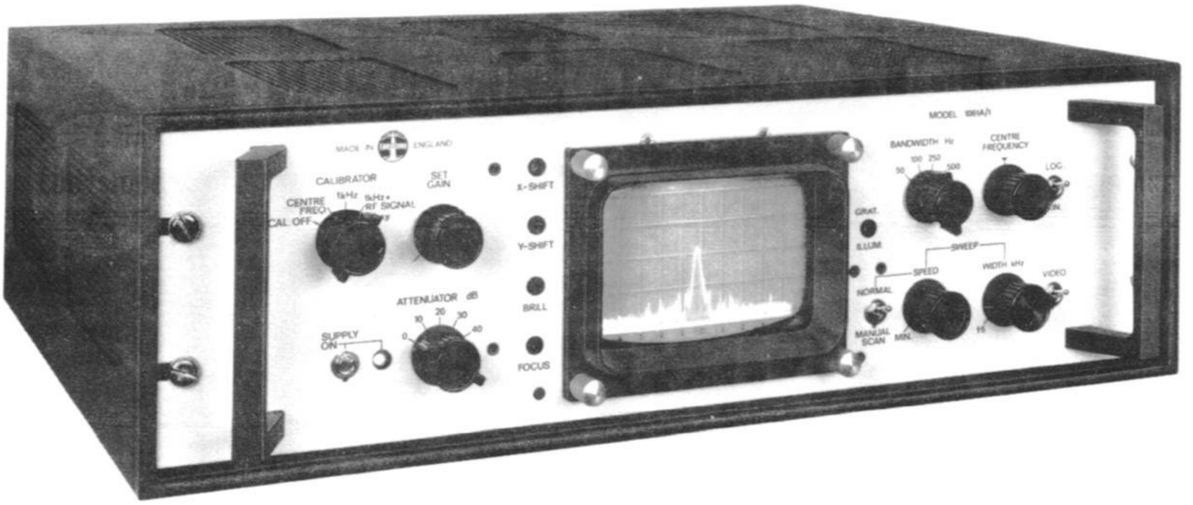
Eddystone

PANORAMIC DISPLAY UNIT

MODEL EP 1061A



MODEL 1061A/1

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RF SIGNAL DISPLAY UNIT

TYPE EP 1061A

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

ERRATA

EP 1061A

PANORAMIC DISPLAY UNIT

An error has occurred at section 4 page 13 (4-13) para. 115 which should read as follows: "Check voltage at pin 90 (3V to 9V according to setting of RV1)". Reference made to pin 30 is therefore incorrect.

An error has occurred on the OVERALL CIRCUIT PART 2, Fig. 14 (2) MODULE NO. 10 (EHT UNIT). Diodes D2, D3, D4 and D5 should be type BY187 (or BY409) and NOT BY127 as shown. The components fitted and the component list designations are correct.

July 1978

CHAPTER 1

GENERAL DESCRIPTION

INTRODUCTION

1. The EP1061A RF Signal Display Unit is a fully solid state, double-conversion receiver, utilising a 10 cm by 6 cm long persistence tube for its display.

2. The unit is suitable for use with 958, 1830 & 1837/38 series communications receivers in frequency measuring or frequency monitoring applications, and will display the signals received within the selected bandwidth of the receiver. Other receivers with an IF of 1.4MHz or 100kHz are also suitable.

BRIEF TECHNICAL DESCRIPTION

3. The following brief technical description should be read in conjunction with the simplified block diagram Fig. 1. For a more detailed description refer to Chapter 3.

4. The 1.4MHz input signal from the receiver is applied to a front panel switched attenuator (0-40dB in 10dB steps) and then to the mixer stage. Signals at 100kHz are passed from the attenuator to a 100kHz to 1400kHz up convertor (switching from 100kHz to 1400kHz by means of a rear panel switch) and then to the mixer stage.

5. The second input signal applied to the first mixer is derived from a voltage controlled oscillator (VCO). The output frequency of the VCO, centred at 1430kHz, is controlled by the output of a sweep generator which may be set by a front panel control to any sweep width between 1.5 and 15kHz.

6. The resultant intermediate frequency (IF) centred at 30kHz is applied via an LC filter (with switched bandwidths of 50, 100, 250 and 500Hz) to an IF amplifier. The gain of the IF amplifier is variable over a 10dB range by means of a front panel control.

7. The output signal passed by the selected bandwidth filter is applied to a peak detector and thence via linear-to-logarithmic conversion (when LOG is selected) and switching circuits to the Y amplifier. The X amplifier receives its input from the sweep generator and the X and Y output signals are applied to the cathode ray tube (CRT).

8. For the display of Lissajous figures, the calibrator switch is set to the XY position; this allows the X and Y input signals (applied to rear-panel sockets) to be applied to the CRT via the respective amplifier stages.

RF SIGNAL DISPLAY UNIT EP1061A

TECHNICAL SPECIFICATION

Input Frequency	1.4MHz or 100kHz. (100kHz input is up-converted to 1.4MHz).
Input impedance	50 ohms unbalanced.
Intermediate frequency	30kHz.
Sensitivity	1mV p.d. per cm, at minimum speed and bandwidth.
Spurious responses	Better than -40dB
Resolution	60Hz maximum for 6dB separation.
Sweep width	1.5kHz -15kHz continuously variable.
Calibration markers	Centre frequency and/or 1kHz comb.
Tube	10cm x 6cm, long persistance.
Display	Vertical scaling Log : 0-40dB in 10dB steps Lin : 0-100% in 25% steps Frequency base:- Linear with 10 divisions.
Bandwidth	500Hz, 250Hz, 100Hz and 50Hz switched.
Sweep speed	Continuously variable 200mS-20 sec, or manual.
Centre frequency shift	±8kHz continuously variable.
X and Y amplifiers	Sensitivity 25mV ± 6dB per cm up to 100kHz Input impedance 50-75 ohms Bandwidth 0-100kHz
Power supplies	100-125V, 200-250V: 45-65Hz AC Internally selected
Consumption	27 Watts approx.
Weight	14.1kg (31 lbs) rack-mounting, 19.3kg (42.5lbs) in cabinet
Dimensions	Rack-mounting style: Panel 483mm x 133mm (19 x 5.25 in.) Rack intrusion: 411mm (16.2 in.) Bench-mounting style : Width 502mm (19.75in) Height: (including feet) 165mm (6.5in) Depth: 457mm (18in)

TECHNICAL SPECIFICATION (continued)

Environmental conditions	-10°C to 50°C (-20°C to +70°C storage). Relative humidity 95% at 40°C.
Controls: Front panel	Supply on/off with LED indicator. Calibrator switch Set gain control Attenuator switch Bandwidth switch Sweep width control Sweep speed control Normal/manual scan switch Centre frequency control Log/Lin switch Video on switch Pre-set controls: X shift Y shift Brilliance Focus Graticule Illumination
Controls: Rear panel	Scan normal/invert switch 1.4MHz/100kHz switch Signal input, X and Y input, BNC sockets Pre-set controls: Astigmatism Distortion

CHAPTER 2

INSTALLATION AND OPERATING INSTRUCTIONS

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CHAPTER 2

INSTALLATION AND OPERATING INSTRUCTIONS

INSTALLATION

1. (1) Check that the voltage taps on the internal power transformer are correctly set to suit the local source of a.c. power.

   (2) Check that the 1 amp. supply fuse (on the rear panel) is serviceable.

   (3) Install the unit in the rack or cabinet.

   (4) Connect the supply lead from PL1 to the local source of a.c. power.

   (5) Connect the IF output of the receiver (setting the rear panel switch to 1.4 MHz or 100 kHz as required) to the 50 ohm BNC input socket on the rear panel.

   (6) Connect the earth terminal on the rear panel to the rack or system earth.

FUNCTION OF CONTROLS

2. (1) SUPPLY ON: The main supply switch is located bottom left of the front panel. The adjacent lamp indicates the presence of the internal d.c. supply.

   (2) 1.4 MHz or 100kHz INPUT CONNECTOR: A 50 ohm BNC socket is located on the rear panel.

   (3) SCAN NORMAL/INVERT: Operation of the SCAN NORMAL/INVERT switch on the rear panel enables the tuning action of the main receiver to shift the display to either left or right for the same direction of tuning. The resultant scan may thus always maintain the higher frequency at the right hand side of the screen, regardless of any frequency inversion that may occur in the main receiver.

   (4) CALIBRATOR: In the extreme counter clockwise position CENTRE FREQ. this switch provides a calibration marker at 1.4 MHz enabling the

(4) CALIBRATOR (cont'd): centre of the frequency band to be located. In the 1 kHz position a spectrum of markers at 1 kHz spacing is generated to enable sweep width to be set. In the 1 kHz + SIGNAL position the 1 kHz markers are displayed together with the signal being received, the height of the markers being unaffected by any operation of gain control or bandwidth setting. In the CAL OFF position signals only are displayed. By setting the switch to the XY position, the X and Y input sockets on the rear panel are connected to the X and Y deflection amplifiers, thus enabling a Lissajou figure to be obtained.

(5) CENTRE FREQUENCY: This control allows accurate setting of the 1.4 MHz point at the centre of the display in conjunction with the calibrator marker.

(6) ATTENUATOR: A 50 ohm attenuator is positioned directly at the input to the unit. The scale settings are 0 - 40 dB in 10 dB steps.

(7) SET GAIN: Provides manual gain control of the IF amplifier over a 10 dB range.

(8) SWEEPWIDTH: A sweep range of 15 kHz down to 1.5 kHz is obtainable.

(9) BANDWIDTH: Four bandwidth positions are provided; 500Hz, 250Hz, 100Hz, 50Hz.

(10) NORMAL/MANUAL SCAN: With switch at NORMAL X deflection is by means of internal sweep generator while with switch at MANUAL SCAN X deflection is obtained manually by operation of the SWEEP SPEED CONTROL.

(11) SWEEP SPEED: This control allows the operator to optimise the sweep speed to suit the selected sweep width and bandwidth when used with the MANUAL SCAN/NORMAL switch at NORMAL, or with the switch at MANUAL SCAN enables any part of the scan to be

(11) SWEEP SPEED (cont'd): examined at length under control of the operator.

(12) VIDEO ON: When using a slow sweep speed together with a narrow bandwidth or a high sweep speed together with a low sweep width the trace may be improved by setting this switch to ON.

(13) LOG/LIN: The Y deflection may be displayed in two modes, either Linear (LIN) or logarithmic (LOG). In the latter case a range of greater than 40dB is obtainable.

(14) X SHIFT)
(15) Y SHIFT)
(16) BRILLIANCE)
(17) FOCUS)

These are preset screwdriver controls located on the front panel.

(18) DISTORTION)
(19) ASTIGMATISM)

These are preset screwdriver controls located on the rear panel. These should not normally require adjustment and are provided with screw-on covers.

(20) GRATICULE ILLUMINATION: This is a preset control located on the front panel.

NOTE: Two graticules are available:-
Light green - standard
Orange - Filter

SETTING-UP AND OPERATING PROCEDURES

3. (1) Set SUPPLY switch to ON and allow 30 minutes to warm up.

(2) Adjust BRILLIANCE to suit existing ambient light conditions.

(3) Set BANDWIDTH switch to 500Hz.

(4) Set CALIBRATOR switch to CENTRE FREQ. position.

(5) Adjust FOCUS for best possible spot definition.

(6) Adjust Y shift to position trace on graticule line, 5 mm above base.

(7) Set ATTENUATOR to ODB and position SET GAIN at half way.

(8) Set manual SCAN/NORMAL switch to Normal

(9) Set SWEEP WIDTH to 1.5kHz using WIDTH and SPEED controls.

(10) Adjust CENTRE FREQUENCY control to centralize calibration marker.

(11) Set SWEEP WIDTH to 15 kHz and adjust X SHIFT to centralize calibration marker.

(12) Switch CALIBRATOR switch to CAL OFF.

(13) Tune main receiver to give trace in tube centre.

(14) Adjust ATTENUATOR to provide correct amplitude of signal.

(15) Trace may now be expanded about centre by turning SWEEP WIDTH anti-clockwise. (Width may be measured by turning CALIBRATOR switch to 1 kHz + signal and using calibration markers.

(16) Resolution may be adjusted to requirement by setting of BANDWIDTH control.

GRATICULE

4. To change graticule remove the four knurled screws securing the CRT escutcheon frame. Change graticule and refit escutcheon frame.

CHAPTER 3

CIRCUIT DESCRIPTION

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CHAPTER 3

CIRCUIT DESCRIPTION

INTRODUCTION

1. The circuit description given in this chapter should be read in conjunction with the overall circuit diagram Fig. 14. The circuitry employed is described in the following sections by reference to the sub-units. The description follows the conventional signal path.

INPUT ATTENUATOR

2. The input attenuator is a five position 0 - 40 dB T-pad attenuator of 50 ohm nominal impedance. The attenuator resistors are mounted directly across the tags of the wafer switches SW7a and SW7b.

VOLTAGE CONTROLLED OSCILLATOR

3. The voltage controlled oscillator is located in an aluminium diecast box to the rear right hand side of the equipment. It comprises a grounded base oscillator at a nominal frequency of 1430kHz which is swept by means of a varactor diode. The output from the oscillator is fed to a buffer stage and thence to gate 2 of the mixer.

SWEEP GENERATOR

4. The sweep generator board is located at the rear right hand side of the unit and performs two functions; it generates a sawtooth waveform which is applied, in part, to the voltage controlled oscillator and to the deflection amplifier; it also provides a mixing facility whereby a variable DC potential may be added to the sawtooth before final application to the varactor diode. This enables the centre frequency of the sweep, as well as its magnitude, to be adjusted from the front panel. A further provision allows the sawtooth generator supplies to be switched off and the scan manually controlled by a variable DC voltage obtained from a front panel control. The operation of the sweep generator is as follows:-
2IC1 is a Miller integrator, 2IC2 operates as a trigger to invert the charging potential to the Miller integrator when its run down is complete. A square pulse thus appears at the output (pin 6 of 2IC1). This voltage provides the integrating current to 2IC1 and is adjusted by potentiometer 2RV2 and also by the sweep speed potentiometer 1RV1. The sweep width is varied by attenuating, by means of preset 2RV1 and sweep width control 1RV2. The attenuated sawtooth and the DC potential (centre frequency control voltage derived from 1RV3) are mixed in the virtual earth amplifier 2IC3 and then applied to the voltage controlled oscillator. By use of this technique no interaction between sweep width and centre frequency can occur. The flyback time is governed by the discharge path 2R2 and 1D3. The flyback diode connections may be reversed by means of the scan normal/invert switch on the rear

panel, thus providing a positive or negative going sawtooth which enables signals higher or lower in frequency than the centre frequency to be displayed to left or right of mid-screen as required. Flyback suppression pulses are also derived from this board and applied to 9TR1 located on the power supply and deflection amplifier board.

FILTER UNIT

5. The input to the filter comprises two signals, first the 1.4 MHz input signal and second the output from the voltage controlled oscillator. The two signals are mixed in a dual gate MOSFET mixer (6 TR1), the VCO sweeping about 1430 kHz thus providing an intermediate frequency of 30 kHz. The filtering at 30 kHz is performed by a six section LC filter with switched coupling capacitors and damping resistors. This filter provides 6 dB bandwidths of 50 Hz, 100 Hz, 250 Hz and 500 Hz and a 60 dB - 6 dB shape factor of better than 6 : 1. Trimmers are provided on the three narrowest bandwidths to correct centre frequency. The output of the filter is via a junction FET amplifier (6 TR2).

100 kHz - 1.4 MHz UP CONVERTER

6. Where signal input frequency from receiver is 100 kHz a converter is employed consisting of a balanced mixer (4IC1) and a 1300 kHz crystal oscillator (4TR1). This provides a 1.4 MHz output to tuned buffer amplifier (4TR2). The overall gain of the unit is adjusted to provide unity gain between input and output and a flat frequency response over ± 7.5 kHz of centre frequency.

IF LOG/LIN AMPLIFIER

7. The IF amplifier consists of a junction FET (5 TR1) source follower incorporating an IF gain control with a 10 dB range. This is followed by two broadband stages (5TR2 and 5TR3) which feed a peak detector stage consisting of 5IC1 and 5D1. The output of the peak detector is amplified by 5 IC2 and followed by unity gain impedance selector 5IC3. The output from 5IC3 provides linear vertical deflection. Video filtering is provided by 5C16 and 5R17. 5C18 and 5R25 provide additional filtering when the VIDEO switch is set to ON. If LOG mode is required the linear signal is passed to 5IC4 where the log function is generated by 5D2. 5RV3 must be adjusted to compensate for the offset voltages of 5IC1, 5IC2 and 5IC3, such that the input to 5IC4 cannot become negative, since the circuit employed can only produce the log of positive going potentials. The log output must then be modified; the DC threshold which will exist at the minimum input signal must be compensated for in the virtual earth amplifier 5IC5, the level of compensation being set by 5RV8. The gain of the resultant function is then set by 5RV9 such that the 40 dB dynamic range occupies the full scan height. The 'Y' filtering is used in both log and linear modes. The output is then passed directly to the 'Y' amplifier via the log/lin switch.

DEFLECTION AMPLIFIERS AND POWER SUPPLY

8. These two functions are both accommodated on the power unit chassis and vertically mounted printed circuit board. The 'X' and 'Y' amplifiers are identical and

comprise simple longtailed pairs, the gain of which is set by 9RV3 for the 'X' and 9RV4 for the 'Y' sections respectively. The shift controls are applied directly to the differential amplifiers. The output from the 'X' amplifier does not, however, pass directly to the 'X' deflection plates but must go through a reversing switch to maintain a left to right scan when the scan normal/invert switch SW1 is operated. The supply for the deflection amplifiers is maintained at approximately + and - 200V. These supplies are generated by the bridge rectifiers 9D1 and 9D2. The main low voltage supplies are generated by a bridge rectifier 1D1 and two IC voltage regulators 1 1C1 and 1 1C2 producing + 15V and - 15V. A further IC regulator 91C1 and a tracking regulator 91C2 and 9TR2 produce + 8V and - 8V.

EHT UNIT

9. The EHT unit is located on the left hand side plate and is a push pull inverter operating at approximately 10 kHz. This unit operates at an input voltage of + 15V and produces DC output voltages of + 5kV and - 1.3kV to supply the cathode ray tube.

LISSAJOU BOARD

10. This board is located on the left hand side of the unit adjacent to the power supply chassis. It consists of a pair of deflection pre-amplifier stages 81C1 and 81C2 for the 'Y' and 'X' signals connected to the rear panel 'Y' and 'X' input sockets. Potentiometers 9RV1 and 8RV3 provide preset gain adjustment, whilst 8RV2 and 8RV4 provide for preset 'Y' and 'X' shift respectively. The phase is reversed in the 'X' amplifier to allow correct in-phase display on the CRT.

CALIBRATOR BOARD

11. This board , which is located at the left hand front of the unit, provides a centre frequency marker at 1.4 MHz and a comb of 1 kHz markers centred on 1.4 MHz. A crystal oscillator 7TR1 operating at 1.5 MHz feeds a balanced mixer 7 IC2, the other input to the mixer being from a relaxation oscillator 71C1 operating at 1 kHz; this produces a flat comb spectrum of 1 kHz signals centred on 1.5 MHz. The output from this mixer at 1.5 MHz is fed to gate 1 of a dual gate MOSFET 7TR2, the other gate being fed by the VCO which is sweeping about 1.43 MHz. A 4 section LC filter tuned to 70 kHz selectes a signal at each kHz as the VCO sweeping 1422.5 to 1437.5 kHz produces a 70 kHz output by mixing with the comb of 1 kHz signals from 1492.5 kHz to 1507.5 kHz. If only a centre frequency marker is required the relaxation oscillator is switched off and the crystal oscillator at 1.5 MHz produces a 70 kHz output by mixing with the VCO centre frequency of 1.43 MHz. The 70 kHz signals are amplified by 7TR3 and 7TR4 and rectified by 7D4. The rectified signal is now amplified by 71C3 and 71C4 and fed to a dual monostable 71C5 which serves to generate an output pulse of fixed duration which is triggered from the leading edge of the input signal. The output of the first half of the monostable is buffered by 71C9 and then used to synchronise an astable 71C10. This astable operates at approximately 10 kHz and is used to switch two FET gates 7TR5 and 7TR6 to feed the 'Y' amplifier when

calibrator or calibrator + signal is required; these gates are fed by unity gain buffers 71C8 and 71C6. A further buffer 71C7 which is not multiplexed is fed with signal only when calibrator is not required. The purpose of synchronisation of the astable is to prevent jitter on the trace due to spurious triggering. Output from the three buffers is mixed in a virtual earth stage 71C11 and fed to the 'Y' amplifier. The arrangement of the calibrator circuitry enables signals and calibrator markers to be displayed simultaneously without any interaction.

CHAPTER 4

MAINTENANCE

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ILLUSTRATIONS

CHAPTER 4

MAINTENANCE

PRELIMINARY NOTES

(1) Metric thread cross-head screws fitted to this equipment are of the "POZIDRIV" type. "Phillips" type and "Pozidriv" type screwdrivers are NOT interchangeable and use of the wrong screwdriver will cause head damage.

(2) With few exceptions, ISO METRIC hardware is used throughout this equipment. Where these exceptions apply, the IMPERIAL hardware will be marked with RED DYE.

(3) Use of hardware of the wrong size or pitch will cause thread damage.

CHAPTER 4

MAINTENANCE

TEST EQUIPMENT

1. The following test equipment will be required:-
Signal Generator covering the range 20kHz - 1.5MHz.
General purpose Oscilloscope with low capacity probe.
Frequency Counter covering the range 20kHz - 1.5MHz.
Multimeter (Avo Model 8 or similar).

WARNING

2. Lethal voltages are used in this equipment and extreme caution is essential. When working on the equipment it may be necessary for power to be connected and normal precautions for safety under these conditions should be observed. In particular beware of the following voltages.

MAINS	:	Power supply, mains input connector, fuses and switch.
±200V d.c.	:	Power supply and deflection, scan switch, tube controls, tube.
-1.3kV d.c.	:	EHT unit, tube controls, tube, heater and transformer heater winding.
+5kV d.c.	:	EHT unit, tube anode.

3. Also beware of capacitors (including Tube Anode) which may be charged to any of these voltages, and discharge if necessary.

PERFORMANCE CHECK

4. The performance figures quoted are typical only and should not be interpreted as a test specification.

5. Check that the brilliance control varies the intensity of trace from zero to maximum, without affecting position of baseline by more than 3 mm. Check that baseline is level with graticule, see para. 112. Check operation of focus and astigmatism controls. Check that the trace is not curved, adjust distortion control if necessary.

6. Check shift controls. X shift should move the trace by 50 mm in each direction, Y shift should move the trace by 50 mm upwards and off the screen downwards.

7. With sweep switch set to normal, check that the sweep speed can be varied from 5Hz (0.2 secs) to 0.05Hz (20 secs). With sweep switch set to manual check that the spot traverses the screen completely with rotation of the sweep speed control.

8. Switch to 1kHz Calibrator and check 15 markers are visible at maximum sweep width and 2 markers at minimum sweep width.

9. Switch to Centre Frequency Calibrator and at maximum sweep width check that by using the Centre Frequency Control the marker can be set to mid-position on the screen with this control near mechanical centre. Check that at extreme positions of the control the centre frequency marker is shifted by ±8kHz.

10. Check Sensitivity as follows:-

Set Controls:		
	Y shift	Trace on baseline
	Log/Lin	Lin.
	Gain	Mid-position
	Attenuator	OdB
	Width	Maximum
	Speed	Minimum
	Bandwidth	500Hz
	Calibrator	Cal off
	100/1400kHz	1400kHz

11. Connect the signal generator set to 1mV p.d. at 1.4MHz to input socket. Check that response on screen is approx. 10 mm.

12. Check attenuator action. Increase signal generator output to give mid-scale response. Set attenuator to 10dB and increase generator output to restore the trace to mid-position. Generator increase should be 10dB. Repeat for each attenuator setting.

13. Set Log/Lin control to Log and increase input level to give a response touching the OdB line. Reduce the generator output in 10dB steps and check that the response is correct to within 3dB at each position. Switch to 100kHz input, reset generator and check that the full-scale response is within 3dB of that at 1.4MHz.

14. Check operation of Video filter by selecting maximum gain and check that the noise level reduces by approx. 6dB.

FAULT FINDING PROCEDURE

15. Check that the Power Supply is available and connected, mainfuse is intact, supply switch is on. LED 'ON' indicator shows presence of +15V supply rail, graticule lamps indicate presence of -15V supply rail.

16. Follow the instructions under "Setting Up and Operations Procedures" chapter 2 Ensure Brilliance control is adequately advanced, and shift controls are correctly set. Check calibrator control.

17. If there is a trace but no signal, check input lead, 100kHz/1.4MHz switch. Set the receiver to cal. and check for receivers calibrator signal. Check attenuator, log/lin switch, filter switch.

18. If the fault is still present it will be necessary to remove the unit from the rack.

19. Remove the dust covers and inspect for obvious faults, i.e. broken wires, burnt components etc.

20. Check the presence of all power supplies:-

+15V	at pin 92
-15V	at pin 95
+8V	at pin 94
-8V	at pin 96
+200V	at pin 106
-200V	across 9C2 (PSU and Deflection Board)
-1.3kV	at anti-clockwise end of RV7 (Brilliance Control)
+5kV	at Tube Anode Cap

21. Remove the tube cover plate on the rear panel (3 screws) and check the 6.3V a.c. heater supply.

NOTE: the heater potential is -1.3kV. Heater pins are 3 and 4.

22. If there is no trace, check paragraph 28, then test the PSU and Deflection module according to the instructions in para. 112.

23. If there is a trace but no signal, disconnect the lead to pin 33 and introduce at pin 33 a 30kHz carrier signal, at approx. 12mV p.d. from 50 ohms.

24. If this has no effect continue with para. 25. If it has the effect of lifting the trace to approx. full scale (at Maximum gain) continue with para. 26.

25. Using an oscilloscope check the outputs at pins 41 (log) and 43 (lin). If there is no signal, the fault lies in the I.F. log/lin amp. module. (If there is no signal on Log, the fault lies on the Log converter). If signal is present at both these points check for signal at pin 47. With MODE switch at "signal only" check pin 68, then pin 64.

26. If no signal is present check calibrator. If signal is present check at pin 102, then at tube Y plates. Reconnect the lead at pin 33.

27. Reconnect the lead at pin 33 and inject the signal at pin 51. For the same result the signal level should be 50mV emf. If no effect check the filter unit. If satisfactory change the signal to 6mV emf at 1.4MHz. If no signal is observed check VCO. If signal peak is present check input attenuator and upconverter.

28. If there is no trace, set to manual scan. If trace returns check sweep generator and blanking.

SWEEP GENERATOR

29. Check +8V to pins 4 and 15, -8V to pins 3 and 10, earth to pin 8.

30. Set Manual Sweep Switch to normal, set centre frequency control to give 4.25V at pin 12.

31. Connect oscilloscope to pin 7 and check that a sawtooth waveform is present with a peak-to-peak amplitude of 9V.

32. Set sweep speed to maximum and adjust RV2 so that the fall time of the sawtooth is 200mS as shown below:-

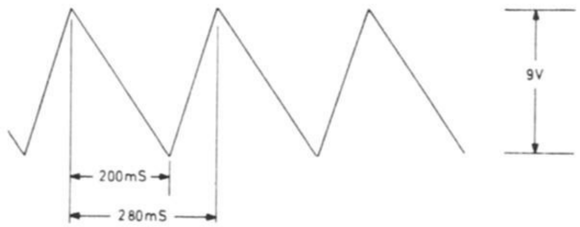


Fig. 4·1

33. Set sweep speed to minimum and check the fall time is now 19-24s.

34. Connect the oscilloscope to pin 9, reset the sweep speed to maximum, and check that the waveform is as shown below:-

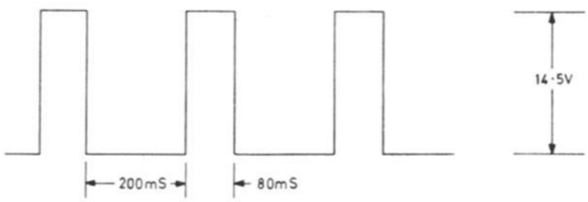


Fig. 4·2

35. Connect oscilloscope to pin 14 and set sweep width to maximum. Set RV1 to give the waveform as in (para. 32) but with peak-to-peak amplitude of 1V.

36. Adjust centre frequency to centre this waveform about +6.3V.

37. Set sweep width to minimum and check that the peak-to-peak amplitude is now 100mV.

VOLTAGE CONTROLLED OSCILLATOR

38. Check +8V supply to pin 19, -8V to pins 17 and 20, earth to pin 18.

39. Set Sweep to manual and adjust Sweep speed to give +6.3V at pin 16.

40. Connect frequency counter to TR1 collector (using a high impedance probe) and adjust L1 core to give a frequency of 1.430MHz.

41. Replace the counter with the oscilloscope and check that the waveform is a sinewave with no apparent distortion and of amplitude 12-14V peak-to-peak.

42. Connect oscilloscope to pin 21 (earthpin 22) and adjust L2 core for maximum amplitude of 4.5 - 5.5V peak-to-peak. Check that there is no visible distortion.

43. Replace the oscilloscope by the counter and adjust the sweep control to give 6.3V±0.5V at pin 16. Check that the frequency changes by ±(7.0kHz to 8.5kHz).

100kHz to 1.4MHz CONVERTER

44. Check +8V supply to pin 27, +15V to pin 25, earth to pin 26.

45. Connect an oscilloscope to the junction of R5 and L3, check that a signal at about 1.3MHz is present. The voltage should be 280mV peak-to-peak, adjust R5 if necessary to obtain this.

46. Connect a frequency counter to the junction of R5 and L3 and check that the frequency is 1.3MHz ± 50Hz.

47. Set the signal generator to 100kHz at 50mV emf., and connect to input (pin 23, earth pin 24).

48. Connect oscilloscope to output (pin 28 earth pin 29).

49. Tune L1 and L2 for maximum output at 1.4MHz. The output level should be 140mV ± 2dB.

50. Tune the generator over the range 91kHz to 109kHz and check that the output remains constant within 0.5dB (adjust L1 and L2 slightly if required to achieve this condition).

51. Tune the generator to 140kHz and check that the output falls by at least 25dB. Tune the generator to 70kHz and check that the output falls by at least 15dB.

LOG/LIN AMPLIFIER

52. Check the presence of +15V at pin 42, earth at pin 40, -15V at pin 39.

53. Disconnect the lead to pin 33 and connect a signal generator set to 16mV emf. at 30kHz to pin 33 (earth to pin 32).

54. Using a high impedance RF Voltmeter or Oscilloscope check the signal at the collector of TR2 is 90mV to 125mV rms with gain control at maximum.

55. Check that the signal at the collector of TR3 is 0.9V to 1.25V rms.

56. Reduce gain to minimum and adjust RV1 so that the signal at the collector of TR3 is now 10dB lower than that measured in (52) above. Disconnect the generator.

57. Set gain control to mid-position and reconnect the RF signal generator to pin 33 (earth to pin 32). Set the generator to 30kHz modulated 60% at 30Hz. Check that the output is 290mV rms. for an input of 18-30mV emf.

58. Remove modulation from generator, set log/lin switch to lin and gain to max. Adjust generator emf. to give a trace deflection of 60 mm. Check that the generator emf. is between 28mV and 34mV emf.

59. With the signal generator set as above switch log/lin switch to log and adjust RV3 and RV9 to give the same trace deflection (60 mm). Ensure that it is possible to increase the deflection without limiting occuring, as these controls are effectively in series.

60. Switch generator off and adjust RV4, RV5, RV7 and RV8 to give the same baseline position for both positions of the log/lin switch.

61. Switch generator on and check that in log mode the trace falls by 1 division (10 mm) for each 10dB decrease in input signal level. Tolerance on this is ±2dB on 10, 20 and 30dB marks and ±3dB on 40dB mark.

62. Repeat (59), (60) and (61) as necessary for consistent results.

63. Check that in lin mode the response falls by 2 divisions (20 mm) for a 6dB decrease in input level from maximum and by 1 division (10 mm) for a further 6dB decrease. Check that for a total decrease of 20dB the response falls by 4 divisions.

64. With no signal input and with the lead to pin 33 reconnected check that at maximum gain operation of the video switch reduces the baseline noise response by 6dB at least.

30kHz FILTER UNIT

65. Check +15V supply to pin 56, OV to pin 55.

66. Set bandwidth to 500Hz.

67. Set signal generator to 30kHz and connect to filter input (pin 51, earth pin 52). Set generator to 3mV output.

68. Connect oscilloscope to TR1 drain and check gain of stage is 25-28dB.

69. Connect oscilloscope to wiper of SW6F and tune core of L1 for maximum.

70. Connect oscilloscope to wiper of SW6C and tune core of L2 for maximum. Check that L1 is still tuned for maximum.

71. Repeat the procedure in (69) and (70) for:-

    SW6e and L3, SW6g and L4,

    SW6i and L5, SW6k and L6.

72. Connect oscilloscope to output lead (pin 54) and retune L6 for maximum.

73. Check bandwidth at -6dB points. This should be 500Hz ±50Hz.

74. Set bandwidth to 250Hz.

75. Adjust Trimmers C9, C20, C32, C44, C56 and C68 for maximum.

76. Check bandwidth at -6dB points. This should be 250Hz ± 40Hz.

77. Set Bandwidth to 100Hz.

78. Adjust trimmers C10, C21, C33, C45, C57 and C69 for maximum.

79. Check bandwidth at -6dB points. This should be 100Hz ± 30Hz.

80. Set bandwidth to 50Hz.

81. Adjust trimmers C8, C19, C31, C43, C55 and C67 for maximum.

82. Check bandwidth at -6dB points. This should be 50Hz ± 10Hz.

83. Check that the shape factor 6-60dB for each bandwidth position is better than 6:1;

84. Check that the gain for 500Hz bandwidth is 18-22dB.

85. Check that the gain for each setting of bandwidth is the same as 500Hz position within 1dB. If necessary adjust R20, R25 and R26 to achieve balance.

86. Check the presence of -8V at pins 63, 77; +8V at pin 78; earth to pins 62, 72 and 76. With Cal. switch set to Centre Frequency check -8V at pins 66, 74; +8V at pins 65, 75; +15V at pin 69.

87. With Cal. switch set to 1kHz check -8V at pins 60, 66, 74; +8V at pins 61, 65, 75; +15V at pin 59.

88. With Cal. switch set to 1kHz + Signal, check -8V at pins 60, 66, 71, 74; +8V at pins 61, 65, 73, 75; +15V at pin 59.

89. With Cal. switch set to Cal. off, check -8V at pins 66, 69, +8V at pins 65, 67.

90. Set Cal. switch to Centre Frequency and connect oscilloscope to test point A. Check that voltage is2.5-2.9V peak-to-peak and approx. sinusoidal shape.

91. Remove oscilloscope and connect frequency counter to test point A. Check that the frequency is 1500kHz ± 75kHz.

92. Set Cal. switch to 1kHz and connect oscilloscope to test point B. Check that the signal is 230-270mV peak-to-peak. Adjust RV1 to give a repetition rate of 1kHz, as shown below.

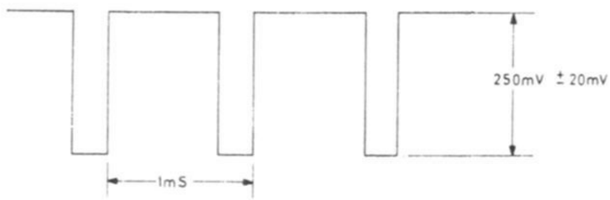


Fig. 4·3

93. Connect an oscilloscope to test point C. and adjust RV5 to give a signal of 280mV peak-to-peak as shown below.

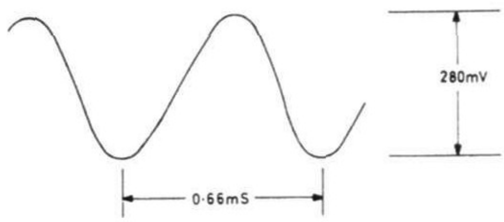


Fig. 4·4

94. Connect an oscilloscope to test point D. and check that the signal is as shown below.

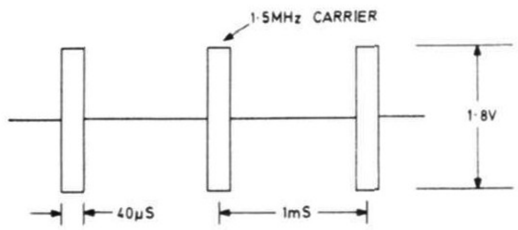


Fig. 4·5

95. Connect signal generator to test point D. via a 0.1µF isolating capacitor. Disconnect the lead to pin 58. Set signal generator to 70kHz. Connect oscilloscope to test point F, and set generator to give 3.2V peak-to-peak output. Adjust cores of L3, L4, L5 and L6 for maximum output, reducing generator output as necessary. Repeat until no improvement is possible. The generator output should be 40–65mV emf.

96. Check the bandwidth is ± (350 - 500)Hz to -6dB points.

97. Disconnect signal generator and reconnect the lead to pin 58. Connect oscilloscope to test point E. Check that the signal is as shown below.

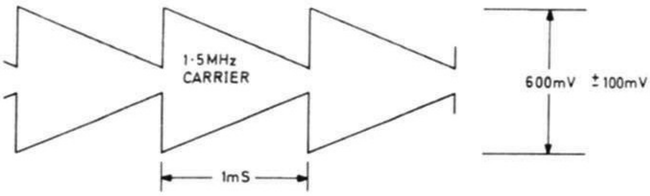


Fig. 4·6

98. Connect oscilloscope to test point G. Check that the signal is as shown below. Adjust RV3 so that the signal just clips on fastest sweep speed.

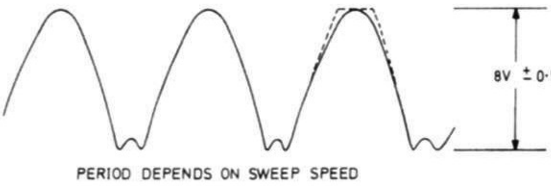


Fig. 4·7

99. Connect oscilloscope to test point H. Check that the signal is as shown below.

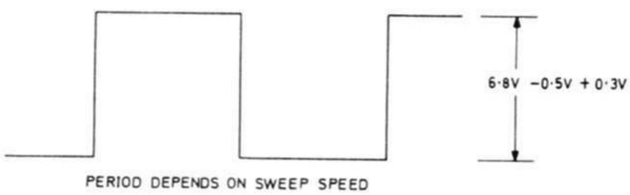


Fig. 4·8

100. Connect oscilloscope to test point M and check that the waveform is as shown below.

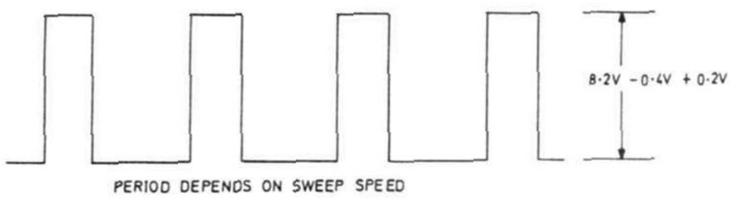


Fig. 4·9

101. Connect oscilloscope to test point J and check that the signal is as shown below.

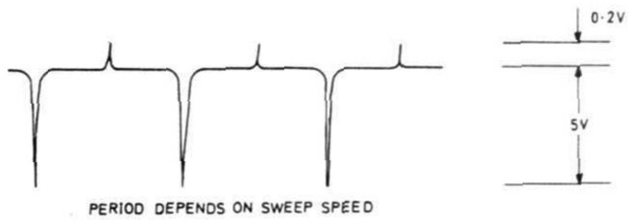


Fig. 4·10

102. Connect oscilloscope to test point K and check that the signal is as shown below.

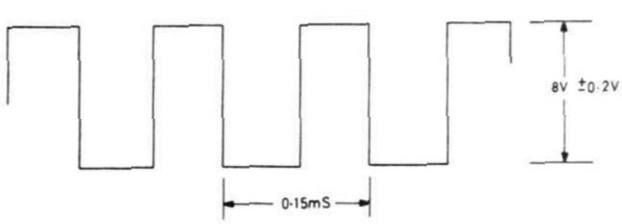


Fig. 4·11

103. Connect oscilloscope to test point L and adjust RV6 to give the amplitude shown. If it is required to vary the marker height adjust RV6 to suit.

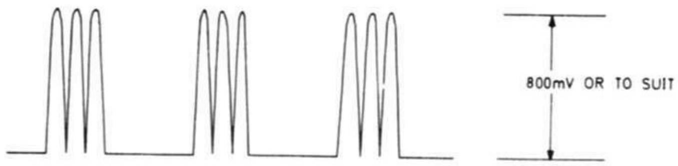


Fig. 4·12

LISSAJOU AMPLIFIERS

104. Check +8V supply to pin 85, OV to pin 83, -8V to pin 84.

105. Set signal generator to 100mV pd output at 100kHz and connect to Y input. Connect oscilloscope to Y output (pin 89, earth pin 88).

106. Adjust Y gain preset control (RV1) to give 10V peak-to-peak signal observed on the oscilloscope.

107. Reset signal generator to 10kHz and check that the output is the same within -0dB + 3dB.

108. Reset signal generator to 200kHz and check that the output is the same within +0dB -4dB.

109. Repeat paras. (105) to (108) with signal generator connected to X input, oscilloscope connected to pin 80 (X output) and adjust RV3 (X gain preset).

110. Remove oscilloscope and signal generator and connect a centre-zero voltmeter to Y output (pin 89, earth pin 88). Set output to zero by means of RV2 (Y zero).

111. Repeat (110) with voltmeter connected to X output (pin 80, earth pin 79). Adjust RV4 (X zero).

P.S.U. & DEFLECTION MODULE

112. Check presence of +15V at pin 92, -15V at pin 95, earth at pin 93.

113. Check presence of +8V at pin 94, adjust RV2 if necessary for exactly 8V. Check presence of -8V at pin 96 (-7.6 to 8.2V).

114. Check voltage at pin 91 (+1.5 to +1.7V).

115. Check voltage at pin 30 (3V to 9V according to setting of RV1).

116. Check voltage at pin 106 (+190 to 220V).

117. Check voltage across C2 (-190 to -220V).

118. Disconnect the lead to pin 102. To pin 102 connect an audio signal generator (earth to pin 101) and set to give an output of 420mV rms. at 30Hz. Set RV4 to give a peak-to-peak deflection on the screen of 60 mm (full screen), adjusting Y-shift as necessary. Set the generator to 100kHz and check that the response has not fallen by more than 6dB. Reconnect the lead pin 102.

119. Disconnect the lead to pin 100. To pin 100 connect an audio signal generator (earth to pin 101) and set to give an output of 2.7V rms at 30Hz. Set RV3 to give a peak-to-peak deflection on the screen of 100 mm (full screen), adjusting X-shift as necessary. Set the generator to 100kHz and check that the response has not fallen by more than 6dB.

120. Reconnect the lead to pin 100 and check that the trace is blanked during the flyback period (check with scan normal/invert switch in both positions).

EHT UNIT

121. WARNING: This unit develops high voltages. Ensure safety at all times when working on the unit. Switch off and discharge all capacitors before attempting any adjustments.

122. Disconnect EHT lead from tube anode and connect to AV08 fitted with 10kV multiplier. Disconnect lead from pin 116 (-1.3kV) and connect a load of 4.4M ohm (2 x 2.2M ohm in series) between pin 116 and earth.

123. Switch on and check for +15V at pin 117, earth at pin 115. Check EHT voltage is within the limits 4.6kV to 5.6kV. Check -1.3kV line is within the limits 1.3kV to 1.45kV. Check oscillator frequency (use pick-up from vicinity of transformer core) is between 11kHz and 16kHz.

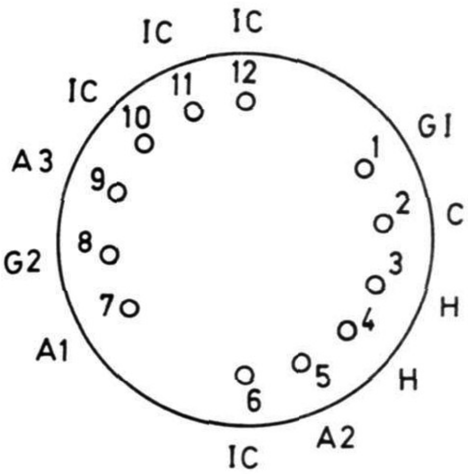
124. Connect an additional load of 2.2M ohm in parallel with the 4.4M ohm and check that the output voltages have changed by less than 300V on 5kV line and less than 150V on - 1.5kV line. Check the oscillator is still working in the same mode. Switch on and off a few times and ensure oscillator starts and works correctly each time. (Adjust value of R3 if necessary, absolute minimum resistance is 1k ohm).

125. Reconnect EHT lead, remove loads and reconnect lead to pin 116.

VOLTAGE ANALYSIS

126. The readings given were taken with a 20K ohm/V multimeter (e.g. AVO 8) using the lowest available range unless marked (*), in which case the 25V range was used. A 20% variation should be allowed to cover component tolerances. All voltages are measured with respect to earth unless stated otherwise.

Cathode Ray Tube



Tube Valveholder Connections viewed onto pins.

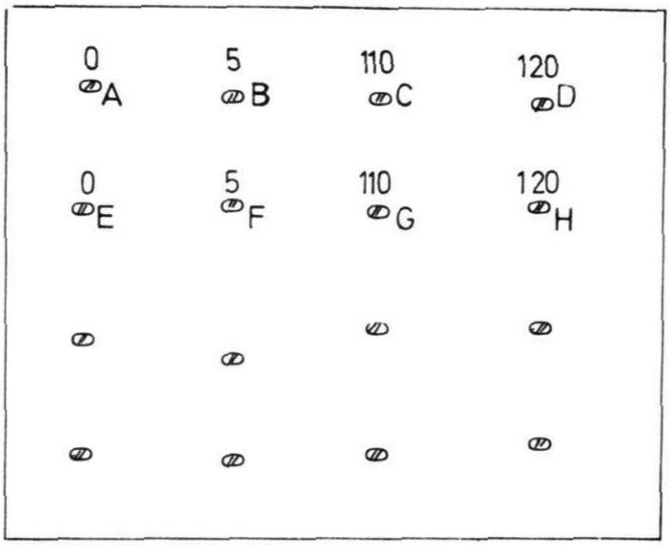
Base Type B12F

Pin	Electrode	Voltage	Notes
1	G1	-1200	
2	K	-1160	
3	H	-1160	) 6.7V A.C. across
4	H	-1160	) pins 3 and 4.
5	A2	-900	
7	A1	0	
8	G2	-70	When blanked.
9	A3	+210	
Y1		145	) Depends on base-
Y2		110	) line position.
S		100	
X1		130	) Depends on
X2		130	) sweep position.
A4		5000	

Transistors

Circuit Ref	C/S	b/g(1)	g(2)	c/d	Notes
3TR1	-0.5	0	-	5.0	
3TR2	-0.5	0	-	7.0	
4TR1	6.0	3.5*	-	14.5	
4TR2	3.0	3.5*	-	7.5	
5TR1	12.0	9.0	-	14.5	
5TR2	3.5	4.0	-	14.5	
5TR3	3.5	4.0	-	14.5	
6TR1	2.5	2.1*	3.0*	14.0	
6TR2	1.9	0	-	13.5	
7TR1	4.0	2.0*	-	14.5	
2	3.0	2.0*	3.2*	14.5	
3	2.0	0	-	14.5	
4	3.4	3.9	-	14.5	
5	0	-4.2	-	-0.1	Cal. "OFF"
6	0	-3.8	-	0	Cal. "OFF"
(	0	0	-	-70.0	Blanked
9TR1 (	-0.65	0	-	-0.6	Unblanked, normal scan.
(	0	-0.65	-	-0.1	Unblanked, inverted scan.
2	-8.4	-9.1	-	-14.7	
3	-0.5	-0.4	-	130	) No signal, baseline
4	-1.0	-0.5	-	130	) normal position.
5	-0.6	-0.1	-	145	
6	-0.2	-0.4	-	110	
10TR1	0	-0.8	-	14.8	
10TR2	0	-3.0	-	14.8	

Supply



Mains Transformer T1

Green	Blue	Link	Nominal Voltage	Notes
B	C	B-F, C-G	105	± 5V Variation Allowable 2A Fuse
A	C	A-E, C-G	110	
B	D	B-F, D-H	115	
A	D	A-E, D-H	120	
B	G	C-F	210	± 10V Variation Allowable 1A Fuse
B	G	C-E	215	
A	G	C-E	220	
B	H	C-E	225	
B	H	D-F	230	
B	H	D-E	235	
A	H	D-E	240	

Supply Lead colour code:

BROWN - LINE
BLUE - NEUTRAL
GREEN/YELLOW - EARTH

CHAPTER 5

COMPONENTS LIST

LOCATION CODE

Each component reference in the Tables which follow is prefixed by a number which will assist in the location of the component. All components for a particular circuit module are uniquely identified by the prefix number which corresponds with the individual module number.

The coding is as follows:

1.	CHASSIS & MISCELLANEOUS	6.	FILTER UNIT
2.	SWEEP GENERATOR	7.	CALIBRATOR
3.	V.C.O.	8.	LISSAJOU AMPLIFIERS
4.	100kHz - 1.4MHz UP CONVERTER	9.	PSU & DEFLECTION AMPLIFIERS
5.	LOG/LIN AMPLIFIER	10.	EHT UNIT

REPLACEMENT SPARES:

Spares should be ordered by quoting the complete circuit Reference, including the module prefix (where applicable), the component description and the part number where this is given in the lists.

From time to time, components of the type specified may be unavailable and in such circumstances equivalent types may be fitted or supplied as replacements. All orders and enquiries should be directed to the address below, quoting the type and Serial Numbers of the Equipment in all communications.

EDDYSTONE RADIO LIMITED	TELEPHONE:	021-475-2231
SALES AND SERVICE DEPT,	TELEX:	337081
ALVECHURCH ROAD,	CABLES:	EDDYSTONE BIRMINGHAM
BIRMINGHAM B31 3PP.		
ENGLAND.		

Capacitors

Ref.	Value	Type	Tolerance	Wkg Voltage
1C1	2200μF	Electrolytic	+50%-20%	40V
1C2	2200μF	Electrolytic	+50%-20%	40V
1C3	4700μF	Electrolytic	+50%-20%	16V
1C4	4700μF	Electrolytic	+50%-20%	16V
1C5	10n	Ceramic	+80%-20%	2000V
1C6	10n	Ceramic	+80%-20%	2000V
1C7	10n	Ceramic	+80%-20%	2000V
1C8	100n	Polycarbonate	20%	100V
1C9	100n	Polycarbonate	20%	100V
1C10	22μF	Tantalum	20%	16V
2C1	100n	Polycarbonate	20%	100V
2C2	470n	Polycarbonate	20%	100V
2C3	100n	Polycarbonate	20%	100V
3C1	100n	Polycarbonate	20%	100V
3C2	100n	Polycarbonate	20%	100V
3C3	39pF	Tubular Ceramic	5%	200V
3C4	82pF	Silvered Mica	2%	350V
3C5	2n2	Polystyrene	2%	125V
3C6	100n	Polycarbonate	20%	100V
3C7	100n	Polycarbonate	20%	100V
3C8	330pF	Polystyrene	2%	125V
3C9	10n	Polycarbonate	20%	100V
3C10	100n	Polycarbonate	10%	100V
4C1	390pF	Polystyrene	2%	125V
4C2	100pF	Polystyrene	2%	125V
4C3	1n	Disc Ceramic	20%	500V
4C4	100n	Polycarbonate	20%	100V
4C5	1n	Disc Ceramic	20%	500V
4C6	560pF	Polystyrene	2%	125V
4C7	10μF	Tantalum	20%	16V
4C8	10μF	Tantalum	20%	16V
4C9	10n	Polycarbonate	20%	100V
4C10	470n	Polycarbonate	20%	100V
4C11	100n	Polycarbonate	20%	100V
4C12	1n	Disc Ceramic	20%	500V
4C13	22μF	Tantalum	20%	16V
4C14	22μF	Tantalum	20%	16V
4C15	1n2	Polystyrene	20%	125V
4C16	15pF	Tubular Ceramic	5%	200V
4C17	10n	Disc Ceramic	+80%-20%	250V
4C18	1n2	Polystyrene	20%	125V
4C19	10n	Polycarbonate	20%	100V

Capacitors continued...

Ref.	Value	Type	Tolerance	Wkg Voltage
5C1	10n	Disc Ceramic	+80%-20%	250V
5C2	680n	Polycarbonate	20%	100V
5C3	680n	Polycarbonate	20%	100V
5C4	10μF	Tantalum	20%	20V
5C5	5n6	Polystyrene	2%	125V
5C6	1μF	Tantalum	20%	20V
5C7	680n	Polycarbonate	20%	100V
5C8	1μF	Tantalum	20%	20V
5C9	8n2	Polystyrene	2%	125V
5C10	680n	Polycarbonate	20%	100V
5C11	10μF	Tantalum	20%	20V
5C12	22μF	Tantalum	20%	20V
5C13	470pF	Polystyrene	2%	125V
5C14	2n2	Polystyrene	2%	125V
5C15	1n	Polystyrene	2%	125V
5C16	220n	Polycarbonate	20%	100V
5C17	100n	Polycarbonate	20%	100V
5C18	470n	Polycarbonate	20%	100V
5C19	220μF	Electrolytic	20%	16V
5C20	220μF	Electrolytic	20%	16V
6C1	100n	Polycarbonate	20%	100V
6C2	100n	Polycarbonate	20%	100V
6C3	10μF	Tantalum	20%	20V
6C4	22μF	Tantalum	20%	20V
6C5	4.7μF	Tantalum	20%	20V
6C6	2n7	Polystyrene	2%	125V
6C7	100pF	Tubular Ceramic	5%	200V
6C8	4-30pF	Trimmer Plastic Film		50V
6C9	4-30pF	Trimmer Plastic Film		50V
6C10	4-30pF	Trimmer Plastic Film		50V
6C11	27pF	Polystyrene	2%	125V
6C12	15pF	Polystyrene	2%	125V
6C13	3.3pF	Tubular Ceramic	± 0.5pF	200V
6C14	8.2pF	Tubular Ceramic	5%	200V
6C15	33pF	Tubular Ceramic	5%	200V
6C16	15pF	Tubular Ceramic	5%	200V
6C17	2n7	Polystyrene	2%	125V
6C18	68pF	Tubular Ceramic	5%	125V
6C19	4-30pF	Trimmer Plastic Film		50V
6C20	4-30pF	Trimmer Plastic Film		50V
6C21	4-30pF	Trimmer Plastic Film		50V
6C22	27pF	Polystyrene	2%	125V
6C23	39pF	Polystyrene	2%	125V
6C24	47pF	Polystyrene	2%	125V
6C25	3.3pF	Tubular Ceramic	± 0.5pF	200V
6C26	8.2pF	Tubular Ceramic	± 0.5pF	200V

Capacitors continued...

Ref.	Value	Type	Tolerance	Wkg Voltage
6C27	33pF	Tubular Ceramic	5%	200V
6C28	15pF	Tubular Ceramic	5%	200V
6C29	2n7	Polystyrene	2%	125V
6C30	68pF	Tubular Ceramic	5%	125V
6C31	4-30pF	Trimmer Plastic Film		50V
6C32	4-30pF	Trimmer Plastic Film		50V
6C33	4-30pF	Trimmer Plastic Film		50V
6C34	27pF	Polystyrene	2%	125V
6C35	39pF	Polystyrene	2%	125V
6C36	47pF	Polystyrene	2%	125V
6C37	3.3pF	Tubular Ceramic	± 0.5pF	200V
6C38	8.2pF	Tubular Ceramic	5%	200V
6C39	33pF	Tubular Ceramic	5%	200V
6C40	15pF	Tubular Ceramic	5%	200V
6C41	2n7	Polystyrene	2%	125V
6C42	68pF	Tubular Ceramic	5%	125V
6C43	4-30pF	Trimmer Plastic Film		50V
6C44	4-30pF	Trimmer Plastic Film		50V
6C45	4-30pF	Trimmer Plastic Film		50V
6C46	18pF	Polystyrene	2%	125V
6C47	33pF	Polystyrene	2%	125V
6C48	39pF	Polystyrene	2%	125V
6C49	3.3pF	Tubular Ceramic	± 0.5%	200V
6C50	8.2pF	Tubular Ceramic	5%	200V
6C51	33pF	Tubular Ceramic	5%	200V
6C52	15pF	Tubular Ceramic	5%	200V
6C53	2n7	Polystyrene	2%	125V
6C54	68pF	Tubular Ceramic	5%	125V
6C55	4-30pF	Trimmer Plastic Film		50V
6C56	4-30pF	Trimmer Plastic Film		50V
6C57	4-30pF	Trimmer Plastic Film		50V
6C58	18pF	Polystyrene	2%	125V
6C59	33pF	Polystyrene	2%	125V
6C60	39pF	Polystyrene	2%	125V
6C61	2n7	Polystyrene	2%	125V
6C62	68pF	Tubular Ceramic	5%	125V
6C63	3.3pF	Tubular Ceramic	± 0.5pF	200V
6C64	8.2pF	Tubular Ceramic	5%	200V
6C65	33pF	Tubular Ceramic	5%	200V
6C66	15pF	Tubular Ceramic	5%	200V
6C67	4-30pF	Trimmer Plastic Film		50V
6C68	4-30pF	Trimmer Plastic Film		50V
6C69	4-30pF	Trimmer Plastic Film		50V
6C70	82pF	Polystyrene	2%	125V
6C71	82pF	Polystyrene	2%	125V
6C72	12pF	Tubular Ceramic	5%	200V
6C73	4.7pF	Tubular Ceramic	± 0.5pF	200V
6C74	390pF	Polystyrene	2%	125V

Capacitors continued...

Ref.	Value	Type	Tolerance	Wkg Voltage
6C75	270pF	Polystyrene	2%	125V
6C76	100n	Polycarbonate	20%	100V
6C77	22µF	Tantalum	20%	20V
6C78	22µF	Tantalum	20%	20V
6C79	27pF	Polystyrene	2%	125V
6C80	100n	Polycarbonate	20%	100V
6C81	4.7µF	Tantalum	20%	20V
7C1	22n	Polycarbonate	20%	100V
7C2	22µF	Tantalum	20%	20V
7C3	10µF	Tantalum	20%	20V
7C4	10µF	Tantalum	20%	20V
7C5	220pF	Polystyrene	2%	125V
7C6	22µF	Tantalum	20%	20V
7C7	100pF	Polystyrene	1%	125V
7C8	390pF	Polystyrene	2%	125V
7C9	100n	Polycarbonate	20%	100V
7C10	1µF	Tantalum	20%	35V
7C11	1n	Disc Ceramic	20%	500V
7C12	100n	Polycarbonate	20%	100V
7C13	22µF	Tantalum	20%	20V
7C14	10µF	Tantalum	20%	20V
7C15	680n	Tantalum	20%	35V
7C16	1n2	Polystyrene	2%	125V
7C17	6.8pF	Tubular Ceramic	± 0.5pF	200V
7C18	2n2	Polystyrene	2%	125V
7C19	6.8pF	Tubular Ceramic	± 0.5pF	200V
7C20	2n2	Polystyrene	2%	125V
7C21	6.8pF	Tubular Ceramic	± 0.5pF	200V
7C22	2n2	Polystyrene	2%	125V
7C23	100pF	Tubular Ceramic	5%	200V
7C24	680n	Tantalum	20%	35V
7C25	3n6	Polystyrene	1%	125V
7C26	100n	Polycarbonate	20%	100V
7C27	1µF	Tantalum	20%	35V
7C28	3n6	Polystyrene	1%	125V
7C29	22µF	Tantalum	20%	20V
7C30	220n	Polycarbonate	20%	100V
7C31	22n	Polycarbonate	20%	100V
7C32	47n	Polycarbonate	20%	100V
7C33	10n	Polycarbonate	20%	100V
7C34	1n	Disc Ceramic	20%	500V
7C35	220pF	Polystyrene	2%	125V
7C36	100n	Polycarbonate	20%	100V

Capacitors continued....

Ref.	Value	Type	Tolerance	Wkg Voltage
8C1	100pF	Polystyrene	5%	125V
8C2	3.3pF	Tubular Ceramic	± 0.5pF	200V
8C3	100pF	Polystyrene	5%	125V
8C4	3.3pF	Tubular Ceramic	± 0.5pF	200V
8C5	10n	Polycarbonate	20%	100V
8C6	68µF	Tantalum	20%	16V
9C1	100µF	Electrolytic	+50%-20%	315V
9C2	100µF	Electrolytic	+50%-20%	315V
9C3	1n	Disc Ceramic	20%	500V
9C4	150pF	Silvered Mica	5%	350V
10C1	47n	Polycarbonate	20%	100V
10C2	22µF	Tantalum	20%	20V
10C3	47n	Polycarbonate	20%	100V
10C4	4n7	Ceramic	+50%-20%	12.5KV
10C5	10n	Ceramic	+20%-80%	2KV
10C6	4n7	Ceramic	+50%-20%	12.5KV
10C7	10n	Ceramic	+20%-80%	2KV
10C8	10n	Disc Ceramic	20%	500V

Resistors

All resistors are 5% tolerance 0.3W rating CR25 unless otherwise stated.

1R4, 1R5, 1R6, 1R8 and 10R4 are composition.
1R7 is metal oxide.
1R22 is wire wound 2.5W rating.
7R30 is a thermistor.

Ref.	Value Ohms	Rating W	Ref.	Value Ohms	Rating W	Ref.	Value Ohms	Rating W
1R1	1K		1R13	100	0.25	1R25	10K	
1R2	10K		1R14	120	0.25	1R26	10K	
1R3	10K		1R15	100	0.25	1R27	100K	
1R4	1M	0.5	1R16	120	0.25			
1R5	1M	0.5	1R17	100	0.25	2R1	270K	
1R6	1M	0.5	1R18	120	0.25	2R2	220K	0.25
1R7	270K	0.5	1R19	47	0.25	2R3	10K	
1R8	15K	0.5	1R20	15K		2R4	68K	
1R9	100	0.25	1R21	27K	0.25	2R5	15K	0.5
1R10	180	0.25	1R22	18	2.5W/W	2R6	120K	0.25
1R11	100	0.25	1R23	4K7		2R7	390K	0.25
1R12	150	0.25	1R24	100K		2R8	390K	0.25

Resistors continued......

Ref.	Value Ohms	Rating W	Ref.	Value Ohms	Rating W	Ref.	Value Ohms	Rating W
2R9	10K		5R19	470		7R11	15K	
2R10	100K		5R20	1K		7R12	39K	
			5R21	10K		7R13	47	
3R1	22K		5R22	100K		7R14	680	
3R2	10K		5R23	100K		7R15	680	
3R3	4K7		5R24	10K		7R16	1K8	
3R4	4K7		5R25	47K		7R17	12K	
3R5	470					7R18	10K	
3R6	10K		6R1	12K		7R19	1K	
3R7	1K		6R2	39K		7R20	39K	
			6R3	10K		7R21	56K	
4R1	12K		6R4	56K		7R22	1K	
4R2	39K		6R5	1K		7R23	220	
4R3	1K2		6R6	1K		7R24	270	
4R4	47		6R7	220K	0.25	7R25	1K	
4R5	10K	A.O.T.	6R8	100K		7R26	4K7	
4R6	2K2		6R9	220K	0.25	7R27	5K6	
4R7	22		6R10	100K		7R28	390	
4R8	1K		6R11	220K	0.25	7R29	2K2	
4R9	NOT FITTED		6R12	100K		7R30	Thermistor *	
4R10	3K9		6R13	220K	0.25	7R31	470	A.O.T.
4R11	8K2		6R14	100K		7R32	3K9	
4R12	8K2		6R15	220K	0.25	7R33	1K	
4R13	10		6R16	100K		7R34	2K2	
4R14	100		6R17	220K	0.25	7R35	1K	
4R15	100		6R18	100K		7R36	10K	
4R16	100		6R19	220K	0.25	7R37	2K2	
			6R20	18K	A.O.T.	7R38	2K7	
5R1	220K	0.25	6R21	270K		7R39	1K	
5R2	8K2		6R22	1K		7R40	22K	
5R3	47K		6R23	47K		7R41	100K	
5R4	47K		6R24	22		7R42	100K	
5R5	5K6		6R25	18K	A.O.T.	7R43	NOT FITTED	
5R6	15K		6R26	120K	0.25	7R44	10K	
5R7	22				(A.O.T.)	7R45	10K	
5R8	390					7R46	10K	
5R9	220		7R1	2K2		7R47	10K	
5R10	5K6		7R2	1K8		7R48	10K	
5R11	150	0.25	7R3	4K7		7R49	10K	
5R12	120	0.25	7R4	4K7		7R50	10K	
5R13	15K		7R5	27K	0.25	7R51	10K	
5R14	22		7R6	1K		7R52	10K	
5R15	1K8		7R7	220K	0.25	7R53	1K	
5R16	10K		7R8	10K		7R54	10K	
5R17	10K		7R9	6K8		7R55	100K	
5R18	1K		7R10	1K		7R56	1K	

Resistors continued...

Ref.	Value Ohms	Rating W	Ref.	Value Ohms	Rating W
7R57	10K		9R7	22	
7R58	10K		9R8	100K	
7R59	100K		9R9	220K	
			9R10	47K	
8R1	1K		9R11	27K	0.25
8R2	100K		9R12	27K	0.25
8R3	1K		9R13	47K	
8R4	100K		9R14	47K	
8R5	100K		9R15	47K	
8R6	1K5		9R16	27K	0.25
8R7	100K		9R17	27K	0.25
8R8	1K5		9R18	47K	
			9R19	47K	
9R1	220				
9R2	1K		10R1	330	
9R3	10		10R2	330	
9R4	10		10R3	2K7	A.O.T.
9R5	10K		10R4	1M	0.5
9R6	10K				

THERMISTOR *	
Ref.	Type
7R30	VA.1066S

Potentiometers

Ref	Value	Law	Type	Function
1RV1	100K	Lin.	Carbon (Dual/RV11)	Sweep speed
1RV2	100K	Lin.	Carbon	Sweep width
1RV3	10K	Lin.	Carbon	Centre frequency
1RV4	250K	Lin.	Carbon pre-set	Astigmatism
1RV5	250K	Lin.	Carbon pre-set	Geometry
1RV6	1M	Lin.	Carbon	Focus
1RV7	470K	Lin.	Carbon pre-set	Brilliance
1RV8	10K	Lin.	Carbon pre-set	X Shift
1RV9	10K	Lin.	Carbon pre-set	Y Shift
1RV10	100	Lin.	W.W. Pre-set	Graticule illumination
1RV11	100K	Lin.	Carbon (Dual/RV1)	Manual sweep
1RV12	10K	Lin.	Carbon	Gain
2RV1	220K	Lin.	Cermet Horiz pre-set	
2RV2	47K	Lin.	Cermet Horiz pre-set	
5RV1	10K	Lin.	Cermet Horiz pre-set	
5RV2	10K	Lin.	Cermet Horiz pre-set	
5RV3	47K	Lin.	Cermet Horiz pre-set	
5RV4	10K	Lin.	Cermet Horiz pre-set	
5RV5	10K	Lin.	Cermet Horiz pre-set	

Potentiometers continued...

Ref.	Value Ohms	Law	Type	Function
5RV6	470K	Lin.	Cermet Horiz pre-set	
5RV7	10K	Lin.	Cermet Horiz pre-set	
5RV8	10K	Lin.	Cermet Horiz pre-set	
5RV9	470K	Lin.	Cermet Horiz pre-set	
7RV1	100K	Lin.	Cermet Horiz pre-set	
7RV2	470K	Lin.	Cermet Horiz pre-set	
7RV3	1K	Lin.	Cermet Horiz pre-set	
7RV4	4K7	Lin.	Cermet Horiz pre-set	
7RV5	10K	Lin.	Cermet Vert pre-set	
7RV6	220K	Lin.	Cermet Vert pre-set	
8RV1	100	Lin.	Cermet Horiz pre-set	
8RV2	100K	Lin.	Cermet Horiz pre-set	
8RV3	100	Lin.	Cermet Horiz pre-set	
8RV4	100K	Lin.	Cermet Horiz pre-set	
9RV1	1K	Lin.	Cermet Horiz pre-set	
9RV2	10K	Lin.	Cermet Horiz pre-set	
9RV3	10K	Lin.	Cermet Horiz pre-set	
9RV4	100K	Lin.	Cermet Horiz pre-set	

Diodes

Ref	Type	Manufacturer
1D1	OSHO1A	H. Packard
1D2	4082-4850 (LED)	H. Packard
1D3	IN4148	S.T.C.
1D4	IN4004	Motorola
1D5	IN4004	Motorola
1D6	IN4004	Motorola
1D7	IN4004	Motorola
1D8	IN4004	Motorola
1D9	IN4004	Motorola
1D10	IN4004	Motorola
1D11	IN4004	Motorola
3D1	MV 1648	Motorola
4D1	BZY88C 6V2 (Zener)	Mullard
5D1	IS44	Texas
5D2	IN4004	Motorola
5D3	IN4004	Motorola

Diodes continued....

Ref.	Type	Manufacturer
7D1	BAX13	Mullard
7D2	BZY88C6V2 (Zener)	Mullard
7D3	BZY88C15 (Zener)	Mullard
7D4	BAX13	Mullard
7D5	BZY88C6V8 (Zener)	Mullard
9D1	BY179	Mullard
9D2	BY179	Mullard
9D3	IN4148	Mullard
10D1	IN4007	STC
10D2	BY187	Mullard
10D3	BY187	Mullard
10D4	BY187	Mullard
10D5	BY187	Mullard

Transistors

Ref.	Type	Manufacturer
3TR1	BFX89	Mullard
3TR2	BFX89	Mullard
4TR1	UC734B	Union Carbide
4TR2	BC107B	Mullard
5TR1	UC734B	Union Carbide
5TR2	BC107B	Mullard
5TR3	BC107B	Mullard
6TR1	40673	RCA
6TR2	BF254B	Mullard
7TR1	UC734B	Union Carbide
7TR2	40673	RCA
7TR3	UC734B	Union Carbide
7TR4	BC107B	Mullard
7TR5	UC734B	Union Carbide
7TR6	UC734B	Union Carbide
9TR1	BFW44	SGS
9TR2	BFX88	Mullard
9TR3	BF338	Mullard
9TR4	BF338	Mullard
9TR5	BF338	Mullard
9TR6	BF338	Mullard

Transistors continued....

Ref.	Type	Manufacturer
10TR1	2N3055	
10TR2	2N3055	

Integrated Circuits

Ref	Type	Manufacturer
1IC1	7815CP	Motorola
1IC2	7915CP	Motorola
2IC1	307	Fairchild
2IC2	741C	Fairchild MA.741C
2IC3	741C	Fairchild MA.741C
4IC1	SL641	Plessey
5IC1	715C	Fairchild
5IC2	741C	Fairchild
5IC3	741C	Fairchild
5IC4	741C	Fairchild
5IC5	741C	Fairchild
7IC1	709C	Fairchild
7IC2	SL641	Plessey
7IC3	741C	Fairchild
7IC4	741C	Fairchild
7IC5	MC 14528 CP	Motorola
7IC6	741C	Fairchild
7IC7	741C	Fairchild
7IC8	741C	Fairchild
7IC9	741C	Fairchild
7IC10	741C	Fairchild
7IC11	MC4011P	Motorola
8IC1	709C	Fairchild
8IC2	709C	Fairchild
9IC1	723C	Fairchild
9IC2	741C	Fairchild

Inductors

Ref.	Type		Manufacturer
1L1	D4 101 Twist coil		Eddystone
3L1	D5063		Eddystone
4L1	D5061		Eddystone
4L2	D5062		Eddystone
4L3	SC60	22μH	Sigma
5L1	SC60	4.7mH	Sigma
5L2	SC30/19	3.3mH	Sigma
6L1	D5028		Eddystone
6L2	D5027		Eddystone
6L3	D5027		Eddystone
6L4	D5027		Eddystone
6L5	D5027		Eddystone
6L6	D5027		Eddystone
6L7	SC60	100mH	Sigma
6L8	SC60	10mH	Sigma
7L1	SC60	47μH	Sigma
7L2	SC60	4.7μH	Sigma
7L3	D5067		Eddystone
7L4	D5066		Eddystone
7L5	D5066		Eddystone
7L6	D5066/1		Eddystone
7L7	SC60	1.5mH	Sigma
7L8	SC60	1.5mH	Sigma
10L1	D5096		Eddystone

Major Spares

Ref	Description	Part No.
	MODULES AND UNITS:	
2	Sweep generator (PCB ONLY)	NO MODULE
3	Voltage controlled oscillator	LP3514
4	100kHz to 1.4MHz up convertor	LP3527
5	LOG/LIN amplifier (PCB ONLY)	NO MODULE
6	Filter unit	LP3525
7	Calibrator (PCB ONLY)	NO MODULE
8	Lissajou amplifier (PCB ONLY)	NO MODULE
9	Deflection amplifier and P.S.U.	LP3513
10	EHT Inverter	LP3526

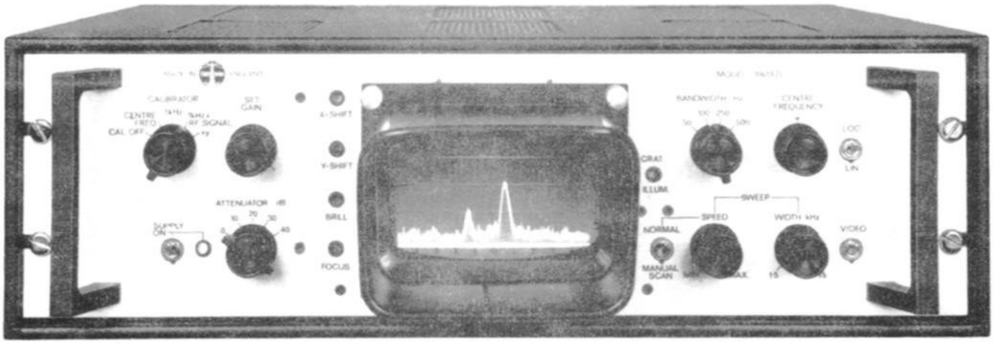
Major Spares continued....

Ref.	Description	Part No.
	PRINTED CIRCUIT BOARDS INCLUDING COMPONENTS:	
2	Sweep generator board	LP3503/5
3	Voltage controlled oscillator board	LP3503/2
4	100kHz to 1.4MHz up convertor board	LP3503/1
5	LOG/LIN amplifier board	LP3503/3
6	Filter unit board	LP3503/7
7	Calibrator board	LP3503/9
8	Lissajou amplifier board	LP3503/4
9	Deflection amplifier board and P.S.U.	LP3503/6
10	EHT Inverter board	LP3503/8
	SWITCHES:	
1S1	Scan invert	9822P
1S2	Mains	7201P
1S3	Calibrator	9690P
1S4	LOG/LIN	6760P
1S5	Video	6760P
1S6	N/A see 6S1 (filter)	-
1S7	Attenuator unit complete	LP3515
1S8	Input select	9823P
1S9	Manual sweep	98244P
6S1	(Filter) spindle clicker assy.	9678P
6S1	Coupling Hub	7353P
6S1	Extension spindle	8382P
6S1	Wafers A-L	8537P
6S1	Wafer M	9293P
	TRIMMER CAPACITORS:	
6C8	)	
6C9	)	
6C10	)	
6C19	)	
6C20	)	
6C21	)	
6C31	) 4-30pF	8735P
6C32	)	
6C33	)	
6C43	)	
6C44	)	
6C45	)	
6C55	)	
6C56	)	

Ref.	Description	Part No.
	TRIMMER CAPACITORS continued:	
6C57	)	
6C67	) 4-30pF	8735P
6C68	)	
6C69	)	
	CONNECTORS:	
	AC supply connector complete with 3 core cable	D4815
PL1	Mains IEC 6A filtered input	9872/1P
PL2	Signal Input)	
PL3	Y Input) BNC Plug	8012P
PL4	X Input)	
SK2	Signal Input)	
SK3	Y Input) 50Ω BNC Socket	7225P
SK4	X Input)	
	TRANSFORMERS:	
1T1	Mains	9541P
3T1	Output transformer	D5064
10T1	Inverter	D5068
	CONTROL KNOBS:	
	Sweep speed) Dual concentric	
	Manual sweep)	LP3462
	Sweep width	LP3460
	Centre frequency	LP3460
	Focus	LP3460
	Gain	LP3460
	CRYSTALS:	
4XL1	1300kHz Style D series resonant	9825P
7XL1	1500kHz Style D series resonant	9826P

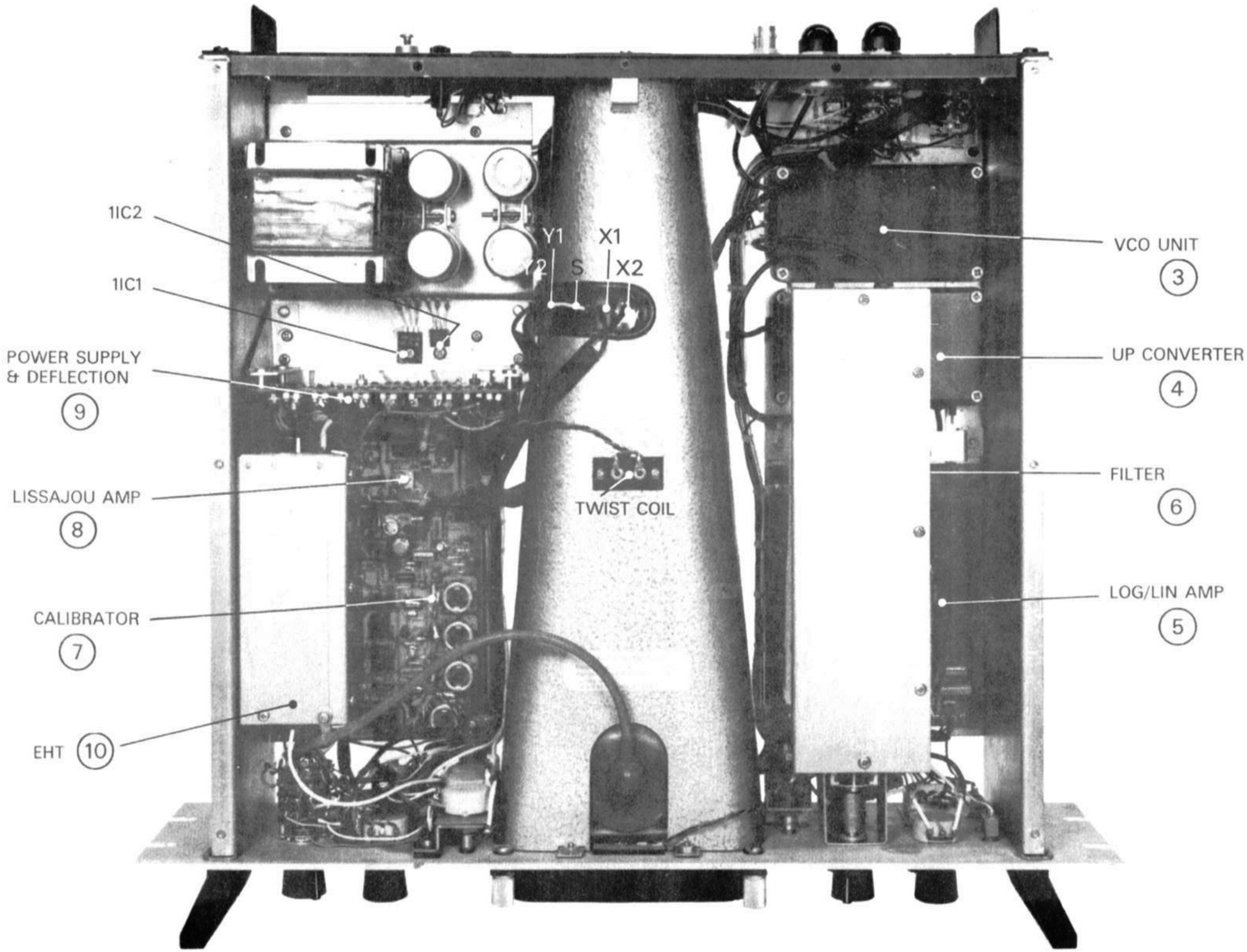
Major Spares continued...

Ref	Description	Part No.
	MISCELLANEOUS:	
V1	CRT D 13/33 GM	9827P
	CRT Mumetal shield	9828P
LP1	Graticule Lamp 12V 80mA	8448P
LP2	Graticule Lamp 12V 80mA	8448P
FS1	Mains fuse 1 amp anti-surge	7173P
	Fuse Holder	8458P
	Earth terminal	6371P
	Top Cover	9558P
	Bottom Cover	9559P
	Shroud	9482P
	Box Spanner	9057P
	Trimming Tool	833P
	Trimming Tool	8451P

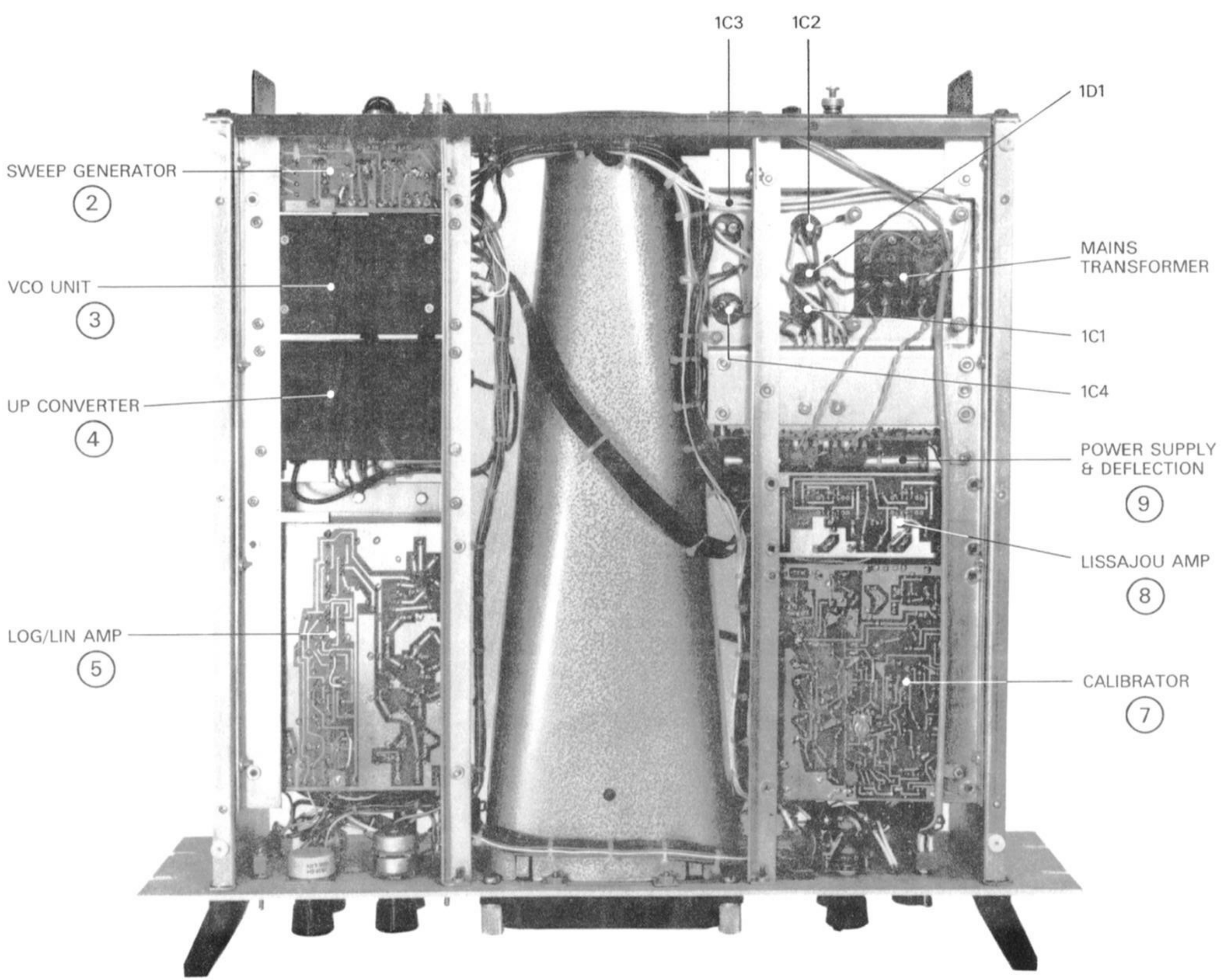


Front View Shown With Optional Anti-Glare Shroud Fitted

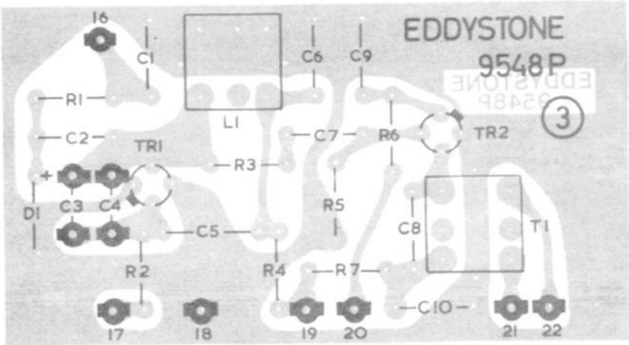
Front & Rear Views Fig. 1



Internal View (Top) Fig. 2

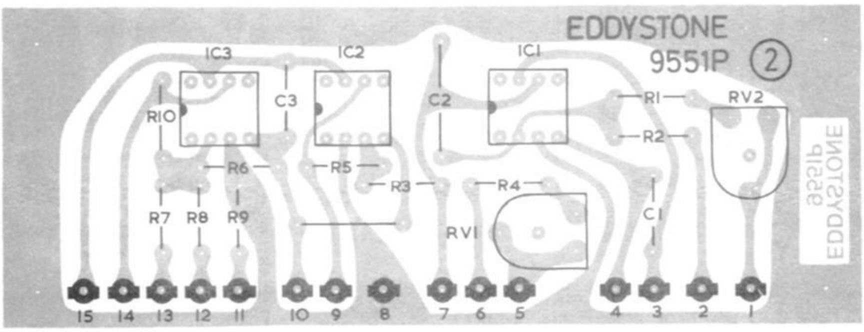


Internal View (Underside) Fig. 3



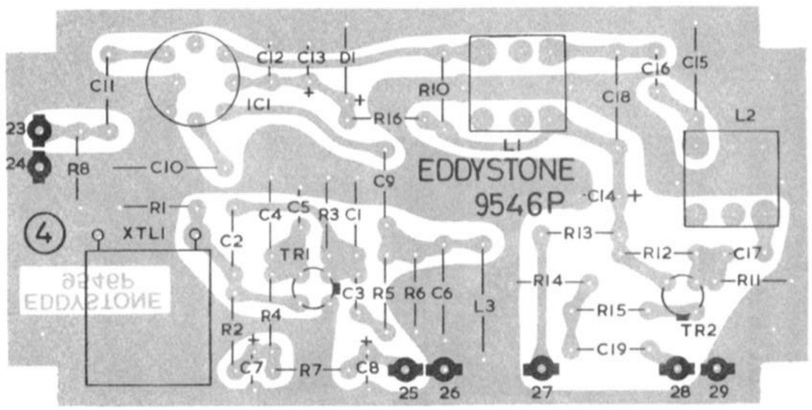
VCO

Fig. 4



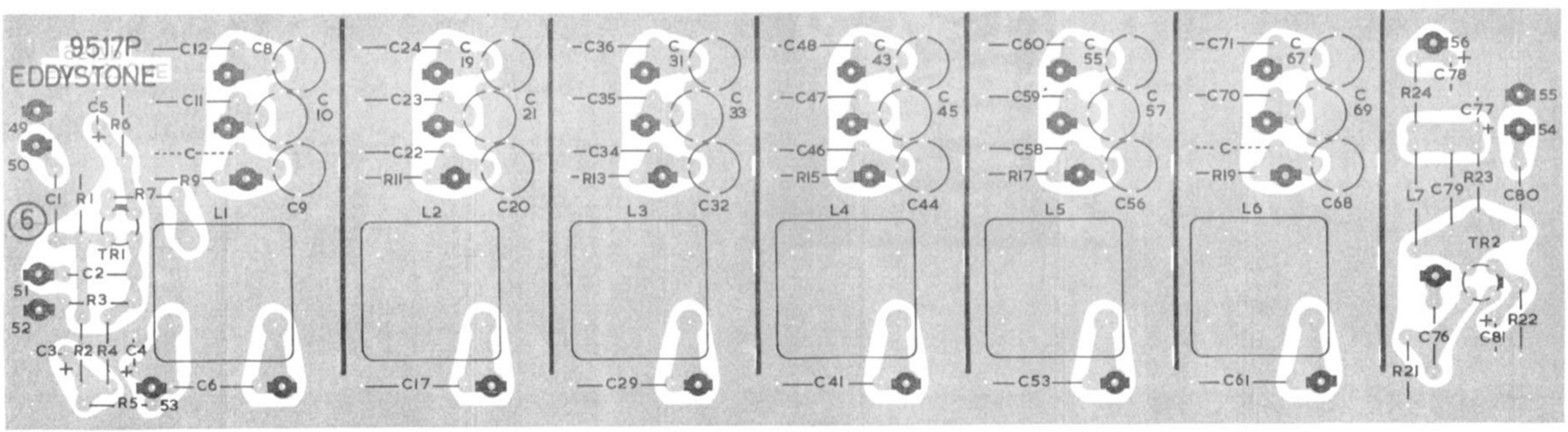
SWEEP GENERATOR

Fig. 5



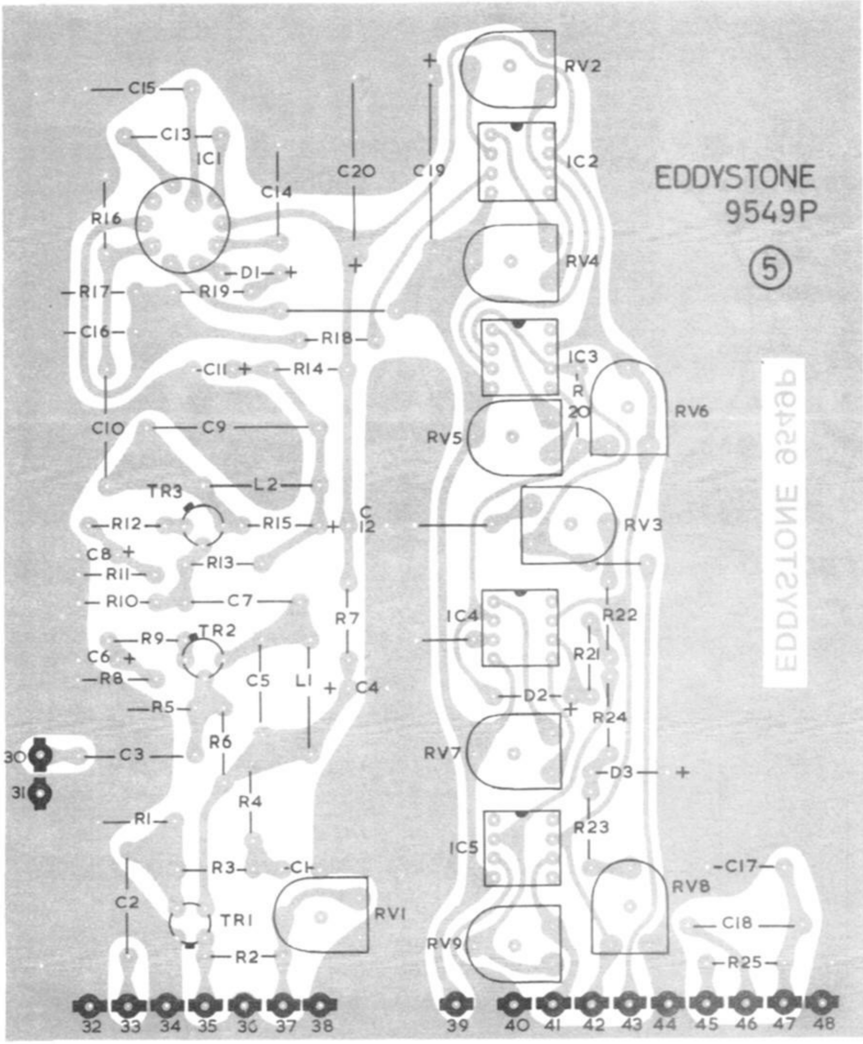
100 kHz TO 1.4 MHz UP CONVERTER

Fig. 6

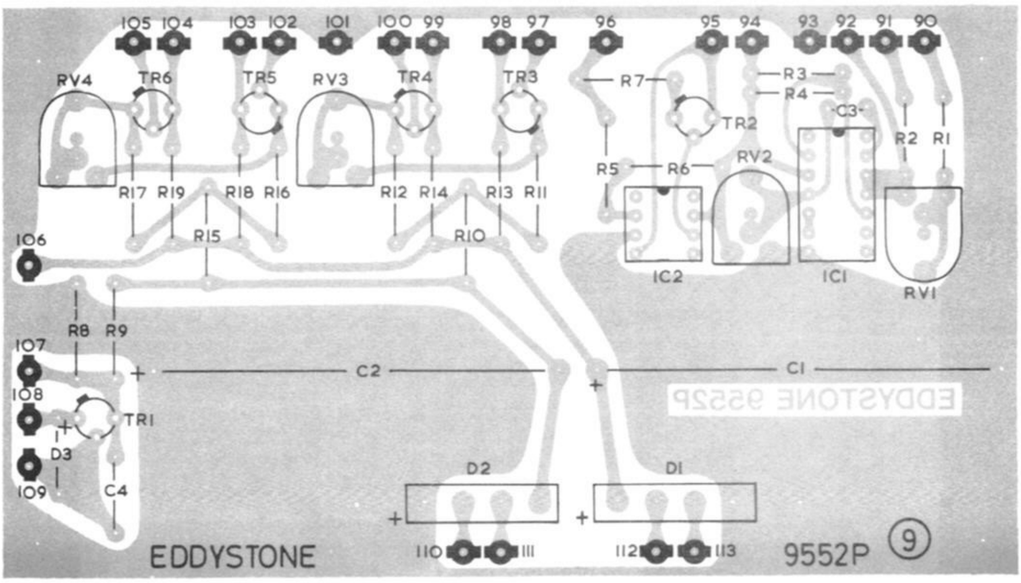


FILTER UNIT

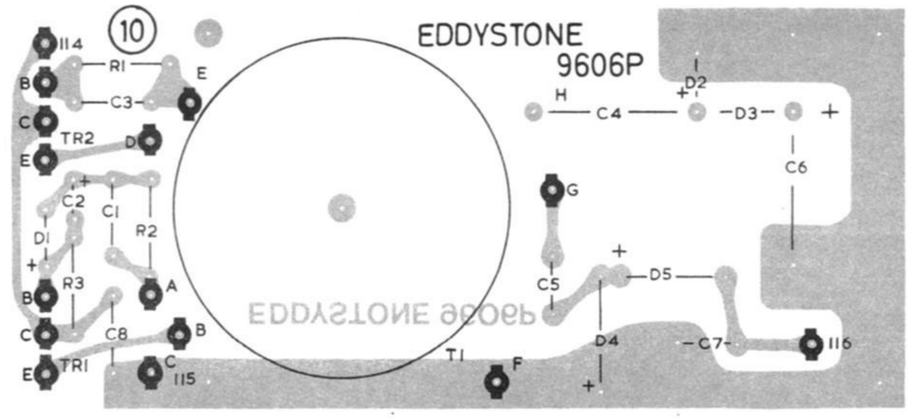
Fig. 7



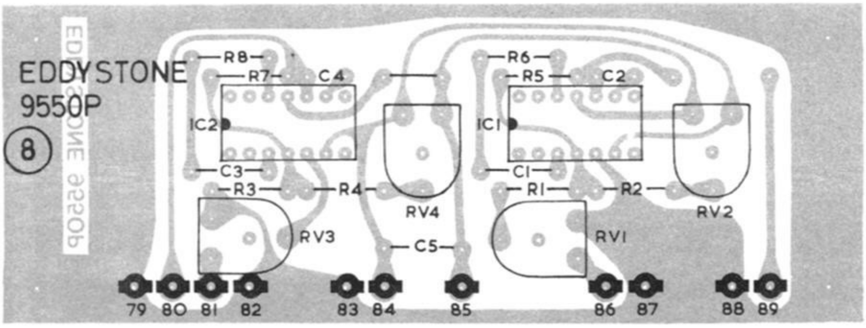
LOG/LIN AMP Fig. 8



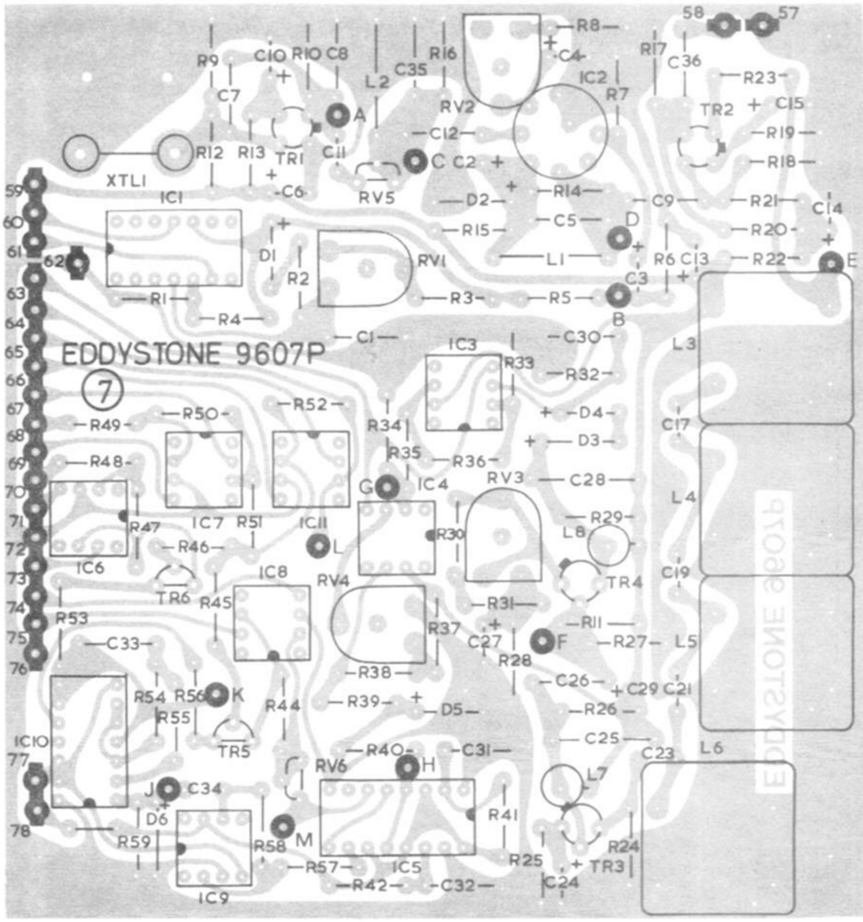
DEFLECTION AMPS Fig. 9



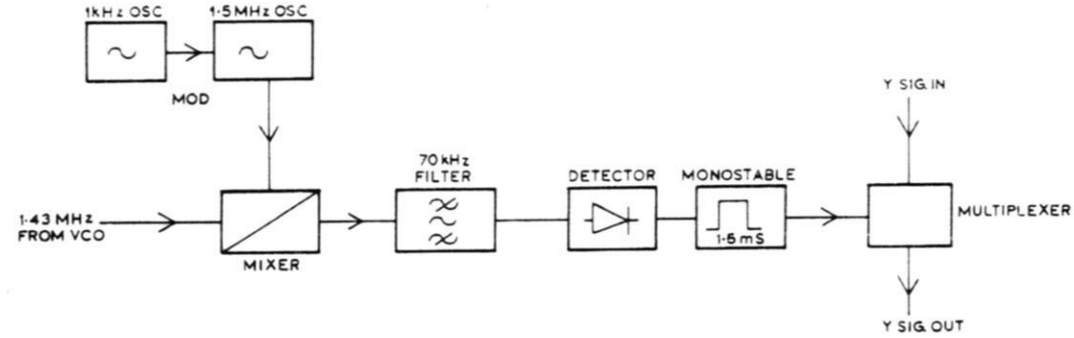
E H T BOARD **Fig. 10**

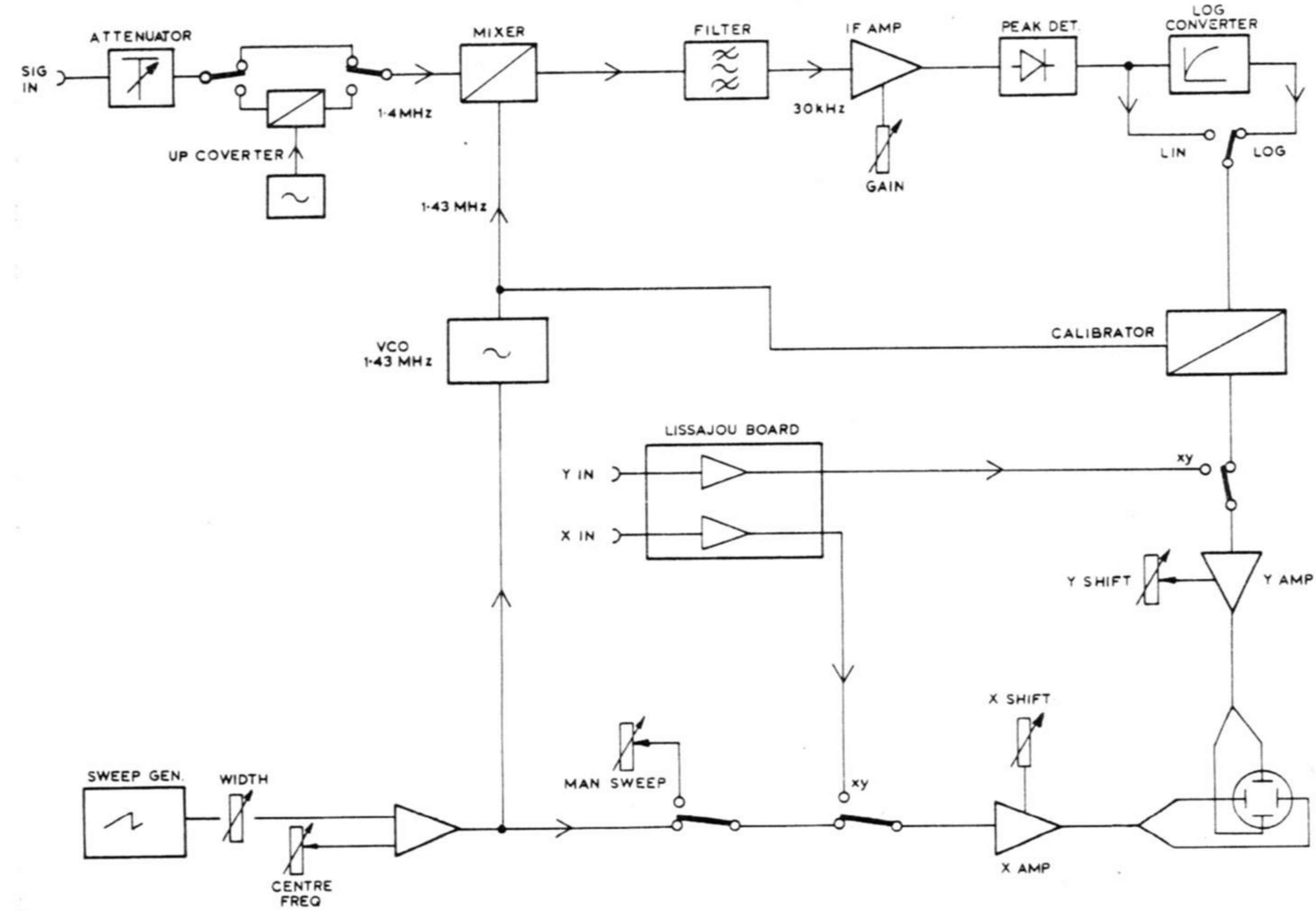


LISSAJOU BOARD **Fig. 11**



CALIBRATOR BOARD **Fig. 12**





Block Diagram
EP 1061A Simplified Block Diagram

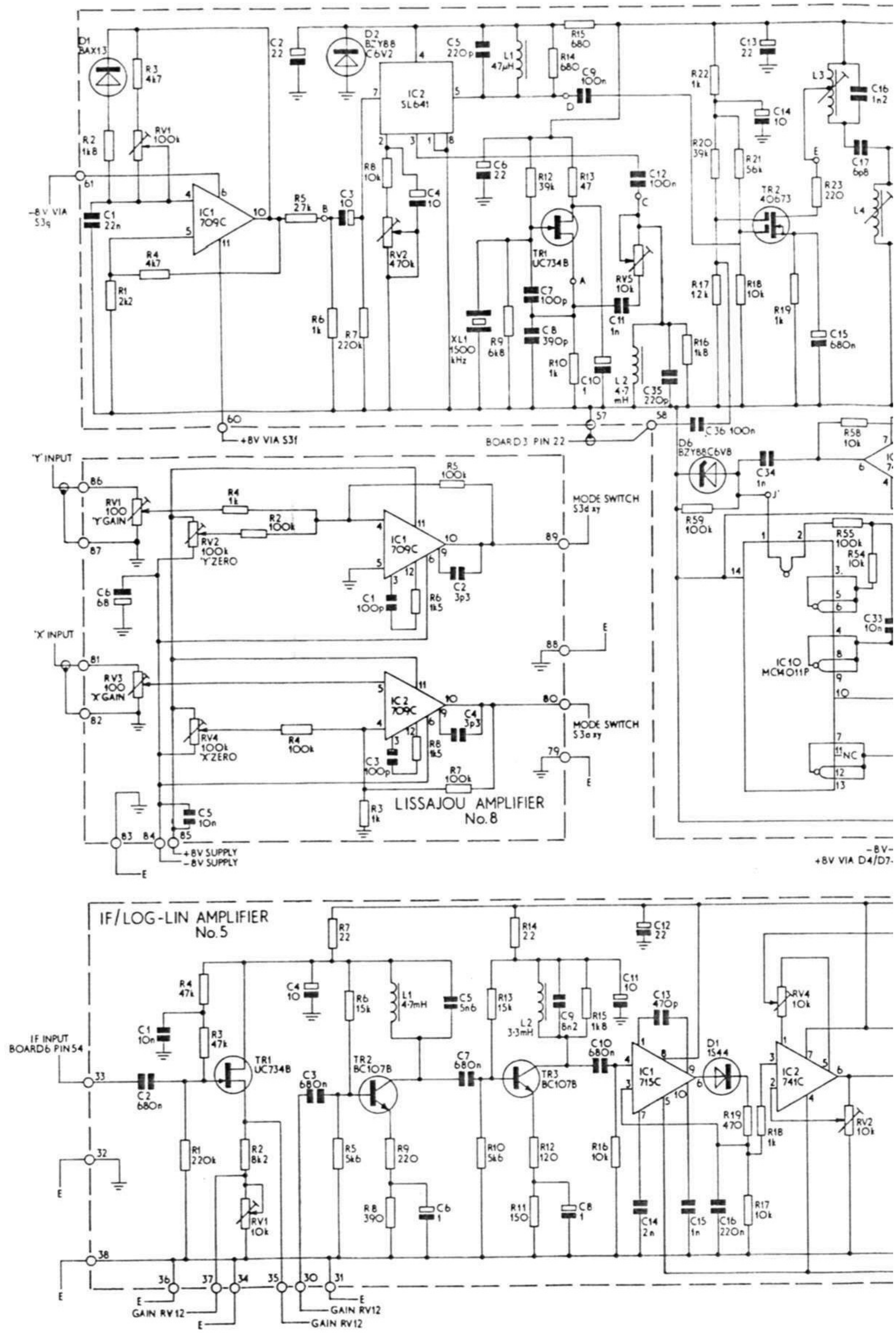
Fig. 13

Integrated Circuits

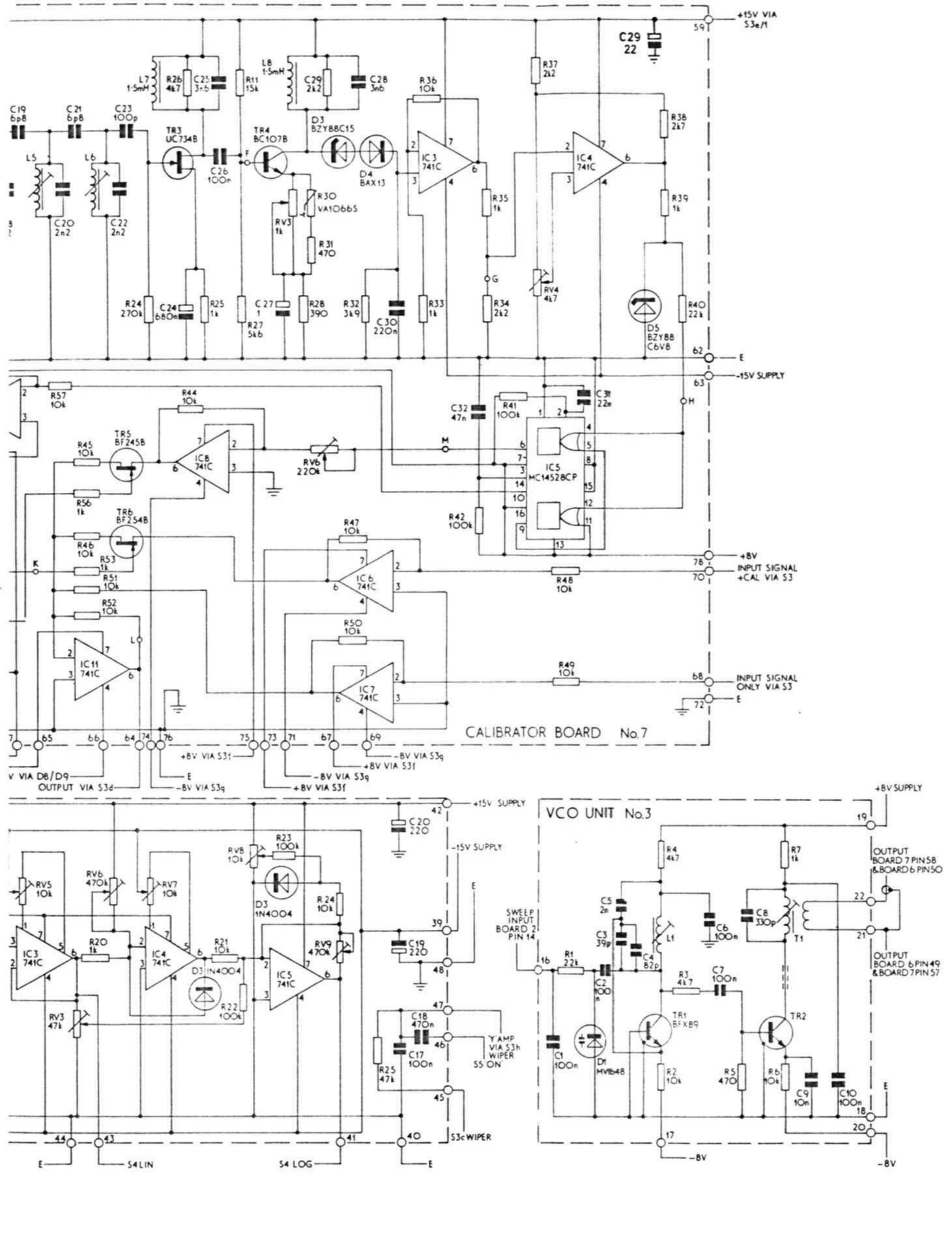
Circuit Ref:	1	2	3	4	5	6	7	
1IC1	23	0	+15					
1IC2	-23	0	-15					
2IC1				-8.0			8.0	
2IC2				-8.0			8.0	
2IC3				-8.0			8.0	
4IC1	0	2.8	2.8	6.3	7.8	-	2.8	
5IC1	11.7	10.6	0	0	-15	-13.0	13.4	14.
5IC2	-14.6	0	0	-15	-14.6	0	15	
5IC3	-14.6	0	0	-15	-14.7	0	15	
5IC4	-14.6	0	0	-15	-14.6	0.4	15	
5IC5	-14.6	0	0	-15	-14.6	0.1	15	
7IC1	0	0	4.6	0.5	1.9	-7.5	0	0
7IC2	0	2.8	2.8	6.3	6.3	0	2.8	0
7IC3	-14.6	0.3	0.3	-14.6	-14.6	4.5	14.5	0
7IC4	-14.6	3.5	2.5	-14.6	-14.6	4.5	14.5	0
7IC5	0	5.2	8.0	3.5	6.5	0.6	7.4	0
7IC6	-8.0	0	0	-8.0	-8.0	0	8.0	0
7IC7	-8.0	0	0	-8.0	-8.0	0	8.0	0
7IC8	-6.8	0	0	-6.8	-6.8	0	6.8	0
7IC9	-8.0	0	0	-8.0	-8.0	-0.5	8.0	0
7IC10	0	-4.0	-4.0	-3.6	-4.0	-4.0	-8.0	-3.
7IC11	-6.0	0	0	-6.0	-6.0	0	6.0	0
8IC1	0	0	5.0	0	0	-8.0	0	0
8IC2	0	0	5.0	0	0	-8.0	0	0
9IC1	-	8.2	8.0	7.2	7.2	7.2	0	-
9IC2	-15	0	0	-15	-15	-9	8	0

PIN

3	9	10	11	12	13	14	15	16	Notes
6	11.6	11.6							
	-7.1	6.1	7.4	4.5	0	0			Cal. at "1K + Sig"
	6.8	1.5	8.0	3.5	8.0	5.0	0	8.0	
									Cal. "OFF"
6	-3.6	-4.0	0	-8.0	-8.0	0			Cal. at "1K + Sig"
	-7.3	0.5	8.0	5.7	0	0			
	-7.3	-0.5	8.0	5.7	0	0			
	1.6	8.2	15.0	15.0	9.4	-			



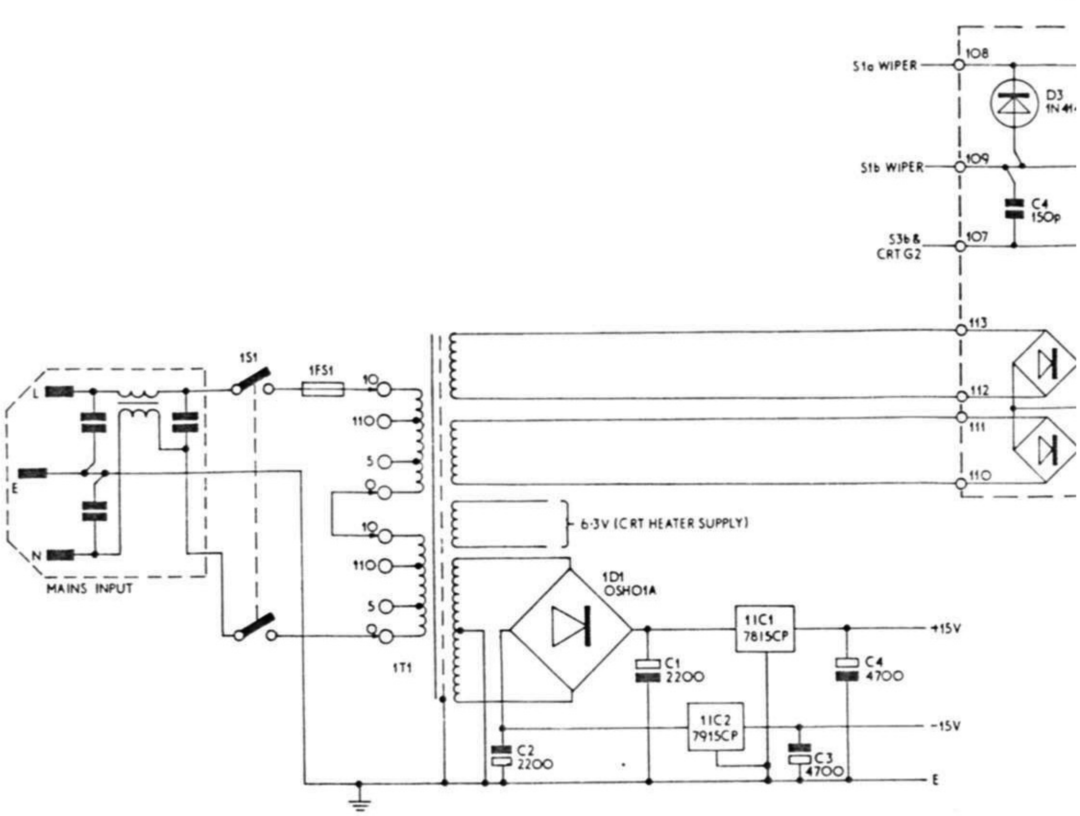
-8V VIA S3g
+8V VIA S3f
BOARD 3 PIN 22
'Y' INPUT
'X' INPUT
MODE SWITCH S3d xy
MODE SWITCH S3a xy
LISSAJOU AMPLIFIER No.8
+8V SUPPLY
-8V SUPPLY
+8V VIA D4/D7
IF/LOG-LIN AMPLIFIER No.5
IF INPUT BOARD6 PIN54
GAIN RV12

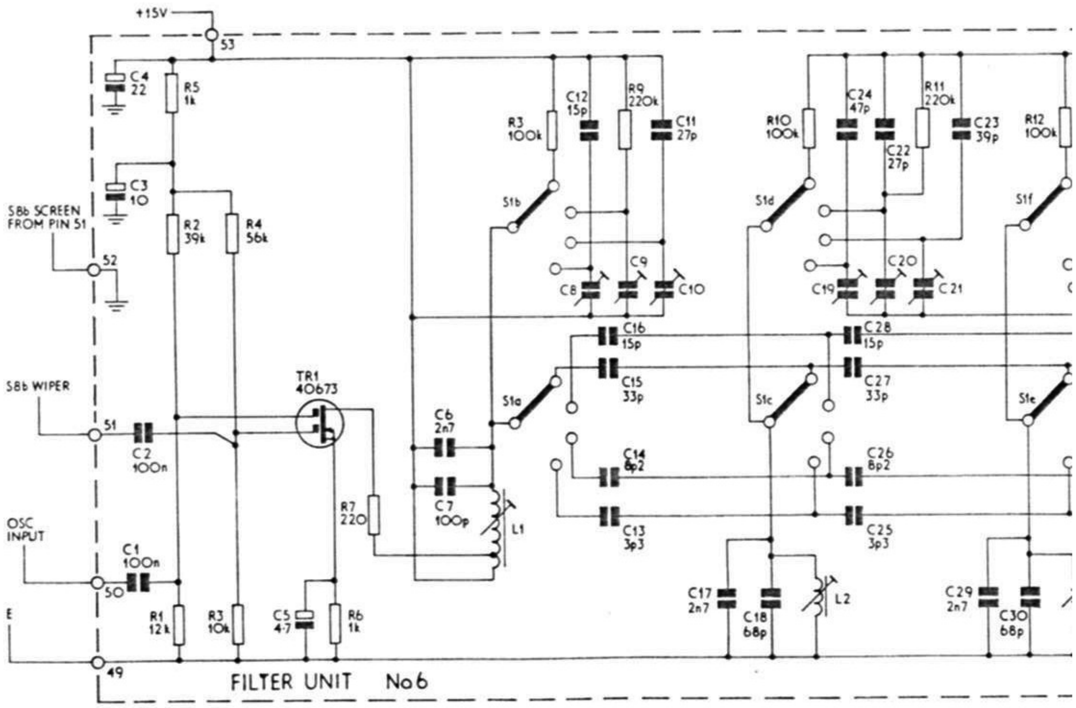


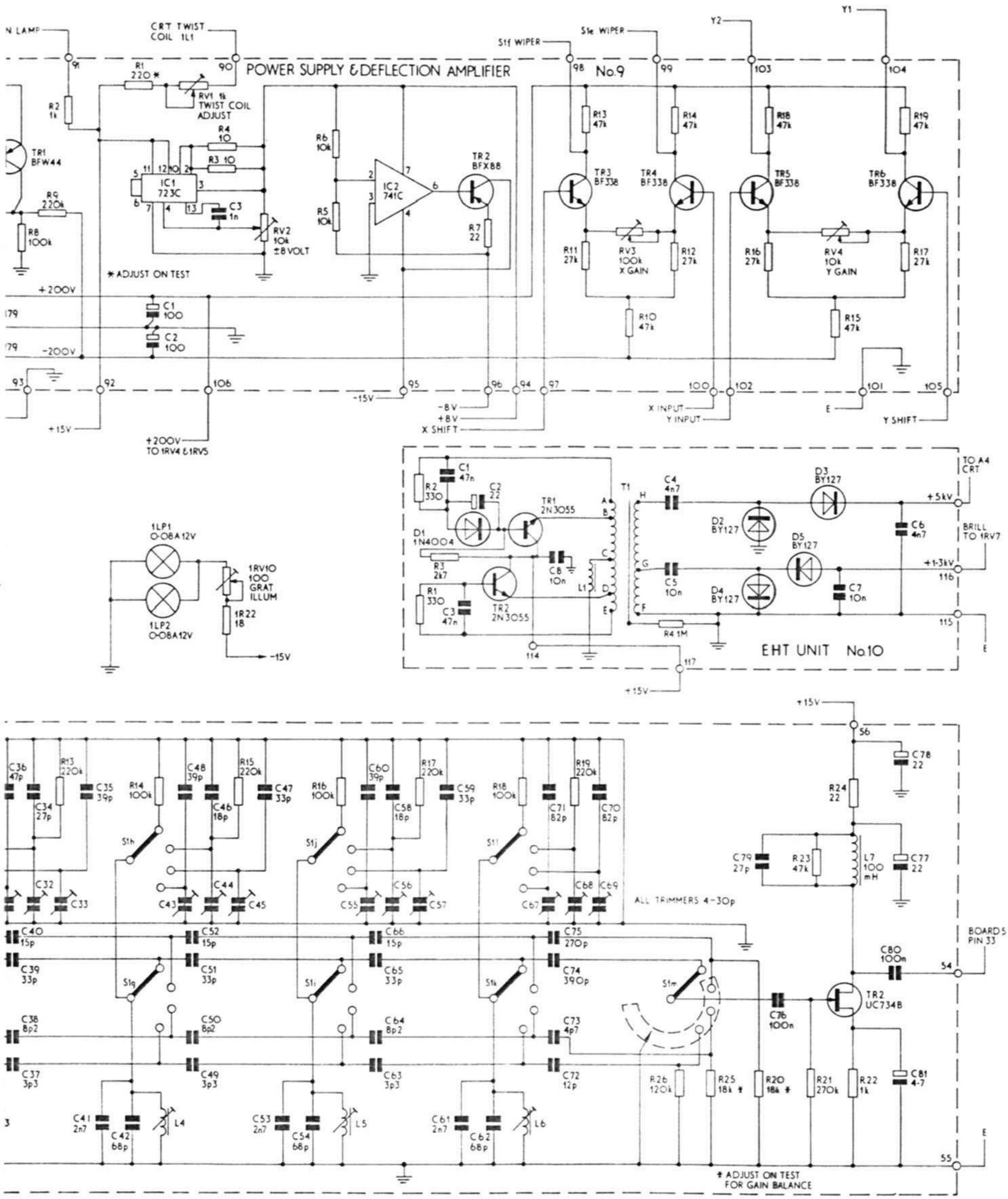
Circuit Diagram: EP1061A

Overall Circuit Part 1

Fig. 14 (1)


SUPPL
S1a WIPER
108
D3
S1b WIPER
109
C4
150p
S3b &
CRT G2
107
113
112
111
110
L
E
N
MAINS INPUT
1S1
1FS1
110
5
1T1
6·3V (CRT HEATER SUPPLY)
1D1
OSH01A
1IC1
7815CP
+15V
C1
2200
C4
4700
1IC2
7915CP
-15V
C2
2200
C3
4700
E

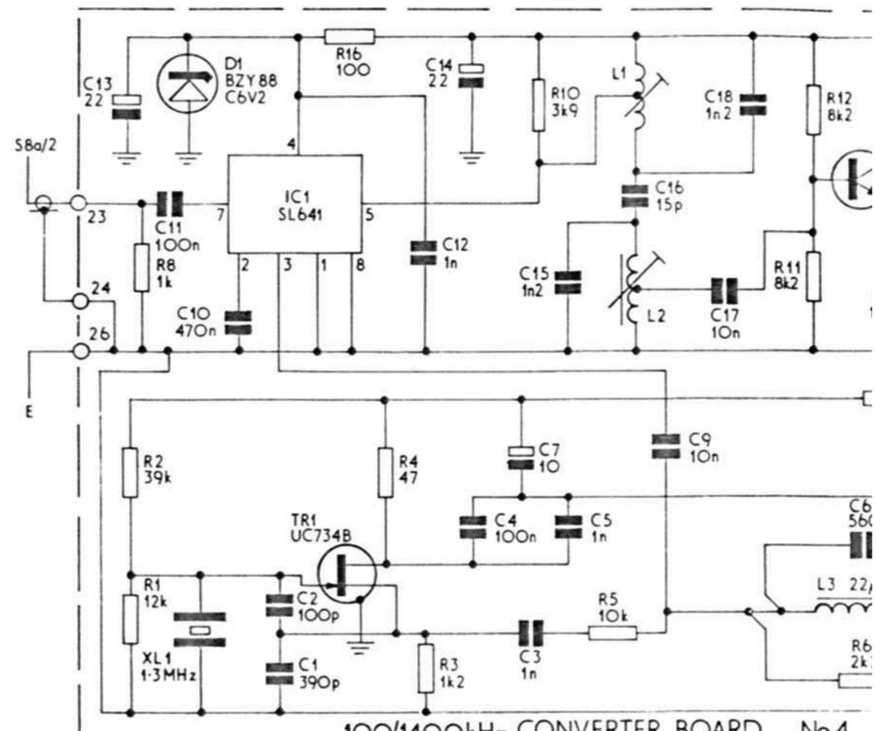

+15V
53
C4
22
R5
1k
C3
10
R2
39k
R4
56k
S8b SCREEN
FROM PIN 51
52
S8b WIPER
51
C2
100n
TR1
40673
R7
220
OSC
INPUT
C1
100n
50
R1
12k
R3
10k
C5
4·7
R6
1k
E
49
FILTER UNIT No6
C6
2n7
C7
100p
L1
R3
100k
C12
15p
R9
220k
C11
27p
S1b
C8
C9
C10
C16
15p
C15
33p
S1a
C14
8p2
C13
3p3
R10
100k
C24
47p
C22
27p
R11
220k
C23
39p
S1d
C19
C20
C21
C28
15p
C27
33p
S1c
C26
8p2
C25
3p3
C17
2n7
C18
68p
L2
R12
100k
S1f
S1e
C29
2n7
C30
68p



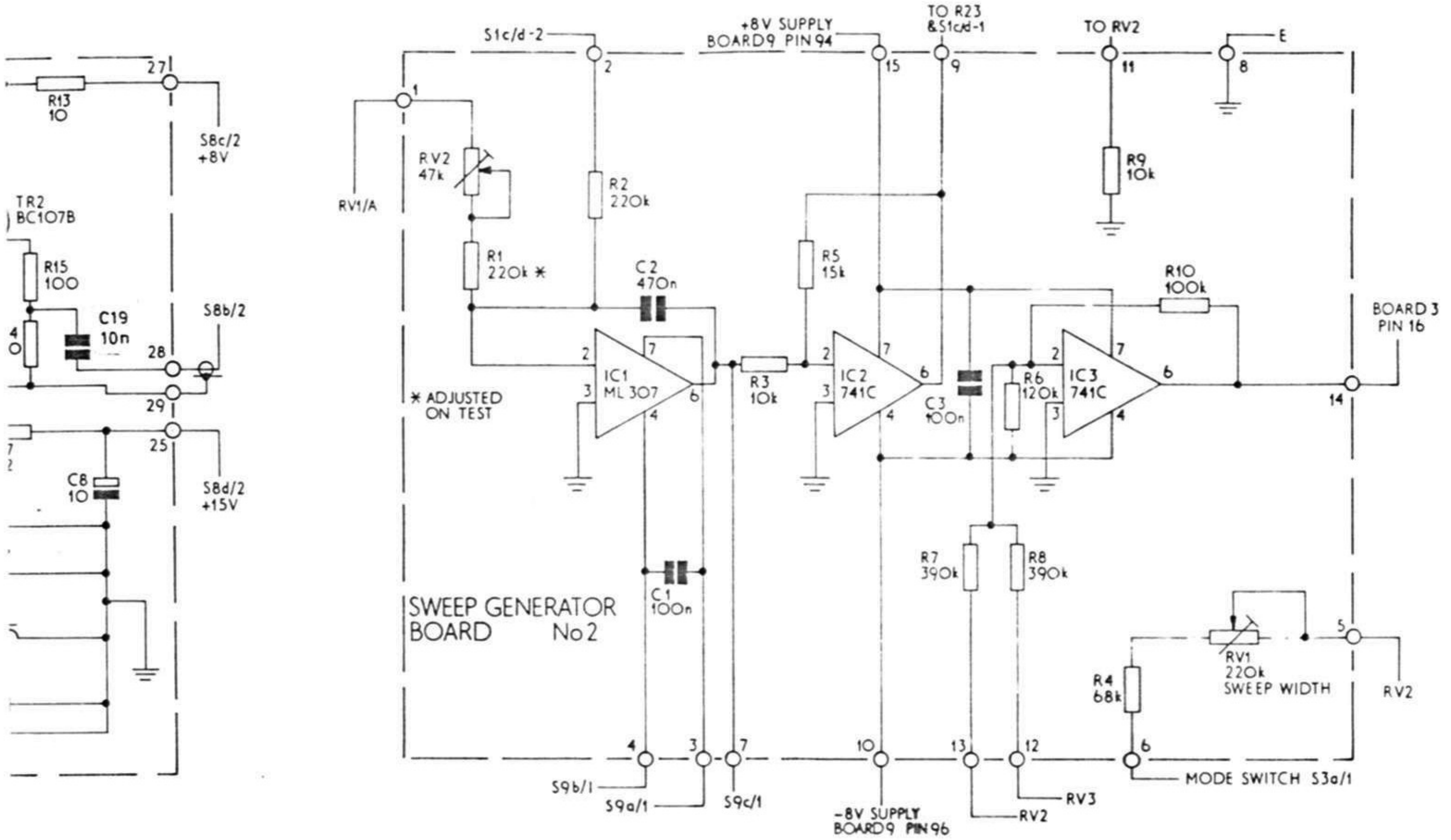
Circuit Diagram: EP 1061A

Overall Circuit Part 2

Fig. 14 (2)

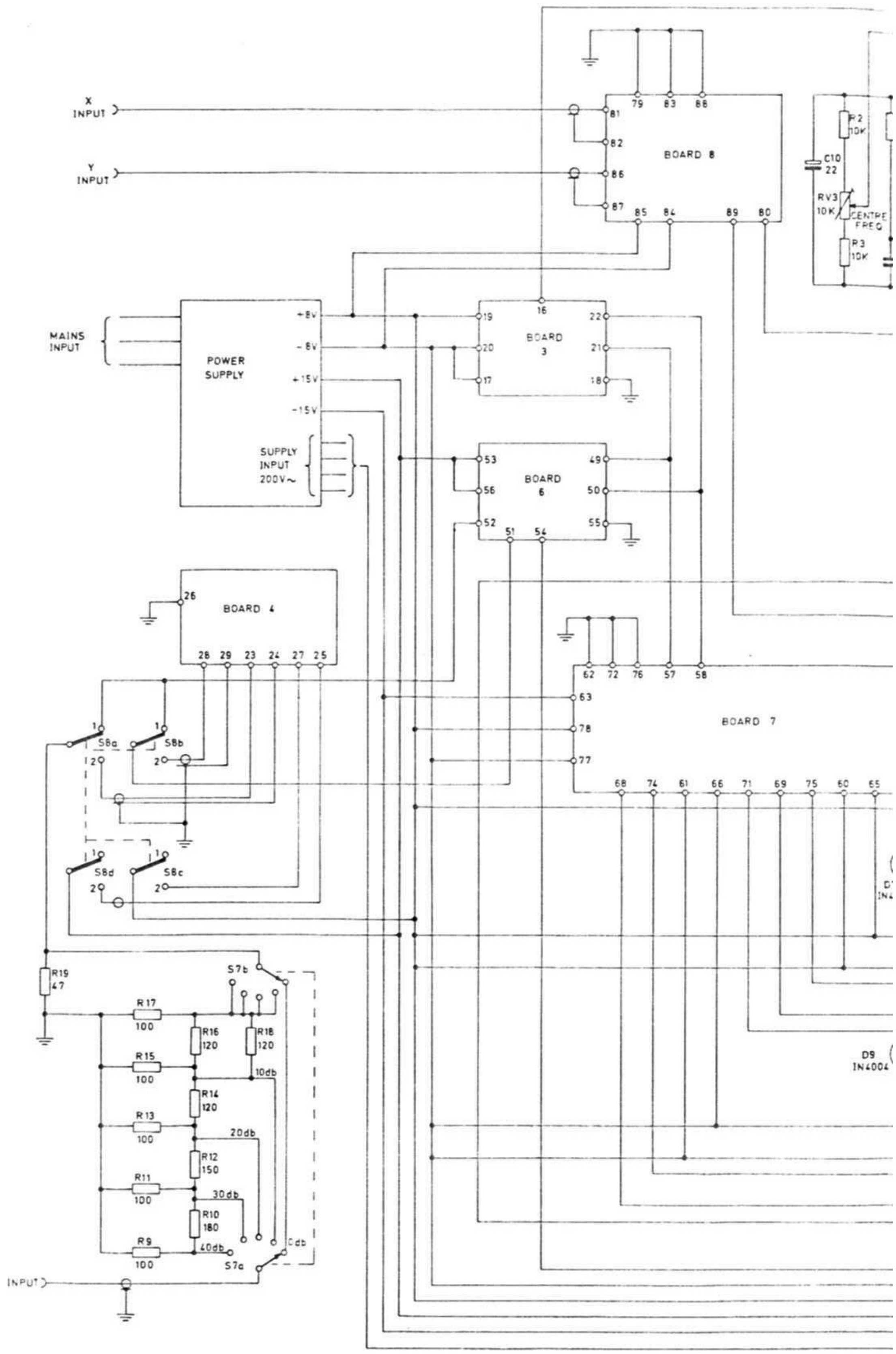


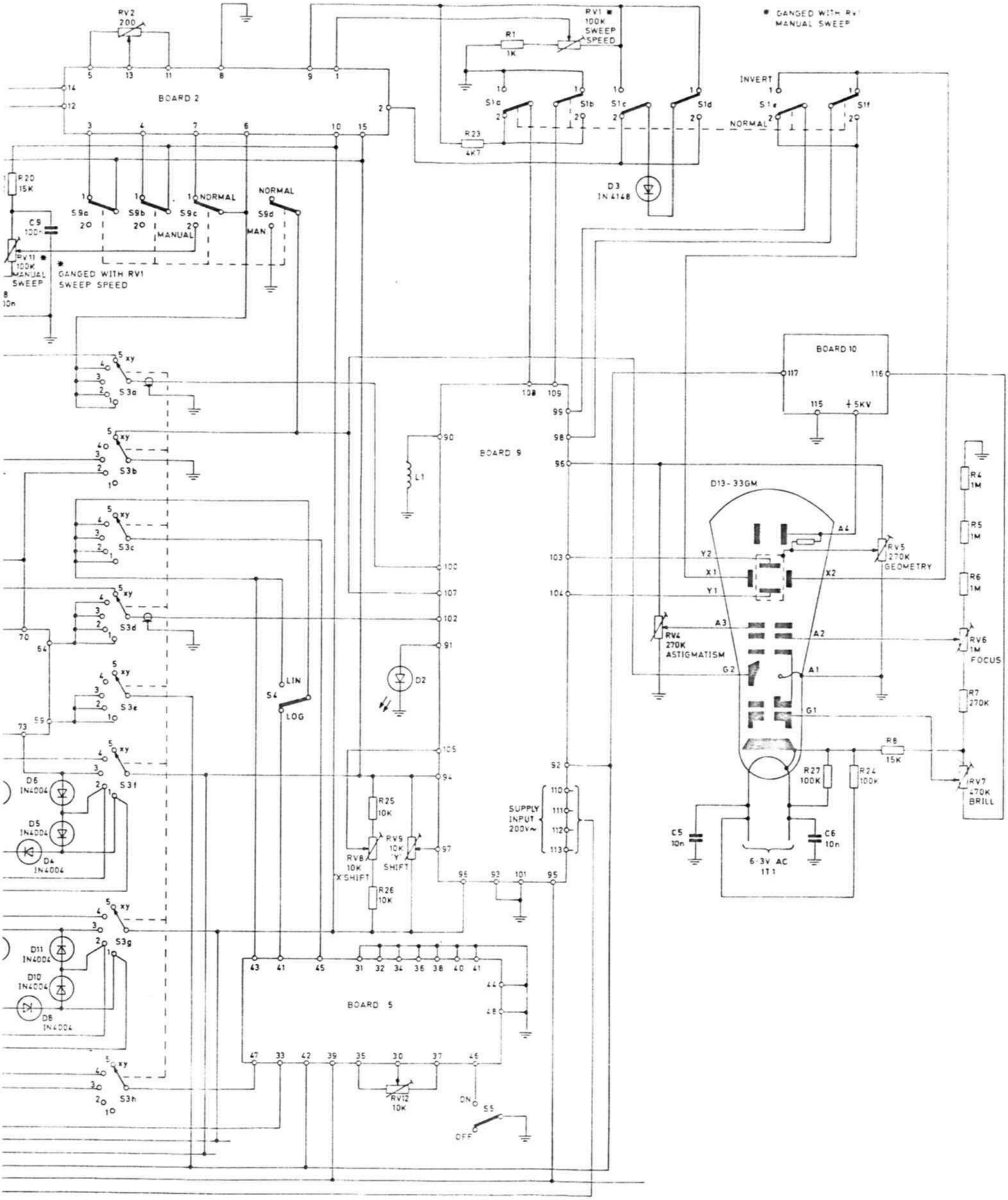
100/1400kHz CONVERTER BOARD No 4



Circuit Diagram: EP 1061A
Overall Circuit Part 3

Fig. 14(3)


X INPUT
Y INPUT
BOARD 8
MAINS INPUT
POWER SUPPLY
+8V
-8V
+15V
-15V
SUPPLY INPUT 200V~
BOARD 3
BOARD 6
BOARD 4
BOARD 7
S8a
S8b
S8c
S8d
S7a
S7b
R19 47
R17 100
R16 120
R18 120
R15 100
R14 120
R13 100
R12 150
R11 100
R10 180
R9 100
10db
20db
30db
40db
0db
INPUT
R2 10K
C10 22
RV3 10K CENTRE FREQ
R3 10K
D9 IN4004



Wiring Diagram: EP1061A

Interconnecting Diagram

Fig. 15