EP17R

EDDYSTONE

PANORAMIC DISPLAY UNIT EP 17 R

STRATTON & CO. LTD.
ALVECHURCH ROAD
BIRMINGHAM 31

EDDYSTONE MODEL EP17R

PANORAMIC DISPLAY UNIT

The EDDYSTONE Model EP17R is a general-purpose mains-operated panoramic display unit intended primarily for use with the Eddystone 770R (Mk.II) and 770U (Mk.II) VHF and UHF receivers. The unit can be used with other receivers having standard intermediate frequencies of 5.2 and 5.25 Mc/s. Operation as a wobbulator is also possible in which mode standard IF's of 5.2 Mc/s, 10.7 Mc/s etc. fall within the range of the sweep frequency output.

A continuously variable display width of from one megacycle down to less than 30 kc/s is available with a resolution capability of the order 2 kc/s when using a slow speed scan at the narrower sweep widths. Four selectable sweep frequencies can be used to provide accurate presentation of widely differing signal displays.

A single conversion circuit is employed with a selective crystal filter in the two stage intermediate frequency amplifier. The intermediate frequency is 720 kc/s and manual gain control is provided at this point in the circuit to extend the flexibility of the calibrated attenuator which is included in the earlier stages. A crystal controlled calibration system provides 100 kc/s markers to allow direct frequency measurement on the c.r.t. trace.

The cathode ray tube is a medium persistance type with a green trace and has an extended hood to permit direct viewing under difficult lighting conditions. It has an engraved graticule to facilitate direct measurement and the hood dimensions are such that a standard oscilloscope camera can be fitted when required.

Advanced design, rugged construction and high quality components are used throughout and the dimensions and styling match those of the 770 VHF and UHF receivers. Both rack and surface mounting versions are available. Operation is from any standard AC mains supply and a blower fan is fitted to permit prolonged operation at elevated temperatures.

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Sole Manufacturers:- STRATTON & CO., LTD., ALVECHURCH ROAD, BIRMINGHAM 31, ENGLAND.

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TECHNICAL DATA

GENERAL

Input Frequency.

5.2 Mc/s.

Input Bandwidth.

One megacycle (4.7-5.7 Mc/s).

Wobbulator Frequency Coverage.

Dependent on the settings of the OSCILLATOR FREQUENCY switch and the WIDTH control. With the WIDTH control at one megacycle sweep and the OSCILLATOR FREQUENCY switch to position '1' the fundamental output is 5.42-6.42 Mc/s. The 2nd and 3rd harmonics of this range permit coverage of the bands 10.84-12.84 Mc/s and 16.26-19.26 Mc/s.

With the OSCILLATOR FREQUENCY switch to position '2' the fundamental range is modified to become 4.8-5.6 Mc/s and the harmonics then cover 9.6-11.2 Mc/s and 14.4-16.8 Mc/s.

Intermediate Frequency.

720 kc/s. Crystal filter provides bandwidth of 400 c/s.

Valve Complement.

Ref	Type	Circuit Function
V1	E180F or 6688 (CV3998)	Input Amplifier (grounded-grid).
V2	ECF80 or 6BL8 (CV5215)	5.2 Mc/s Amplifier.
V3	EF94 or 6AU6 (CV2524)	Cathode Follower.
V4	E180F or 6688 (CV3998)	5.2 Mc/s Amplifier (grounded-grid)
V5	ECF80 or 6BL8 (CV5215)	Mixer/Sweep Oscillator.
V6	ECF80 or 6BL8 (CV5215)	Reactance Control/Oscillator Cathode
V7	EF93 or 6BA6 (CV454)	1st 720 kc/s Amplifier. Follower.
V8	EF93 or 6BA6 (CV454)	2nd 720 kc/s Amplifier.
V9	EB91 or 6AL5 (CV140)	Detector.
V10	EF94 or 6AU6 (CV2524)	Crystal Calibrator.
V11	ECF80 or 6BL8 (CV5215)	'Y' Amplifier.
V12	ECF80 or 6BL8 (CV5215)	Timebase.
V13	ECF80 or 6BL8 (CV5215)	Timebase Inverter.
V14	150C2 or OA2 (CV1832)	HT Stabiliser.
V15	108C1 or OB2 (CV1833)	HT Stabiliser.
D1	100SC2 - -	Variable Capacity Diode (Sweep Osc.).
D2	DD006 - -	Linearising Diode.
D3	DD058 - -	Blanking Diode.
D4/5	K8/20 - -	EHT Voltage Doubler.
D6/9	DD058 - -	HT Rectifier.
CRT	DH7-91 or 3AFP31 (CV5302)	($2\frac{3}{4}$" diameter, medium persistence)

Input and Output Impedances.

IF Input . . 50-75Ω (nominal) unbalanced. Osc. Output . . 140Ω (approx) unbalanced.
'Y' Amp . . 0.25MΩ

Power Supply.

Single-phase AC mains 100/125V and 200/250V (40-60 c/s). Consumption : 55VA.

Display.

Signal amplitude(20dB full scale) on the vertical axis and frequency (1 Mc/s max) on the horizontal axis.

Calibrator.

An internal crystal oscillator provides calibration markers at 100 kc/s intervals.

Camera.

Provision is made for fitting a standard oscilloscope camera. The hood dimensions are:- length : 3.3/32" (7.86 cm.), o/s diameter : 3.3/8" (8.57 cm.) at the front edge with a one degree outward taper towards the rear.

Sweep Width.

Continuously variable from less than 30 kc/s to 1 Mc/s maximum with linear scale.

Sweep Rate.

Four selectable speeds; 5, 10, 20 and 40 sweeps per sec.

Centre Frequency Shift.

300 kc/s at all sweep widths.

Attenuator.

Calibrated in 10dB steps to -60dB max.

PERFORMANCE

Sensitivity.

Averages 20μV for full trace deflection with the attenuator at 0dB.

Resolution.

Dependent on rate and width of sweep. 2 kc/s at narrow sweep width with timebase set to 5 c/s position.

DIMENSIONS AND WEIGHT

Rack Mounting Version.

Panel	19" x $5\frac{1}{4}$" (48.3 x 13.3 cm).
*Depth	15.1/16" (38.3 cm). (excluding projection of c.r.t. hood)
*Depth behind panel	$13\frac{3}{4}$" (34.9 cm).
Weight	36 lb. (16.3 kg).

Surface Mounting Version.

Panel	$16\frac{3}{4}$" x $5\frac{1}{4}$" (42.5 x 13.3 cm).
*Depth	$13\frac{1}{2}$" (34.3 cm). (excluding projection of c.r.t. hood).
Height	$5\frac{3}{4}$" (14.6 cm). (panel height plus rubber mounting feet).
Weight	$35\frac{3}{4}$ lb. (16.2 kg).

*Dimensions exclude projections at rear.

CIRCUIT DESCRIPTION

5.2 Mc/s Stages.

The first four stages provide an input bandwidth of one megacycle centred on 5.2 Mc/s. Two input sockets are fitted (one at the rear for normal use and one on the front panel). The sockets are wired in parallel and a toroidal transformer is used to couple the signal input to the cathode of the Input Amplifier V1 (E180F). The input impedance is of the order 50/75Ω.

Some measure of isolation between the receiver and display unit is obtained by operating the Input Amplifier in grounded-grid. Its anode circuit is broadly resonant at the operating frequency and is coupled to the grid of the second stage via C3. The pentode portion of an ECF80 is used in this position (V2A) and provides amplification of all signals in the range 4.7-5.7 Mc/s. The triode portion of V2 is not used.

The screen feed to V2A is taken via one section of the CALIBRATOR switch (S1a) which removes the HT in the 'CAL' position. This is done to limit signal breakthrough when observation of the calibrator display alone is required. R8 provides a DC return for the screen when the circuit is broken at S1a.

An over-coupled transformer (T2) passes the signal on to the following stage which is a triode-strapped EF94 (V3) operating as a cathode follower. The low output impedance of V3 matches the input of the 5.2 Mc/s filter which comprises L1-L7. The filter response combines with the double-humped response of T2 and the single broad peak of T3 to give sensibly constant gain over the bandwidth of the amplifier. The rejector circuits in the filter provide a rapid cut-off above 5.7 Mc/s and below 4.7 Mc/s.

The filter output is fed directly to a six-step attenuator which provides a maximum attenuation of 60dB. The attenuator is terminated at the cathode of V4 (E180F) which serves as a grounded-grid amplifier to match the low impedance at this point in the Crystal Calibrator is applied at the anode of V4 so that the amplitude of the marker pips is unaffected by the attenuator.

The Crystal Calibrator.

This stage provides a display of marker pips spaced at 100 kc/s intervals to facilitate frequency measurement on the horizontal axis of the trace.

The EF94 used in this position (V10) employs a 100 kc/s crystal with feedback from the screen circuit L10/C66 which is tuned to the crystal frequency. The anode circuit is broadbanded over the 5.2 Mc/s range by the two tuned circuits L8/C62 and L9/C64. Output is taken via C68 and the pre-set injection capacitor C23a which permits adjustment of the marker display amplitude during initial alignment. A further pre-set capacitor (C67) provides a means of setting the crystal accurately to 100 kc/s.

Switching of the Calibrator is by S1c which completes the HT feed via the 0.1MΩ resistor R60. The CALIBRATOR switch S1 has three positions:-

'CAL'	Calibrator display only.
'CAL & SIG'	Calibrator display combined with signal display.
'SIG'	Signal display only.

HT is removed from the Calibrator in the 'SIG' position. S1a removes the screen supply from V2A in the 'CAL' position and the remaining section (S1b) occurs in the 720 kc/s circuit as described later.

The Frequency Conversion Stage.

Output from the last 5.2 Mc/s Stage (V4) is coupled to g1 of V5A (½ ECF80) which functions as the Mixer Stage. Injection from the Sweep Oscillator is to the same grid via C28.

The Oscillator employs the triode portion of V5 in a Colpitt's circuit with the coil L13 (which is wound on a ferrite core) located between the pole-pieces of the soft iron cored inductor L14. The magnetic field associated with L14 follows the sawtooth variations in the anode current of the Reactance Control Valve (V6B) and so varies the effective permeability of the ferrite core to sweep the oscillator over the selected range. The actual coverage is determined by the OSC FREQ switch S4. The normal position is '1' and in this case a maximum sweep of 5.42-6.42 Mc/s obtains. Position '2' is used when the unit is employed in wobbulator service for alignment of amplifiers in the 5.2 Mc/s band. In this case the oscillator coverage becomes 4.8-5.6 Mc/s due to the introduction of C74/C75 across the oscillator tuned circuit.

Three controls are provided for accurate adjustment of the centre frequency. One, (RV3) is pre-set during initial alignment of the unit to give the correct standing current through L14. The other two are panel controls (RV2 and C73). RV2 controls the reverse bias to the capacity diode D1 (100SC2) and is the control normally used for centering the display when operating the unit. It is marked CENTRE FREQUENCY. C73 is a pre-set panel control which provides a means of setting the centre frequency coincident with the mid-travel position of RV2. The control is adjusted with a small screwdriver and in operation will require infrequent adjustment only. It is not marked but is referred to as the CENTRE FREQUENCY TRIMMER.

The width of the frequency sweep is controlled by RV5 which varies the amplitude of the sawtooth voltage applied to the grid of V6B. The linearity of the sweep is adjusted during alignment by the pre-set control RV4 which is in series with the Linearising Diode D2 (DD006).

The triode portion of V6 functions as a cathode follower to provide an outlet for the Sweep Oscillator when the EP17R is used as a wobbulator. Provision of an external attenuator may be necessary in cases where there is no form of gain control on the amplifier being tested. The output impedance at the 'OSC OUT' socket is of the order 140Ω and any suitable coaxial attenuator can be used.

720 kc/s Amplifiers and Detector.

Output from the Mixer Stage is coupled through T4 to a symmetrically phased crystal filter before passing to the two 720 kc/s Amplifiers V7 and V8 (2 x EF93). The cathodes of V7/V8 are returned to one section of the CALIBRATOR switch (S1b) and in normal operation ('SIG' and 'CAL & SIG') the circuit is completed by the GAIN control RV1. When the CALIBRATOR switch is moved to 'CAL', RV1 is taken out of circuit and the gain is set at a fixed level by R44. This arrangement eliminates the need for re-adjustment of the GAIN control when moving between the 'CAL & SIG' and 'CAL' positions since the marker pips would not be visible at low gain settings.

The 2nd 720 kc/s Amplifier feeds the Detector V9 which is a low impedance type employing an EB91 with both diodes strapped in parallel.

C.R.T. Circuits.

A positive-going output is developed across the Detector load resistor R49 and applied directly to the triode grid of the ECF80 (V11) which serves as the 'Y' Amplifier. SKT4 provides a means of connecting an external detector circuit to the 'Y' Amplifier when using the EP17R as a wobbulator. The input is blocked to DC by C88.

The triode portion of V11 is direct-coupled to the pentode portion, the anode of which feeds directly the Y2 plate of the c.r.t. RV6 is connected to the other 'Y' plate and provides the normal 'Y' shift function.

The focus and brilliance adjustments follow normal oscilloscope practice. S4d is arranged to introduce compensating resistors to maintain the centre frequency when the timebase frequency is changed. RV9 allows the final anode voltage on the c.r.t. to be set to give even focus over the whole picture area.

Another ECF80 is used in the Timebase circuit (V12). This provides a negative-going sawtooth with an extremely fast flyback and is set to produce a full width trace on the scanning stroke by adjustment of the pre-set control RV11. The function of this 'width' control (marked 'X' WIDTH) should not be confused with that of RV5 which controls the width of the frequency spectrum shown on the display; the trace width is always the same. Flyback suppression is by a negative pulse which is developed at the anode of V12A and applied to the grid of the c.r.t. via the shaping diode D3 (DD058).

Output from the Timebase is inverted before application to the grid of the Reactance Control Valve since the positive-going sawtooth which results simplifies the linearisation arrangements in the grid circuit of this stage (V6B). The inversion is performed by V13 (ECF80) which comprises a cathode follower and direct-coupled amplifier. Capacity coupling is used to the grid of V6B to avoid complications in the biasing arrangements on this stage.

Power Supply.

The power supply section provides four separate HT and three 6.3V LT supplies. Rectification for the positive HT supplies is by four silicon diodes (D6-D9 : DD058) arranged in a conventional bi-phase half-wave circuit. Protection against voltage surges is by the limiting resistors R120 and R122 and the thermistor R121 (CZ6) which is wired in series with the centre-tap of the HT secondary winding.

The main HT rail (HT1) runs at 350V and it is from this line that the other two positive supplies are developed. HT1 supplies the 'Y' Amplifier, Timebase, Inverter and the shift networks for the c.r.t. V14 (150C2) and V15 (108C1) are series connected to provide a stabilised supply of 258V (HT2) which feeds the oscillators and V6B. The other positive supply is of 250V (HT3) to feed the remaining stages.

HT4, the negative EHT supply, is derived from the voltage doubler circuit (D4/5 : 2 x K8/20) which is fed from one half of the HT secondary. Resistance-capacity smoothing is used (C100/C101/R119) and the output voltage is of the order -800V.

The three LT supplies are rated at 4A, 2.5A and 1A respectively. LT1 has an earthed centre-tap and feeds the heaters of V1-V10. LT2 has its centre-tap returned to the divider network R117/R118 to bring the heater/cathode voltage of V12 within the ratings for the valve. LT3 is insulated to 1000V and supplies the heater of the c.r.t.

A blower fan is provided for cooling and is operative regardless of ambient temperature. It is permanently adjusted for 110V operation and connected across one 110V section of the power transformer primary. Thus on 200/250V working the primary winding of the transformer serves as an auto transformer to give the correct working voltage. Details on adjustment of the power transformer primary taps will be found in the Section dealing with 'Installation'.

I N S T A L L A T I O N

GENERAL INFORMATION

The EP17R is supplied complete with all valves and c.r.t. and a 6' mains lead terminated with a plug to match the socket at the rear of the unit. Other accessories are available as follows:-

(1) Interconnecting lead (coaxial) terminated with two Belling Lee coaxial plugs Type L.734. (Suitable for connecting the IF Output socket on either of the Eddystone Models 770R (Mk.II) or 770U (Mk.II) to the Input socket on the EP17R Display Unit) Part No. D.3286.

(2) Tie-bars (two reqd.). For mounting the EP17R on top of the 770R (Mk.II) or 770U (Mk.II) receiver. Part No. 6496P.

(3) Screws (four required). For attaching tie-bars to the 770R (Mk.II) or 770U (Mk.II) receiver. Part No. 5446P.

(4) Loudspeaker Unit. (Attaches to underside of 770U (Mk.II) or 770R (Mk.II) receiver to form a plinth for the complete installation). Cat. No. 906.

(5) Screws (four required). For attaching the Loudspeaker Unit to the underside of the 770U (Mk.II) or 770R (Mk.II) receiver. Stores Ref. No. 40A-245 (2BA x $\frac{3}{8}$" binding head).

A complete Panoramic Display Installation will comprise all the items listed above together with the appropriate receiver (770U (Mk.II) UHF receiver for Installation Type EPR25, 770R (Mk.II) VHF receiver for Installation Type EPR26). Existing receivers can be modified to EPR25 or EPR26 by adding the accessories above.

Assembly of EPR25 or EPR26 Installation.

1. Invert receiver and fit Loudspeaker Unit using four 2BA screws ($\frac{3}{8}$" binding head).
2. Connect the loudspeaker lead to the 2.5Ω terminals at the rear of the receiver.
3. Place receiver in a face-down position and remove the four cabinet retaining screws.
*4. Fit the tie-bars to the receiver and secure with the cabinet retaining screws.
5. Set receiver down in normal position resting on plinth.
6. Remove the four cabinet retaining screws from the EP17R and place this on top of the receiver (do not remove cabinet). Re-fit the retaining screws through the holes provided in the tie-bars.
7. Connect the 5.2 Mc/s IF Output socket on the receiver (IF '2' socket on 770U) to the Input socket at the rear of the EP17R using the coaxial lead provided.
8. Make all other connections as described in the Manual supplied with the receiver.

*NOTE When an EP17R is ordered as a separate item, the cabinet retaining screws fitted to the receiver may be found to be the wrong type (i.e. too short). Replacement screws of the correct length can be obtained from Stratton & Co. by quoting Part No. 5446P.

EXTERNAL CONNECTIONS

Mains.

The AC mains supply is connected to a socket at the rear using the connector provided with the unit. The connector is a non-reversible type and is supplied ready-wired with six feet of 3-core mains cable. One end of the lead is left free so that the user can fit a plug of a type suited to the installation. The wires are colour-coded as follows:-

Red : Live line. Black : Neutral line. Green : Earth.

The EP17R is despatched from the factory with the tappings on the power transformer set for 240V operation. The transformer has two separate primary windings (operated in series for 200/250V and in parallel for 100/125V). Taps are adjusted as shown in the Table on the following page.

Input Sockets.

Two parallel-connected input sockets are provided, one on the front panel and the other at the rear of the unit. The socket at the rear will be found most convenient when the unit forms part of an EPR25 or EPR26 Installation.

Oscillator Output and 'Y' Amplifier Input.

These two sockets are both located on the front of the unit and are used only when the EP17R is employed as a wobbulator. Connection is by Belling Lee Type L.734 plugs terminating coaxial leads. When not in use, the 'OSC OUT' socket is shorted with the special plug provided with the unit. This reduces direct pick-up of the oscillator signal and its harmonics by the receiver with which the unit is used.

Earth.

The terminal at the rear should be connected to a suitable earthing point.

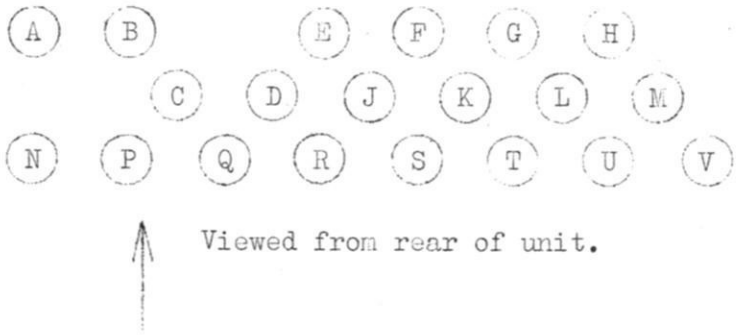
POWER TRANSFORMER VOLTAGE ADJUSTMENT

Supply	Link	Input to
100V	M & H L & G	M & L
110V	M & H K & F	M & K
120V	M & H J & E	M & J
125V	M & H J & E	M & J
200V	L & H	M & G
210V	K & H	M & G
220V	J & H	M & G
230V	J & H	M & F
240V	J & H	M & E
250V	J & H	M & E

NOTE DO NOT ALTER THE CONNECTIONS TO THE FAN WHEN CHANGING TAPS ON POWER TRANSFORMER.

The fan is adjusted for 110V operation and connection is such that the fan works normally regardless of the mains input voltage.

Power Transformer Connections.



Viewed from rear of unit.

Primary 1 : E(+10)/F(0)/G(10)/H(110).
Primary 2 : J(+10)/K(0)/L(10)/M(110).
HT Sec. : Q(350)/R(0)/S(350).
LT1 : N/P(CT)/C.
LT2 : T/U(CT)/V.
LT3 : A/B.
Screen : D

OPERATION

CONTROL FUNCTIONS

Calibrator Switch.

The CALIBRATOR switch has three positions as follows:

'SIG' . . . . Calibrator off, normal display.
'CAL & SIG' . . Calibrator on, normal display.
'CAL' . . . . Calibrator on, no signal display.

Calibration markers appear as 'pips' at 100 kc/s intervals across the trace and are usable at all sweep widths greater than 100 kc/s. The amplitude of the pips is affected by the setting of the GAIN control when in the 'CAL & SIG' position. In the 'CAL' position the GAIN control is inoperative and the marker amplitude is fixed.

Oscillator Frequency Switch.

For normal operation, this control is always set to Position '1'. Position '2' is used only when the unit is employed as a wobbulator. Its function is to modify the coverage of the Sweep Oscillator to provide for alignment of 5.2 Mc/s amplifiers. It may also be found convenient to use the alternative range when aligning an amplifier on a frequency towards the low end of the normal swept range. Use of Position '2' in this case will bring the wanted response closer to the centre of the tube thus allowing greater freedom in use of the WIDTH control to give a larger display.

Width.

Provides adjustment of the width of the spectrum being viewed by controlling the excursion made by the Sweep Oscillator during each cycle of the timebase output. The control provides a maximum sweep width of one megacycle for checking station congestion and activity, and a minimum width of less than 30 kc/s when observation of a single signal is called for. The sweep width in terms of frequency can be checked at any time by switching on the internal calibrator.

Centre Frequency.

Permits 'fine' adjustment of the centre frequency independently of the external receiver tuning. An overall movement of approximately 300 kc/s is available by adjustment of this control which varies the reverse bias to a variable capacity diode connected across the Sweep Oscillator tuned circuit.

Centre Frequency Trimmer.

This is a pre-set panel control which can be used to set the centre frequency of the display to coincide with the mid-travel position of the normal operational CENTRE FREQUENCY control. A slot is provided for screwdriver adjustment. Infrequent adjustment only will be required.

Gain Control.

This controls the overall gain of the unit by variation of the bias on the two 720 kc/s Amplifiers. The range of adjustment provided can be supplemented by altering the setting of the ATTENUATOR if this is found necessary.

The main function of the GAIN control is to initially set the display amplitude against the crossed lines on the tube graticule so that comparative measurements can be made by use of the ATTENUATOR.

It should be noted that the GAIN control varies the amplitude of both the signal display and the calibration markers when the CALIBRATOR switch is at 'CAL & SIG'.

Attenuator.

Provides up to 60dB signal attenuation in 10dB steps to facilitate direct measurements on the signal display. The relative levels of a number of signals can be compared rapidly by setting one signal to a convenient reference level and adjusting the ATTENUATOR to give the same display amplitude on the other signals. The difference in level can be deduced immediately from the ATTENUATOR readings.

When examining a single signal, adjustment of the GAIN control will allow the display to be set to occupy the full height of the graticule (corresponding to 20dB) with the ATTENUATOR at the lowest level achievable in relation to the strength of the signal. In the case of strong signals for example the attenuation can be increased to -60dB so that it is possible to view the response at a maximum of 80dB down.

The ATTENUATOR occurs prior to the point in the circuit at which the calibration markers are injected. Thus adjustment of the ATTENUATOR does not affect the height of the markers which remain at the height determined by the setting of the GAIN control.

Timebase Frequency.

This control provides four selectable sweep speeds of 5, 10, 20 and 40 c/s. In general, the lower speeds will be used when examining relatively narrow bands of frequencies (narrow sweep width). The higher speeds have some advantage in reducing the trace flicker when viewing with a greater sweep width. An exception to this rule is that when using the unit as a wobbulator. a low speed should be used to examine any steep-sided response.

If, at 'switch-on', the timebase fails to operate, move the TIMEBASE FREQUENCY switch to the adjacent position and back again. The oscillator will now function and it should be noted that the effect is normal and is not a fault condition.

Brilliance, Focus, 'X' and 'Y' Shifts.

These controls have the normal functions associated with oscilloscope use. The 'X' and 'Y' SHIFTS are effectively pre-set controls and although provided with a screwdriver slot, can be adjusted by hand.

Always operate the unit with the brilliance at the lowest convenient level.

Mains.

Normal supply switch. Completes mains to unit and blower motor.

INITIAL ADJUSTMENTS

Panoramic Display.

1. Switch on by depressing the MAINS switch at the centre of the panel. The pilot light will become illuminated to give an indication that the unit is operative. The fan will also be heard working. Allow a short period for warm-up.
2. Set the BRILLIANCE and FOCUS controls. The BRILLIANCE should be set at the lowest convenient intensity in relation to the ambient lighting.
3. Set the 'Y' SHIFT to position the trace coincident with the bottom horizontal line on the graticule.
4. Set the OSC FREQ switch to position '1', the TIMEBASE FREQ to 10 c/s, the ATTENUATOR to 0dB and the GAIN control near maximum.

5. Adjust the 'X' SHIFT by proceeding as follows:-

(a) Move the CALIBRATOR switch to the 'CAL' position.

(b) Set the WIDTH control to 'MIN'.

(c) Adjust the CENTRE FREQUENCY control to approximately mid-travel such that one 100 kc/s marker is displayed at the centre of the c.r.t. screen.

(d) Slowly increase the WIDTH setting while observing the marker at the centre of the trace. Other markers will appear as the width increases but these should be ignored, attention being concentrated on the one in (c) above. If this remains in the middle of the display as the WIDTH control is moved towards the 'MAX' position, adjustment of the 'X' SHIFT will not be required. On the other hand, if the marker does wander away from centre, adjust the 'X' SHIFT slightly and repeat the check until the marker remains in the centre of the trace at any setting of the WIDTH control.

It must be emphasised that when carrying out the checks above, the WIDTH control must be turned very slowly to avoid hysteresis effects in the reactor, since these will cause the marker to ride off-screen as the WIDTH is returned to the 'MIN' position. If this should occur, set the WIDTH control to 'MIN' and bring the marker back on screen by adjustment of the CENTRE FREQUENCY control before proceeding with the check.

6. Adjust the CENTRE FREQUENCY TRIMMER to centre the display at the mid-travel setting of the CENTRE FREQUENCY control. This operation can be carried quite simply by reference to the Crystal Calibrator fitted in the receiver with which the unit is used.

Model 770R (Mk.II) VHF Receiver - EPR26 Installation.

(a) Set the slot in the CENTRE FREQUENCY TRIMMER to a vertical position (i.e. to coincide with the dot on the panel).

(b) Set the EP17R controls as follows:-

CALIBRATOR SWITCH	CAL & SIG.
CENTRE FREQUENCY	mid-travel.
WIDTH	mid-travel.
GAIN	to give a calibration display with a height of approximately 1 cm.

(c) Press the CALIBRATOR button on the 770R receiver and identify the calibration marker on the c.r.t. trace.

(d) Adjust the CENTRE FREQUENCY TRIMMER so that the second 100 kc/s marker to the right of the 770R marker falls at the centre of the display.

The Calibrator in the 770R receiver has a fundamental frequency of 5 Mc/s and is available for checking the centering adjustment regardless of the frequency to which the receiver is tuned.

Model 770U (Mk.II) UHF Receiver - EPR25 Installation.

(a) Set the slot in the CENTRE FREQUENCY TRIMMER to a vertical position (i.e. to coincide with the dot on the panel).

(b) Set the EP17R controls as follows:-

CALIBRATOR SWITCH	CAL & SIG.
CENTRE FREQUENCY	mid-travel.
WIDTH	mid-travel.
GAIN	to give a calibration display with a height of approximately 1 cm.

(c) Tune the 770U receiver to any convenient calibration point, press the CALIBRATOR button and carry out a normal calibration check as described in the Manual supplied with the receiver.

(d) Keep the CALIBRATOR button pressed and identify the calibration marker on the c.r.t. trace. (Do not alter the setting of the 770U TUNING control).

(e) Adjust the CENTRE FREQUENCY TRIMMER so that the calibration marker from the 770U receiver falls at the centre of the display.

The Calibrator in the 770U receiver has a fundamental frequency of 50 Mc/s. Centering of the display can be carried out at any of the crystal check frequencies.

Further adjustment of the CENTRE FREQUENCY TRIMMER should not be necessary unless the unit remains in use for a prolonged period. A minor adjustment may then be required to compensate for slight reactor drift. Drift during normal periods of observation will be found negligible.

7. Set the WIDTH control as required for coverage to be displayed.

USE OF THE CALIBRATION DISPLAY

Once the unit has been adjusted in the manner described above, the calibration display can be used to allow direct frequency measurement on the face of the c.r.t. The 100 kc/s marker pip at the centre of the trace corresponds to the tune frequency of the receiver and it will be found most convenient to arrange the tune frequency to be a 0.1 Mc/s calibration point.

Deflection of the spot along the 'X' axis and the direction of oscillator sweep are arranged such that the right-hand end of the trace corresponds to the highest display frequency when the unit is used in conjunction with a single conversion receiver in which the conversion oscillator runs on the 'high' side of the input signal.

Most receivers have their conversion oscillator on the high frequency side to simplify the tracking arrangements so that in the majority of cases the c.r.t. calibration will be conventional (i.e. with the lowest frequency at the left-hand end of the trace). The 770R VHF receiver falls into this category as does the 770U UHF receiver when used on Ranges 3-6.

The latter receiver employs a double conversion circuit in which the 1st Oscillator operates above the signal on the four low frequency ranges and below the signal on the highest ranges (Ranges 1 and 2). Reversal of the intermediate frequency spectrum does not occur when the oscillator is on the 'low' side so that when using the 770U on Ranges 1 and 2 it should be borne in mind that the lowest frequency occurs at the right hand side of the display. The 2nd Oscillator in this receiver is permanently on the low frequency side and therefore has no effect on the direction of the calibration.

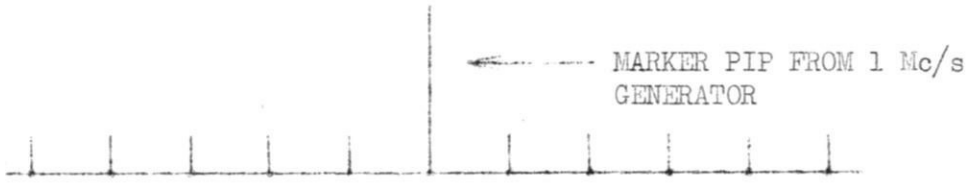
If the EP17R is used with a 'direct' input (i.e. one derived from a signal source applied directly to the input of the unit rather than via the intermediate frequency channel of an associated receiver) the direction of the trace calibration will be the same as when using the unit with a receiver in which the conversion oscillator is on the 'low' side (i.e. the right-hand side of the display will correspond to the lowest frequency).

One very useful application of the calibration display when the EP17R is used in conjunction with the 770R VHF receiver is for interpolation between the one megacycle calibration points on the receiver scale. Readings obtained by combining the vernier setting with the figure obtained from the horizontal logging scale (below the frequency scales) can be recorded to allow accurate frequency setting directly to better than 0.1 Mc/s and by interpolation between adjacent 0.1 Mc/s points to within 5 kc/s at the highest frequencies covered by the receiver. An accurate 1 Mc/s harmonic generator is required and the procedure to be followed is detailed below:-

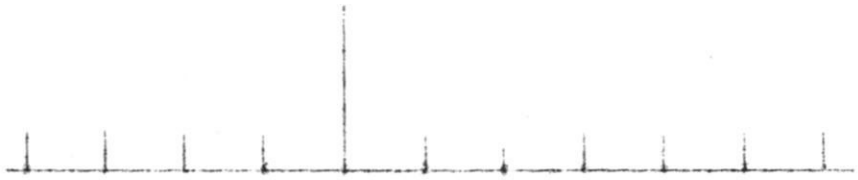
1. Carry out a normal calibration check on the 770R receiver at the nearest crystal check point to the frequency band to be interpolated.

2. Check the centering of the 100 kc/s calibration display on the Display Unit by switching on the calibrator in the 770R receiver. The display should be set for a full one megacycle coverage with the CALIBRATOR switch set to the 'CAL & SIG' position. The display will appear as shown below when the adjustment has been made correctly.

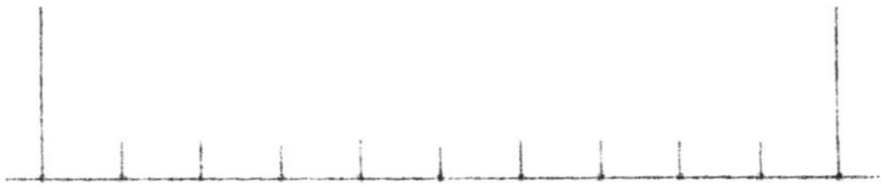
3. Assume that the band 67-68 Mc/s is to be calibrated. Connect the output from the 1 Mc/s harmonic generator to the input of the receiver and identify the marker which corresponds to 67 Mc/s. Adjust the receiver TUNING so that the marker coincides with the 100 kc/s pip at the centre of the display. Record the vernier reading.



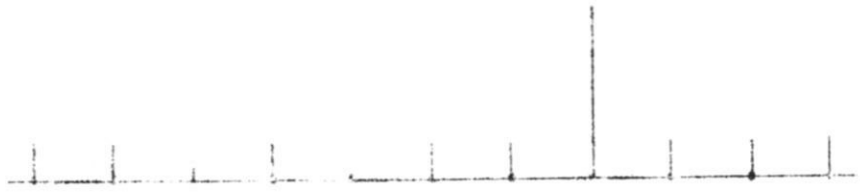
4. Tune receiver so that the 1 Mc/s marker corresponding to 67 Mc/s moves to the next 100 kc/s marker to the <u>left</u> of the centre marker. Record the vernier reading (the frequency is 67.1 Mc/s).



5. Continue as above, recording each 0.1 Mc/s point until 67.5 Mc/s is reached. The display will then appear thus:-



The marker at the right-hand end of the trace is the one that corresponds to 68 Mc/s and is used for completion of the interpolation. For example, the display shown below represents a tune frequency of 67.8 Mc/s.



If calibration of the vernier scale is required only to allow accurate measurement of the difference in frequency between two adjacent signals and not to permit accurate measurement of the actual frequency of either, any convenient signal source of reasonable stability can be used in place of the 1 Mc/s generator used in the example above.

A similar procedure can be applied for interpolation on the 770U UHF receiver. In this case frequencies can be interpolated to better than 10 kc/s at 500 Mc/s provided that both 1 Mc/s and 10 Mc/s harmonic generators are available. Difference frequencies can be interpolated to the same accuracy with any stable source as the reference signal.

Calibration marks on the 770U scale appear at 5 Mc/s intervals and it is therefore necessary to identify the individual megacycle points before proceeding to use the 100 kc/s markers for more precise interpolation. The most convenient technique is to first calibrate the receiver scale against the internal 50 Mc/s Calibrator and then identify the 10 Mc/s marker which falls nearest to the frequency to be measured. The 1 Mc/s markers can now be introduced and should be counted as they pass across the face of the c.r.t. when tuning the receiver. Once the wanted frequency lies on the c.r.t. trace the 100 kc/s markers can be used as on the 770R installation.

USE OF THE EP17R AS A WOBBULATOR

General.

The EP17R can be used for direct visual alignment of amplifiers operating in the following frequency bands:-

OSC FREQ switch to position '1'.		OSC FREQ switch to position '2'.	
5.42 - 6.42 Mc/s.	(x1)	4.8 - 5.6 Mc/s.	(x1)
10.84 - 12.84 Mc/s.	(x2)	9.6 - 11.2 Mc/s.	(x2)
16.26 - 19.26 Mc/s.	(x3)	14.4 - 16.8 Mc/s.	(x3)

These figures are quoted on the basis of a fundamental sweep width of one megacycle about a fixed centre frequency. Greater coverage can be obtained by using the CENTRE FREQUENCY TRIMMER to shift the nominal centre frequency. The exact limits of the actual ranges will vary slightly from unit to unit since they are dependent on the final setting of the CENTRE FREQUENCY TRIMMER obtained during initial alignment.

Greatest flexibility in operation will occur when the alignment frequency falls in the centre of the sweep range since this allows greater freedom in use of the WIDTH control for widening the signal display. Standard IF's of 5.2 Mc/s and 10.7 Mc/s lie in the middle of the appropriate ranges and are therefore convenient in this respect.

Alignment of IF amplifiers on frequencies which lie outside the ranges given above can be carried out provided the receivers in which they are used are capable of being tuned to one or other of the sweep ranges available.

When the EP17R is used in its secondary role as a wobbulator, the ATTENUATOR (which occurs in the early signal frequency circuits) is non-functional. The calibration display is available (with the pips spaced 100 kc/s apart) but will be offset by 20 kc/s from the true 0.1 Mc/s points as a direct result of the mixing process. Further, when the unit is used with the OSC FREQ switch at position '2', an image of the main display will appear in a position displaced from the main display by 40 kc/s.

It is not intended in this mode of operation that the calibration display be used as anything more than a rough guide. It will in any case be more convenient to use a standardised signal generator fed into the receiver under test in parallel with the output from the sweep oscillator since this will allow continuous calibration in the form of a tunable marker pip.

If the internal calibrator is used, the CALIBRATOR switch should be set to the 'CAL & SIG' position to allow adjustment of the marker height by use of the normal GAIN control. This latter control is non-functional except in this application.

Control of the level of oscillator drive to the receiver under test must be arranged externally to the unit and can conveniently take the form of a coaxial attenuator included in series with the lead from the OSC OUT socket. Attenuators of the type normally used for equalising signal strengths in multi-channel domestic television aerial installations will be found ideal for this application. Suitable units are the Belling Lee Type L.729 and the Egen Type 141. Either type can be arranged to provide control of the oscillator drive in steps of 6dB.

When accurate measurement is not required, one simple and effective method of varying the oscillator drive is to wire a 100Ω variable resistor in shunt with the oscillator output lead. Continuous adjustment of the level will then be possible.

Visual Alignment of 770R IF Stages and Discriminator.

1. Check that all IF circuits are peaked accurately to 5.2 Mc/s by carrying out normal alignment procedure using a modulated signal generator and audio output meter. The generator should be checked against a reliable frequency standard and all equipment allowed half an hour for 'warm-up' before commencing alignment. (Use 'CW' position of MODE switch as detailed in the Manual supplied with the receiver).

2. Connect the OSC OUT socket on the front of the EP17R to the IF OUT socket on the receiver using a short length of coaxial cable terminated at each end with a Belling Lee Type L.734 coaxial plug. Arrange some form of control over the level of oscillator output as described previously.

3. Connect a screened lead or coaxial cable terminated at one end with an L.734 plug to the 'Y' AMP INPUT socket on the EP17R unit. Connect the screen at the other end to the left-hand terminal of the pair of terminals labelled 'AF INPUT' at the rear of the receiver. Connect the inner of the screened lead to the right-hand terminal through a 0.1MΩ resistor. The left-hand terminal is directly earthed within the receiver and the other is connected to the AM Detector load resistor.

4. Set the receiver controls as follows:-

   (a) Place the MODE switch in the 'CW' position to disable the AGC circuit.

   (b) Set the IF GAIN to maximum and the AF GAIN to minimum.

   (c) Switch off the N/L and MUTING.

   (d) Put the STANDBY switch to 'ON' (i.e. dolly down).

5. Set the EP17R controls as follows:-

   (a) Move the OSC FREQ switch to position '2'.

(b) Set the TIMEBASE FREQ to 5 c/s.

(c) Move the CENTRE FREQUENCY control to its mid-travel position.

6. Adjust the CENTRE FREQUENCY TRIMMER and WIDTH control to give a sweep of the order 200 kc/s with the response at 5.2 Mc/s centred in the middle of the tube.

7. Adjust the level of oscillator drive to the IF OUT socket on the receiver to give a suitable display.

8. Examine closely the response on the face of the c.r.t. , checking carefully the overall symmetry. The oscillator drive can be increased and the WIDTH setting altered to allow inspection of the skirt response below 20dB down. Any re-alignment which may be required should if possible be restricted to T3, T4 and T5. It should be noted that the re-adjustment required will be very small indeed and should be distributed evenly between the three transformers mentioned rather than by attempting to obtain complete correction by adjusting one circuit alone.

9. Transfer the 'Y' AMP INPUT lead to the junction of R47 and R48, retaining the 0.1MΩ series resistor as before.

10. Adjust the 'Y' SHIFT on the EP17R to position the trace mid-way up the screen so that both peaks of the Discriminator characteristic can be seen clearly. Adjust the level of oscillator drive and the WIDTH setting as required to give a suitable display.

11. First observe the centering of the characteristic by feeding in a marker signal on 5.2 Mc/s. If the response lies off-centre a correction can be made by adjustment of the top (secondary) core of T6. Any tendency towards non-linearity can be eliminated with the primary core and each adjustment should be repeated as necessary until a symmetrical response is obtained.

Visual Alignment of the 770U 5.2 Mc/s IF Stages and Discriminator.

The procedure to be adopted when aligning the 5.2 Mc/s Amplifiers and the Discriminator of a 770U (Mk.II) receiver is as follows:-

1. Check that the appropriate IF circuits are peaked accurately to 5.2 Mc/s by carrying out normal alignment procedure using a modulated signal generator and audio output meter. The generator should be checked against a reliable frequency standard and all equipment should be allowed half an hour for 'warm-up' before commencing alignment. Reference should be made to the Manual supplied with the receiver for details of connections, control settings etc.

2. Connect the OSC OUT socket on the front of the EP17R to the IF(2) socket on the receiver using a short length of coaxial cable terminated at each end with a Belling Lee Type L.734 coaxial plug. Arrange some form of control over the level of oscillator output as described previously.

3. Connect a screened lead or coaxial cable terminated at one end with an L.734 Plug to the 'Y' AMP INPUT socket on the EP17R unit. Connect the screen at the other end to the left-hand terminal of the pair of terminals labelled 'AF INPUT' at the rear of the receiver. Connect the inner of the screened lead to the right-hand terminal through a 0.1MΩ resistor. The left-hand terminal is directly earthed within the receiver and the other is connected to the AM Detector load resistor.

4. Set the receiver controls as follows:-

(a) Place the MODE switch in the 'AM' position.

(b) Set the IF GAIN to maximum and the AF GAIN to minimum.

(c) Switch off the N/L, MUTING and AGC. (d) Put the STANDBY switch to 'ON'.

5. Set the EP17R controls as follows:-

   (a) Move the OSC FREQ switch to position '2'.

   (b) Set the TIMEBASE FREQ to 5 c/s.

   (c) Move the CENTRE FREQUENCY control to its mid-travel position.

6. Adjust the CENTRE FREQUENCY TRIMMER and WIDTH control to give a sweep of the order 200 kc/s with the 5.2 Mc/s signal response centred in the middle of the tube.

7. Adjust the level of oscillator drive to the IF(2) socket on the receiver to give a suitable display.

8. Examine closely the response on the face of the c.r.t., checking carefully the overall symmetry. The oscillator drive can be increased and the WIDTH setting altered to allow inspection of the skirt response below 20dB down. Any re-alignment which may be required should if possible be restricted to T8 and T9.

9. Transfer the 'Y' AMP INPUT lead to the junction of R45 and R47 (retain the 0.1MΩ series resistor) and proceed with alignment of the Discriminator by following the Instructions in paras 10 and 11 under 'Visual Alignment of 770R'. The Discriminator transformer is T10 in the case of the 770U.

RE-ALIGNMENT OF THE DISPLAY UNIT

Test Equipment.

The following items of test equipment are required for re-alignment of the EP17R.

1. Signal Generator(s) covering 720 kc/s and the range 4-6.5 Mc/s (o/p Z = 50/75Ω)
2. Multi-range testmeter having DC current ranges of 50μA and 10mA.
3. Monitor receiver.
4. Trimming tools: (a) Neosid H.S.1. hexagonal tool. (b) Insulated screwdriver.

NOTE A period of at least half an hour should be allowed for the equipment to reach operating temperature before commencing alignment.

Re-alignment of the 720 kc/s Amplifiers.

This is the first stage in the alignment procedure and is carried out by introducing an unmodulated 720 kc/s signal at the grid of the Mixer Stage (V5A, pin 2). A μAmmeter (50μA f.s.d.) is connected across the 0.27MΩ diode load resistor (R49) to provide an indication of output. (The negative side of the meter is earthed).

Before alignment is commenced, disable the Sweep Oscillator by earthing its grid (V5B, pin 1) and set the GAIN control to maximum.

Tune the generator to approximately 720 kc/s and then swing slightly to either side of this point to locate the centre frequency of the amplifier. The μAmmeter will show a sharp rise as the signal is tuned to the peak of the crystal filter and the generator should be left set to this frequency. Adjust the attenuator on the generator to give a meter reading of 30-40μA and then peak the cores in T4-T7. All cores are adjusted on their outer peak and the attenuator should be adjusted as necessary to maintain the same output reading throughout the alignment.

Adjustment of the crystal phasing capacitor (C37) may be required and is carried out as follows:- First remove the short from the grid of V5B and then transfer the generator to the input socket of the unit and re-tune it to 5.2 Mc/s. Set the EP17R ATTENUATOR to 0dB. Adjust the CENTRE FREQUENCY and WIDTH controls to obtain a suitable display of the 5.2 Mc/s signal (a scan width of the order 50 kc/s will be found most convenient). The response that appears on the face of the c.r.t. is that of the 720 kc/s amplifiers and any side lobe due to incorrect adjustment of the phasing capacitor will be seen quite clearly. The capacitor should be set to eliminate the side lobe and leave a smooth response. C37 is located on the underside of T5 and can be adjusted with a small insulated screwdriver type tool. A low sweep speed should be used while making the adjustment and any slight tendency for the response to lean can be corrected by slight re-trimming of T4/T5 while observing the display on the c.r.t.

This completes re-alignment of the 720 kc/s stages, the μAmmeter can be disconnected before proceeding.

Re-alignment of the Sweep Oscillator.

The Sweep Oscillator must be set to cover the range 5.42-6.42 Mc/s when the OSC FREQ switch is at position '1'. This step in the alignment is achieved by adjustment of the trimmer C73 and the pre-set COARSE CENTRE FREQUENCY control RV3. These adjustments are closely associated with those for the pre-set 'X' WIDTH and LINEARITY controls and the procedure given must be followed very closely. C73 is referred to as the CENTRE FREQUENCY TRIMMER and is adjusted by means of a slotted screw on the front panel.

First check the adjustment of the pre-set 'X' WIDTH control. This should be set such that the amount of overscan is equal to approximately 30% of the total trace width. The adjustment is not critical but should be carried out carefully in conjunction with the panel 'X' SHIFT control to allow identification of the extremeties of the trace. Ensure that the 'X' SHIFT is left in the correct position, i.e. with an equal amount of overscan at each side of the screen.

Next adjust the COARSE CENTRE FREQUENCY control RV3. To do this, break the HT feed to V6B at the 1,000Ω resistor (R67) and connect a milliammeter (10mA f.s.d.) to read the combined anode and screen currents. Set the panel WIDTH control to minimum (fully clockwise) and then adjust RV3 for a meter reading of 4mA. Disconnect the meter and re-connect the resistor.

Keep the WIDTH control at minimum and inject at the input socket a 5.2 Mc/s signal from the generator (previously checked against an external frequency standard) and adjust C73 to give a signal response at the centre of the trace. The panel control marked CENTRE FREQUENCY must be set to mid-travel when making this adjustment and a monitor receiver can be brought into operation to check that the oscillator is set on the 'high' side of the signal (i.e. sweeping across a centre frequency of 5.92 Mc/s). A short length of wire attached to the receiver aerial terminal will provide adequate pick-up of the oscillator signal. Once C73 has been set correctly, slacken the drive coupler and re-set the slot in the adjusting screw to coincide with the dot on the panel.

At this stage it is convenient to check the accuracy of the 'X' SHIFT setting. If the 5.2 Mc/s signal remains in the centre of the screen when the WIDTH control is rotated towards minimum, then the 'X' SHIFT is set correctly. If the signal wanders away from centre as the WIDTH is varied then the control is set incorrectly and a correction must be made before proceeding.

Now switch to 'CAL & SIG' and increase the WIDTH setting until the display comprises the 5.2 Mc/s marker signal together with ten 100 kc/s marker pips (five to either side of the 5.2 Mc/s signal). Do not pay attention at this stage to the relative amplitudes of the crystal markers but examine closely the spacing between them.

If any variation in spacing is noted, adjust the pre-set LINEARITY control RV4 to give optium separation. It is in order to re-adjust the WIDTH control slightly if the end markers move off the screen when making this adjustment and at the same time any tendency for the 5.2 Mc/s signal to move away from centre should be corrected by adjustment of C73. It must be realised that there is a fundamental interaction between the adjustments just described and each should be repeated as necessary until the desired result is obtained.

NOTE If difficulty is experienced in obtaining good linearity, try re-setting the anode/screen current of V6B to a slightly different value in the range 3.5-4.5mA and then repeat the adjustments described above.

Re-alignment of the 5.2 Mc/s Stages.

First check whether re-alignment is required. Set up the unit to provide a 1 Mc/s display centred on 5.2 Mc/s and introduce at the input socket a 5.2 Mc/s signal from the generator. Adjust the generator output to give a display with a height of about 2 cm. Now tune the generator over the range 4.7-5.7 Mc/s and check for variation in signal amplitude. If the alignment is correct the height of the display will not vary by more than 2dB from the reference level at 5.2 Mc/s. If a greater variation is observed leave the display width at 1 Mc/s and proceed as follows:-

Connect a μAmmeter (50μA f.s.d.) across the diode load resistor R49 (0.27MΩ). As an alternative a valve voltmeter can be used in which case a convenient point for connection would be at the grid of the 2nd 720 kc/s Amplifier (V8, pin 1). Feed the generator into the input socket and set it first to 5.2 Mc/s. With the EP17R ATTENUATOR at 0dB and the GAIN control at maximum, adjust the generator output for a reading of 30-40μA on the meter across R49. Adjust T3 for a peak reading and then re-tune to 5.8 Mc/s. The top core (secondary) of T2 is adjusted for a peak at this frequency and then the bottom core at 4.7 Mc/s. Both cores tune on their 'outer' peak.

Now proceed to align the 5.2 Mc/s Filter (L1-L7). Tune the generator to 6.15 Mc/s and adjust L1 and L6 for minimum output. (It will be necessary to increase the WIDTH setting and also to offset the CENTRE FREQUENCY control to permit coverage of 6.15 Mc/s. The controls should be returned to their initial settings after the adjustments have been made). Re-tune to 4.15 Mc/s and with the OSC FREQ switch to position '2', trim L2 and L7 for minimum output. Revert to position '1', set the generator to 5.2 Mc/s and adjust L4 for maximum output. Re-tune the generator to 5.35 Mc/s and adjust L5 for maximum. Finally, adjust L3 for maximum output with the generator set to 5.5 Mc/s.

This completes the alignment of the 5.2 Mc/s stages and a final check can be made by observing the display while tuning the generator over the range 4.7-5.7 Mc/s.

Re-alignment of the Crystal Calibrator.

The first step in re-alignment of this stage is to peak L10 for maximum height of the crystal markers. Once this has been done, the crystal frequency must be set accurately to 100 kc/s. Position a short pick-up wire near to L8/L9 and attach it to the aerial of a monitor receiver tuned to a reliable frequency standard on 5.2 Mc/s. Identify the signal from the calibrator and then adjust C67 (below chassis) for zero-beat.

The relative height of the crystal markers must now be equalised. Set the unit to provide a one megacycle sweep with the CALIBRATOR switch in the 'CAL' position. Adjust L8/L9 alternately until all markers are of the same average height.

Finally, set the overall height of the calibration display to approximately 0.5cm. by adjustment of the injection capacitor C23a, (CALIBRATOR switch to 'CAL').

APPENDIX 'A'

METHODS OF CONNECTING VHF/UHF RECEIVERS TO THE EP17R

Although provision is made on certain Eddystone receivers for direct connection to the EP17R Panoramic Display Unit, such facilities may not be available on other types. Any receiver having an intermediate frequency of 5.2 or 5.25 Mc/s can be used in conjunction with the EP17R and the notes which follow detail minor modifications which can be carried out to obtain a suitable low level output to drive the Display Unit.

In many cases the receiver will have an IF output socket already fitted but the chances are that the output will be taken from a point towards the end of the IF chain. The resultant loss of bandwidth will to some extent limit the usefulness of the EP17R although it will still be possible to examine a single signal response. Greater bandwidth will be available at the anode of the receiver Mixer Stage and the solution is to re-wire the socket to this point in the circuit. One convenient method of connection is as follows:-

Locate the decoupling capacitor in the HT feed to the 1st IF transformer and lift its earth connection. Fit a suitable stand-off tag and return the capacitor to earth through a resistor of say 68Ω. Output can be taken from the junction between the resistor and capacitor using coaxial cable, either to the existing socket or to an additional socket mounted in a suitable position. Slight re-alignment of the IF transformer may be called for but the normal performance of the receiver will be virtually unaffected by this modification.

With this arrangement the only restriction on bandwidth is the selectivity of the front-end signal frequency circuits. It is unlikely that this in a VHF/UHF receiver would be sufficient to prevent full use of the one megacycle sweep which is available with the EP17R. In fact, even in a double conversion receiver (with 2nd IF of 5.2 Mc/s) full coverage should be possible when the output is taken from the anode of the 2nd Mixer.

Another simple method of obtaining a suitable output is to lift the earthy end of the bypass capacitor on the cathode of the 1st IF Amplifier and use it as a coupling capacitor to feed the coaxial output. Bandwidth will be somewhat less than in the previous case due to the selectivity of the 1st IF transformer but it may be that this point is more readily accessible for connection. Some slight loss of receiver gain may be noticed with this form of connection.

If the bandwidth obtained by using either of the foregoing methods should be found insufficient, greater bandwidth can be achieved by wiring a resistor in series with the HT+ side of the primary tuning capacitor in the 1st IF transformer. Output is taken from the junction of the resistor and capacitor and must be blocked to DC by a suitably rated capacitor of 0.001-0.01μF. The bandwidth will depend on the value of the resistor and can be determined by experiment. A coaxial output lead should be used as before.

The loss of gain produced by this last arrangement will be somewhat greater than that which results from use of the other two methods. This will not be serious in so far as the EP17R is concerned but it may possibly reduce the usefulness of the receiver in normal 'audio' applications.

APPENDIX 'B'

INSTRUCTIONS FOR FITTING REPLACEMENT C.R.T.

1. Remove the B9G holder at the base of the original c.r.t.
2. Remove the screw which holds the base clip and take off the earth connection.
3. Remove two screws and take off the c.r.t. saddle.
4. Lift the tube clear of the unit.
5. Remove the rubber ring at the screen end of the tube and then slide off the mu-metal screen. (The ring prevents light entering the rear of the tube face).
6. Reverse the procedure above to fit the replacement, making sure that the foam strip is replaced round the mu-metal screen (under the saddle) and the earth tag is re-connected to the base clip.

   The orientation for the base is with pin 5 uppermost, (i.e. the locating lug on the centre spigot points vertically downwards). The two screws holding the saddle should be left loose to allow rotation of the tube for correct orientation while observing the trace on the screen. Once the tube has been set correctly the two screws should be securely tightened.

APPENDIX 'C'

TABLE OF VOLTAGE VALUES

The "Table of Voltage Values" given below will prove useful in the event of the unit developing a fault which makes it necessary to carry out voltage checks. All readings are typical and were taken with a meter having a sensitivity of 20,000Ω/V and an applied mains voltage of 240V. A nominal tolerance of 10% will apply to all readings taken with a meter of the sensitivity quoted and this should be increased accordingly if readings are taken with a meter of lower sensitivity.

Readings should be taken under 'no-signal' conditions with the controls set as indicated (see Notes). All readings are positive w.r.t. chassis except where indicated.

Ref	Anode		Screen		Cathode		Note
	Pin	Reading	Pin	Reading	Pin	Reading	
V1	7	168V	9	168V	1	1.8V	
V2A	6	255V	3	170V	7	2.8V	NOTE 1
V2B	1	-	-	-	8	-	NOTE 2
V3	5	255V	6	255V	7	3.6V	
V4	7	234V	9	234V	1	3.7V	
V5A	6	256V	3	147V	7	-	
V5B	1	25V	-	-	8	-	
V6A	1	85V	-	-	8	2.5V	

Ref	Anode		Screen		Cathode		Note
	Pin	Reading	Pin	Reading	Pin	Reading	
V6B	6	196V	3	196V	7	3.9V	NOTE 3
V7	5	260V	6	145V	7	1.65V	NOTE 4
V8	5	260V	6	185V	7	6.5V	NOTE 5
V9	2/7	-	-	-	1/5	0.35V	
V10	5	4V	6	70V	7	-	NOTE 6
V11A	1	20V	-	-	8	1.25V	
V11B	6	75V	3	235V	7	25V	
V12A	1	300V	-	-	8	145V	NOTE 7
V12B	6	120V	3	11.5V	7	-	NOTE 7
V13A	1	350V	-	-	8	135V	NOTE 7
V13B	6	105V	3	105V	7	30V	NOTE 7
V14	1	150V	-	-	7	-	
V15	1	258V	-	-	7	150V	

NOTE 1. Readings taken with CALIBRATOR switch at 'SIG' position.

NOTE 2. This section of V2 is not used. Electrodes are earthed.

NOTE 3. WIDTH control to 'MIN', TIMEBASE FREQ to 40 c/s. Allowance should be made for the variation available with RV3.

NOTE 4. Readings taken with GAIN control at maximum and CALIBRATOR switch to 'SIG'. The cathode voltage becomes 5V when the CALIBRATOR switch is moved to 'CAL'.

NOTE 5. Readings taken with GAIN control at maximum and CALIBRATOR switch to 'SIG'. The cathode voltage becomes 10V when the CALIBRATOR switch is moved to 'CAL'.

NOTE 6. CALIBRATOR switch to 'CAL' position.

NOTE 7. TIMEBASE FREQ to 40 c/s.

C.R.T. Voltages.

The cathode ray tube voltages are as follows:-

Anode 1/3	(pin 4)		90V.
Anode 2	(pin 7)		-600V.
Grid	(pin 8)		-850V.
Cathode	(pin 1)		-845V.

APPENDIX 'D'

LIST OF COMPONENT VALUES, TOLERANCES AND RATINGS

Capacitors.

Ref	Value	Type	Tolerance	Wkg. V.
C1	0.047µF	Polyester	10%	400V
C2	0.01µF	Metallised Paper	20%	150V
C3	100pF	Tubular Ceramic	10%	750V
C4	-	(Used on EP14 only)	-	-
C5	0.047µF	Polyester	10%	400V
C6	0.047µF	Polyester	10%	400V
C7	60pF	Tubular Ceramic	10%	750V
C8	35pF	Tubular Ceramic	10%	750V
C9	0.047µF	Polyester	10%	400V
C10	0.01µF	Metallised Paper	20%	150V
C11	0.01µF	Metallised Paper	20%	150V
C12	0.001µF	Polystyrene	5%	125V
C13	0.0018µF	Polystyrene	5%	125V
C14	0.002µF	Polystyrene	5%	125V
C15	0.0018µF	Polystyrene	5%	125V
C16	0.0022µF	Polystyrene	5%	125V
C17	0.0022µF	Polystyrene	5%	125V
C18	70pF	Polystyrene	5%	125V
C19	0.001µF	Polystyrene	5%	125V
C20	0.0018µF	Polystyrene	5%	125V
C21	0.002µF	Polystyrene	5%	125V
C22	0.0018µF	Polystyrene	5%	125V
C23	0.01µF	Metallised Paper	20%	150V
C23a	3-23pF	Air Trimmer	-	-
C24	6pF	Tubular Ceramic	10%	750V
C25	10pF	Tubular Ceramic	10%	750V
C26	0.047µF	Polyester	10%	400V
C27	100pF	Tubular Ceramic	10%	750V
C28	40pF	Tubular Ceramic	10%	750V
C29	3pF	Tubular Ceramic	0.5pF	750V
C30	0.01µF	Metallised Paper	20%	150V
C31	0.047µF	Polyester	10%	400V
C32	0.047µF	Polyester	10%	400V
C33	0.047µF	Polyester	10%	400V
C34	400pF	Silvered Mica	2%	350V
C35	800pF	Silvered Mica	2%	350V
C36	800pF	Silvered Mica	2%	350V
C37	2-12pF	Air Trimmer	-	-
C38	50pF	Tubular Ceramic	10%	750V
C39	100pF	Silvered Mica	2%	350V
C40	100pF	Tubular Ceramic	10%	750V
C41	0.047µF	Polyester	10%	400V
C42	0.047µF	Polyester	10%	400V
C43	0.047µF	Polyester	10%	400V
C44	400pF	Silvered Mica	2%	350V

Ref	Value	Type	Tolerance	Wkg. V.
C45	400pF	Silvered Mica	2%	350V
C46	0.047µF	Polyester	10%	400V
C47	0.047µF	Polyester	10%	400V
C48	0.047µF	Polyester	10%	400V
C49	400pF	Silvered Mica	2%	350V
C50	400pF	Silvered Mica	2%	350V
C51	0.001µF	Tubular Ceramic	+50 -25%	750V
C52	0.001µF	Tubular Ceramic	+50 -25%	750V
C53	-	(Capacitors	-	-
C54	-	C53-C59	-	-
C55	-	are used	-	-
C56	-	only on	-	-
C57	-	EP14	-	-
C58	-	Display	-	-
C59	-	Unit)	-	-
C60	0.01µF	Tubular Ceramic	+80 -20%	250V
C61	0.01µF	Tubular Ceramic	+80 -20%	250V
C61a	3pF	Silvered Mica	0.5pF	350V
C62	6pF	Tubular Ceramic	10%	750V
C63	10pF	Tubular Ceramic	10%	750V
C64	40pF	Tubular Ceramic	10%	750V
C65	0.01µF	Tubular Ceramic	+80 -20%	250V
C66	50pF	Silvered Mica	10%	350V
C67	3-23pF	Air Trimmer	-	-
C68	10pF	Tubular Ceramic	10%	750V
C69	0.047µF	Polyester	10%	400V
C70	50pF	Tubular Ceramic	10%	750V
C71	330pF	Silvered Mica	5%	350V
C72	330pF	Polystyrene	5%	125V
C73	9-189pF	Foil Dielectric Variable	-	-
C73a	500pF	Silvered Mica	10%	350V
C74	390pF	Polystyrene	5%	125V
C75	70pF	Polystyrene	5%	125V
C76	0.002µF	Polystyrene	5%	125V
C77	0.01µF	Metallised Paper	20%	150V
C78	0.01µF	Metallised Paper	20%	150V
C79	0.047µF	Polyester	10%	400V
C80	2µF	Metallised Paper	25%	1000V
C81	2µF	Metallised Paper	25%	1000V
C82	0.01µF	Metallised Paper	20%	150V
C83	0.01µF	Metallised Paper	20%	150V
C84	0.01µF	Metallised Paper	20%	150V
C85	0.01µF	Metallised Paper	20%	150V
C86	0.01µF	Metallised Paper	20%	150V
C87	0.01µF	Metallised Paper	20%	150V
C88	2µF	Metallised Paper	25%	1000V
C89	4µF	Tubular Electrolytic	+50 -20%	350V
C90	4µF	Tubular Electrolytic	+50 -20%	350V
C91	0.1µF	Duomold	20%	500V
C92	0.05µF	Visconal *RMS	20%	600V*
C93	0.1µF	Duomold	20%	500V
C94	4µF	Tubular Electrolytic	+50 -20%	350V

Ref	Value	Type	Tolerance	Wkg. V.
C95	0.05µF	Duomold	20%	600V
C96	0.05µF	Duomold	20%	600V
C97	0.1µF	Duomold	20%	500V
C98	0.1µF	Duomold	20%	500V
C99	0.1µF	Duomold	20%	500V
C100	0.5µF	Nitrogol (dual unit)	20%	1000V
C101	0.5µF	Nitrogol	20%	1000V
C102	0.5µF	Metallised Paper	20%	1000V
C103	0.5µF	Metallised Paper	20%	150V
C104	32 + 32µF	Tubular Electrolytic	+50 -20%	350V
C105	50µF	Tubular Electrolytic	+50 -20%	450V
C106	50µF	Tubular Electrolytic	+50 -20%	450V

Resistors.

Ref	Value	Tol.	Rating
R1	2,200Ω	10%	1 watt
R2	3,300Ω	10%	1 watt
R3	820Ω	10%	½ watt
R4	10,000Ω	10%	½ watt
R5	100Ω	10%	½ watt
R6	1MΩ	10%	½ watt
R7	470Ω	10%	½ watt
R8	0.27MΩ	10%	½ watt
R9	68,000Ω	10%	½ watt
R10	2,200Ω	10%	½ watt
R11	12,000Ω	10%	½ watt
R12	12,000Ω	10%	½ watt
R13	12Ω	10%	½ watt
R14	1,000Ω	10%	½ watt
R15	330Ω	10%	½ watt
R16	150Ω	10%	½ watt
R17	220Ω	10%	½ watt
R18	150Ω	10%	½ watt
R19	220Ω	10%	½ watt
R20	220Ω	10%	½ watt
R21	150Ω	10%	½ watt
R22	150Ω	10%	½ watt
R23	220Ω	10%	½ watt
R24	220Ω	10%	½ watt
R25	150Ω	10%	½ watt
R26	150Ω	10%	½ watt
R27	100Ω	10%	½ watt
R28	220Ω	10%	½ watt
R29	3,300Ω	10%	1 watt

Ref	Value	Tol.	Rating
R30	12,000Ω	10%	½ watt
R31	12Ω	10%	½ watt
R32	390Ω	10%	½ watt
R33	1MΩ	10%	½ watt
R34	68,000Ω	10%	½ watt
R35	1,000Ω	10%	½ watt
R36	47,000Ω	10%	1 watt
R37	47,000Ω	10%	1 watt
R38	0.47MΩ	10%	½ watt
R39	330Ω	10%	½ watt
R40	0.47MΩ	10%	½ watt
R41	47,000Ω	10%	1 watt
R42	2,200Ω	10%	½ watt
R43	100Ω	10%	½ watt
R44	220Ω	10%	½ watt
R45	47,000Ω	10%	1 watt
R46	2,200Ω	10%	½ watt
R47*	1,000Ω	10%	½ watt
R48	27,000Ω	10%	½ watt
R49	0.27MΩ	10%	½ watt
R50	Resistors	-	-
R51	R50-R55	-	-
R52	are used	-	-
R53	only on	-	-
R54	EP14	-	-
R55	Display Unit	-	-
R56	0.27MΩ	10%	½ watt
R56a*	33,000Ω	10%	½ watt
R57*	4,700Ω	10%	½ watt
R58	22,000Ω	10%	½ watt
R58a	0.27MΩ	10%	½ watt
R59	1MΩ	10%	½ watt

*Nominal. Value may be adjusted during test.

Ref	Value	Tol.	Rating
R60	0.1MΩ	10%	½ watt
R61	3.3MΩ	10%	½ watt
R62	47,000Ω	10%	1 watt
R63	22,000Ω	10%	1 watt
R64	22,000Ω	10%	½ watt
R65	0.1MΩ	10%	½ watt
R66	22,000Ω	10%	½ watt
R67	1,000Ω	10%	½ watt
R68	0.1MΩ	10%	1 watt
R69	68Ω	10%	½ watt
R70	330Ω	10%	½ watt
R71	1,000Ω	10%	½ watt
R72	100Ω	10%	½ watt
R73	10,000Ω	10%	½ watt
R74	0.27MΩ	10%	½ watt
R75	100Ω	10%	½ watt
R76	1,000Ω	10%	½ watt
R77	3,300Ω	10%	½ watt
R78	0.1MΩ	10%	1 watt
R79	0.1MΩ	10%	1 watt
R80	68,000Ω	10%	½ watt
R81	0.47MΩ	10%	½ watt
R82	1MΩ	10%	½ watt
R83	10,000Ω	10%	½ watt
R84	1MΩ	10%	½ watt
R85†	0.1MΩ	10%	1 watt
R86†			
R87†	0.47MΩ	10%	½ watt
R88†			
R89	0.27MΩ	10%	½ watt

† Reference not allocated.

Ref	Value	Tol.	Rating
R90	0.18MΩ	10%	½ watt
R91	22,000Ω	10%	½ watt
R92	0.22MΩ	10%	½ watt
R93	0.22MΩ	10%	½ watt
R94	0.1MΩ	10%	1 watt
R95	10,000Ω	10%	½ watt
R96	0.47MΩ	10%	½ watt
R97	1MΩ	10%	½ watt
R98	2.2MΩ	10%	½ watt
R99	47,000Ω	10%	1 watt
R100	0.1MΩ	10%	½ watt
R101	1MΩ	10%	½ watt
R102	3,300Ω	10%	½ watt
R103	22,000Ω	10%	½ watt
R104	2.2MΩ	10%	½ watt
R105	22,000Ω	10%	½ watt
R106	470Ω	10%	½ watt
R107	22,000Ω	10%	1 watt
R108	4,700Ω	10%	½ watt
R109	1,000Ω	10%	½ watt
R110	10,000Ω	10%	½ watt
R111	470Ω	10%	½ watt
R112	0.1MΩ	10%	1 watt
R113	47,000Ω	10%	1 watt
R114	15,000Ω	10%	½ watt
R115	2,700Ω	5%	6 watt
R116	1,100Ω	5%	12 watt
R117	0.1MΩ	10%	1 watt
R118	68,000Ω	10%	½ watt
R119	47,000Ω	10%	½ watt
R120	140Ω	5%	6 watt
R121	CZ6 Thermistor	-	-
R122	140Ω	5%	6 watt

Potentiometers.

Ref	Value	Type
RV1	10,000Ω	Carbon
RV2	10,000Ω	Carbon
RV3	1,000Ω	Carbon
RV4	47,000Ω	Carbon
RV5	10,000Ω	Carbon

Ref	Value	Type
RV6	0.47MΩ	Carbon
RV7	0.5MΩ	Carbon
RV8	50,000Ω	Carbon
RV9	47,000Ω	Carbon
RV10	0.47MΩ	Carbon
RV11	0.47MΩ	Carbon

APPENDIX 'E'

LIST OF SPARES

The following list details all major spares for the EP17R Display Unit. 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 unit should be stated in all communications.

All orders should be addressed to:-

Stratton & Co., Ltd., Sales and Service Dept., Alvechurch Road., Birmingham,31.

In cases of extreme urgency, ring PRIory 2231/4, cable 'Stratnoid', Birmingham or use Telex 33708.

Inductors.

L1-L7	Not available separately. Order complete Filter Unit	D3116
L8	Crystal Calibrator anode coil (1)	D3130
L9	Crystal Calibrator anode coil (2)	D3131
L10	Crystal Calibrator screen coil	D3124
L11/L12	Not available separately. Order complete Reactor Unit	D3117

Chokes and Transformers.

CH1	Ferrite-cored choke	D3128
CH2	Ferrite-cored choke	D3129
CH3	HT smoothing choke	6260P
T1	Ferrite-cored toroidal input transformer	D3127
T2	1st 5.2 Mc/s IF transformer	D3118
T3	2nd 5.2 Mc/s IF transformer	D3119
T4	1st 720 kc/s IF transformer	D3120
T5	Crystal Filter output coil	D3123
T6	2nd 720 kc/s IF transformer	D3121
T7	3rd 720 kc/s IF transformer	D3122
T8	Power transformer	6407P

Crystals.

XL1	720 kc/s ± 0.05% Style 'E'	6121P
XL2	100 kc/s ± 0.005% Style 'E'	6099P

Switches.

S1	Calibrator switch (3P-3W wafer type)	D3182
S2	Not available separately. Order complete Attenuator	D3113
S3	Osc. Freq. switch (2P-2W wafer type)	D3184
S4	Timebase Frequency switch (4P-4W wafer type)	D3185
S5	Mains switch (DPDT toggle type)	4772PA

Plugs.

Standard coaxial plug (as used for Input, Osc. Output, etc.)	6079P
Mains plug (non-reversible with earth connection) complete with 6' cable	D2311/1

Sockets.

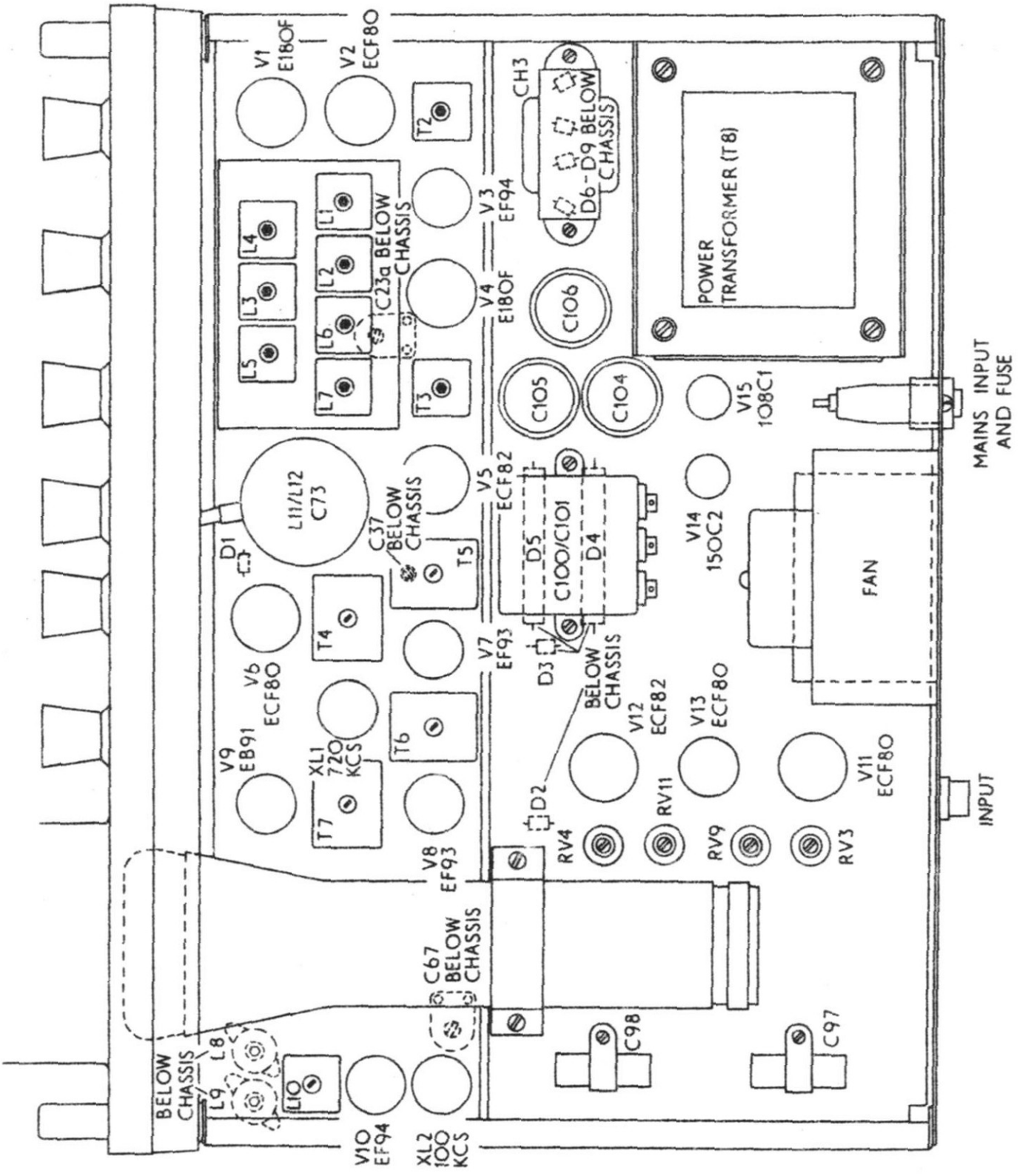
SKT1-4	Standard coaxial sockets (as used for Input, Osc. Output, etc.)	6087P
SKT5	Mains socket (polarised with earth contact)	D2310

Potentiometers.

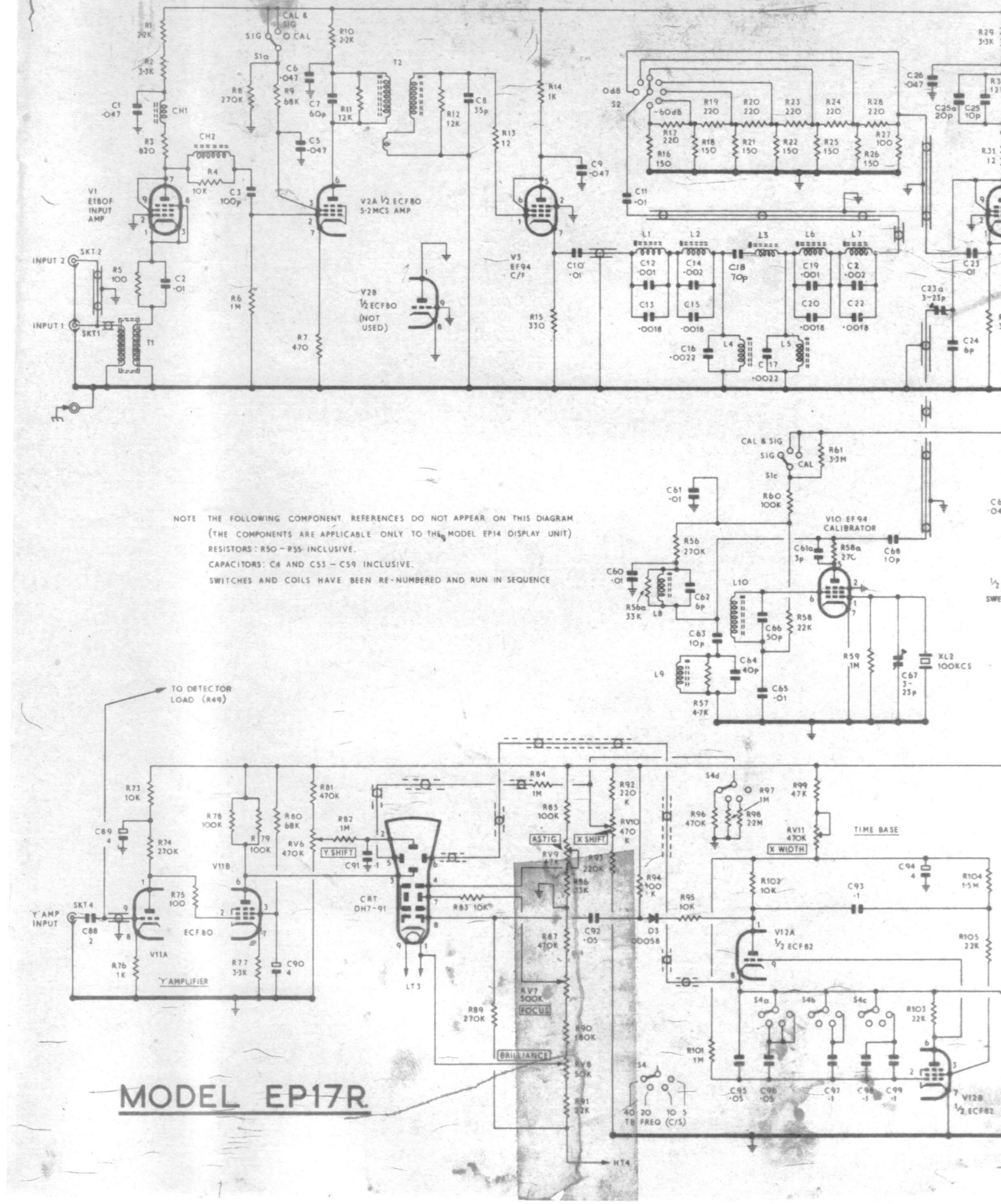
RV1	10,000Ω	5937P
RV2	10,000Ω	5937P
RV3	1,000Ω (pre-set)	6076P
RV4	47,000Ω (pre-set)	6488P
RV5	10,000Ω	5937P
RV6	0.47MΩ (pre-set)	6077P
RV7	0.5MΩ	6428/1P
RV8	50,000Ω	6428P
RV9	47,000Ω (pre-set)	6488P
RV10	0.47MΩ (pre-set)	6077P
RV11	0.47MΩ (pre-set)	6077P

Miscellaneous.

Chromium Plated panel handles	5827P
Earth Terminal	6371P
Fan	6492P
Fuseholder.	6103P
Fuse (1.5A x $1\frac{1}{4}$")	6104P
Graticule	6390P
Knobs	5816P
Pilot bulb	6599P
Pilot bulb holder	6598P
Thermistor (CZ6)	6493P
Valve Retainer (spring type)	5311PA
Valve screening can (B7G)	6126P
Valve screening can (B9A)	6127P



PLAN VIEW OF MODEL EP17R.



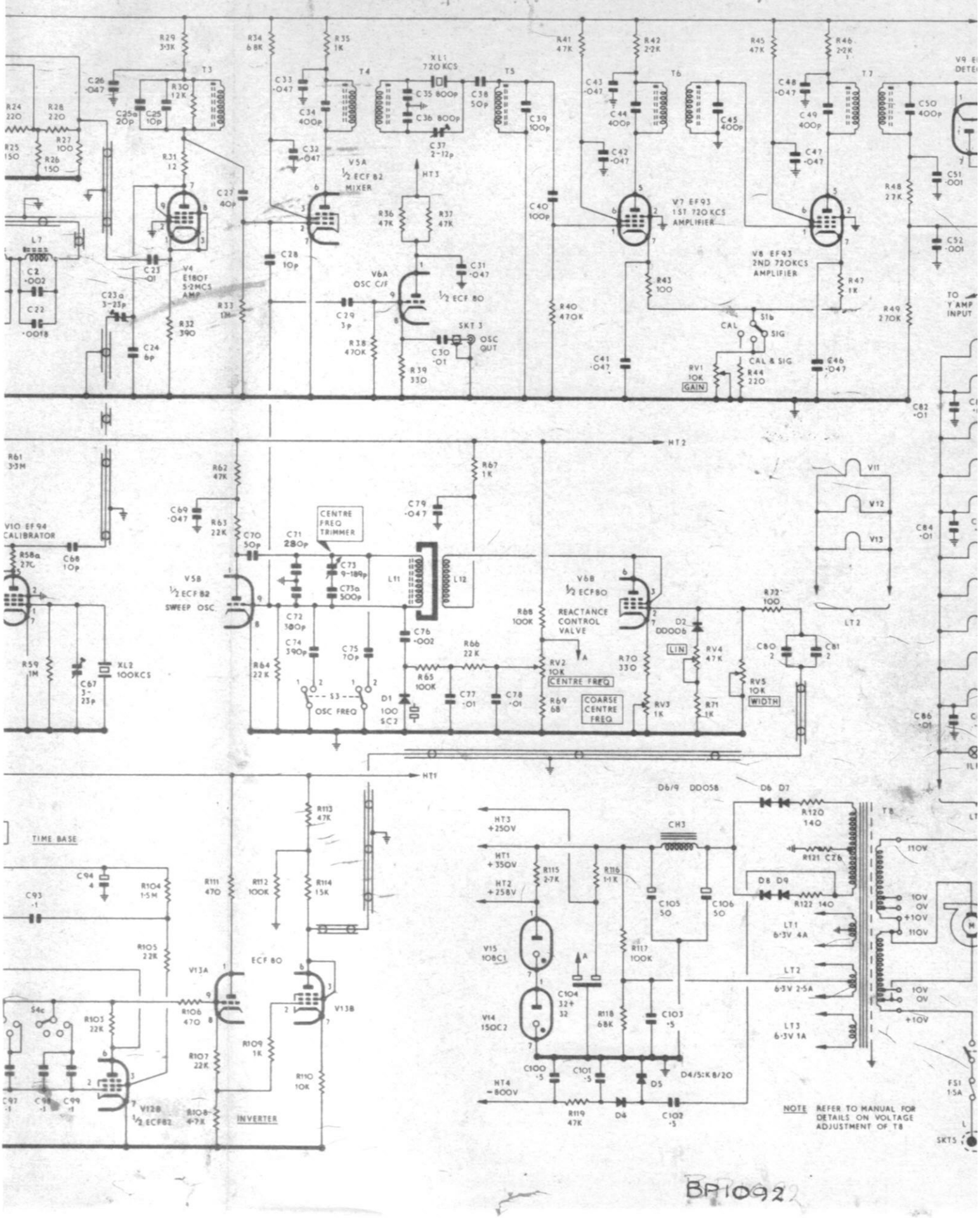
NOTE THE FOLLOWING COMPONENT REFERENCES DO NOT APPEAR ON THIS DIAGRAM (THE COMPONENTS ARE APPLICABLE ONLY TO THE MODEL EP14 DISPLAY UNIT)

RESISTORS : R50 – R55 INCLUSIVE.

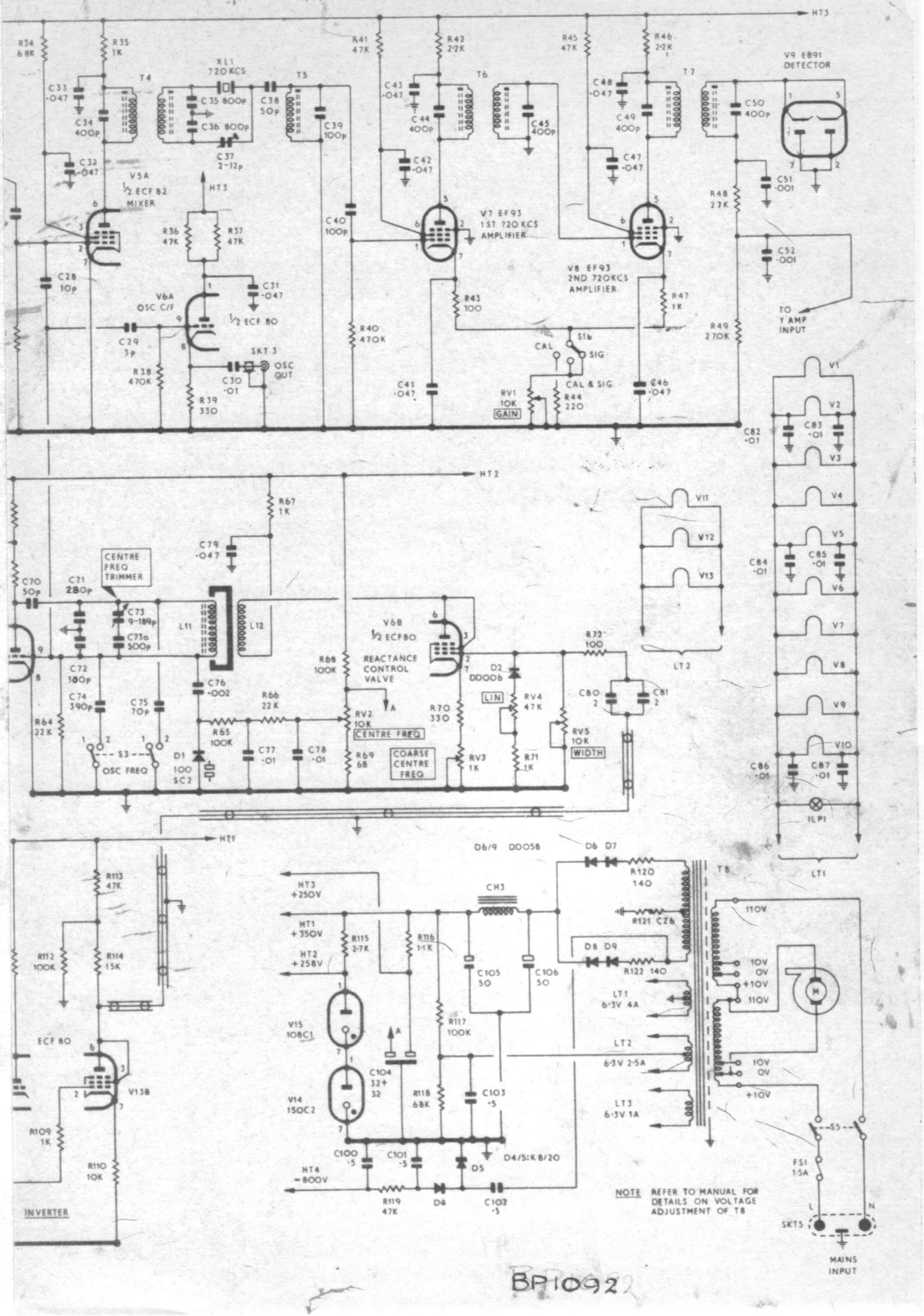
CAPACITORS: C4 AND C53 – C59 INCLUSIVE.

SWITCHES AND COILS HAVE BEEN RE-NUMBERED AND RUN IN SEQUENCE

MODEL EP17R


R29 3·3K
R34 6·8K
R35 1K
XL1 720 KCS
R41 47K
R42 2·2K
R45 47K
R46 2·2K
T3
T4
T5
T6
T7
C26 ·047
C33 ·047
C34 400p
C35 800p
C36 800p
C37 2–12p
C38 50p
C39 100p
C43 ·047
C44 400p
C45 400p
C48 ·047
C49 400p
C50 400p
C42 ·047
C47 ·047
C51 ·001
C52 ·001
R24 220
R28 220
R25 150
R27 100
R26 150
R30 12K
C25a 20p
C25 10p
R31 12
C32 ·047
V5A ½ ECF 82 MIXER
HT3
R36 47K
R37 47K
C27 40p
C28 10p
C40 100p
V7 EF93 1ST 720 KCS AMPLIFIER
V8 EF93 2ND 720 KCS AMPLIFIER
R48 27K
R49 270K
TO Y AMP INPUT
L7
C2 ·002
C22 ·0018
C23 ·01
C23a 3–23p
V4 E180F 5·2MCS AMP
R32 390
C24 6p
R33 1M
V6A OSC C/F
½ ECF 80
C29 3p
C31 ·047
SKT 3
OSC OUT
C30 ·01
R38 470K
R39 330
R40 470K
R43 100
R47 1K
CAL
S1b
SIG
CAL & SIG
RV1 10K GAIN
R44 220
C41 ·047
C46 ·047
C82 ·01
HT2
R61 3·3M
R62 47K
R67 1K
C69 ·047
R63 22K
C70 50p
C71 280p
CENTRE FREQ TRIMMER
C79 ·047
V10 EF 94 CALIBRATOR
R58a 27K
C68 10p
V5B ½ ECF 82 SWEEP OSC.
C73 9–189p
C73a 500p
L11
L12
C72 180p
C74 390p
C75 70p
C76 ·002
R66 22K
R65 100K
R64 22K
S3
OSC FREQ
D1 100 SC2
C77 ·01
C78 ·01
R59 1M
C67 3–23p
XL2 100KCS
V6B ½ ECF80 REACTANCE CONTROL VALVE
R68 100K
RV2 10K CENTRE FREQ
R69 68
COARSE CENTRE FREQ
R70 330
RV3 1K
R71 1K
D2 DD006
LIN
RV4 47K
RV5 10K WIDTH
R72 100
C80 2
C81 2
V11
V12
V13
LT2
C84 ·01
C86 ·01
HT1
TIME BASE
R113 47K
R111 470
R112 100K
R114 15K
C94 4
C93 ·1
R104 1·5M
R105 22K
V13A ECF 80
V13B
S4c
R103 22K
R106 470
R107 22K
R109 1K
R110 10K
C97 ·1
C98 ·1
C99 ·1
V12B ½ ECF82
R108 4·7K
INVERTER
D6/9 DD058
D6 D7
R120 140
T8
HT3 +250V
HT1 +350V
HT2 +258V
CH3
R115 2·7K
R116 1·1K
C105 50
C106 50
D8 D9
R122 140
R121 CZ6
110V
10V
0V
+10V
110V
LT1 6·3V 4A
LT2 6·3V 2·5A
LT3 6·3V 1A
V15 108C1
V14 150C2
C104 32+32
R117 100K
R118 68K
C103 ·5
C100 ·5
C101 ·5
D5
D4/5:K8/20
HT4 –800V
R119 47K
D4
C102 ·5
NOTE REFER TO MANUAL FOR DETAILS ON VOLTAGE ADJUSTMENT OF T8
FS1 1·5A
SKT5

BP1092


HT3
R34 6·8K
R35 1K
XL1 720 KCS
T4
T5
T6
T7
C33 ·047
C34 400p
C35 800p
C36 800p
C37 2-12p
C38 50p
C39 100p
C32 ·047
V5A ½ ECF 82 MIXER
R36 47K
R37 47K
C28 10p
V6A OSC C/F ½ ECF 80
C31 ·047
C29 3p
R38 470K
SKT 3
OSC OUT
C30 ·01
R39 330
R41 47K
R42 2·2K
C43 ·047
C44 400p
C45 400p
C42 ·047
C40 100p
V7 EF93 1ST 720 KCS AMPLIFIER
R40 470K
R43 100
R45 47K
R46 2·2K
C48 ·047
C49 400p
C47 ·047
V8 EF93 2ND 720KCS AMPLIFIER
R47 1K
V9 EB91 DETECTOR
C50 400p
C51 ·001
R48 27K
C52 ·001
TO Y AMP INPUT
R49 270K
S1b
CAL
SIG
CAL & SIG
R44 220
C46 ·047
C41 ·047
RV1 10K GAIN
C82 ·01
V1
V2
V3
V4
V5
V6
V7
V8
V9
V10
V11
V12
V13
C83 ·01
C84 ·01
C85 ·01
C86 ·01
C87 ·01
ILP1
LT1
LT2
HT2
R67 1K
C79 ·047
CENTRE FREQ TRIMMER
C70 50p
C71 280p
C73 9-189p
C73a 500p
L11
L12
C72 380p
C74 390p
C75 70p
C76 ·002
R64 22K
R65 100K
R66 22K
S3
OSC FREQ
D1 100 SC2
C77 ·01
C78 ·01
V6B ½ ECF80 REACTANCE CONTROL VALVE
R68 100K
R69 68
RV2 10K CENTRE FREQ
COARSE CENTRE FREQ
R70 330
RV3 1K
D2 DD006
LIN
RV4 47K
R71 1K
RV5 10K WIDTH
R72 100
C80 2
C81 2
HT1
R113 47K
R112 100K
R114 15K
ECF 80
V13B
R109 1K
R110 10K
INVERTER
D6/9 DD058
D6 D7
R120 140
T8
CH3
R121 CZ6
D8 D9
R122 140
110V
10V
0V
+10V
110V
LT1 6·3V 4A
LT2 6·3V 2·5A
LT3 6·3V 1A
HT3 +250V
HT1 +350V
HT2 +258V
R115 2·7K
R116 1·1K
C105 50
C106 50
R117 100K
V15 108C1
V14 150C2
C104 32+32
R118 68K
C103 ·5
C100 ·5
C101 ·5
D5
D4/5:K8/20
HT4 −800V
R119 47K
D4
C102 ·5
S5
FS1 1·5A
L
N
SKT5
MAINS INPUT
NOTE REFER TO MANUAL FOR DETAILS ON VOLTAGE ADJUSTMENT OF T8
BP1092