	0.047uF	Polycarbonate	20%	100V	D
C53	0.1uF	Polycarbonate	20%	100V	D
C54	0.01uF	Metallised Paper	20%	200V	D
C55	0.1uF	Polycarbonate	20%	100V	D
C56	3pF	Tubular Ceramic	0.5pF	200V	D
C57	0.1uF	Polycarbonate	20%	100V	D
C58	0.047uF	Polycarbonate	20%	100V	D
C59	0.047uF	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	0.047uF	Polycarbonate	20%	100V	D
C64	0.1uF	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	0.1uF	Polycarbonate	20%	100V	D
C70	0.001uF	Silvered Mica	5%	350V	D
C71	0.047uF	Polycarbonate	20%	100V	D
C72	0.047uF	Polycarbonate	20%	100V	D
C73	150pF	Silvered Mica	5%	350V	D
C74	0.1uF	Polycarbonate	20%	100V	D
C75-C76	-	References not allocated	-	-	-
C77	0.047uF	Polycarbonate	20%	100V	D
C78	12pF	Tubular Ceramic (N750)	10%	750V	D
C79	0.1uF	Polycarbonate	20%	100V	D
C80	0.001uF	Silvered Mica	5%	350V	E
C81	15pF	Tubular Ceramic	10%	100V	E
C82	0.001uF	Silvered Mica	5%	350V	E
C83	0.1uF	Polycarbonate	20%	100V	E
C84	0.1uF	Polycarbonate	20%	100V	E
C85	0.1uF	Polycarbonate	20%	100V	E
C86	0.0015uF	Tubular Ceramic	10%	750V	E
C87	0.001uF	Silvered Mica	5%	350V	E
C88	15pF	Tubular Ceramic	10%	100V	E
C89	0.001uF	Silvered Mica	5%	350V	E
C78A	6pF	Tubular Ceramic	10%	750V	D

Ref	Value	Type	Tolerance	Wkg. V.	Loc
C90	40pF	Tubular Ceramic	10%	750V	E
C91	22pF	Tubular Ceramic	10%	100V	E
C92	0.047uF	Polycarbonate	20%	100V	E
C93	0.001uF	Silvered Mica	5%	350V	E
C94	0.047uF	Polycarbonate	20%	100V	E
C95	0.047uF	Polycarbonate	20%	100V	E
C96	0.1uF	Polycarbonate	20%	100V	E
C97	0.001uF	Silvered Mica	5%	350V	E
C98	100pF	Silvered Mica	5%	350V	E
C99	0.001uF	Silvered Mica	5%	350V	E
C100	0.01uF	Polycarbonate	20%	100V	E
C101	0.1uF	Polycarbonate	20%	100V	E
C102	0.1uF	Polycarbonate	20%	100V	E
C103	8.2pF	Tubular Ceramic	10%	100V	E
C104	0.1uF	Polycarbonate	20%	100V	E
C105	0.001uF	Silvered Mica	5%	350V	E
C106	0.001uF	Tubular Ceramic	10%	750V	E
C107	0.1uF	Polycarbonate	20%	100V	E
C108	0.1uF	Polycarbonate	20%	100V	E
C109	-	Reference not allocated	-	-	-
C110	0.1uF	Polycarbonate	20%	100V	F
C111	0.1uF	Polycarbonate	20%	100V	F
C112	0.1uF	Polycarbonate	20%	100V	F
C113	0.001uF	Disk Ceramic	20%	500V	F
C114	0.0015uF	Tubular Ceramic	10%	750V	F
C115	0.047uF	Polycarbonate	20%	100V	F
C116	0.1uF	Polycarbonate	20%	100V	F
C117	0.01uF	Polycarbonate	20%	100V	F
C118	0.002uF	Silvered Mica	5%	350V	F
C119	0.001uF	Disk Ceramic	20%	500V	F
C120	0.1uF	Polycarbonate	20%	100V	F
C121	0.1uF	Polycarbonate	20%	100V	F
C122	0.01uF	Polycarbonate	20%	100V	F
C123	250pF	Silvered Mica	5%	350V	F
C124	1.5-19.5pF	Tube Trimmer	-	-	F
C125*	15 pF	Silvered Mica	5%	350V	F
C126	0.1uF	Polycarbonate	20%	100V	F
C127	0.1uF	Polycarbonate	20%	100V	F
C128	0.1uF	Polycarbonate	20%	100V	F
C129	50pF	Tubular Ceramic	10%	750V	F
C130	0.047uF	Polycarbonate	20%	100V	F
C131	0.001uF	Tubular Ceramic	10%	750V	F
C133-C137	0.1uF	References not allocated	-	-	-
C138	0.1uF	Polycarbonate	20%	100V	T
C139	0.1uF	Polycarbonate	20%	100V	T

C132?

(*) Value may be adjusted on test.

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)	D3891
L2	935kHz Coil No. 2)		D3859
L3	935kHz Coil No. 3)		D3860
L4	935kHz Coil No. 4)		D3861
L5	935kHz Coil No. 5)	(935kHz Loop Module)	D3862
L6	935kHz Coil No. 6)		D3998
L7	935kHz Coil No. 7)		D3863
L8	935kHz Coil No. 8)		D3864
L9	935kHz Coil No. 9)		D3865
L10	1235-1335kHz Coil No. 1)		D3881
L11	1235-1335kHz Coil No. 2)	(Tunable IF Module)	D3882
L12	1235-1335kHz Coil No. 3)		D3883
L13	1485-1585kHz Coil No. 1)		D3884
L14	1485-1585kHz Coil No. 2)	(Tunable IF Module)	D3885
L15	1485-1585kHz Coil No. 3)		D3886
L16	Incremental Oscillator Coil)		D3846
*L17	Low-pass Filter Coil No. 1)	(Inc. Osc. Unit)	D3847
*L18	Low-pass Filter Coil No. 2)		
L19			-
L20	References not allocated		-
L21			-
L22			-
L23	Reference not allocated	(was 100kHz Coil No. 1)	-
L24	100kHz Coil No. 2)		D3840
L25	100kHz Coil No. 3)		D3841
L26	100kHz Coil No. 4)	(100kHz IF Filter Unit)	D3841
L27	100kHz Coil No. 5)		D3841
L28	100kHz Coil No. 6)		D3841
L29	100kHz Coil No. 7)		D3871
L30	100kHz Coil No. 8)	(100kHz IF Amplifier Module)	D3869
L31	100kHz Coil No. 9)		D3870
L32	BFO Coil	(CW Det/BFO Unit)	D4551
L33	100kHz Coil No. 10)	(FSK Module)	D3889
L34	100kHz Coil No. 11)		D3890
L35	100kHz Coil No. 12	(Master Oscillator Unit)	D3839

* Single Assembly

Ref	Description		Part No.
L136	Range 1 Aerial Coil)		D3892B
L137	Range 2 Aerial Coil)		D3893B
L138	Range 3 Aerial Coil)		D3894A
L139	Range 4 Aerial Coil)		D3895A
L140	High-pass Filter Coil No. 2)		D3898A
L141	High-pass Filter Coil No. 1)	(Turret Disk "A")	D3899A
L142	Range 5 Aerial Coil)		D4555
L143	Range 6 Aerial Coil)		D4556
L144	250kHz IF Rejector Coil)		D3896/1C
L145	Range 7 Aerial Coil)		D4557
L146	Range 8 Aerial Coil)		D4558
L44	Range 1 RF Coil)		D3900A
L45	Range 2 RF Coil)		D3901A
L46	Range 3 RF Coil)	(Turret Disk "B")	D3902A
L47	Range 4 RF Coil)		D3903A
L48	Range 5 RF (Aerial) Coil)		D4573
L49	Range 6 RF (Aerial) Coil)		D4574
L50	Range 7 RF (Aerial) Coil)		D4575
L51	Range 8 RF (Aerial) Coil)	(Turret Disk "B")	D4441
L52	Range 9 RF (Aerial) Coil)		D3908
L53	Range 10 RF (Aerial) Coil)		D3909A
L54	Range 1 Mixer Coil)		D3910
L55	Range 2 Mixer Coil)		D3911A
L56	Range 3 Mixer Coil)		D3912
L57	Range 4 Mixer Coil)		D3913
L58	Range 5 Mixer Coil)		D3914
L59	Range 6 Mixer Coil)	(Turret Disk "C")	D3915
L60	Range 7 Mixer Coil)		D3916
L61	Range 8 Mixer Coil)		D3917A
L62	Range 9 Mixer Coil)		D3918
L63	Range 10 Mixer Coil)		D3919
L64	Range 1 Oscillator Coil)		D3921
L65	Range 2 Oscillator Coil)		D3922
L66	Range 3 Oscillator Coil)		D3923
L67	Range 4 Oscillator Coil)		D3924
L68	Range 5 Oscillator Coil)		D3925
L69	Range 6 Oscillator Coil)	(Turret Disk "D")	D3926
L70	Range 7 Oscillator Coil)		D3927
L71	Range 8 Oscillator Coil)		D3928
L72	Range 9 Oscillator Coil)		D3930
L73	Range 10 Oscillator Coil)		D3931
L74	Range 1 Loop Mixer Coil)		D3932B
L75	Range 2 Loop Mixer Coil)		D3933B
L76	Range 3 Loop Mixer Coil)	(Turret Disk "E")	D3934B
L77	Range 4 Loop Mixer Coil)		D3935
L78	Range 1 Harmonic Amplifier Coil)		D3979E
L79	Range 2 Harmonic Amplifier Coil)		D3933B
L80	Range 3 Harmonic Amplifier Coil)	(Turret Disk "F")	D4405
L81	Range 4 Harmonic Amplifier Coil)		D3935

Ref	Description	Part No.
	SWITCHES	
S1	CALIBRATOR SWITCH. Miniature biased toggle	8486P
S2	AERIAL ATTENUATOR SWITCH. 3-pole, 3-position miniature lever switch	7491P
S3	RANGE SWITCH (Wafers S3A-S3E). 5, 10-posn wafers supplied as complete assembly	D4084
S4	Not fitted on Model EC958/3	
S5	Not fitted on Model EC958/3	
S6	NORMAL/SLAVE SWITCH. Miniature toggle	7352P
S7	BFO CAL SWITCH. Miniature biased toggle	8486P
S8	SELECTIVITY SWITCH. Part of 100kHz IF Filter Unit. Four wafers, each 2-pole 5-way. S8A/B, S8C/D, S8E, S8F/G	7285PA
	Clicker mechanism for S8	7507P
S9	AGC ON/OFF SWITCH. Miniature toggle	7352P
S10	SIGNAL MODE SWITCH. 3-pole, 3-position miniature lever switch	7491P
S11	SPEAKER SWITCH. Miniature toggle	7352P
S12	METER SWITCH. 3-pole, 3-position miniature lever switch	7491P
S13	SUPPLY SWITCH. Miniature toggle	7352P
	POTENTIOMETERS	
RV1	PEAK-RF/AE TRIM. 20,000 ohms carbon, linear law	7761P
RV2	AFC ADJ. 1,000 ohms carbon pre-set, linear law	6076P
RV3	TUNABLE IF TUNE. 10,000 ohms carbon, linear law	7762P
RV4	TUNABLE IF TRIM. 10,000 ohms carbon pre-set, linear law	6840P
RV5	IF GAIN. 50,000 ohms carbon, logarithmic law	4103/1P
RV6	LINE LEVEL. 0.47 Megohm carbon pre-set, linear law	6077P
RV7	AF GAIN. 0.5 Megohm carbon, logarithmic law	4103P
RV8	TR38 ADJ. 1,000 ohms carbon pre-set, linear law	6076P
RV9	*AFC CZ SET 3,300 ohms carbon pre-set, linear law	7850P
RV10	AF ZERO SET. 4,700 ohms carbon pre-set, linear law	6844P
RV11	RF ZERO SET. 1,000 ohms carbon pre-set, linear law	6076P
RV12	AF CALIB. 0.47 Megohm carbon pre-set, linear law	6077P
RV13	FSK ADJ. 2,700 ohms carbon pre-set, linear law	6841P
RV14	FSK RELAY BIAS ADJ. 10,000 ohms carbon pre-set, linear law	6840P
RV15	DIAL DIMMER. 10 ohms wire-wound pre-set, linear law	7763P
RV16	HARM. DRIVE ADJ. 1,000 ohms carbon pre-set, linear law	6076P
RV17	INC CAL. 10,000 ohms carbon pre-set, linear law	6840P
RV18	FINE IF TRIM. 47,000 ohms carbon pre-set, linear law	6488P
	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
C124	Trimmer. 1.5 - 19.5pF	7767P
C176	Trimmer. 4 - 29pF Concentric	6597P
C177	Gang Assembly. 1 x 15-150pF	LP3079
C310/311	Gang Assembly. 2 x 8.5 - 126.5pF	6631P

(*) Marked 'FSK'.

Ref	Description	Part No.
	PLUGS AND SOCKETS ETC.	
	Inter-Unit Coaxial Connectors as fitted on coaxial leads coded "E", "H1", "H2", "J", "K", "L", "M", "P" & "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, Ext. Osc. Drive	7225P
	Ditto - plugs (free component)	8012P
PL/A	15-way Drive Assembly Connector (male - free)	7772P
PL/B	37-way Panel Connector (male - free)	7774P
SK/A	15-way Drive Assembly Connector (female - fixed)	7770P
SK/B	37-way Panel Connector (female - fixed)	7773P
	"Amp" pin - fixed (as used for module connections etc.)	7775P
	"Amp" socket - free (-do-)	7776P
	Miniature B/L coaxial plug*	7293P
	Miniature B/L coaxial socket*	7292P
	(*) As used for connections to 100kHz Filter etc.	
	Ancillaries Terminal Strip	8533P
	Octal socket (as used for MO 1MHz Crystal Oscillator)	6689P
	Telephone plug	6567P
	Standard push-terminals as used for High-Z Aerial Input	6102P
	Earth terminal	6371P
JK1	Telephone socket	6660P
PL/SK-D	Two-way polarised connector (each part identical)	7245P
	NB: PL/SK-C not utilised on Model EC958/3.	
	KNOBS ETC.	
	Main Tuning, Incremental Tuning (less skirt)	D3613/1
	Skirt for Main Tuning and Incremental Tuning	7089P
	IF Gain, AF Gain, Selectivity, complete with skirt	D3614
	BFO (less skirt)	D3957
	Skirt for BFO (special adjustable type)	D4563
	Range Switch (bar knob)	D4012
	Dolly for Mode, Aerial Attenuator and Meter Switches	7777P
	Lock for Main/Incremental Tuning Controls	SKM87
	Cal. Adj. knob : 8487P. Cap for Cal. Adj. knob :	8532P
	Skirt for Range Knob	7703P

Resistors (all 5%, 0.1W)

Disk	Range	Ref	Value
"A"	1	R350	0.1 Megohm
"A"	2	R351	0.1 Megohm
"B"	1	R360	0.1 Megohm
"B"	2	R361	0.1 Megohm
"C"	1	R370	0.1 Megohm
"C"	2	R371	0.1 Megohm
"C"	7	R372	2,200 ohms

Disk	Range	Ref	Value
"C"	7	R373	2,200 ohms
"C"	9	R374	0.1 Megohm
"C"	9	R375	2,200 ohms
"C"	10	R376	2,200 ohms
"C"	10	R377	0.1 Megohm
"C"	8	R378	47,000 ohms
"F"	3	R380	1,000 ohms

R353-359, R362-369, R379 & R381-389 not allocated.

ADDENDUM

Disk "A" R352 220ohms
(Loc:- 250kHz IF Rejector)

CONTINUATION OF APPENDIX "D" - PART 1

Capacitors

Ref	Value	Type	Tolerance	Wkg. V.	Loc
C540	0.1uF	Polycarbonate	20%	100V	U
C541	-	Reference not allocated	-	-	-
C542	0.1uF	Polycarbonate	20%	100V	U
C543	0.1uF	Polycarbonate	20%	100V	U
C544	0.01uF	Polycarbonate	20%	100V	U
C545	0.1uF	Polycarbonate	20%	100V	U
C546	100pF	Polystyrene	5%	125V	U
C547	70pF	Polystyrene	5%	125V	U
C548	100pF	Polystyrene	5%	125V	U
C549	10uF	Tantalum	20%	25V	U
C550	0.68uF	Tantalum	20%	35V	U
C551	0.1uF	Polycarbonate	20%	100V	U
C552	10uF	Tantalum	20%	25V	U
C553	0.1uF	Polycarbonate	20%	100V	U
C554	10uF	Tantalum	20%	25V	U
C555	22uF	Tantalum	20%	16V	U

Resistors

Ref	Value	Tol	Rtg	Loc
R440	47,000 ohms	5%	0.1W	U
R440A	56,000 ohms	5%	0.1W	U
R441	27,000 ohms	5%	0.1W	U
R442	470 ohms	5%	0.1W	U
R443	1,000 ohms	5%	0.1W	U
R444	150 ohms	5%	0.1W	U
R445	470 ohms	5%	0.1W	U
R446	10,000 ohms	5%	0.1W	U

Ref	Value	Tol	Rtg	Loc
R447	2,200 ohms	5%	0.1W	U
R448	1,500 ohms	5%	0.1W	U
R449	2,200 ohms	5%	0.1W	U
R450	27,000 ohms	5%	0.1W	U
R451	12,000 ohms	5%	0.1W	U
R452	5,600 ohms	5%	0.1W	U
R453	6,800 ohms	5%	0.1W	U

APPENDIX "E"

SPARES LIST FOR EC958/3 RECEIVER

The following list details all major spares for the EC958/3 Receiver. Spares should be ordered by quoting the Circuit Ref. (where applicable), the written description given in the list and the Part No. in the right-hand column. The Serial No. of the receiver should be quoted in all communications.

Ref	Description	Part No.
	MODULES, UNITS AND ASSEMBLIES	
	RF Assembly. (Less Crystal Calibrator, Peak-RF Board, AFC Board and Turret Disks)	D4080
	935kHz Loop Amplifier Module	LP3055A
	Tunable IF Module	LP3057A
	250kHz IF Module	LP3061/1
	100kHz IF Amplifier Module	LP3056
	Audio Amplifier Module	LP3053/2
	FSK Module. (Fitted to special order only)	LP3058
	Aerial Attenuator Unit (0-20-40dB)	LP3260/1
	Master Oscillator Unit	LP3045
	1MHz Crystal Oscillator	8473P
	Incremental Oscillator Unit	LP3273
	100kHz IF Filter Unit	LP3274
	CW Detector & BFO Unit	LP3269
	Crystal Calibrator Board	LP3059
	Peak-RF Board	LP3065
	Meter Board	LP3066
	100kHz Crystal Filter Unit (150Hz bandwidth)	LP3270
	3-ohm Output Stage	LP3067
	AFC Board	LP3081
	250kHz IF Filter	8331P
	10kHz Calibrator Unit	LP3272
	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

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 -449	-	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	40pF	Tubular Ceramic	10%	750V	10
C476	30pF	Tubular Ceramic	10%	750V	9
C477-479	-	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 -489	-	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

Ref	Value	Tol	Rtg	Loc
R300	Not allocated	-	-	-
R301	1 Megohm	5%	0.1 W	P
R302	1,000 ohms	5%	0.1 W	P
R303	1,000 ohms	5%	0.1 W	Q
R304	100 ohms	5%	0.1 W	P
R305	560 ohms	5%	0.1 W	P
R306	10,000 ohms	5%	0.1 W	P
R307	Not allocated	-	-	-
R308	Not allocated	-	-	-
R309	2.2 Megohms	10%	0.05 W	Q
R310	100 ohms	5%	0.5 W	N
R311	68 ohms	5%	0.1 W	N
R312	68 ohms	5%	0.1 W	N
R313	33,000 ohms	5%	0.1 W	N
R314	33,000 ohms	5%	0.1 W	N
R315	33,000 ohms	5%	0.1 W	N
R316	0.47 Megohm	5%	0.1 W	N
R317	2,200 ohms	5%	0.1 W	N
R318	15,000 ohms	5%	0.1 W	N
R319	1,000 ohms	5%	0.1 W	N

Ref	Value	Tol	Rtg	Loc
R320	1,200 ohms	5%	0.1W	N
R321	4,700 ohms	5%	0.1W	N
R322	6,800 ohms	5%	0.1W	N
R323	6,800 ohms	5%	0.1W	N
R324	4,700 ohms	5%	0.1W	N
R325	10,000 ohms	5%	0.1W	N
R326	10,000 ohms	5%	0.1W	N
R327 -328	Not allocated	-	-	-
R329	1,800 ohms	5%	12W	T
R330	5 ohms w.w.	5%	6W	O
R331	5 ohms w.w.	5%	9W	O
R332	100 ohms w.w.	5%	6W	O
R333	1.2 ohms w.w.	10%	1W	Q
R334 -349	Not allocated			
R350 -380	Allocated to Turret Disks			
R390 -439	Not allocated			
R440 -453	Allocated to 10kHz Cal Unit			
	See Page XXVII			

Potentiometers

Ref	Value	Law	Type	Function	Loc
RV1	20,000 ohms	Lin.	Carbon	Peak-RF/Aerial Trimmer	Q
RV2	1,000 ohms	Lin.	Carbon pre-set	AFC Adjuster	P
RV3	10,000 ohms	Lin.	Carbon	V.V.C. Control (Tunable IF)	R
RV4	10,000 ohms	Lin.	Carbon pre-set	V.V.C. Tracker (Tunable IF)	P
RV5	50,000 ohms	Log.	Carbon	IF Gain	Q
RV6	0.47 Megohm	Lin.	Carbon pre-set	Line Level	Q
RV7	0.5 Megohm	Log.	Carbon	AF Gain	Q
RV8	1,000 ohms	Lin.	Carbon pre-set	TR38 Adjuster	S
RV9	3,300 ohms	Lin.	Carbon pre-set	AFC CZ Set*	P
RV10	4,700 ohms	Lin.	Carbon pre-set	AF Zero Set	P
RV11	1,000 ohms	Lin.	Carbon pre-set	RF Zero Set	P
RV12	0.47 Megohm	Lin.	Carbon pre-set	AF Calib.	P
RV13	2,700 ohms	Lin.	Carbon pre-set	FSK	N
RV14	10,000 ohms	Lin.	Carbon pre-set	FSK Relay Bias Adj.	N
RV15	10 ohms	Lin.	Wirewound	Dial Dimmer	Q
RV16	1,000 ohms	Lin.	Carbon pre-set	Harmonic Drive Adj.	F
RV17	10,000 ohms	Lin.	Carbon pre-set	INC CAL	Q
RV18	47,000 ohms	Lin.	Carbon pre-set	Fine IF Trim	R
				(*) Marked 'FSK' as on standard receiver.	

APPENDIX "D"

LIST OF COMPONENT VALUES, 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	6 - 30pF	Ceramic Trimmer	-	-	7
C396	6 - 30pF	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	-	-	-

Ref	Value	Tol	Rtg	Loc
R100	47 ohms	5%	0.1 W	F
R101	100 ohms	5%	0.1 W	F
R102	47,000 ohms	5%	0.1 W	F
R103	27,000 ohms	5%	0.1 W	F
R104	470 ohms	5%	0.1 W	F
R105	100 ohms	5%	0.1 W	F
R106	3,300 ohms	5%	0.1 W	F
R107	0.22 Megohm	5%	0.1 W	F
R108	0.12 Megohm	5%	0.1 W	F
R109	150 ohms	5%	0.1 W	F
R110	150 ohms	5%	0.1 W	F
R111	47,000 ohms	5%	0.1 W	F
R112	3,900 ohms	5%	0.1 W	F
R113	330 ohms	5%	0.1 W	F
R114	100 ohms	5%	0.1 W	F
R115				
-118	Not allocated	-	-	-
R119	680 ohms*	5%	0.1 W	R
R120	220 ohms	5%	0.1 W	G
R120A	0.27 Megohm	5%	0.1 W	G
R121	0.39 Megohm	5%	0.1 W	G
R122	0.39 Megohm	5%	0.1 W	G
R123	0.39 Megohm	5%	0.1 W	G
R124	0.47 Megohm	5%	0.1 W	G
R125	47,000 ohms	5%	0.1 W	G
R126	0.68 Megohm	5%	0.1 W	G
R127	2,700 ohms	5%	0.1 W	G
R128	470 ohms	5%	0.1 W	G
R129	220 ohms	5%	0.1 W	G
R130	680 ohms	5%	0.1 W	G
R131				
-133	Not allocated	-	-	-
R134	0.39 Megohm	5%	0.1 W	G
R134A	0.27 Megohm	5%	0.1 W	G
R135	0.39 Megohm	5%	0.1 W	G
R136	0.39 Megohm	5%	0.1 W	G
R137	10,000 ohms	5%	0.1 W	G
R138	10,000 ohms	5%	0.1 W	G
R139	4,700 ohms	5%	0.1 W	R
R140	10,000 ohms	5%	0.1 W	H
R141	0.47 Megohm	5%	0.1 W	H
R142	47,000 ohms	5%	0.1 W	H
R143	680 ohms	5%	0.1 W	H
R144	180 ohms	5%	0.1 W	H
R145	120 ohms	5%	0.1 W	H
R146	22,000 ohms	5%	0.1 W	H
R147	47,000 ohms	5%	0.1 W	H
R148	470 ohms	5%	0.1 W	H
R149	68 ohms	5%	0.1 W	H

Ref	Value	Tol	Rtg	Loc
R150	22 ohms	5%	0.1 W	H
R151	22,000 ohms	5%	0.1 W	H
R152	47,000 ohms	5%	0.1 W	H
R153	680 ohms	5%	0.1 W	H
R154	68 ohms	5%	0.1 W	H
R155	150 ohms	5%	0.1 W	H
R156				
-159	Not allocated	-	-	-
R160	220 ohms	5%	0.1 W	I
R161	2,200 ohms	5%	0.1 W	I
R162	1,000 ohms	5%	0.1 W	I
R163	1,000 ohms	5%	0.1 W	I
R164	39,000 ohms	5%	0.1 W	I
R164A	22,000 ohms	5%	0.1 W	I
R165	220 ohms	5%	0.1 W	I
R166	1,200 ohms	5%	0.1 W	I
R167	150 ohms	5%	0.1 W	I
R167A	1,000 ohms	5%	0.1 W	I
R168	4,700 ohms	5%	0.1 W	I
R168A	0.12 Megohm	5%	0.1 W	I
R169	12,000 ohms	5%	0.1 W	I
R170	0.1 Megohm	5%	0.1 W	I
R170A	220 ohms	5%	0.1 W	I
R171	22,000 ohms	5%	0.1 W	I
R171A	22,000 ohms	5%	0.1 W	I
R172	1,000 ohms	5%	0.1 W	I
R172A	1,000 ohms	5%	0.1 W	I
R173	100 ohms	5%	0.1 W	I
R174	0.27 Megohm	5%	0.1 W	I
R175	560 ohms	5%	0.1 W	I
R176	150 ohms	5%	0.1 W	I
R177	1,000 ohms	5%	0.1 W	I
R178	22,000 ohms	5%	0.1 W	I
R179	2,200 ohms	5%	0.1 W	Q
R180	82,000 ohms	5%	0.1 W	J
R181	22,000 ohms	5%	0.1 W	J
R182	220 ohms	5%	0.1 W	J
R183	82,000 ohms	5%	0.1 W	J
R184	10,000 ohms	5%	0.1 W	J
R185	82,000 ohms	5%	0.1 W	J
R186	10,000 ohms	5%	0.1 W	J
R187	Not allocated	-	-	-
R188	22,000 ohms	5%	0.1 W	J
R189	82,000 ohms	5%	0.1 W	J
R190	10,000 ohms	5%	0.1 W	J
R191				
-195	Not allocated	-	-	-
R196	1,800 ohms	5%	0.1 W	R
R197	220 ohms	5%	0.1 W	R
R198	Not allocated	-	-	-
R199	Not allocated	-	-	-

* Subject to adjustment on test.

Ref	Value	Tol	Rtg	Loc
R200	0.27 Megohm	5%	0.1 W	K
R201	1,000 ohms	5%	0.1 W	K
R202	5,600 ohms	5%	0.1 W	K
R203	330 ohms	5%	0.1 W	K
R204	0.27 Megohm	5%	0.1 W	K
R205	1,000 ohms	5%	0.1 W	K
R206	1,200 ohms	5%	0.1 W	K
R207	330 ohms	5%	0.1 W	K
R208	0.27 Megohm	5%	0.1 W	K
R209	1,000 ohms	5%	0.1 W	K
R210	5,600 ohms	5%	0.1 W	K
R211	330 ohms	5%	0.1 W	K
R212	0.1 Megohm	5%	0.1 W	K
R213	1,000 ohms	5%	0.1 W	K
R214	8,200 ohms	5%	0.1 W	K
R215	330 ohms	5%	0.1 W	K
R216	47,000 ohms	5%	0.1 W	K
R217	22,000 ohms	5%	0.1 W	K
R218	100 ohms	5%	0.1 W	K
R219	22,000 ohms	5%	0.1 W	K
R220	33,000 ohms	5%	0.1 W	K
R221	47 ohms	5%	0.1 W	K
R222	270 ohms	5%	0.1 W	K
R223	0.47 Megohm	5%	0.1 W	K
R224	Not allocated	-	-	-
R225	1,000 ohms	5%	0.1 W	K
R226	47,000 ohms	5%	0.1 W	K
R227	22,000 ohms	5%	0.1 W	K
R228	100 ohms	5%	0.1 W	K
R229	0.27 Megohm	5%	0.1 W	K
R230	10,000 ohms	5%	0.1 W	K
R231	2,200 ohms	5%	0.1 W	K
R232	47,000 ohms	5%	0.1 W	K
R233	0.27 Megohm	5%	0.1 W	K
R234	1,000 ohms	5%	0.1 W	K
R235	1,500 ohms	5%	0.1 W	K
R236	47,000 ohms	5%	0.1 W	K
R237	22,000 ohms	5%	0.1 W	K
R238	100 ohms	5%	0.1 W	K
R239	10,000 ohms	5%	0.1 W	K
R240	3,300 ohms	5%	0.1 W	K
R241	1 Megohm	5%	0.1 W	K
R242	22,000 ohms	5%	0.1 W	K
R243	330 ohms	5%	0.1 W	K
R244	150 ohms	5%	0.1 W	K
R245	Not allocated	-	-	-
R246	Not allocated	-	-	-
R247	Not allocated	-	-	-
R248	47,000 ohms	5%	0.1 W	Q
R249	0.1 Megohm	5%	0.1 W	Q
R250	Not allocated	-	-	-
R251	0.27 Megohm	5%	0.1W	L
R252	22,000 ohms	5%	0.1W	L
R253	27,000 ohms	5%	0.1W	L
R254	8,200 ohms	5%	0.1W	L
R254A	10,000 ohms	5%	0.1W	L
R255	680 ohms	5%	0.1W	L
R255A	220 ohms	5%	0.1W	L
R256	22,000 ohms	5%	0.1W	L
R256A	470 ohms	5%	0.1W	L
R257	2,200 ohms	5%	0.1W	L
R258	1,000 ohms	5%	0.1W	L
R259	4,700 ohms*	5%	0.1W	L
R260	1,000 ohms	5%	0.1W	L
R261	10,000 ohms	5%	0.1W	L
R262	2,700 ohms	5%	0.1W	L
R263	100 ohms	5%	0.1W	L
R264 -269	Not allocated	-	-	-
R270	1 Megohm	5%	0.1 W	M
R271	0.1 Megohm	5%	0.1 W	M
R272	39 ohms	5%	0.1 W	M
R273	10,000 ohms	5%	0.1 W	M
R274	82,000 ohms	5%	0.1 W	M
R275	10,000 ohms	5%	0.1 W	M
R276	150 ohms	5%	0.1 W	M
R277	47,000 ohms	5%	0.1 W	M
R278	8,200 ohms	5%	0.1 W	M
R279	150 ohms	5%	0.1 W	M
R280	33,000 ohms	5%	0.1 W	M
R281	0.1 Megohm	5%	0.1 W	M
R282	0.47 Megohm	5%	0.1 W	M
R283	47,000 ohms	5%	0.1 W	M
R284	47 ohms	5%	0.1 W	M
R285	220 ohms	5%	0.1 W	M
R286	4,700 ohms	5%	0.1 W	M
R287	3,300 ohms	5%	0.1 W	M
R288	150 ohms	5%	0.1 W	M
R289	10,000 ohms	5%	0.1 W	M
R290	1,500 ohms	5%	0.1 W	M
R291	100 ohms	5%	0.1 W	M
R292	1 Megohm	5%	0.1 W	M
R293	33 ohms	5%	0.1 W	M
R294	100 ohms	5%	0.1 W	M
R295	Not allocated	-	-	-
R296	470 ohms	10%	0.5 W	S
R297	100 ohms	5%	0.5 W	S
R298	2.2 ohms w.w.	5%	2.5 W	S
R299	12 ohms	10%	0.5 W	Q

(*) Value may be adjusted on test.

Ref	Value	Type	Tolerance	Wkg. V.	Loc
C350	80uF	Tubular Electrolytic	+50%-10%	25V	N
C351	0.047uF	Polycarbonate	20%	100V	N
C352	0.1uF	Polycarbonate	20%	100V	N
C353	0.1uF	Polycarbonate	20%	100V	N
C354	0.1uF	Polycarbonate	20%	100V	N
C355	0.01uF	Polystyrene	1%	125V	N
C356	0.001uF	Silvered Mica	5%	350V	N
C357	0.0047uF	Polystyrene	1%	125V	N
C358	0.001uF	Disk Ceramic	20%	500V	N
C359	0.047uF	Polycarbonate	20%	100V	N
C360	0.047uF	Polycarbonate	20%	100V	N
C361	0.1uF	Polycarbonate	20%	100V	N
C362	0.1uF	Polycarbonate	20%	100V	N
C363	0.1uF	Polycarbonate	20%	100V	N
C364	0.1uF	Polycarbonate	20%	100V	N
C365	0.1uF	Polycarbonate	20%	100V	N
C366-369	-	See below	-	-	-
C370	6,400uF	Tubular Electrolytic	+50%-10%	16V	O
C371	6,400uF	Tubular Electrolytic	+50%-10%	16V	O
C372	6,400uF	Tubular Electrolytic	+50%-10%	25V	O
C373	1,000uF	Tubular Electrolytic	+50%-20%	16V	O
C374	1,000uF	Tubular Electrolytic	+50%-20%	16V	O
C375	0.005uF	Disk Ceramic	+80%-20%	3000V	O
C376	0.047uF	Metallised Paper	20%	400V	S
C377	0.047uF	Metallised Paper	20%	400V	S
C378-379	-	References not allocated	-	-	-
C380-497	-	References allocated to Turret Disks (see Page XXIV)	-	-	-
C497-539	-	References not allocated	-	-	-
C540-555	-	References allocated to 10kHz Cal. Unit See Page XXVII.	-	-	-
C556-559	-	References not allocated	-	-	-
C560	0.0039µF	Silvered Mica	1%	350V	V
C561	0.0032µF	Silvered Mica	1%	350V	V
C562	0.0032µF	Silvered Mica	1%	350V	V
C563	0.0032µF	Silvered Mica	1%	350V	V
C564	0.0032µF	Silvered Mica	1%	350V	V
C565	2x2-14pF	Air-spaced Trimmer	-	-	V
C566	0.0091µF	Polystyrene	2%	63V	V
C567	0.0091µF	Polystyrene	2%	63V	V
C568	170pF	Silvered Mica	5%	350V	V
C569	10pF	Tubular Ceramic	10%	750V	V
C570	0.0047µF	Polystyrene	2%	125V	V
C571	100pF	Silvered Mica	5%	350V	V
FC1	1500pF	Filtercon Type 1201-077 (Erie)	-	200V	D

R1-R99

Resistors

Ref	Value	Tol	Rtg	Loc
R1	1,000 ohms	5%	0.1 W	A
R2	1,000 ohms	5%	0.1 W	A
R3	1,500 ohms	5%	0.1 W	A
R4	1,800 ohms	5%	0.1 W	A
R5-R9	Not allocated	-	-	-
R10	Not allocated	-	-	-
R11	68 ohms	5%	0.1 W	B
R12	68 ohms	5%	0.1 W	B
R13	18 ohms	5%	0.1 W	B
R14	68 ohms	5%	0.1 W	B
R15	68 ohms	5%	0.1 W	B
R16	18 ohms	5%	0.1 W	B
R17-R19	Not allocated	-	-	-
R20	6,800 ohms	5%	0.1 W	R
R21	100 ohms	5%	0.1 W	R
R22	1,000 ohms	5%	0.1 W	R
R23	22,000 ohms	5%	0.1 W	R
R24-R29	Not allocated	-	-	-
R30	47,000 ohms	5%	0.1 W	C
R31	1.8 Megohm	10%	0.05W	C
R32	47,000 ohms	5%	0.1 W	C
R33	1.8 Megohm	10%	0.05W	C
R34	0.1 Megohm	5%	0.1 W	C
R35	47,000 ohms	5%	0.1 W	C
R36	1.8 Megohm	10%	0.05W	C
R37-R39	Not allocated	-	-	-
R40	1.8 Megohm	10%	0.05W	D
R41	270 ohms	5%	0.1 W	D
R42	0.1 Megohm	5%	0.1 W	D
R43	22 ohms	5%	0.1 W	D
R44	180 ohms	5%	0.1 W	D
R45	1 Megohm	5%	0.1 W	D
R46	33,000 ohms	5%	0.1 W	D
R47	270 ohms	5%	0.1 W	D
R48	0.47 Megohm	5%	0.1 W	D
R49	4,700 ohms	5%	0.1 W	D
R50	22 ohms	5%	0.1 W	D
R51	220 ohms	5%	0.1 W	D
R52	22 ohms	5%	0.1 W	D
R53	0.22 Megohm	5%	0.1 W	D
R54	0.22 Megohm	5%	0.1 W	D
R55	0.1 Megohm	5%	0.1 W	D
R56	330 ohms	5%	0.1 W	D
R57	0.22 Megohm	5%	0.1 W	D
R58	100 ohms	5%	0.1 W	D
R59	270 ohms	5%	0.1 W	D
R60	820 ohms	5%	0.1 W	D
R61	0.1 Megohm	5%	0.1 W	D
R62	330 ohms	5%	0.1 W	D
R63	22 ohms	5%	0.1 W	D
R64	220 ohms	5%	0.1 W	D
R65	0.1 Megohm	5%	0.1 W	D
R66	470 ohms	5%	0.1 W	D
R67	470 ohms	5%	0.1 W	D
R68	10,000 ohms	5%	0.1 W	D
R69	150 ohms	5%	0.1 W	D
R70	22 ohms	5%	0.1 W	D
R71-R78	Not allocated	-	-	-
R79	47 ohms	5%	0.1 W	D
R80	220 ohms	5%	0.1 W	E
R81	47,000 ohms	5%	0.1 W	E
R82	47,000 ohms	5%	0.1 W	E
R83	0.1 Megohm	5%	0.1 W	E
R84	2,200 ohms	5%	0.1 W	E
R85	4,700 ohms	5%	0.1 W	E
R86	1,200 ohms	5%	0.1 W	E
R87	1,000 ohms	5%	0.1 W	E
R88	1,000 ohms	5%	0.1 W	E
R89	100 ohms	5%	0.1 W	E
R90	68,000 ohms	5%	0.1 W	E
R91	0.12 Megohm	5%	0.1 W	E
R92	68,000 ohms	5%	0.1 W	E
R93	3,900 ohms	5%	0.1 W	E
R94	22,000 ohms	5%	0.1 W	E
R95	22 ohms	5%	0.1 W	E
R96-R98	4.7 ohms w.w.*	5%	5W	T
R99	150 ohms	10%	0.5 W	R

(*) R98 is short-circuited when 1MHz Oven 8473P is fitted.

Ref	Value	Type	Tolerance	Wkg. V.	Loc
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	0.0044uF	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	0.0044uF	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	0.001uF	Disk Ceramic	20%	500V	K
C261	0.1uF	Polycarbonate	20%	100V	K
C262	0.047uF	Polycarbonate	20%	100V	K
C263	0.1uF	Polycarbonate	20%	100V	K
C264	0.1uF	Polycarbonate	20%	100V	K
C265	0.001uF	Disk Ceramic	20%	500V	K
C266	0.047uF	Polycarbonate	20%	100V	K
C267	0.1uF	Polycarbonate	20%	100V	K
C268	0.1uF	Polycarbonate	20%	100V	K
C269	0.001uF	Disk Ceramic	20%	500V	K
C270	0.047uF	Polycarbonate	20%	100V	K
C271	0.1uF	Polycarbonate	20%	100V	K
C272	0.001uF	Disk Ceramic	20%	500V	K
C273	540pF	Silvered Mica	5%	350V	K
C274	0.047uF	Polycarbonate	20%	100V	K
C275	0.1uF	Polycarbonate	20%	100V	K
C276	0.001uF	Disk Ceramic	20%	500V	K
C277	0.1uF	Polycarbonate	20%	100V	K
C278	0.1uF	Polycarbonate	20%	100V	K
C279	0.002uF	Silvered Mica	5%	350V	K
C280	0.001uF	Disk Ceramic	20%	500V	K
C281	0.001uF	Disk Ceramic	20%	500V	K
C282	100pF	Silvered Mica	5%	350V	K
C283	0.1uF	Polycarbonate	20%	100V	K
C284	0.001uF	Disk Ceramic	20%	500V	K
C285	0.1uF	Polycarbonate	20%	100V	K
C286	0.002uF	Silvered Mica	5%	350V	K
C287	0.001uF	Disk Ceramic	20%	500V	K
C288	10uF	Tubular Electrolytic	+50%-10%	16V	K
C289	0.1uF	Polycarbonate	20%	100V	K

Ref	Value	Type	Tolerance	Wkg. V.	Loc
C290	0.1uF	Polycarbonate	20%	100V	K
C291	0.1uF	Polycarbonate	20%	100V	K
C292	0.001uF	Tubular Ceramic	20%	750V	K
C293	0.047uF	Polycarbonate	20%	100V	K
C294	0.001uF	Disk Ceramic	20%	500V	K
C295	0.1uF	Polycarbonate	20%	100V	K
C296	0.1uF	Polycarbonate	20%	100V	K
C297	0.1uF	Polycarbonate	20%	100V	K
C298	0.001uF	Disk Ceramic	20%	500V	K
C299	0.002uF	Silvered Mica	5%	350V	K
C300	10uF	Tubular Electrolytic	+50%-10%	16V	K
C301-308	-	References not allocated	-	-	-
C309	1uF	Tantalum	20%	35V	Q
C310	8.5-126.5pF	Air-spaced variable	-	-	L
C311	8.5-126.5pF	Air-spaced variable	-	-	L
C312	47pF*	Polystyrene	2.5%	125V	L
C312A	500pF	Silvered Mica	5%	350V	L
C313	50pF	Polystyrene	2%	125V	L
C314	0.005uF	Metallised Paper	20%	250V	L
C315	0.1uF	Polycarbonate	20%	100V	L
C316	0.005uF	Metallised Paper	20%	250V	L
C316A	0.68uF	Tantalum	20%	35V	L
C317	0.1uF	Polycarbonate	20%	100V	L
C317A	22uF	Tantalum	20%	16V	L
C318	0.001uF	Disk Ceramic	20%	500V	L
C318A	0.001uF	Disk Ceramic	20%	500V	L
C319	10uF	Tantalum	20%	25V	L
C320	0.1uF	Polycarbonate	20%	100V	L
C321	0.001uF	Disk Ceramic	20%	500V	L
C322	0.001uF	Disk Ceramic	20%	500V	L
C323	0.001uF	Disk Ceramic	20%	500V	L
C324	22uF	Tantalum	20%	16V	L
C325-329	-	References not allocated	-	-	-
C330	80uF	Tubular Electrolytic	+50%-10%	25V	M
C331	0.01uF	Polycarbonate	20%	100V	M
C332	25uF	Tubular Electrolytic	+50%-10%	25V	M
C333	0.002uF	Metallised Paper	20%	250V	M
C334	1uF	Tubular Electrolytic	+100%-10%	40V	M
C335	0.1uF	Polycarbonate	20%	100V	M
C336	80uF	Tubular Electrolytic	+50%-10%	25V	M
C337	0.1uF	Polycarbonate	20%	100V	M
C338	0.1uF	Polycarbonate	20%	100V	M
C339	80uF	Tubular Electrolytic	+50%-10%	25V	M
C340	0.1uF	Polycarbonate	20%	100V	M
C341	10uF	Tubular Electrolytic	+50%-10%	16V	M
C342	10uF	Tubular Electrolytic	+50%-10%	16V	M
C343	0.002uF	Metallised Paper	20%	250V	M
C344	10uF	Tubular Electrolytic	+50%-10%	16V	M
C345	80uF	Tubular Electrolytic	+50%-10%	25V	M
C346	0.1uF	Polycarbonate	20%	100V	M
C347	125uF	Tubular Electrolytic	+50%-10%	16V	M
C348	80uF	Tubular Electrolytic	+50%-10%	25V	S
C349	0.1uF	Polycarbonate	20%	100V	P

ERRATA: Values of C333 & C343 are marked incorrectly on Main Circuit.

(*) Nominal value - subject to adjustment on test.

Ref	Value	Type	Tolerance	Wkg. V.	Loc
C140	10uF	Tubular Electrolytic	+50%-10%	16V	G
C141	110pF	Silvered Mica	5%	350V	G
C142	0.047uF	Polycarbonate	20%	100V	G
C143	2pF	Tubular Ceramic	0.25pF	750V	G
C144	0.001uF	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
C149	0.1uF	Polycarbonate	20%	100V	G
C150	-	Reference not allocated	-	-	-
C151	0.047uF	Polycarbonate	20%	100V	G
C152	0.1uF	Polycarbonate	20%	100V	G
C153	0.047uF	Polycarbonate	20%	100V	G
C154	10-40pF	Disk Ceramic Trimmer	-	-	G
C155*	100pF	Polystyrene	5%	125V	G
C155A	250pF	Polystyrene	5%	125V	G
C156	0.1uF	Polycarbonate	20%	100V	G
C157*	680pF	Polystyrene	2%	125V	G
C158	0.1uF	Polycarbonate	20%	100V	G
C159	150pF	Silvered Mica	5%	350V	G
C160	6pF	Tubular Ceramic	10%	750V	G
C161	0.001uF	Disk Ceramic	20%	500V	G
C162	150pF	Silvered Mica	5%	350V	G
C163	6pF	Tubular Ceramic	10%	750V	G
C164	-	Reference not allocated	-	-	-
C165	0.1uF	Polycarbonate	20%	100V	G
C166	150pF	Silvered Mica	5%	350V	G
C167	-	Reference not allocated	-	-	-
C168	0.047uF	Polycarbonate	20%	100V	G
C169	-	Reference not allocated	-	-	-
C170	22pF	Tubular Ceramic	10%	750V	H
C171	0.1uF	Polycarbonate	20%	100V	H
C172	0.047uF	Polycarbonate	20%	100V	H
C173*	22pF	Tubular Ceramic	10%	750V	H
C174*	60pF	Tubular Ceramic	10%	750V	H
C175*	150pF	Silvered Mica	5%	350V	H
C176	4-29pF	Trimmer	-	-	H
C177	15-150pF	Air-spaced variable	-	-	H
C178	5pF	Silvered Mica	5%	350V	H
C179	0.1uF	Polycarbonate	20%	100V	H
C180/181	0.1uF	Polycarbonate	20%	100V	H
C182 & A	0.001uF	Silvered Mica	5%	350V	H
C183	0.1uF	Polycarbonate	20%	100V	H
C184	0.047uF	Polycarbonate	20%	100V	H
C185	500pF	Silvered Mica	5%	350V	H
C186	0.0018uF	Silvered Mica	5%	350V	H
C187	300pF	Silvered Mica	5%	350V	H
C188	0.0022uF	Silvered Mica	5%	200V	H
C189	200pF	Silvered Mica	5%	350V	H

* Adjusted on test.

Ref	Value	Type	Tolerance	Wkg. V.	Loc
C190	10uF	Tantalum	+50%-20%	25V	I
C191	0.0012uF	Silvered Mica	1%	350V	I
C192	0.1uF	Polycarbonate	20%	100V	I
C193	0.1uF	Polycarbonate	20%	100V	I
C194	10uF	Tantalum	+50%-20%	25V	I
C195	0.002uF	Silvered Mica	5%	350V	I
C196	10uF	Tantalum	+50%-20%	25V	I
C197	0.1uF	Polycarbonate	20%	100V	I
C198	0.001uF	Disk Ceramic	20%	500V	I
C199	0.1uF	Polycarbonate	20%	100V	I
C200/201	-	References not allocated	-	-	-
C202	0.1uF	Polycarbonate	20%	100V	I
C203	0.1uF	Polycarbonate	20%	100V	I
C204	0.1uF	Polycarbonate	20%	100V	I
C205	0.1uF	Polycarbonate	20%	100V	I
C206	0.1uF	Polycarbonate	20%	100V	I
C206A	200pF	Silvered Mica	2%	350V	I
C207	0.1uF	Polycarbonate	20%	100V	I
C208	3pF	Tubular Ceramic	0.5pF	200V	I
C209	3pF	Tubular Ceramic	0.5pF	200V	I
C210	10uF	Tantalum	+50%-20%	25V	I
C211	-	Reference not allocated	-	-	-
C212	10uF	Tantalum	+50%-20%	25V	I
C213	0.001uF	Tubular Ceramic	10%	750V	I
C214	100pF	Polystyrene	2%	125V	I
C215	-	Reference not allocated	-	-	-
C216	390pF	Polystyrene	5%	125V	I
C217	350pF	Silvered Mica	5%	350V	J
C218	250pF	Silvered Mica	5%	350V	J
C219	0.047uF	Polycarbonate	20%	100V	R
C220	0.047uF	Polycarbonate	20%	100V	J
C221	70pF	Tubular Ceramic	10%	750V	J
C222	300pF	Silvered Mica	5%	350V	J
C223	0.0044uF	Polystyrene	2%	30V	J
C224	400pF	Silvered Mica	5%	350V	J
C225	0.1uF	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	0.0044uF	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	0.0044uF	Polystyrene	2%	30V	J

Ref	Description		Part No.
	CHOKES		
CH1	47 microhenries	RF Assembly	7753P
CH2	10 microhenries	RF Assembly	7752P
CH3	10 microhenries	RF Assembly	7752P
CH4	47 microhenries	RF Assembly	7753P
CH5	4.7 millihenries	935kHz Loop Module	7472P
CH6	4.7 millihenries	935kHz Loop Module	7472P
CH7	4.7 millihenries	935kHz Loop Module	7472P
CH8	4.7 millihenries	935kHz Loop Module	7472P
CH9	1 millihenry	Master Oscillator Unit	7754P
CH10	4.7 millihenries	Master Oscillator Unit	7472P
CH11	100 millihenries	Master Oscillator Unit	7350P
CH12	68 millihenries	Master Oscillator Unit	7759P
CH13	27.5 microhenries	Master Oscillator Unit	D2413
CH15	1 millihenry	250kHz IF Module	7754P
CH15A	560 microhenries	250kHz IF Module	8042P
CH16	4.7 millihenries	250kHz IF Module	7472P
CH17	330 microhenries	250kHz IF Module	8400P
CH17A	220 microhenries	250kHz IF Module	8401P
CH18	68 millihenries	100kHz IF Amp. Module	7759P
CH19	68 millihenries	100kHz IF Amp. Module	7759P
CH20	68 millihenries	100kHz IF Amp. Module	7759P
CH21	68 millihenries	100kHz IF Amp. Module	7759P
CH22	100 millihenries	100kHz IF Amp. Module	7350P
CH23	100 millihenries	100kHz IF Amp. Module	7350P
CH24	4.7 millihenries	100kHz IF Amp. Module	7472P
CH25	68 millihenries	100kHz IF Amp. Module	7759P
CH26	1 millihenry	100kHz IF Amp. Module	7754P
CH27	100 millihenries	100kHz IF Amp. Module	7350P
CH28	1 millihenry	CW Detector & BFO Unit	7754P
CH31	100 millihenries	CW Detector & BFO Unit	7350P
CH32	100 millihenries	FSK Module	7350P
CH33	3 microhenries	Mains Input Filter	D2854/1
CH34	3 microhenries	Mains Input Filter	D2854/1
CH35	100 microhenries	Inc. Osc. Unit	7760P
CH36	4.7 millihenries	100kHz IF Filter	7472P
CH41	68 millihenries	10kHz Calibrator Unit	7759P
CH42	1 millihenry	10kHz Calibrator Unit	7754P
CH43	560 microhenries	10kHz Calibrator Unit	8042P
CH44	100 millihenries	10kHz Calibrator Unit	7350P
	NB: Refs CH14, 29, 30 & 37-40 not allocated.		
	TRANSFORMERS		
T1	600/75Ω Balun Transformer		D3850
T2	600-ohm Line Output Transformer		7524P
T3	Audio Driver Transformer (3-ohm Channel)		7523P
T4	3-ohm Output Transformer		7553P
T5	Power Transformer		7600P

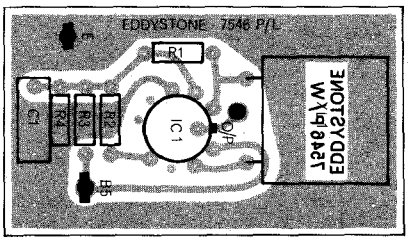
Ref	Description	Part No.
	BULBS AND FUSES	
LP1-3	Standard L.E.S. 6V, 60mA. (legend lamps)	6659P
LP4-5	Projection Bulb (6V, 0.2A)	8542P
FS1	Standard 5/8" x 3/16" glass cartridge rated at 2A	6704P
FS2	Standard 5/8" x 3/16" glass cartridge rated at 1A	7173P
-	Fuseholder	6372P
-	Lampholder (L.E.S.)	6600P
-	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
	Light Unit - Incremental (complete assembly)	D3975/1
	Lens Block (Incremental Display)	D3973
	Lens Block (Main Display)	D3974
	Calibration Disk (Incremental Display)	7483/1P
	Calibration Disk (Main Display)	8475P
	MISCELLANEOUS	
	Panel Handles	6553P
	Meter (50-0-50uA with special scaling)	7489P
	Panel Speaker	6101P
	Grille for Panel Speaker	6976P
	Dial Escutcheon	7397PA
	Finger Plate	8477P
	Panel Fixing Screws : 40A-336. Washers :	5310P
	Flexible Coupler (Huco)	7327P
	Module Box (as used for Tunable IF etc.)	7521P
	Screwdriver	7612P
	Trimming Tool (Neosid Type T.T.1.)	7780P
	Disk Insertion Tool	7857P
	Flexible Coupler (Eddystone)	LP3310

APPENDIX 'F'

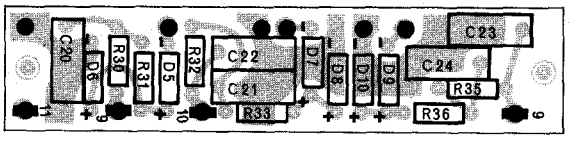
PRINTED CIRCUIT BOARD PATTERNS AND LEGENDS

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 7564P 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.

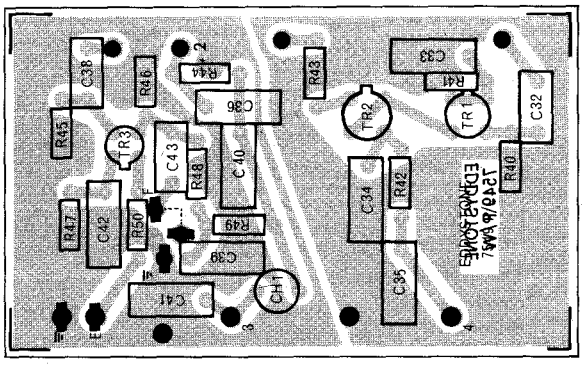
RF ASSEMBLY BOARDS



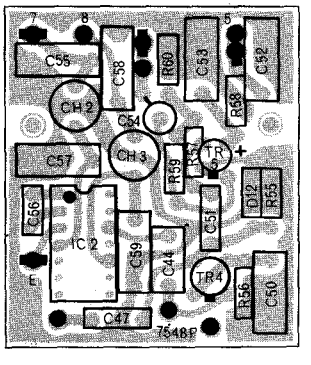
Board No. 1. CRYSTAL CALIBRATOR



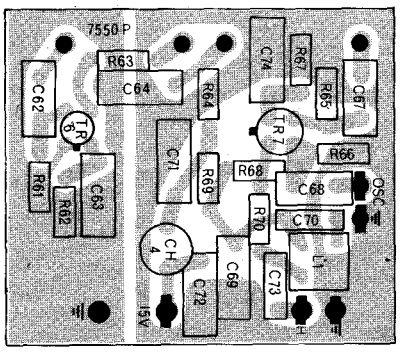
Board No. 2. PEAK-RF



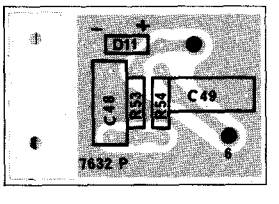
Board No. 3. RF AMPLIFIER



Board No. 4. MAIN-TUNE OSC.

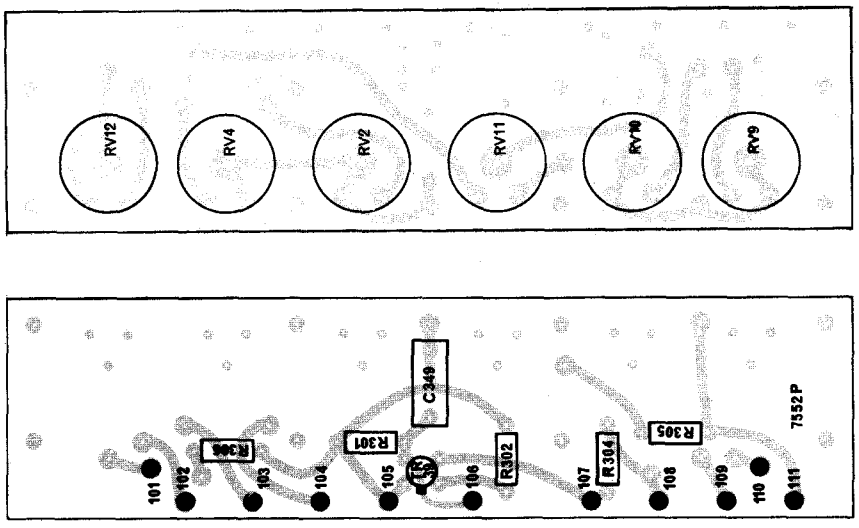


Board No. 5. HARMONIC AMPLIFIER

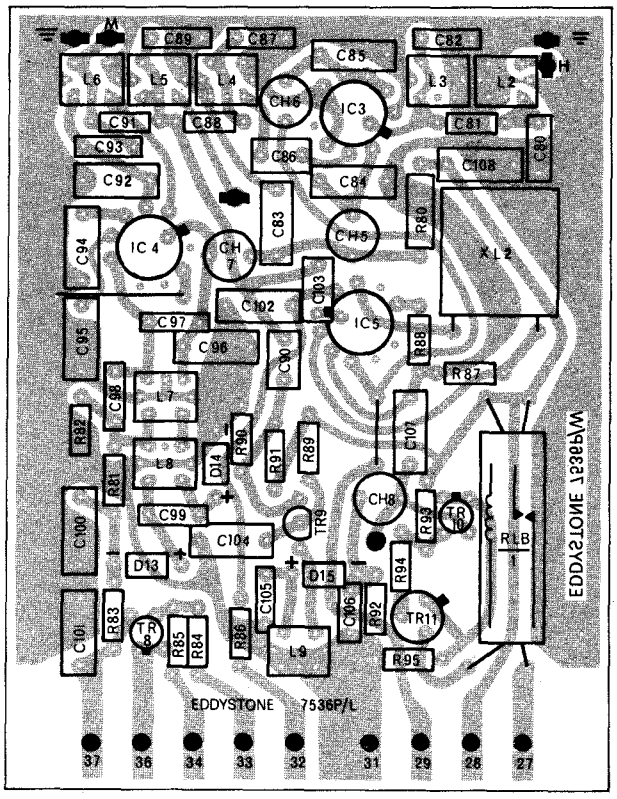


Board No. 6. MAIN-TUNE OSC. AFC

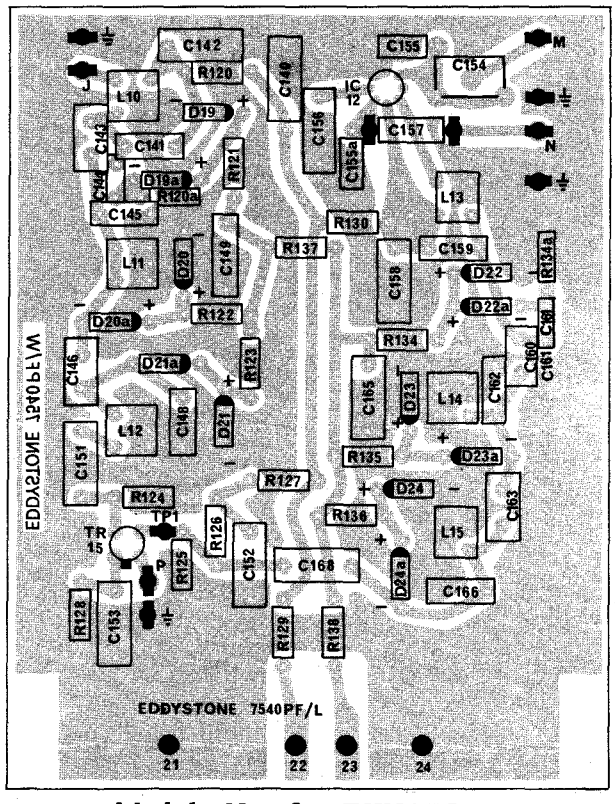
Printed Board No. 7. METER BOARD (Double-sided)



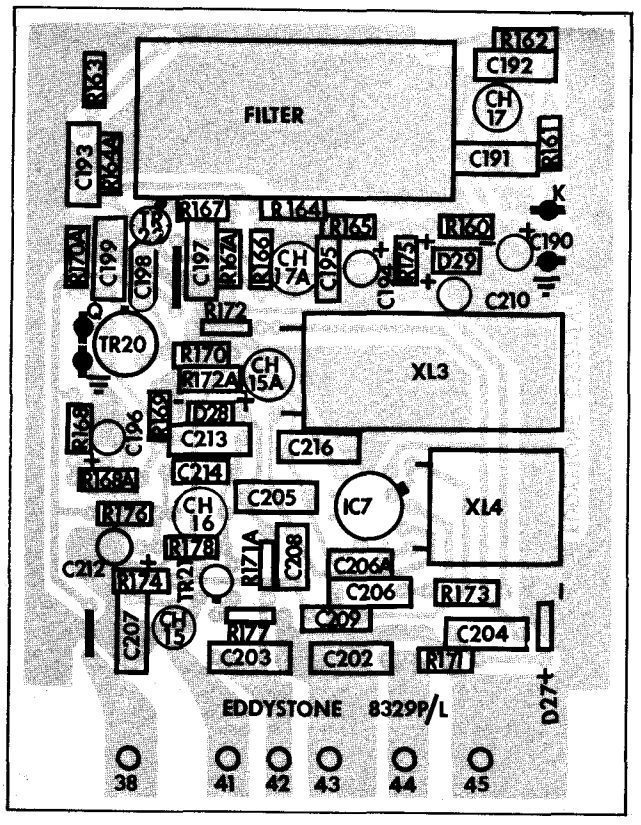
MODULE BOARDS



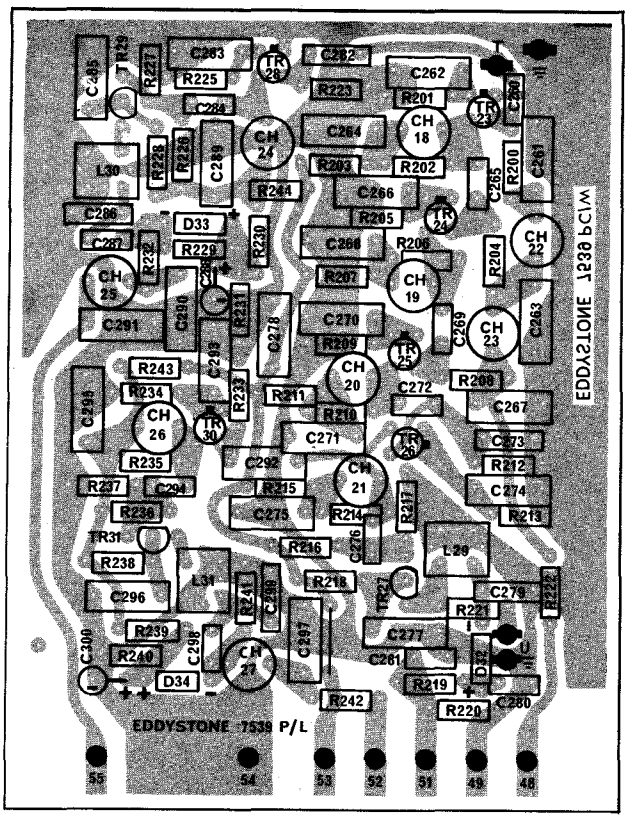
Module No. 1. 935kHz LOOP AMPLIFIER



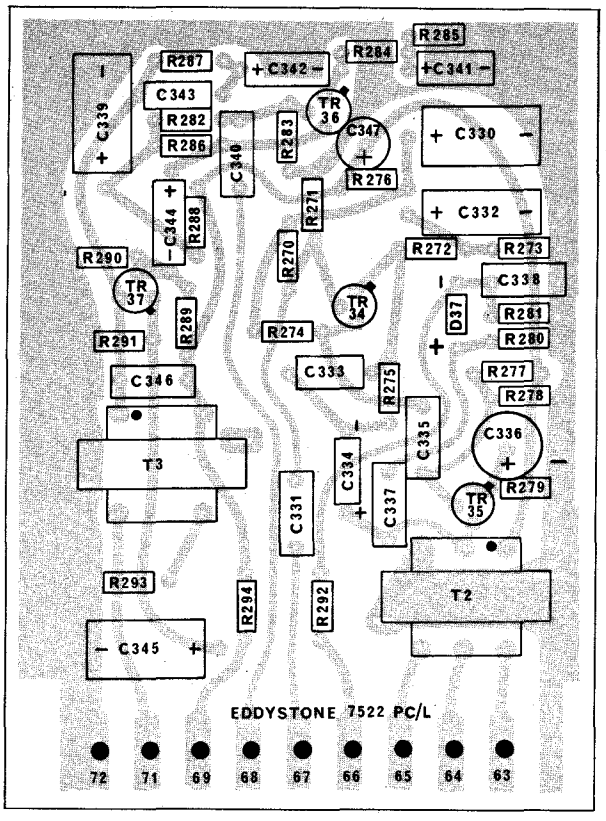
Module No. 2. TUNABLE IF



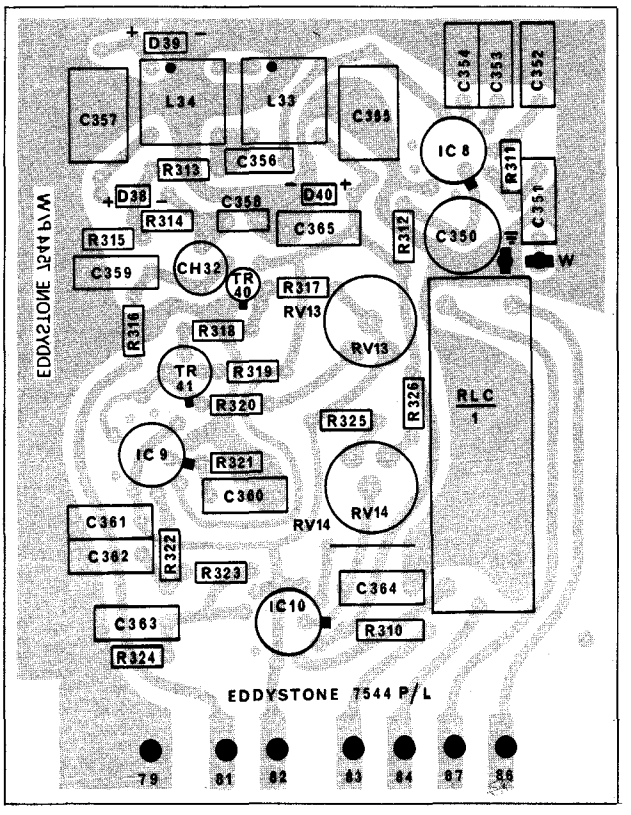
Module No. 3. 250kHz IF



Module No. 4. 100kHz IF AMPLIFIER



Module No. 5. AUDIO AMPLIFIERS



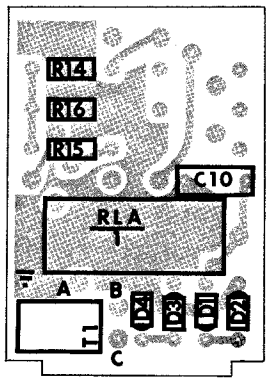
Module No. 6. FSK (Optional)

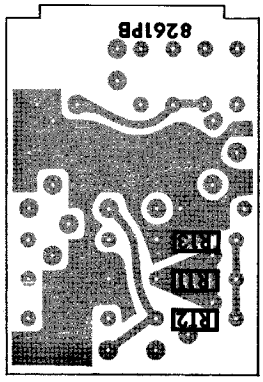
UNIT BOARDS

* 1. AERIAL ATTENUATOR UNIT
2. MASTER OSCILLATOR UNIT
* 3. INCREMENTAL OSCILLATOR UNIT
4. 100kHz IF FILTER UNIT
5. CW/SSB DETECTOR & BFO UNIT

* Double-sided boards

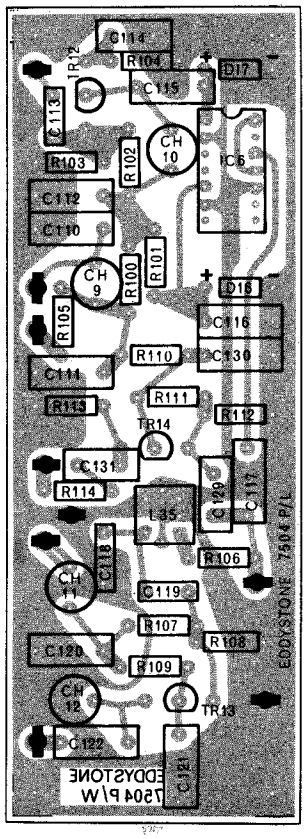
①



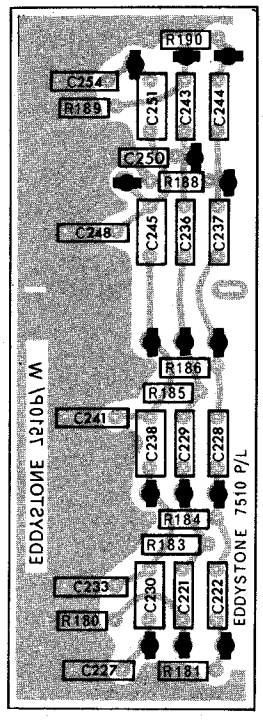


D1-D4 replaced by PC1 (8 diodes).

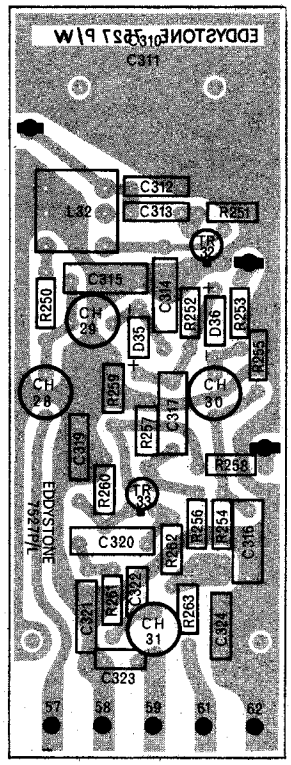
②



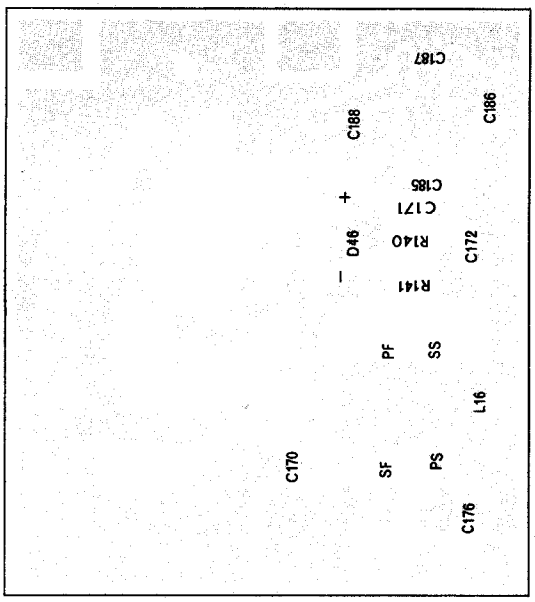
④

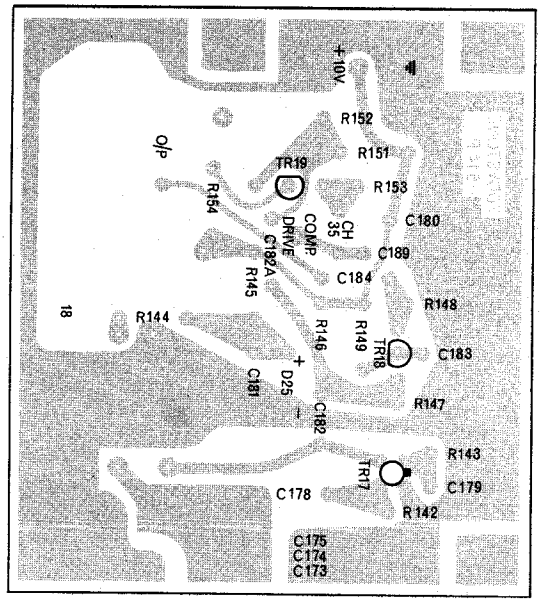


⑤



③

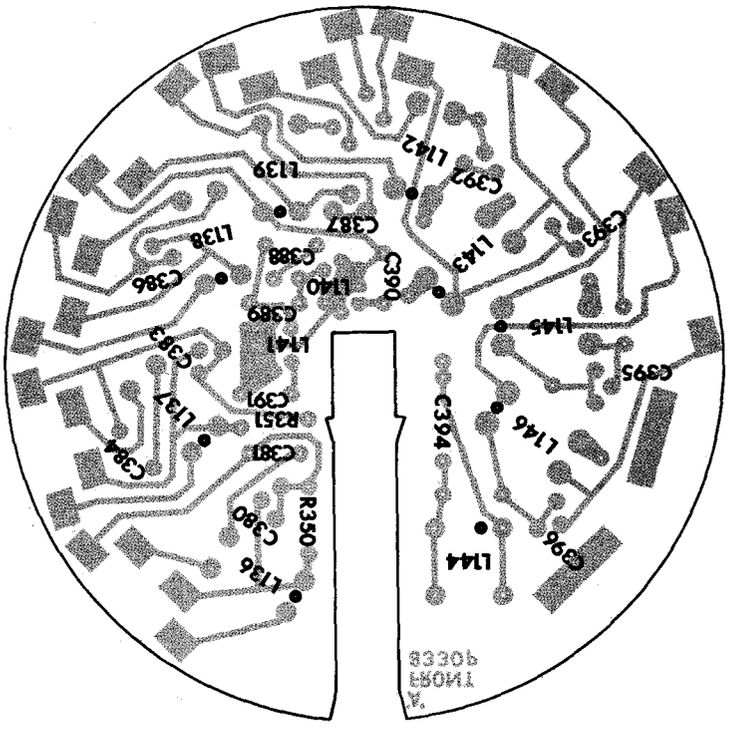




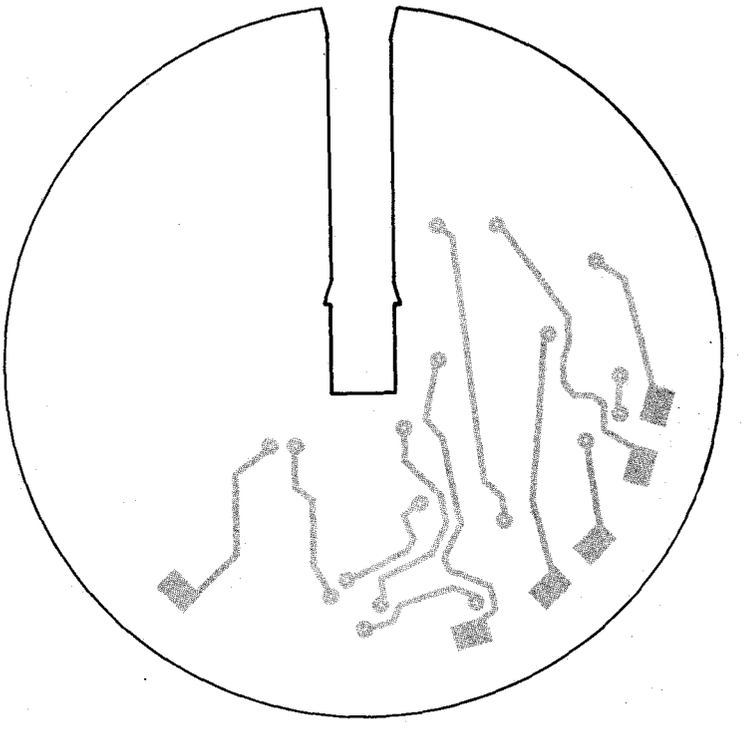
TURRET DISKS

DISK 'A'. AERIAL

REAR

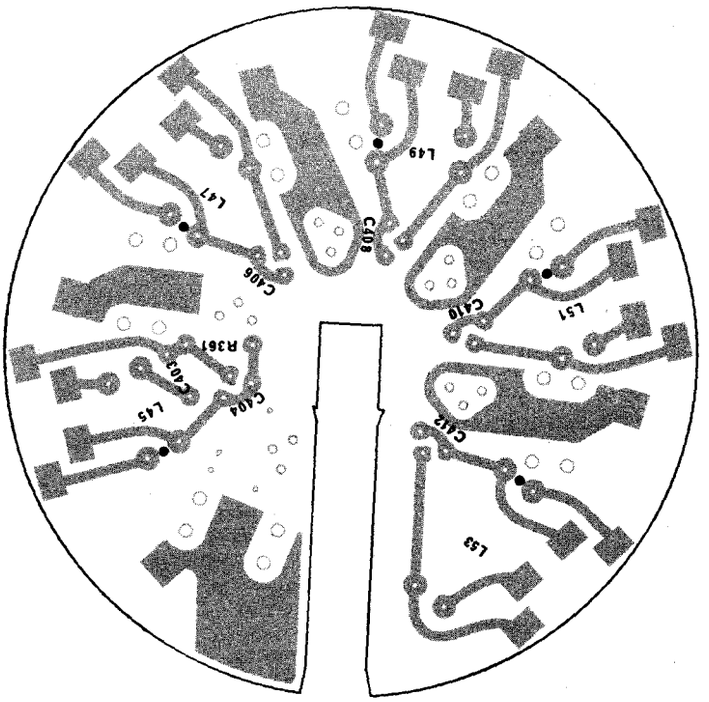


FRONT

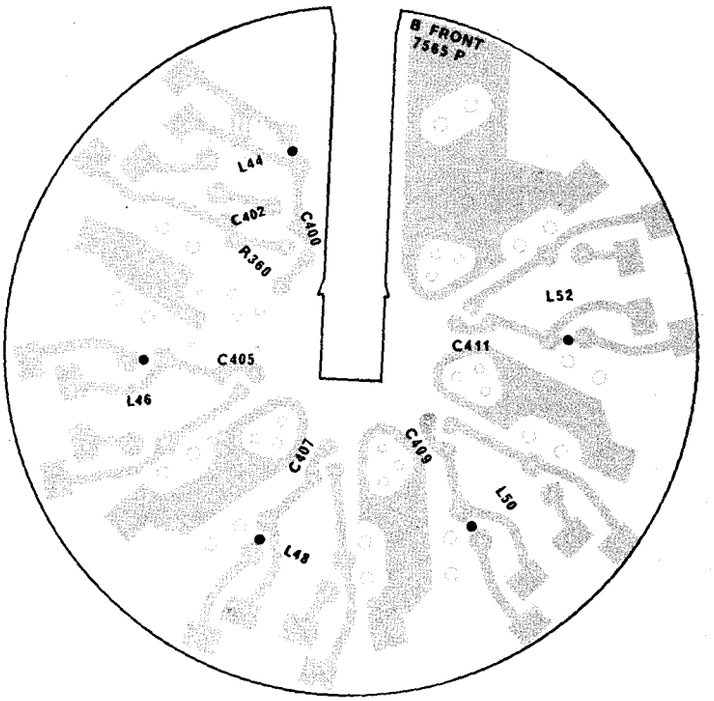


DISK 'B' RF

REAR



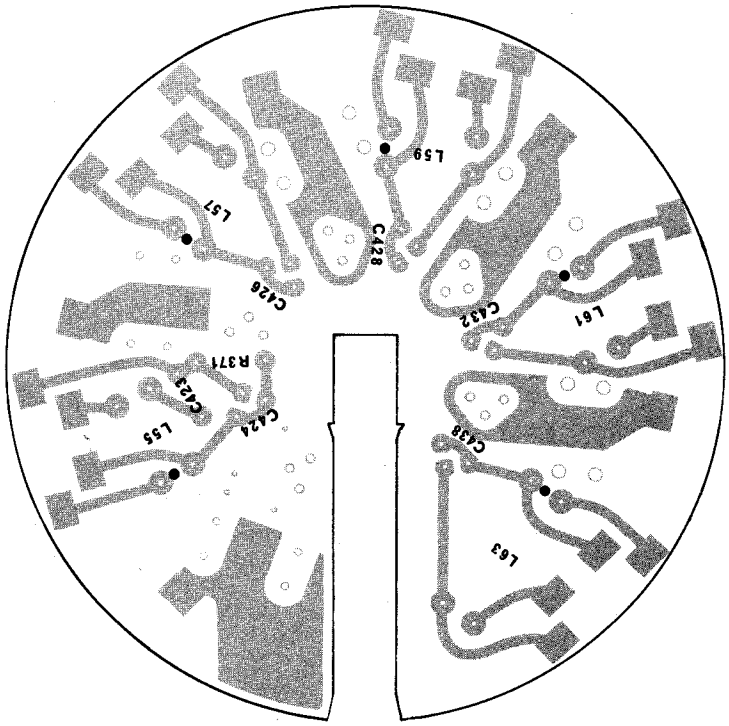
FRONT



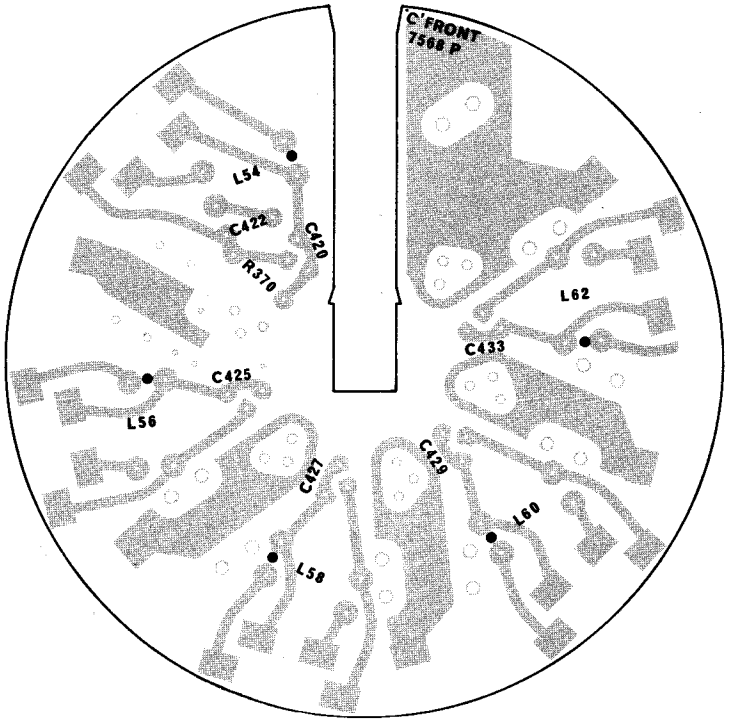
XL

DISK 'C' SIGNAL MIXER

REAR

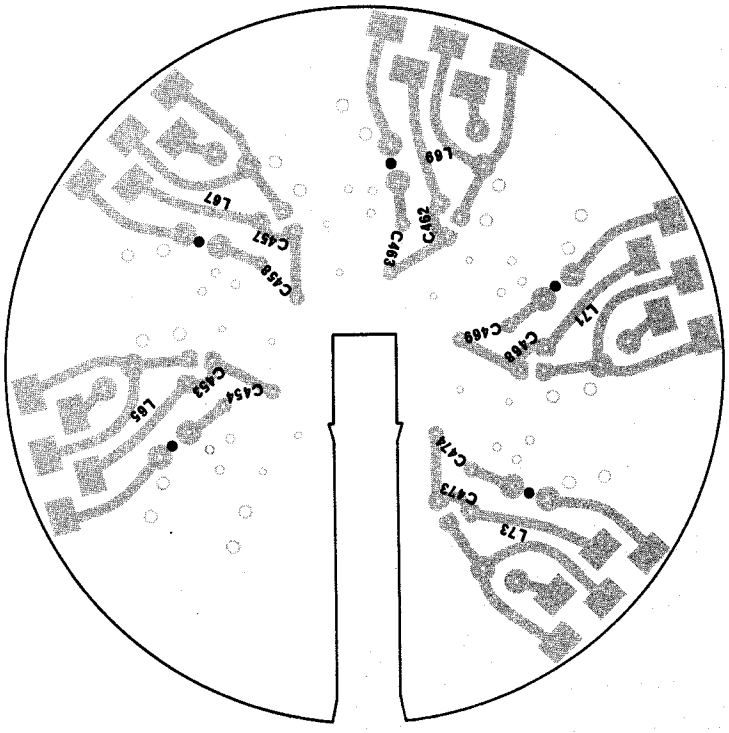


FRONT

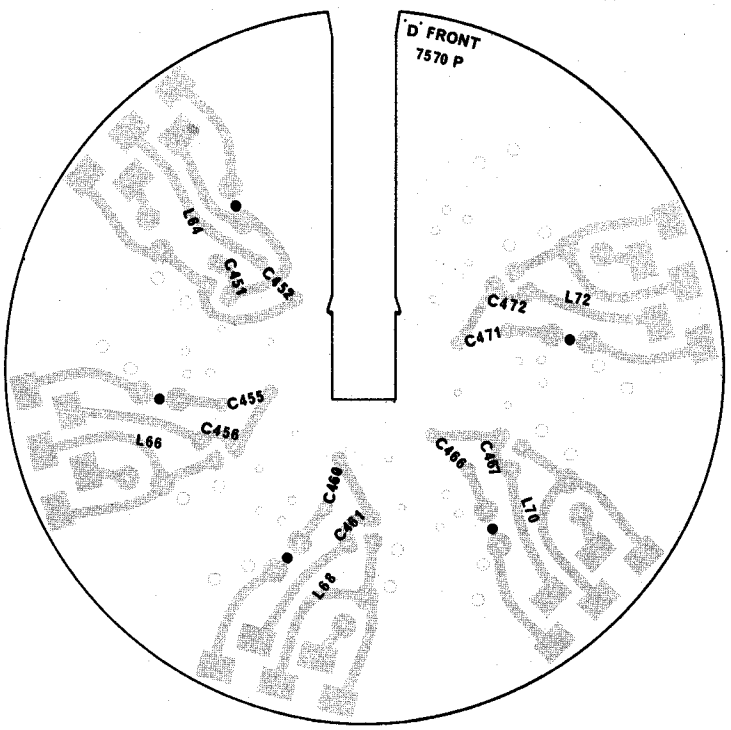


DISK 'D' MAIN-TUNE OSCILLATOR

REAR

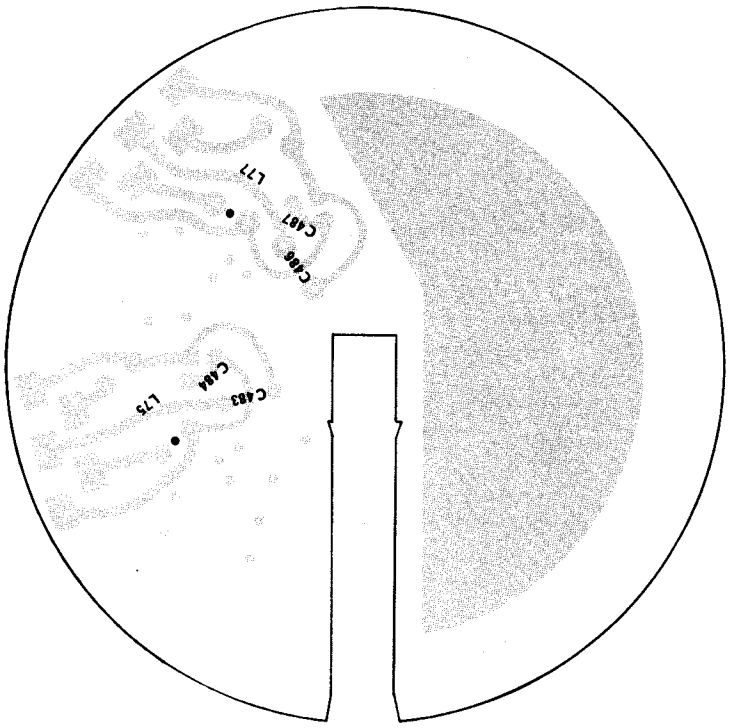


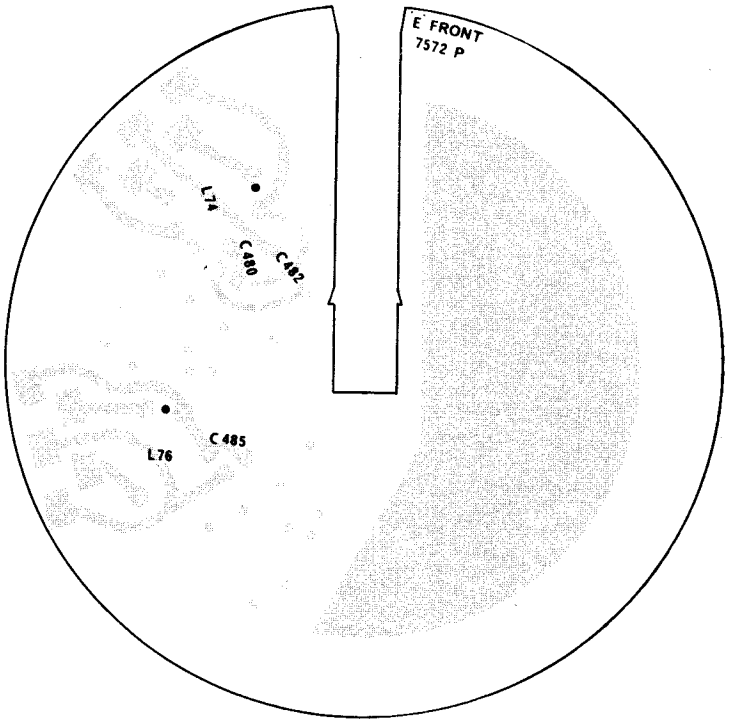
FRONT



DISK 'E' LOOP MIXER

REAR

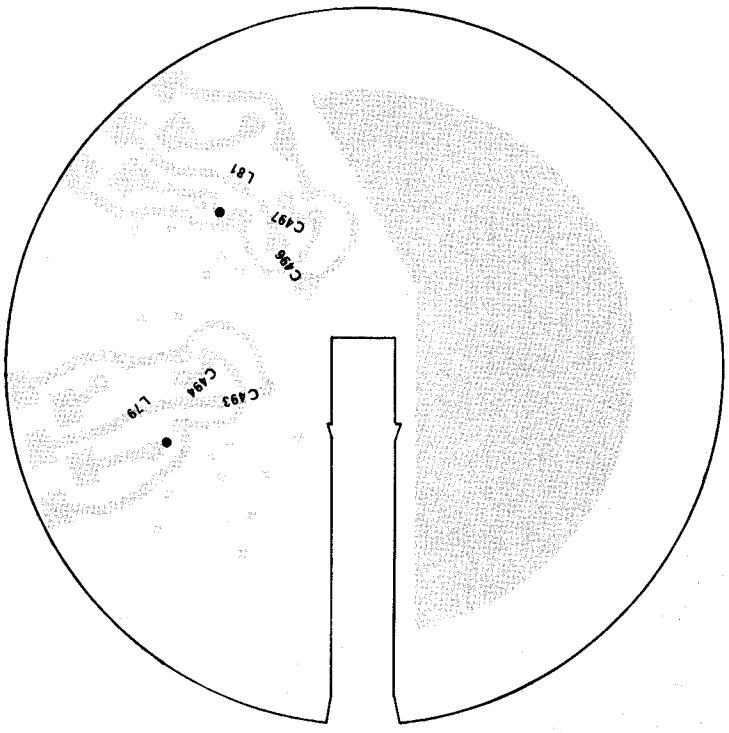




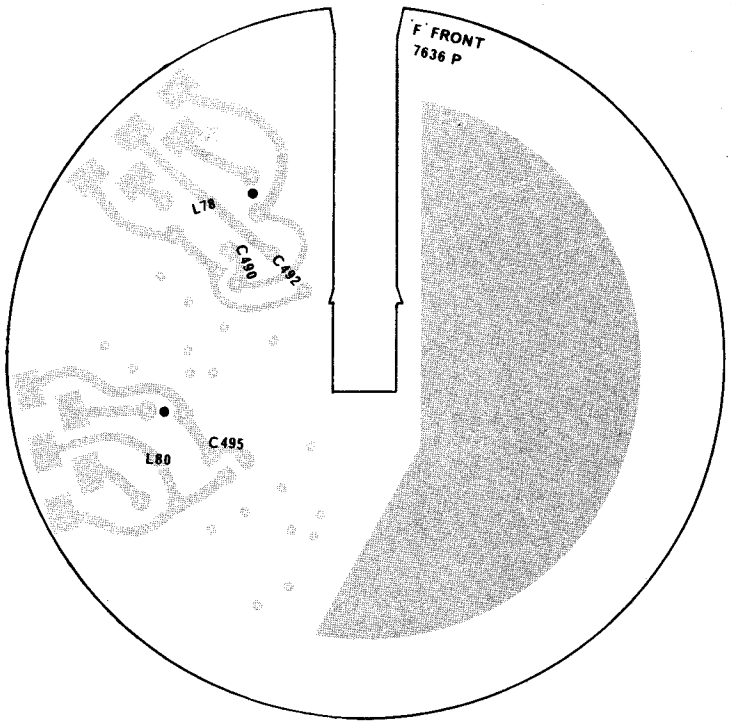
FRONT

DISK 'F' HARMONIC AMPLIFIER

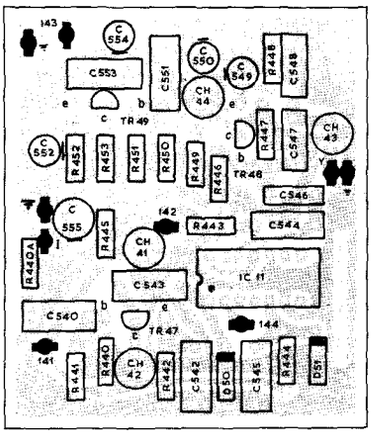
REAR



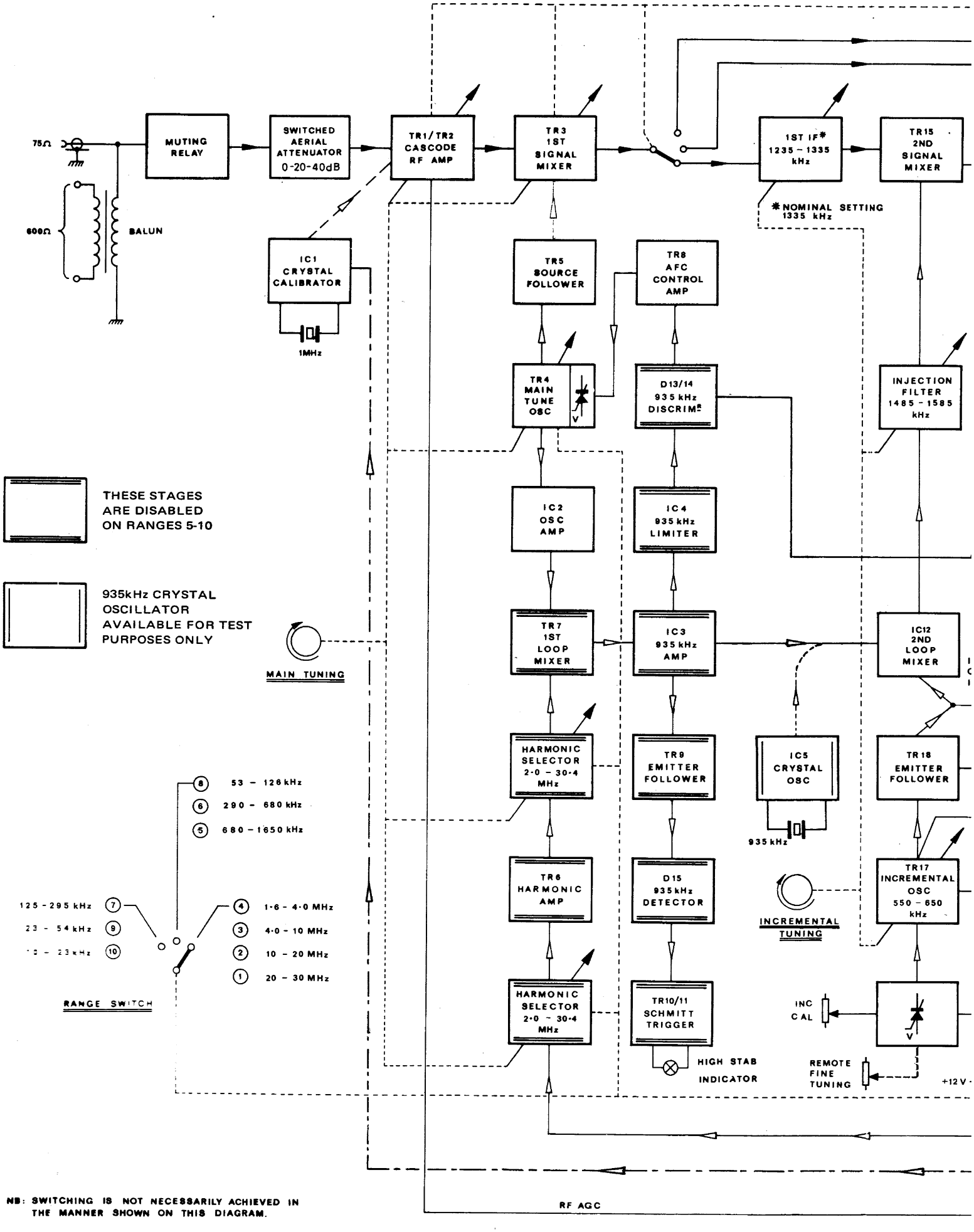
FRONT



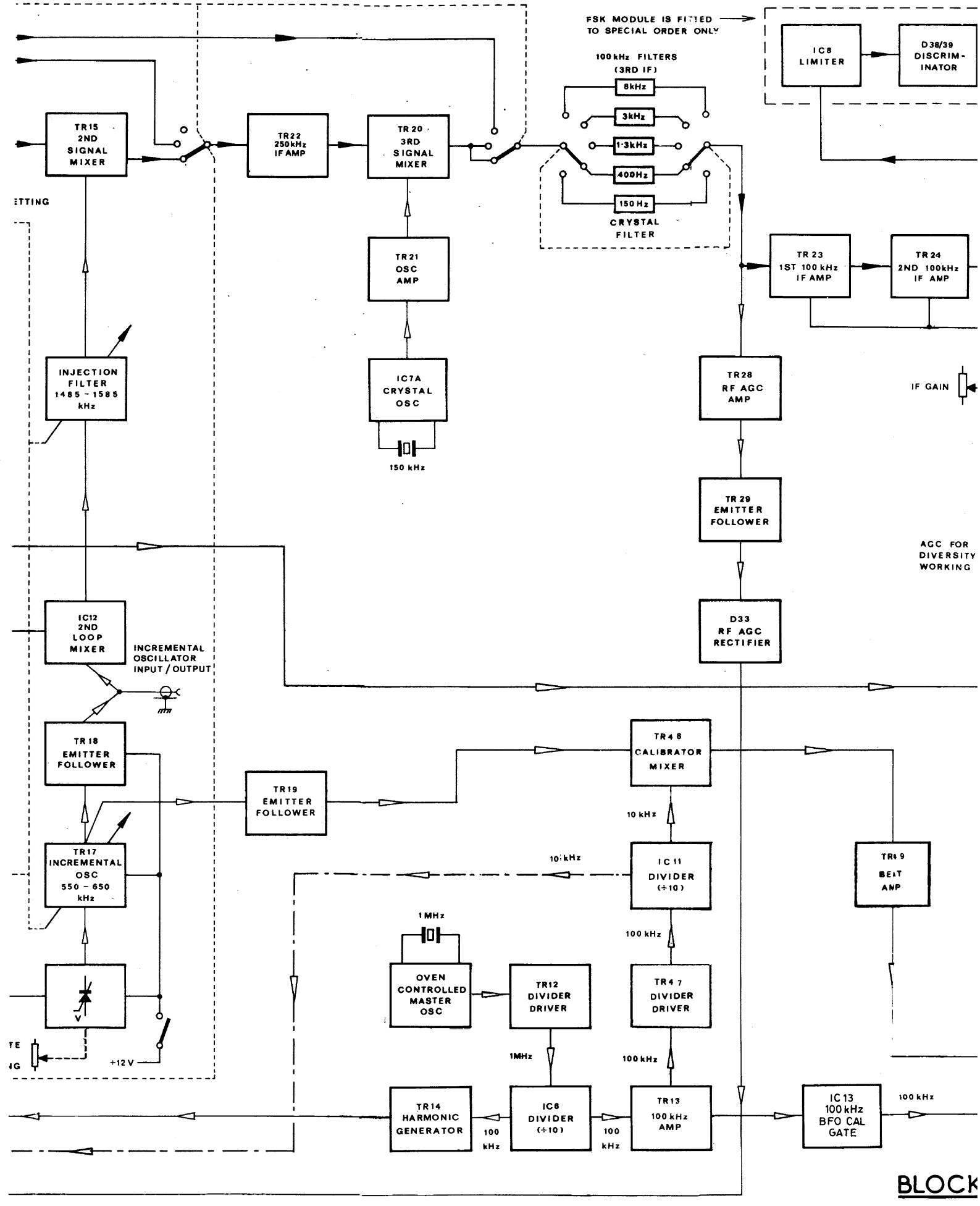
10kHz CALIBRATOR UNIT



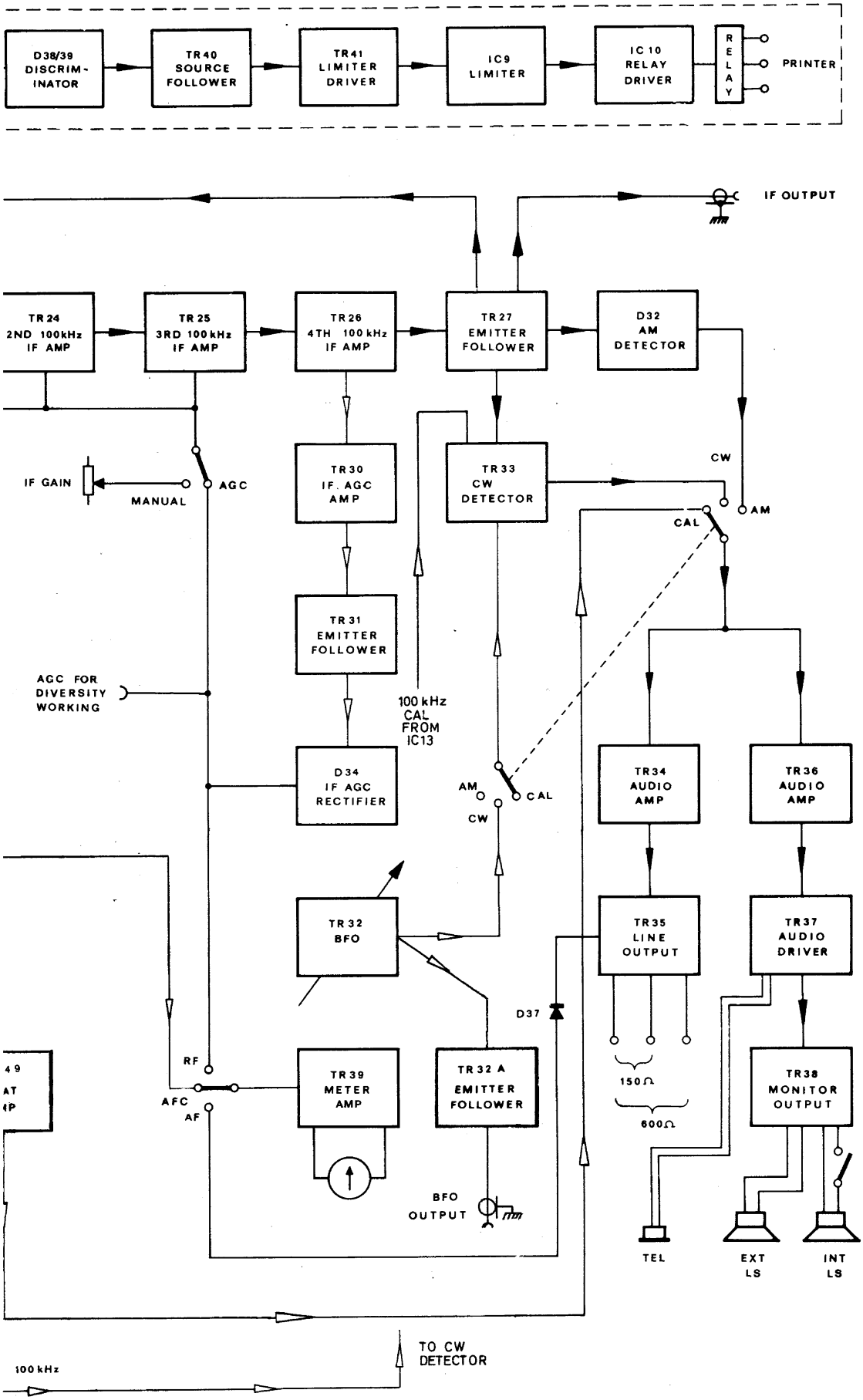
In the introductory notes on page XXXV,
7564P should read:- 8330P



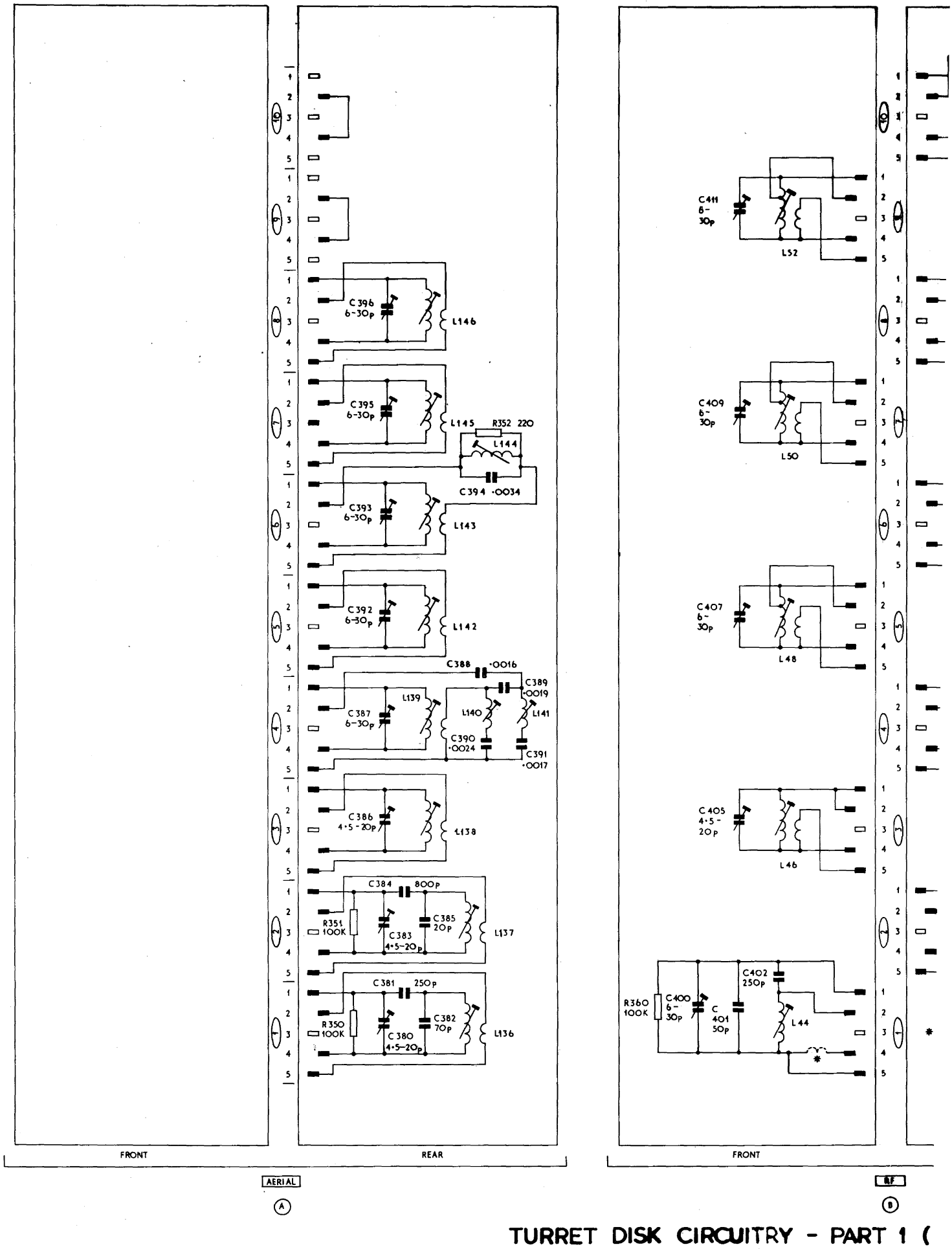
NB: SWITCHING IS NOT NECESSARILY ACHIEVED IN THE MANNER SHOWN ON THIS DIAGRAM.


FSK MODULE IS FITTED TO SPECIAL ORDER ONLY
IC8 LIMITER
D38/39 DISCRIM-INATOR
100kHz FILTERS (3RD IF)
8kHz
3kHz
1·3kHz
400Hz
150 Hz
CRYSTAL FILTER
TR15 2ND SIGNAL MIXER
TR22 250kHz IF AMP
TR20 3RD SIGNAL MIXER
TR21 OSC AMP
IC7A CRYSTAL OSC
150 kHz
TR23 1ST 100 kHz IF AMP
TR24 2ND 100kHz IF AMP
IF GAIN
TR28 RF AGC AMP
TR29 EMITTER FOLLOWER
D33 RF AGC RECTIFIER
AGC FOR DIVERSITY WORKING
INJECTION FILTER 1485 - 1585 kHz
IC12 2ND LOOP MIXER
INCREMENTAL OSCILLATOR INPUT / OUTPUT
TR18 EMITTER FOLLOWER
TR19 EMITTER FOLLOWER
TR48 CALIBRATOR MIXER
10 kHz
TR17 INCREMENTAL OSC 550 - 650 kHz
10 kHz
IC11 DIVIDER (÷10)
TR49 BEAT AMP
1MHz
100 kHz
OVEN CONTROLLED MASTER OSC
TR12 DIVIDER DRIVER
TR47 DIVIDER DRIVER
V
+12 V
1MHz
100 kHz
TR14 HARMONIC GENERATOR
100 kHz
IC6 DIVIDER (÷10)
100 kHz
TR13 100 kHz AMP
IC13 100 kHz BFO CAL GATE
100 kHz

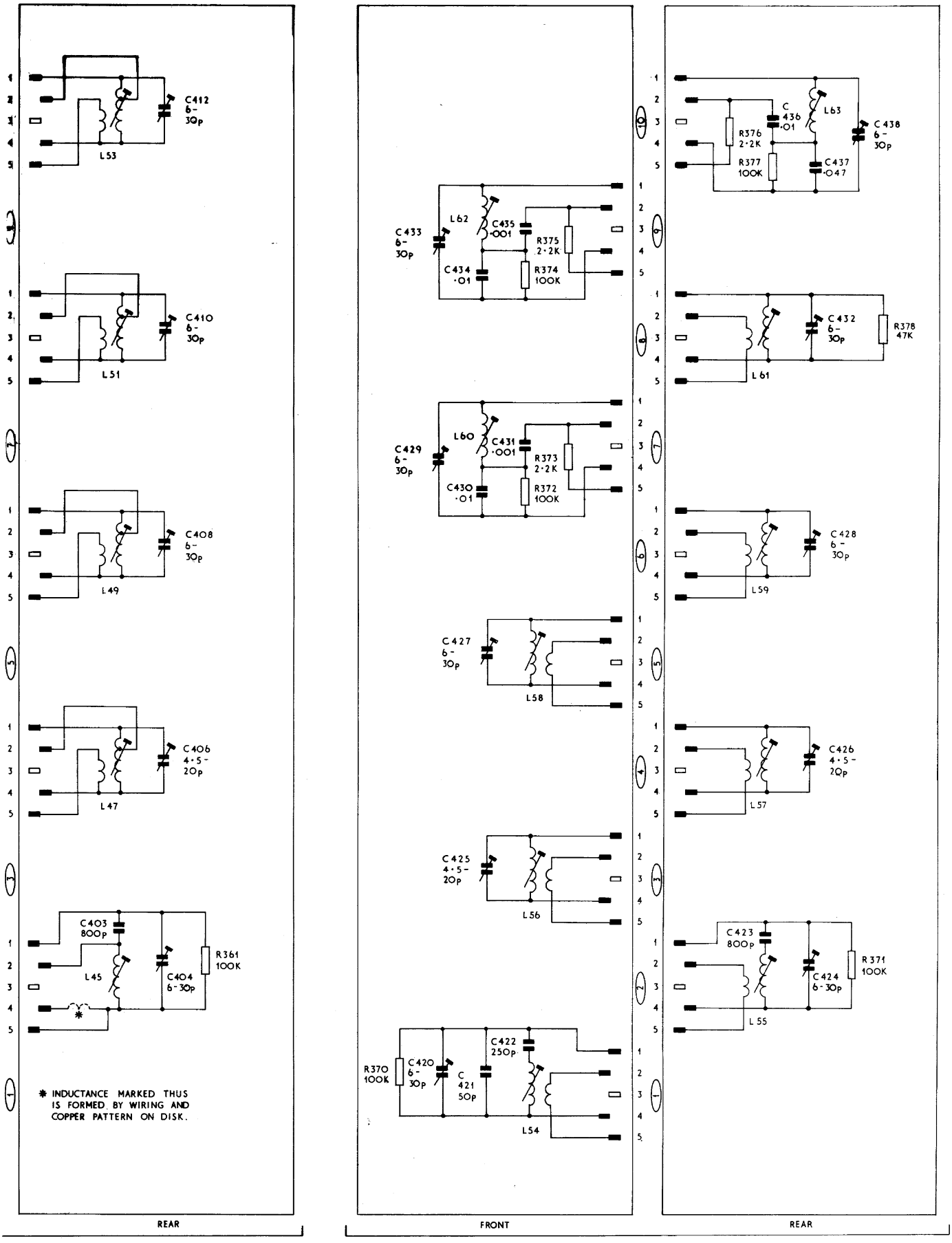
BLOCK



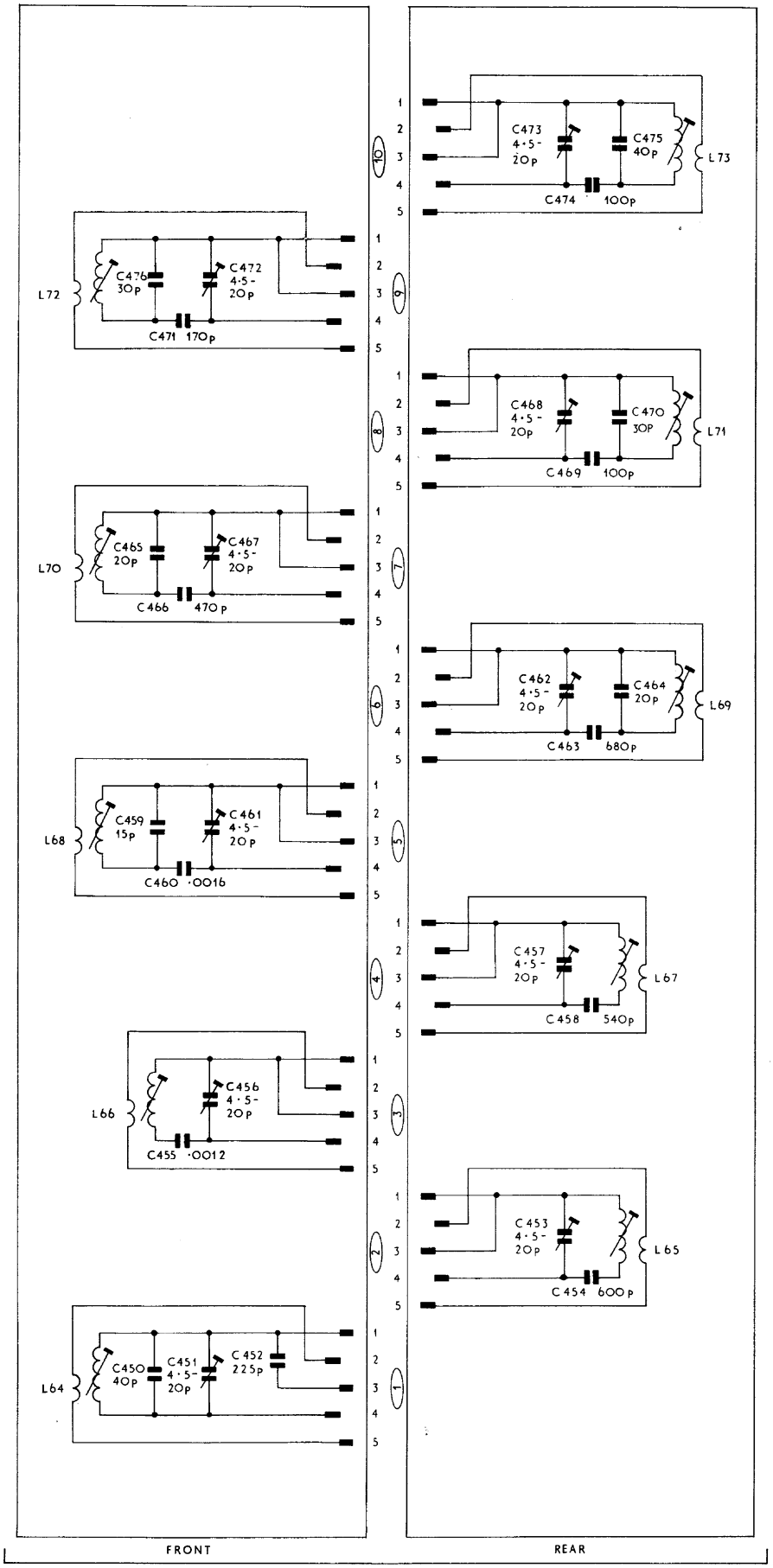
BLOCK DIAGRAM MODEL EC958/3 BP1294

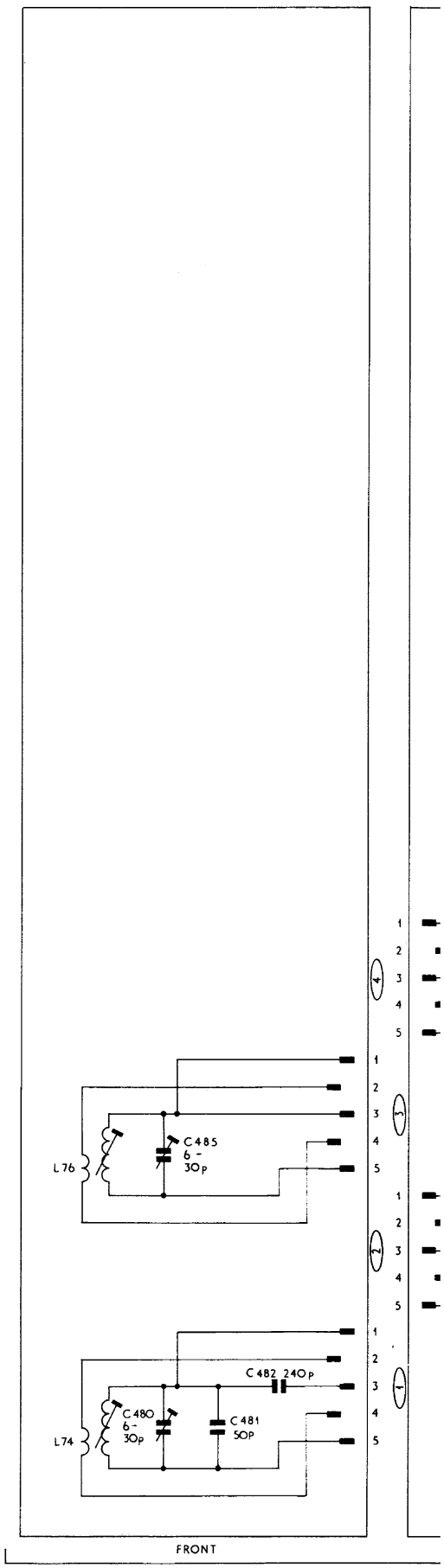


TURRET DISK CIRCUITRY - PART 1 (



1 (DISKS "A","B" & "C") EC958/3

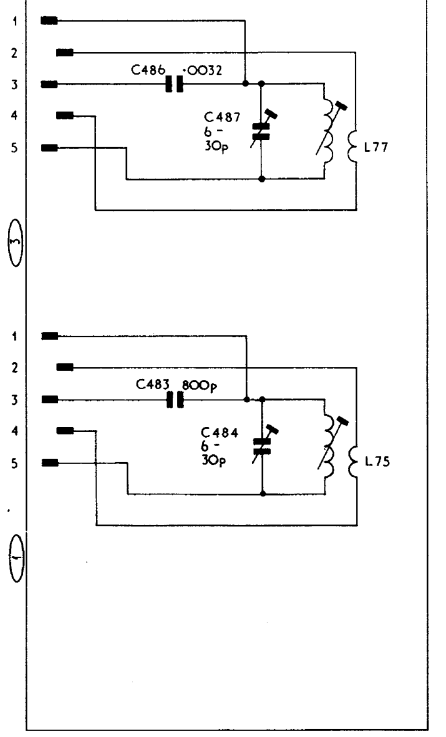


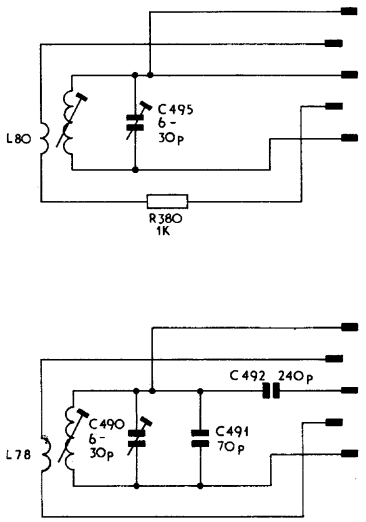


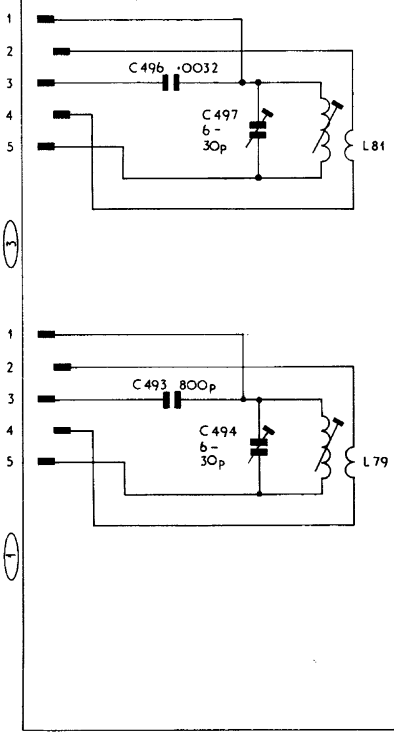
TURRET DISK CIRCUITRY - PART 2 (

REVISIONS

C475 : : 50pF
C491 : : 50pF







REAR

FRONT

REAR

MIXER

HARMONIC AMP

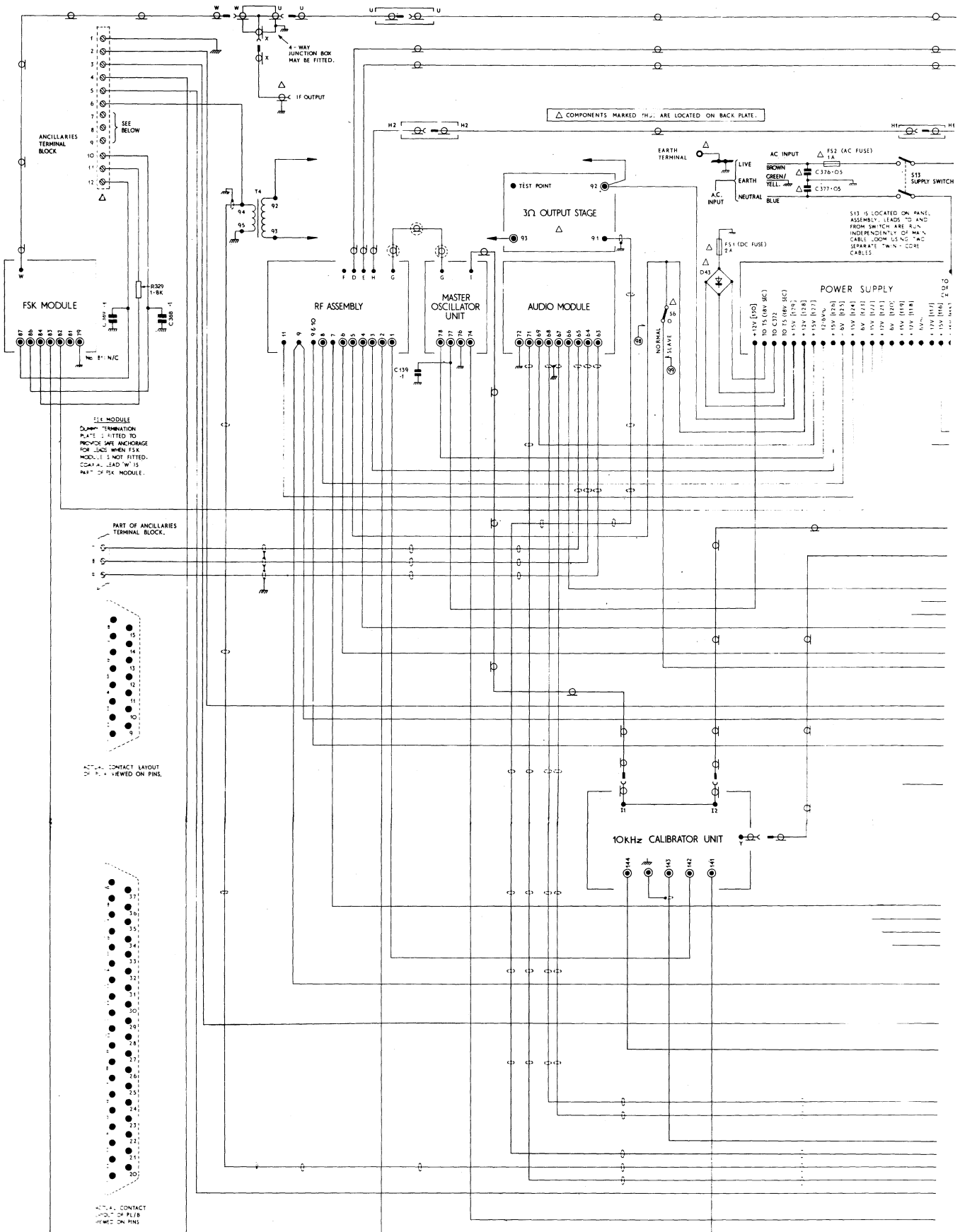
(E)

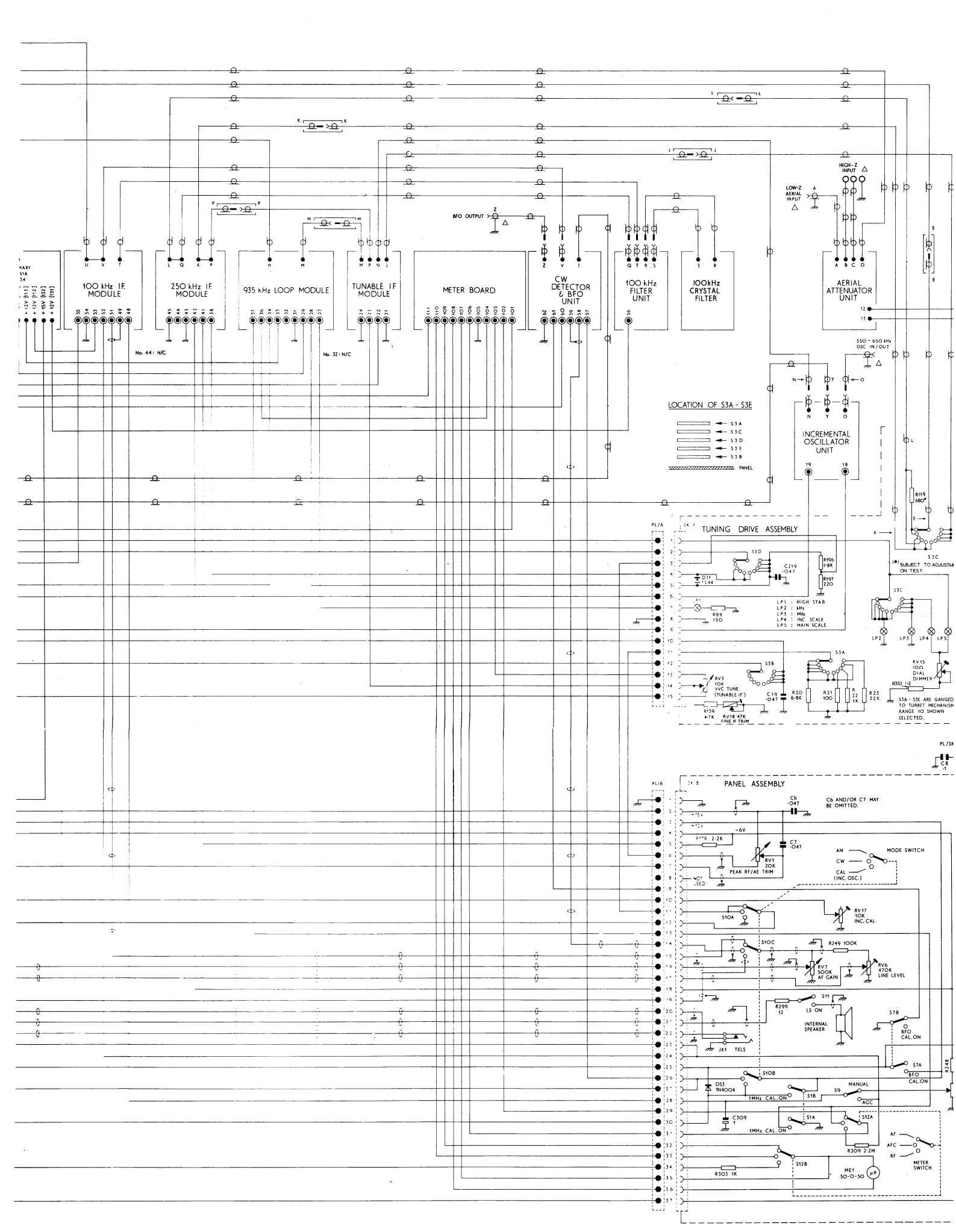
(F)

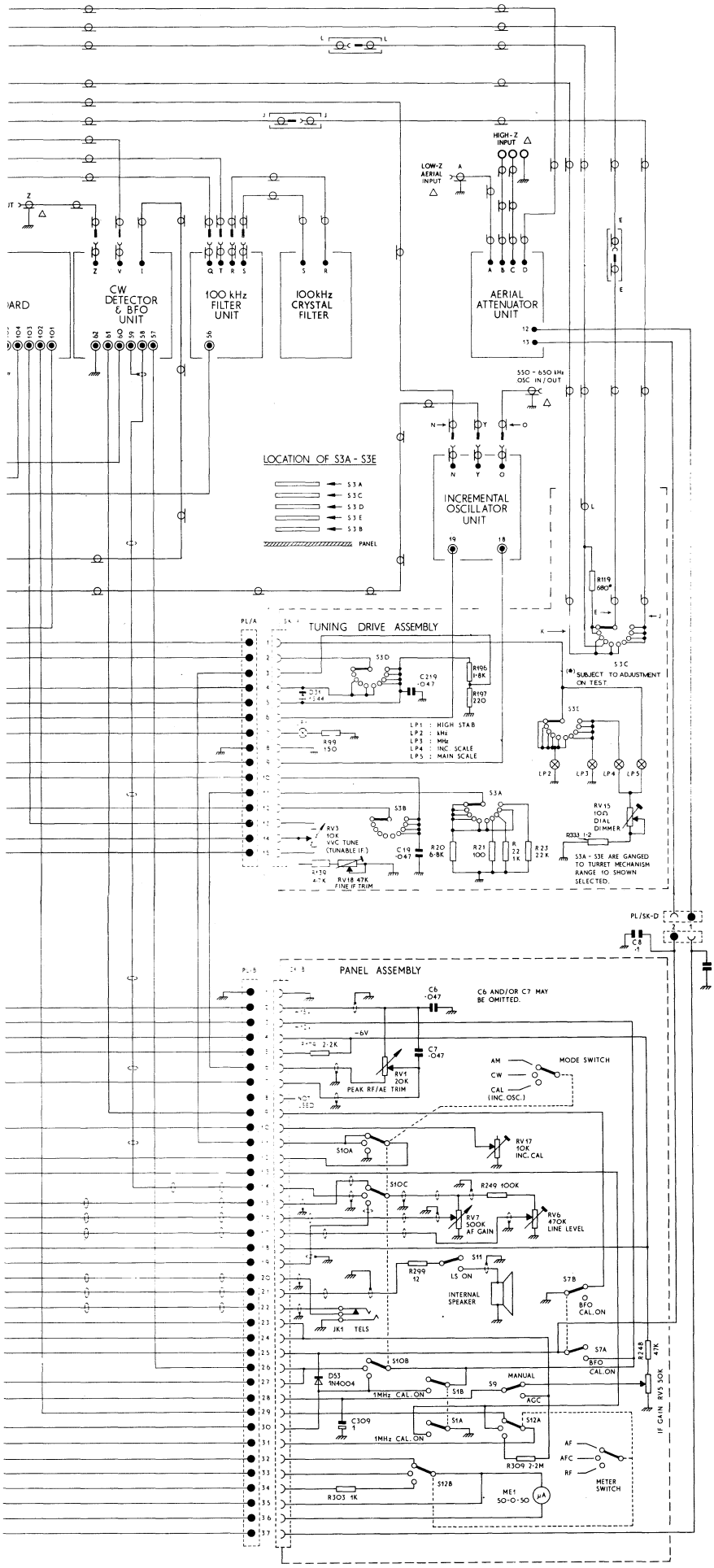
2 (DISKS "D","E" & "F")

EC 958

BP 1240 ISSUE 2

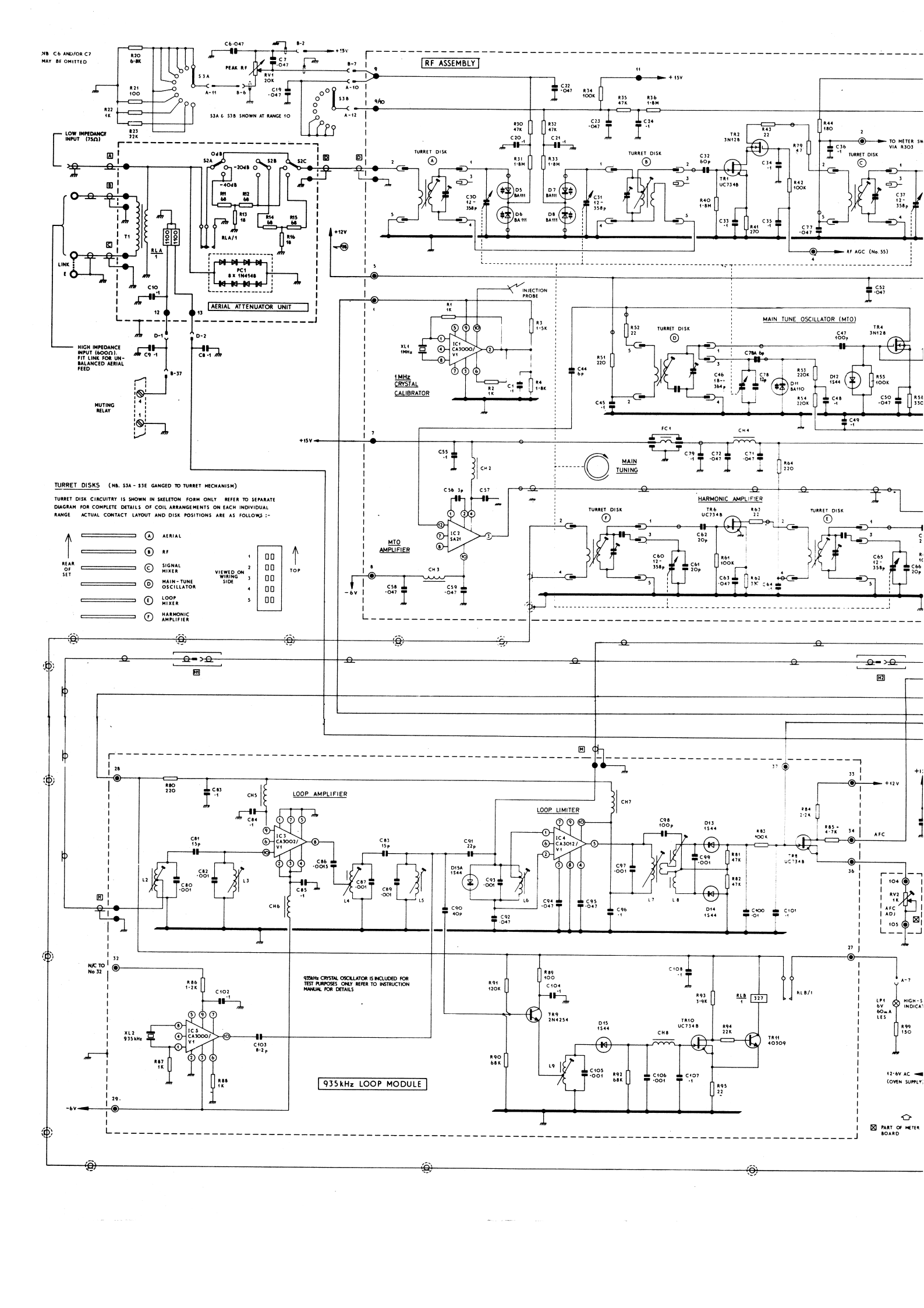

4 - WAY JUNCTION BOX MAY BE FITTED.
IF OUTPUT
ANCILLARIES TERMINAL BLOCK
SEE BELOW
△ COMPONENTS MARKED THUS △ ARE LOCATED ON BACK PLATE.
EARTH TERMINAL
AC INPUT
FS2 (AC FUSE) 1A
LIVE
BROWN
GREEN/ YELL.
EARTH
NEUTRAL
BLUE
C376·05
C377·05
S13 SUPPLY SWITCH
A.C. INPUT
S13 IS LOCATED ON PANEL ASSEMBLY. LEADS TO AND FROM SWITCH ARE RUN INDEPENDENTLY OF MAIN CABLE LOOM USING TWO SEPARATE TWIN - CORE CABLES
TEST POINT
3Ω OUTPUT STAGE
FS1 (DC FUSE) 2A
D43
POWER SUPPLY
FSK MODULE
R329 1·8K
C 369 -1
C 368 -1
NO. 8 : N/C
FSK MODULE
DUMMY TERMINATION PLATE IS FITTED TO PROVIDE SAFE ANCHORAGE FOR LEADS WHEN FSK MODULE IS NOT FITTED. COAXIAL LEAD 'W' IS PART OF FSK MODULE.
RF ASSEMBLY
MASTER OSCILLATOR UNIT
AUDIO MODULE
C 139 -1
NORMAL
SLAVE
PART OF ANCILLARIES TERMINAL BLOCK.
ACTUAL CONTACT LAYOUT OF PL/A VIEWED ON PINS.
ACTUAL CONTACT LAYOUT OF PL/B VIEWED ON PINS.
10KHz CALIBRATOR UNIT

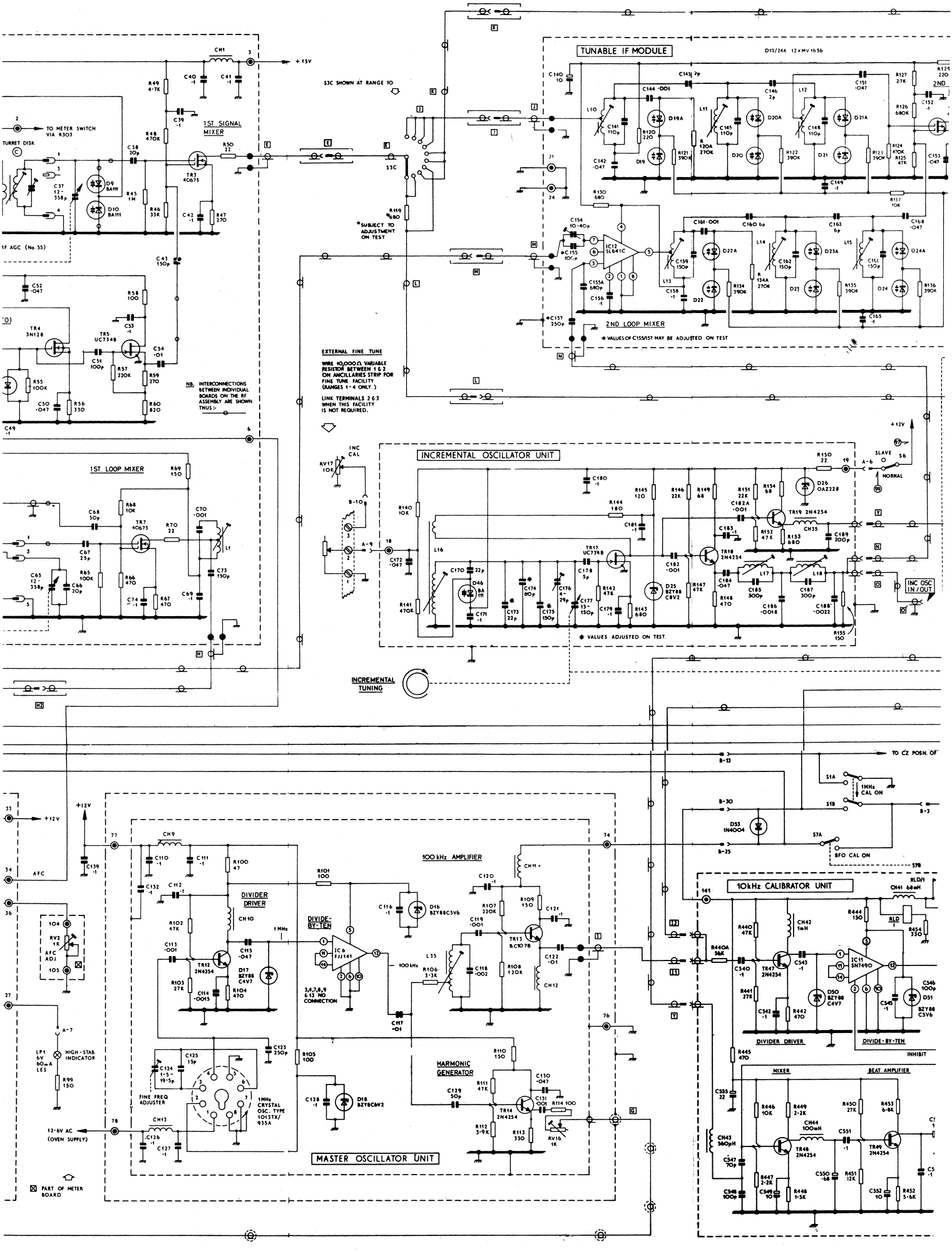

100 kHz I.F. MODULE
250 kHz I.F. MODULE
935 kHz LOOP MODULE
TUNABLE I.F. MODULE
METER BOARD
CW DETECTOR & BFO UNIT
100 kHz FILTER UNIT
100kHz CRYSTAL FILTER
AERIAL ATTENUATOR UNIT
INCREMENTAL OSCILLATOR UNIT
BFO OUTPUT
HIGH-Z INPUT
LOW-Z AERIAL INPUT
550 - 650 kHz OSC IN/OUT
No. 44 : N/C
No. 32 : N/C
LOCATION OF S3A - S3E
S3A
S3C
S3D
S3E
S3B
PANEL
TUNING DRIVE ASSEMBLY
PL/A
SK A
S3D
D31 1S44
C219 .047
R196 1·8K
R197 220
R99 150
LP1 : HIGH STAB
LP2 : kHz
LP3 : MHz
LP4 : INC. SCALE
LP5 : MAIN SCALE
S3C
(*) SUBJECT TO ADJUSTMENT ON TEST.
S3E
LP2
LP3
LP4
LP5
S3B
S3A
RV3 10K VXC TUNE (TUNABLE I.F.)
R239 4·7K
RV18 47K FINE IF TRIM
C19 .047
R20 6·8K
R21 100
R 22 1K
R23 22K
RV15 10Ω DIAL DIMMER
R333 1·2
S3A - S3E ARE GANGED TO TURRET MECHANISM RANGE TO SHOWN SELECTED.
PL/SK
C8 ·1
PL/B
SK B
PANEL ASSEMBLY
C6 AND/OR C7 MAY BE OMITTED.
C6 .047
-6V
R249 2·2K
C7 .047
RV1 20K PEAK RF/AE TRIM
MODE SWITCH
AM
CW
CAL (INC. OSC.)
S10A
RV17 10K INC. CAL
S10C
R249 100K
RV7 500K AF GAIN
RV6 470K LINE LEVEL
R299 12
S11
LS ON
INTERNAL SPEAKER
S7B
BFO CAL. ON
JK1 TELS
S7A
BFO CAL. ON
R248
S10B
D53 1N4004
1MHz CAL. ON
S1B
MANUAL AGC
S9
C309 1
S1A
S12A
R309 2·2M
AF
AFC
RF
METER SWITCH
S12B
R303 1K
ME1 50-0-50 µA

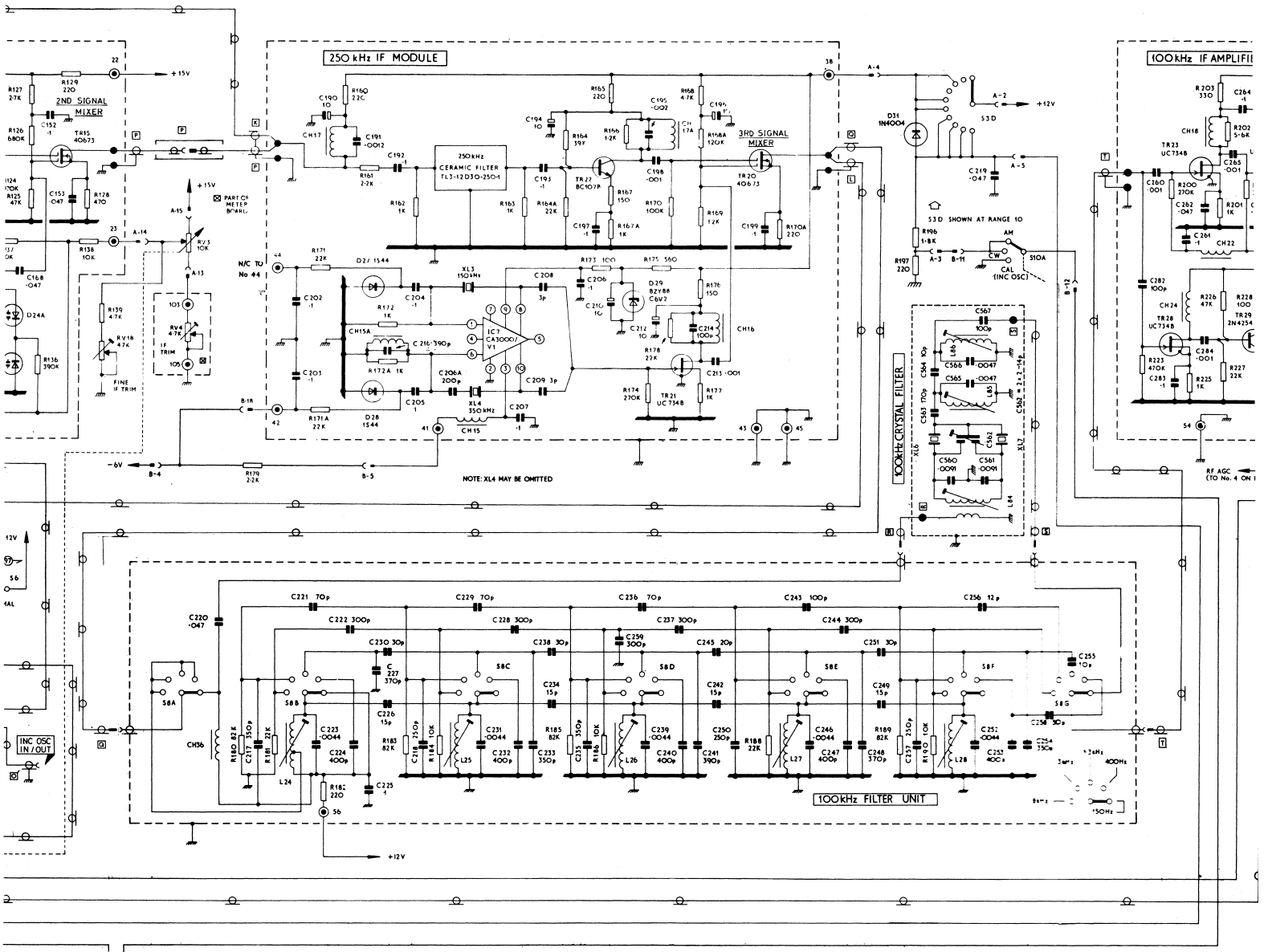


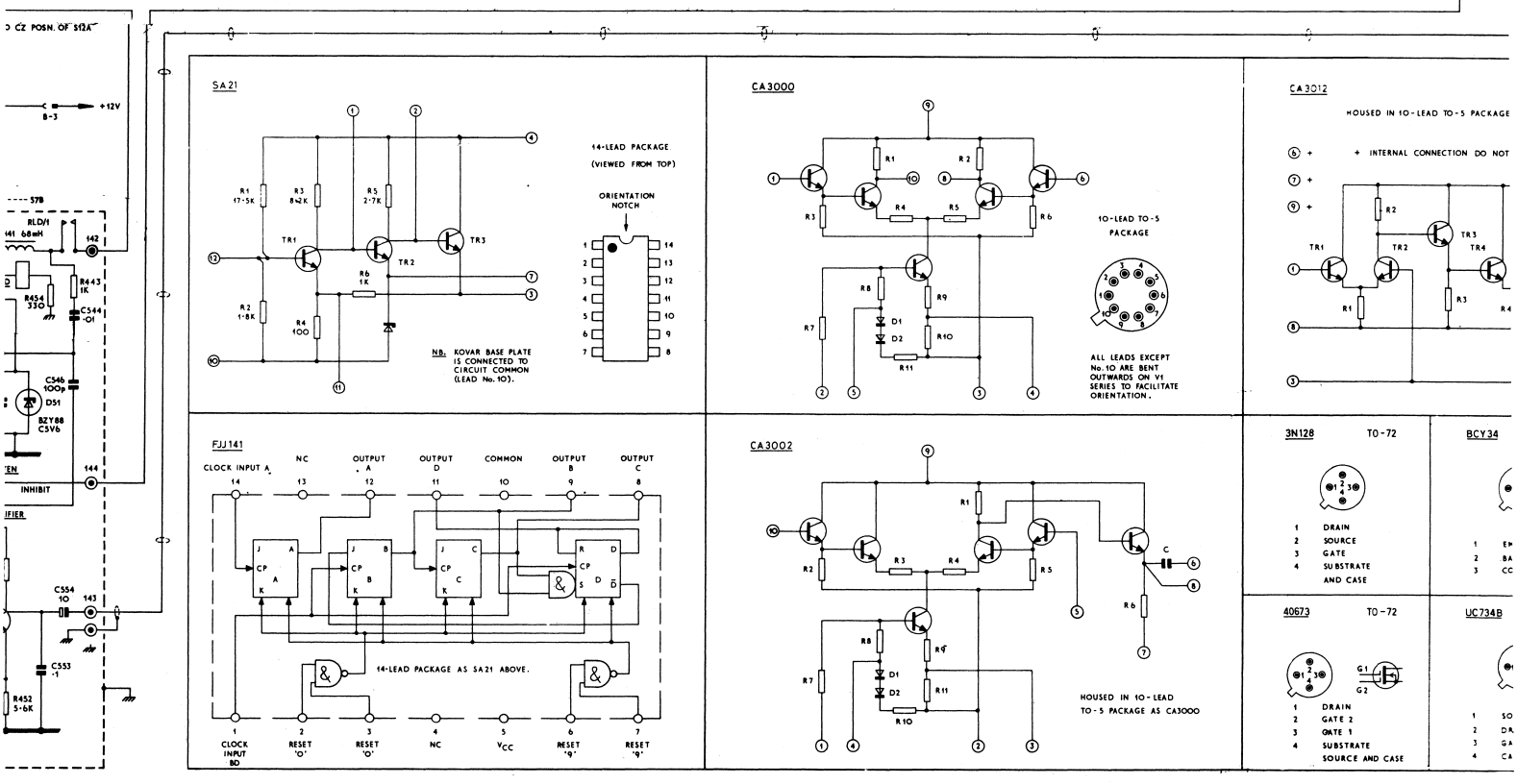
INTERCONNECTION CIRCUIT - MODEL EC958/3

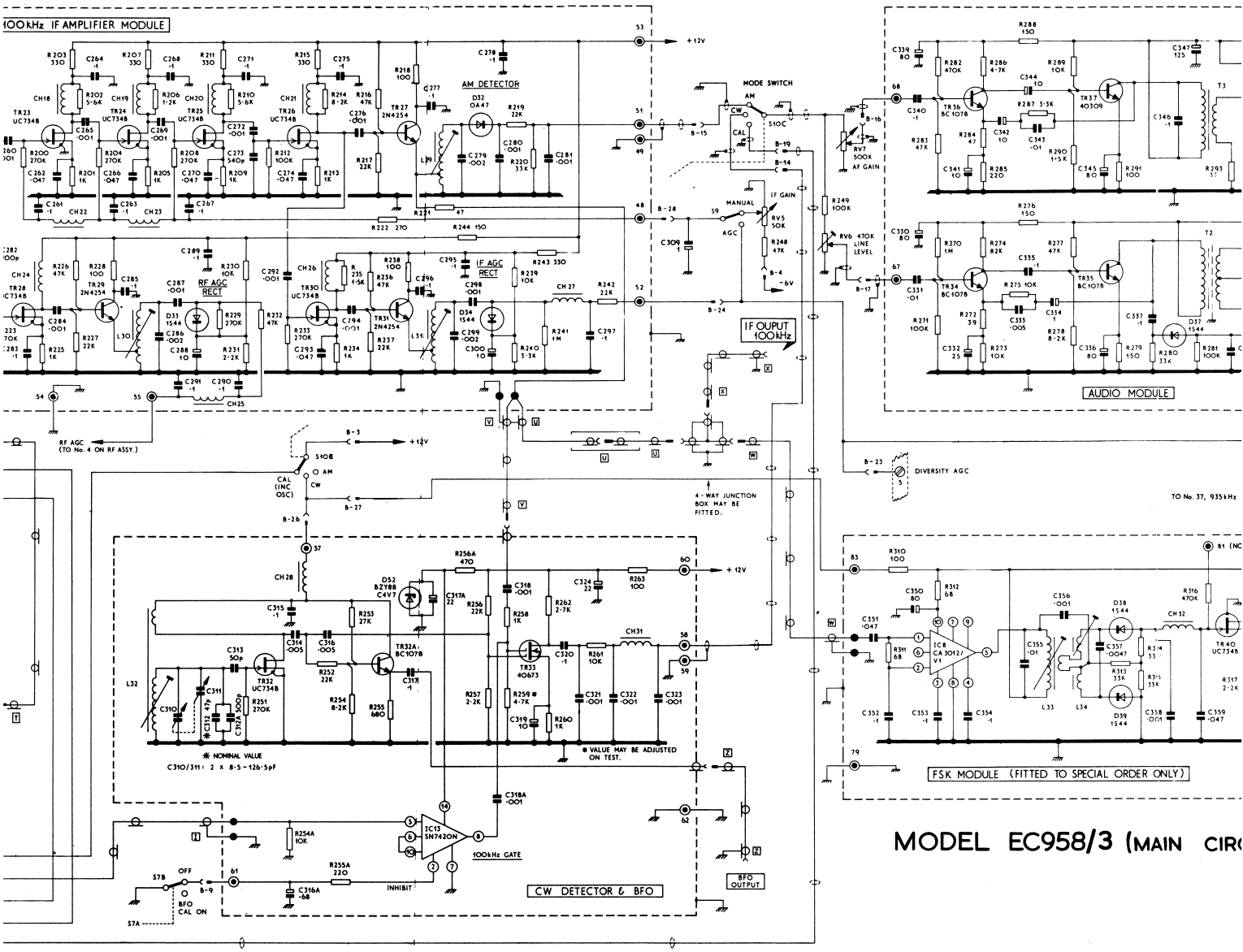
ISSUE 1


RF ASSEMBLY
AERIAL ATTENUATOR UNIT
MAIN TUNE OSCILLATOR (MTO)
HARMONIC AMPLIFIER
LOOP AMPLIFIER
LOOP LIMITER
935kHz LOOP MODULE
1MHz CRYSTAL CALIBRATOR
MTO AMPLIFIER
MAIN TUNING
MUTING RELAY
TURRET DISKS (Nb. S3A - S3E 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 :-
A AERIAL
B RF
C SIGNAL MIXER
D MAIN-TUNE OSCILLATOR
E LOOP MIXER
F HARMONIC AMPLIFIER
REAR OF SET
VIEWED ON WIRING SIDE
TOP
NB C6 AND/OR C7 MAY BE OMITTED
LOW IMPEDANCE INPUT (75Ω)
HIGH IMPEDANCE INPUT (600Ω). FIT LINK FOR UN-BALANCED AERIAL FEED
LINK E
S3A & S3B SHOWN AT RANGE 10
PEAK RF
INJECTION PROBE
TO METER SW VIA R303
RF AGC (No. 55)
AFC
AFC ADJ
N/C TO No 32
935kHz CRYSTAL OSCILLATOR IS INCLUDED FOR TEST PURPOSES ONLY REFER TO INSTRUCTION MANUAL FOR DETAILS
12·6V AC (OVEN SUPPLY)
PART OF METER BOARD
+15V
+12V
-6V


TUNABLE IF MODULE
D19/24A 12 x MV 1656
1ST SIGNAL MIXER
1ST. LOOP MIXER
2ND LOOP MIXER
INCREMENTAL OSCILLATOR UNIT
INCREMENTAL TUNING
EXTERNAL FINE TUNE
WIRE 10,000Ω VARIABLE RESISTOR BETWEEN 1 & 3 ON ANCILLARIES STRIP FOR FINE TUNE FACILITY (RANGES 1-4 ONLY.)
LINK TERMINALS 2 & 3 WHEN THIS FACILITY IS NOT REQUIRED.
NB. INTERCONNECTIONS BETWEEN INDIVIDUAL BOARDS ON THE RF ASSEMBLY ARE SHOWN THUS :-
S3C SHOWN AT RANGE 10
*SUBJECT TO ADJUSTMENT ON TEST
* VALUES OF C155/157 MAY BE ADJUSTED ON TEST
* VALUES ADJUSTED ON TEST.
TO METER SWITCH VIA R303
TURRET DISK
IF AGC (No. 55)
+15V
+12V
INC CAL
SLAVE
NORMAL
INC OSC IN / OUT
TO CZ POSN. OF
1MHz CAL ON
BFO CAL ON
10kHz CALIBRATOR UNIT
DIVIDER DRIVER
DIVIDE-BY-TEN
INHIBIT
MIXER
BEAT AMPLIFIER
100 kHz AMPLIFIER
HARMONIC GENERATOR
MASTER OSCILLATOR UNIT
AFC
AFC ADJ
HIGH-STAB INDICATOR
FINE FREQ ADJUSTER
12·6V AC (OVEN SUPPLY)
PART OF METER BOARD
1MHz CRYSTAL OSC. TYPE 1013TX/935A
3,4,7,8,9 & 13 NO CONNECTION


250 kHz IF MODULE
2ND SIGNAL MIXER
3RD SIGNAL MIXER
250kHz CERAMIC FILTER TL3-12D30-250-1
100kHz IF AMPLIFI
100kHz CRYSTAL FILTER
100kHz FILTER UNIT
S3D SHOWN AT RANGE 10
NOTE: XL4 MAY BE OMITTED
INC OSC IN / OUT
RF AGC (TO No. 4 ON I

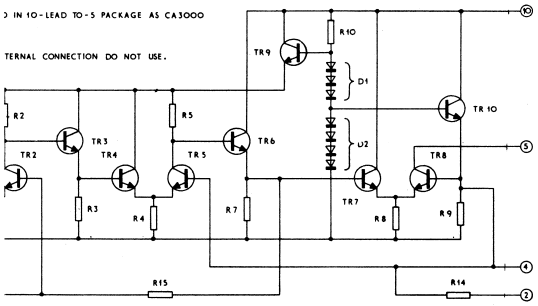

SA21
14-LEAD PACKAGE (VIEWED FROM TOP)
ORIENTATION NOTCH
NB. KOVAR BASE PLATE IS CONNECTED TO CIRCUIT COMMON (LEAD No. 10).
CA3000
10-LEAD TO-5 PACKAGE
ALL LEADS EXCEPT No. 10 ARE BENT OUTWARDS ON V1 SERIES TO FACILITATE ORIENTATION.
CA3012
HOUSED IN 10-LEAD TO-5 PACKAGE
+ INTERNAL CONNECTION DO NOT
FJJ141
CLOCK INPUT A
NC
OUTPUT A
OUTPUT D
COMMON
OUTPUT B
OUTPUT C
14-LEAD PACKAGE AS SA21 ABOVE.
CLOCK INPUT B0
RESET '0'
NC
VCC
RESET '9'
CA3002
HOUSED IN 10-LEAD TO-5 PACKAGE AS CA3000
3N128
TO-72
1 DRAIN
2 SOURCE
3 GATE
4 SUBSTRATE AND CASE
BCY34
40673
TO-72
1 DRAIN
2 GATE 2
3 GATE 1
4 SUBSTRATE SOURCE AND CASE
UC734B



MODEL EC958/3 (MAIN CIRC

) IN 10-LEAD TO-5 PACKAGE AS CA3000

TERNAL CONNECTION DO NOT USE.



1-72	BCY34	TO-5	2N4254	TO-92	40309	TO-5
	1 EMITTER 2 BASE 3 COLLECTOR		1 BASE 2 COLLECTOR 3 EMITTER		1 EMITTER 2 BASE 3 COLLECTOR AND CASE	
1-72	UC734B	TO-72	2N3054	TO-66	BC107B	TO-18
	1 SOURCE 2 DRAIN 3 GATE 4 CASE		1 BASE 2 EMITTER 3 COLLECTOR AND CASE		1 EMITTER 2 BASE 3 COLLECTOR AND CASE	
) CASE						

NOTES

THIS CIRCUIT DIAGRAM CONFORMS GENERALLY TO THE RECOMMENDATIONS GIVEN IN BS.3939. DIAGRAMS OF IC1-IC11 ARE REPRODUCED BY PERMISSION OF RCA LTD, THORN-AEI LTD. AND MULLARD LTD.

INTERCONNECTIONS:- WIRING TERMINATIONS ARE CODED 1-144. PIN & SOCKET CONNECTIONS ARE SHOWN ◎ AND SOLDERED CONNECTIONS ● COAXIAL INTERCONNECTING LEADS ARE CODED A TO Z EXCLUDING F. CONNECTORS ARE IDENTIFIED BY THE LETTER OF THE LEAD IN WHICH THEY OCCUR.

PL/A: 15-WAY CONNECTOR COMPLETING HARNESS TO TUNING DRIVE ASSEMBLY SHOWN THUS —■— A-15

PL/B: 37-WAY CONNECTOR COMPLETING HARNESS TO PANEL ASSEMBLY SHOWN THUS —■— B-37

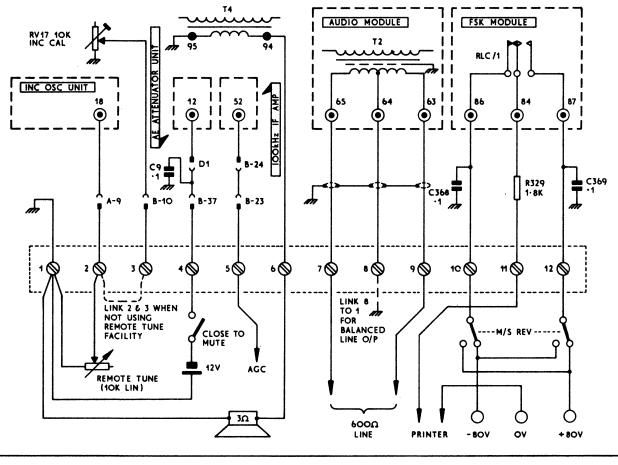
PL/C: NOT FITTED ON THIS VERSION OF EC958.

PL/D: 2-WAY POLARISED CONNECTOR CARRYING SUPPLY TO RLA 1

ASSOCIATED DRAWINGS:

BP1291 INTERCONNECTION CIRCUIT.
BP1293 DISK CIRCUIT: PART 1.
BP1240 DISK CIRCUIT: PART 2.

ANCILLARY TERMINALS AND ASSOCIATED WIRING.



+15V

+12V

D41 OA2230

-6V

A-8

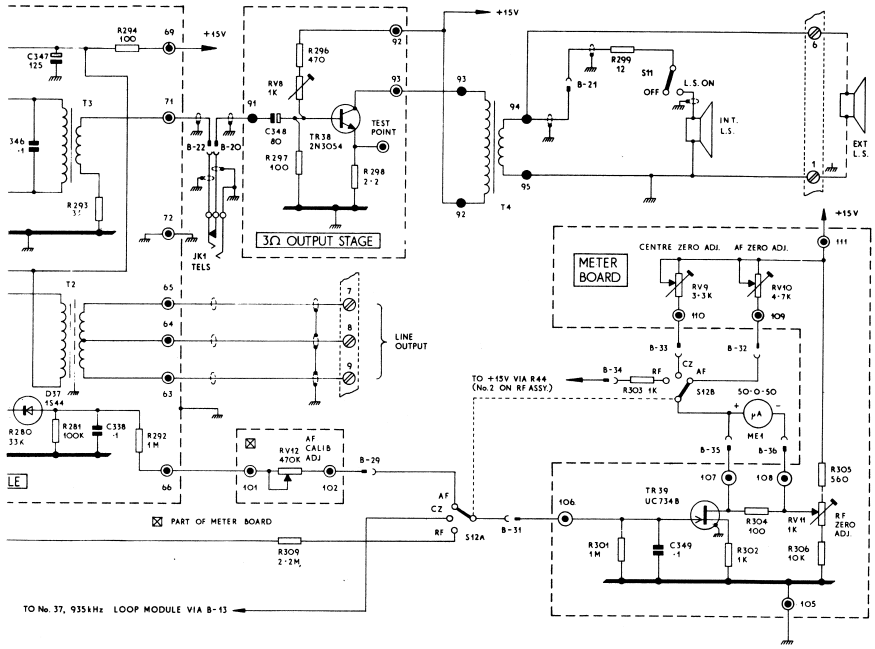
B-1

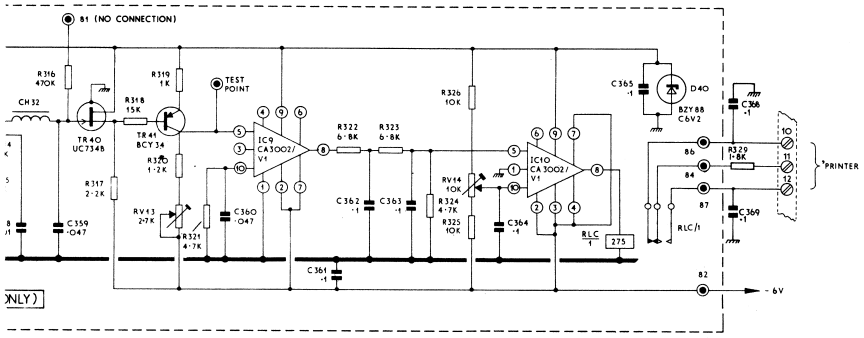
EARTH RETURNS FROM PANEL AND TUNING DRIVE ASSEMBLIES.

S3E SHOWN AT RANGE 10

LP2 : 8MHz LEGEND
LP3 : MHz LEGEND
LP4 : INCREMENTAL SCALE
LP5 : MAIN SCALE

LEGEND LAMPS : 6V 60mA LES
SCALE LAMPS : 6V 0·2A MES





IN CIRCUIT DIAGRAM) BP1292–ISSUE 1