INSTRUCTION MANUAL

EDDYSTONE

880

COMMUNICATIONS RECEIVER

STRATTON & CO. LTD.
EDDYSTONE WORKS
BIRMINGHAM 31

EDDYSTONE MODEL '880'

HIGH STABILITY

COMMUNICATIONS RECEIVER

INTRODUCTION

The EDDYSTONE Model '880' is an HF communications receiver of unique design and construction covering the frequency range 500 kc/s to 30.5 Mc/s in thirty switched ranges. Provision is made for the reception of AM, CW and SSB signals and the receiver operates directly from all standard AC mains supplies, or if these are not available, from any source capable of supplying the necessary HT and LT voltages.

The receiver is exceptionally stable and uses double conversion technique, employing a crystal controlled 1st Local Oscillator and a tuned 'first IF' at all frequencies except those between 2.5-4.5 Mc/s. This band of frequencies coincides with the coverage of the 'first IF' and over this range the receiver functions as a single conversion superhet.

Each of the thirty tuning ranges has a nominal coverage of one Megacycle so giving a constant tuning rate regardless of the range in use. Bandspread is more than adequate for all purposes, the main tuning control requiring no fewer than twenty-four revolutions to cover each range. The presentation of the tuning scale is so arranged that only the calibration applicable to the range in use is visible and the re-setting accuracy is within 1000 cycles at any frequency.

The '880' is of robust construction, may be rack or table mounted, and is housed in a strong protective cabinet. All panel controls are conveniently positioned for ease of operation and outputs are available for connection to an external speaker, telephones or remote lines. Provision of a reactance control circuit permits fine tuning of the receiver from a distant point, while a 500 kc/s IF output is available for connection to ancillary equipment. A number of receivers may be operated under diversity conditions by linking their AGC lines. Common oscillator control can be used if desired with one receiver controlling up to two others.

Radiation has been kept to an extremely low level, a feature of great importance where receivers are to be operated in close proximity to one another. High quality components are employed throughout and the receiver is suitable for continuous operation in all areas under extreme climatic conditions.

Manufacturer:- STRATTON & CO. LTD., ALVECHURCH ROAD, BIRMINGHAM 31

LIST OF CONTENTS

ILLUSTRATIONS

TECHNICAL DATA

GENERAL

Frequency Coverage.

The complete coverage is from 500 kc/s to 30.5 Mc/s in thirty switched ranges. Each range has a nominal coverage of 1 Megacycle, but a 100 kc/s overlap is provided at the ends of each range making the actual coverage 1.2 Mc/s.

Range 1 covers 0.5 - 1.5 Mc/s (nominal)
Range 30 covers 29.5 - 30.5 Mc/s (nominal)

Intermediate Frequencies.

'First IF' - Tuned over the nominal coverage of 2.5-3.5 Mc/s on all 'odd' ranges except Range 1. Tuned over the nominal coverage of 3.5-4.5 Mc/s on Range 1 and all 'even' ranges.

'Second IF' - Fixed tuned to 500 kc/s with variable selectivity. The BFO is adjustable to either side of the pass band by means of a panel control.

Stage Sequence.

A table giving the valves and silicon rectifiers used in the Model 880 appears on the following page.

Input and Output Impedances.

Aerial input	-	75 ohms (nominal) unbalanced.
IF output	-	75 ohms (nominal) unbalanced.
AF input	-	0.1 Megohm (approx)
AF output	-	Loudspeaker : 2.5-3 ohms. Lines : 600 ohms (balanced or unbalanced). Telephones : Nominally 2000 ohms but suitable for a wide range of impedances.

Power Supply.

Mains Operation	-	100/125 volts or 200/250 volts AC (40-60 c/s). Consumption 0.37 Amps at 240 volts.
External Power Supplies	-	210 volts at 150mA for HT 6.3 volts at 6.6 Amps for LT
Accessory Supplies	-	When operating from AC mains, the following supplies are available for external use: HT : ~~235~~ 210 volts at 15mA. LT : 6.3 volts at 3 Amps.

Power Supply (continued)

Fuses - The live side of the mains input is fused at 1.5 Amps. When operating from external power supplies it is advisable that they are fused at their source.

TABLE 1.

STAGE SEQUENCE

Circuit Ref	Type	Circuit Function
V1	6BA6 (CV454)	1st RF Amplifier.
V2	6BA6 (CV454)	2nd RF Amplifier.
V3	6AK5 (CV850)	1st Mixer.
V4	6BA6 (CV454)	Tuned IF Amplifier.
V5	6AK5 (CV850)	2nd Mixer.
V6	5840* (CV3929)	Crystal Oscillator. *EF732
V7	5840* (CV3929)	Buffer/Multiplier.
V8A	6U8	Reactance Control Valve.
V8B		Variable Frequency Oscillator.
V9	6C4 (CV133)	Buffer.
V10	6BA6 (CV454)	1st 500 kc/s IF Amplifier.
V11	6BA6 (CV454)	2nd 500 kc/s IF Amplifier.
V12	6BA6 (CV454)	3rd 500 kc/s IF Amplifier.
V13A	6AL5 (CV140)	Noise Limiter.
V13B		AGC Rectifier.
V14A	12AT7 (CV455)	Cathode Follower (IF Output).
V14B		Cathode Follower (CW/SSB Detector).
V15A	12AT7 (CV455)	Meter Control Valve.
V15B		AF Amplifier.
V16	6BE6 (CV453)	CW/SSB Detector.
V17A	12AU7 (CV491)	AF Amplifier.
V17B		Phase Splitter.
V18	6AM5 (CV136)	Push-pull AF Output.
V19	6AM5 (CV136)	
V20	OB2 (CV1833)	Voltage Stabiliser.
V21	6489 (CV469)	AM Detector.
D1-D4	DD006 (FST1/4)	HT Rectifier. (silicon diodes)

PERFORMANCE

Sensitivity.

At frequencies above 10 Mc/s., better than 3uV for an output of 50mW with a signal modulated to a depth of 30% and a signal-to-noise ratio of 15dB. At frequencies below 10 Mc/s (except Range 1), better than 5uV under the same conditions. On Range 1, the sensitivity is somewhat lower being of the order 30uV for a 15dB signal-to-noise ratio. Absolute sensitivity better than 1uV except Range 1 (2uV).

Selectivity.

Five degrees of overall selectivity are provided, namely:

'BROAD'	'CRYSTAL'
'INTERMEDIATE'	'CRYSTAL WITH AUDIO FILTER'
'NARROW'	

Typical IF response figures for each position are as follows:

'BROAD'	:	6dB down at 7 kc/s off resonance. 30dB down at 13 kc/s off resonance.
'INTERMEDIATE'	:	6dB down at 3 kc/s off resonance. 30dB down at 7 kc/s off resonance.
'NARROW'	:	6dB down at 1.5 kc/s off resonance. 30dB down at 4 kc/s off resonance.
'CRYSTAL'	:	6dB down at 200 c/s off resonance. 30dB down at 2 kc/s off resonance.

Stability.

Thermal.

At any frequency, drift does not exceed 100 c/s in 1 hour after a 2 hour 'warm-up' period.
Long term drift with temperature changes of up to 20° C. is not greater than 50 c/s.

Mains Voltage Variation.

A variation of ± 10% in the applied mains voltage does not affect the frequency stability by more than ± 100 c/s.

Image Rejection.

Rejection of all images is greater than -70dB at signal frequencies above 15 Mc/s., rising to greater than -90dB below 15 Mc/s.

IF Rejection.

Greater than -90dB on all ranges except Range 1. Rejection on Range 1 is greater than -60dB.

Calibration and Re-setting Accuracy.

Within 1000 c/s at all frequencies.

Noise Factor.

Ranges 2-30 : 5dB. Range 1 : Noise figure measurements not reliable in this range.

Cross Modulation.

With a desired signal 60dB above 1uV, the interference produced by a signal 10 kc/s 'off-tune' and of strength 90dB above 1uV will be 30dB below the output of the desired signal.

Intermodulation.

Two signals whose sum or difference frequency is equal to either the Intermediate Frequency or the selected Signal Frequency, must each be of a level greater than 100dB above 1uV to produce an output equal to that produced by a normal signal 20dB above 1uV.

Blocking.

With a desired signal 60dB above 1uV, an interfering carrier 10 kc/s 'off-tune', has to be of a level exceeding 90dB above 1uV to affect the output by 3dB.

AGC Characteristic.

With AGC in operation, the audio output level does not change by more than 6dB for a carrier variation of 100dB above 3uV.

Two AGC time constants are provided as follows:

AGC 'FAST' : 0.025 sec. AGC 'SLOW' : 0.25 sec.

AGC is available for diversity reception if required (terminal at rear of set).

Audio Output and Response.

The push-pull AF Output Stage will deliver up to 2 watts of audio power to a 2.5 ohm loudspeaker.

The audio response depends on the position of the Bass Switch and whether the audio filter is in or out of circuit. Graphs at the rear of this manual show the response of the Audio Section with the Audio Filter switched out (Fig. 1.) and the overall receiver selectivity with the Audio Filter in circuit (Fig. 2.).

Distortion.

For an output of 1 watt : 5%, 2 watts : 10%

Hum Level.

Better than -50dB below 1 watt.

IF Output.

With AGC in use, an output of 100 millivolts is obtained for an input signal of 5uV.

A maximum output of 300mV is available with AGC 'OFF'.

Radiation.

1st Oscillator. Less than 5uV into 75 ohms on fundamental. Harmonics at least 10dB below this figure.

2nd Oscillator. Virtually undetectable on fundamental. No harmonics.

Remote Frequency Control.

Average rate of freq.change : 1000 c/s for 2V applied.

CIRCUIT DESCRIPTION

PRINCIPLE OF TUNING EMPLOYED IN THE MODEL '880'

Before considering the complete circuit in detail, it will be advantageous to the user to have a knowledge of the somewhat unusual method of tuning used in the '880'. The IF/AF Section will be dealt with first, since, in addition to being the simpler portion of the receiver, a knowledge of its operation is helpful in understanding the more unconventional RF Section.

Reference to Fig. 3. will show that the IF/AF Section (V4 etc.) is in effect, a single conversion superhet having two switched tuning ranges, the range switching and tuning being ganged to the corresponding controls in the RF Section. On all the 'odd' RF ranges except Range 1, the IF Section tunes from 2.5-3.5 Mc/s but changes over to 3.5-4.5 Mc/s on Range 1 and all the 'even' RF ranges. The two IF ranges will be known as Ranges 'A' and 'B' respectively.

The Local Oscillator associated with the IF Section always tunes the range 3.0-4.0 Mc/s, tracking 500 kc/s high on Range 'A' and 500 kc/s low on Range 'B' resulting in a constant difference frequency of 500 kc/s appearing in the output from the Mixer Stage (V5). This IF output is applied to a conventional three stage IF amplifier feeding the later stages in the receiver.

The tuning of the IF Section is arranged so that regardless of the RF range in use, the 'tuned' IF will be set to its highest frequency when the tuning pointer lies at the left-hand end of the tuning scale. This of course, is the reverse of normal practice, where the highest frequency usually occurs at the right-hand end of the scale. The reason for arranging the tuning in this way will be made clear later when dealing with the RF Section.

The RF tuning of the '880' covers the band 500 kc/s to 30.5 Mc/s in thirty 'one Megacycle ranges', two of which, Ranges 3 and 4, coincide with the two ranges of the tuned IF. On these ranges the receiver functions as a single conversion superhet, the tuned IF stage becoming an RF stage since it operates at the same frequency as the incoming signal. Fig. 3 shows that the tuned IF Stage is preceded by the 1st Mixer and this also functions as an RF amplifier on Ranges 3 and 4, its Local Oscillator being rendered inoperative by the range switching. The two RF Stages, V1 and V2, operate normally, so that the receiver has a total of four stages of RF amplification when used as a single conversion superhet. All the four stages are gang tuned, the direction of tuning being dictated by that employed in the IF Section, namely frequency increasing from right to left on the tuning scale. On all other ranges the scale calibration follows normal practice with frequency increasing from left to right.

On frequencies other than those in the band 2.5-4.5 Mc/s., the receiver becomes a double conversion superhet having two tuned RF Stages, a crystal controlled 1st Local Oscillator and a tuned 'first IF'. The injection frequency from the 1st Local Oscillator is so arranged that when tuning any one of the RF ranges (other than Ranges 3 and 4), the output from the 1st Mixer will lie in one of the ranges covered by the tuned IF Stage.

Taking as an example the RF range covering 10.5-11.5 Mc/s. Injection from the 1st Local Oscillator is at 14 Mc/s resulting in an IF output of 3.5 Mc/s for a signal at 10.5 Mc/s and 2.5 Mc/s for an 11.5 Mc/s signal. It will be noted that the highest frequency in the RF range produces the lowest frequency in the IF range, and it is for this reason that the IF tuning is in the reverse direction to normal. The RF tuning is arranged (as is the scale calibration) to increase in frequency with pointer movement from left to right.

On the next range lower (9.5-10.5 Mc/s), the same injection frequency is employed, but since the RF range is removed one Megacycle further from the crystal frequency, the IF output will be one Megacycle higher, i.e. 3.5-4.5 Mc/s.

On the range above 10.5-11.5 Mc/s, the crystal is changed by the range switching to produce an injection frequency of 16 Mc/s. At the LF end of the range (11.5 Mc/s), the IF output becomes 4.5 Mc/s, while a signal at 12.5 Mc/s produces output from the 1st Mixer at 3.5 Mc/s.

The same crystal (16 Mc/s) is used on the next range higher, producing an IF output in the lower of the two IF ranges (Range 'A').

Careful study of Table 2 will provide a complete picture of the technique adopted in covering the entire tuning range of the '880'. In general, one crystal serves for two adjacent ranges (one 'odd' and one 'even'), the 1st IF alternating between Range 'A' and Range 'B'. The exception to this rule is that Range 1 employs an injection frequency of 5 Mc/s and uses Range 'B' of the tuned IF.

It should be noted that each range is adjusted and calibrated to cover a little more than the figures given in the table. To provide an overlap between adjacent ranges, each range tunes 100 kc/s outside the limits quoted. The same applies to the tuned IF which covers either 2.4-3.6 Mc/s or 3.4-4.6 Mc/s depending on the RF range in use. A coverage of exactly one Megacycle per range was assumed in order to simplify both the explanation above and the table which follows.

THE RF SECTION

This comprises two stages of RF amplification together with the 1st Mixer Stage and its associated Local Oscillator Unit.

The two RF Stages, V1 and V2, employ high slope vari-mu RF pentodes (6BA6) with automatic and/or manual gain control. A low noise high slope RF pentode (6AK5) functions as the 1st Mixer with cathode injection from the Local Oscillator. The Mixer operates with fixed cathode bias, no gain control being provided on this stage.

Permeability tuning is used in both the RF and Mixer Stages, a total of thirty-five variable inductances being required to cover the complete tuning range. These inductances are selected by means of the Wavechange Switch which also connects the required pre-set 'tuning' capacitors across them. It should be noted that some coils are used on more than one range, and in this case range selection is by means of the switched capacitors only. (See Detached Circuits Nos. 1, 2 and 3 which give the complete RF and 1st Mixer range switching.)

TABLE 2

Range	RF Coverage	Injection Frequency	IF Range
1	0.5 - 1.5 Mc/s	5 Mc/s	3.5 - 4.5 Mc/s ('B')
2	1.5 - 2.5 Mc/s	6 Mc/s	3.5 - 4.5 Mc/s ('B')
3	2.5 - 3.5 Mc/s	-	2.5 - 3.5 Mc/s ('A')
4	3.5 - 4.5 Mc/s	-	3.5 - 4.5 Mc/s ('B')
5	4.5 - 5.5 Mc/s	8 Mc/s	2.5 - 3.5 Mc/s ('A')
6	5.5 - 6.5 Mc/s	10 Mc/s	3.5 - 4.5 Mc/s ('B')
7	6.5 - 7.5 Mc/s	10 Mc/s	2.5 - 3.5 Mc/s ('A')
8	7.5 - 8.5 Mc/s	12 Mc/s	3.5 - 4.5 Mc/s ('B')
9	8.5 - 9.5 Mc/s	12 Mc/s	2.5 - 3.5 Mc/s ('A')
10	9.5 - 10.5 Mc/s	14 Mc/s	3.5 - 4.5 Mc/s ('B')
11	10.5 - 11.5 Mc/s	14 Mc/s	2.5 - 3.5 Mc/s ('A')
12	11.5 - 12.5 Mc/s	16 Mc/s	3.5 - 4.5 Mc/s ('B')
13	12.5 - 13.5 Mc/s	16 Mc/s	2.5 - 3.5 Mc/s ('A')
14	13.5 - 14.5 Mc/s	18 Mc/s	3.5 - 4.5 Mc/s ('B')
15	14.5 - 15.5 Mc/s	18 Mc/s	2.5 - 3.5 Mc/s ('A')
16	15.5 - 16.5 Mc/s	20 Mc/s	3.5 - 4.5 Mc/s ('B')
17	16.5 - 17.5 Mc/s	20 Mc/s	2.5 - 3.5 Mc/s ('A')
18	17.5 - 18.5 Mc/s	22 Mc/s	3.5 - 4.5 Mc/s ('B')
19	18.5 - 19.5 Mc/s	22 Mc/s	2.5 - 3.5 Mc/s ('A')
20	19.5 - 20.5 Mc/s	24 Mc/s	3.5 - 4.5 Mc/s ('B')
21	20.5 - 21.5 Mc/s	24 Mc/s	2.5 - 3.5 Mc/s ('A')
22	21.5 - 22.5 Mc/s	26 Mc/s	3.5 - 4.5 Mc/s ('B')
23	22.5 - 23.5 Mc/s	26 Mc/s	2.5 - 3.5 Mc/s ('A')
24	23.5 - 24.5 Mc/s	28 Mc/s	3.5 - 4.5 Mc/s ('B')
25	24.5 - 25.5 Mc/s	28 Mc/s	2.5 - 3.5 Mc/s ('A')
26	25.5 - 26.5 Mc/s	30 Mc/s	3.5 - 4.5 Mc/s ('B')
27	26.5 - 27.5 Mc/s	30 Mc/s	2.5 - 3.5 Mc/s ('A')
28	27.5 - 28.5 Mc/s	32 Mc/s	3.5 - 4.5 Mc/s ('B')
29	28.5 - 29.5 Mc/s	32 Mc/s	2.5 - 3.5 Mc/s ('A')
30	29.5 - 30.5 Mc/s	34 Mc/s	3.5 - 4.5 Mc/s ('B')

Two image filters are fitted in the aerial input circuit to assist in maintaining the image signals at a low level on the higher tuning ranges of the receiver. Filter 'A' (See Main Circuit Diagram - Part 1) is of the low pass type and has a cut-off frequency of about 30.6 Mc/s. It remains in circuit on all ranges but only functions as an image filter at signal frequencies above 23.5 Mc/s. The filter is kept in circuit on all ranges to provide a constant aerial input impedance of approximately 75 ohms on all frequencies to which the receiver may be tuned. Filter 'E' (See Detached Circuit No. 1) is brought into circuit on Ranges 14-17 to ensure an image response of better than -90dB at all signal frequencies up to 15 Mc/s. The cut-off frequency of Filter 'E' is approximately 17.6 Mc/s and above 15 Mc/s the image rejection is better than -70dB.

The input circuit of the 1st RF Stage is provided with an 'Aerial Trimmer Control' (C166) which allows accurate adjustment of the first tuned circuit when using aerials of impedances differing appreciably from 75 ohms.

AGC bias is shunt fed to the two RF Stages via the feed resistors R1 and R6. Detuning effects are reduced to a minimum by returning the suppressor grids of the controlled stages direct to their cathodes.

Manual RF gain control is effected by taking the cathode bias resistors of the RF Stages to the junction of R10 and R11 via the common variable cathode resistor RV1. In normal operation, R11 is shorted out either by a wire strap across the desensitising terminals or a closed relay contact across the same points. This connects the RF Gain Control, RV1, direct to earth, giving normal bias to V1 and V2. The receiver is desensitised by open circuiting the terminals referred to above and under these conditions, the voltage developed across R11 is applied in series with the normal cathode voltage. This increases the bias applied to the RF Stages and so reduces their gain.

Low value grid stoppers, R2, R7 and R14 are fitted in the RF and Mixer Stages to ensure freedom from instability. The stages are well screened from one another for the same reason.

The 1st Local Oscillator Unit employs two sub-miniature 'high reliability' RF pentodes (EF732) as Crystal Oscillator and Buffer/Multiplier Stages. The whole unit is contained in a double screening box to prevent direct radiation and so permit receivers to be operated side by side without fear of interaction. A double screened coaxial output lead is used for the same reason, the inner screen being connected to the inner screening box and the outer screen to the outer box. The two boxes are insulated from one another, as are the screening conductors of the coaxial output lead. Earthing of the inner box occurs at the coaxial socket (SKT3) in the cathode of the 1st Mixer.

Both stages operate from a stabilised HT supply, and this and the LT supply are well filtered to prevent radiation from the wiring external to the screened boxes. In this way spurious responses are kept to a very low level (of the order -120dB and greater).

The Crystal Oscillator always works on the fundamental crystal frequency, any necessary multiplication taking place in the following stage. A total of 10 crystals are used to cover the 28 ranges when the receiver functions with double conversion. Table 3 gives a full summary of the crystals used for the various ranges, indicating multiplication factors where applicable.

The required crystal is selected by the Wavechange Switch which also introduces the correct pre-tuned output circuit for the Buffer/Multiplier Stage. Sixteen separate output circuits are used and these are shown in Detached Circuit No. 5. Each output circuit is provided with a low impedance coupling coil which provides output to the cathode of the 1st Mixer Stage. On Ranges 3 and 4, the 10 Mc/s crystal is switched into circuit to maintain V6 within its ratings. No injection is required on these ranges so S1p is arranged to bypass the output circuit. The lack of oscillator injection allows V3 (1st Mixer) to function as an RF Amplifier in the range 2.5 - 4.5 Mc/s when the receiver operates with single conversion. The output trap L86/C319 is tuned to 12 Mc/s to severely attenuate the 2nd harmonic output on Ranges 14 and 15.

TABLE 3

Crystal Frequency	Multiplication Factor		
	X1	X2	X3
5 Mc/s	Range 1	-	-
6 Mc/s	Range 2	-	Ranges 14 & 15
8 Mc/s	Range 5	-	-
10 Mc/s	Ranges 6 & 7	Ranges 16 & 17	Ranges 26 & 27
11 Mc/s	-	Ranges 18 & 19	-
12 Mc/s	Ranges 8 & 9	Ranges 20 & 21	-
13 Mc/s	-	Ranges 22 & 23	-
14 Mc/s	Ranges 10 & 11	Ranges 24 & 25	-
16 Mc/s	Ranges 12 & 13	Ranges 28 & 29	-
17 Mc/s	-	Range 30	-

THE IF/AF SECTION

The output from the RF Section is applied to the tuned IF Stage, V4 via a low-pass filter (Filter 'B') having a cut-off frequency of 4.9 Mc/s. This filter attenuates the higher frequency components in the Mixer output so maintaining the spurious response at a very low level.

The tuned IF Stage (6BA6) feeds the 2nd Mixer which employs a 6AK5 with cathode injection from the 2nd Oscillator Unit. Both V4 and V5 input circuits are permeability tuned and ganged to the tuning of the RF and 1st Mixer Stages.

No manual gain control is applied to either stage since adequate adjustment of the overall IF gain is provided in the stages operating at the 'second IF'. AGC is applied to V4 via the feed resistor R22. As in the RF Section, grid stoppers are fitted to both V4 and V5, and these, together with extensive screening, ensure stable operation.

The 2nd Local Oscillator Unit employs a 6U8 triode-pentode as a combined electron coupled oscillator (V8B) and reactance control valve (V8A), together with the triode V9 (6C4) which functions as a cathode follower providing a low impedance output to the 2nd Mixer Stage V5.

The total coverage of the E.C.O. is 2.9-4.1 Mc/s inclusive of the 100 kc/s band edge overlaps, and whereas all other tuned stages employ permeability tuning, the 2nd Local Oscillator Unit uses a high quality variable capacitor which is ganged to the main tuning control.

To prevent harmonics of the oscillator reaching the Mixer Stage, two low-pass filters (Filters 'C' and 'D') are incorporated in the 2nd Local Oscillator Unit. The unit itself is housed in a double screening box to prevent radiation of oscillator harmonics which would otherwise fall within the tuning range of the receiver. Radiation from wiring leaving the unit is avoided by filtering these leads at their point of exit. A coaxial output lead is used for the same reason.

V8 operates from the stabilised supply (108 volts), while the main HT line supplies the Buffer Stage V9.

The triode portion of V8 is connected in parallel with the E.C.O. tuned circuit and allows the receiver to be remotely tuned as explained in the Section dealing with Installation.

The output from the 2nd Mixer is fed to a three-stage amplifier operating at the 'second IF' of 500 kc/s. High slope vari-mu RF pentodes of the 6BA6 type are used in this amplifier which may be switched to give four degrees of IF selectivity, one of which involves the use of a dual crystal bandpass filter. A fifth position of the Selectivity Switch introduces an Audio Filter which supplements the selectivity of the crystal filter when receiving CW signals under conditions of severe adjacent channel interference.

Fig. 4. shows in simplified form, the IF circuit coupling arrangements in each position of the Selectivity Switch. Switched tertiary windings are used to vary the coupling factor and the gain is maintained at a constant level by the switched taps on the circuit feeding the first stage. The crystal phasing capacitor is pre-set during alignment to produce a response having very steep sides with little or no evidence of the rejection notches due to the crystals. To prevent coupling to the crystals when the crystal filter is not in use, both crystals are shorted by the Selectivity Switch. The two crystals whose frequencies differ by 400 c/s are contained in a single B7G type holder.

AGC is applied to the first two stages, V10 and V11 via the feed resistors R56 and R61, while manual control of the overall IF gain is provided by RV2 which is in series with the cathode bias resistors of the same two stages. The third stage, V12, operates at fixed gain and feeds V13B, V14A, V14B and the miniature diode V21.

V13B (½ 6AL5) is the AGC Rectifier which controls the RF Amplifiers V1 and V2 and the IF Stages V4, V10 and V11 when AGC is in use. The AGC Switch, S4, provides a choice of two AGC time constants and AGC 'OFF'. A delay voltage of some 18-20 volts is applied to the cathode of V13B from the potential divider made up of R77 and R78.

Also controlled by the AGC line, is the DC Amplifier, V15A (½ 12AT7) which operates the carrier level meter when the AGC is in use. A pre-set control (RV3) is provided to permit accurate zeroing of the meter which is very useful when carrying out comparative checks on carrier levels.

V14A and B are fed in parallel from the secondary of T7, a 12AT7 double-triode being used in this position. Both triodes function as cathode followers, V14A providing a low impedance output for external use, while V14B feeds the CW/SSB Detector V16. This stage (V16) operates as a multiplicative mixer (product detector) and gives superior results to those obtained when using a conventional diode detector for CW and SSB reception. The injection frequency from the oscillator section (BFO) is variable over the range 500 kc/s plus or minus 6 kc/s by the BFO Control (C128).

The CW/SSB Detector is housed in a screening can to prevent radiation of oscillator harmonics which would otherwise cause interference throughout the range of the receiver. The screen supply for V16 is obtained from a stabilised source and is applied during CW and SSB reception by one section of the Mode Switch (S5a).

Output from V16 is taken via the coupling capacitor C124 to the other section of the Mode Switch (S5b) either direct or via the Audio Filter dependent on the position of the Selectivity Switch S2.

The miniature diode V21 is used as Detector for the reception of AM signals. Incorporated in the detector circuit is a series pulse limiter, V13A, which may be used to reduce impulse noise during AM reception. If not required, the limiter can be taken out of circuit by means of S3.

The detected signal output across R75 is fed to the grid of V15B (½ 12AT7) which provides additional audio amplification when receiving AM signals. This extra amplification compensates for the higher gain of the CW/SSB Detector and obviates the need for adjustment of the gain controls when moving the Mode Switch from one position to the other.

Provision is made in the grid circuit of V15B for connection of audio signals derived from an external source. Such signals may be introduced by means of a standard jack plug inserted into the socket JK1. Insertion of the plug automatically disconnects the detector output and prevents interference from normal signals. It should be noted that the Mode Switch must be in the AM position when the receiver is used in this way since V15B is not in circuit on CW and SSB.

S5b selects the required audio output from either V15B during AM reception, or V16 when receiving CW or SSB signals. Audio is fed via the switched bass filter to the AF Gain Control RV4 which functions on both internal and external audio signals. The audio voltage across RV4 is applied to the audio stage V17A (½ 12AU7) which operates in conjunction with the phase splitter (V17B) to provide a push-pull input to the AF Output Stage comprising V18 and V19. This stage, using a pair of 6AM5 pentodes, provides outputs for connection to high impedance telephones, loudspeaker and remote lines. Negative feedback is provided by R104 and R108 and a power output of up to 2 watts is available. It should be noted that inserting a pair of telephones disconnects the external speaker and connects a loading resistor (R112) across the 2.5 ohm secondardy winding of T9.

THE POWER SUPPLY SECTION

Apart from the use of miniature silicon rectifiers, this portion of the receiver is of fairly conventional design. Four of these rectifiers are used in a full wave circuit, the output of which is smoothed by the capacity input filter comprising C151, C152 and CH15.

V20 provides a 108 volt stabilised HT supply to V6, V7, V8, V16 (screen only) and the potential divider in the meter circuit. A separate HT supply is employed for V15B, V16 (anode) and V17 and is obtained from the junction of R113 and C150.

Three separate LT windings are provided on T10. All valve heaters with the exception of V13, are fed from the 6.3 volt 6 Amp winding (LT1), one side of which is earthed. The three dial lamps are also fed from this source via the variable resistor RV5 which provides a means of adjusting the brilliancy of the scale illumination.

V13 is fed from a separate LT winding (LT2) to prevent the introduction of hum in the noise limiter circuit. This winding is rated at 6.3 volts 0.5 Amps and its centre tap is returned to the junction of R115 and R116.

The remaining LT winding is connected to pins 3 and 6 of SKT7 and may be used as a heater supply for external units. Up to 3 Amps can be taken from the winding (LT3). An associated HT supply is also available at SKT7 (pins 11 and 12), a maximum drain of 15mA at 210 volts being permissible.

The receiver can be operated from external HT and LT supplies when an AC mains supply is not available. Full details are given later in the Section dealing with 'Installation'.

The AC mains input is switched in both live and neutral poles by the double pole switch S7. The live pole is fused at 1.5 Amp by the cartridge fuse FS1.

NOTE: Details of the mains transformer adjustments are given in the Section on 'Installation'.

CONSTRUCTIONAL DETAILS

GENERAL

The Model '880' can be supplied as a standard rack mounting unit or as a table mounting unit. Either model may be converted to the other by removing certain parts of the existing cover and fitting plates etc. for the desired type of mounting. Conversion 'kits' are available to special order.

DIMENSIONS AND WEIGHT

Rack Mounted Version.

Width	:	19 inches (48.3 cm)	Depth	:	20⅛ inches (51.1 cm)
Height	:	8¾ inches (22.2 cm)	Weight	:	75 pounds (34 kg)

Table Mounted Version.

Width	:	19½ inches (49.5 cm)	Depth	:	20⅛ inches (51.1 cm)
Height	:	9.7/16 inches (23.9 cm)	Weight	:	95 pounds (43 kg)

COVER

Rack and Table Mounted Models.

The main panel and chassis assembly together with the side plates and the combined rear and bottom cover are all common to both rack and table mounting models. Ventilation is provided by perforated areas in the rear cover, bottom cover and side plates. A removable plate at the right-hand side of the receiver allows access to the 1st Oscillator Unit.

Rack Mounted Model.

In addition to the covers mentioned above, rack mounted models are fitted with a further cover. This completely encloses the top of the receiver and carries on the underside of the leading edge, the three festoon lamps for dial illumination. The LT supply for these lamps is fed via a small free two-way connector situated at the right-hand end of the drive mechanism. Care should be taken to uncouple this connector when removing the top cover.

The panel handles fitted to rack mounting models have a longer reach than those fitted to table models. This is necessary to ensure adequate protection for the panel controls since the rack mounting version does not feature a panel escutcheon.

Table Mounted Model.

A hinged lift-up lid is fitted in place of the fixed top cover used on the rack mounting model. The hinges are easily removed and are fitted to the top edge of the rear cover, the fixing holes being provided as a standard feature. Full instructions for removing the lid are given in the Section dealing with 'Maintenance'.

The dial lamp assembly in this model is carried on a small cover which serves to protect the drive assembly. The same free connector is employed as on the rack mounting model. Close to the front of the lid are the two 'Oddie' fasteners which engage with clips located beneath holes in the drive cover.

Specially shaped side covers are fitted in addition to the existing side plates. These are each fitted with three plastic mounting feet along the lower edge to prevent damage to the table surface and are provided with perforated areas to ensure adequate ventilation.

A panel escutcheon is fitted to increase the panel size slightly to match the styling of the cabinet. Short reach handles are fitted in lieu of the long reach types on the rack mounted version.

CHASSIS

Sub-chassis construction is employed throughout, all sub-chassis being built around a central 'RF frame' which is securely bolted to the rear of the two drive plates situated behind the front panel.

Six sub-chassis, together with two double screened boxes go to make up the main assembly which is of extremely rigid construction when bolted together.

The six sub-chassis are as follows:-

1. 1st RF Amplifier.
2. 2nd RF Amplifier.
3. 1st Mixer Stage.
4. Tuned IF and 2nd Mixer Stages.
5. IF/AF Chassis.
6. Power Unit Chassis.

These, together with the two Oscillator Units, are inter-connected by a number of cable forms terminated in suitable plugs and sockets which permit units to be removed without resort to a soldering iron.

Both Oscillator Units and all sub-chassis except the Power Unit chassis are of brass, heavily silver plated and lacquered. The Power Unit chassis is of steel, suitably rustproofed and sprayed grey enamel.

PANEL

This is of ⅛" steel plate, hammer finished, with a cast escutcheon surrounding the dial aperture. A further escutcheon is fitted in the case of table mounted models, and this fits around and over the outer edge of the main panel, slightly increasing its dimensions. A double anodised aluminium finger plate is fitted behind the receiver controls and is labelled with their functions.

Chromium plated panel handles are fitted, and these, besides their normal use in lifting the receiver, allow it to be placed 'face-down' without damage to the controls.

TUNING DIAL AND DRIVE MECHANISM

The tuning dial occupies the top half of the front panel and has two horizontal scales bearing calibration marks at 100 kc/s intervals. The top scale is printed in black and is for use on all ranges except 3 and 4. On these two ranges the lower scale is used, the red colouring being used to avoid confusion.

Direct frequency calibration is provided by three calibrated discs which are positioned behind apertures in the scale plate and rotated by the wavechange mechanism. Interpolation between the 100 kc/s points is achieved by means of the vernier scale located in the lower centre of the main scale.

The main tuning control operates a spring loaded split gear system which provides two main drive outlets together with a pulley drive for the scale pointer and a gear drive for the vernier scale.

One of the main drive outlets is coupled to the rotor of the tuning capacitor in the 2nd Oscillator Unit while the other drives a helical gear mechanism which raises and lowers the tuning platform carrying the cores for the RF, Mixer and Tuned IF Stages.

The gear ratios are such that it requires twenty-four revolutions of the main tuning control to move the pointer from end to end of its traverse, a total distance of some fourteen inches. At the same time, the vernier scale makes a total of twelve revolutions, each of which corresponds to a frequency change of 100 kc/s. The resulting tuning rate - 50 kc/s per revolution - is adequate for all types of reception.

INTER-UNIT WIRING

As mentioned earlier in this Section, all units are inter-connected by means of cable forms terminated in suitable plugs and sockets to allow easy removal of individual units.

Five miniature six-way sockets located on the Power Unit chassis distribute the HT and LT supplies to the various sections of the receiver while three similar sockets are mounted on the rear of the front panel to provide connection to the panel controls.

To simplify the layout of the Main Circuit Diagram, the connectors referred to above have not been shown. No confusion will result if it is borne in mind that the two potential dividers R10/R11 and R85/R86 are located in the Power Unit.

INSTALLATION

MOUNTING

The Model 880 is supplied complete with all valves either as a table mounted unit or in a form suitable for rack mounting. When rack mounted, the receiver occupies 8¾ inches of height in a standard rack of 19 inch width. An area 19½" x 20⅛" is required for table mounting.

Four standard fixing slots are provided when the receiver is intended for use in a rack but no fixing is required in a table mounted installation.

When installing the receiver, due regard should be paid to positioning both for convenience in operation and ease of access to external connections at the rear.

When a number of receivers are mounted in a common rack (e.g. in a diversity installation), care should be taken to avoid obstructing the ventilation areas at the rear and in the sides of the cabinet.

EXTERNAL CONNECTIONS

Mains.

The three-core PVC insulated lead should be terminated in a suitable three-pin plug for connection to the local AC mains supply. The plug should be wired as follows:-

Red lead to live line.
Black lead to neutral line. Green lead to earth.

NOTE: Before connecting to the local AC mains supply, check that the mains transformer is adjusted for the appropriate voltage. (see 'Mains Voltage Adjustment' later in this Section)

External Power Supplies.

Provision is made for the receiver to be powered from external HT and LT supplies when an AC mains supply is not available. The HT and LT voltages required are as follows and should be connected to a suitable 12-way female plug (Elcom) to mate with SKT7.

HT	210 volts at 150mA. (DC)
LT	6.3 volts at 6.6 Amps. (DC)

These voltages may be obtained from any convenient source - a motor generator, vibrator pack, transistor convertor, or even direct from suitable accumulators. The HT supply is taken to the input side of the receiver filter circuit so that additional smoothing is available to supplement that provided in the external power supply.

NOTE: The negative sides of both HT and LT supplies are common connections and are earthed at SKT7.

The plug (PL5) should be wired as shown in Part 2 of the Main Circuit Diagram, taking care not to omit the straps between pins 4 & 7 and 5 & 8. These links complete the heater supply to V13. Provision should be made to switch and fuse the external supplies at their source.

It should be borne in mind that the current drain of the 880 LT circuit is quite high (6.6 Amps) and to avoid excessive voltage drop in the LT connections these should be made with heavy gauge wire.

When operating from AC mains supplies, a similar 12-way plug must be in place at SKT7 to complete the LT circuits from the transformer secondary windings to the valve heaters and dial lamps. The plug should be wired with straps between the following pins:-

1 and 4   2 and 5   7 and 10

If HT and LT supplies are required to power some small item of ancillary equipment, these may be taken from the same plug. (see PL6, Main Circuit Diagram - Part 2)

The voltages and currents available are as follows and under no circumstances should these values be exceeded.

HT	. . . .	210 volts at 15mA.	(DC)
LT	. . . .	6.3 volts at 3 Amps.	(AC)

Aerial.

Connection is by means of a standard BNC coaxial plug terminating a 75 ohm coaxial line. A suitable plug is provided with the receiver. The input impedance is nominally 75 ohms unbalanced but other impedances can be used satisfactorily since provision is made for tuning the input circuit by means of the Aerial Trimmer, C166.

Earth.

A short direct lead of heavy gauge wire should be taken from this terminal to a suitable earthing point.

NOTE: When the receiver is supplied from a source which includes a circuit breaker (earth trip) no connection should be made to the earth terminal.

Loudspeaker.

An external loudspeaker may be connected to the two quick-release terminals marked 2.5 ohms. Any 2.5-3 ohm loudspeaker can be used, but the EDDYSTONE Cat. No. 688E is recommended as it matches the receiver both electrically and in finish.

Telephones.

If loudspeaker reception is not required, telephones can be plugged into the jack at the left-hand side of the front panel. Although the output impedance is nominally 2000 ohms, lower telephone impedances can be used satisfactorily.

Insertion of the telephone plug disconnects the loudspeaker and connects a loading resistor (R112) across the 2.5 ohm secondary winding of T9.

Line Output.

Connection is made to the quick-release terminals marked 600 ohms. If a balanced output is required, the centre terminal (CT) should be connected to earth.

IF Output.

Connection should be made by means of a standard BNC coaxial plug terminating a 75 ohm coaxial line. The output available is an un-rectified 500 kc/s IF signal and may be connected to a suitable FSK adaptor or other ancillary equipment.

AF Input.

When required, the receiver may be used as an AF Amplifier. Connection should be made to JK1 using a standard GPO jack plug, the sleeve of which is the earth connection. Insertion of the plug automatically disconnects the audio output from the AM Detector so preventing interference from received signals.

An output of up to 2 watts is available and the Bass Switch and AF Gain function normally when the receiver is used in this way.

NOTE: The Mode Switch must be in the AM position when feeding in external audio signals.

AGC Terminal.

When two or more Model 880 receivers are used under diversity conditions, their AGC terminals should be joined together. In this way the operative AGC voltage will be that due to the receiver with the greatest input and the rising noise of the other receiver(s) will be suppressed.

Common oscillator control can be used to simplify the initial adjustments in setting up the receivers. The necessary cables, junction boxes etc. are available to special order.

The built-in carrier level meter will be found extremely useful when setting up an installation of this kind.

Oscillator Remote Control.

Fine tuning of the receiver can be carried out from a distant listening oint if use is made of the Reactance Control Valve (V8A).

Under normal conditions, the bias on this stage is fixed by its cathode resistor R42, the terminals marked 'G' and 'K' being strapped to terminal 'E' (earth). Removing the strap across terminals 'E' and 'K' will cause the bias on V8A to increase due to voltage drop across the now unshorted resistor R39. A 1000 ohm variable resistor connected across R39 (i.e. between 'E' and 'K') will provide a means of altering the bias on V8A and therefore the frequency of the VFO (V8B), so tuning the receiver independently of the main tuning control.

It will be realised that this simple method entails 'off-tuning' the receiver slightly so that the correct frequency obtains when the variable resistor is set to 500 ohms. If this adjustment is not carried out, tuning will be possible in one direction only.

A more elaborate method is to remove both shorting straps and connect terminal 'G' to the slider of a potentiometer across the output of a low voltage power supply. The negative side of the power supply should be connected to terminal 'E' so that the bias on the control grid of V8A may be set positive by an amount equal to the increase in cathode bias due to removal of the strap across R39.

When the latter method is employed 'off-tuning' will not be necessary since complete control is available by means of the potentiometer.

NOTE: When remote tuning is not required, terminals 'G' and 'K' must be strapped to terminal 'E' otherwise the dial calibration will be upset.

External Relay Terminals.

When desensitising facilities are required, an external relay contact may be connected across the two quick-release terminals marked 'D' and 'E'. The contact should be arranged to close when the receiver is required to function normally and open to desensitise the receiver when an associated transmitter is in operation.

If desensitising is not required, the two terminals must be connected together by means of a wire strap.

MAINS VOLTAGE ADJUSTMENT

As despatched, the mains transformer tappings are set for 240V operation. When operation is to be from other mains voltages, the tappings should be set as shown in the table below.

TABLE 4.

Voltage	Strap	Input to
100	C & D E & H	C & H
110	C & D F & G	C & G
115	A & B E & H	B & H
125	A & B F & G	A & G

Voltage	Strap	Input to
200	D & E	C & H
210	D & F	C & H
220	D & F	C & G
230	A & E	B & H
240	A & E	B & G
250	A & F	B & G

OPERATION

CONTROL FUNCTIONS

Tuning and Wavechange.

These two controls, operated in conjunction with one another, determine the frequency to which the receiver is tuned. Dial calibration is presented in such a way that the only figures visible are those applicable to the range in use. This is achieved by means of three calibrated discs rotated by the wavechange mechanism and appearing behind suitably positioned apertures along the main tuning scale.

Rotation of the tuning control causes a pointer to traverse this scale which has a length of some 14 inches and bears calibration marks at 100 kc/s intervals. Interpolation between these points is provided by a vernier scale which is graduated into 100 divisions each representing 1 kilocycle. This scale is conveniently located above and between the Tuning and Wavechange controls.

In point of fact, the vernier carries two scales, one printed in red, the other black. The red scale is calibrated in the reverse direction to the black scale and is intended for use when operating on Ranges 3 and 4 which employ 'reverse tuning'(see Circuit Description). Likewise, the main scale calibration appears in red on these two ranges and is a reminder to the user that the scale must be read in reverse.

Aerial Trimmer.

Provides a means of accurately resonating the aerial input circuit. In operation, this control should always be peaked - either on background hiss or a received signal - to give maximum audio output.

Gain Controls.

Three gain controls are provided, these being as follows:-

RF Gain (RV1)	Controls V1 and V2.
IF Gain (RV2)	Controls V10 and V11.
AF Gain (RV4)	Controls input to Audio Section with either internal or external AF signals.

The RF Gain should be well advanced during all types of reception since the best signal-to-noise ratio will result under this condition of operation. When receiving CW signals, however, it may be necessary to reduce the RF Gain to supplement the control range of the IF Gain. This latter control will, at normal signal levels, give an adequate range of adjustment of pre-detector gain.

When searching for signals, the RF Gain should be fully advanced and the IF Gain set to give a barely audible noise level.

The AF Gain will prove most useful during AM reception when the RF and IF Gains are well advanced to secure the best possible AGC action.

Selectivity Switch.

Five degrees of selectivity are provided, ranging from 14 kc/s at 6dB down in the 'BROAD' position to 400 c/s at 6dB down in the 'CRYSTAL' position. With the Audio Filter in circuit the overall bandwidth becomes 100 c/s at 6dB down and this position is of immense value when receiving CW signals under conditions of severe adjacent channel interference. The 'BROAD' position will provide excellent quality from broadcast stations when the receiver is used as a terminal for recording or re-transmission purposes.

For communications work, increasing the selectivity will improve the signal-to-noise ratio without making tuning unduly critical.

BFO Adjustment.

Varies the 'pitch' of the beat note when receiving CW signals. The control can be set so that the injected frequency from the oscillator lies on either side of the IF passband so providing a means of 'single signal' CW reception with attenuation of either the HF or LF adjacent channel as required.

In SSB reception the BFO should be set to correspond with the sideband in use, and, once set should require no further adjustment.

Bass Switch.

Provides a means of restoring a 'balance' to the received transmission when sharp selectivity is being used. Cutting the bass to compensate for the loss of the high frequencies will render a signal far more readable than would otherwise be the case. When external audio signals are fed to the receiver, the switch functions as a tone control in the normal way.

Mode Switch.

This control selects audio output from the appropriate detector for either AM or CW and SSB reception. The screen voltage is removed from V16 during AM reception.

AGC Switch.

Provides a choice of either automatic and/or manual gain control of the pre-detector stages.

Two positions of AGC are provided, namely 'AGC FAST' and 'AGC SLOW'. In the 'FAST' position, the time constant of the AGC circuit is adjusted to suit the reception of rapidly fading telephony signals or high speed automatic telegraphy. For slower speed telegraphy a longer time constant is required and this is provided in the 'SLOW' position.

Noise Limiter Switch.

This control is only operative during the reception of AM signals. Placing the switch to the 'ON' position introduces a series pulse limiter into the detector circuit and this is effective in reducing impulse noises which may be experienced during AM reception.

Mains Switch.

Makes or breaks both live and neutral poles of the AC supply to the mains transformer T10.

The Mains Switch performs no function when the receiver is used with external power supplies.

Meter Zero Adjustment.

Permits adjustment of the meter needle to zero before comparative checks of carrier level are made.

Dial Lamp Brilliancy.

A pre-set control located at the rear of the receiver. Allows the dial illumination to be set to suit the conditions under which the receiver is used.

TUNING INSTRUCTIONS

Preliminary.

Check that the AC mains supply or external HT and LT supplies are available. Check all external connections and ascertain that a suitable aerial is in use. Either connect a loudspeaker, or if speaker reception is not required, connect a pair of high impedance telephones at the socket on the front panel.

Next place the Mains Switch to 'ON'. (In the case of operation from external supplies, the Mains Switch may be left 'OFF' but the external supplies should be switched 'ON' at their source.) An indication that the receiver is operative is given by the illumination of the tuning dial. The brilliancy of this illumination can be set as required by means of a control at the rear of the receiver.

While the receiver is warming up, the following adjustments may be carried out. Firstly, select the appropriate range and tune to the required frequency.

NOTE: When using Ranges 3 and 4, scale calibration appears in red and this indicates that the scale (and the vernier) should be read in the reverse direction to the other ranges.

If AGC is to be used, place the AGC Switch to 'FAST' or 'SLOW' (as appropriate to the type of reception) and, when the background noise becomes apparent, adjust the gain controls to provide a suitable output. The Aerial Trimmer may now be peaked and the required degree of selectivity obtained by adjustment of S2.

AM Reception.

Place the Mode Switch to AM and, having obtained the desired signal, make any re-adjustments as required. If impulse noise is troublesome the Noise Limiter Switch may be placed in the 'ON' position. The Bass Switch should be set to provide the desired audio response.

CW Reception.

With the Mode Switch at CW/SSB and the BFO offset from zero, tune in the required signal. By alternate adjustment of the BFO and Tuning Control (and selectivity if necessary) obtain the best conditions of reception.

NOTE: The Noise Limiter is inoperative in the CW/SSB position of the Mode Switch.

SSB Reception.

With the AGC 'ON' and the Mode Switch to AM, tune the receiver for maximum deflection of the carrier level indicator. Switch to CW/SSB and with the AGC 'OFF', adjust the BFO for clear intelligible speech. The Main Tuning Control should not be touched and the Selectivity Switch should be placed in the 'NARROW' position.

ADJUSTMENT OF THE METER ZERO

To accurately adjust the meter needle to zero before carrying out comparative checks on carrier levels, first remove the aerial and connect a 75 ohm carbon resistor across the aerial socket.

With the RF and IF Gain Controls set to maximum and with the AGC at either 'ON' position, adjust the Meter Zero Control (using a screwdriver) so that the meter needle is coincident with the '0' mark on the meter scale.

The meter scale is calibrated in 6dB steps from 0-9, while above 9, calibration is directly in decibels.

MAINTENANCE

GENERAL

The Model '880' is intended for continuous operation in all areas under extreme climatic conditions and should require very little in the way of maintenance over long periods of use.

As with any piece of electronic equipment, periodical dust removal should be carried out, taking care not to disturb the pre-set adjustments.

All switches used in the receiver are of the self-cleaning type and should therefore require no attention. All moving parts are lubricated with a permanent lubricant (molybdenum disulphide) so that regular lubrication is unnecessary. If, however, after long periods of use, lubrication is thought necessary, any light mineral oil (suitable for the temperature conditions under which the receiver is operated) may be used.

External connections, especially telephone leads should be checked from time to time to ensure complete serviceability.

DIAL LAMP REPLACEMENT

Faulty dial lamps may be replaced quickly and without difficulty by removing the drive cover (table models) or the top cover (rack models). Either cover can be completely removed by taking out the appropriate screws and disengaging the miniature two-way connector which completes the LT supply to the dial lamps. This plug and socket arrangement is located at the right hand side of the drive mechanism.

To change a bulb, merely ease back one of the spring contacts, slip out the faulty bulb and fit the replacement.

6 volt 3 watt 'Festoon' bulbs should be used as spares.

FUSE REPLACEMENT

The fuse (FS1) fitted in the Model '880' lies in the live mains input lead so that failure will result in complete loss of power to the receiver.

A faulty fuse may be changed by unscrewing the fuse holder located at the rear of the receiver (L.H.S.). A 1.5 Amp cartridge type fuse should be used for replacement and two of these are provided in clips located on the platform cover.

If the replacement fuse blows immediately the receiver is switched on, or fuses burn out regularly over short periods of operation, checks should be made to ascertain the cause.

VALVE REPLACEMENT

Of the valves visible on removing the top cover or lifting the lid (as appropriate), all except the two output valves may be removed without using an extraction tool. V18 and 19 can be removed quite easily with a suitable extraction tool.

Replacement of the valves in the Oscillator Units is a little more involved but should present no difficulty if the instructions given below are carefully followed. The wired-in diode (V21), which is located beneath the IF chassis is accessible when the cover is removed.

Replacement of V6 and V7. (1st Oscillator Unit)

First, remove the alignment plate at the right-hand side of the receiver to expose the outer cover of the 1st Oscillator Unit.

In the case of table mounting models it is necessary to remove the shaped side cover to gain access to the alignment plate. The procedure is quite simple - merely slacken off the three 2BA screws at the rear of the cover and the two ¼" BSF 'Allen' types situated behind the panel handle. The cover is provided with slots which locate with these fixing points and allow it to be lifted clear without removing the screws completely. The same procedure should be adopted when it is necessary to remove the left-hand cover during IF alignment.

Next, take out the seven 6BA screws and remove the outer cover by sliding out from under the flange at the lower edge. This will reveal the inner cover which can be removed in the same way.

Once the inner cover is removed, the turret lugs to which the valve connections are soldered will be clearly visible. V6 is above V7 when the crystals lie to the left of the valve positions.

A faulty valve may easily be removed by unsoldering the connections to the turret lugs and withdrawing the valve from its clip.

When fitting replacement valves of this type (EF732) , soldered connections must be at least 5 mm from the glass seal and should be made using a thermal shunt. Bends in the lead-out wires must be at least 1.5 mm from the glass seals. Orientation of the valve lead-out wires should be checked before removing the faulty valve.

Having fitted the replacement, check the receiver for normal operation before replacing the unit covers, alignment plate etc..

Replacement of V8 and V9. (2nd Oscillator Unit)

Access to V8 and V9 is from the top of the 2nd Oscillator Unit. First remove the four screws securing the outer cover. In lifting this cover away from the unit some resistance will be felt; this is due to the spring earthing strip along the inside edges.

Two inner covers will now be visible, one being hinged at the centre where the two covers meet. This hinged cover can only be lifted by removing the two screws securing the strip carrying the feed-through capacitors and taking off the 'push-fit' front cover. V8 is located beneath the front cover and V9 beneath the hinged cover at the rear. When lifting the rear cover, remove PL4 from SKT4 and feed the coaxial output lead through the hole in the left-hand side of the outer box and the hole in the inner cover so that the cable receives no strain when the cover is lifted.

Both V8 and V9 are secured by clips and these should be carefully replaced whenever a valve is changed.

In replacing the covers, do not omit to replace the two screws holding the feed-through strip and ensure that the edges of the outer cover and front inner cover which carry no earthing strip are towards the rear of the receiver.

NOTE: Care should be taken when working on either of the Oscillator Units not to drop screws or other metallic objects into the gaps between the inner and outer boxes. Such items of hardware if left in place would most certainly short circuit the inner and outer screening boxes and impair their screening properties.

Replacement of XL1 and XL2.

These two crystals which are used in the 500 kc/s IF crystal filter, are located in a holder mounted on top of the large IF transformer T2. Both crystals are contained in a single B7G type envelope and replacement is simple and straightforward.

XL3 - XL12.

These ten crystals are located in the 1st Oscillator Unit. To remove and replace, it is necessary to open up the unit as described above - see 'Replacement of V6 and V7'.

The crystals are positioned in two rows of five crystals to the left of V6 and V7. Correct positions for the crystals are as follows:-

Top row, reading from left to right (all frequencies in Mc/s).

17 - 13 - 11 - 16 - 14

Bottom row.

5 - 6 - 8 - 10 - 12

It is most unlikely that a crystal would ever need changing, but should it prove necessary, reference should be made to the Section dealing with 'Re-alignment'.

REMOVAL OF LID - TABLE MOUNTING MODEL ONLY

It may prove convenient to remove the lift-up lid completely when carrying out maintenance on the table mounting version.

Removal is accomplished by first taking out the retaining stop from the lid stay and then removing the four screws which locate with hank bushes in the top edge of the rear cover. The lid can then be lifted clear without obstruction.

The procedure for further stripping of the cabinet will be obvious upon inspection, no involved operations being called for. This is also true of the rack mounted model since the greater part of the cabinet is common to both models.

FAULT LOCATION

Faults falling in the categories 'loss of output', 'low sensitivity' and in some cases 'faults of an intermittent nature' may be localised by application of straightforward signal tracing techniques. The 'sectional' construction of the Model '880' makes it an ideal subject for this type of fault location.

For example, the Audio Section can be checked by injecting an AF signal at JK1. An input of 8mV (400 c/s) should produce 50mW output with the AF Gain and Bass Switch at maximum. The Mode Switch must be set to AM for this simple test which will reveal immediately whether the Audio Section is functioning or not.

A fault in the AM Detector circuit is an obvious conclusion if the set appears 'dead' when it is known that the Audio Section is functioning normally and signals are available at the IF Output Socket SKT6, while the Mode Switch is set to AM.

The 2nd Mixer Stage (V5) and the 500 kc/s IF Stages (V10, 11 and 12) are easily checked by injecting a modulated 500 kc/s signal at SKT4.

Likewise the operation of the tuned IF Section may be checked with a suitable signal introduced at SKT3. (see 'Re-alignment')

If an output is obtained with a 500 kc/s signal introduced at SKT4 but no output is available with a suitable signal injected at SKT3, the fault may be in the 2nd Oscillator Unit. This can be verified by removing PL4 and, with the receiver aerial connected, introducing at SKT4 a 'substitute' oscillator signal from a signal generator. Some 200mV will be required and the generator output impedance should be low (75 ohms). Tune the receiver to any frequency and swing the generator tuning over the 3.0 - 4.0 Mc/s range. If normal reception is possible when the generator is tuned in step with the receiver tuning, it is a clear indication that the fault lies in the 2nd Oscillator Unit.

NOTE: Remember that the 2nd Oscillator tunes in the reverse direction to the RF tuning as explained in the Section dealing with 'Circuit Description'.

A similar test can be carried out at SKT3 if the 1st Oscillator Unit is suspected, but will require a greater level of injection voltage (upwards of 400mV).

Once a fault has been localised to a certain section of the receiver, normal servicing techniques, voltage checks, substitution of valves, checking components etc., will quickly reveal the faulty stage.

RE-ALIGNMENT

General.

Although more complex than the average communications receiver, complete re-alignment of the '880' is simplified by virtue of the fact that the 1st Oscillator requires no adjustment and the 2nd Oscillator, once set to its fixed coverage (3.0 - 4.0 Mc/s), ensures accurate calibration on all ranges. The user should not be deterred by the number of stages involved in complete re-alignment since it is most unlikely that such a task would ever be necessary.

It is advisable, however, that partial re-alignment be carried out should it be necessary to change a faulty valve or component. Such adjustment should be restricted to the circuits associated with the stage or stages involved: for example, replacement of V8 may call for slight adjustment of C51 and L11, but no other adjustment need be made.

Provided suitable test equipment is available, re-alignment of any portion of the receiver may be carried out speedily and efficiently by reference to the instructions given in this Section.

Test Equipment.

The Table on the following page gives details of the test equipment and associated items required to satisfactorily re-align the various stages of the Model '880'. Three trimming tools are provided with the receiver, and these allow adjustment of all necessary controls.

TABLE 5.

Section	Items required
500 kc/s IF Amplifiers	1. Sweep Generator capable of providing a 'centre sweep frequency' of 500 kc/s, with suitable 'scope. 2. Modulated Signal Generator with calibrated attenuator and output of 500 kc/s. NOTE: Both the above to have coaxial output leads terminated in Belling Lee Type L.734/P coaxial plugs. 3. Output Meter matched to either 2.5 or 600 ohms. 4. Trimming Tools:- Neosid Type H.S.1. and screw-driver types with broad and narrow blades.
Oscillator Units	1. Frequency Meter or Crystal Calibrator covering the range 3.0 - 34.0 Mc/s - accuracy 0.003%, provided with output lead terminated in Belling Lee Free Socket Type L.734/J (or plug Type L.734/P with coaxial line coupling Type L.616.). 2. Valve Voltmeter, 1.5V f.s.d. 3. Trimming Tools:- Broad and narrow screwdriver and Phillips concentric trimmer type.
Tuned IF and RF Sections	1. Modulated Signal Generator covering the range 500 kc/s - 30.5 Mc/s. Output lead terminated with an adaptor to suit both Belling Lee Type L.604/S and standard BNC coaxial sockets. 2. Output Meter matched to either 2.5 or 600 ohms. 3. Trimming Tool:- Narrow bladed screwdriver type.

Re-alignment of the 500 kc/s IF Amplifiers.

Switch on the receiver, sweep generator and oscilloscope and, while warming up, set the receiver controls as follows:-

Selectivity Switch	'Crystal'	AGC Switch	'Off'
Mode Switch	'AM'	NL Switch	'Off'
IF Gain	'Maximum'	Bass Switch	'Maximum'

Remove PL4, connect the output lead from the sweep generator to SKT4 and a screened lead from the Oscilloscope 'Y' plate amplifier between the Noise Limiter Switch and chassis, i.e. across the lower part of the AM Detector load. The AF Gain should be reduced and telephones plugged in to effectively mute the Audio Section of the receiver.

Having set the generator to sweep the IF passband, adjust all IF transformer cores commencing at T7 secondary and working back to the primary winding of T1, trimming for greatest amplitude and symetrical response. Two points of resonance will be obtained with each core; the correct one to use is that occurring when the core is furthest from the opposite coil. The exception to this rule is that the secondary core of T7 is adjusted to the inner peak. Side responses due to the crystals can be balanced by means of the phasing capacitor C80 the rejection notches being well down on the skirts and scarcely discernible when the adjustment is correctly made.

NOTE: Refer to Fig. 5. for identification of primary and secondary cores, both of which are adjusted from the top using a Neosid trimming tool Type H.S.1. The lower core in each case is, of course opposite to the one indicated.
The cores used have an hexagonal bore which runs completely through the core and allows one end of the trimming tool (provided with a shank of reduced diameter) to be passed through the top core for adjustment of the lower winding. Adjustment is quite straightforward and the cores are self-locking.
The crystal filter output coil (T2) is adjusted through the LOWER, and the phasing capacitor(C80) through the UPPER of the two holes provided in the receiver side plate. In the case of table mounted receivers, the shaped side cover (L.H.S.) must be removed to gain access to these adjustments and instructions for its removal are given elsewhere in this Section. (see 'Replacement of V6 and V7)

Having aligned the receiver in the 'Crystal' position, check that the response is symetrical in the other positions of the Selectivity Switch. It may be found necessary to adjust T2 slightly in the 'Broad' position and this can be done quite simply without upsetting the response in the other positions of the switch.

A sensitivity check may now be carried out with S2 at 'Narrow' using a standard signal generator. With 30% modulation at 400 c/s and with the signal introduced at SKT4, an input of approximately 1uV should give an output of 50mW. If the sensitivity appears low, stage by stage checks will reveal the faulty stage. The following figures are indicative of the sensitivities to be expected, and in each case the signal is introduced via the grid capacitor of the stage being checked (C83, 91 and 99 respectively).

V10	. .	10uV for 50mW output.
V11	. .	160uV for 50mW output.
V12	. .	2mV for 50mW output.

If a sweep generator is not available, alignment can be carried out using a standard signal generator and output meter but great care should be exercised in adjusting the phasing capacitor C80.

Re-alignment of the BFO.

First set the BFO Tuning Control (C128) to '0' on its scale and check that the mark on the control shaft (adjacent to the BFO Unit) is positioned vertically with respect to the shaft indicating that the capacitor is at 'half-capacity'.

Inject an unmodulated signal in the centre of the IF passband and, with the Mode Switch to CW/SSB adjust L25 (see Fig. 5.) for zero beat using a large insulated screwdriver type trimming tool.

Re-alignment of the 1st Oscillator Unit.

It is most unlikely that adjustment of this unit will ever be necessary but details are given here for the sake of completeness.

Place the receiver on end, right-hand side uppermost and remove the 1st Oscillator alignment plate. (In table mounted receivers it will be necessary to remove the shaped side cover to expose the alignment plate - see 'Replacement of V6 and V7').

Next, remove the outer and inner covers of the 1st Oscillator Unit (accessible when the alignment plate is removed).

Remove PL3 from SKT3 and connect PL3 to a suitable frequency standard. Switch on the receiver and frequency standard and allow adequate time for both to reach operating temperature. Select the appropriate receiver range and, with the frequency standard set to the frequency indicated in the table below, adjust the correct trimmer to nullify any inaccuracy in the crystal frequency. All trimmers are mounted adjacent to their appropriate crystal.

TABLE 6.

Range	Standard	Trimmer	Range	Standard	Trimmer
1	5 Mc/s	C314	10	14 Mc/s	C309
2	6 Mc/s	C313	12	16 Mc/s	C308
5	8 Mc/s	C312	18	22 Mc/s	C307
6	10 Mc/s	C311	22	26 Mc/s	C306
8	12 Mc/s	C310	30	34 Mc/s	C305

Having 'zeroed' all the crystals, disconnect the frequency standard and connect PL3 to a valve voltmeter of approx 1.5 volts F.S.D..

Select the ranges indicated in Table 7 and adjust the appropriate inductances for maximum reading in the valve voltmeter.

The unit may now be re-connected, no further adjustment being required.

Re-alignment of the 2nd Oscillator Unit.

First remove PL4 from SKT4 and connect PL4 to a suitable frequency standard. The reactance control terminals ('G', 'E' and 'K') at the rear of the receiver must be connected together by means of wire straps before alignment is commenced.

TABLE 7.

Range	Inductance
1	L70
2	L71
5	L72
6	L73
8	L74
10	L75
12	L76
14	L77

Range	Inductance
16	L78
18	L79
20	L80
22	L81
24	L82
26	L83
28	L84
30	L85

NOTE: The 'body' of PL4 must be earthed to the chassis of the receiver to complete the 'earthy' side of the HT and LT supplies to the Oscillator Unit. (Earthing normally takes place at SKT4)

Remove the top outer cover of the 2nd Oscillator Unit (immediately to the right of the tuning platform) to reveal the two inner covers, the front one of which is provided with two holes for adjustment of L11 and C51.

Switch on the receiver and frequency standard and allow adequate time for both to reach operating temperature.

Set the frequency standard to 3.0 Mc/s and, though it is immaterial which range is selected, it is convenient to place the receiver Wavechange Switch at Range 1 so that reference can be made to the dial calibration. Adjust the main tuning control so that the tuning pointer coincides with the calibration mark at 1.5 Mc/s and monitor the output from the frequency standard to ascertain what error (if any) exists.

Now alter the frequency standard to 4.0 Mc/s, set the receiver tuning pointer coincident with the 0.5 Mc/s calibration mark and check the accuracy at this point.

NOTE: The 2nd Oscillator tunes in the reverse direction to the RF tuning as explained in the Section headed 'Circuit Description'.

If any error exists, it can be corrected by adopting standard tracking technique in adjusting C51 (Phillips trimming tool) at the 4 Mc/s point and L11 (Insulated screwdriver type trimming tool) at the LF end of the Oscillator range (3 Mc/s).

Once the 'end' frequencies are correct, a check should be made at each of the 100 kc/s points along the tuning scale, remembering that the Oscillator tuning and scale calibration are reversed. Errors at these points are most unlikely since the tuning capacitor used is of the straight-line-frequency type and once the 'end' frequencies have been established no further adjustment should be necessary.

Re-alignment of the 'Tuned' IF Section.

Switch on the receiver and signal generator and allow adequate time for both to reach operating temperature. Remove PL3 from SKT3 and connect the output lead from the generator to SKT3.

With the receiver controls set as when checking the sensitivity of the 500 kc/s stages, and with an output meter connected to either the 2.5 or 600 ohm terminals, select Range 3 and tune the receiver and signal generator to 3.0 Mc/s (generator modulated 30% at 400 c/s). Using a small screwdriver type trimming tool adjust the 2.5-3.5 Mc/s 'Tuned' IF and 2nd Mixer cores for maximum output. (See Fig. 5. for location of these trimming adjustments which are situated on the tuning platform)

Now alter the generator tuning to 4.0 Mc/s and, without touching the receiver tuning, set the receiver Wavechange Switch to Range 4. This automatically tunes the receiver to 4.0 Mc/s and the 3.5-4.5 Mc/s cores should be peaked for maximum output.

A sensitivity check may now be carried out and should result in an output of 50mW for an input of approximately 10uV (signal introduced at SKT3). Checks should be made at both alignment frequencies.

NOTE: The lower sensitivity at this point compared with that at SKT4 is due to the fact that V5 is now functioning as a mixer, whereas previously when checking the 500 kc/s stages, V5 operated as an amplifier. When used as a mixer, V5 is operated with very low oscillator injection (in the interests of reduced radiation) and under conditions of minimum noise factor.

<u>Re-alignment of the RF Section.</u> (V1, V2 and V3)

Complete re-alignment of the RF Section will only be required if it has been necessary to remove the tuning platform - a most unlikely operation.

Fig. 5. shows the location of all trimming capacitors and cores applicable to RF alignment, and these are labelled for convenience, not with the circuit reference number, but with the range to which they apply. Also shown is a grid reference system which simplifies location of the correct trimmer on the 2nd RF and 1st Mixer sub-chassis. On Fig. 5. locate the desired trimmer - say 2nd RF, Range 21 - and obtain the reference 'A-3'. This same reference appears on the receiver sub-chassis and enables the correct trimmer to be located without error. On the tuning platform the range is indicated directly, no reference system being required.

The instructions given below are for <u>complete</u> re-alignment. No adjustments are necessary when a valve is replaced but partial re-alignment must be carried out should it be necessary to change a component associated with the tuned circuits. Such re-alignment only calls for adjustment of the circuit concerned and no further trimming should be attempted.

In carrying out complete re-alignment, first switch on the receiver and generator and while these reach operating temperature, connect a suitable output meter and set the receiver controls as follows:-

Selectivity Switch	'Narrow'	AGC Switch	'Off'
Mode Switch	'AM'	NL Switch	'Off'
RF, IF and AF Gains	'Maximum'	Bass Switch	'Maximum'

Connect the signal generator output lead to the receiver aerial socket (BNC plug) and set the tuning control so that the pointer lies on the 'Megacycle point' at the centre of the scale. Check that the vernier scale reads zero. Once set, the tuning control should not be touched throughout the whole alignment.

Set the generator modulation depth at 30% (400 c/s), select the receiver ranges and generator frequencies indicated in the Table below and adjust the appropriate trimmers or cores for maximum output reading.

TABLE 8.

Range	Sig. Gen.	1st RF Stage		2nd RF Stage		1st Mixer Stage	
		Trimmer	Core	Trimmer	Core	Trimmer	Core
1	1 Mc/s	NIL	L41	NIL	L53	NIL	L65*
2	2 Mc/s	NIL	L40	NIL	L52	NIL	L64
3	3 Mc/s	NIL	L39	NIL	L51	NIL	L63
4	4 Mc/s	NIL	L38	NIL	L50	NIL	L62
5	5 Mc/s	NIL	L37	NIL	L49	NIL	L61
6	6 Mc/s	NIL	L36	NIL	L48	NIL	L60
7	7 Mc/s	NIL	L35	NIL	L47	NIL	L59
8	8 Mc/s	NIL	L34	NIL	L46	NIL	L58
9	9 Mc/s	NIL	L33**	C229(A6)	L45**	C285(E6)	L57**
10	10 Mc/s	NIL		C228(B6)		C284(F6)	
11	11 Mc/s	NIL	L32**	C227(C6)	L44**	C283(G6)	L56**
12	12 Mc/s	NIL		C226(D6)		C282(H6)	
13	13 Mc/s	NIL		C225(A5)		C284(E5)	
14	14 Mc/s	NIL	L31**	C224(B5)	L43**	C280(F5)	L55**
15	15 Mc/s	NIL		C223(C5)		C279(G5)	
16	16 Mc/s	NIL		C222(D5)		C278(H5)	
17	17 Mc/s	NIL		C221(A4)		C270(E4)	
18	18 Mc/s	NIL	L30**	C220(B4)	L42**	C269(F4)	L54**
19	19 Mc/s	NIL		C219(C4)		C268(G4)	
20	20 Mc/s	NIL		C218(D4)		C274(H4)	
21	21 Mc/s	NIL		C217(A3)		C273(E3)	
22	22 Mc/s	NIL		C216(B3)		C272(F3)	
23	23 Mc/s	NIL		C215(C3)		C264(G3)	
24	24 Mc/s	NIL		C214(D3)		C266(H3)	
25	25 Mc/s	NIL		C213(A2)		C269(E2)	
26	26 Mc/s	NIL		C212(B2)		C262(F2)	
27	27 Mc/s	NIL		C211(C2)		C260(G2)	
28	28 Mc/s	NIL		C210(D2)		C260(H2)	
29	29 Mc/s	NIL		C209(B1)		C258(F1)	
30	30 Mc/s	NIL		C208(C1)		C257(G1)	

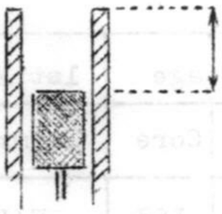
229 / 285.

* This core is pre-set during initial alignment and will not require adjustment.

** All cores marked in this way should only be adjusted if it proves impossible to correctly align (using the appropriate trimmers) all, or any of the ranges for which they are used.

If adjustment is required, it will be necessary to set the core(s) by measurement of the depth of penetration into the former (measured from the end remote from the tuning platform) with the tuning control set to centre scale. The Table below gives the correct settings required.

TABLE 9.



Inductance	'X'
L33, 45 and 57	1. 15/16"
L32, 44 and 56	1. 7/8"
L31, 43 and 55	2"
L30, 42 and 54	1. 7/8"

NOTE: The 2nd RF and 1st Mixer trimmers C201 and C256 (marked 'X' in Fig. 5.) should not be touched when carrying out re-alignment. These trimmers are in circuit on all ranges and are used to balance circuit capacities during initial alignment of the receiver.

The Aerial Trimmer (panel control) should be set at 'half capacity' on Ranges 1-8, but on the other ranges its ability to resonate the input circuit indicates correct alignment of L30-33.

Alignment of the 12 Mc/s Trap. (1st Oscillator Unit)

This parallel tuned trap (L86/C319) is connected in series with the low impedance output from L77. Its purpose is to reduce the second harmonic output from the 6 Mc/s crystal when using Range 15. The method of adjustment is as follows:

Tune the receiver to 14.7 Mc/s and inject a modulated signal at 15.3 Mc/s. Adjust L86 for maximum attenuation of the resultant output.

APPENDIX 'A'

VALVE BASE CONNECTIONS

B7G Types.

Type	Pin Connections						
	1	2	3	4	5	6	7
OB2	A	K	IC	K	A	IC	K
6AK5	G1	K,G3,S	H	H	A	G2	K,G3,S
6AL5	K'	A"	H	H	K"	S	A'
6AM5	G1	K,G3	H	H	A	NC	G2
6BA6	G1	G3,S	H	H	A	G2	K
6BE6	G1	K,G5	H	H	A	G2&G4	G3
6C4	A	NC	H	H	A	G	K

B9A Types.

Type	Pin Connections								
	1	2	3	4	5	6	7	8	9
6U8	A_t	$G1_p$	$G2_p$	H	H	A_p	K_p,S $G3_p$	K_t	$G1_t$
12AT7/12AU7	A"	G"	K"	H	H	A'	G'	K'	H_{tap}

Flying Lead Types. (B5B/F Base)

Type	Lead Connections				
	1	2	3	4	5
EA76/6489	H	A	K	H	A

B8D/F Base.

Type	1	2	3	4	5	6	7	8
EF732	G1	K,G3	H	K,G3	A	H	G2	K,G3

APPENDIX 'B'

COMPONENT VALUES, TOLERANCES AND RATINGS

Capacitors.

C1	30 pF Silvered Mica ± 5% 200V DC wkg.
C2	140 pF Silvered Mica ± 5% 200V DC wkg.
C3	30 pF Silvered Mica ± 5% 200V DC wkg.
C4	100 pF Silvered Mica ±10% 350V DC wkg.
C5	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C6	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C7	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C8	100 pF Silvered Mica ± 10% 350V DC wkg.
C9	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C10	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C11	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C12	100 pF Silvered Mica ± 10% 350V DC wkg.
C13	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C14	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C15	400 pF Silvered Mica ± 2% 350V DC wkg.
C16	40 pF Silvered Mica ± 5% 200V DC wkg.
C17	90 pF Silvered Mica ± 5% 200V DC wkg.
C18	100 pF Silvered Mica ± 5% 200V DC wkg.
C19	40 pF Silvered Mica ± 5% 200V DC wkg.
C20	100 pF Silvered Mica ± 10% 350V DC wkg.
C21	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C22	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C23	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C24	100 pF Silvered Mica ± 10% 350V DC wkg.
C25	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C26	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C27	1500 pF Silvered Ceramic ± 20% 350V DC wkg.
C28	800 pF Silvered Mica ± 2% 350V DC wkg.
C28a	3 pF Silvered Ceramic ± ½ pF 350V DC wkg.
C29	100 pF Silvered Mica ± 10% 350V DC wkg.
C30	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C31	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C32	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C33	6 pF Silvered Ceramic ± 1 pF 350V DC wkg.
C34	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C35	1500 pF Silvered Ceramic ± 20% 350V DC wkg.
C36	1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C37	1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C38	1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C39	1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.

C40	1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C41	1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C42	1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C43	1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C44	1500 pF Silvered Ceramic ± 20% 350V DC wkg.
C45	1500 pF Silvered Ceramic ± 20% 350V DC wkg.
C46	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C47	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C48	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C49	400 pF Silvered Mica ± 2% 350V DC wkg.
C50	15 - 150 pF (nominal) Air Spaced Variable.
C51	3 - 30 pF Air Trimmer.
C52	40 pF Silvered Mica.
C53	20 pF Silvered Ceramic.
C54	12 pF Silvered Mica ± 1 pF 200V DC wkg.
C55	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C56	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C57	400 pF Silvered Mica ± 10% 350V DC wkg.
C58	40 pF Silvered Mica ± 5% 200V DC wkg.
C59	100 pF Silvered Mica ± 5% 200V DC wkg.
C60	130 pF Silvered Mica ± 5% 200V DC wkg.
C61	40 pF Silvered Mica ± 5% 200V DC wkg.
C62	1500 pF Silvered Ceramic ± 20% 350V DC wkg.
C63	1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C64	1500 pF Silvered Ceramic ± 20% 350V DC wkg.
C65	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C66	100 pF Silvered Mica ± 10% 350V DC wkg.
C67	0.01 mfd Tubular Paper ± 20% 350V DC wkg.
C68	300 pF Silvered Mica ± 5% 200V DC wkg.
C69	770 pF Silvered Mica ± 5% 200V DC wkg.
C70	970 pF Silvered Mica ± 5% 200V DC wkg.
C71	300 pF Silvered Mica ± 5% 200V DC wkg.
C72	1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C73	1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C74	1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C75	1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C76	400 pF Silvered Mica ± 2% 350V DC wkg.
C77	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C78	800 pF Silvered Mica ± 2% 350V DC wkg.
C79	800 pF Silvered Mica ± 2% 350V DC wkg.
C80	2 - 10 pF Air Trimmer (Differential).
C81	20 pF Silvered Mica ± 10% 350V DC wkg.
C82	400 pF Silvered Mica ± 2% 350V DC wkg.
C83	100 pF Silvered Mica ± 10% 350V DC wkg.
C84	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C85	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C86	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C87	400 pF Silvered Mica ± 2% 350V DC wkg.
C88	400 pF Silvered Mica ± 2% 350V DC wkg.
C89	400 pF Silvered Mica ± 2% 350V DC wkg.

C90	400 pF Silvered Mica ± 2% 350V DC wkg.
C91	100 pF Silvered Mica ± 10% 350V DC wkg.
C92	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C93	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C94	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C95	400 pF Silvered Mica ± 2% 350V DC wkg.
C96	400 pF Silvered Mica ± 2% 350V DC wkg.
C97	400 pF Silvered Mica ± 2% 350V DC wkg.
C98	400 pF Silvered Mica ± 2% 350V DC wkg.
C99	100 pF Silvered Mica ± 10% 350V DC wkg.
C100	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C101	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C102	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C103	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C104	100 pF Silvered Mica ± 2% 350V DC wkg.
C105	40 pF Silvered Ceramic ± 10% 350V DC wkg.
C106	100 pF Silvered Mica ± 2% 350V DC wkg.
C107	100 pF Silvered Mica ± 10% 350V DC wkg.
C108	500 pF Moulded Mica ± 20% 350V DC wkg.
C109	0.01 mfd Moulded Mica ± 20% 350V DC wkg.
C110	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C111	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C112	10 pF Silvered Mica ± 2% 350V DC wkg.
C113	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C114	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C115	0.5 mfd Tubular Paper ± 20% 350V DC wkg.
C116	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C117	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C118	0.01 mfd Moulded Mica ± 20% 350V DC wkg.
C119	30 mfd Tubular Electrolytic 15V DC wkg.
C120	0.05 mfd Tubular Paper ± 20% 350V DC wkg.
C121	0.5 mfd Tubular Paper ± 20% 350V DC wkg.
C122	0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C123	500 pF Tubular Paper ± 20% 350V DC wkg.
C124	5000 pF Silvered Ceramic ± 20% 350V DC wkg.
C124a	40 pF Silvered Mica ± 10% 350V DC wkg.
C125	500 pF Tubular Paper ± 20% 350V DC wkg.
C126	12 pF Silvered Mica ± 1 pF 200V DC wkg.
C127	30 mfd Tubular Electrolytic 15V DC wkg.
C128	3-15 pF Air Spaced Variable.
C129	100 pF Silvered Mica ± 2% 350V DC wkg.
C130	7000 pF Silvered Mica ± 1% 350V DC wkg.
C131	7000 pF Silvered Mica ± 1% 350V DC wkg.
C132	1000 pF Silvered Ceramic ± 20% 350V DC wkg.
C133	1000 pF Silvered Ceramic ± 20% 350V DC wkg.
C134	1000 pF Silvered Ceramic ± 20% 350V DC wkg.
C135	30 mfd Tubular Electrolytic 15V DC wkg.
C136	0.01 mfd Moulded Mica ± 20% 350V DC wkg.
C137	0.01 mfd Moulded Mica ± 20% 350V DC wkg.
C138	30 mfd Tubular Electrolytic 15V DC wkg.
C139	0.01 mfd Moulded Mica ± 20% 350V DC wkg.

C140 0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C141 0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C142 1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C143 1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C144 0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C145 1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C146 0.01 mfd Tubular Paper ± 20% 150V DC wkg.
C147 1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C148 1500 pF Silvered Ceramic Feed Thru' ± 20% 350V DC wkg.
C149 0.25 mfd Tubular Paper ± 20% 150V DC wkg.

C150 50 mfd Tubular Electrolytic 450V DC wkg.
C151 50 mfd Tubular Electrolytic 450V DC wkg.
C152 50 mfd Tubular Electrolytic 450V DC wkg.
C153 0.5 mfd Tubular Paper ± 20% 150V DC wkg.

C154 - C319 See Detached Circuits 1-5.

Resistors.

R1 0.27 Megohm ± 10% ¼ watt.
R2 12 ohms ± 20% ¼ watt.
R3 47,000 ohms ± 10% 1 watt.
R4 68 ohms ± 10% ½ watt.
R5 2,200 ohms ± 10% ½ watt.
R6 0.27 Megohm ± 10% ¼ watt.
R7 12 ohms ± 20% ¼ watt.
R8 47,000 ohms ± 10% 1 watt.
R9 68 ohms ± 10% ½ watt.

R10 0.1 Megohm ± 10% ½ watt.
R11 47,000 ohms ± 10% ½ watt.
R12 2,200 ohms ± 10% ½ watt.
R13 0.27 Megohm ± 10% ¼ watt.
R14 12 ohms ± 20% ¼ watt.
R15 270 ohms ± 10% ½ watt.
R16 2,200 ohms ± 10% ½ watt.
R17 470 ohms ± 10% ½ watt.
R18 1 Megohm ± 10% ¼ watt.
R19 10,000 ohms ± 10% 1 watt.

R20 47,000 ohms ± 10% 1 watt.
R21 470 ohms ± 10% ¼ watt.
R22 0.27 Megohm ± 10% ¼ watt.
R23 12 ohms ± 20% ¼ watt.
R24 47,000 ohms ± 10% 1 watt.
R25 68 ohms ± 10% ½ watt.
R26 2,200 ohms ± 10% ½ watt.
R27 0.27 Megohm ± 10% ¼ watt.
R28 12 ohms ± 20% ¼ watt.
R29 1 Megohm ± 10% ¼ watt.

R30 270 ohms ± 10% ½ watt.
R31 0.1 Megohm ± 10% ¼ watt.
R32 2,200 ohms ± 10% ½ watt.
R33 2,200 ohms ± 10% ½ watt.
R34 3,300 ohms ± 10% ½ watt.
R35 47,000 ohms ± 10% ½ watt.
R36 10,000 ohms ± 10% ½ watt.
R37 150 ohms ± 10% ½ watt.
R38 68 ohms ± 10% ¼ watt.
R38a 10,000 ohms ± 10% ½ watt.
R39 1000 ohms ± 10% ½ watt.

R40 2,200 ohms ± 10% ½ watt.
R41 0.47 Megohm ± 10% ¼ watt.
R42 150 ohms ± 10% ½ watt.
R43 2,200 ohms ± 10% ½ watt.
R44 47,000 ohms ± 10% ½ watt.
R45 0.1 Megohm ± 10% ½ watt.
R46 2,200 ohms ± 10% ½ watt.
R47 470 ohms ± 10% ½ watt.
R48 33,000 ohms ± 10% ½ watt.
R49 470 ohms ± 10% ½ watt.

R50 2,200 ohms ± 10% ½ watt.
R51 680 ohms ± 10% ½ watt.
R52 68 ohms ± 10% ½ watt.
R53 2,200 ohms ± 10% ½ watt.
R54 10,000 ohms ± 10% 1 watt.
R55 47,000 ohms ± 10% 1 watt.
R56 0.27 Megohm ± 10% ¼ watt.
R57 47,000 ohms ± 10% 1 watt.
R58 2,200 ohms ± 10% ½ watt.
R59 100 ohms ± 10% ½ watt.

R60 12 ohms ± 20% ¼ watt.
R61 0.27 Megohm ± 10% ¼ watt.
R62 47,000 ohms ± 10% 1 watt.
R63 2,200 ohms ± 10% ½ watt.
R64 100 ohms ± 10% ½ watt.
R65 12 ohms ± 20% ¼ watt.
R66 0.27 Megohm ± 10% ¼ watt.
R67 47,000 ohms ± 10% 1 watt.
R68 2,200 ohms ± 10% ½ watt.
R69 0.47 Megohm ± 10% ¼ watt.

R70 150 ohms ± 10% ½ watt.
R71 0.47 Megohm ± 10% ½ watt.
R72 1 Megohm ± 10% ¼ watt.
R73 1 Megohm ± 10% ¼ watt.
R74 0.1 Megohm ± 10% ½ watt.
R75 2 Megohm ± 10% ½ watt.
R76 0.1 Megohm ± 10% ½ watt.
R77 0.1 Megohm ± 10% ½ watt.
R78 10,000 ohms ± 10% ½ watt.
R79 1 Megohm ± 10% ½ watt.

R80 10,000 ohms ± 10% ½ watt.
R81 470 ohms ± 10% ½ watt.
R82 2,200 ohms ± 10% ½ watt.
R83 4,700 ohms ± 10% 1 watt.
R83a 1000 ohms ± 10% ½ watt.
R84 470 ohms ± 10% ½ watt.
R85 47,000 ohms ± 10% ½ watt.
R86 470 ohms ± 10% ½ watt.
R87 0.47 Megohm ± 10% ½ watt.
R88 0.1 Megohm ± 10% 1 watt.
R89 3,300 ohms ± 10% ½ watt.

R90 0.47 Megohm ± 10% ½ watt.
R91 47 ohms ± 10% ½ watt.
R92 1000 ohms ± 10% ½ watt.
R93 33,000 ohms ± 10% ½ watt.
R94 10,000 ohms ± 10% ½ watt.
R95 Replaced by CH16.
R96 0.1 Megohm ± 10% ½ watt.
R97 220 ohms ± 10% ½ watt.
R98 1 Megohm ± 10% ½ watt.
R99 1 Megohm ± 10% ½ watt.

R100 1 Megohm ± 10% ½ watt.
R101 0.1 Megohm ± 10% ½ watt.
R102 3,300 ohms ± 10% ½ watt.
R102a 3,300 ohms ± 10% ½ watt.
R103 0.1 Megohm ± 10% ½ watt.
R104 3.3 Megohm ± 10% ½ watt.
R105 0.47 Megohm ± 10% ½ watt.
R106 68,000 ohms ± 5% ½ watt.
R107 0.47 Megohm ± 10% ½ watt.
R108 3.3 Megohm ± 10% ½ watt.
R109 620 ohms ± 10% ½ watt.

R110 0.1 Megohm ± 10% 1 watt.
R111 4,700 ohms ± 10% ½ watt.
R112 10 ohms ± 10% 3 watt wirewound.
R113 10,000 ohms ± 10% 1 watt.
R114 2,200 ohms ± 10% 6 watt wirewound.
R115 0.27 Megohm ± 10% ½ watt.
R116 10,000 ohms ± 10% ½ watt.
R117 140 ohms ± 10% 5 watt wirewound.
R118 140 ohms ± 10% 5 watt wirewound.

R118a -
R129 See Detached Circuits 1-5.

Potentiometers.

RV1 10,000 ohms wirewound.
RV2 10,000 ohms wirewound.
RV3 600 ohms wirewound.
RV4 0.5 Megohm carbon.
RV5 5 ohms wirewound.

APPENDIX 'C'

TABLE OF VOLTAGE VALUES

The following Table of voltages will prove useful when carrying out voltage checks during servicing. All readings are taken under no signal conditions with an AVO Model 8 testmeter (20,000 ohm/volt).

Valve	Anode	Screen	Cathode
V1/V2	190 - 210*	75 - 200*	0.75 - 30*
V3	160	20	0.3
V4	190	85	0.8
V5	160	20	0.3
V6	75	100	-
V7	95	90	0.8
V8A	30	-	0.2
V8B	100	75	-
V9	175	-	5.0
V10/V11	190 - 210**	90 - 210**	1.1 - 30**
V12	210	90	1.7
V13A	-	-	-
V13B	-	-	22.0
V14A/V14B	185	-	2.4
V15A	210	-	3.0
V15B	120	-	2.5
V16	See Note below.		
V17A/V17B	75	-	3.6
V18/V19	210	210	12.0
V20	108	-	-
V21	-	-	-

* Voltage extremes, RF Gain Max to Min.
** Voltage extremes, IF Gain Max to Min.

NOTE: V16 is inaccessible for voltage checks. External applied voltages are as follows:

Anode (orange wire) . . 180
Screen (blue wire) . . 108 (Mode Switch to CW/SSB)

The following voltage readings, taken across C150-C153 may also prove of use.

C150 . . 180V (HT2)
C151 . . 210V (HT1)
C152 . . 245V
C153 . . 6.0V

AMENDMENTS TO DETACHED CIRCUITS NOS. 1, 3 AND 5

Detached Circuit No. 1. (Page 49)

A 68 ohm resistor should be shown connected between the Sla side of C165 and chassis. The component should be allocated the reference R118a and added to the list at the foot of the diagram:-

"R118a 68 ohms ± 10% ¼ watt"

Detached Circuit No. 3. (Page 51)

A 500 pF capacitor should be shown connected between the top end of L65 and the range switch wafer Sli. The component should be allocated the reference C254a and added to the list at the foot of the diagram:-

"C254a 500 pF Tubular Paper ± 20% 350V DC wkg"

Detached Circuit No. 5. (Page 53)

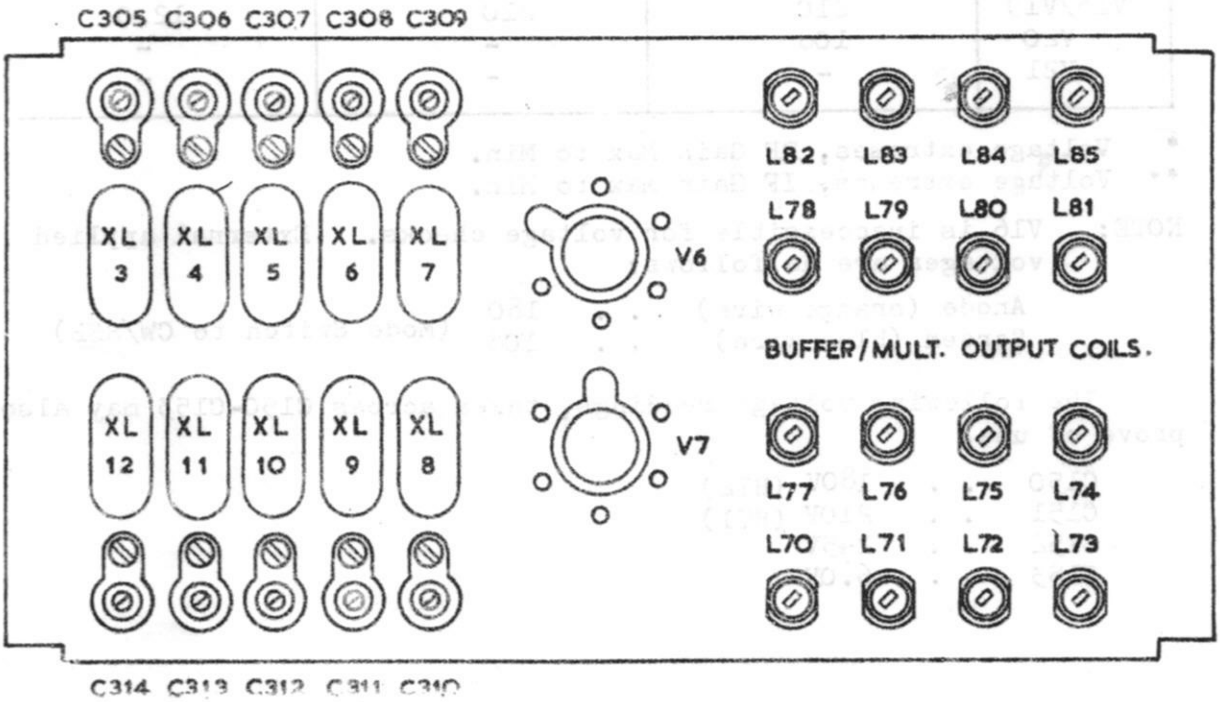
1. A parallel tuned rejector circuit should be shown in series with the lead from L77 secondary to Slq. The inductor reference should be given as L86 and the capacitor as C319. The following addition should be made to the list of components (opposite page).

   "C319 40 pF Silvered Mica ± 10% 350V DC wkg"

2. The 10 Mc/s crystal (XL9) should be shown wired to the vacant switch contacts (Ranges 3 and 4) on Sln and Slo.

3. C33 should be shown connected to the top end of R126 and not to chassis.

FIG. 6. CRYSTAL/COIL LOCATION - 1ST OSCILLATOR UNIT



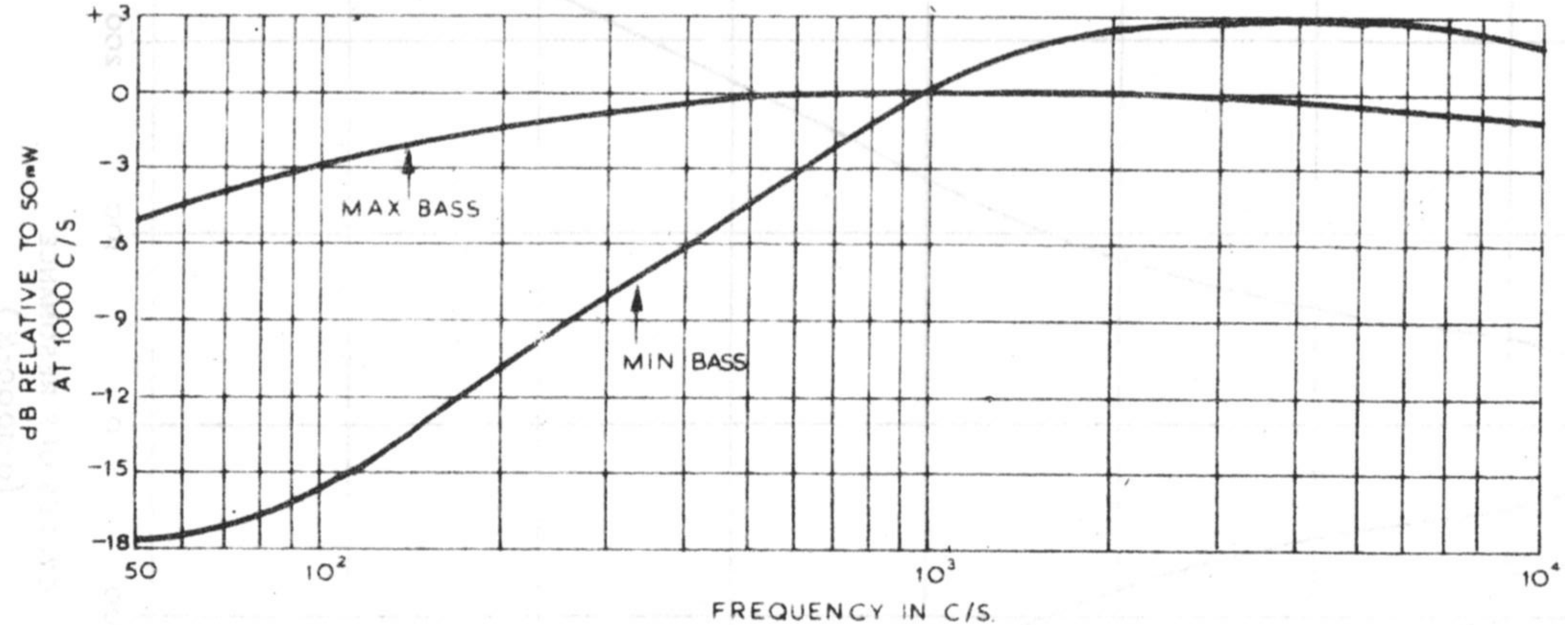


FIG 1. AUDIO RESPONSE IN MAXIMUM AND MINIMUM POSITIONS OF BASS SWITCH.
(AUDIO FILTER OUT OF CIRCUIT AND VOLUME CONTROL AT MAX)

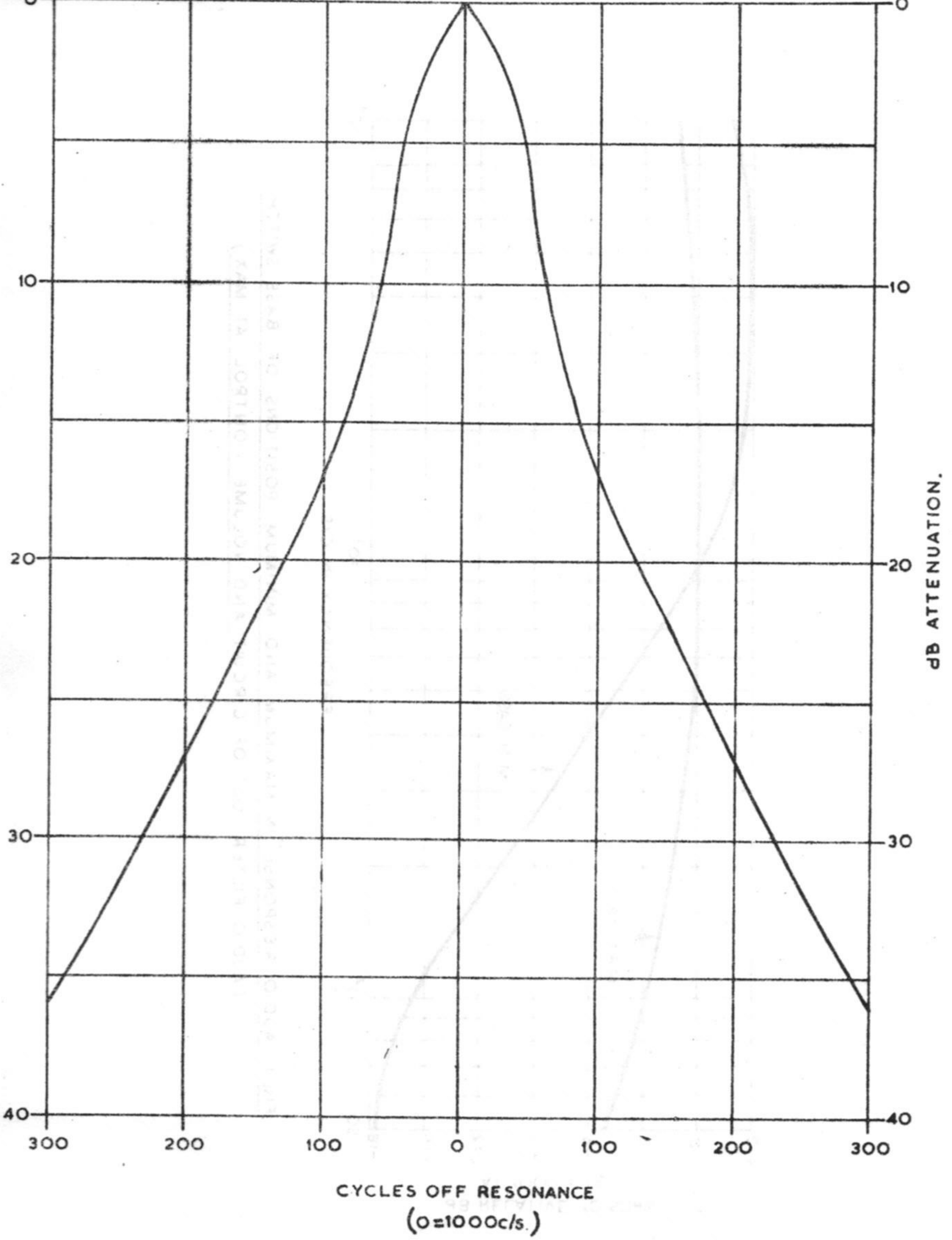
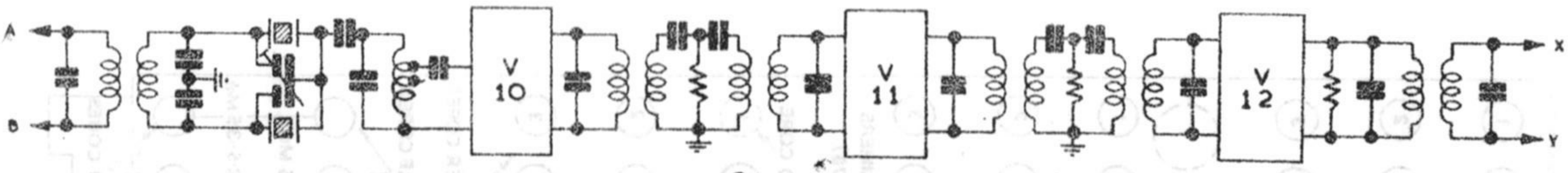
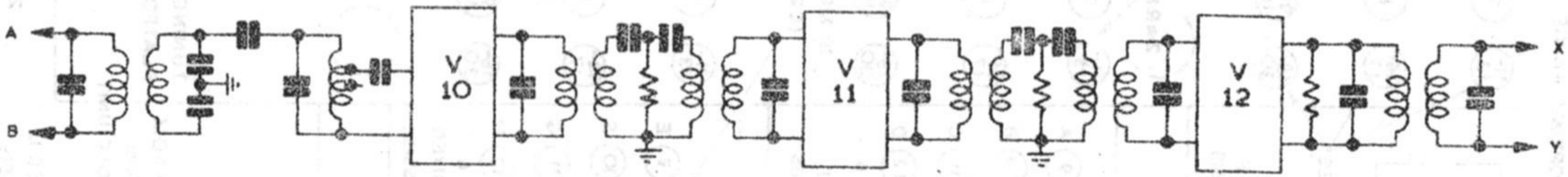


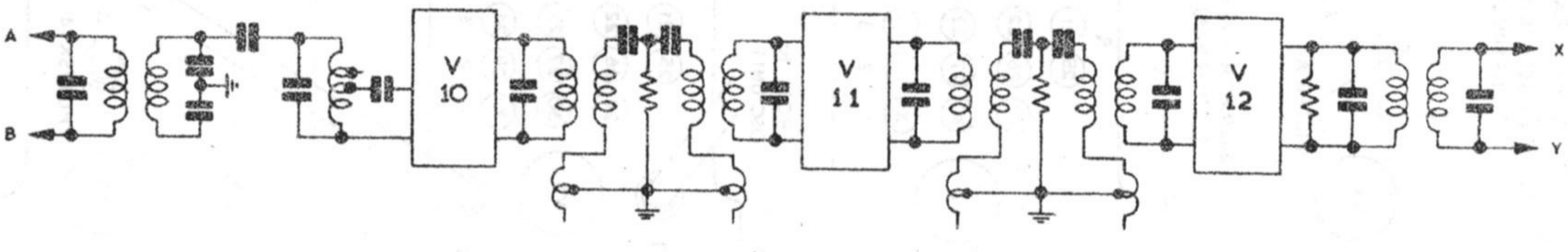
FIG 2 OVERALL SELECTIVITY AUDIO FILTER IN CIRCUIT.



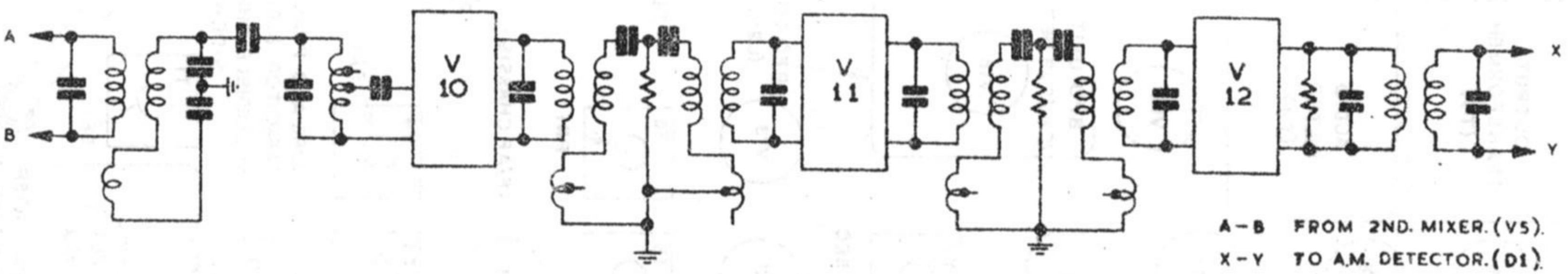
S2 AT POSITION 1 "CRYSTAL WITH AUDIO FILTER" AND POSITION 2 "CRYSTAL."



S2 AT POSITION 3 "NARROW."



S2 AT POSITION 4 "INTERMEDIATE."



S2 AT POSITION 5 "BROAD."

FIG. 4. COUPLING ARRANGEMENTS AT EACH POSITION OF SELECTIVITY SWITCH (S2)

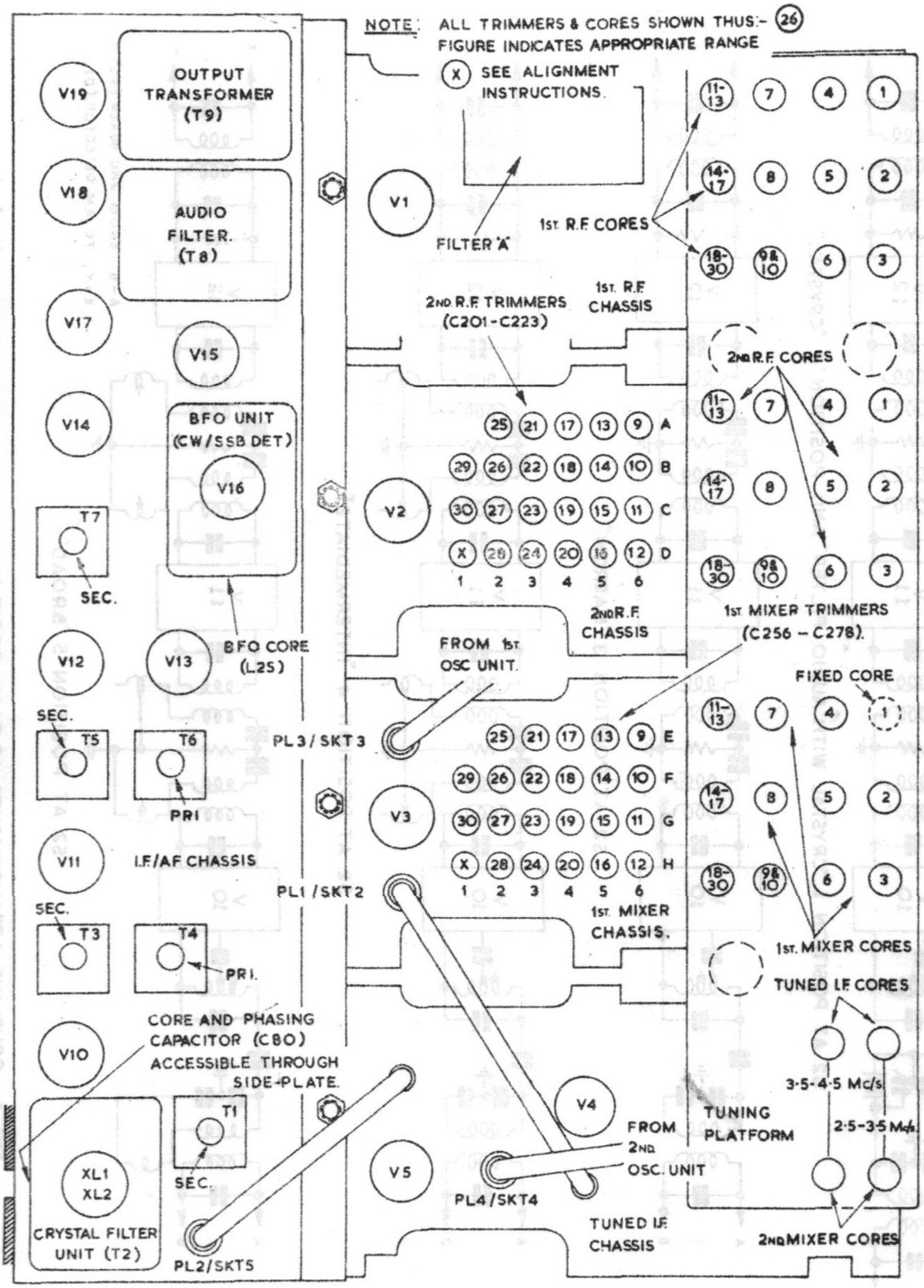
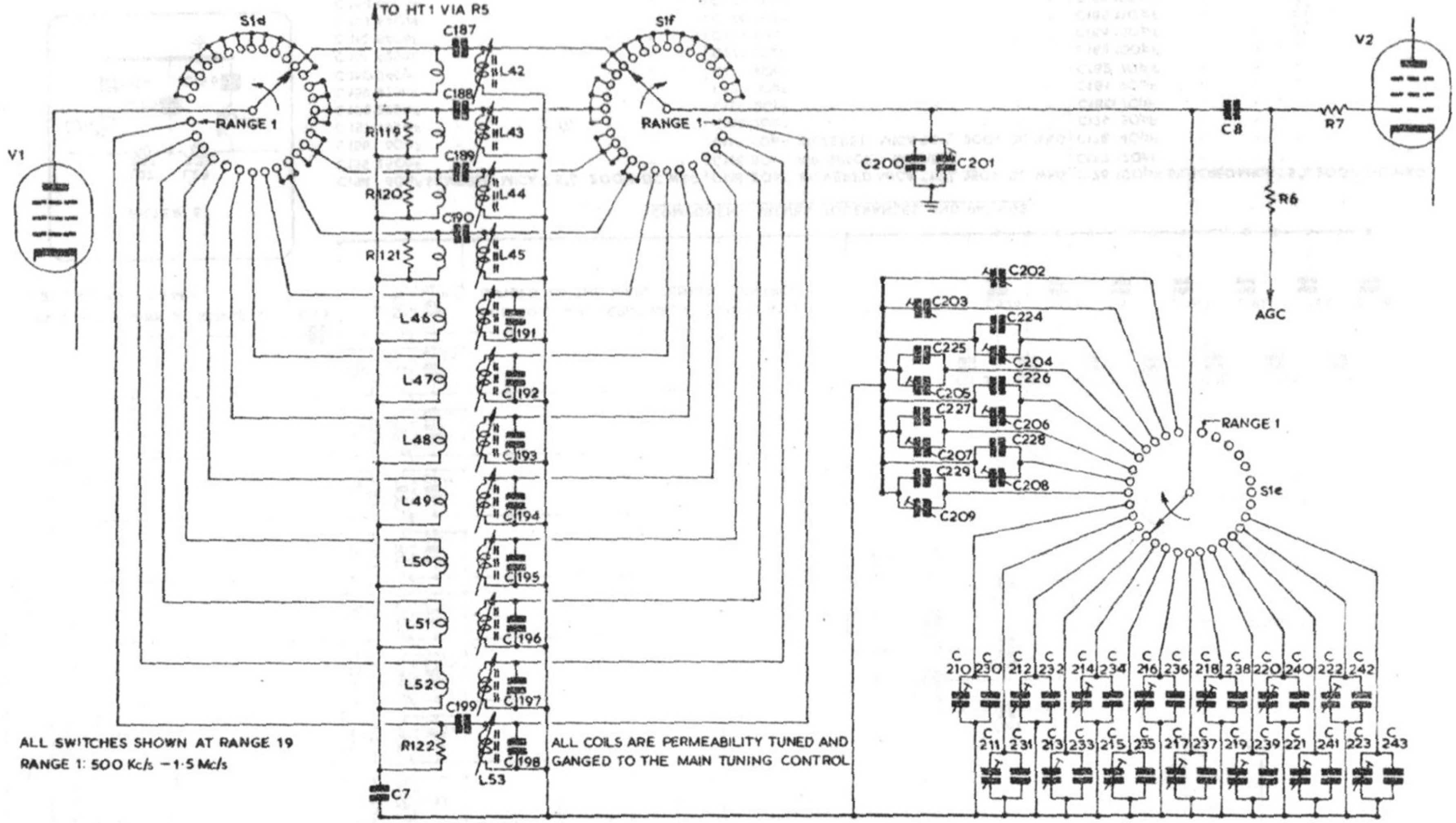


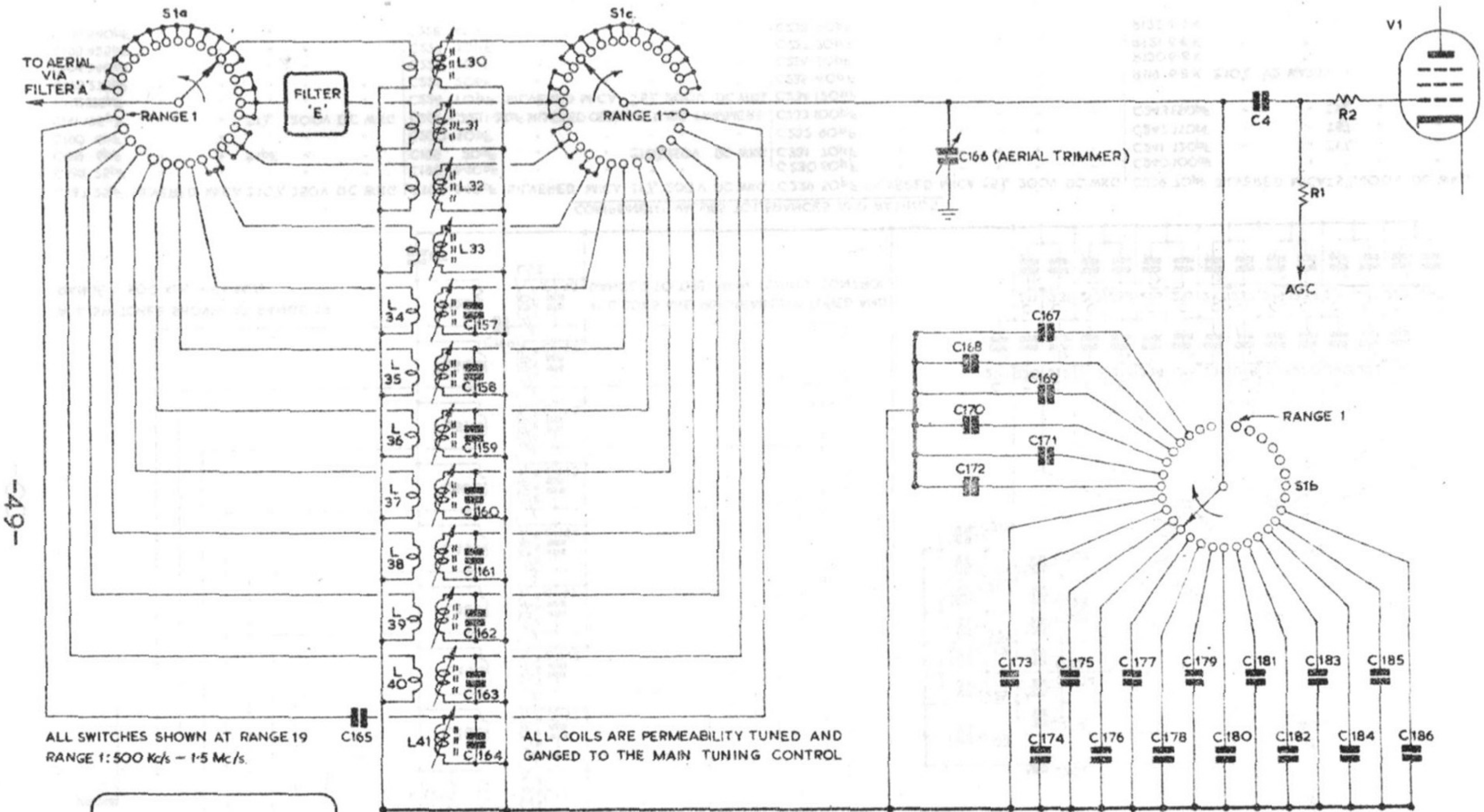
FIG 5 LOCATION OF R.F. AND I.F. TRIMMING ADJUSTMENTS.

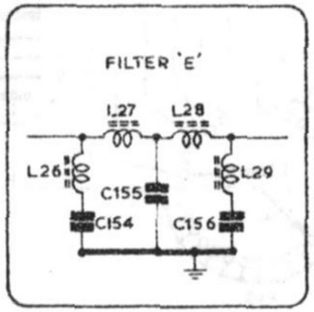


COMPONENT VALUES TOLERANCES AND RATINGS.

C187 25pF SILVERED MICA ±10% 350V DC WKG.	C197 640pF SILVERED MICA ±1% 200V DC WKG	C229 50pF SILVERED MICA ±5% 200V DC WKG	C239 70pF SILVERED MICA ±5% 200V DC WKG.
C188 25pF " " " " "	C198 640pF " " " " "	C230 60pF " " " " "	C240 100pF " " " "
C189 6pF " " ±1pF " "	C199 20pF " " ±10% 350V DC WKG	C231 70pF " " " " "	C241 130pF " " ±1% " "
C190 6pF " " " " "	C200 10pF " " " " "	C232 90pF " " " " "	C242 110pF " " ±5% " "
C191 195pF " " ±1% 200V DC WKG.	C201-C223 1-22pF SILVERED CERAMIC TUBE TRIMMERS	C233 100pF " " " " "	C243 150pF " " ±1% " "
C192 225pF " " " " "	C224 10pF SILVERED MICA ±5% 200V DC WKG	C234 120pF " " " " "	
C193 275pF " " " " "	C225 20pF " " " " "	C235 40pF " " " " "	R119 6·8 K ±10% ½ WATT
C194 340pF " " " " "	C226 20pF " " " " "	C236 50pF " " " " "	R120 6·8 K " "
C195 425pF " " " " "	C227 30pF " " " " "	C237 70pF " " " " "	R121 6·8 K " "
C196 540pF " " " " "	C228 40pF " " " " "	C238 90pF " " " " "	R122 4·7 K " "

DETACHED CIRCUIT No. 2.



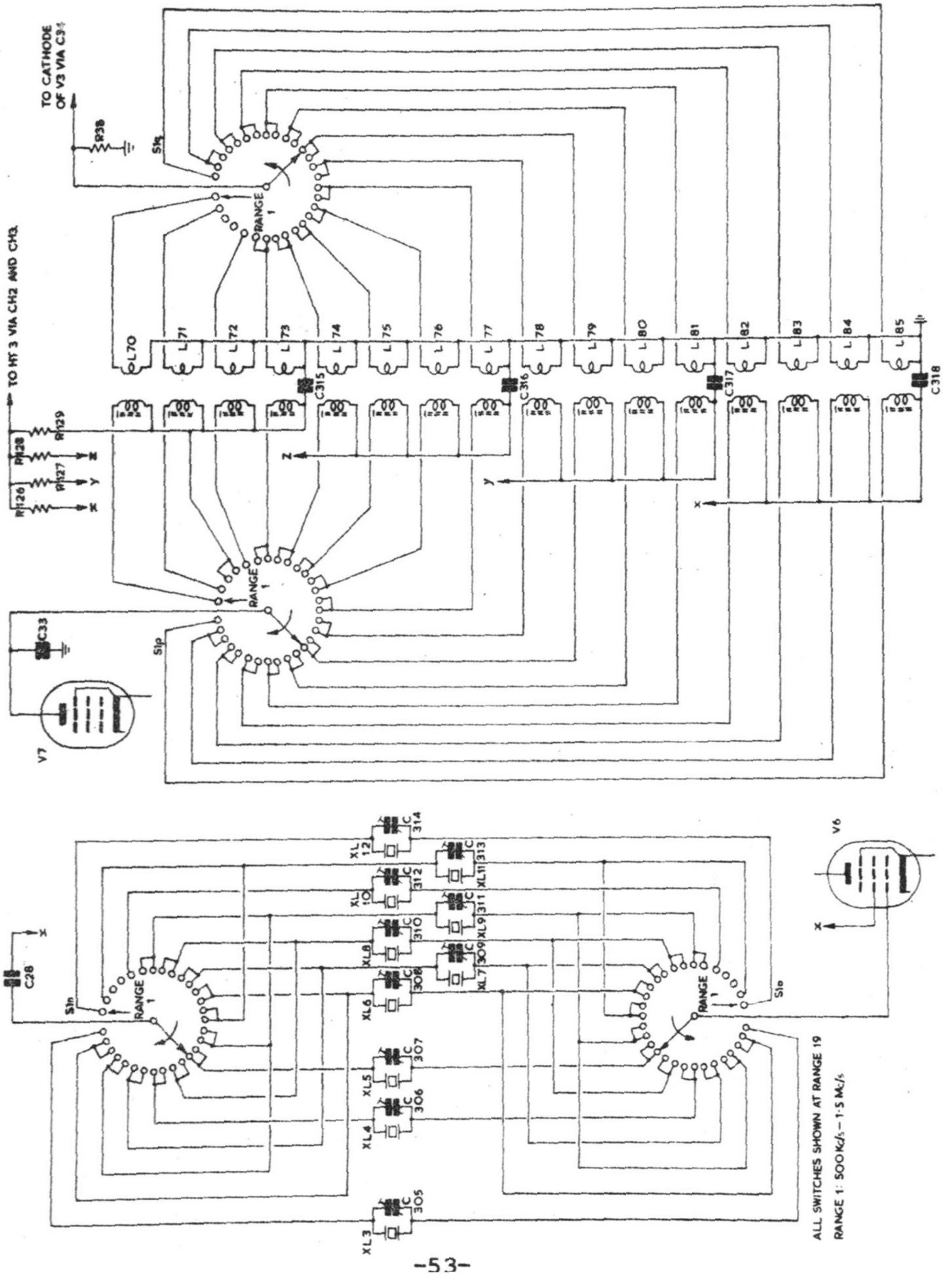


COMPONENT VALUES TOLERANCES AND RATINGS.

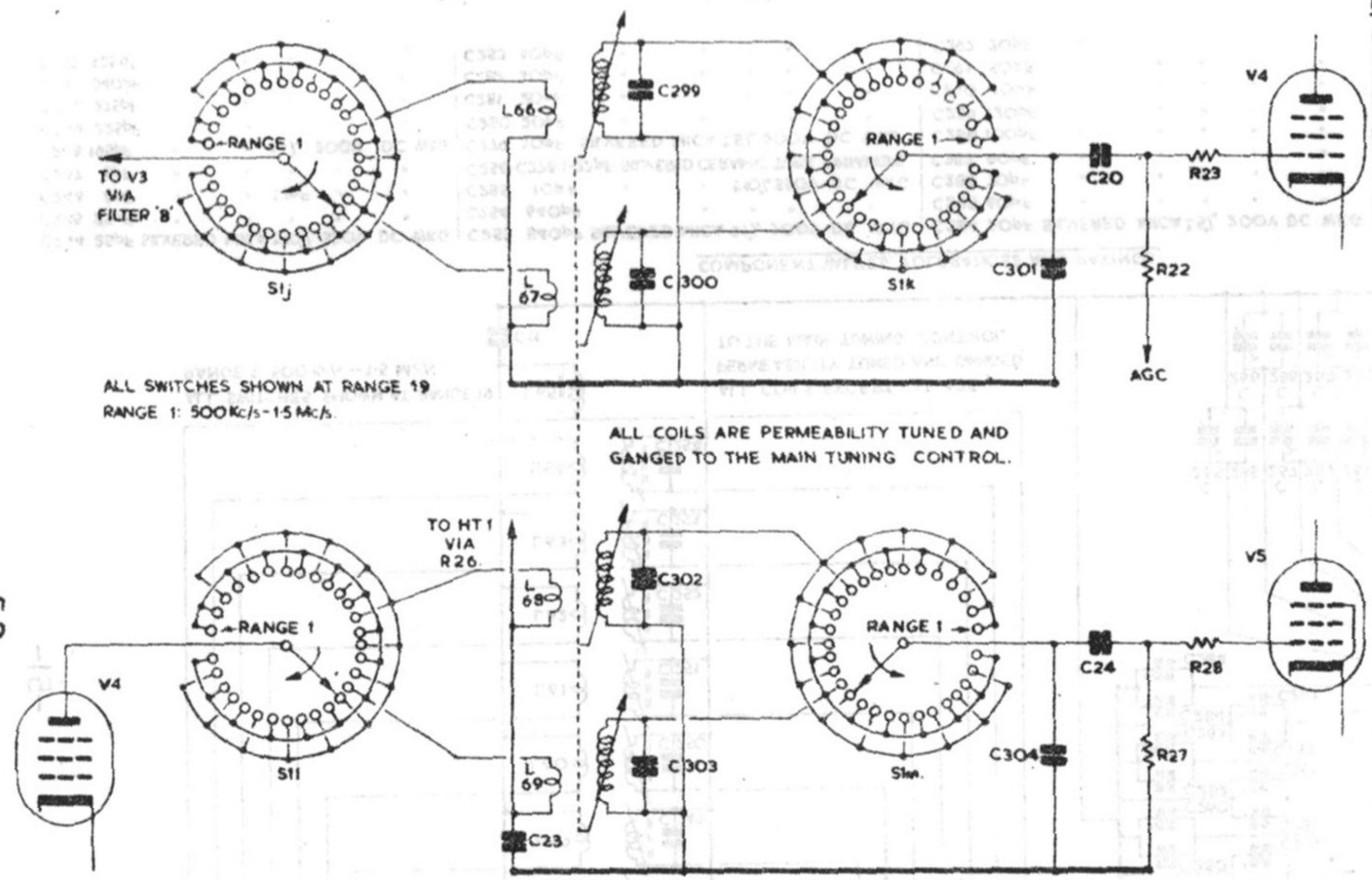
C154 60pF	SILVERED MICA ± 5% 200V DC WKG.	C165 20pF	SILVERED MICA ± 10% 350V DC WKG
C155 250pF	" " " " " "	C166 50pF	AIR SPACED VARIABLE
C156 60pF	" " " " " "	C167 10pF	SILVERED MICA ± 5% 200V DC WKG
C 157 195pF	" " ± 1% " " "	C168 20pF	" " " " " "
C 158 225pF	" " " " " "	C169 20pF	" " " " " "
C 159 275pF	" " " " " "	C170 30pF	" " " " " "
C 160 340pF	" " " " " "	C171 40pF	" " " " " "
C 161 425pF	" " " " " "	C172 50pF	" " " " " "
C 162 540pF	" " " " " "	C173 60pF	" " " " " "
C 163 640pF	" " " " " "	C174 70pF	" " " " " "
C 164 640pF	" " " " " "	C175 90pF	" " " " " "

C176 100pF	SILVERED MICA ± 5% 200V DC WKG.
C177 120pF	" " " " " "
C178 40pF	" " " " " "
C179 50pF	" " " " " "
C180 70pF	" " " " " "
C181 90pF	" " " " " "
C182 70pF	" " " " " "
C183 100pF	" " " " " "
C184 130pF	" " 1% " " "
C185 110pF	" " 5% " " "
C186 150pF	" " 1% " " "

DETACHED CIRCUIT No.1.


TO CATHODE OF V3 VIA C34
R38
S1q
RANGE 1
TO HT 3 VIA CH2 AND CH3
R126
R127
R128
R129
X
Y
Z
L70
L71
L72
L73
L74
L75
L76
L77
L78
L79
L80
L81
L82
L83
L84
L85
C315
C316
C317
C318
V7
C33
S1p
C28
S1n
S1o
XL3
XL4
XL5
XL6
XL7
XL8
XL9
XL10
XL11
XL12
C305
C306
C307
C308
C309
C310
C311
C312
C313
C314
V6
ALL SWITCHES SHOWN AT RANGE 19
RANGE 1: 500 Kc/s – 1·5 Mc/s

DETACHED CIRCUIT No. 4



COMPONENT VALUES, TOLERANCES AND RATINGS.

C299 275pF S.MICA ±1% 200V DC WKG
C300 225pF S.MICA ±1% 200V DC WKG
C301 25pF S.MICA ±5% 200V DC WKG

C302 275pF S.MICA ±1% 200V DC WKG.
C303 225pF S.MICA ±1% 200V DC WKG.
C304 25pF S.MICA ±5% 200V DC WKG.

DETACHED CIRCUIT No. 5 (SEE OPPOSITE)

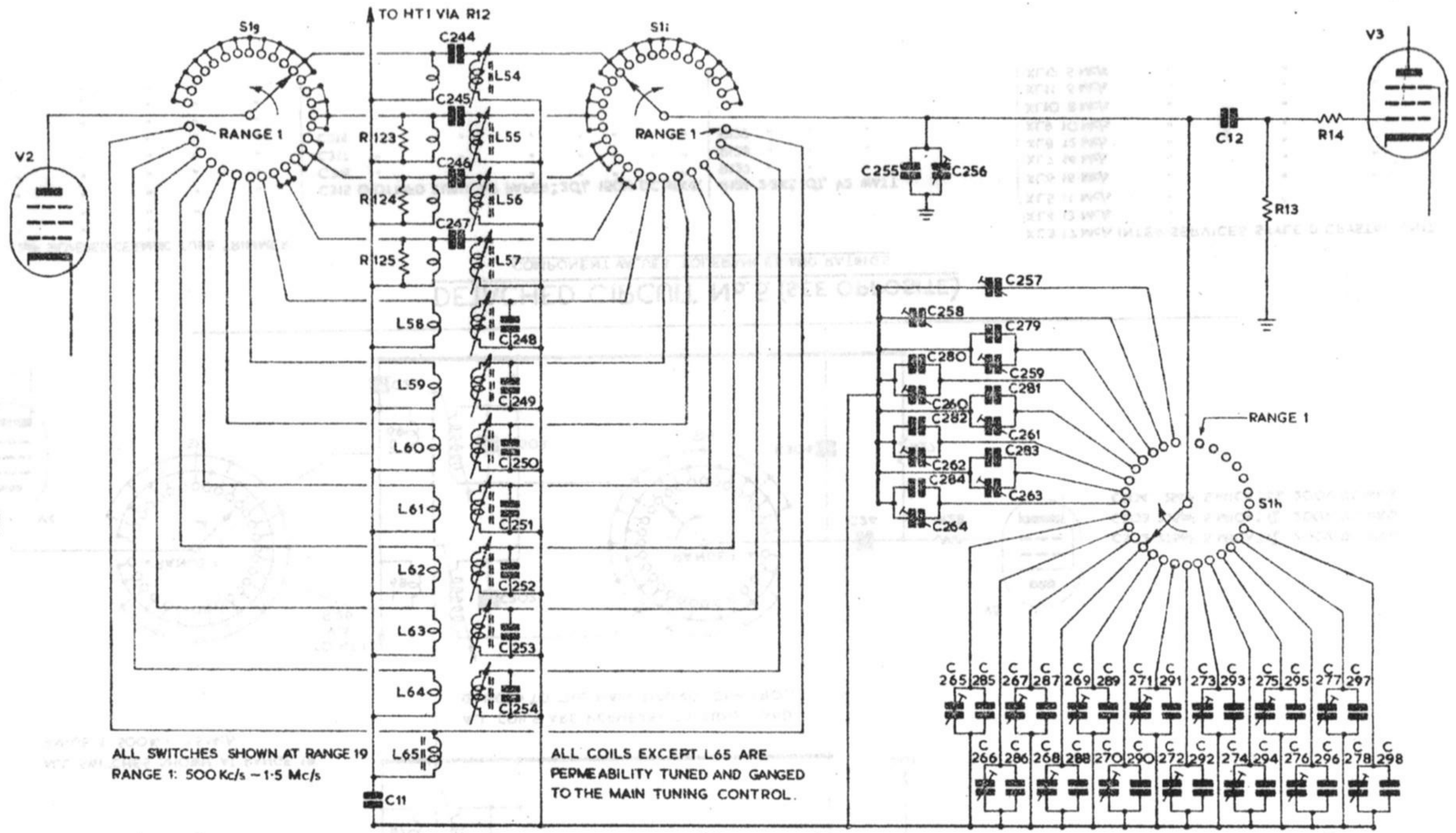
COMPONENT VALUES, TOLERANCES AND RATINGS.

C305 1-22pF SILVERED CERAMIC TUBE TRIMMER.
C306 " " " " "
C307 " " " " "
C308 " " " " "
C309 " " " " "
C310 " " " " "
C311 " " " " "
C312 " " " " "
C313 " " " " "
C314 " " " " "

C315 0·01 MFD TUBULAR PAPER ±20% 150V DC WKG.
C316 " " " " " " " "
C317 " " " " " " " "
C318 " " " " " " " "

R126 2·2K ±10% ½ WATT.
R127 " " "
R128 " " "
R129 " " "

XL3 17 Mc/s INTER-SERVICES STYLE 'D' CRYSTAL UNIT.
XL4 13 Mc/s " " "
XL5 11 Mc/s " " "
XL6 16 Mc/s " " "
XL7 14 Mc/s " " "
XL8 12 Mc/s " " "
XL9 10 Mc/s " " "
XL10 8 Mc/s " " "
XL11 6 Mc/s " " "
XL12 5 Mc/s " " "



COMPONENT VALUES. TOLERANCES AND RATINGS.

C244 25pF SILVERED MICA ±10% 350V DC WKG	C253 540pF SILVERED MICA ±1% 200V DC WKG	C284 50pF SILVERED MICA ±5% 200V DC WKG	C293 90pF SILVERED MICA ±5% 200V DC WKG
C245 25pF " " " " "	C254 640pF " " " " "	C285 60pF " " " " "	C294 70pF " " " " "
C246 6pF " " ±1pF " "	C255 10pF " " ±10% 350V DC WKG	C286 70pF " " " " "	C295 100pF " " " " "
C247 6pF " " " " "	C256-C278 1-22pF SILVERED CERAMIC TUBE TRIMMERS	C287 90pF " " " " "	C296 130pF " " ±1% " "
C248 195pF " " ±1% 200V DC WKG	C279 10pF SILVERED MICA ±5% 200V DC WKG	C288 100pF " " " " "	C297 110pF " " ±5% " "
C249 225pF " " " " "	C280 20pF " " " " "	C289 120pF " " " " "	C298 150pF " " ±1% " "
C250 275pF " " " " "	C281 20pF " " " " "	C290 40pF " " " " "	R123 6·8K 10% ½ WATT.
C251 340pF " " " " "	C282 30pF " " " " "	C291 50pF " " " " "	R124 6·8K " "
C252 425pF " " " " "	C283 40pF " " " " "	C292 70pF " " " " "	R125 6·8K " "

DETACHED CIRCUIT No.3.

TECHNICAL SUPPLEMENT TO THE MODEL 880 INSTRUCTION MANUAL

This supplement has been prepared in response to many enquiries relating to the Model 880. It amplifies certain information contained in the Instruction Manual and also gives additional information on some special features of the receiver.

PERFORMANCE

Sensitivity.

Experience has shown that the sensitivity of the Model 880 is superior to that of other receivers of comparable design/cost and that the performance is such that signals of level below 1uV can be copied satisfactorily under conditions of strong adjacent channel interference.

Selectivity.

Curves are attached and these will give a clearer picture of the overall selectivity. The NARROW position should be used for SSB reception.

Stability.

Although the outside limit of long term drift is quoted as 50 c/s, the performance of an average receiver indicates that a long term stability of 15 - 20 c/s can be expected under normal operational conditions.

Cross Modulation etc.

Great care has been taken in the design of the Model 880 to ensure excellent performance with respect to cross modulation, intermodulation and blocking since it is well known that receivers of this type often fail to meet their specification when subjected to high level "off channel" interference. This receiver is very suitable for use in situations where high power transmitting equipment is located close to the receiving site.

Audio Response.

The graph attached replaces that on page 45 of the Manual and takes account of the revised audio circuitry.

The switched Bass filter is extremely useful in restoring a balance to the received transmission when high selectivity is being used. Cutting the bass to oompensate for the loss of the high frequencies will render a signal far more readable than would otherwise be the case.

Radiation.

Radiation from the 2nd Oscillator Unit is virtually undetectable at the fundamental and harmonics are non-existent.

Radiation from the 1st Oscillator Unit does not exceed 5uV into 75 ohms at the fundamental frequency and any harmonic radiation is at least 10dB below this figure.

It is doubtful whether any other standard production receiver can compete with the Model 880 in this respect and the receiver is therefore the logical choice for installations that combine HF and VHF monitoring in the same building.

•

BFO Note Stability.

The excellent properties of the Model 880 under high signal input conditions are emphasised by the fact that an increase of input from 10uV to 1000mV produces no detectable change in the output beat note.

REMOTE FREQUENCY CONTROL

The internal Reactance Control Stage permits fine tuning of the receiver from a distant listening point when the receiver is situated at a remote location.

Two methods of control are possible one of which requires an external control voltage. In this case a swing of 6 kc/s is available for a voltage change of approximately 12 volts. If an external supply is not available, a total coverage of approximately 3 kc/s can be obtained.

The main advantage of the system is that the receiving operator is made more independent of the receiving station staff since any transmitter drift can be compensated for at the listening point - a feature of great importance when single sideband transmissions are being monitored. In the case of CW reception each operator will have a preference for a certain pitch of note dependent on the interference present. This feature gives just the control needed under such conditions.

DIVERSITY RECEPTION

During the development of the Model 880, the need for a high stability diversity equipment with flexible frequency control was borne in mind. As a result, the Model 880 is the ideal receiver for incorporation in existing installations especially where such installations are remotely located.

Provision is made for linking the receiver AGC lines so that the signal-to-noise ratio is determined by the receiver having the greatest input.

When the diversity installation is located at a distance, it is advantageous to be able to peak the receiver tuning from the monitoring position. In this case, common oscillator control may be used with one 2nd Oscillator Unit controlling its own receiver and also up to two others. The reactance control system will then permit simultaneous re-adjustment of the complete installation.

Common oscillator control also offers an advantage when it is necessary to make frequent changes in the monitored channel. For normal fixed frequency working however, the high stability of individual oscillator units and the provision of independent tuning meters makes common oscillator working unnecessary in installations that are not remotely located.

Combination of the outputs can be arranged using any series or parallel connection of the 2.5 ohm and 600 ohm secondary windings (T9), a matching transformer being used to feed a single channel amplifier (if required) either direct or over lines.

..

Some slight advantage in the form of reduced detector distortion can be obtained if the 500 kc/s IF Output sockets are used as the source of diversity signals. In this case, an external 500 kc/s demodulator unit using separate diodes working into a common load would be required. The audio signal developed across this load could be fed into the Audio Section of one of the diversity receivers via JK1. The Audio Section of the other receiver(s) would not of course be used. A further advantage of this system is that direct outputs of 2.5 and 600 ohms are available without the need for external matching devices.

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

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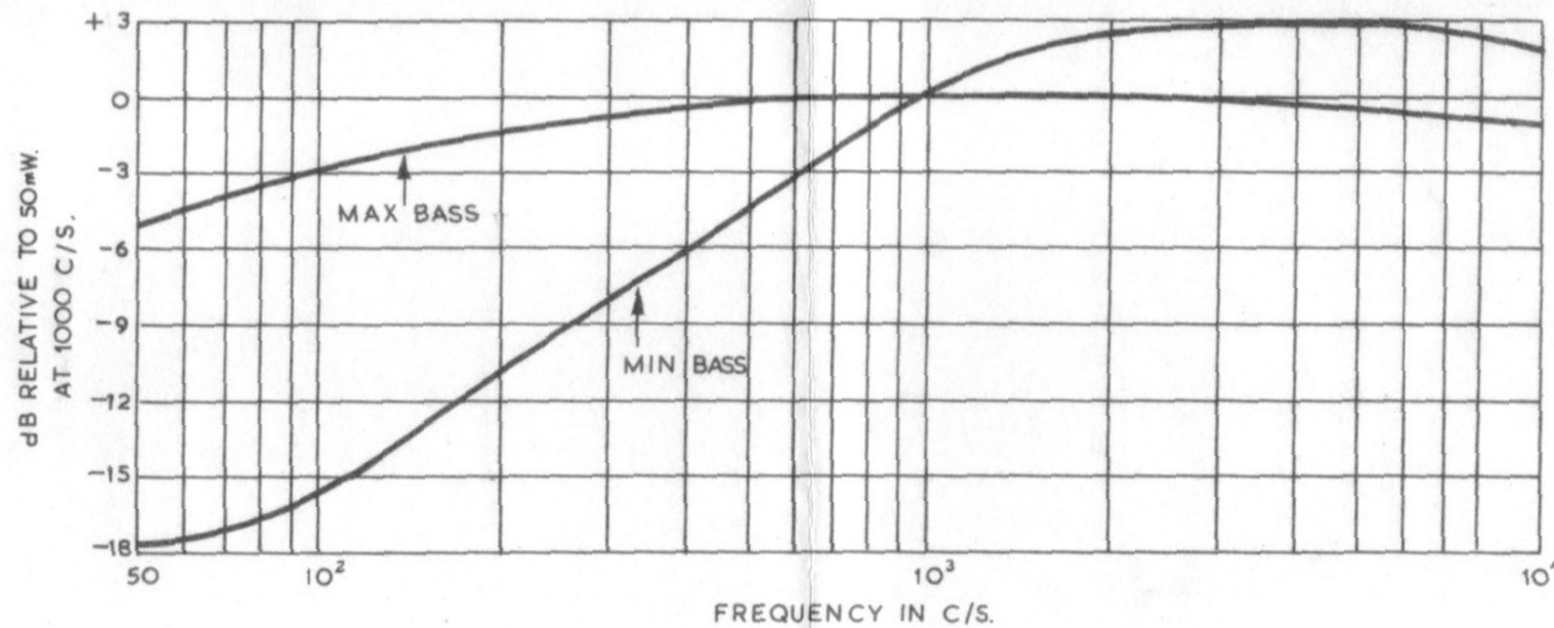
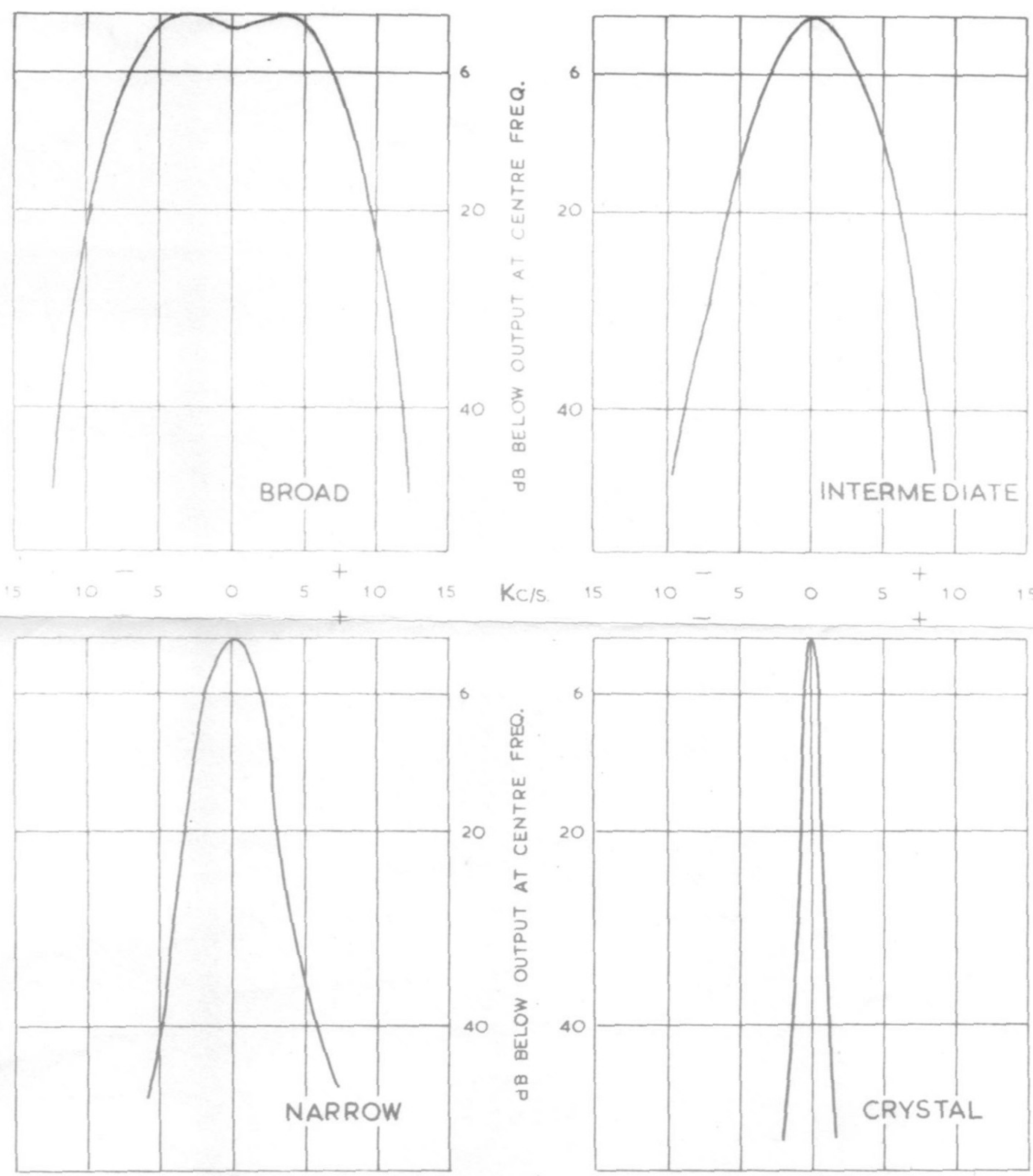


AUDIO RESPONSE IN MAXIMUM AND MINIMUM POSITIONS OF BASS SWITCH.

(AUDIO FILTER OUT OF CIRCUIT AND VOLUME CONTROL AT MAX.)



I.F. SELECTIVITY–MODEL 880.

Model 'S880'

December 1959

AMENDMENT SHEET NO. 2

(Supersedes Sheet No. 1 - Sept. 1959)

The following changes and corrections should be made to the text to cover modifications etc. carried out since the preparation and production of this Manual.

Page 2. Add to LIST OF CONTENTS:-
"Corrigendum - Revision of Crystal Positions (XL3-XL12) .. .. .. Following Page 53."

Pages 3, 18 and 19. The LT current consumption should be given as 6.6A.

Page 4. In TABLE 1:-
Delete "D1 . . CV448" and substitute "V21 . . 6489 (CV469)"
Transpose V15A and V15B. V15A functions as Meter Control Valve.
Alter "D2-D5" to read "D1-D4".

Pages 5 and 6. In the paragraphs headed "Cross Modulation" and "Blocking", 20dB should read 60dB. In the paragraph headed "AGC", 1uV should read 3uV.

Page 7. Fourth line from foot of page should read:-
".........in the band 2.5-4.5 Mc/s, the ...."

Pages 12 and 13. References to "the germanium diode D1" should be altered to read:- " the miniature diode V21". At the foot of Page 13, "R105 and R108" should read "R104 and R108".

Page 28. Alongside the heading "XL3-XL12" add:- "See Corrigendum at rear of Manual".

Pages 30 and 31. References to Neosid trimming tool should read "H.S.3.".

Page 37. Add base connections for V21 as follows:-
"B5B/F Base. Type 6489 (CV469) - Anode 2&5, Cathode 3, Heater 1&4".

Page 45. Fig. 1. As a result of modifications to the circuitry associated with V17, V18 and V19, the audio response shown in Fig. 1. is incorrect. Typical response figures are now as follows:-

f in c/s	50	100	500	1000	5000	10,000
MAX BASS	-5dB	-3dB	-0.1dB	0dB	-0.2dB	-1.2dB
MIN BASS	-18dB	-16dB	-4dB	0dB	+3dB	+2dB

All figures are relative to 50mW output at 1000 c/s and the response is maintained at outputs up to 2 watts.

~~Page 47. Fig. 4. Add:- "NOTE: C104a not shown".~~ ALS

Page 49. Detached Circuit No. 1. A 68 ohm resistor should be shown connected between the S1a side of C165 and chassis. The component should be referenced R118a and added to the list at the foot of the diagram:- "R118a 68 ohms ± 10% ¼ watt".

NOTE: APPENDIX 'B' at the rear of this manual has been amended, as have Parts 1 and 2 of the Main Circuit Diagram.

1259150

 December 1960

AMENDMENT SHEET NO. 6

(To be used in conjunction with Sheets 2-5)

Page 39. Change C54 to read "12 pF Silvered Mica ± 1 pF 350V DC wkg."

Page 41. Change C126 to read "12 pF Silvered Mica ± 1 pF 350V DC wkg."

Page 43. Change R45 to read "0.1 Megohm ± 10% ½ watt."

Page 43. Change R96 to read "0.1 Megohm ± 10% ½ watt."

THE FOLLOWING CHANGES ARE APPLICABLE TO THE 1ST LOCAL OSCILLATOR UNIT.

Main Circuit Diagram - Part 1.

*Note that a 3pF capacitor is added between g1 of V6 and ground.

*Add a 3pF capacitor between g1 of V6 and ground.

This component *is/should be referenced C28a and is to be added to the component list on Page 38:-

"C28a 3 pF Silvered Ceramic ± ½ pF 350V DC wkg."

Detached Circuit No. 5.

The wiring of S1n and S1o should be changed as follows:-

The 10 Mc/s crystal (XL9) should be shown wired to the vacant switch contacts on Ranges 3 and 4. This change is necessary to avoid exceeding the rated dissipation at the screen of V6 when using the reduced value of R32 listed below.

Page 38. Change C27 to read "1500 pF Silvered Ceramic ± 20% 350V DC wkg."

Page 43. Change R32 to read "2,200 ohms ± 10% ½ watt."

*delete as appropriate.

Model 880

January
1961

AMENDMENT SHEET NO. 7

(To be used in conjunction with Sheets 2-6)

Page 38. C17 should read:- "90 pF Silvered Mica ± 5% 200V DC wkg".
Page 38. C18 should read:- "100 pF Silvered Mica ± 5% 200V DC wkg".
Page 41. C124 should read:- "5000 pF Silvered Ceramic ± 20% 350V DC wkg".

Page 42. The NOTE below C153 should read:-

"C154-C319 See Detached Circuits 1-5".

NOTE: The working voltage for C54 and C126 should read 200V DC and not 350V DC as given in AMENDMENT SHEET NO. 6.

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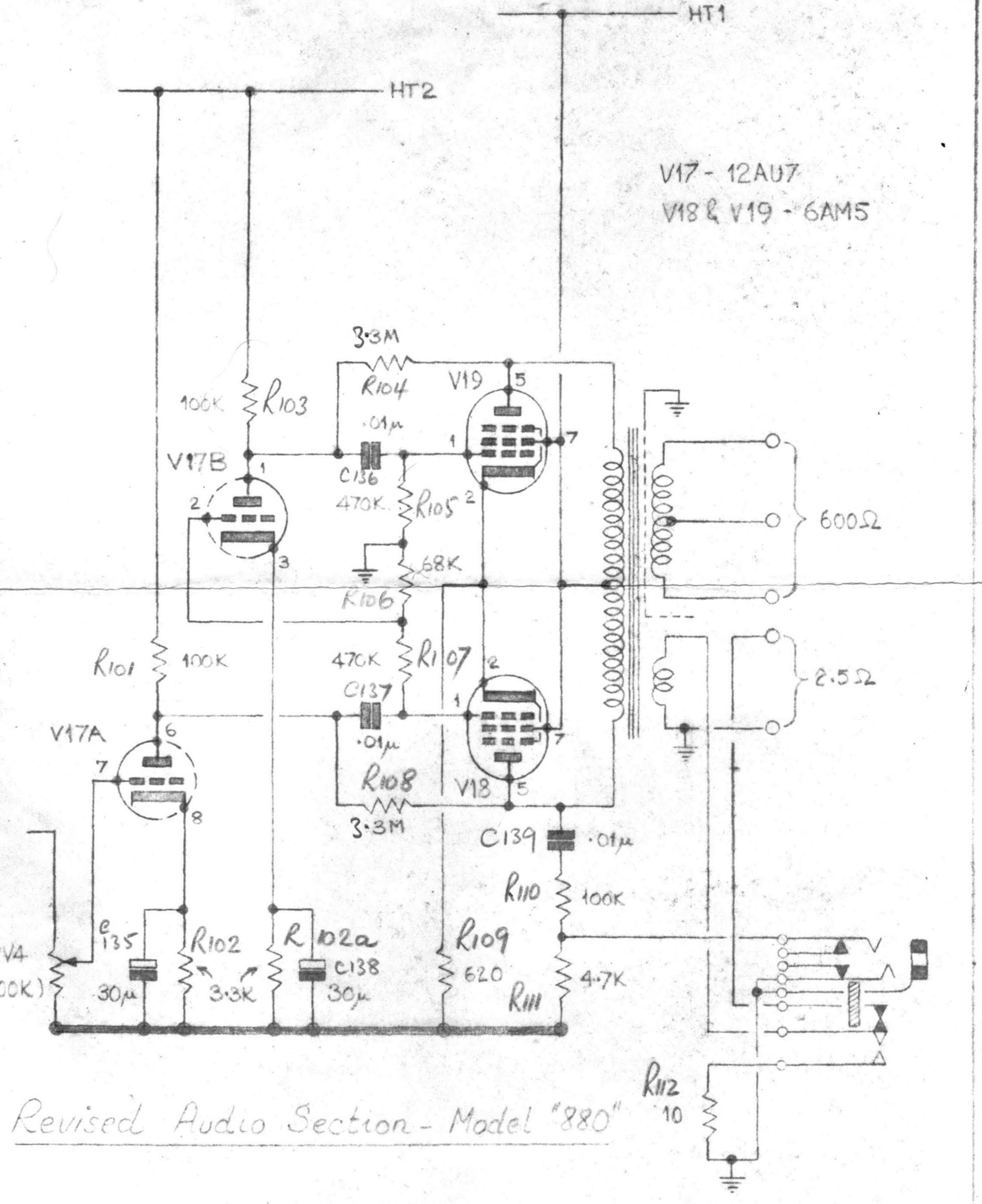
JAB 27.11.59



Revised Audio Section - Model "880"

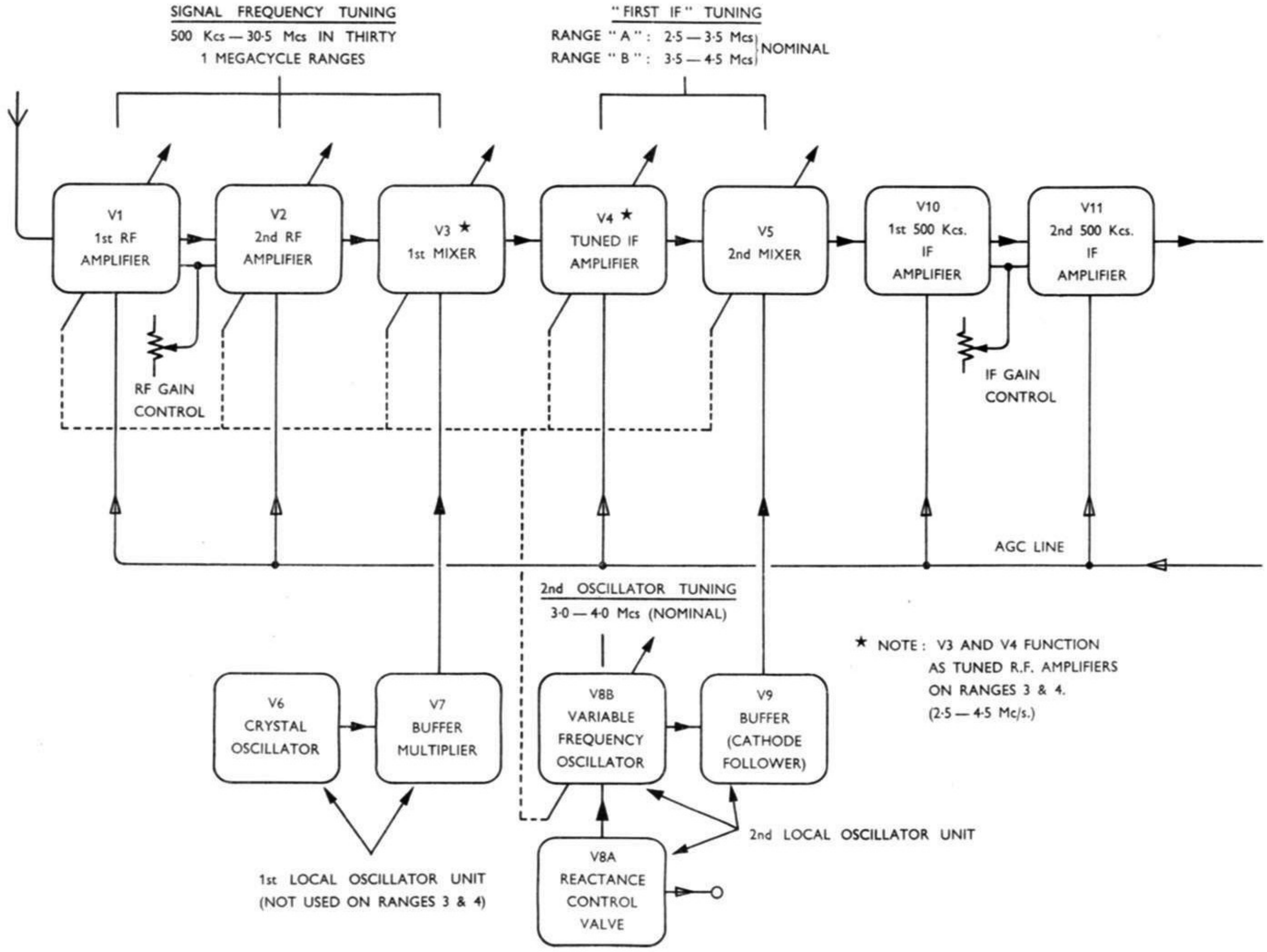


Fig. 3. Block Schematic

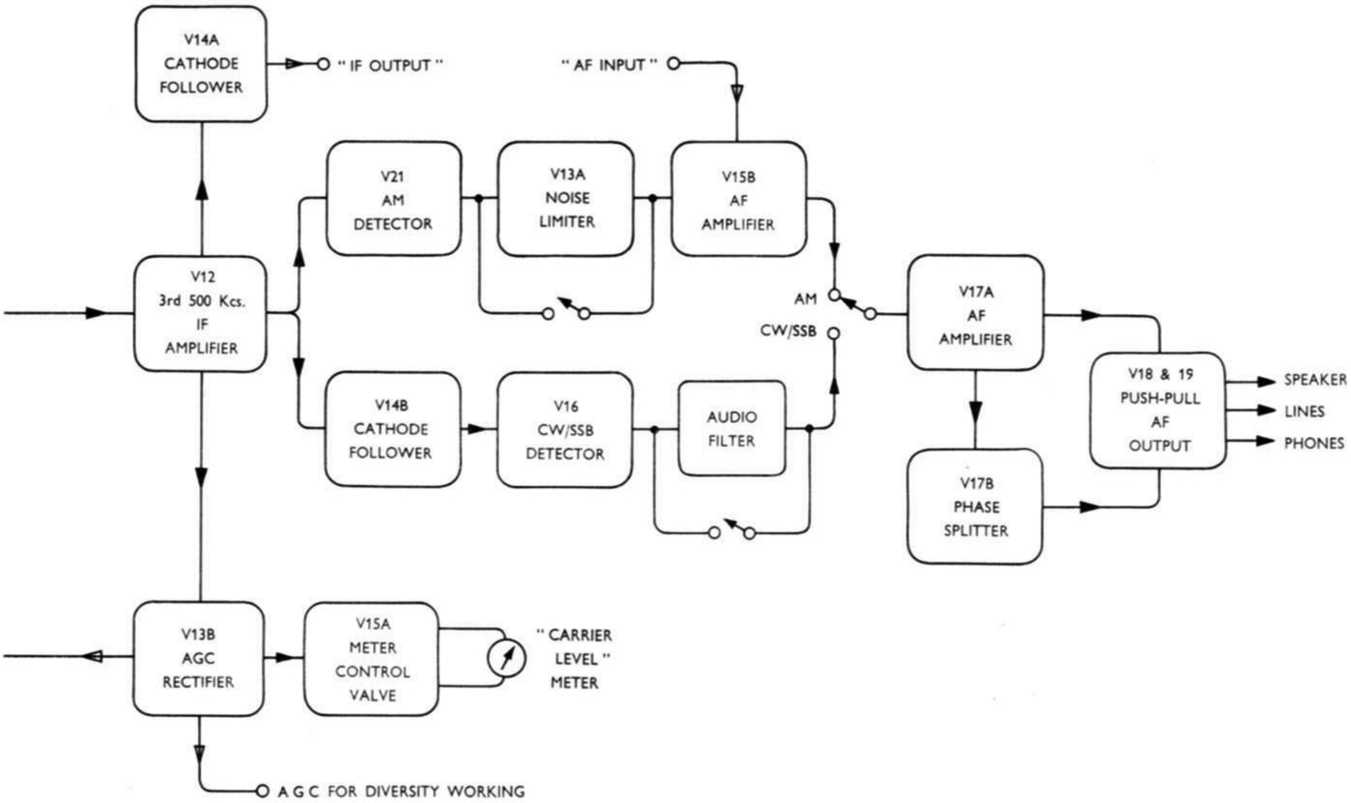
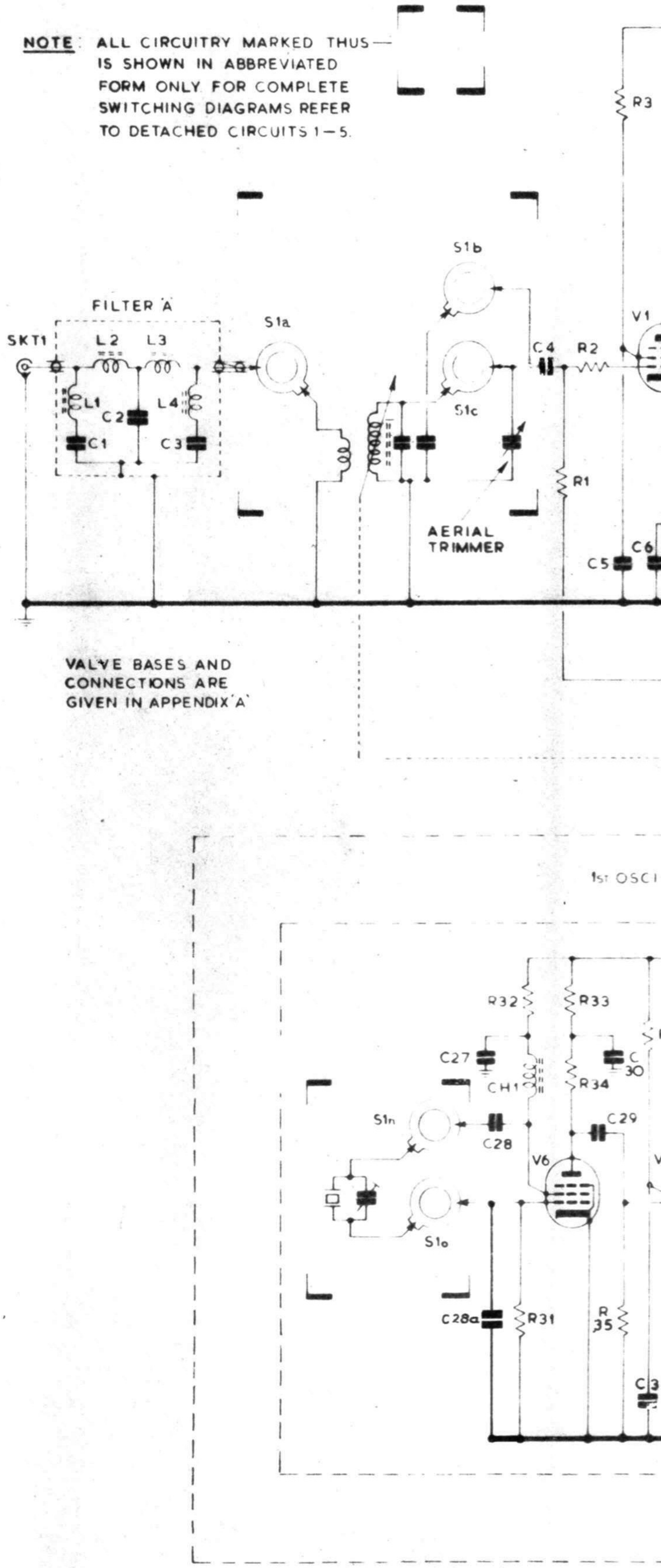


Diagram — Model 'S880'

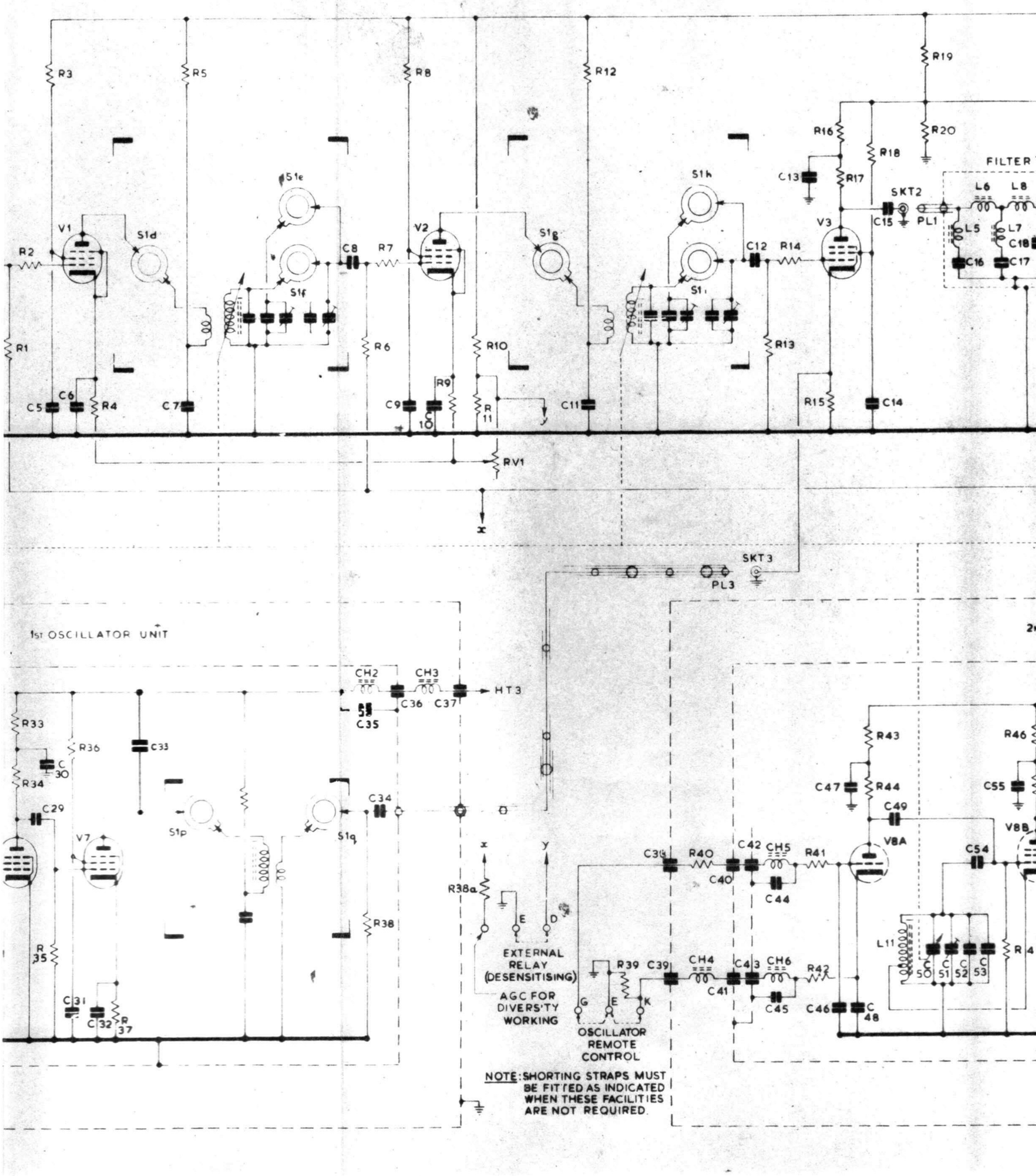
IT DIAGRAM

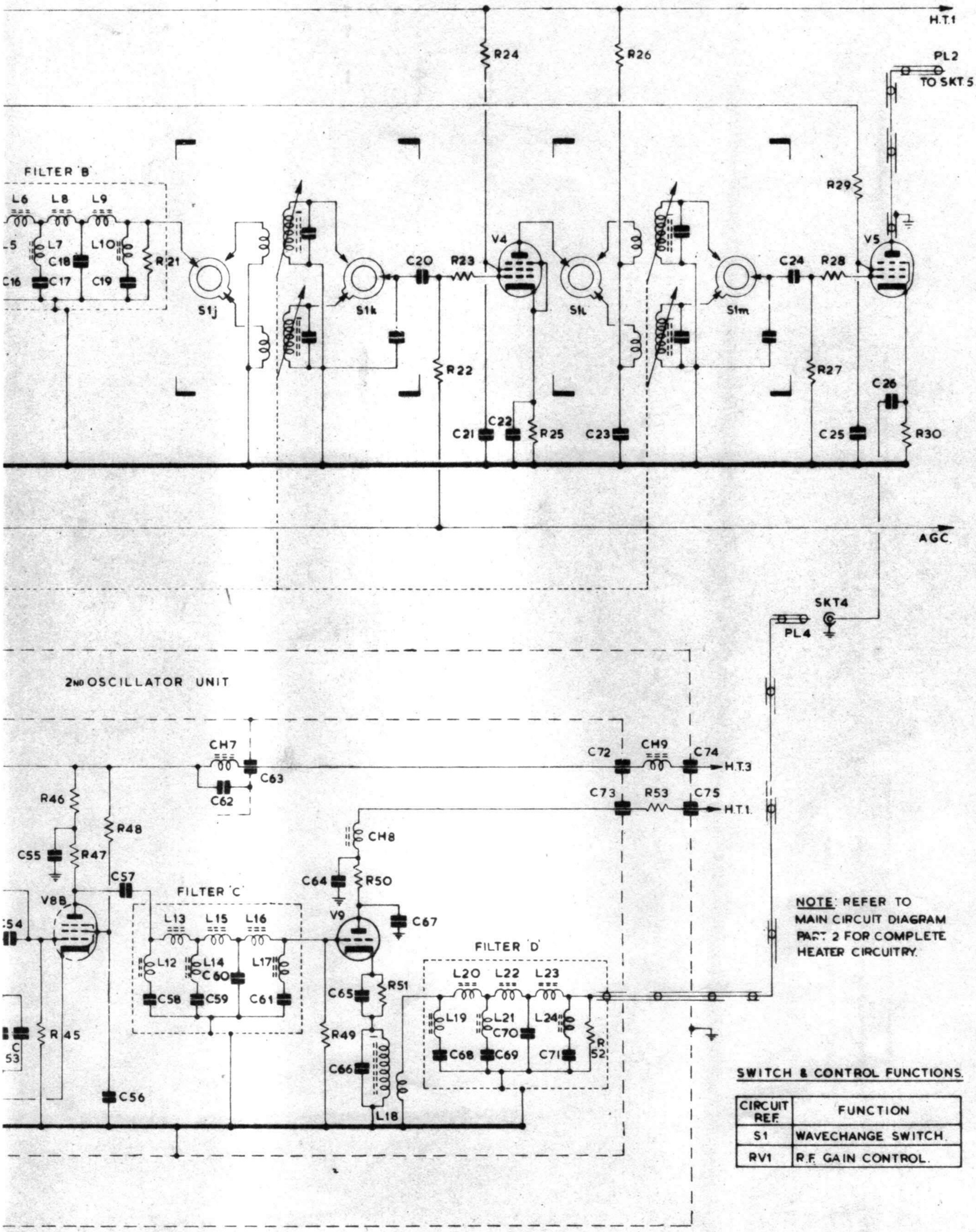
RT 1.

NOTE: ALL CIRCUITRY MARKED THUS — IS SHOWN IN ABBREVIATED FORM ONLY. FOR COMPLETE SWITCHING DIAGRAMS REFER TO DETACHED CIRCUITS 1—5.



VALVE BASES AND CONNECTIONS ARE GIVEN IN APPENDIX 'A'

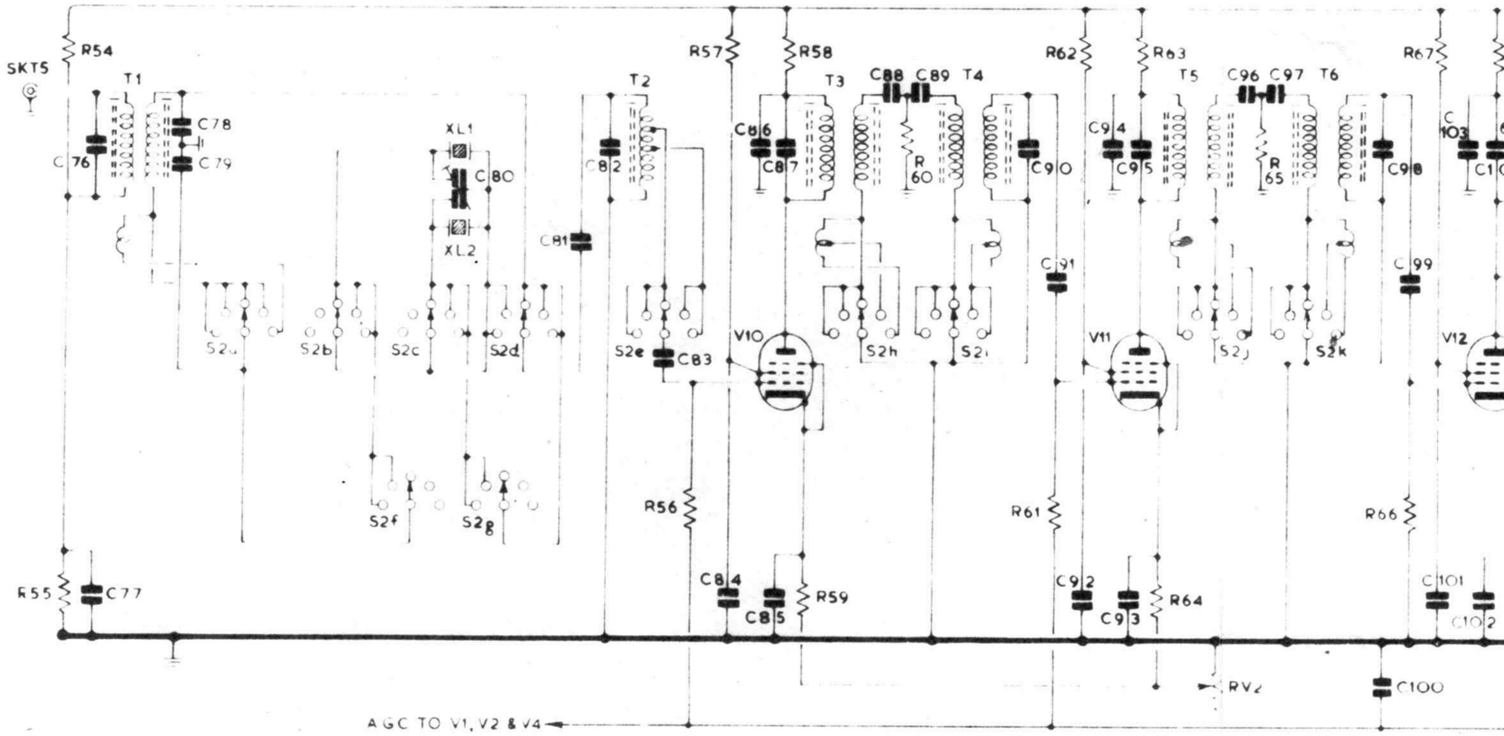

R3
R5
R8
R12
R19
R20
R16
R18
R17
C13
FILTER
S1e
S1h
V1
S1d
R2
S1f
C8
R7
V2
S1g
C12
R14
V3
SKT2
C15
PL1
L6
L8
L5
L7
C18
C16
C17
S1i
R1
R6
R10
R13
C5
C6
R4
C7
C9
R9
C10
R11
C11
R15
C14
RV1
x
y
SKT3
PL3
1st OSCILLATOR UNIT
CH2
CH3
C35
C36
C37
HT3
R33
R36
C33
C30
R34
C29
C34
S1p
S1q
V7
R35
R38
C31
C32
R37
R38a
E
D
EXTERNAL RELAY (DESENSITISING)
AGC FOR DIVERSITY WORKING
R43
R46
C47
R44
C55
C49
V8A
V8B
C38
R40
C42
CH5
R41
C54
C40
C44
L11
C50
C51
C52
C53
R39
C39
CH4
C43
CH6
R42
C41
C45
C46
C48
G
K
OSCILLATOR REMOTE CONTROL
NOTE: SHORTING STRAPS MUST BE FITTED AS INDICATED WHEN THESE FACILITIES ARE NOT REQUIRED.



NOTE: REFER TO MAIN CIRCUIT DIAGRAM PART 2 FOR COMPLETE HEATER CIRCUITRY.

SWITCH & CONTROL FUNCTIONS.

CIRCUIT REF.	FUNCTION
S1	WAVECHANGE SWITCH.
RV1	R.F. GAIN CONTROL.



SWITCH FUNCTIONS

CIRCUIT REF	FUNCTION
S2	SELECTIVITY SWITCH
S3	NOISE LIMITER SWITCH
S4	AGC SWITCH
S5	MODE SWITCH
S6	BASS SWITCH
S7	MAINS SWITCH

CONTROL FUNCTIONS

CIRCUIT REF	FUNCTION
RV2	I.F. GAIN CONTROL
RV3	METER ADJ
RV4	A.F. GAIN CONTROL
RV5	DIAL LAMP BRILLIANCY
C128	BFO PITCH

SWITCH POSITIONS

S2

NARROW
CRYSTAL
INTERMEDIATE
CRYSTAL WITH AUDIO FILTER
BROAD

S4

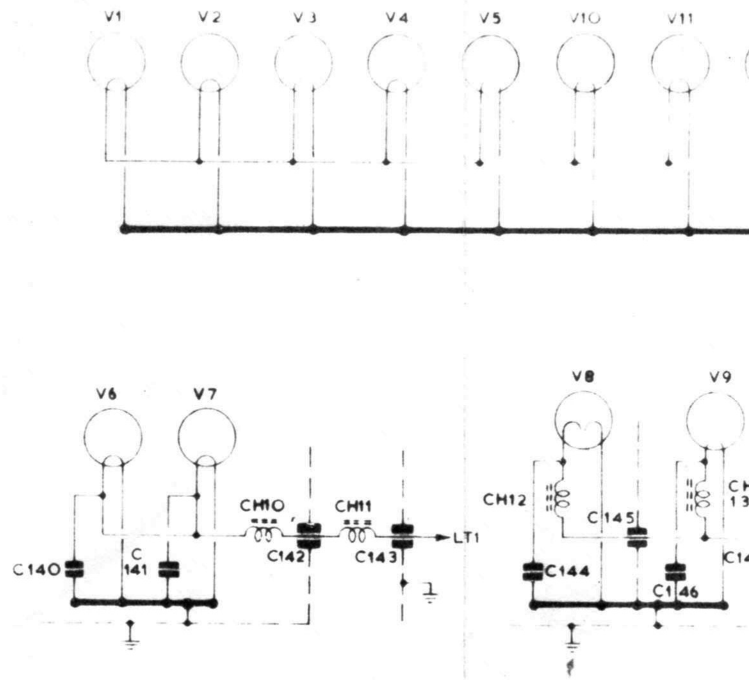
AGC FAST
AGC OFF
AGC SLOW

S5

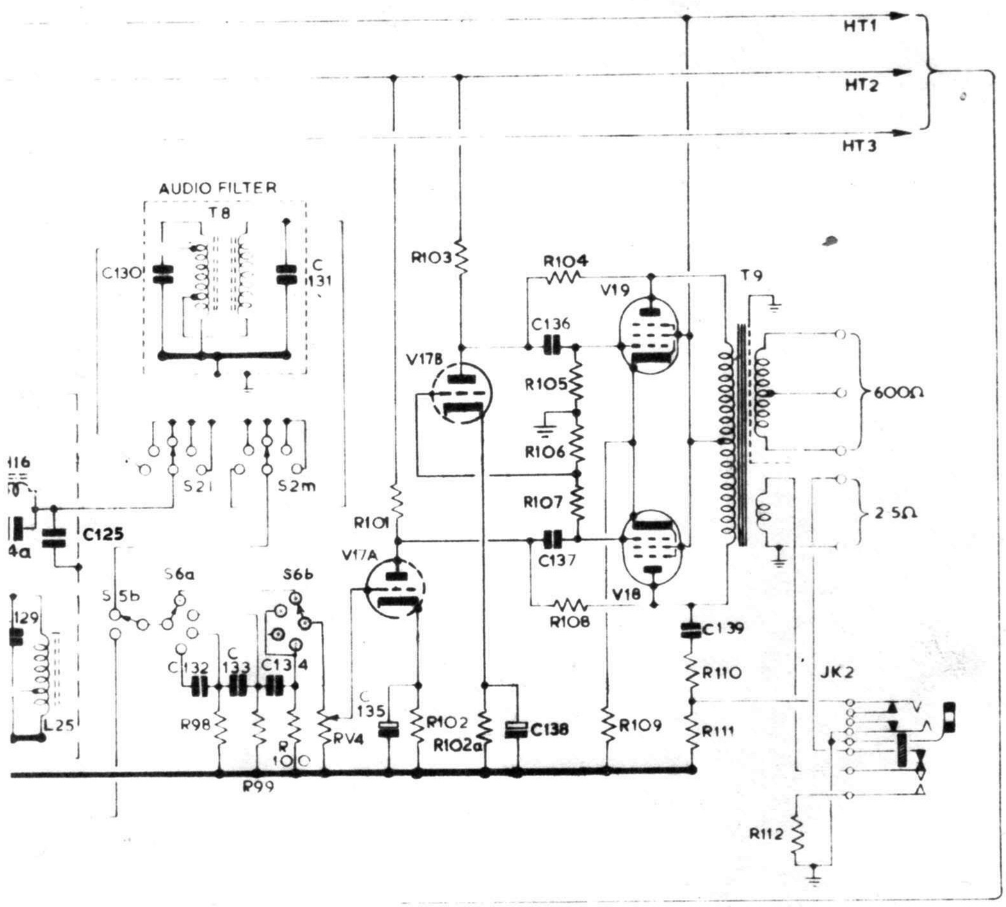
AM
CW/SSB

SWITCHES ON MAIN DIAGRAM SHOWN IN POSITIONS AS ABOVE. S3 ON, S7 OFF AND S6 SHOWN IN MAXIMUM POSITION.

HEATER C




AUDIO FILTER
T8
C96 C97 T6
R65
T7
R67 R68
C103 R69 C104
C98
C106 C107 C108
V21
C112
R83a
R83
C116
V14A V14B
SKT6
C113
R80 R81 R84
IF OUTPUT
C117
R92 S5a
C120 C121
C130
R74 V13A R76
S3
C99 C105
V12
R73
C109
R75
C110
S2j S2k
R93 R94
CH16
C124
C123
C124a
C125
R91 V16
C122
S21
JK1
AF INPUT
R82
V15A
R88
C118
V15B
S5b S6a
V13B
R66
R77
R79
RV3
M1
R85
R87
R90
R96
R97
C126
C129
C128
C127
L25
C132 133
R98
R99
C101 C102 R70 R72
C111
R78
C114
R86
C119
R89
RV2
C100
R71
C115
S4
HEATER CIRCUITRY
V5 V10 V11 V12 V13 V14 V15 V16 V17 V18 V19 V21
C 149
LT1
LT2a
LT2b
HT3
HT2
HT1
R 113
R114
V20
C150
V8 V9
CH12
C145
CH 13
CH14
C144
C146
C147
C148
LT1
VALVE BASES AND
CONNECTIONS ARE
GIVEN IN APPENDIX 'A'
PL5
PL6
LT
HT
EXTERNAL
SUPPLIES
ACCESSORY
SUPPLIES



T10 PRIMARY SHOWN SET FOR 230V OPERATION. TAPPINGS FOR OTHER VOLTAGES ARE GIVEN IN THE SECTION ON INSTALLATION.