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Front view of Receiver Type RA.17

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THE RACAL COMMUNICATIONS RECEIVER
TYPE R.A.17

PART 1

TECHNICAL DETAILS
AND
OPERATION

PART 1

TECHNICAL DETAILS AND OPERATION

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TECHNICAL SPECIFICATION

Frequency Range

1–30 Mc/s. Range extends to 0·5 Mc/s with slight degradation of performance.

Stability

During a warm-up time of three hours, overall drift is less than 1,500 c/s under conditions of constant supply voltage and ambient temperature; beyond this period, drift will be less than 150 c/s at all frequencies and under normal operating conditions.

Input Impedance

75Ω unbalanced.

Tuning

Effective scale length of approximately 145 feet, *i.e.*, about 6 inches of scale length corresponds to 100 kc/s. Frequency increments remain substantially constant over the entire band.

Calibration

A 100 kc/s signal derived from a 1 Mc/s crystal oscillator having a stability of 5 parts in 10^6 provides check points at 100 kc/s intervals.

Sensitivity

A1 reception, bandwidth 3 kc/s: 1μV for 20dB signal-to-noise ratio.
A2 reception, 30% modulated, bandwidth 3 kc/s: 3μV for 20dB signal-to-noise ratio.

Cross Modulation

By using the aerial (antenna) attenuator with a tuned input together with a 3 kc/s i.f. bandwidth and a wanted signal of 1mV, an unwanted signal differing by 10 kc/s and modulated by 30% must have a level at least 30dB greater than the wanted signal in order to cause a cross modulation output equivalent to 1% modulation of the wanted signal.

Selectivity

Six alternative i.f. bandwidths are obtained by means of a selector switch. Filter details are:—

	—6dB	—66dB
1.	8 kc/s	30 kc/s
2.	3 kc/s	15 kc/s
3.	1·2 kc/s	8 kc/s
4.	0·75 kc/s	Less than 3·5 kc/s
5.	0·3 kc/s	
6.	0·10 kc/s	

Bandwidths 4, 5 and 6 are obtained with crystal lattice filters. Differences in centre frequencies of these filters do not exceed 50 c/s.

I.F. Output

100 kc/s at 75Ω impedance. Two outlets in parallel are provided.

Image and Spurious Responses

With a tuned input, external image signals are at least 60dB down. Internally generated spurious responses are below noise level in all cases.

Noise Factor

1·5 Mc/s:	less than 8dB.
3, 6, 12 and 24 Mc/s:	less than 6dB.

B.F.O. Stability

With constant ambient temperature and supply voltage, 30 minutes after switching on, drift does not exceed 50 c/s. For input level variations from 10μV to 1mV, b.f.o. drift does not exceed 100 c/s.

Automatic Volume Control

An increase in signal level of 20dB above 1μV improves the signal-to-noise ratio by 20 dB.
An increase in signal level of 60dB above 1μV (a.v.c. threshold) increases the a.f. output by less than 6dB.

A.V.C. Time Constants

Short: charge — 25 milliseconds.
discharge — 200 milliseconds.
Long: charge — 200 milliseconds.
discharge — 1 second.

A.F. Output

1. 2½-in. loudspeaker (50mW) on front panel (switched).
2. Two headphone sockets in parallel on front panel.
3. Three independent outputs of 3mW at 600Ω on rear of chassis.
4. One output of 10mW at 600Ω. Preset level is independent of A.F. GAIN control setting.

Note : The two headphone sockets are connected across the loudspeaker on the British version and across one of the 600Ω 3mW outlets on the North American version of the receiver.

A.F. Response

With 8 kc/s i.f. bandwidth, response remains within ±3dB from 250 c/s to 3,500 c/s.

Distortion

Not greater than 5% at 50mW output.

Hum Level

—50dB at 1mW with A.F. GAIN control at maximum.

Noise Limiter

A series noise limiter circuit can be switched into operation to provide limiting at modulation levels exceeding 30%.

Meter Indication

Alternative switching for signal carrier level or a.f. output level. An " S " meter is incorporated in the North American version of the receiver.

Controls

MEGACYCLES tuning
AE. (ANT.) RANGE MC/S
AE. (ANT.) ATTENUATOR
I.F. GAIN
System switch
B.F.O. on/off
A.F. GAIN
LIMITER on/off
POWER on/off

KILOCYCLES tuning
AE. (ANT.) TUNE
Tuning lock
I.F. BANDWIDTH
A.V.C. time-constant
B.F.O. NOTE KC/S
Line output level
SPEAKER on/off
METER

Power Supply

100–125 and 200–250 volts, 45–65 c/s. Power consumption 85W approx.

Dimensions

		Height	*Width*	*Depth*
	For rack mounting (fitted dust cover)	10½	19	20⅛-in.
		26·7	48·25	51 cm.
	Fitted cabinet	12	20½	21⅞-in.
		30·5	52	55·6 cm.
Weight	Rack mounted	67-lb. (30·5 kg.).		
	In cabinet	97-lb. (44 kg.).		

Construction

Cast chassis with ⅛-in. steel front panel. Finished to comply with highest durability and climatic specifications.

SECTION 1

GENERAL DESCRIPTION

1.1 GENERAL DETAILS

The Communications Receiver Type RA.17 has been designed for use as a general purpose receiver which will provide a high order of sensitivity, selectivity and stability. The tuning range is from 1·0 to 30·0 Mc/s and extending, with slightly degraded performance, down to 500 kc/s.

The circuit employs a triple superheterodyne principle with electronic bandswitching in steps of one megacycle. Fine tuning is accomplished by means of a very stable interpolation receiver covering a spectrum of 1 Mc/s. A 60-in. film scale is provided and this is accurately calibrated in 1 kc/s divisions. Check signals can be injected at every 100 kc/s.

A number of audio and i.f. outputs are provided for flexibility during operation; a small loudspeaker is fitted for monitoring purposes.

The set is designed to operate from 100–125 volts and 200–250 volts, 45–65 c/s mains. The power consumption is approximately 85 watts.

1.2 NORTH AMERICAN VERSION

North American versions of the RA.17 receiver are identical in design to the Standard model but include minor variations in detail to comply with North American practice. Certain tubes are changed to ensure that the set employs types commercially available in North America ; this entails slight circuit changes to allow for differences in the tube operating voltages. The level meter circuits are modified to include a calibrated " S " meter range. Coaxial connections are changed from British to North American standards and the supply connection comprises a lead directly connected to the set in place of the fixed plug and free socket fitted to the British version.

These instructions cover both types of receiver. Where applicable, attention is drawn to the differences between the two versions.

1.3 MECHANICAL DETAILS

The receiver is designed for both bench (table) and rack mounting. The front panel is painted Light Battleship Grey (British Standard Specification 381C, colour 697) and has been carefully designed to minimise operator fatigue.

The dimensions of the $\frac{1}{8}$-in. thick front panel conform with the requirements for mounting in a standard 19-in. rack.

For bench mounting, the receiver is fitted in a robust steel cabinet which has a rear opening to enable the operator to gain easy access to the power input socket (Standard version only), the fuse and the termination strips.

A dust cover is provided with both models. This may be removed from cabinet-mounted receivers in conditions of high ambient temperature.

The chassis and major modules are of cast construction thus ensuring maximum rigidity and effective electrical screening.

Each receiver is supplied with three keys to facilitate removal of the control knobs, a plastic trimming tool and free coaxial terminations for aerial and i.f. connections. Extra sleeves are provided with the terminations for alternative coaxial cable sizes.

SECTION 2

INSTALLATION

After carefully unpacking the receiver, remove the dust cover and make sure that all valves and screening cans are firmly in place and that no packing material remains within the tuning mechanism.

2.1 SUPPLY

Ascertain that the main transformer is set to the appropriate voltage tapping. This is carried out by means of the plug-in links in Standard models and by soldered connections to the transformer in the North American versions. Connect a 3-core power lead (not provided) to the free 3-pin socket supplied and attach this to the input power plug (PL10). On North American versions, a power cable is permanently fitted. Check that the terminals HT.1 and HT.2 situated on the main chassis are linked (unless the RA.37 L.F. Convertor is in use). Note that a form of receiver muting can be obtained by opening this link when the associated transmitter is keyed.

Connect the power lead to the mains supply.

2.2 FUSE

Ensure that the rating of the supply fuse is correct viz: 2A.

2.3 AERIAL

The impedance at the aerial (antenna) input plug is designed to match into a 75Ω unbalanced transmission line. The cable termination supplied with the receiver is provided with alternative sleeves to enable it to be used with a type UR.18 or UR.70 cable or similar cables of nominal diameter $\frac{1}{2}$-in. or $\frac{1}{4}$-in. respectively.

2.4 AUDIO OUTPUTS

(*a*) The two headphone sockets situated on the front panel are connected across the 3Ω speaker.
Note: On the North American receiver, the headphone sockets are connected across one of the 600Ω 3mW. outlets.

(*b*) The following outputs are connected to the terminal strip situated on the rear of the receiver :—
(i) Three 600Ω outlets at 3mW.
(ii) One 3Ω outlet at 50mW.
(iii) One 600Ω outlet at 10mW. This output is controlled by a pre-set A.F. LEVEL control on the front panel and is independent of the outputs previously described.

2.5 100 KC/S I.F. OUTPUT

The connection consists of two coaxial plugs connected in parallel to the 100 kc/s output. The total load should not be less than 70Ω (*e.g.* with one outlet loaded by 75Ω, the other can be used as a high impedance source).

2.6 AUTOMATIC VOLUME CONTROL

The a.v.c. line is brought out to the terminal strip on the rear of the chassis for such applications as diversity reception.

SECTION 3

OPERATION

References to the controls are in capitals and are in accordance with the panel titles adjacent to them. Control names on the North American versions are shown in brackets when they differ from the standard titles.

It should be noted that the method of operation of the receiver, which is extremely simple, depends largely upon the purpose for which the receiver is being employed. The instructions given below are concerned with tuning the receiver to a signal of known frequency ; also, notes are included on the use of the various controls.

3.1 PRELIMINARY SETTING-UP

Switch on the supply by means of the MAINS (POWER) switch. Allow a few minutes for the receiver to warm up.

Set the AE. (ANT.) RANGE MC/S switch to WIDEBAND. Switch the AE. (ANT.) ATTENUATOR to MIN. Set the A.F. GAIN control to its mid-position. Turn the System switch to MAN. Switch the LIMITER and B.F.O. off.

Select a BANDWIDTH of 3 or 8 KC/S. Rotate the I.F. GAIN control to three-quarters of fully clockwise.

3.2 FILM SCALE CALIBRATION

Set the System switch to CAL. Select a BANDWIDTH of 3 KC/S.

Set the KILOCYCLES scale to that 100 kc/s point which is nearest to the frequency required and adjust the control accurately until a zero beat note is obtained. Move the milled cursor slide on the dial escutcheon so that the pointer coincides exactly with the selected 100 kc/s division.

Restore all other controls to the preliminary setting shown in Section 3.1 above.

3.3 B.F.O. CALIBRATION

Switch on the b.f.o. and set the System switch to CHECK B.F.O.

Adjust the B.F.O. NOTE KC/S control to zero beat.

Restore all other controls to the preliminary setting shown in Section 3.1 above.

3.4 TUNING

Set the MEGACYCLES dial to the required integer. The tuning of this control is quite flat and the optimum position may be found by adjusting the control to the point at which the receiver noise is greatest.

Set the KILOCYCLES scale to the required frequency.

Set the AE. (ANT.) RANGE MC/S switch to the correct frequency band. Adjust the AE. (ANT.) TUNE control for maximum noise.

It should now be possible to identify the desired signal. Switch on the b.f.o. if the required signal is not modulated.

Switch on the b.f.o. and set the calibrated B.F.O. NOTE KC/S control to the zero position, then adjust finally for a zero beat note.

If it is desired to operate the receiver on c.w., adjust the B.F.O. NOTE KC/S control to the most acceptable audio beat note. Set the BANDWIDTH control for optimum reception. Set the A.F. GAIN to MAX. (consistent with no over-loading) and adjust the output level with the I.F. GAIN control.

For m.c.w. or r.t. reception, switch the b.f.o. off. Adjust the I.F. and A.F. GAIN controls as for c.w. reception. (Refer to 3.6.12.)

Set the System switch to A.V.C. and select a SHORT or LONG time-constant as required.

Set the BANDWIDTH control to the optimum position.

3.5 " S " METER

The " S " meter in North American versions should be correctly set to zero in order to obtain the maximum accuracy of calibration.

With no antenna connected, set the AE. (ANT.) ATTENUATOR to MAX. Set the System switch to A.V.C. Turn the I.F. GAIN control to the maximum clockwise position. *Note :* Unless the I.F. GAIN control is in the maximum position, the " S " meter calibration is upset.

Remove the plated cap below the meter.

Adjust the setting of the balance control (accessible through the hole in the panel) by means of a screwdriver until the meter reads zero.

3.6 USE OF CONTROLS

3.6.1 BANDWIDTH

The three crystal filters determining the bandwidth are adjusted to ensure that their centre frequencies are all within 50 c/s, thus any bandwidth can be selected without retuning the receiver.

Six bandwidths are provided as follows :—

8 kc/s, 3 kc/s and 1·2 kc/s (L–C) ; 750 c/s, 300 c/s and 100 c/s (crystal).

3.6.2 B.F.O. NOTE KC/S

The b.f.o. is exactly tuned to a central point on the i.f. amplifier response when the B.F.O. NOTE control is set to zero beat with the calibrator. Having standardised the b.f.o. frequency, the frequency of an incoming signal may be accurately measured by setting the KILOCYCLES control to a zero beat position; the b.f.o. should be detuned in order to produce an acceptable note for c.w. reception.

3.6.3 AE. (ANT.) TUNE AND AE. (ANT.) RANGE MC/S

If maximum sensitivity is not required, the aerial need not be tuned unless strong unwanted signals are present. It should be noted that the presence of very strong signals anywhere within the spectrum may cause cross-modulation unless the aerial is tuned. Under these conditions, CARE MUST BE TAKEN TO AVOID TUNING THE INPUT TO THE INTERFERING SIGNALS instead of the signal required. Familiarity with the tuning controls will obviate this.

3.6.4 AE. (ANT.) ATTENUATOR

This control enables the operator to reduce the level of all incoming signals when strong unwanted signals are present which cannot be rejected sufficiently by tuning the aerial ; the input level can also be reduced if the required signal is causing overloading in the early stages of the receiver.

3.6.5 MEGACYCLES

This scale should be occasionally checked to ensure that its setting is reasonably central with respect to the band in use. This is indicated by a reduction of signal or noise on either side of the correct setting.

3.6.6 SPURIOUS CHANNEL INTERFERENCE

Should high level unwanted signals cause interference with the desired signal, the spurious response may be eliminated by slight resetting of the MEGACYCLE control without disturbing the desired signal.

3.6.7 KILOCYCLES

The calibration of this scale may be checked at 100 kc/s intervals by setting the System switch to the CAL. position.

3.6.8 METER

With the METER switch in the R.F. LEVEL position, the meter indicates the signal diode current. In the A.F. LEVEL position, the 10mW 600Ω output only is monitored. A calibration mark is provided at 10mW. In North American versions, the " S " meter position shows the signal strength in " S " points.

3.6.9 A.F. LEVEL

This preset control sets the a.f. level in a separate a.f. stage for feeding a 600Ω 10mW line. It is unaffected by the position of the main A.F. GAIN control.

3.6.10 A.V.C.

The choice of time-constant depends largely on conditions. The LONG time-constant (1 second) should be employed with voice signals ; the SHORT time-constant may be used with high-speed telegraphy or voice. For hand (low) speed telegraphy, the MAN. position of the System switch should be used. (Refer to 3.6.12.)

3.6.11 LIMITER

When switched into use, the LIMITER reduces the effects of noise peaks exceeding the level of a 30% modulated signal. It does not introduce noticeable distortion below a 30% modulation level.

3.6.12 I.F. GAIN

The I.F. GAIN control is operative both in the MAN. and the A.V.C. positions of the System switch. In the MAN. position of the System switch, the setting of the control should always be at a minimum consistent with satisfactory a.f. level. The following should be noted when the System switch is in the A.V.C. position. Reducing the i.f. gain results in a reduction of a.v.c. loop gain together with a degraded a.v.c. characteristic. Therefore, when in the A.V.C. position, it is desirable that the I.F. GAIN control be set to maximum. A possible exception to this occurs when receiving interrupted signals in which the carrier is periodically switched off ; in this case, receiver noise could be troublesome during the quiet intervals.

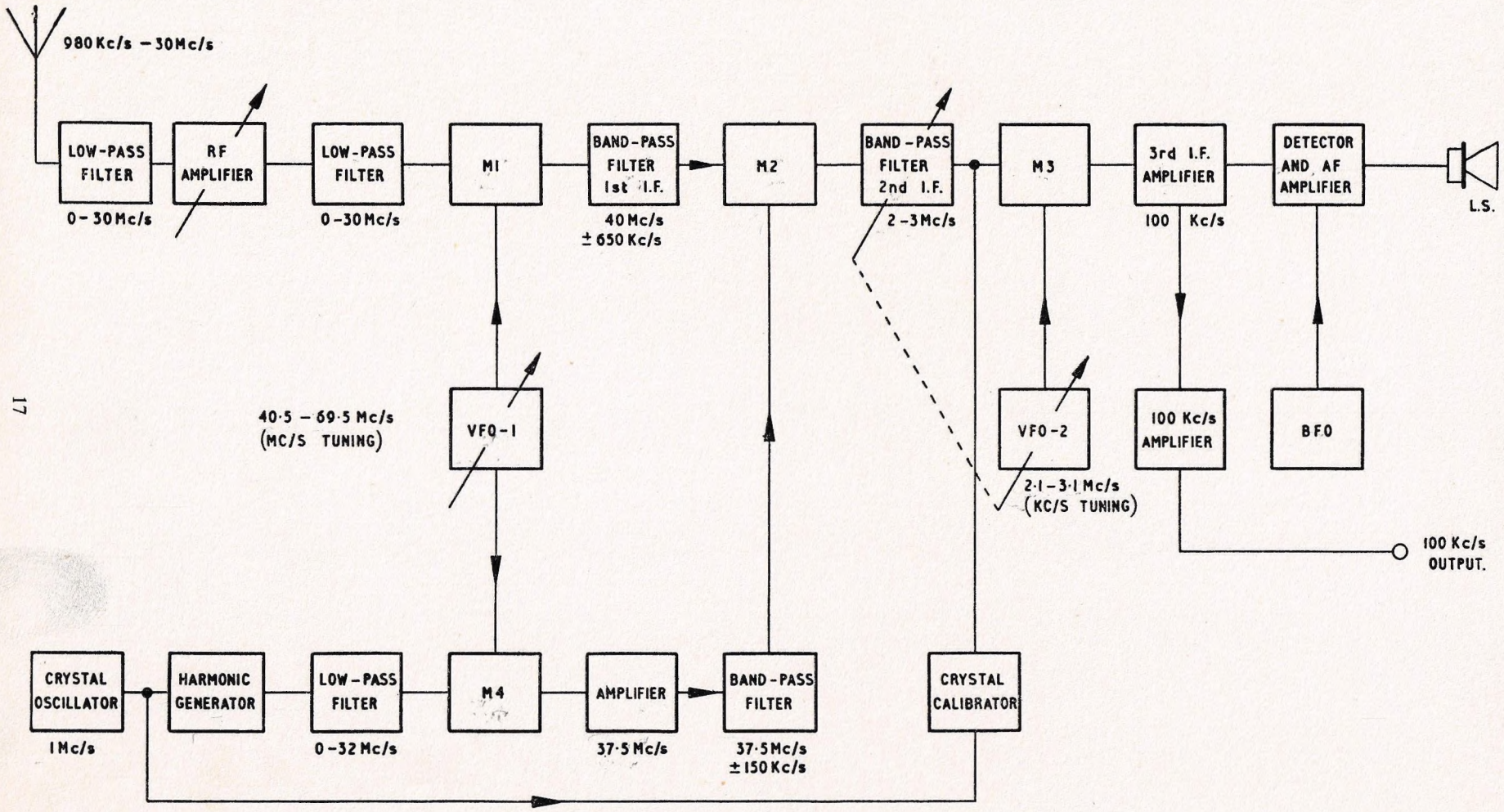


FIG. 1 BLOCK DIAGRAM OF THE RECEIVER TYPE RA.17

SECTION 4

BRIEF TECHNICAL DESCRIPTION

This section describes briefly, with the aid of the block diagram in Fig. 1, the basic theory of operation. For a more detailed explanation of the receiver, Section 5 (DETAILED CIRCUIT DESCRIPTION) should be consulted.

4.1 SIGNAL INPUT

The aerial loading (75Ω unbalanced) is designed for optimum performance when the input circuits are tuned. With the AE. (ANT.) RANGE MC/S switch set to WIDEBAND, the input impedance is high unless the AE. (ANT.) ATTENUATOR is in use.

4.2 FIRST MIXER

Input signals between 0·98 and 30 Mc/s are fed via an r.f. amplifier and a 30 Mc/s low-pass filter to the first mixer (M1) where they are mixed with the output from a variable frequency oscillator VFO–1 (MEGACYCLES tuning). This oscillator has a frequency range of 40·5 to 69·5 Mc/s. The first i.f. stage is in effect a band-pass filter tuned to 40 Mc/s$\pm$650 kc/s. Thus, according to the setting of VFO–1, any spectrum of signals 1 Mc/s wide and existing in the range 0·98 to 30 Mc/s can be mixed in M1 to produce an output acceptable to the first i.f. band-pass filter.

It should be noted at this stage that the exact setting of VFO–1 is determined by conditions in the second and fourth mixer circuits ; these restrict the possible settings to positions 1 Mc/s apart (*e.g.* 40·5, 41·5, 42·5 Mc/s, etc.).

4.3 HARMONIC GENERATOR AND MIXER

The output from a 1 Mc/s crystal oscillator is connected to a harmonic generator. The harmonics derived from this stage are passed through a 32 Mc/s low-pass filter and mixed with the output from VFO–1 in the fourth mixer (M4). This mixer provides an output at 37·5 Mc/s which is amplified before passing through a band-pass filter tuned to 37·5 Mc/s with a bandwidth of $\pm$ 150 kc/s.

The presence of this filter restricts the setting of VFO–1 to an exact number of Mc/s plus 37·5 Mc/s in order to give an output acceptable to the filter and amplifier. As a result, the first v.f.o. must be tuned in 1 Mc/s steps.

4.4 SECOND MIXER

The 40 Mc/s first i.f. signal is mixed in the second mixer (M2) with the 37·5 Mc/s output from M4 in order to produce an output consisting of a 1 Mc/s spectrum in the frequency range 2–3 Mc/s (second i.f.).

To clarify this method of operation, some examples of dial settings and intermediate frequencies corresponding to various incoming signals are tabulated below :—

Dial Mc/s	*Settings* kc/s	*Signal Freq.* f_sMc/s	*VFO*-1 f_oMc/s	*Xtal Harmonic* nf_cMc/s	1*st I.F.* f_o-f_s	*Het. Freq.* f_o-nf_c (M4 output)	2*nd I.F.* nf_c-f_s
4	1,000	5·0	44·5	7th	39·5	37·5	2·0
5	0	5·0	45·5	8th	40·5	37·5	3·0
18	600	18·6	58·5	21st	39·9	37·5	2·4

Frequency drift of VFO–1 within the limits of the 37·5 Mc/s filter bandwidth, does not affect the frequency stability of the receiver. A change in this oscillator frequency will alter the first i.f. to the same extent and in the same sense as the nominal 37·5 Mc/s signal from M4. Therefore the difference frequency from M2 will remain constant.

4.5 THIRD MIXER

The 2–3 Mc/s receiver, which follows M2, is preceded by a tuned three stage band-pass filter ganged to the second variable frequency oscillator VFO–2 (KILOCYCLES tuning). This oscillator is temperature compensated and the output is mixed in the third mixer (M3) with the 2–3 Mc/s output from the band-pass filter to provide the third and final intermediate frequency of 100 kc/s.

4.6 THIRD I.F. STAGE

The final i.f. stages are preceded by crystal lattice and L–C filters which provide six alternative bandwidths. Separate signal and a.v.c. diodes are employed and alternative switched time-constants give the optimum conditions for telegraphy and telephony reception. An additional i.f. amplifier is incorporated to give an independent output at 100 kc/s.

4.7 A.F. STAGES

Two independent audio frequency stages are incorporated for either line output or headphone sockets and internal loudspeaker ; each stage is provided with a level control (see TECHNICAL SPECIFICATION).

4.8 CRYSTAL CALIBRATOR

A crystal calibrator unit is incorporated to enable the scale of VFO–2 to be checked at 100 kc/s intervals. These check points are obtained from a regenerative divider controlled by the 1 Mc/s crystal oscillator.

SECTION 5

DETAILED CIRCUIT DESCRIPTION

Reference should be made to the circuit diagram at the end of this handbook.

5.1 AERIAL CIRCUIT

A 75Ω unbalanced aerial source is connected to the tuned r.f. amplifier through a three-section 30 Mc/s low-pass filter and a five-position attenuator covering a range of 0 to 40 dB. Switch S2 selects wideband operation or any one of the six aerial coils L4–9 for tuned operation. These aerial coils may be aligned by means of dust iron cores. The aerial is tuned by a capacitor C18 which is switched out of circuit in the wideband position.

5.2 R.F. AMPLIFIER

C28, the coupling capacitor, feeds the incoming signals through the grid stopper R25 to the control grid of the r.f. amplifier (V3) which employs a high gain low noise pentode so that sufficient gain is obtained over the whole frequency range. The capacitors C40, C41, C49 and C57 ensure that the cathode is adequately decoupled over the wide frequency range.

5.3 30 Mc/s LOW-PASS FILTER

The amplified signal is passed to a 30 Mc/s low-pass filter which has a substantially flat response over the frequency range. L27, C47 and R28 constitute the first ' L half-section ' of the filter. The signal is then fed at low impedance (680Ω) through the coupling capacitor C74 and the grid stopper R45 to the control grid of V7, the first mixer stage. The input capacitance of V7 forms the capacitance to ground between L15 and L17 required to complete the filter network.

Note : This capacitance is not critical, therefore no adjustment will be necessary should V7 be changed.

5.4 FIRST VARIABLE FREQUENCY OSCILLATOR (VFO–1)

This circuit comprises a cathode-coupled Hartley oscillator stage (V5) which may be continuously tuned over the frequency range of 40·5–69·5 Mc/s. The frequency determining components are an inductance L36 and a variable capacitance C76. Alignment is accomplished by adjusting the aluminium core of L36 and the trimming capacitor C77. The variable capacitor C76 is coupled to the Mc/s dial which is calibrated from 0 to 29 Mc/s. The anode load consists of L20, a compensating inductance which is wound on a 470Ω resistor R18. The oscillator is coupled via C85 to the signal grid of the first mixer stage V7 and also via C42 to the control grid of the harmonic mixer V4.

Note : The Mc/s dial calibration may be affected if V5 is changed. The necessary correction may be made by adjusting C77 with the Mc/s dial set to 29 Mc/s.

5.5 FIRST MIXER (M1)

The outputs from the 30 Mc/s low-pass filter and the variable frequency oscillator VFO–1 are fed to the signal grid of the mixer stage (V7) which produces a signal at 40 Mc/s. The signal is then passed to a 40 Mc/s band-pass filter which forms the anode load of this stage.

5.6 40 Mc/s BAND-PASS FILTER

The 40 Mc/s band-pass filter consists of eight over-coupled tuned circuits connected in cascade and is tuned by the trimming capacitors C21, C33, C43, C53, C61, C70, C79 and C88. This filter which has a passband of 40 Mc/s$\pm$650 kc/s ensures that only the required 1 Mc/s spectrum of signals is passed to the second mixer stage. This filter is deliberately set to a slightly wider passband than is theoretically required, to allow for possible drift in VFO–1.

5.7 1 Mc/s CRYSTAL OSCILLATOR

The frequency of the crystal oscillator V1 (which is a cathode-coupled Colpitts circuit) may be set precisely to 1 Mc/s by adjusting the trimming capacitor C2. The anode coil L2 which is adjusted to 1 Mc/s by means of a dust iron core is electron coupled to the oscillator. The fixed capacitors C9, C10 and C11 complete the tuned circuit. The output from this circuit is fed to the harmonic generator and also the coaxial plugs PL2, PL3 and PL3A.

5.8 HARMONIC GENERATOR

The 1 Mc/s signal is fed through the coupling capacitor C8 to the control grid of the harmonic generator (V2). Megacycle harmonics are produced in this stage by operating the valve in a non-linear state. A suitable bias potential is produced due to the time constant of C8 and R13. The screen grid is not de-coupled.

5.9 32 Mc/s LOW-PASS FILTER

The megacycle harmonics are fed through a 32 Mc/s low-pass filter circuit to prevent harmonics other than those required from passing to the harmonic mixer (V4). Some control over the cut-off frequency is provided by C7 which is adjusted to equalise the output from the filter at the harmonic frequencies corresponding to 28 and 29 Mc/s on the MEGACYCLE dial.

5.10 HARMONIC MIXER (M4)

The outputs from the 32 Mc/s low-pass filter and VFO–1 are mixed in the harmonic mixer (M4) by applying the filtered megacycle harmonics to the suppressor grid and the output from the VFO–1 to the control grid. The 37·5 Mc/s output is selected by the tuned anode load, consisting of a fixed capacitor C50 and an inductance L28, which may be adjusted by means of a dust iron core, and coupled by C51 to V6. R36 is a grid stopper.

5.11 2-STAGE 37·5 Mc/s AMPLIFIER (1)

The anode load of V6 is a tuned circuit consisting of a fixed capacitor C67 and an inductance L33 which is tuned to 37·5 Mc/s. Frequency adjustment is by the dust iron core in L33. This stage feeds the amplified signal via C68 to the following stage V8. The 37·5 Mc/s signal is then passed to the 37·5 Mc/s band-pass filter. The anode load of this stage is provided by this filter.

5.12 37·5 Mc/s BAND-PASS FILTER

The 37·5 Mc/s band-pass filter consists of eight under-coupled tuned circuits arranged in cascade. These filter sections may be tuned by C24, C35, C45, C55, C63, C72, C81 and C90 respectively. This filter, which has a passband of 300 kc/s, allows for possible drift in VFO–1. The narrow passband and high rejection to frequencies outside the passband prevent spurious signals from reaching the second mixer stage (V9).

5.13 37·5 Mc/s AMPLIFIER (2)

The filtered 37·5 Mc/s signal is further amplified by V10 before being passed to the second mixer stage (V9). To prevent interaction between the 40 Mc/s band-pass filter and the 37·5 Mc/s tuned circuit (L50 and C113) and to enable either circuit to be adjusted without affecting the other, a balancing circuit is included which is shown in a simplified form in figure 2.

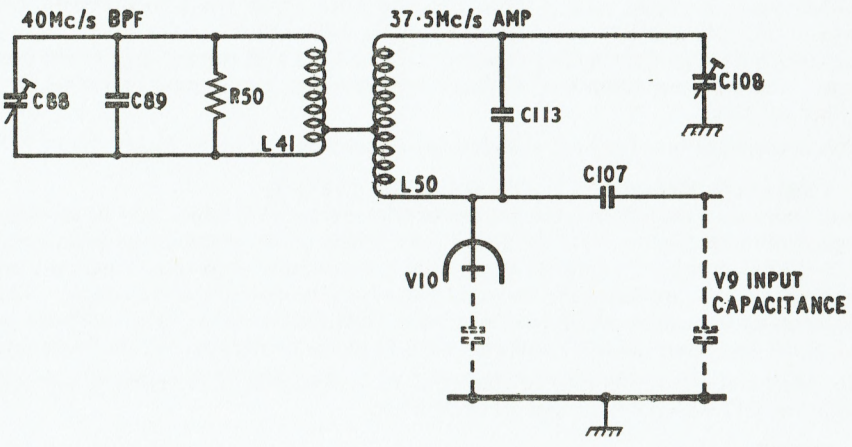


FIGURE 2

The 40 Mc/s signal is introduced into the 37·5 Mc/s tuned circuit at a point of zero r.f. potential since L50 is centre tapped and C108 is adjusted to be equal to the total of the capacitances of V10 anode to ground, C107 and the input capacitance of V9.

Notes : The anode load of V10 is adjusted to 37·5 Mc/s by adjusting the dust iron core in L50.
The balancing circuit will not be affected if V9 or V10 is changed.

5.14 SECOND MIXER (M2)

This mixer (V9) produces the second intermediate frequency of 2–3 Mc/s by mixing the 40 Mc/s i.f. and the 37·5 Mc/s signal. The anode choke L51 and the tuned circuit formed by C116 and L52 remove the 37·5 Mc/s frequency and other h.f. components, so that only the second i.f. is passed to the 2–3 Mc/s band-pass filter preceding the third mixer stage. The series tuned circuit is tuned to 37·5 Mc/s by adjusting the dust iron core in L52.

5.15 2–3 Mc/s TUNED BAND-PASS FILTER

This filter (which is ganged to the second Variable Frequency Oscillator) consists of three tuned band-pass filter sections as follows :—

(*a*) An inductance L59 and a variable capacitor C129. A fixed capacitor C127 and a trimmer C128 complete this section. L59 is tapped to provide an input connection via the coaxial plug PL5 so that the 2–3 Mc/s low impedance output of the L.F. Convertor Type RA.37 may be connected.

(*b*) A variable inductance L58 is connected in series with a coupling coil L60 and a variable capacitor C126. A fixed capacitor C124 and a trimmer C125 are connected in parallel with C126.

(*c*) An inductance L57 and a variable capacitor C123 in parallel with a fixed capacitor C121 and a trimmer C122 form the final section.

The correct bandwidth is obtained by adjusting the dust iron cores and the trimming capacitors C128, C125 and C122 respectively.

5.16 THIRD MIXER

The output from the 2–3 Mc/s band-pass filter is directly coupled to the signal grid of a pentagrid valve V11 and second VFO output (2·1 to 3·1 Mc/s) is fed through the coupling capacitor C143 to the oscillator grid. The resistor R68 completes the D.C. path from this grid to earth. The 100 kc/s output obtained from this mixer stage is then fed via PL6, SK6 and a screened cable to the crystal filter unit.

Note : The resistors R67 and R72 are grid stoppers.

5.17 SECOND VARIABLE FREQUENCY OSCILLATOR (VFO-2)

The second Variable Frequency Oscillator, covering a frequency range of 2·1 to 3·1 Mc/s, is an electron coupled Hartley circuit. The oscillation frequency is determined by an inductance L55 (which can be adjusted by means of a ferrite core), a fixed capacitor C137, a trimming capacitor C136 and a variable capacitor C139 which is ganged to the tuned band-pass filter. The KILOCYCLES scale which is calibrated between 0 and 1,000 kc/s is coupled to this ganged capacitor. The output from VFO–2 is resistance-capacitance coupled (R76 C143) to the third mixer stage (V11) and via C999 to a coaxial socket for feeding auxiliary units.

5.18 CRYSTAL FILTER

Six alternative switched i.f. bandwidths are available as follows :—

100 c/s 300 c/s 750 c/s	Crystal.	1·2 kc/s 3·0 kc/s 8·0 kc/s	L-C.

In the crystal positions the third mixer anode is connected to L48 in the crystal filter. L47 and L49 provide a balanced output which is tuned by capacitors C109 and C110. In the 100 c/s position, the balanced output is connected through the crystals XL2 and XL5 to the first tuned section of the 100 kc/s L-C filter. The differential trimmer C118 is the phasing control for this bandwidth. XL3, XL6, C119 and XL4, XL7, C120 form similar circuits for 300 c/s and 750 c/s respectively, but damping resistors (R64 and R63) are connected across the tuned circuits to obtain the required passband.

In the three L-C bandwidth positions the crystal filter is by-passed and the anode of the third mixer valve (V11) is connected directly to the first tuned section of the 100 kc/s L-C filter.

5.19 100 kc/s L-C FILTER

(i) L-C Bandwidths

This filter consists of four tuned circuits arranged in cascade. In the L-C bandwidth positions, the signal is fed to the tuned circuit formed by L61 and the combination of the capacitors C145, C146, C146A and C147. The second section consists of L62 and L63 in series with C152, C152A and C153. The third section is identical to the preceding section and consists of L64 and L67 in series with C157, C157A and C158. The final section, consisting of L68 and L71 in series with C161 and C162, is damped by the series resistors R86, R87 or R88 according to the bandwidth. In the L-C positions the output is taken from a capacitative divider formed by C161 and C161A with C170, to equalise the gains in the L-C and crystal bandwidth positions.

The L-C bandwidths are obtained by varying the degree of coupling between each section of the filter in addition to the damping resistors in the final stage. The capacitor C175 is included to compensate for the effective reduction of the input capacitance of V14, appearing across the tuned circuit, when switching from crystal to L-C positions.

In early models (up to Serial No. 510) C146A, C152A, C157A and C161A are not fitted.

(ii) Crystal Bandwidths

To maintain the input capacitance of the L-C filter, in the crystal positions, a trimming capacitor C148 is switched into circuit. This trimmer is adjusted to be equal to the output capacitance of V11 and the screened cable.

In the crystal bandwidth positions, the L-C filter is operating in its narrow bandwidth position, *i.e.* 1·2 kc/s.

Note : The damping resistors R77 and R80 are disconnected except during filter alignment.

5.20 FIRST 100 kc/s I.F. AMPLIFIER

The output from the L-C filter is passed through a coupling capacitor C164 to the control grid of the pentode amplifier valve V14. This grid is returned via R96 to the a.v.c. line which is filtered at this point by R102 and C173. The screen potential is derived from a potential divider formed by R93, R94 and R97. This stage is coupled to the second i.f. amplifier and the i.f. output stage by a double tuned transformer having an over-coupled characteristic.

5.21 SECOND 100 kc/s I.F. AMPLIFIER

The signal from the first i.f. transformer is fed through the grid stopper R114 to the control grid of the second i.f. amplifier. The control grid of this valve is returned to the a.v.c. line via L73 and L74. H.T. is supplied to the screen via the dropping resistor R113 and is de-coupled by C181. The anode load is a tuned circuit consisting of L77, C192 and C191. This circuit is heavily damped by R112. The secondary winding L78 and L79 is tuned by C195A and C195B with R120A as a damping resistor. The output is fed to the diode detector anode. In early models (up to Serial No. 510), the secondary winding of this i.f. transformer is not tuned.

5.22 DIODE DETECTOR

The low potential end of L79 is connected through the r.f. filter (C209, R128, C210, R129 and C211) to the diode load R130. With the meter switched to R.F. LEVEL the meter indicates the detector diode current. The resistor R131 is included to complete the diode detector circuit when the meter is switched out of circuit.

5.23 NOISE LIMITER

The noise limiter diode (pins 2 and 5 of V21) is connected in a series circuit to operate at approximately 30% modulation. Its operation is explained with reference to Figure 3.

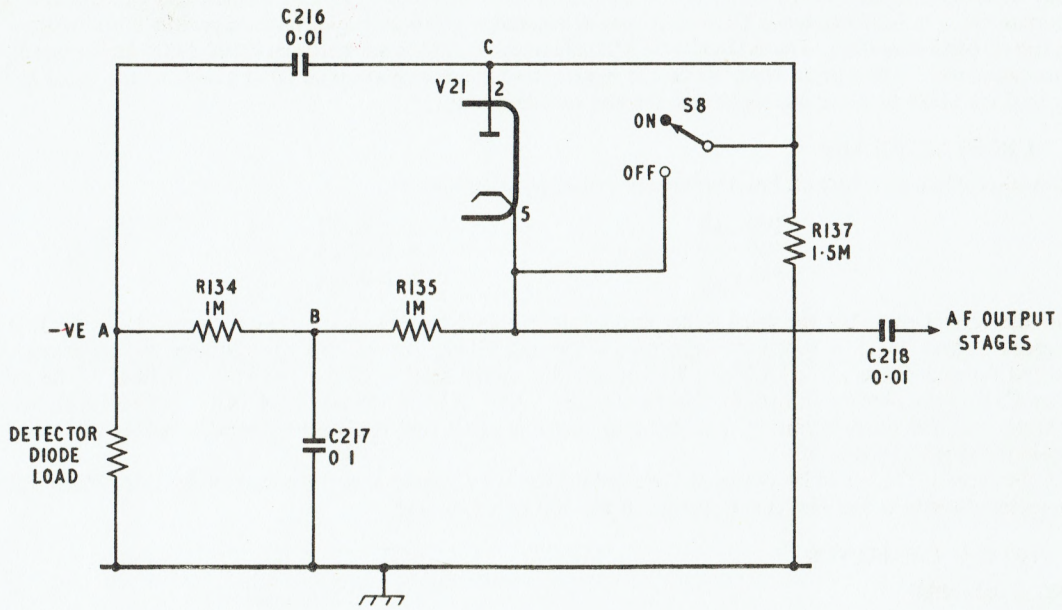


FIGURE 3

The D.C. path from point A is through R134, R135, the diode and R137. The a.f. signal path from the detector diode load is through C216, the diode and C218 when S8 is open. In the presence of a signal, a negative potential varying with the depth of modulation, will be developed at point A thus causing the diode to conduct. The negative potential at B, will be lower than that at A and will be maintained at a constant level due to the long time constant of R134 and C217. R135 allows the cathode potential to vary in sympathy with the modulation provided the modulation depth does not exceed 30%. The potential appearing at the cathode of the noise limiter diode therefore consists of a steady negative potential with the modulation superimposed. When noise impulses corresponding to high modulation peaks appear at point A and via C216 at point C, the voltage across the diode changes sign thereby causing the diode to stop conducting and open circuit the a.f. signal path. S8 renders the limiter inoperative.

5.24 A.V.C. AND T.C. DIODE

The signal appearing at the anode of V16 is passed through the coupling capacitor C193 to the anode of the a.v.c. diode. The diode load is formed by R116. A positive potential derived from R120, R121 and R122, supplies the required a.v.c. delay voltage to the cathode of this diode. When the A.V.C. switch is in the SHORT position and the System switch set to a position in which the a.v.c. is operative, *i.e.* A.V.C., CAL or CHECK B.F.O., the anode of the a.v.c. diode is connected to the a.v.c. line via L81 and R127. The choke L81 is tuned by C203 to a frequency slightly below 100 kc/s so that it presents a small capacitance at 100 kc/s, thus R127 is prevented from shunting the diode load. When the A.V.C. switch is in the LONG position the a.v.c. de-coupling capacitors C182 and C173 are charged through R127, the Time Constant diode and R119. When the signal level falls, the capacitors C182 and C173 discharge through R119, R118, R127 and L81 into the diode load resistor R116. The a.v.c. potential is brought out via R123 to the tag strip at the rear of the receiver for external use if required. With the System switch set to the MANUAL position, the a.v.c. line is connected to the I.F. GAIN control RV1, thus the gain of the 100 kc/s amplifiers may be varied by adjusting the negative potential applied to the a.v.c. line.

In early models (up to Serial No. 510), the I.F. GAIN control is out of circuit when the a.v.c. is operative.

5.25 AUDIO OUTPUT

Audio frequencies are applied to the control grid of V22 via RV2 audio gain control. The output transformer (T2) provides four separate outputs as follows : 50mW into 3Ω, and three windings supplying 3mW into 600Ω.

The headphone jacks JK1 and JK2 and the internal loudspeaker (which may be switched out of circuit by operating S11) are connected across the 3Ω winding.

5.26 A.F. LINE OUTPUT

The audio frequencies are also applied to the grid of V23 via RV3, the A.F. LEVEL control ; this control presets the level from the output transformer T3. The transformer provides a 10mW output at 600Ω which is suitable for direct connection to landlines. A bridge rectifier MR3 is connected across the output via R142 and R143. The meter may be switched across the rectifier circuit so that the operator can monitor the a.f. output.

Note : The red line on the meter scale corresponds to 10mW output into 600Ω.

5.27 BEAT FREQUENCY OSCILLATOR

The beat frequency oscillator (V19) employs an electron-coupled Hartley circuit. The oscillation frequency is determined by a fixed inductance L82 and a variable capacitor C200 in parallel with C202 and C201. The trimming capacitor C201 is adjusted to produce an output frequency of precisely 100 kc/s when the beat frequency oscillator frequency control is set to zero. Bias is applied to this valve by C199 and R125.

The b.f.o. output is coupled to the diode detector anode via C215. The b.f.o. is supplied with h.t. via S7 except when the System switch is in the CAL or STANDBY positions.

5.28 100 kc/s I.F. OUTPUT

The control grid of V17 is connected to the secondary of the first 100 kc/s i.f. transformer which feeds the stage with the a.v.c. potential as well as the 100 kc/s signal. The screen resistor R108 and the cathode bias resistor R115 are of the same values as used in the second 100 kc/s i.f. amplifier, hence the a.v.c. characteristic of this stage is similar to that of the main receiver. The anode load resistor R109 feeds the auto transformer L76 via the blocking capacitor C189. This transformer provides a 70Ω output at PL8 and PL9 for external applications.

Note : PL8 and PL9 are connected in parallel, therefore only one 100 kc/s output is available at 75Ω, and to avoid a mis-match the other connection should be made at high impedance.

5.29 CRYSTAL CALIBRATOR

The crystal calibrator, controlled by the 1 Mc/s crystal, feeds signals at 100 kc/s intervals to the signal grid of the third mixer stage to provide calibration check points.

The 1 Mc/s signal, fed through PL2, is connected through SK2 and the grid stopper R83 to the first grid of the mixer valve V13. The anode load consists of a 100 kc/s tuned circuit (L70 C167) and is coupled to the control grid of V15 through the capacitor C168. The anode load of V15 (L75 C177) is tuned to 900 kc/s and is coupled via C178 to the third grid of V13. V15 is heavily biassed so that it functions as a frequency multiplier.

An output of 900 kc/s, appearing across the tuned circuit (L75 C177) is coupled to grid 3 of V13 thereby producing a difference frequency of 100 kc/s relative to the 1 Mc/s input. The 100 kc/s output appears across the anode tuned circuit (L70 C167) and is fed to the control grid of V15. The ninth harmonic is selected in turn by the anode tuned circuit (L75 C177) of V15 and fed back to the third grid of V13 to provide the beat frequency of 100 kc/s with the 1 Mc/s input. This crystal-controlled regenerative circuit is thus self-maintaining. The 100 kc/s output is obtained from the coil L69 which is mutually coupled to L70 and fed via the octal plug (PL7) to the third mixer V11.

5.30 POWER SUPPLIES

The conventional bi-phase half-wave rectifier circuit, employing a capacitative input filter, provides 240 volts h.t. supply. A 165Ω resistor R124 is connected between the negative line of the power supply and earth, thus providing a 25V negative d.c. supply for gain control purposes. The resistor R136 has been included to limit the peak current of V20 to a safe value. To remove mains-borne interference the capacitors C224 and C225 are included. All valve heaters and the scale illuminating lamp are supplied from the 6·3V 7A winding. The mains transformer T1 has input taps at 0, −5, −10, 110, 125, 210, 230 and 250 volts and is connected to the supply via F1 (2A), S10 and a three-pin Mk. IV plug and socket (PL10, SK10); this does not apply to North American versions of the receiver.

5.31 SYSTEM SWITCH

The following conditions exist for each setting of the System switch. The link on the h.t. adaptor terminals is assumed to be in position.

(*a*) **STANDBY** S5A disconnects the h.t. from all stages and connects R119A across the h.t. as a compensating load. In early models (up to Serial No. 660) R119A is not fitted.

(*b*) **MANUAL**
- (i) The h.t. is passed through S5A, S5B and S5C to all stages except the calibrator unit.
- (ii) S5F connects h.t. to the b.f.o. when S7 is switched on.
- (iii) The a.v.c. line is disconnected from the a.v.c. diode by S5D and connected to the I.F. GAIN control (RV1) by S5E.

(*c*) **A.V.C.**
- (i) (*b*) (i) and (*b*) (ii) applicable.
- (ii) S5E renders the I.F. GAIN control inoperative; this does not apply to serial numbers before 511.
- (iii) S5D connects the a.v.c. line to the a.v.c. diode.

(*d*) **CAL.** (i) H.T. is applied via S5A, S5B and S5F to all stages except :—
The r.f. amplifier (V3)
The first v.f.o. (V5)
The first mixer (V7)
The second mixer (V9)
The final 37·5 Mc/s amplifier (V10)
The b.f.o.
(ii) (*c*) (ii) and (*c*) (iii) applicable.

(*e*) **CHECK BFO** (i) (*d*) (i) applicable except that h.t. is also applied to the b.f.o.
(ii) (*c*) (ii) and (*c*) (iii) applicable.

5.32 " S " METER

Suitable circuitry is included in North American versions only of the receiver. The meter is connected between the cathode of V16 and a point of preset (RV4) positive potential. It is calibrated to provide a reading of " S1 " for a 1·25μV signal and ascending " S " points in approximately 4dB steps. Above " S9 ", divisions are in increments of 10dB. It should be remembered that only with the I.F. GAIN control at maximum is the correct calibration maintained.

PART 2

MAINTENANCE

PART 2

MAINTENANCE

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WARNING

The Receiver will, under normal conditions, remain in alignment over an extremely long period of time, consequently ALL POSSIBILITY OF OTHER CAUSES OF LOW SENSITIVITY SHOULD BE ELIMINATED BEFORE RE-ALIGNMENT IS CONSIDERED, and should then only be undertaken by order of the Engineer responsible for the maintenance of the equipment.

Should it become necessary to re-align any part of the receiver only a very small angular adjustment of the trimmers should be necessary unless units have been changed.

TEST EQUIPMENT REQUIRED FOR MAINTENANCE

The following items of test gear are required to carry out the maintenance described in this part of the handbook :—

(*a*) Valve voltmeter reading up to 5·0V at frequencies up to 70 Mc/s

(*b*) Signal generator capable of operating on fundamental frequencies up to 40 Mc/s

(*c*) Digital frequency meter measuring frequencies at least up to 100 kc/s

(*d*) Multi-meter measuring a.c. and d.c. quantities up to 500V with resistance of 20,000Ω per volt

(*e*) Heterodyne wavemeter measuring 40–70 Mc/s

(*f*) Miscellaneous: viz. 0·1μF capacitor, 4·7kΩ resistor and 12pF trimmer capacitor.

Note : Major users of the RA.17 Receiver are advised to obtain factory-type test jigs for alignment of the various units. Details of these jigs and specially designed test gear will be supplied on request. A supplement to Section 6 (Alignment Procedures) describing the employment of this test gear can be made available to such users.

SECTION 1

SPURIOUS RESPONSES

1.1 ORIGINS OF SPURIOUS RESPONSES

In a highly sensitive receiver, precautions against internally generated spurious responses are essential. To this end, the various sections of the receiver have been carefully screened and the power supplies filtered.

Any reduction in the screening efficiency or the failure of any filtering component may result in spurious signals being generated. It is therefore essential to ensure that the bonding surfaces are clean and that all securing screws are tight. Spurious responses in the receiver may occur from the following main causes:—

(*a*) 37·5 Mc/s break-through from the second mixer V9 to the third mixer V11
(*b*) Break-through of 1 Mc/s harmonics
(*c*) Break-through of b.f.o. harmonics
(*d*) Responses at 2·550 and 3·050 Mc/s due to second v.f.o. break-through.

1.2 CHECKS FOR SPURIOUS RESPONSES

Spurious responses are measured relative to receiver noise in the following manner :—

When a response is located, the receiver is de-tuned from it just sufficiently to render the beat note inaudible. The i.f. gain is then adjusted to provide a convenient noise reference output (1mW) and the receiver re-tuned to the spurious signal for maximum output. The dB rise in audio output is a measure of the spurious signal level relative to receiver noise.

Standard conditions of test :

No connection to aerial socket
System switch to MAN
I.F. GAIN at MAX
B.F.O. on
3 kc/s bandwidth
AE (ANT.) ATTENUATOR at MIN.

(a) 37·5 Mc/s Break-through to Third Mixer

Switch AE (ANT.) RANGE to WIDEBAND.

This response will be indicated as a beat note which varies rapidly in frequency with respect to the KILOCYCLES scale, *i.e.* a change of 1 kc/s on the scale results in a much larger change in the note. It will also move along the KILOCYCLES scale if the MEGACYCLES dial is adjusted slightly. This response may be eliminated by adjusting the 37·5 Mc/s trap (L52 at second mixer anode).

(b) 1 Mc/s Harmonic Break-through

Switch AE (ANT.) RANGE to WIDEBAND.

1 Mc/s break-through responses appear at 0 and 1,000 on the KILOCYCLES scale at each setting of the MEGACYCLES dial and are generally more prominent with wideband input. If the response is dependent upon the setting of the MEGACYCLES dial, the 1 Mc/s spectrum is probably breaking through to the first mixer stage. If the response is independent of the MEGACYCLES dial setting, it is due either to break-through of the second and/or third harmonic to the second or third mixer stage. Remove second mixer valve to eliminate this stage and so determine in which stage the break-through occurs.

(c) First V.F.O. Harmonics

Spurious responses may occur at 4·5, 5·5 and/or 17·5 Mc/s, if C42A and/or C194A are open-circuit. These responses are caused by the harmonics of the first v.f.o. breaking through to the second mixer stage and beating with the harmonics of the 37·5 Mc/s heterodyne voltage.

(d) B.F.O. Harmonics

These responses may be detected at 100 kc/s intervals between 1 and 1·5 Mc/s when the b.f.o. frequency is 100 kc/s and the receiver aerial input is tuned.

(e) Second V.F.O. Break-through

Responses may occur at 2·550 and 3·050 Mc/s with tuned aerial input.

Ascertain that the first and second v.f.o. are not in contact, that the v.f.o. chassis is well bonded to the main chassis and the fixing screws are tight.

Notes: A failure in any one of the following capacitors C66, C92, C96, C97, C98, C103 or C104 may result in increased ' end of band ' responses. These responses will disappear when the MEGACYCLE dial is de-tuned.

The failure of C117, C154, C155, C207, C208 or C214 can result in increased ' end of band ' responses, or b.f.o. harmonic break-through. De-tuning the MEGACYCLES dial will have no effect.

SECTION 2

VALVE DATA

Details of valves used in the British and American receiver are shown below. A key to the valve base connections is provided in Figure 4. The location of valves in the receiver is shown in Figure 5.

2.1 VALVE CONNECTIONS (British Version)

Pin No.	CV138 EF91	CV140 EB91	CV1377 GZ34	CV453 EK90	CV454 EF93	CV2209 6F33	CV3998 E180F
1	Grid 1	Cathode 1	N.C.	Grid 1	Grid 1	Grid 1	Cathode
2	Cathode	Anode 2	Heater	Cathode & Grid 5	Grid 3	Cathode	Grid 1
3	Heater	Heater	Omitted	Heater	Heater	Heater	Cathode
4	Heater	Heater	Anode	Heater	Heater	Heater	Heater
5	Anode	Cathode 2	Omitted	Anode	Anode	Anode	Heater
6	Grid 3 & Screen	Screen	Anode	Grid 2 & Grid 4	Grid 2	Grid 3 & Diode	I.C.
7	Grid 2	Anode 1	Omitted	Grid 3	Cathode	Grid 2	Anode
8	—	—	Heater	—	—	—	Grid 3 & Screen
9	—	—	—	—	—	—	Grid 2
Base	B7G	B7G	Int. Octal	B7G	B7G	B7G	B9A

2.2 VALVE COMPLEMENT AND TYPICAL D.C. VOLTAGES (British Version)

Cct. Ref.	*Function*	*CV No.*	*Equivalent*	*Anode*	*Screen*	*Cathode*	*Cct. Ref.*
V1	Crystal Oscillator	138	EF91	180 (5)	180 (7)	40 (2)	V1
V2	Harmonic Generator	138	EF91	200 (5)	70 (7)	—	V2
V3	R.F. Amplifier	3998	E180F	180 (7)	140 (9)	1·0 (1)	V3
V4	Harmonic Mixer	2209	6F33	210 (5)	160 (7)	2·0 (2)	V4
V5	First V.F.O.	138	EF91	210 (5)	200 (7)	—	V5
V6	37·5 Mc/s Amplifier	138	EF91	210 (5)	140 (7)	1·7 (2)	V6
V7	First Mixer	3998	E180F	180 (7)	150 (9)	0·5 (1)	V7
V8	37·5 Mc/s Amplifier	138	EF91	200 (5)	190 (7)	1·8 (2)	V8
V9	Second Mixer	3998	E180F	190 (7)	130 (9)	1·3 (1)	V9
V10	37·5 Mc/s Amplifier	138	EF91	210 (5)	210 (7)	2·0 (2)	V10
V11	Third Mixer	453	EK90	210 (5)	90 (6)	1·2 (2)	V11
V12	Second V.F.O.	138	EF91	60 (5)	170 (7)	—	V12
V13	Calibrator	453	EK90	250 (5)	90 (6)	2·0 (2)	V13
V14	First I.F. Amplifier	454	EF93	200 (5)	95 (6)	1·6 (7)	V14
V15	Calibrator	454	EF93	230 (5)	130 (6)	6·0 (7)	V15
V16	Second I.F. Amplifier	454	EF93	200 (5)	60 (6)	0·8 (7)	V16
V17	I.F. Output	454	EF93	160 (5)	100 (6)	1·6 (7)	V17
V18	A.V.C. and T.C.	140	EB91	—	—	25 (1)	V18
V19	B.F.O.	138	EF91	180 (5)	210 (7)	—	V19
V20*	Power Rectifier	1377	GZ34	250 (4)	250 (6)	250 (8)	V20*
V21	Detector and Noise Limiter	140	EB91	—	—	—	V21
V22	Audio Output	138	EF91	220 (5)	230 (7)	2·5 (2)	V22
V23	A.F. Output	138	EF91	220 (5)	230 (7)	2·3 (2)	V23

* In British versions of the receiver up to serial No. 1460, V20 is a type GZ33, GZ34 or a CV1377 but NOT CV378 since certain varieties of this valve give poor results.

2.3 VALVE CONNECTIONS (North American Version)

Pin No.	6AU6	6688	6AS6	6BE6	6BA6	6AL5	5V4G
1	Grid 1	Cathode	Grid 1	Grid 1	Grid 1	Cathode 1	N.C.
2	Grid 3 & Screen	Grid 1	Cathode	Cathode & Grid 5	Grid 3 & Screen	Anode 2	Heater
3	Heater	Cathode	Heater	Heater	Heater	Heater	No pin
4	Heater	Heater	Heater	Heater	Heater	Heater	Anode 2
5	Anode	Heater	Anode	Anode	Anode	Cathode 2	No pin
6	Grid 2	I.C.	Grid 2	Grid 2 & Grid 4	Grid 2	Screen	Anode 1
7	Cathode	Anode	Grid 3	Grid 3	Cathode	Anode 1	No pin
8	—	Grid 3 & Screen	—	—	—	—	Cathode & Heater
9	—	Grid 2	—	—	—	—	
Base	B7G	B9A	B7G	B7A	B7G	B7G	Int. Octal

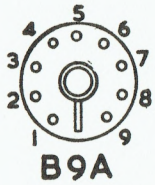
2.4 VALVE COMPLEMENT AND TYPICAL D.C. VOLTAGES (North American Version)

Cct. Ref.	*Function*	*Type*	*Anode*	*Screen*	*Cathode*	*Cct. Ref.*
V1	Crystal Oscillator	6AU6	160 (5)	160 (6)	42·0 (7)	V1
V2	Harmonic Generator	6AU6	180 (5)	40 (6)	— (7)	V2
V3	R.F. Amplifier	6688	160 (7)	120 (9)	1·0 (1)	V3
V4	Harmonic Mixer	6AS6	160 (5)	120 (6)	1·8 (2)	V4
V5	First V.F.O.	6AU6	190 (5)	130 (6)	— (7)	V5
V6	37·5 Mc/s Amplifier	6AU6	190 (5)	100 (6)	0·8 (7)	V6
V7	First Mixer	6688	170 (7)	120 (9)	0·5 (1)	V7
V8	37·5 Mc/s Amplifier	6AU6	190 (5)	100 (6)	0·8 (7)	V8
V9	Second Mixer	6688	180 (7)	140 (9)	0·9 (1)	V9
V10	37·5 Mc/s Amplifier	6AU6	190 (5)	100 (6)	0·8 (7)	V10
V11	Third Mixer	6BE6	190 (5)	80 (6)	1·1 (2)	V11
V12	Second V.F.O.	6AU6	30 (5)	140 (6)	— (7)	V12
V13	Calibrator	6BE6	220 (5)	90 (6)	1·8 (1)	V13
V14	First I.F. Amplifier	6BA6	180 (6)	60 (6)	0·7 (7)	V14
V15	Calibrator	6BA6	220 (5)	120 (6)	6·0 (7)	V15
V16	Second I.F. Amplifier	6BA6	180 (5)	90 (6)	1·6 (7)	V16
V17	I.F. Output	6BA6	150 (5)	90 (6)	1·5 (7)	V17
V18	A.V.C. and T.C.	6AL5	—	—	24·0 (1)	V18
V19	B.F.O.	6AU6	170 (5)	130 (6)	— (7)	V19
V20	Power Rectifier	5V4G	250 (4)	250 (6)	220·0 (8)	V20
V21	Detector and Noise Limiter	6AL5	—	—	— (1)	V21
V22	Audio Output	6AU6	200 (5)	140 (6)	0·9 (7)	V22
V23	A.F. Output	6AU6	190 (5)	140 (6)	0·9 (7)	V23

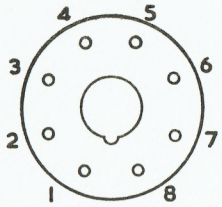
Voltages were obtained from a B9A or B7G stand-off valve base using a 20,000Ω/volt meter on the optimum range in each case. Valve pin numbers are indicated in brackets.

The receiver was set as follows:

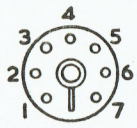
System switch to MAN.
I.F. and A.F. GAIN to MAX.
No signal i.e. 1st and 2nd v.f.o. off tune.
LIMITER off.
B.F.O. off except for checking V19.
System switch to CAL. in order to check V13 and V15 only.



B9A



INTERNATIONAL OCTAL

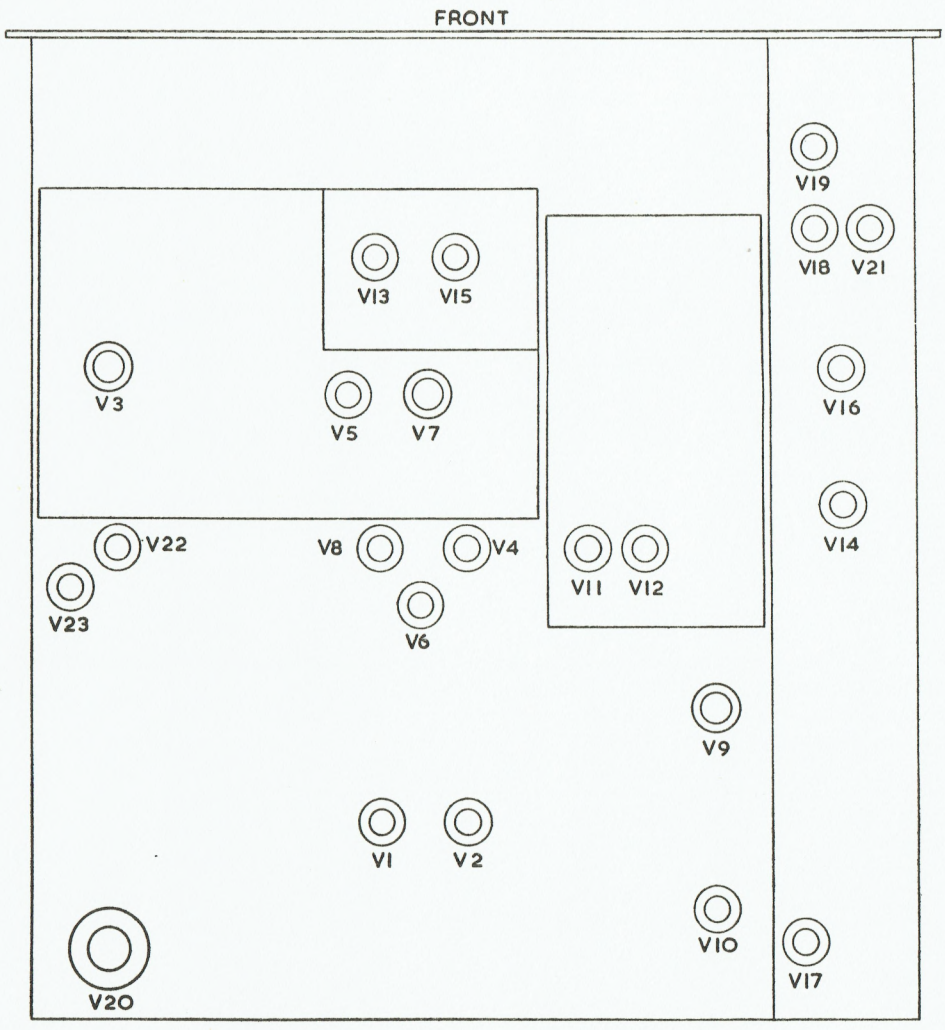


B7G

VALVE BASE CONNECTIONS

(ALL VALVE HOLDERS VIEWED FROM UNDERSIDE)

FIGURE 4



RA17 VALVE LOCATION DIAGRAM

(VIEW FROM ABOVE)

FIGURE 5

SECTION 3

TYPICAL PERFORMANCE

3.1 STABILITY

Overall drift, less than 1,000 c/s during a one and a half hour period from switching on. Thereafter, less than 50 c/s at all frequencies under normal operating conditions.

3.2 SENSITIVITY

For 20dB signal-to-noise ratio ; BANDWIDTH set at 3KC/S.

A 1.—1μV input.
A 2.—3·5μV input (Modulated 30 per cent.).

3.3 SELECTIVITY

	6dB	66dB
Position 1	100 c/s	1·2 kc/s
„ 2	300 c/s	1·7 kc/s
„ 3	750 c/s	2·1 kc/s
„ 4	1·2 kc/s	8 kc/s
„ 5	3 kc/s	15 kc/s
„ 6	8 kc/s	20 kc/s

The centre frequency on crystal bandwidths does not change by more than 50 c/s when the bandwidth is changed. Typical selectivity curves are shown in Figure 6.

3.4 CROSS MODULATION

Conditions: AE. (ANT.) ATTENUATOR at MAX.
BANDWIDTH set at 3 KC/S.
Aerial tuned to wanted signal.
Wanted signal level: 1mV.
Unwanted signal (30% modulated): 30dB above and 10 kc/s from wanted signal.
Resulting cross modulation : equivalent to 1% modulation.

3.5 IMAGE AND SPURIOUS RESPONSE

Rejection greater than 60dB with tuned input. Internally generated spurious responses not greater than 1dB above noise.

3.6 A.V.C.

An increase of 60dB above a.v.c. threshold increases audio output not more than 6dB.

3.7 NOISE FACTOR

1·5 Mc/s: less than 8dB.
3, 6, 12 and 24 Mc/s: less than 6dB.

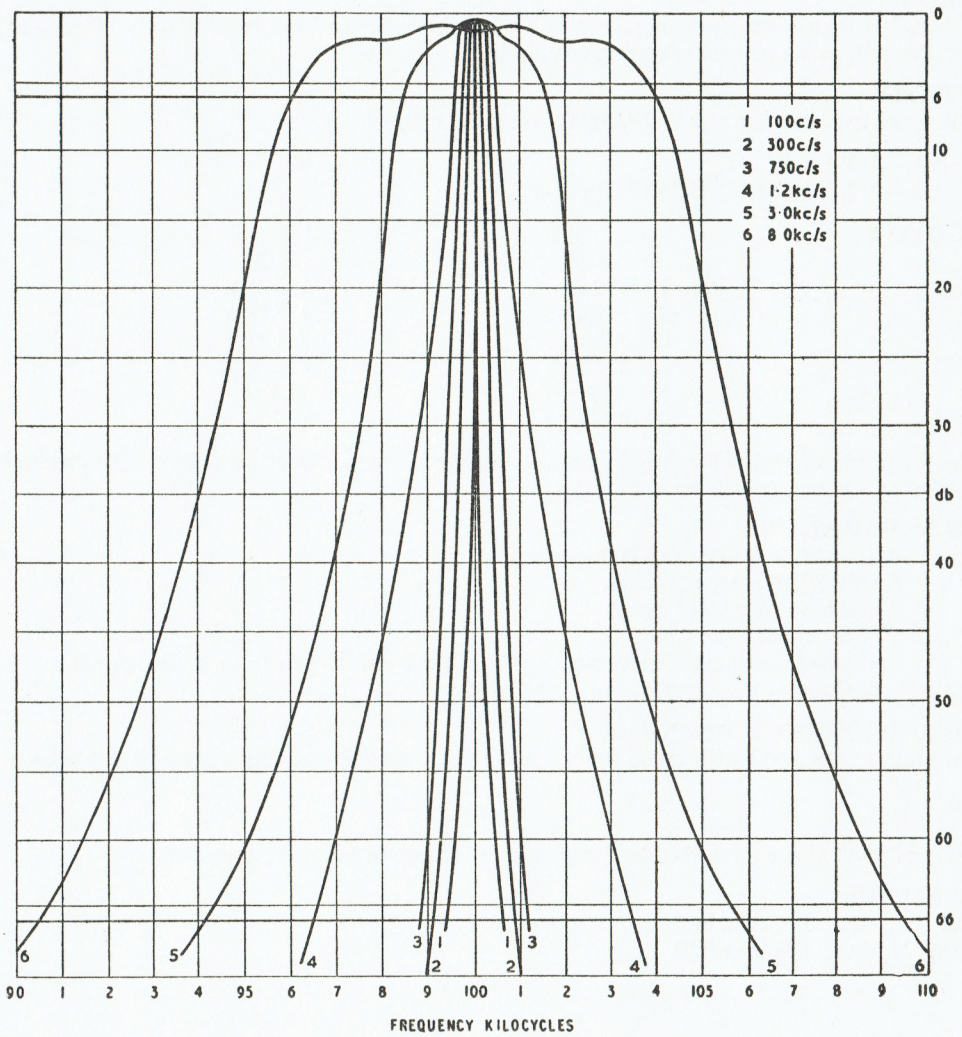


FIGURE 6 TYPICAL SELECTIVITY CURVES

SECTION 4

FAULT LOCATION

4.1 PROCEDURE FOR FAULT LOCATION

The following simple checks enable the faulty section of the receiver to be determined with the minimum of delay. After the initial determination, detailed location of the fault can be carried out by use of the representative test data in Section 5 and examination of voltages at valve electrodes in Section 2.2 (British Version) and Section 2.4 (American Version).

4.2 2–3 Mc/s INTERPOLATION RECEIVER

With the I.F. and A.F. GAIN controls at maximum and the i.f. bandwidth set to 8 kc/s, the first circuit noise of the 2–3 Mc/s interpolation receiver should be audible. Absence of noise indicates a fault in this section, which may be located by the usual techniques.

4.3 SECOND/THIRD MIXER STAGES

The internal noise should rise as each point on the MEGACYCLE dial is tuned through. Should this not occur, trouble at the second mixer stage or misalignment of the ganged circuits between the second and third mixer may be suspected.

4.4 37·5 Mc/s DRIVE

A fault appearing at the second mixer stage may be due either to the mixer circuits or lack of 37·5 Mc/s drive. The latter may be checked by removing the second mixer valve (V9) and connecting a suitable valve voltmeter to the test point TP3. At each setting of the MEGACYCLES scale, several volts at 37·5 Mc/s should be measured. The absence of this voltage will indicate a fault in the harmonic generator and amplifier circuits, harmonic filter, or possibly in the first variable frequency oscillator stage.

4.5 AERIAL TO FIRST I.F. FILTER

Should the noise rise satisfactorily on each megacycle band, the fault must be in the first i.f. filter, first mixer or in the r.f. stage.

4.6 FIRST MIXER

The removal of the first mixer valve (V7) should result in a drop in noise output.

Note: Care must be taken during this check to ' re-peak ' the MEGACYCLES scale as the oscillator frequency is slightly affected.

4.7 FIRST VARIABLE FREQUENCY OSCILLATOR

The output voltage from the first variable frequency oscillator may be checked by removing the valve from the first mixer stage and connecting a suitable valve voltmeter to test point TP2. Several volts should appear at this point throughout the range of the MEGACYCLES scale.

4.8 NOISE

The receiver may be checked overall by ascertaining that the noise rises as the aerial circuits are ' peaked up ' at the correct frequency, with the aerial disconnected. With the System switch set to MAN. the rise in noise should be approximately 5–10dB at the lower frequencies and 1–5dB at the higher frequencies.

SECTION 5

REPRESENTATIVE TEST DATA

	Signal Input to :	*Frequency*	*Input*	*Output*	*Remarks*
(*a*)	Grid V22	1,000 c/s	0·3V	50mW in 3Ω	AUDIO GAIN MAX. A.F. LEVEL MAX.
	Grid V23	1,000 c/s	0·35V	10mW in 600Ω (Output to line)	I.F. GAIN MIN. B.F.O. off. LIMITER off.
(*b*)	Grid V16	100 kc/s c.w.	360mV	100μA R.F. level	B.F.O. off.
	Grid V14	100 kc/s c.w.	850μV	100μA R.F. level	System Switch MAN. I.F. GAIN MAX.
	Anode Connection of V12 via 0·1μF with valve removed	100 kc/s c.w.	100μV	100μA R.F. level	1 Mc/s crystal removed. Mc/s scale set to 20. BANDWIDTH 3 kc/s.
(*c*)	Grid of second mixer (TP3)	2·2 Mc/s c.w. 2·5 Mc/s c.w. 2·9 Mc/s c.w.	7μV 7·5μV 7μV	100μA R.F. level 100μA R.F. level 100μA R.F. level	Image response (*i.e.* receiver frequency plus 200 kc/s) should be at least 60dB down.
(*d*)	Aerial input (WIDEBAND)	3·5 Mc/s c.w.	180mV	0·5V at TP2	WIDEBAND INPUT. AE (ANT.) ATTENUATOR MIN. V5 and V7 removed. Valve voltmeter input shunted to 12μμF.
(*e*)	Aerial Input (WIDEBAND)	3·5 Mc/s c.w.	180mV	0·5V at TP3	WIDEBAND INPUT. AE (ANT.) ATTENUATOR MIN. V5 and V7 replaced. V18 and 1 Mc/s crystal removed. Valve voltmeter input shunted to 12μμF. MEGACYCLES scale 3.
(*f*)	Grid V10	37·5 Mc/s c.w.	40mV	1V at TP3	V9 and V5 and 1 Mc/s crystal removed. Valve voltmeter input shunted to 12μμF.
	Grid V8		25mV		
	TP1		2·8mV		

(*g*) With the 1 Mc/s crystal in place, the output at plugs PL2 and PL3 should be approximately 2 volts.

(*h*) The level of the 37·5 Mc/s drive at TP3 should be between 2 and 10 volts at any MEGACYCLE setting.

SECTION 6

ALIGNMENT PROCEDURES

6.1 GENERAL

The receiver will, under normal conditions, maintain the factory alignment over an extremely long period of time. Consequently ALL POSSIBILITY OF OTHER CAUSES OF TROUBLE SHOULD BE ELIMINATED BEFORE RE-ALIGNMENT IS CONSIDERED.

If it becomes necessary to re-align any part of the receiver, only a very small angular adjustment of any trimmer should be necessary. The signal generator must have a high degree of frequency resetting accuracy and be very stable.

Unless otherwise stated, the panel-mounted R.F. Level meter is used as the output indicator.

6.2 100 kc/s I.F. STRIP

(a) First and Second I.F. Amplifier

Remove the second v.f.o. valve V12. Set the System switch to MAN, the I.F. GAIN to MAX and the meter switch to R.F. LEVEL. Connect the signal generator (100 kc/s c.w.) via a 0·1μF capacitor to the grid of V16 (Pin 1). Adjust C191 to obtain maximum indication on the meter. The output from the generator required to produce 100μA deflection on the meter should be approximately 320mV. Connect the signal generator via a 0·1μF capacitor to the grid of V14 (Pin 1) and connect a 4·7kΩ damping resistor across L72. Adjust C179 to give maximum indication.

Remove the 4·7kΩ resistor from L72 and connect it across L73. Adjust C171 for maximum indication. Remove the 4·7kΩ resistor. The signal generator output required to produce a 100μA deflection should be approximately 800μV. Tune the signal generator through the passband and note the ' double peak ' response. The peak separation should be approximately 5–5·6 kc/s and be symmetrical about 100 kc/s. If the peak amplitudes differ, slight re-adjustment of C191 will compensate for this. The 6dB bandwidth should be approximately 9·5 kc/s.

(b) 100 kc/s (L-C) Filter

Remove the second v.f.o. valve V12 and set controls as in (a) above. Connect the signal generator (100 kc/s) via a 0·1μF capacitor to the anode connection on V12 holder (Pin 5). Remove the L-C filter can. Link R77 to C153 and R80 to C158, and replace filter can. Set bandwidth to 1·2kc/s. Increase the signal generator output until the meter shows a deflection and tune the signal generator to give maximum indication.

The frequency at this setting should be within ±100 c/s of 100 kc/s. Adjust C162, C158, C153 and C147 in this order several times until maximum output is obtained. Remove the links. The sensitivity should be approximately 300μV for 100μA deflection of the meter. Check that the 8, 3 and 1·2 kc/s bandwidths agree approximately with the typical performance figures in Section 3.

(c) Crystal Filter

Remove the second v.f.o. valve V12 and set the controls as in (*a*) above. Switch the bandwidth to 750 c/s. Connect the signal generator via a 0·1μF capacitor to pin 5 on V12 valve base. Tune the signal generator slowly through the passband and observe the crystal responses (f1 and f2). Care must be taken since these are very sharp.

Re-tune the signal generator to the mean of f1 and f2, and adjust C110 and C148 for maximum output. Tune the generator through the passband and ensure that the peak-to-trough ratio does not exceed 3dB and that the peaks are approximately equal in amplitude. Reset the signal generator frequency to 100 kc/s and adjust the output to produce a reading of 100μA. Set the generator frequency to 101, 250 c/s, increase the output by 66dB and adjust the phasing control C118 to obtain minimum output (*i.e.* the point of rejection occurs). Increase the generator frequency slowly and ascertain that the meter reading does not exceed 100μA. Slowly decrease the signal frequency until 100μA reading is obtained and check that the frequency is not greater than 101, 125 c/s.

Tune through the passband, adjusting the generator output as necessary to avoid meter damage. Note the highest frequency at which a signal generator output equal to that used at 101, 250 c/s gives an output of 100μA. This frequency should not be greater than 98, 875 c/s.

Slowly decrease the signal frequency and ensure that the output does not rise above 100μA. Decrease the generator output by 66dB and re-check the frequency response within the passband, re-adjusting C110 and C148 if necessary. Set the signal generator frequency to 100 kc/s and adjust the output for 100μA level. Increase the signal generator output by 6dB and check the bandwidth for 100μA output. The bandwidth should be between 700 and 800 c/s and the mid-position should not deviate from 100 kc/s by more than 25 c/s. The input required for 100μA level should be approximately 500μV.

Switch the bandwidth to 300 c/s. Repeat the procedure with signal generator frequency settings of 101, 025 c/s, 100, 900 c/s and 99, 100 c/s respectively. Adjust phasing capacitor C119 only. The 6dB points should be between 270 and 330 c/s apart and the deviation of the mean from 100 kc/s should not exceed 25 c/s. The sensitivity should be approximately 280μV for 100μA deflection.

Switch the bandwidth to 100 c/s. Proceed as before with frequency settings of 100, 925 c/s, 100, 800 c/s and 99, 200 c/s. Adjust the phasing capacitor C120. The 6dB bandwidth should be between 80 and 120 c/s and the deviation from the mean less than 25 c/s. For 100μA output, the input should be approximately 270μV. Replace V12.

(d) Use of Digital Frequency Meter

The alignment of the i.f. strip and in particular the crystal filter involves the measurement of frequencies to far greater accuracies than those normally obtainable from signal generators. A digital frequency meter should therefore be employed. The equipment should be connected to SK8 or SK9. The exact frequency passing through the circuit will be displayed on the indicator panel. Should the level of output at any time during the alignment procedure be insufficient to drive the frequency meter, the signal generator output can be increased to obtain the frequency check but must be restored to the lower value for level measurements. When such increases are made, the meter on the receiver panel should be switched to A.F. LEVEL to avoid damage.

6.3 SECOND V.F.O.

(a) Minor Corrections

The variable capacitor has been carefully adjusted and should not be readjusted unless absolutely necessary. Minor corrections can be made as follows:—

(i) Set the System switch to CAL.
(ii) Set the KILOCYCLES cursor in line with the MEGACYCLES cursor (*i.e.* central).
(iii) Ensure that the B.F.O. switch is off.
(iv) Rotate the I.F. GAIN to MAX.
(v) Set the BANDWIDTH switch to 3 KC/S.
(vi) Set the KILOCYCLES scale to zero (0 KC/S) and adjust the capacitor C136 to give zero beat note in the loudspeaker.
Note: The capacitor C136 is obscured by V16.
(vii) Set the KILOCYCLES scale to that zero beat point which is nearest to the 1,000 KC/S position.
(viii) Lock the drive sprocket.
(ix) Adjust the position of the film scale to produce correct calibration.
Note: When moving the film scale relative to the sprockets, grip both sides of the film scale in order to create a loop which will allow the film to slide round the drive sprocket; the drive sprocket is on the left when facing the receiver and hence movement of the film scale will have to be to the left.
(x) Repeat (vi) to (ix) until an adequate degree of accuracy is obtained.

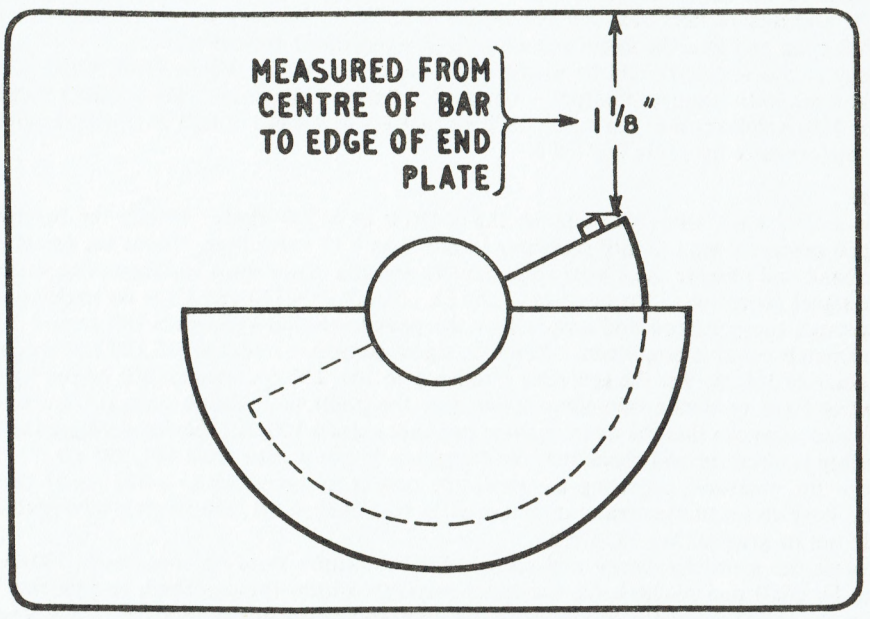


FIGURE 7

(b) Replacement of Ganged Capacitor

The procedure described below should not normally be carried out unless the ganged capacitor is being replaced. Before electrical adjustment, the following mechanical points should be verified :—

(i) Set the KILOCYCLES scale against the mechanical end stop at the 1,000 kc/s end and check that the ganged capacitor is set as shown in Figure 7.

(ii) Check that the distance from the cursor to the extreme end of the scale, adjacent to the 1,000 kc/s point, is approximately ½-in. Should this distance vary appreciably from ½-in., carefully lift the scale from the drive and move the scale round to the required position.

(iii) Whenever the film scale is replaced, endeavour to re-align by adjusting the film to the correct position before trimming.

The procedure for electrical adjustment is carried out as follows:—

(iv) Proceed as in 6.3 (a) above.

(v) Check the calibration of the v.f.o. at 100 kc/s intervals; if the error exceeds 1 kc/s, adjust carefully the two outer plates of the rotor of the oscillator section of the ganged capacitor in order to correct the calibration.

Note: The oscillator capacitor C139 is the second section from the rear of the ganged capacitor unit.

6.4 B.F.O.

Set the System switch to the CHECK B.F.O. position. Switch the meter switch to R.F. LEVEL. Switch the b.f.o. on and set the b.f.o. frequency control knob to zero. Adjust C201 as necessary to obtain zero beat. Observe that the meter reads approximately half f.s.d.

If the b.f.o. frequency control knob has been removed, adjust the frequency capacitor for zero beat with the identification mark on the shaft uppermost. Replace the knob so that the pointer indicates zero.

6.5 SECOND I.F. CIRCUIT

Set the System switch to MAN. Remove the 1 Mc/s crystal. Set the I.F. GAIN to MAX. Set the METER switch to R.F. LEVEL. Connect the signal generator (c.w. output) to TP3. Alignment frequencies are 2·2 and 2·9 Mc/s which correspond to 800 and 100 kc/s respectively on the KILOCYCLES dial. Adjust C122, C125 and C128 at 100 kc/s and L57, L58 and L59 at 800 kc/s. Repeat as necessary until alignment is correct at both ends of the band. The input required for 100μA meter deflection should be between 5 and 10μV.

6.6 37·5 Mc/s FILTER AND AMPLIFIER

Remove the 1 Mc/s crystal, second mixer valve V9 and the first v.f.o. valve V5. Check that all the screening covers are in place. Connect a suitable valve voltmeter, shunted to 12μμF, to TP3. Inject an accurate 37·5 Mc/s signal at TP1. Ensure the valve voltmeter and signal generator leads are short to avoid regeneration. Adjust L50, C90, C81, C72, C63, C55, C45, C35, C24, L28 and L33 in that order, several times, to obtain maximum output. The input required to produce 1V should be approximately 2·5mV. The 6dB bandwidth of the 37·5 Mc/s chain should lie between 229–300 kc/s. The bandwidth at 40dB should not exceed 750 kc/s. The mean of the frequencies corresponding to the 6dB points should not deviate from 37·5 Mc/s by more than 20 kc/s and by more than 25 kc/s at 40dB bandwidth.

C108 is adjusted to avoid interaction between the 37·5 and 40 Mc/s filters and should not normally require further adjustment. Replace the 1 Mc/s crystal, the second mixer and the first v.f.o. valve.

6.7 1 Mc/s CRYSTAL OSCILLATOR

Connect the valve voltmeter to the 1 Mc/s output plug PL2 and adjust L2 for maximum output (2–3V). C2 may be adjusted to 'pull' the crystal to the correct frequency. Adjustment of the crystal frequency should not be attempted unless a standard of accuracy better than one part in 10 is available.

6.8 SECOND MIXER DRIVE LEVEL

Remove the second mixer valve V9. Connect the valve voltmeter, shunted to 12μμF, to TP3. Tune through each megacycle calibration point and check that the level of each output lies between 2 and 10V. To equalise the drive at 28 and 29 Mc/s carefully adjust C7.

6.9 FIRST V.F.O. CALIBRATION

Slacken off the mechanical end-stop until it is inoperative. Set C76 to maximum capacity and ensure that the calibration mark at the zero end of the MEGACYCLES dial coincides with the cursor. Tighten end-stop after moving the scale free from the stop. Check that the mechanical stops operate before the capacitor end-stops become effective at both ends of the band.

To readjust the first v.f.o. calibration, a heterodyne wavemeter should be employed. This is coupled very loosely to V7 by placing its input lead in the vicinity of the valve base. The 1 Mc/s crystal and V12 should be removed.

Set the wavemeter to 40·5 Mc/s and the MEGACYCLES dial to zero. Adjust L36 for zero beat. Change the wavemeter setting to 69·5 Mc/s and the MEGACYCLES dial to 29. Adjust C77 for zero beat. Repeat adjustment as necessary. Check the frequency calibration at 1 Mc/s intervals and ensure that the megacycle positions are reasonably central on the scale markings. Remove the first mixer valve V7 and connect the valve voltmeter, shunted to 12μμF, between TP2 and the chassis. Check that the valve voltmeter indicates at least 1·5V over the range. Replace the 1 Mc/s crystal, V12 and V7.

6.10 AERIAL CIRCUIT

The cores of the aerial coils L4 to L9 should be set so that the correct frequency ranges (plus a small overlap) are available when C18 is tuned.

6.11 CRYSTAL CALIBRATOR

Should no output be obtained from this unit when the System switch is in the CAL position and the KILOCYCLES scale set at a 100 kc/s check point, or if spurious responses are obtained over the Kilocycles range, proceed as follows:—

Set the KILOCYCLES scale to a 100 kc/s point and check the tuning of L70 by carefully rotating the core a half-turn either side of the setting. If the signal does not appear, restore the core to its original setting and repeat the check with L75. If the signal is heard, the cores of L70 and L75 should be set to the centre of the range of adjustment over which a clean signal is produced.

Should a major fault be suspected, or if L70 or L75 have been inadvertently misaligned, it will be necessary to remove the unit and make up an extension cable so that the unit may be operated outside the receiver. The crystal calibrator may be aligned as follows :—

Remove V13 and connect the valve voltmeter probe to grid 3 (Pin 7). Inject a 900 kc/s c.w. signal, from the signal generator, at the grid of V15 (Pin 1) and adjust L75 for maximum output. Disconnect the valve voltmeter and the signal generator, replace V13 and remove V15. Connect the signal generator to grid 1 (Pin 1) of V13 and the valve voltmeter to the grid 1 connection (Pin 1) of V15. Set the signal generator to 100 kc/s c.w. and adjust L70 for maximum indication on the valve voltmeter. Disconnect the valve voltmeter and the generator. Replace V15. Connect the coaxial connector to SK2 on the receiver.

The output should be approximately 0·2V measured between Pin 6 of the octal plug and earth.

6.12 40 Mc/s FILTER

This filter is over-coupled and cannot be readily aligned without a 40 Mc/s sweep oscillator. Readjustment therefore should not be attempted unless the specially designed test equipment and factory-type alignment jigs are available.

SECTION 7

DISMANTLING AND REPLACEMENT PROCEDURES

7.1 UNIT BREAKDOWN

The receiver may be rapidly dismantled to six sub-units as follows:—

1. **Front Panel**
   - (1) Tuning escutcheon.
   - (2) Loudspeaker and escutcheon.
   - (3) Output level meter.
2. **Second Variable Frequency Oscillator**
   - (1) 2–3 Mc/s band-pass filter.
   - (2) Second v.f.o. (V12).
   - (3) Third mixer (V11).
3. **First Variable Frequency Oscillator**
   - (1) R.F. amplifier (V3).
   - (2) First v.f.o. (V5).
   - (3) First mixer (V7).
4. **100 Kc/s I.F. Strip**
   - (1) Beat frequency oscillator (V19).
   - (2) Crystal filter.
   - (3) L–C filter.
   - (4) First and second i.f. amplifiers (V14 and V16).
   - (5) A.V.C. and T.C. stages (V18).
   - (6) Detector and noise limiter (V21).
   - (7) 100 kc/s output (V17).
5. **Crystal Calibrator (V13 and V15).**
6. **Main Chassis**
   - (1) Aerial (antenna) attenuator.
   - (2) Crystal oscillator (V1).
   - (3) Harmonic generator (V2).
   - (4) 30 and 32 Mc/s low-pass filters.
   - (5) 37·5 and 40 Mc/s band-pass filters.
   - (6) Harmonic mixer (V4).
   - (7) The 37·5 Mc/s amplifiers (V6), (V8) and (V10).
   - (8) Second mixer (V9).
   - (9) A.F. output stages (V22) and (V23).
   - (10) Power supplies (V20).

7.2 DISMANTLING AND REPLACEMENT INSTRUCTIONS

1. **Front Panel**
   - (1) Remove all control knobs.
   - (2) Unscrew the eight instrument head panel fixing screws.
     Note: The two at the bottom of the front panel, adjacent to the jack sockets are secured to the main chassis with nuts.
   - (3) Carefully withdraw the front panel and unsolder the connections to the meter and speaker switches; alternatively, the number of wires to be unsoldered can be minimised (loudspeaker only) by removing the securing nuts on the SPEAKER and METER switches and also the nuts securing the solder tags on the rear of the meter. The panel may now be completely removed.
     Note: When replacing the B.F.O. NOTE control knob, ensure that the identification mark on the shaft is uppermost and that the pointer indicates zero when zero beat is obtained.
2. **Second Variable Frequency Oscillator**
   - (1) Remove the bottom cover.
   - (2) Unsolder the three connections on the 4-way tag strip, adjacent to the terminal strip, situated in compartment 6 (see illustration 1: Key to Under-chassis Layout).
   - (3) Remove the front panel: see 1 above.
   - (4) Withdraw the Crystal Calibrator Unit by slackening the knurled nuts, disconnecting the coaxial cable and unplugging the unit.
   - (5) Unbolt the cable cleat securing the dial light cable.
   - (6) Unclip the lampholder.
   - (7) Disconnect the coaxial cables.
   - (8) Remove the screws securing the Megacycles dial to the boss and withdraw the dial.
     Note: Do not unscrew the boss from the shaft. Unscrew the second v.f.o. cover and the two unit retaining screws (indicated in illustration 7).

(9) The v.f.o. may now be withdrawn vertically. When servicing this assembly, clean the wormwheel and the split gear on the ganged capacitor shaft with carbontetrachloride, then apply with a brush, to the wormwheel only (illustration 6), a thin coating of Molybdenum Disulphide grease (Rocol " Molypad ").

(*a*) Removal of Kilocycles film scale:—

(i) Rotate the KILOCYCLES knob to the 100 KC/S end stop.
(ii) Remove the front panel:—see 1 above.
(iii) While firmly holding the two gears situated above the film bobbins, remove the plate carrying the fibre idler gear.
(iv) Allow the two gears to unwind slowly.
(v) Unwind the film scale.

(*b*) To fit a new film scale:—

(i) Pass the 100 KC/S end round the drive sprocket and wrap the end round the split pin on the inner bobbin; rotate this bobbin until most of the film scale is wound.
(ii) Wrap the other end of the film scale round the split pin on the other bobbin, and rotate the bobbin counter-clockwise until the film scale is taut.
(iii) Wind the gears in opposite directions for $\frac{3}{4}$ to 1 turn, and while holding the gears under tension re-engage the idler gear.
(iv) Secure the plate by the two fixing screws.
(v) To check calibration, see second v.f.o. alignment procedure (Section 6.3).

(*c*) Ganged Capacitor

Note: Refer to the second v.f.o. alignment procedure (Section 6.3) before attempting to replace the ganged capacitor.

(i) Remove the second v.f.o. from the receiver in accordance with the instructions above.
(ii) Remove the KILOCYCLES scale.
(iii) Unscrew the remaining cover plate and the under chassis screen.
(iv) Unsolder the capacitor connections.
(v) Remove the drive gear and collet.
(vi) Unscrew the three fixing screws holding the capacitor to the bracket; ensure that the anti-backlash gears are loaded.

3. **First Variable Frequency Oscillator**

(1) Remove the front panel, the bottom cover and the screens from compartments 3, 8 and 13. (See illustration 1: Key to Under-Chassis Layout).
(2) Unsolder the connecting wires from the two turret lugs situated in compartment 3, the leads to the turret lug in compartment 8, the pin connections in compartment 5 and the screened cable in compartment 13.
(3) Unscrew the three fixing screws on the top of the unit.

(*a*) To fit a new chain:—

(i) Take a 63-link length of chain.
(ii) Hold chain tension sprocket down towards the chassis, and fit new chain round the two chain wheels.
(iii) Release the tension sprocket ensuring that it holds the chain under tension. See Front Panel instructions regarding refitting of B.F.O. NOTE control knob: Section 7.2.

4. **100 Kc/s I.F. Strip**

(1) Remove the left-hand gusset plate adjacent to the unit.
(2) Unsolder the leads to the 4 and 12-way tag strips and the 100 KC/S OUTPUT plugs.
(3) Disconnect the coaxial lead to the second v.f.o.
(4) Remove the six screws securing this unit to the main chassis.

Note: Removal of the I.F. GAIN control on the b.f.o. assembly is necessary in order to obtain access to one of the six securing screws.

(*a*) Beat Frequency Oscillator

(i) Remove Front Panel.
(ii) Remove side plate adjacent to i.f. strip.
(iii) Disconnect leads from I.F. GAIN potentiometer.
(iv) Remove bottom cover.
(v) Remove screw securing cable cleat situated adjacent to 150mH choke assembly on underside of i.f. strip.
(vi) Disconnect red-white lead of b.f.o. cableform from terminal on adjacent 12-way tag strip.
(vii) Withdraw red-white lead from cableform.
(viii) Disconnect brown leads from pin 4 of V18 socket.
(ix) Disconnect yellow leads from pin 9 of V21 socket.
(x) Remove remaining three 6 B.A. screws and crinkle washers to release b.f.o. assembly from i.f. strip chassis.

7.3 VALVE REPLACEMENT

With the exception of V5, replacement of valves will not affect receiver alignment.
When V5 is replaced refer to Section 5.

SUPPLEMENT

MODIFICATIONS FOR RA.17D, RA.17E AND RA.17C-3 RECEIVERS

Component changes are made in the Standard versions of the North American (RA.17C) and British (RA.17A) receivers: the modification introduces a 13 kc/s i.f. bandwidth and the new receiver designations become RA.17D (North American) and RA.17E (British).

The values and/or type numbers for the new components are indicated in Section 9.
The following changes in component values have been introduced on later versions of the receiver.

Cct. Ref.	*Value*	*Description*	*Rating*	*Tol.*	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
C146	270pF	Silver/Mica	350V	5%	5910-99-972-9629	Lemco	11065
C146A	100pF	Ceramic	750V	5%		Lemco	316N750
C152	290pF	Silver/Mica	350V	5%		Lemco	11065
C152A	100pF	Ceramic	750V	5%		Lemco	316N750
C157	290pF	Silver/Mica	350V	5%		Lemco	11065
C157A	100pF	Ceramic	750V	5%		Lemco	316N750
C161	290pF	Silver/Mica	350V	5%		Lemco	11065
C161A	100pF	Ceramic	750V	5%		Lemco	316N750

The RA.17C-3 version of the Standard North American receiver employs silicon diodes (MR4-7) in the power supply circuit ; the diodes are manufactured by the B.T.H. Co. and have the type number SJ401B

CORRIGENDA

Main circuit diagrams EC4500/2C, EC4500/2C-2 and EC4500/2C-3 :— change the reference "D" to "F" on the METER switch S9 (S METER position).

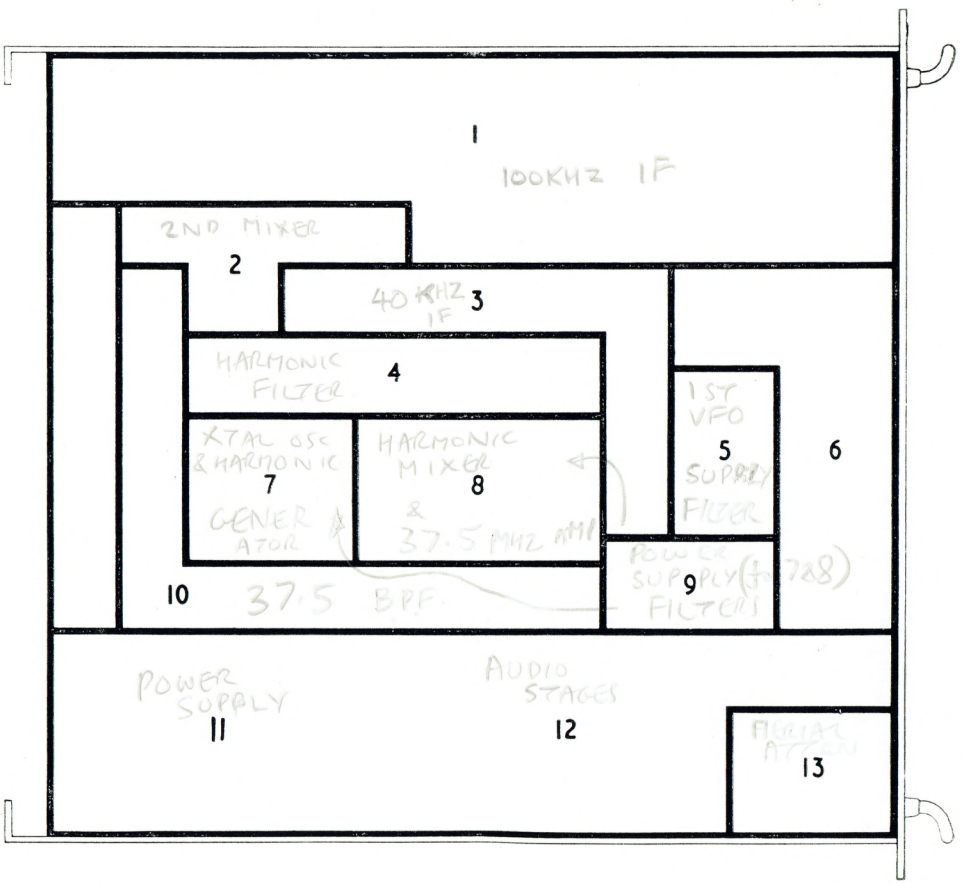
SECTION 2.2 — PART 2 :
* In British versions of the receiver up to serial No. 1460, V20 is a type GZ33 ; if this valve has to be replaced, use either GZ34 or CV1377 but NOT CV378 since certain varieties of this valve give inferior results.

SECTION 8

ILLUSTRATIONS

	Illustration
Key to Under-Chassis Layout	1
Chassis Assembly, Top	2
Chassis Assembly, Underside	3
Crystal Oscillator and Harmonic Filter System, Underside	4
First V.F.O. Unit, Underside	5
Second V.F.O. Unit, Front	6
Second V.F.O. Unit, Rear	7
Second V.F.O. Unit, Underside	8
100 kc/s I.F. Strip, Right Side	9
100 kc/s I.F. Strip, Left Side	10
B.F.O. Unit, Underside	11
Crystal Calibrator Unit, Underside	12

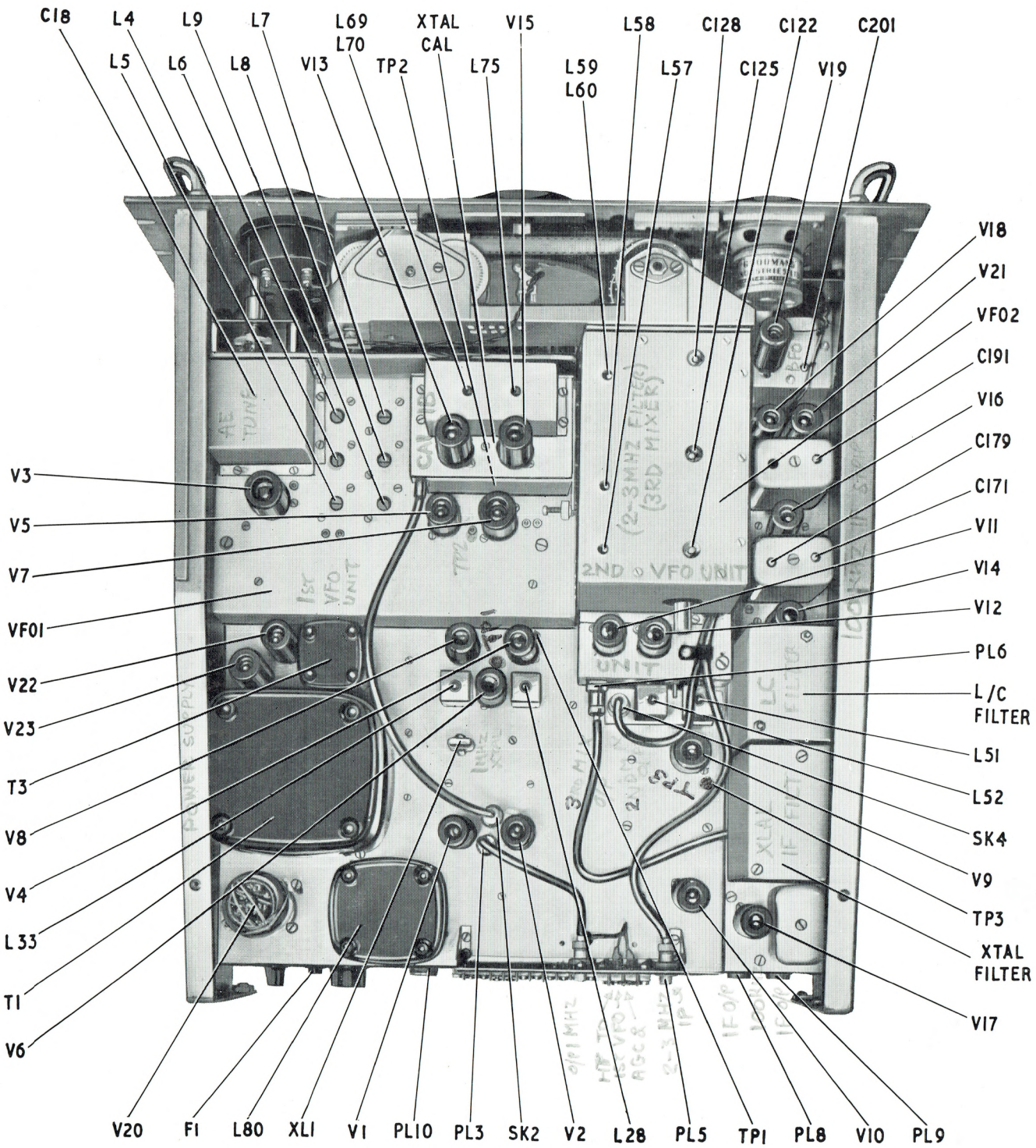
ILLUSTRATION 1



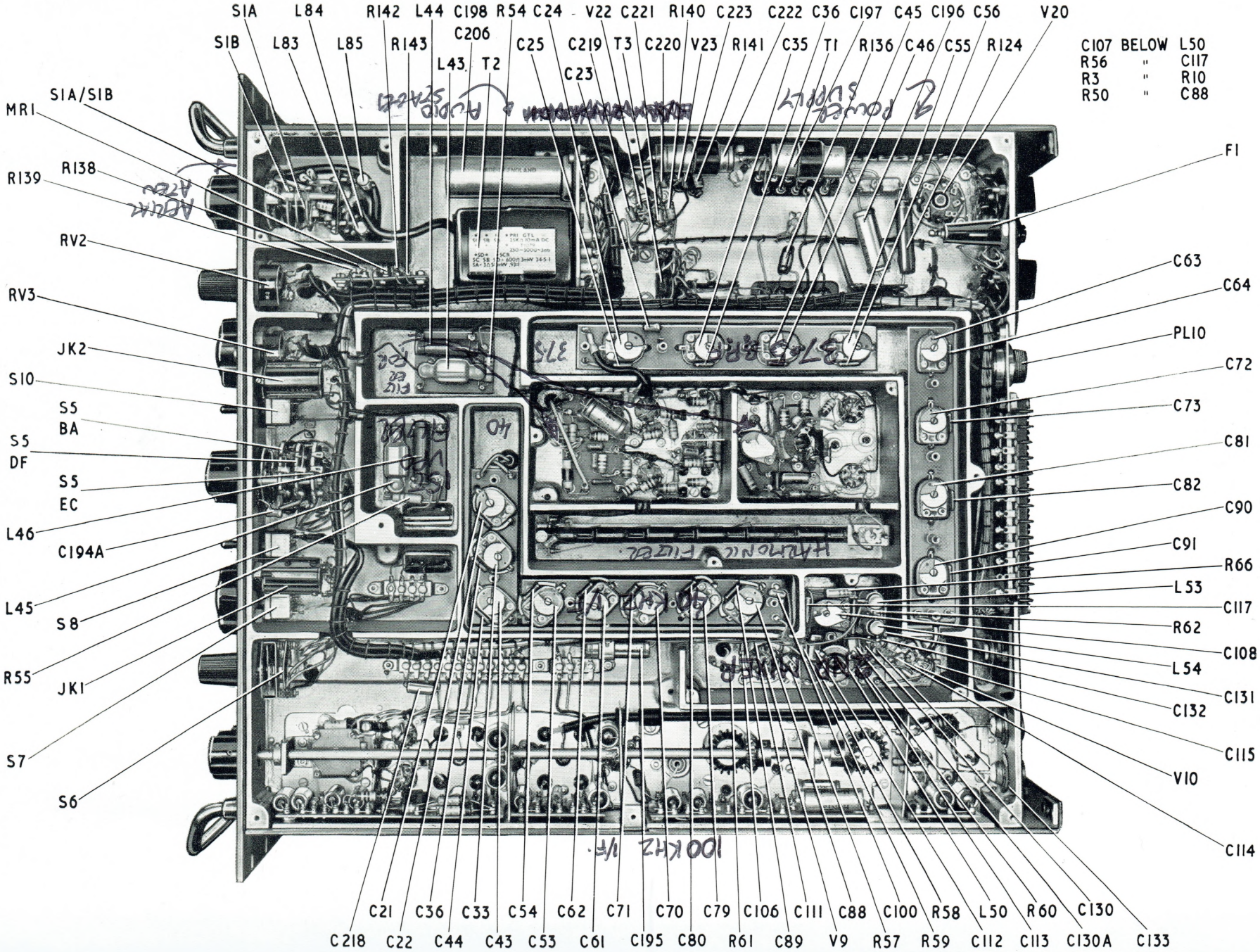
1 100kc/s IF
2 SECOND MIXER
3 40Mc/s. IF
4 HARMONIC FILTER
5 FIRST VFO SUPPLY FILTER
6 SYSTEM COMPARTMENT
7 CRYSTAL OSCILLATOR AND HARMONIC GENERATOR
8 HARMONIC MIXER AND 37·5Mc/s. AMPLIFIER
9 SUPPLY FILTER FOR 7 & 8
10 37·5Mc/s BAND PASS FILTER
11 POWER SUPPLIES
12 AUDIO STAGES
13 AERIAL ATTENUATOR

KEY TO UNDER-CHASSIS LAYOUT

ILLUSTRATION 2



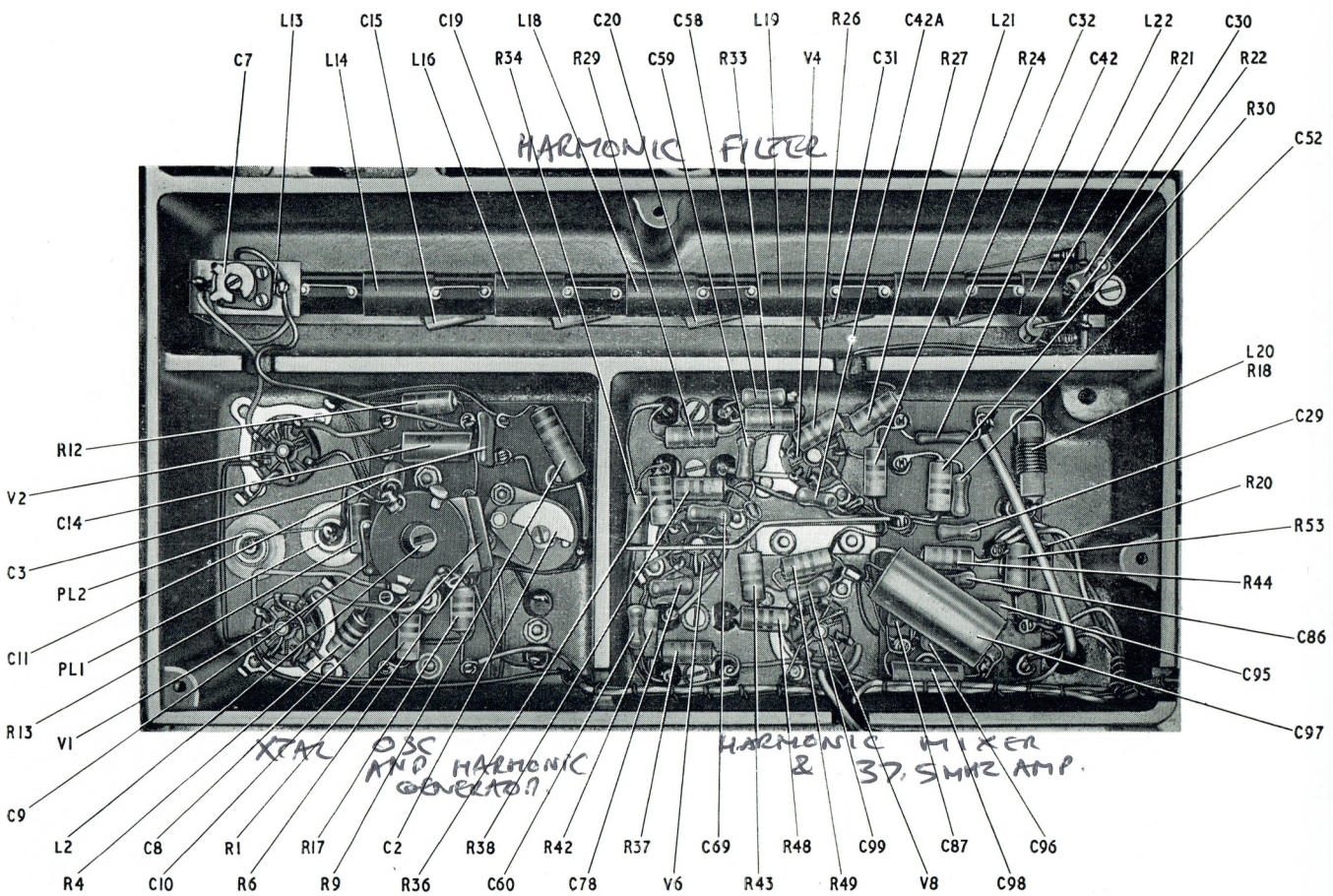
CHASSIS ASSEMBLY (TOP)



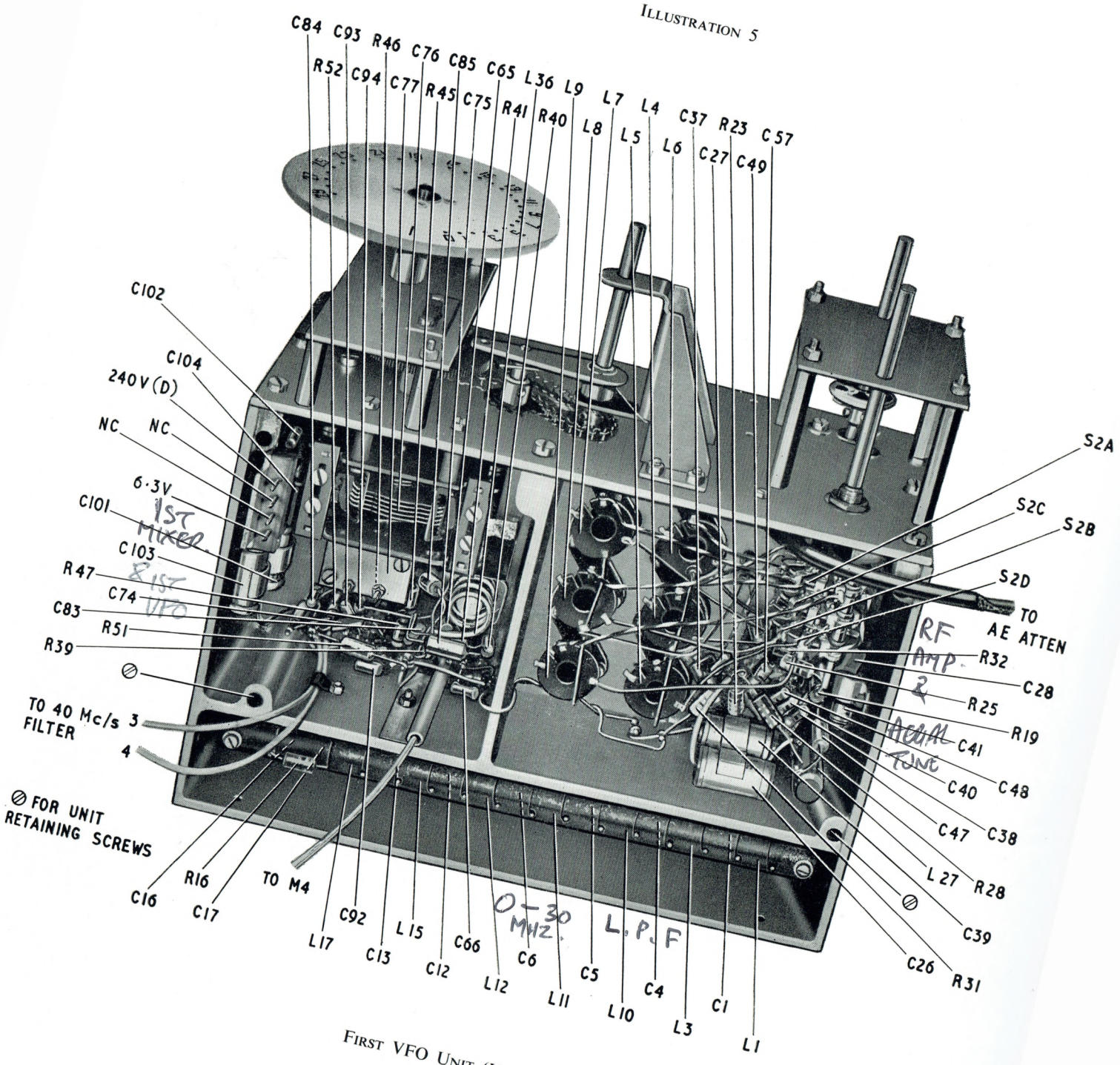
CHASSIS ASSEMBLY (UNDERSIDE)

ILLUSTRATION 3

ILLUSTRATION 4

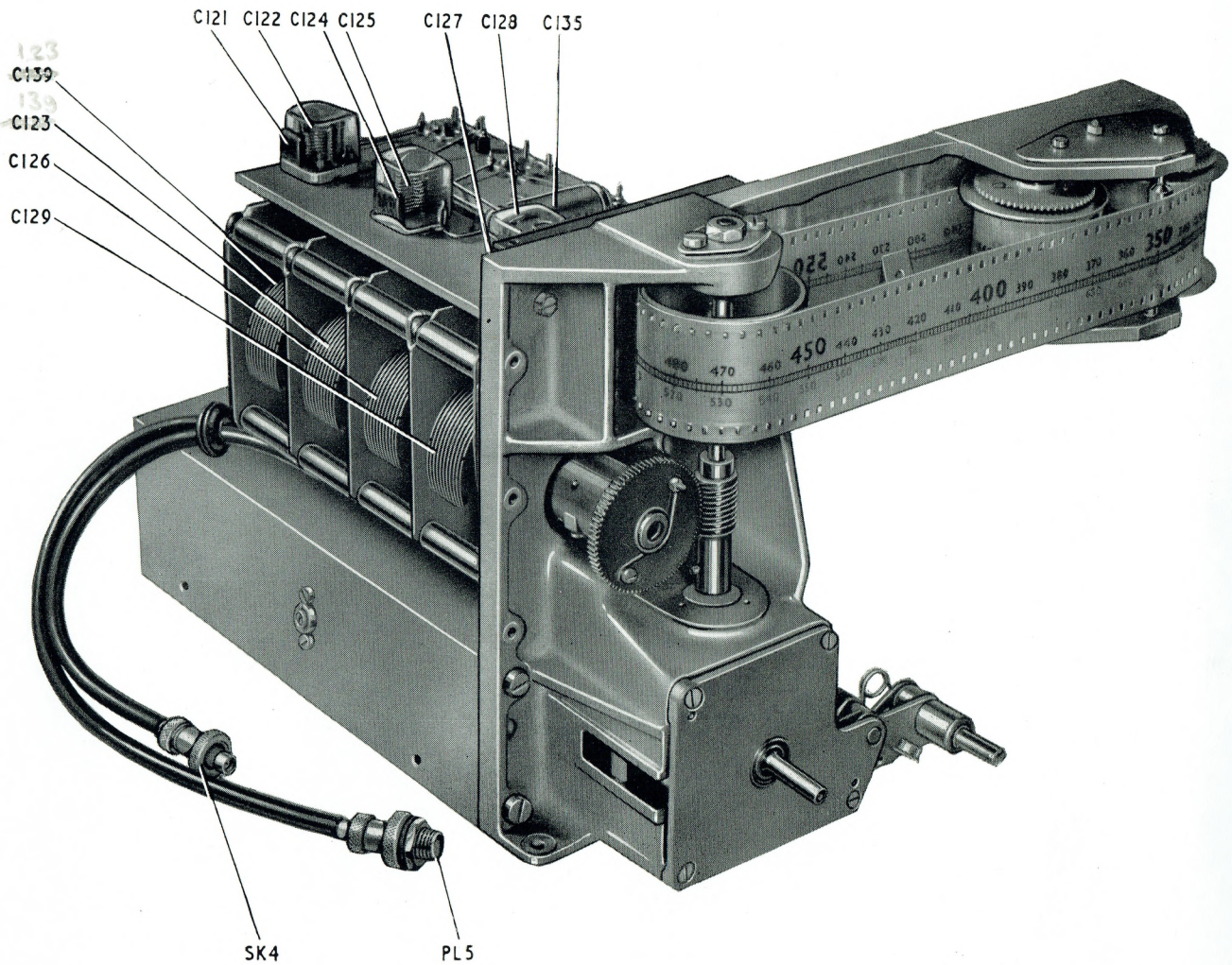


CRYSTAL OSCILLATOR AND HARMONIC FILTER SYSTEM (UNDERSIDE)



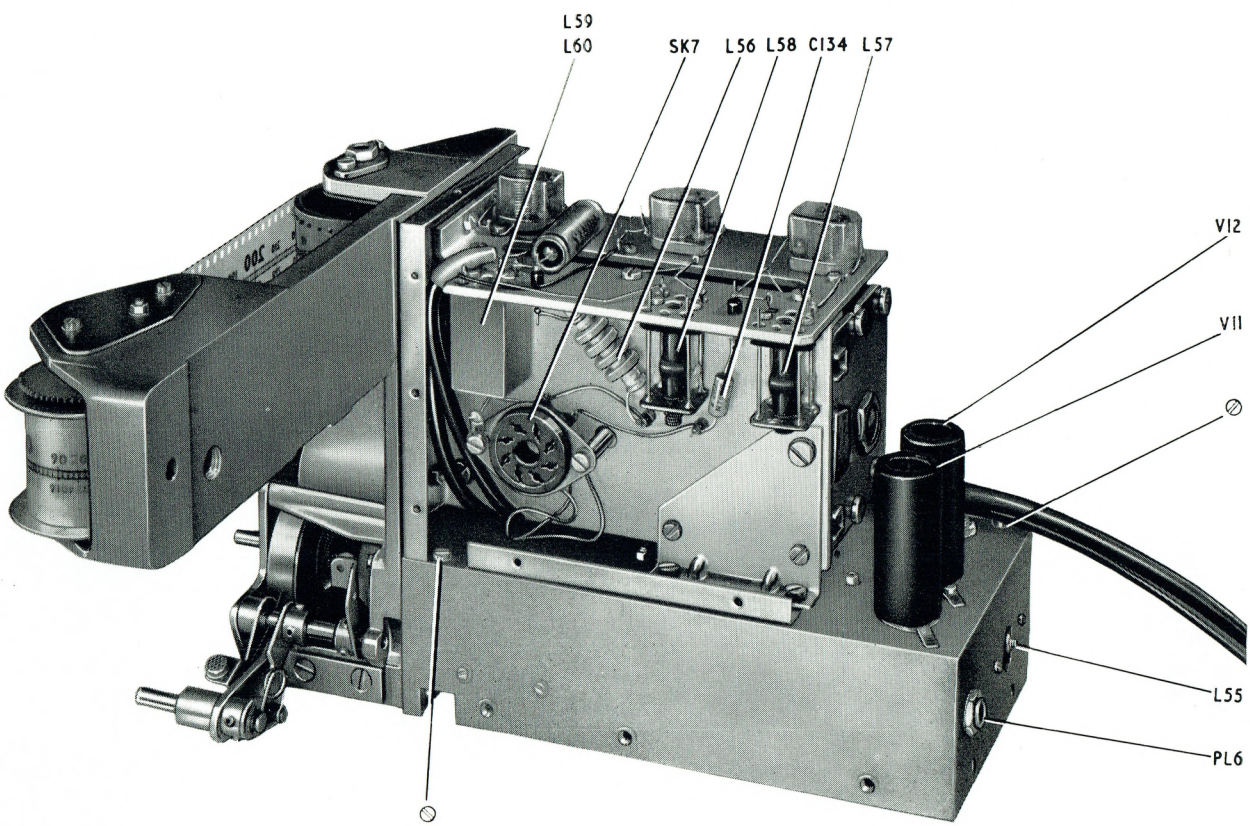
FIRST VFO UNIT (UNDERSIDE)

ILLUSTRATION 6



SECOND VFO UNIT (FRONT)

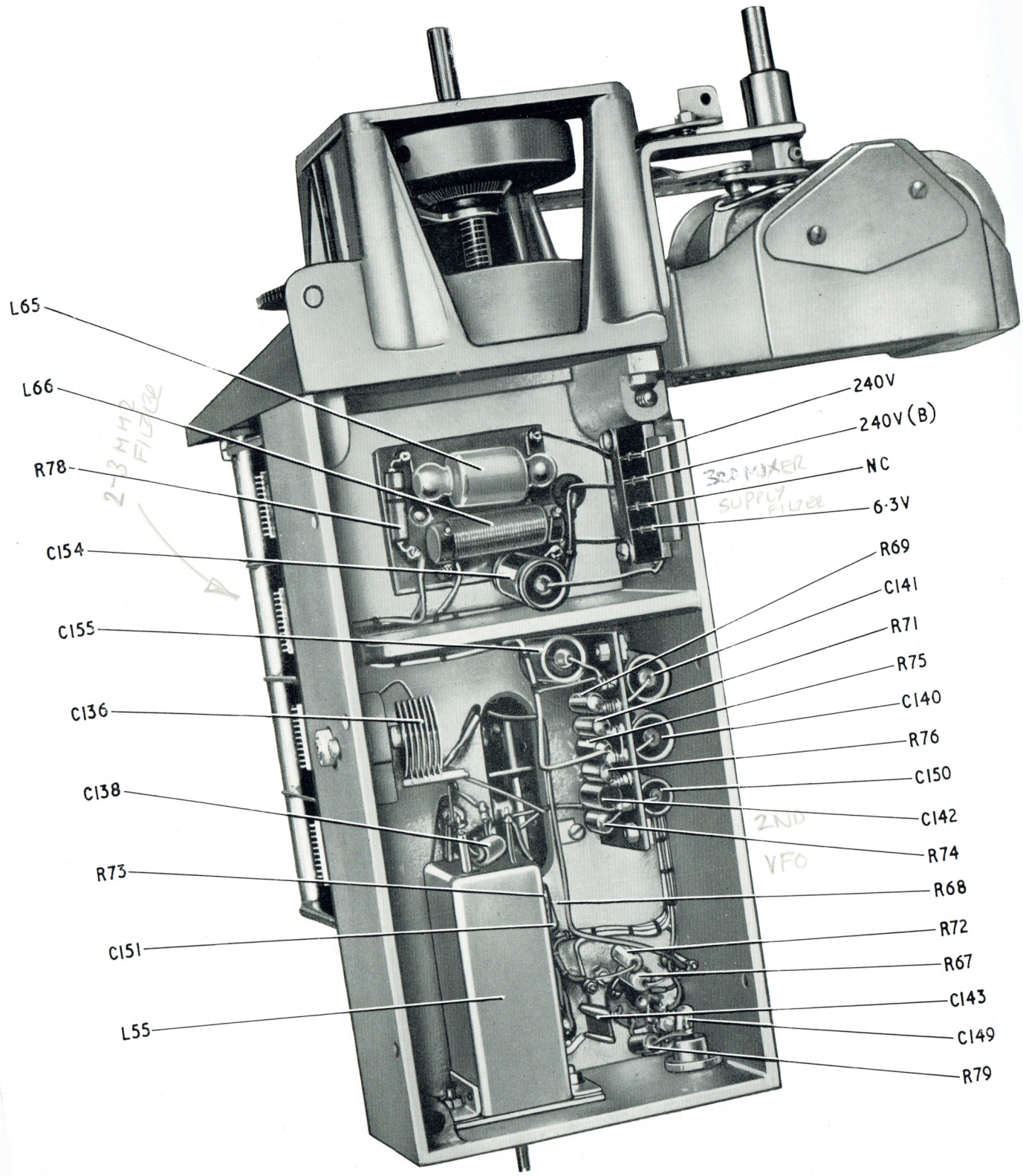
ILLUSTRATION 7



⊘ UNIT RETAINING SCREWS

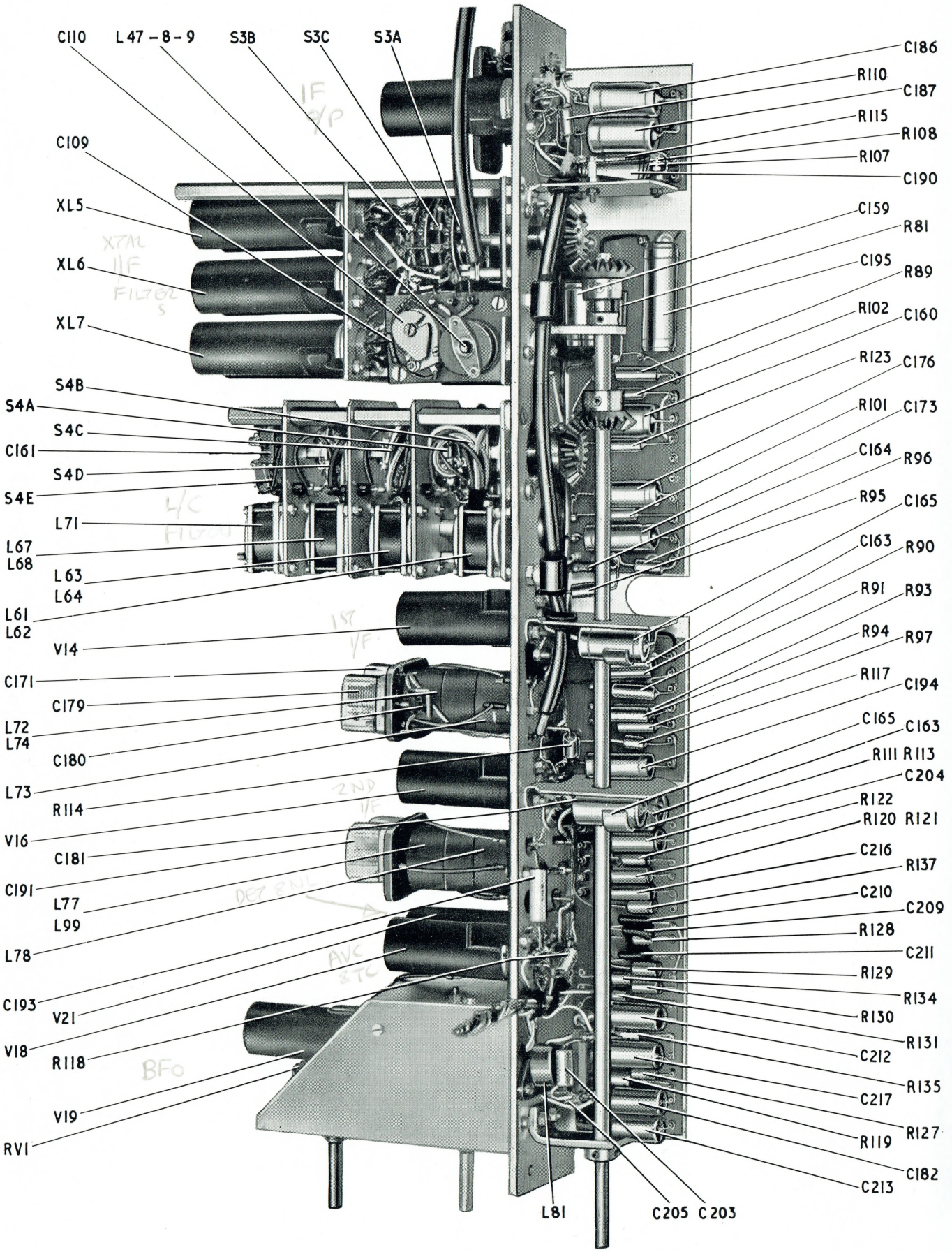
SECOND VFO UNIT (REAR)

ILLUSTRATION 8



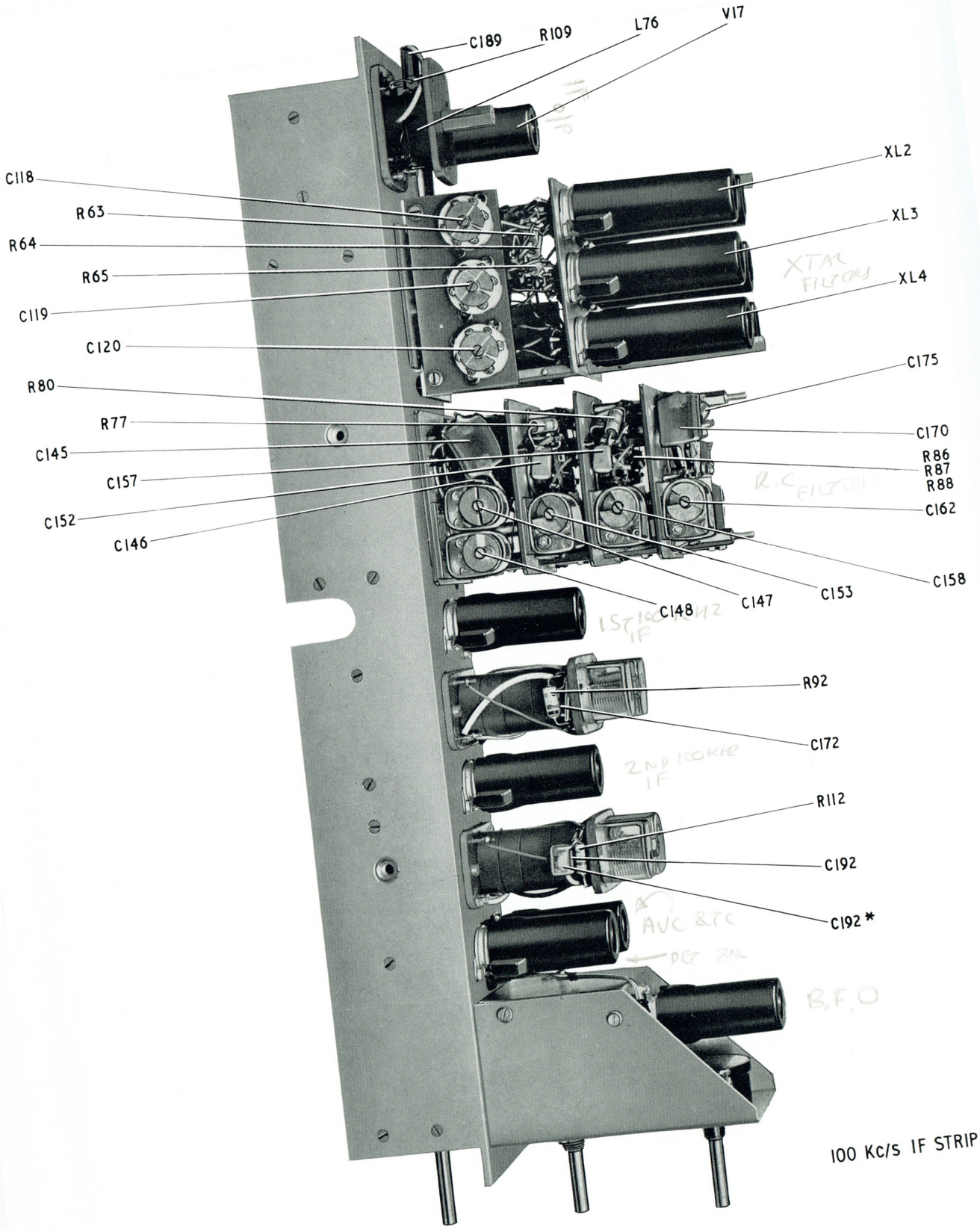
SECOND VFO UNIT (UNDERSIDE)

ILLUSTRATION 9



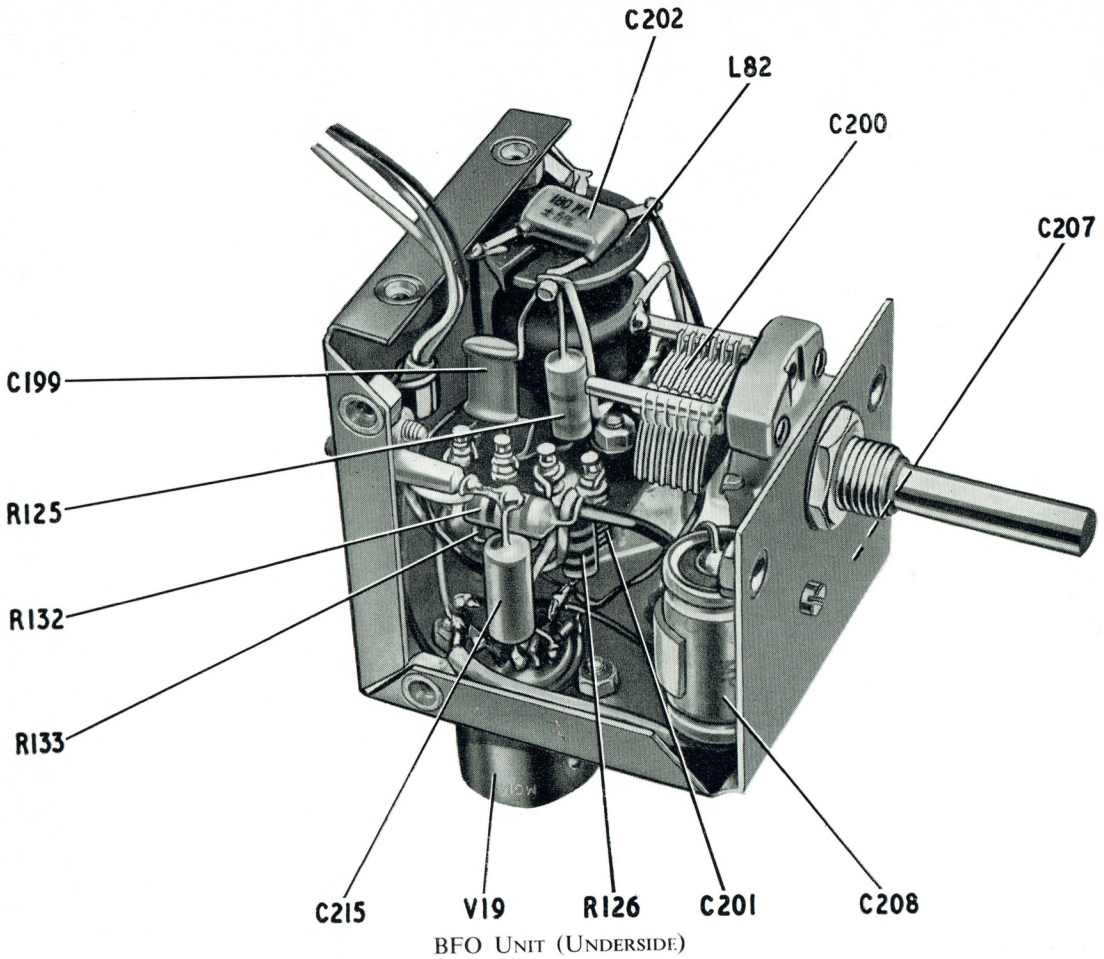
100 KC/S I.F. STRIP (RIGHT SIDE)

ILLUSTRATION 10



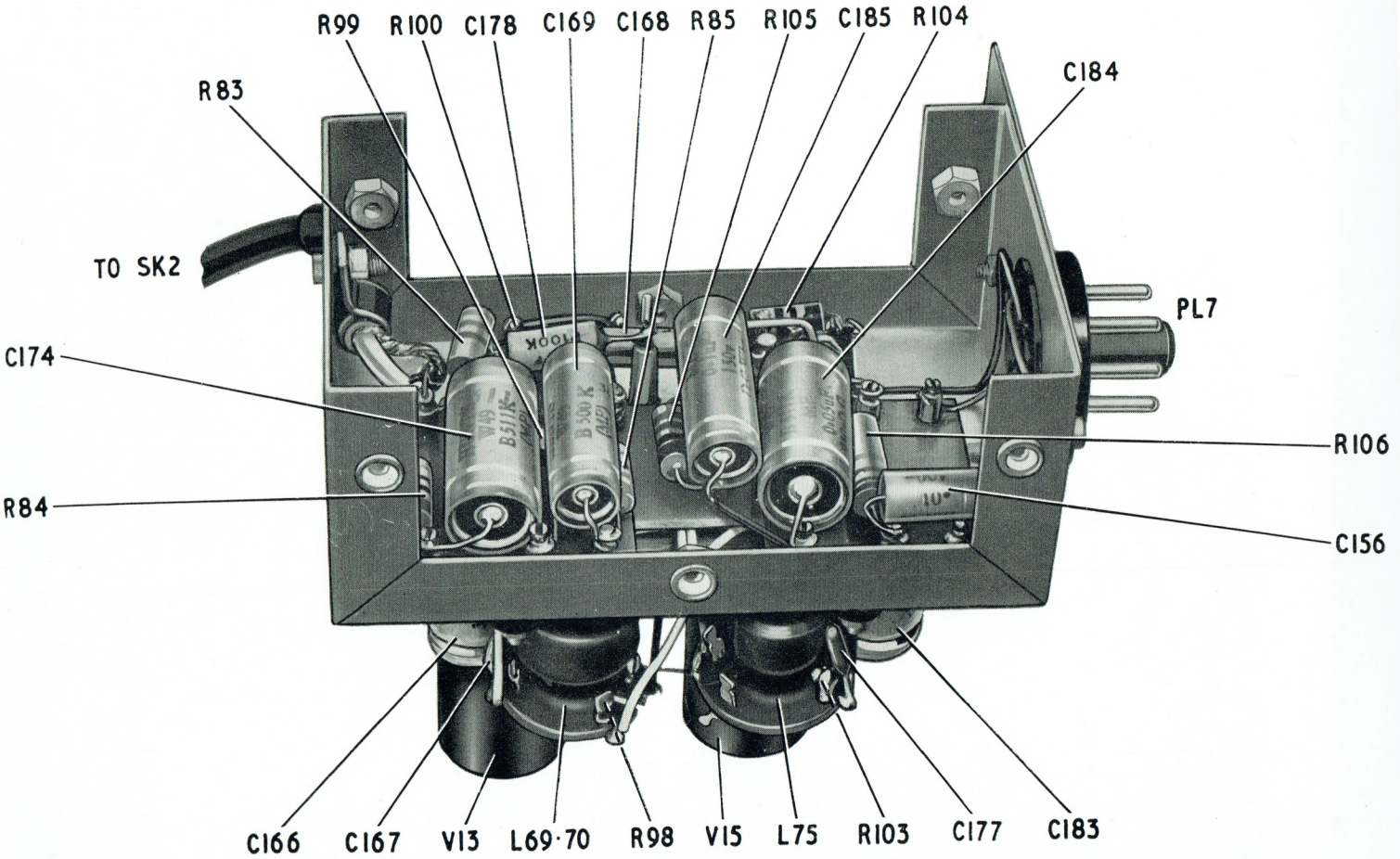
100 KC/S I.F. STRIP (LEFT SIDE)

ILLUSTRATION 11



BFO UNIT (UNDERSIDE)

ILLUSTRATION 12



CRYSTAL CALIBRATOR UNIT (UNDERSIDE)

SECTION 9

LIST OF CIRCUIT COMPONENTS, SUPPLEMENTARY COMPONENTS, SUB-ASSEMBLIES AND SUB-UNITS

9.1 Resistors
9.2 Potentiometers
9.3 Capacitors
9.4 Switches
9.5 Plugs and Sockets
9.6 Valves
9.7 Valve and Crystal Holders
9.8 Inductances
9.9 Transformers
9.10 Rectifier
9.11 Loudspeaker
9.12 Meter
9.13 Crystals
9.14 Fuse and Fuseholder
9.15 Lamp and Holder
9.16 Voltage Selectors
9.17 Supplementary Components, and Sub-Assemblies
9.18 Main Sub-Units

Joint-Service Numbers

(also known as CCA or NATO Stock Numbers)

Commercial and private users will note that the above numbers have been included in this section ; these are for assisting Service users in the provisioning of spare components.

Note: It is recommended that users quote the Serial No. of the equipment on all orders for spare parts.

* Indicates component used in RA.17A Receivers only.

† Indicates component used in RA.17C Receivers only.

‡ Indicates component used in RA.17D and RA.17E Receivers only.

** Specify RA.17A–C–D or E when ordering replacements.

9.1 RESISTORS

Cct. Ref.	*Value*	*Description*	*Rating*	*Tol.*	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
R1	100kΩ	Carbon	¼W	10%	5905–99–022–3038	Erie	9
R2	100Ω	,,	¼W	10%	–1110	,,	9
R3	150Ω	,,	¼W	10%	–1131	,,	9
R4	100Ω	,,	¼W	10%	–1110	,,	9
R5	150Ω	,,	¼W	10%	–1131	,,	9
R6	4·7kΩ	,,	½W	10%	–2090	,,	8
R7	150Ω	,,	¼W	10%	–1131	,,	9
R8	150Ω	,,	¼W	10%	–1131	,,	9
R9	10kΩ	,,	½W	10%	–2132	,,	8
R10	150Ω	,,	¼W	10%	–1131	,,	9
R11	150Ω	,,	¼W	10%	–1131	,,	9
R12	100kΩ	,,	¼W	10%	–3038	,,	9
R13	22kΩ	,,	¼W	10%	–2173	,,	9
R14	150Ω	,,	¼W	10%	–1131	,,	9
R15	100Ω	,,	¼W	10%	–1110	,,	9
R16	680Ω	,,	¼W	10%	–1215	,,	9
R17	1kΩ	,,	½W	10%	–2006	,,	8
R18	470Ω	,,	½W	10%	–1195	,,	8
	(Assy. with L20)						
R19	100kΩ	Carbon	¼W	10%	–3058	,,	9
R20	1kΩ	,,	¼W	10%	–2005	,,	9
R21	330Ω	,,	¼W	10%	–1173	,,	9
R22*	180Ω	,,	¼W	10%	–1143	,,	9
R22†	470Ω	,,	¼W	10%	–1194	,,	9
R23	15kΩ	,,	¼W	10%	–2152	,,	9
R24	10kΩ	,,	¼W	10%	–2131	,,	9
R25	10Ω	,,	¼W	10%	–1002	,,	9
R26	10Ω	,,	¼W	10%	–1002	,,	9
R27	10Ω	,,	¼W	10%	–1002	,,	9
R28	680Ω	,,	¼W	10%	–1215	,,	9
R29*	1kΩ	,,	¼W	10%	–2005	,,	9
R29†	4·7kΩ	,,	½W	10%	–2090	,,	8
R30	220Ω	,,	¼W	10%	–1152	,,	9
R31	470Ω	,,	¼W	10%	–1194	,,	9
R32	56Ω	,,	¼W	10%	–1080	,,	9
R33	10kΩ	,,	¼W	10%	–2131	,,	9
R34	470kΩ	,,	¼W	10%	-3122	,,	9
R35	DELETED						
R36	10Ω	Carbon	¼W	10%	–1002	,,	9
R37	1kΩ	,,	¼W	10%	–2005	,,	9
R38*	220Ω	,,	¼W	10%	–1152	,,	9
R38†	120Ω	,,	¼W	10%	–1122	,,	9
R39*	1kΩ	,,	¼W	10%	–2005	,,	9
R39†	18kΩ	,,	¼W	10%	–2164	,,	9
R40	10Ω	,,	¼W	10%	–1002	,,	9
R41*	47kΩ	,,	¼W	10%	–2215	,,	9
R41†	10kΩ	,,	¼W	10%	–2131	,,	9
R42	47kΩ	,,	¼W	10%	–2215	,,	9
R43*	2·2kΩ	,,	¼W	10%	–2047	,,	9

9.1 RESISTORS (continued)

Cct. Ref.	*Value*	*Description*	*Rating*	*Tol.*	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
R43†	470kΩ	Carbon	¼W	10%	5905-99-022-3122	Erie	9
R44*	10kΩ	,,	¼W	10%	-2131	,,	9
R44†	47kΩ	,,	¼W	10%	-2215	,,	9
R45	10Ω	,,	¼W	10%	-1002	,,	9
R46	100kΩ	,,	¼W	10%	-3038	,,	9
R47	56Ω	,,	¼W	10%	-1080	,,	9
R48	10Ω	,,	¼W	10%	-1002	,,	9
R49*	220Ω	,,	¼W	10%	-1152	,,	9
R49†	120Ω	,,	¼W	10%	-1122	,,	9
R50	2·2kΩ	,,	¼W	10%	-2047	,,	9
R51	1kΩ	,,	¼W	10%	-2005	,,	9
R52	15kΩ	,,	¼W	10%	-2152	,,	9
R53	470Ω	,,	¼W	10%	-1194	,,	9
R54	100Ω	,,	½W	10%	-1111	,,	8
R55	470Ω	,,	½W	10%	-1195	,,	8
R56	15kΩ	,,	¼W	10%	-2152	,,	9
R57	10Ω	,,	¼W	10%	-1002	,,	9
R58	470kΩ	,,	¼W	10%	-3122	,,	9
R59	56Ω	,,	¼W	10%	-1080	,,	9
R60*	220Ω	,,	¼W	10%	-1152	,,	9
R60†	120Ω	,,	¼W	10%	-1122	,,	9
R61	470Ω	,,	¼W	10%	-1194	,,	9
R62*	10kΩ	,,	¼W	10%	-2131	,,	9
R62†	47kΩ	,,	¼W	10%	-2215	,,	9
R63	560kΩ	,,	¼W	10%	-3134	,,	9
R64	330kΩ	,,	¼W	10%	-3101	,,	9
R65	100kΩ	,,	¼W	10%	-3038	,,	9
R66	1kΩ	,,	½W	10%	-2006	,,	8
R67	470Ω	,,	¼W	10%	-1194	,,	9
R68	22kΩ	,,	¼W	10%	-2173	,,	9
R69	18kΩ	,,	½W	10%	-2165	,,	8
R70*	470kΩ	,,	¼W	10%	-3122	,,	9
R70†	82kΩ	,,	¼W	10%	-3029	,,	9
R71	12kΩ	Wire wound	3W	5%	-3346	Painton	P306
R72	470Ω	Carbon	¼W	10%	-1194	Erie	9
R73	470Ω	,,	¼W	10%	-1194	,,	9
R74	150Ω	,,	¼W	10%	-1131	,,	9
R75	8·2kΩ	,,	½W	10%	-2123	,,	8
R76	33kΩ	,,	½W	10%	-2195	,,	8
R76A*	82kΩ	,,	¼W	10%	-3029	,,	9
R76A†	47kΩ	,,	¼W	10%	-2215	,,	9
R77	470kΩ	,,	¼W	10%	-3122	,,	9
R78	470Ω	,,	½W	10%	-1195	,,	8
R79	2·2kΩ	,,	¼W	10%	-2047	,,	9
R80	470kΩ	,,	¼W	10%	-3122	,,	9
R81	2·2kΩ	,,	½W	10%	-2048	,,	8
R82	DELETED						
R83	4·7kΩ	Carbon	¼W	10%	-2089	,,	9
R84	1MΩ	,,	¼W	10%	-3164	,,	9
R85	220Ω	,,	¼W	10%	-1152	,,	9
R86	22Ω	,,	¼W	10%	-1026	,,	9
R87	68Ω	,,	¼W	10%	-1089	,,	9
R87‡	150Ω	,,	¼W	10%	-1131	,,	9
R88	150Ω	,,	¼W	10%	-1131	,,	9
R88‡	330Ω	,,	¼W	10%	-1173	,,	9
R89	2·2kΩ	,,	½W	10%	-2048	,,	8
R90	4·7kΩ	,,	½W	10%	-2090	,,	8
R91	4·7kΩ	,,	½W	10%	-2090	,,	8
R92	560kΩ	,,	¼W	10%	-3134	,,	9

9.1 RESISTORS (continued)

Cct. Ref.	*Value*	*Description*	*Rating*	*Tol.*	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
R92‡	270kΩ	,,	¼W	10%	5905–99–022–3092	Erie	9
R93	47kΩ	Carbon	½W	10%	–2216	,,	8
R94	47kΩ	,,	½W	10%	–2216	,,	8
R95	100Ω	,,	¼W	10%	–1110	,,	9
R96	470kΩ	,,	¼W	10%	–3122	,,	9
R97	15kΩ	,,	½W	10%	–2153	,,	8
R98	2·2kΩ	,,	¼W	10%	–2047	,,	9
R99	22kΩ	,,	¼W	10%	–2173	,,	9
R100	22kΩ	,,	¼W	10%	–2173	,,	9
R101	120Ω	,,	¼W	10%	–1122	,,	9
R102	82kΩ	,,	¼W	10%	–3029	,,	9
R103	2·2kΩ	,,	¼W	10%	–2047	,,	9
R104	1MΩ	,,	¼W	10%	–3164	,,	9
R105	1kΩ	,,	¼W	10%	–2005	,,	9
R106	68kΩ	,,	½W	10%	–3018	,,	8
R107	2·2kΩ	,,	½W	10%	–2048	,,	8
R108	33kΩ	,,	½W	10%	–2195	,,	8
R109	4·7kΩ	,,	½W	10%	–2090	,,	8
R110	100Ω	,,	¼W	10%	–1110	,,	9
R111	2·2kΩ	,,	½W	10%	–2048	,,	8
R112	47kΩ	,,	¼W	10%	–2215	,,	9
R113	33kΩ	,,	½W	10%	–2195	,,	8
R114	100Ω	,,	¼W	10%	–1110	,,	9
R115	150Ω	,,	¼W	10%	–1131	,,	9
R116	470kΩ	,,	¼W	10%	–3122	,,	9
R116A†	6·8kΩ	,,	¼W	5%	–2107	,,	9
R117	150Ω	,,	¼W	10%	–1131	,,	9
R118	2·2MΩ	,,	¼W	10%	–3206	,,	9
R119	470kΩ	,,	¼W	10%	–3122	,,	9
R119A	10kΩ	Wire wound	10W	5%	–972–9514	,,	Style X
R120	100kΩ	Carbon	½W	10%	–022–3039	,,	8
R120A	27kΩ	,,	¼W	10%	–2185	,,	9
R121	100kΩ	,,	½W	10%	–3039	,,	8
R122	6·8kΩ	,,	¼W	10%	–2110	,,	9
R123	82kΩ	,,	½W	10%	–3030	,,	8
R124	165Ω	Wire wound	10W	5%	–972–8311	,,	Style X
R125	47kΩ	Carbon	¼W	10%	–022–2215	,,	9
R126	100Ω	,,	¼W	10%	–1110	,,	9
R127	82kΩ	,,	¼W	10%	–3029	,,	9
R128	18kΩ	,,	¼W	10%	–2164	,,	9
R129	18kΩ	,,	¼W	10%	–2164	,,	9
R130	82kΩ	,,	¼W	10%	–2047	,,	9
R131	4·7kΩ	,,	¼W	10%	–2089	,,	9
R132	1kΩ	,,	¼W	10%	–2005	,,	9
R133	4·7kΩ	,,	¼W	10%	–2089	,,	9
R133A†	27kΩ	,,	¼W	10%	–2185	,,	9
R134	1MΩ	,,	¼W	10%	–3164	,,	9
R135	1·2MΩ	,,	¼W	10%	–3176	,,	9
R136†	82Ω	Wire wound	5W	5%	–011–3294	Painton	P306
R136*	47Ω	,, ,,	3W	5%	–3288	Welwyn	AW3115
R136A†	8·2kΩ	Carbon	½W	10%	–022–2123	Erie	8
R137	1·5MΩ	,,	¼W	10%	–3185	,,	9
R138	120Ω	,,	¼W	10%	–1122	,,	9
R139	120Ω	,,	¼W	10%	–1122	,,	9
R140*	220Ω	,,	¼W	10%	–1152	,,	9
R140†	68Ω	,,	¼W	10%	–1089	,,	9
R141*	220Ω	,,	¼W	10%	–1152	,,	9
R141†	68Ω	,,	¼W	10%	–1089	,,	9
R142	1·2kΩ	,,	¼W	10%	–2017	,,	9

9.1 RESISTORS (continued)

Cct. Ref.	*Value*	*Description*	*Rating*	*Tol.*	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
R143	1·2kΩ	Carbon	¼W	10%	5905-99-022-2017	Erie	9
R144	10Ω	„	¼W	10%	-1002	„	9

9.2 POTENTIOMETERS

RV1	1kΩ	Wire wound			5905-99-972-8314	Colvern	CLR3001/21
RV2	2MΩ	Composition log/law 1″ spindle				AB Metals Clarostat	 37
RV3	2MΩ	Composition log/law ⅝″ spindle, slotted				AB Metals Clarostat	 37
RV4†	1kΩ	Wire wound				Colvern	CLR1189/15S

9.3 CAPACITORS

C1	2·7pF	Ceramic	750V	10%	5910-99-911-8271	Erie	P100K
C2	33pF	Trimmer			-016-0047	Wingrove & Rogers	C31-01/1
C3	220pF	Silver/Mica	350V	10%		Lemco	1106S
C4	14·7pF	Ceramic	750V	10%	-011-8301	Erie	N750K
C5	14·7pF	Ceramic	750V	10%	-011-8301	„	N750K
C6	14·7pF	Ceramic	750V	10%	-011-8301	„	N750K
C7*	10pF	Trimmer			-911-4011	Wingrove & Rogers	C32-01
C8	10pF	Ceramic	750V	5%	-013-2425	Erie	P100K
C9	100pF	Silver/Mica	350V	10%	-911-6929	Lemco	1106S
C10	0·01μF	Paper	400V	20%	-011-5827	Hunt	W97/BM21Z
C11	0·005μF	Paper	400V	20%	-011-5824	„	W97/BM20Z
C12	14·7pF	Ceramic	750V	10%	-011-8301	Erie	N750K
C13	14·7pF	Ceramic	750V	10%	-011-8301	„	N750K
C14	0·01μF	Paper	400V	20%	-011-5827	Hunt	W97/BM21Z
C15	10pF	Ceramic	750V	5%	-013-2425	Erie	P100K
C16	0·01μF	Paper	400V	20%	-011-5827	Hunt	W97/BM21Z
C17	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C18	220pF	Variable			-972-8330	Wingrove & Rogers	C73-01/1E
C19	10pF	Ceramic	750V	5%	-011-2425	Erie	P100K
C20	10pF	Ceramic	750V	5%	-011-2425	„	P100K
C21	18pF	Trimmer, with acetate case	1000V		-972-8322	Oxley	A15/13.2
C22	33pF	Silver/Mica	350V	5%	-911-4291	Lemco	1106S
C23	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C24	18pF	Trimmer, with acetate case	1000V		-972-8322	Oxley	A15/13.2
C25	22pF	Silver/Mica	350V	5%	-911-4294	Lemco	1106S
C26	0·05μF	Paper	350V	20%	-011-5559	Hunt	W49/B511
C27	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C28	220pF	Silver/Mica	350V	10%		Lemco	1106S
C29	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C30	0·001μF	Ceramic	350V		-911-4892	„	K3500/AD
C31	10pF	Ceramic	750V	5%	-013-2425	„	P100K
C32	10pF	Ceramic	750V	5%	-013-2425	„	P100K
C33	18pF	Trimmer, with acetate case	1000V		-972-8322	Oxley	A15/13.2
C34	39pF	Silver/Mica	350V	5%	-911-6837	Lemco	1106S
C35	18pF	Trimmer, with acetate case	1000V		-972-8322	Oxley	A15/13.2
C36	33pF	Silver/Mica	350V	5%	-911-4291	Lemco	1106S

9.3 CAPACITORS (continued)

Cct. Ref.	*Value*	*Description*	*Rating*	*Tol.*	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
C37	0·01μF	Paper	400V	20%	5910–99–011–5827	Hunt	W97/BM21Z
C38	0·001μF	Ceramic	350V		–911–4892	Erie	K3500/AD
C39	0·05μF	Paper	350V	20%	–972–8958	Hunt	W49/B511KZ
C40	0·001μF	Ceramic	350V		–911–4892	Erie	K3500/AD
C41	0·1μF	Paper	150V	20%	–011–5560	Hunt	W49/B500KY
C42	220pF	Silver/Mica	350V	10%		Lemco	1106S
C42A	0·001μF	Ceramic	350V		–911–4892	Erie	K3500/AD
C43	18pF	Trimmer, with acetate case	1000V		–972–8322	Oxley	A15/13.2
C44	39pF	Silver/Mica	350V	5%	–911–6837	Lemco	1106S
C45	18pF	Trimmer, with acetate case	1000V		–972–8322	Oxley	A15/13.2
C46	33pF	Silver/Mica	350V	5%	–911–4291	Lemco	1106S
C47	8·2pF	Ceramic	750V	10%	–013–2424	Erie	P100K
C48	0·001μF	Ceramic	350V		–911–4892	,,	K3500/AD
C49	0·01μF	Paper	400V	20%	–011–5827	Hunt	W97/BM21Z
C50	82pF	Silver/Mica	350V	5%	–911–6952	Lemco	1106S
C51	220pF	Silver/Mica	350V	2%	–911–6839	,,	1106S
C52	0·001μF	Ceramic	350V		–911–4892	Erie	K3500/AD
C53	18pF	Trimmer, with acetate case	1000V		–972–8322	Oxley	A15/13.2
C54	39pF	Silver/Mica	350V	5%	–911–6837	Lemco	1106S
C55	18pF	Trimmer, with acetate case	1000V		–972–8322	Oxley	A15/13.2
C56	33pF	Silver/Mica	350V	5%	–911–4291	Lemco	1106S
C57	0·001μF	Ceramic	350V		–911–4892	Erie	K3500/AD
C58	0·001μF	Ceramic	350V		–911–4892	,,	K3500/AD
C59	0·001μF	Ceramic	350V		–911–4892	,,	K3500/AD
C60	0·001μF	Ceramic	350V		–911–4892	,,	K3500/AD
C61	18pF	Trimmer, with acetate case	1000V		–972–8322	Oxley	A15/13.2
C62	39pF	Silver/Mica	350V	5%	–911–6837	Lemco	1106S
C63	18pF	Trimmer, with acetate case	1000V		–972–8322	Oxley	A15/13.2
C64	33pF	Silver/Mica	350V	5%	–911–4291	Lemco	1106S
C65	0·001μF	Ceramic	350V		–911–4892	Erie	K3500/AD
C66	0·001μF	Ceramic	350V		–911–4892	,,	K3500/AD
C67	82pF	Silver/Mica	350V	5%	–911–6952	Lemco	1106S
C68	220pF	Silver/Mica	350V	2%	–911–6839	,,	1106S
C69	0·001μF	Ceramic	350V		–911–4892	Erie	K3500/AD
C70	18pF	Trimmer, with acetate case	1000V		–972–8322	Oxley	A15/13.2
C71	39pF	Silver/Mica	350V	5%	–911–6837	Lemco	1106S
C72	18pF	Trimmer, with acetate case	1000V		–972–8322	Oxley	A15/13.2
C73	33pF	Silver/Mica	350V	5%	–911–4291	Lemco	1106S
C74	220pF	Silver/Mica	350V	10%		,,	1106S
C75*	47pF	Ceramic	750V	5%	–013–2288	Erie	N750K
C75†	220pF	Silver/Mica	350V	10%		Lemco	1106S
C76	100pF	Variable			–972–8324	Wingrove & Rogers	C1601 10/012SLF
C77	33pF	Trimmer			–016–0047	Wingrove & Rogers	C31–01/1
C78	0·001μF	Ceramic	350V		–911–4892	Erie	K3500/AD
C79	18pF	Trimmer, with acetate case	1000V		–972–8322	Oxley	A15/13.2
C80	39pF	Silver/Mica	350V	5%	–911–6837	Lemco	1106S
C81	18pF	Trimmer, with acetate case	1000V		–972–8322	Oxley	A15/13.2

9.3 CAPACITORS (continued)

Cct. Ref.	*Value*	*Description*	*Rating*	*Tol.*	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
C82	33pF	Silver/Mica	350V	5%	5910-99-911-4291	Lemco	1106S
C83	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C84	0·001μF	Ceramic	350V		-911-4892	„	K3500/AD
C85	3·3pF	Ceramic	750V	10%	-013-2419	„	P100K
C86	0·001μF	Ceramic	350V		-911-4892	„	K3500/AD
C87	0·001μF	Ceramic	350V		-911-4892	„	K3500/AD
C88	18pF	Trimmer, with acetate case	1000V		-972-8322	Oxley	A15/13.2
C89	33pF	Silver/Mica	350V	5%	-911-4291	Lemco	1106S
C90	18pF	Trimmer, with acetate case	1000V		-972-8322	Oxley	A15/13.2
C91	15pF	Silver/Mica	350V	±1pF	-911-6850	Lemco	1106S
C92	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C93	0·001μF	Ceramic	350V		-911-4892	„	K3500/AD
C94	0·001μF	Ceramic	350V		-911-4892	„	K3500/AD
C95	0·01μF	Paper	400V	20%	-011-5287	Hunt	W97/BM21Z
C95A	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C96	0·001μF	Ceramic	350V		-911-4892	„	K3500/AD
C97	0·25μF	Paper	150V	20%	-011-5563	Hunt	W49/B501
C98	0·01μF	Paper	400V	20%	-011-5827	„	W97/BM21Z
C98A	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C99	0·001μF	Ceramic	350V		-911-4892	„	K3500/AD
C100	0·001μF	Ceramic	350V		-911-4892	„	K3500/AD
C101	0·05μF	Paper	350V	20%	-011-5559	Hunt	W49/B511KZ
C102	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C103	0·1μF	Paper	150V	20%	-011-5560	Hunt	W49/B500KY
C104	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C105	0·01μF	Paper	400V	20%	-011-5827	Hunt	W97/BM21Z
C106	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C107	220pF	Silver/Mica	350V	10%		Lemco	1106S
C108	33pF	Trimmer			-016-0047	Wingrove & Rogers	C31-01/1
C109	220pF	Silver/Mica	350V	2%	-911-6839	Lemco	1106S
C110	33pF	Trimmer			-016-0047	Wingrove & Rogers	C31-01/1
C111	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C112	0·01μF	Paper	400V	20%	-011-5827	Hunt	W97/BM21Z
C113	27pF	Ceramic	750V	5%	-013-2279	Erie	N750K
C114	0·001μF	Ceramic	350V		-911-4892	„	K3500/AD
C115	0·001μF	Ceramic	350V		-911-4892	„	K3500/AD
C116	33pF (Assy. with L52)	Silver/Mica	350V	5%	-911-4291	Lemco	1106S
C117	0·01μF	Paper	400V	20%	-011-5827	Hunt	W97/BM21Z
C118	9·3pF	Diff. trimmer			-972-8321	Oxley	Mini trimmer
C119	9·3pF	Diff. trimmer			-972-8321	„	Mini trimmer
C120	9·3pF	Diff. trimmer			-972-8321	„	Mini trimmer
C121	220pF	Silver/Mica	350V	2%	-911-6839	Lemco	1106S
C122	70pF	Trimmer, 12 vane with acetate case			-972-8320	Oxley	464
C123	SEE C139						
C124	220pF	Silver/Mica	350V	2%	-911-6839	Lemco	1106S
C125	70pF	Trimmer, 12 vane with acetate case			-972-8320	Oxley	464
C126	SEE C139						
C127	150pF	Silver/Mica	350V	2%	-972-9056	Lemco	1106S
C128	70pF	Trimmer, 12 vane with acetate case			-972-8320	Oxley	464
C129	SEE C139						
C130	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD

9.3 CAPACITORS (continued)

Cct. Ref.	*Value*	*Description*	*Rating*	*Tol.*	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
C130A	0·01μF	Paper	400V	20%	5910-99-011-5827	Hunt	W97/BM21Z
C131	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C132	0·001μF	Ceramic	350V		-911-4892	,,	K3500/AD
C133	0·001μF	Ceramic	350V		-911-4892	,,	K3500/AD
C134	2·2pF	Ceramic	750V	±·25pF	-972-8959	,,	N750K
C135	0·1μF	Paper	350V	20%	-011-5562	Hunt	W49/B512KZ
C136	50pF	Trimmer			-016-0004	Wingrove & Rogers	C8-03
C137	270pF	Silver/Mica	350V	5%		Johnson Matthey	C22R
C138	DELETED						
C139	443pF	Variable air (4 Gang)			-972-8958	Wingrove & Rogers	C60-04/1
C140	0·05μF	Paper	350V	20%	-011-5559	Hunt	W49/B511KZ
C141	0·05μF	Paper	350V	20%	-011-5559	,,	W49/B511KZ
C142	0·01μF	Paper	400V	20%	-011-5827	,,	W97/BM21Z
C143	220pF	Silver/Mica	350V	5%	-911-6954	Lemco	1106S
C143A	2·2pF	Ceramic	750V	±·25pF	-972-8959	Erie	N750K
C144*	10pF	Silver/Mica	350V	±1pF		Lemco	1106S
C144†	39pF	Silver/Mica	350V	5%	-911-6837	,,	1106S
C145	6800pF	Silver/Mica	350V	5%	-972-8310	Hunt	L4/37S
C146	220pF	Silver/Mica	350V	5%	-911-6954	Lemco	1106S
C146A	150pF	Ceramic	350V	5%	-011-8325	,,	427N750
C147	70pF	Trimmer, 12 vane with acetate case			-972-8320	Oxley	464
C148	70pF	Trimmer, 12 vane with acetate case			-972-8320	,,	464
C149	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C150	0·1μF	Paper	150V	20%	-011-5560	Hunt	W49/B500KY
C151	0·001μF	Ceramic	350V		-911-4892	Erie	K3500/AD
C152	270pF	Silver/Mica	350V	5%	-972-9629	Lemco	1106S
C152A	120pF	Ceramic	750V	5%	-011-8323	,,	316N750
C153	70pF	Trimmer, 12 vane with acetate case			-972-8320	Oxley	464
C154	0·25μF	Paper	150V	20%	-011-5563	Hunt	W49/B501KZ
C155	0·05μF	Paper	350V	20%	-011-5559	,,	W49/B511KZ
C156	0·01μF	Paper	400V	20%	-011-5827	,,	W97/BM21Z
C157	270pF	Silver/Mica	350V	5%	-972-9629	Lemco	1106S
C157A	120pF	Ceramic	750V	5%	-011-8323	,,	316N750
C158	70pF	Trimmer, 12 vane with acetate case			-972-8320	Oxley	464
C159	0·05μF	Paper	350V	20%	-011-5559	Hunt	W49/B511KZ
C160	0·05μF	Paper	350V	20%	-011-5559	,,	W49/B511KZ
C161	270pF	Silver/Mica	350V	5%	-972-9629	Lemco	1106S
C161A	120pF	Ceramic	750V	5%	-011-8323	,,	316N750
C162	70pF	Trimmer, 12 vane with acetate case			-972-8320	Oxley	464
C163	0·05μF	Paper	350V	20%	-011-5559	Hunt	W49/B511KZ
C164	330pF	Silver/Mica	350V	10%	-911-6930	Lemco	1106S
C165	0·05μF	Paper	350V	20%	-011-5559	Hunt	W49/B511KZ
C166	0·05μF	Paper	350V	20%	-011-5559	,,	W49/B511KZ
C167	470pF	Silver/Mica	350V	5%	-972-8962	Lemco	1106S
C168	10pF	Ceramic	750V	5%	-013-2425	Erie	P100K
C169	0·1μF	Paper	150V	20%	-011-5560	Hunt	W49/B500KY
C170	3900pF	Silver/Mica	350V	5%	-972-8309	,,	L4/37S
C170‡	2700pF	Silver/Mica	350V	5%	-972-8309	,,	L4/37S
C171	70pF	Trimmer, 12 vane with acetate case			-972-8320	Oxley	464
C172	120pF	Silver/Mica	350V	5%	-972-8960	Lemco	1106S
C173	0·1μF	Paper	150V	20%	-011-5560	Hunt	W49/B500KY

9.3 CAPACITORS (continued)

Cct. Ref.	*Value*	*Description*	*Rating*	*Tol.*	*Joint Service No.*	*Manufacturer and Type or Drawing No.*
C174	0·05μF	Paper	350V	20%	5910-99-011-5559	Hunt W49/B511KZ
C175	33pF	Ceramic	750V	5%	-013-2282	Erie N750K
C176	0·1μF	Paper	150V	20%	-011-5560	Hunt W49/B500KY
C177	100pF	Silver/Mica	350V	10%	-911-6929	Lemco 1106S
C178	10pF	Ceramic	750V	5%	-013-2425	Erie P100K
C179	70pF	Trimmer, 12 vane with acetate case			-972-8320	Oxley 464
C180	100pF	Silver/Mica	350V	5%	-911-6953	Lemco 1106S
C181	0·05μF	Paper	350V	20%	-011-5559	Hunt W49/B511KZ
C182	0·1μF	Paper	150V	20%	-011-5560	,, W49/B500KY
C183	0·05μF	Paper	350V	20%	-011-5559	,, W49/B511KZ
C184	0·05μF	Paper	350V	20%	-011-5559	,, W49/B511KZ
C185	0·1μF	Paper	150V	20%	-011-5560	,, W49/B500KY
C186	0·05μF	Paper	350V	20%	-011-5559	,, W49/B511KZ
C187	0·05μF	Paper	350V	20%	-011-5559	,, W49/B511KZ
C188	0·05μF	Paper	350V	20%	-011-5559	,, W49/B511KZ
C189	0·01μF	Paper	400V	20%	-011-5827	,, W97/BM21Z
C190	0·1μF	Paper	150V	20%	-011-5560	,, W49/B500KY
C191	70pF	Trimmer, 12 vane with acetate case			-972-8320	Oxley 464
C192	390pF	Silver/Mica	350V	5%	-911-6943	Lemco 1106S
C193	100pF	Ceramic	750V	10%	-011-2300	Erie N750L
C193A	0·001μF	Ceramic	350V		-911-4892	,, K3500/AD
C194	0·1μF	Paper	150V	20%	-011-5560	Hunt W49/B500KY
C194A	0·001μF	Ceramic	350V		-911-4892	Erie K3500/AD
C195	0·1μF	Paper	350V	20%	-011-5562	Hunt W49/B512KZ
C195A	390pF	Silver/Mica	350V	5%	-911-6943	Lemco 1106S
C195B	70pF	Trimmer, 12 vane with acetate case			-972-8320	Oxley 464
C196	0·5μF	Paper	150V	20%	-011-5566	Hunt W49/B502KY
C197	100μF	Electrolytic	50V		-014-5515	,, L37/1 85° C JF104
C198	32+32μF	Electrolytic (see C206)	350V		-972-8308	Plessey CE818
C199	220pF	Silver/Mica	350V	5%	-911-6954	Lemco 1106S
C200	50pF	Variable			-972-8957	Wingrove & Rogers C8-04/128
C201	70pF	Trimmer, 12 vane with acetate case			-972-8320	Oxley 464
C202	180pF	Silver/Mica	350V	10%	-972-8961	Lemco 1106S
C203	22pF	Ceramic	750V	5%	-011-2276	Erie N750K
C204	0·1μF	Paper	150V	20%	-011-5560	Hunt W49/B500KY
C205	0·001μF	Ceramic	350V		-911-4892	Erie K3500/AD
C206	See C198					
C207	0·05μF	Paper	350V	20%	-011-5559	Hunt W49/B511KZ
C208	0·05μF	Paper	350V	20%	-011-5559	,, W49/B511KZ
C208A†	0·01μF	Paper	400V	20%	-011-5827	,, W97/BM21Z
C209	330pF	Silver/Mica	350V	10%	-911-6930	Lemco 1106S
C210	330pF	Silver/Mica	350V	10%	-911-6930	,, 1106S
C211	330pF	Silver/Mica	350V	10%	-911-6930	,, 1106S
C212	0·1μF	Paper	150V	20%	-011-5560	Hunt W49/B500KY
C213	0·1μF	Paper	150V	20%	-011-5560	,, W49/B500KY
C214	0·1μF	Paper	350V	20%	-011-5562	,, W49/B512KZ
C215	47pF	Ceramic	750V	5%	-013-2288	Erie N750K
C216	0·01μF	Paper	400V	20%	-011-5827	Hunt W97/BM21Z
C217	0·1μF	Paper	150V	20%	-011-5560	,, W49/B500KY
C217A†	2μF	Electrolytic	350V		-014-5011	,, JD401T
C218	0·01μF	Paper	400V	20%	-011-5827	,, W97/BM21Z
C219	0·001μF	Ceramic	350V		-911-4892	Erie K3500/AD

9.3 CAPACITORS (continued)

Cct. Ref.	*Value*	*Description*	*Rating*	*Tol.*	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
C220	0·001μF	Ceramic	350V		5910–99–911–4892	Erie	K3500/AD
C221*	0·001μF	Ceramic	350V		–911–4892	,,	K3500/AD
C222	50μF	Electrolytic	12V		–014–5200	Plessey	CE102/2
C223*	0·001μF	Ceramic	350V		–911–4892	Erie	K3500/AD
C224	0·01μF	Silver/Ceramic	750V	20%	–972–8307	Lemco	420K
C225	0·01μF	Silver/Ceramic	750V	20%	–972–8307	,,	420K
C226	82pF	Silver/Ceramic	750V	5%	–972–9990	FEC	316N750
C227	82pF	Silver/Ceramic	750V	5%	–972–9990	,,	316N750
C228	82pF	Silver/Ceramic	750V	5%	–972–9990	,,	316N750
C229	82pF	Silver/Ceramic	750V	5%	–972–9990	,,	316N750
C230	82pF	Silver/Ceramic	750V	5%	–972–9990	,,	316N750
C231	82pF	Silver/Ceramic	750V	5%	–972–9990	,,	316N750

9.4 SWITCHES

S1	Aerial Attenuator	5930–99–920–6716	Racal	BSW10834
S2	Frequency Selection	–972–8849	,,	SW4
S3	Crystal Filter	–972–8852	,,	SW7
S4	100 kc/s. Filter	–972–8853	,,	SW8–9–11
S5	System Switch	–972–8851	,,	SW6
S6	A.V.C.	–972–8848	,,	SW3
S7	B.F.O. (DPCO)	–051–0554	NSF	—
S8	Noise Limiter (DPCO)	–051–0554	,,	—
S9*	Meter (DPCO)	–051–0554	,,	—
S9†	Meter (3PCO)		Racal	SW63
S10	Mains (DPCO)	–051–0554	NSF	—
S11	Speaker (DPCO)	–051–0554	,,	—

9.5 PLUGS AND SOCKETS

PL1*	Aerial input	5935–99–054–0101	Films & Eqpts.	—
PL1†	Aerial input		,, ,,	PL259
SK1*	Aerial input	–054–9028	,, ,,	—
SK1†	Aerial input		,, ,,	SO239
PL2	1 Mc/s output	–054–0151	Power Controls	—
SK2	1 Mc/s Crystal calibrator	–054–0155	,, ,,	—
PL3	1 Mc/s output	–054–1051	,, ,,	—
PL3A	1 Mc/s output	–054–0152	,, ,,	—
SK3	RA.37 output	–054–0155	,, ,,	—
PL4	2–3 Mc/s B.P. filter input	–054–0151	,, ,,	—
SK4	2–3 Mc/s B.P. filter input	–054–0155	,, ,,	—
PL5	RA.37 input	–054–0152	,, ,,	—
PL6	Crystal filter input	–054–0151	,, ,,	—
SK6	Crystal filter input	–054–0155	,, ,,	—
PL7	Crystal calibrator input	–940–8342	McMurdo	C8/USP
SK7	Crystal calibrator input	–054–0101	,,	X8/U
PL8*	100 kc/s i.f. output	–054–0101	Films & Eqpts.	—
PL8†	100 kc/s i.f. output		,, ,,	PL259
SK8*	100 kc/s i.f. output	–054–9028	,, ,,	—
SK8†	100 kc/s i.f. output		,, ,,	SO239
PL9*	100 kc/s i.f. output	–054–0101	,, ,,	—
PL9†	100 kc/s i.f. output		,, ,,	PL259
SK9*	100 kc/s i.f. output	–054–9028	,, ,,	—
SK9†	100 kc/s i.f. output		,, ,,	SO239
PL10*	Mains input Mk. IV fixed 3-pin	–056–0060	Plessey	CZ48993
SK10*	Mains input Mk. IV free 3-pin	–056–0100	,,	CZ49015
PL11	2nd V.F.O. output	–054–0151	Power Controls	—
JK1*	Headphone Jack		Shipton	AP61492A
JK1†	Headphone Jack		Bulgin	J2

9.5 PLUGS AND SOCKETS (continued)

Cct. Ref.	*Description*	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
JK2*	Headphone Jack		Shipton	AP61492A
JK2†	Headphone Jack		Bulgin	J2
*	Headphone Jack Plug		S. T. & C.	G.P.O. Type 316
†	Headphone Jack Plug		MIL–P–642A	PJ.055B

9.6 VALVES

			British	*American*
V1	Pentode	CV138	EF91	6AU6
V2	Pentode	CV138	EF91	6AU6
V3	Pentode	CV3998	E180F	6688
V4	Pentode	CV2209	6F33	6AS6
V5	Pentode	CV138	EF91	6AU6
V6	Pentode	CV138	EF91	6AU6
V7	Pentode	CV3998	E180F	6688
V8	Pentode	CV138	EF91	6AU6
V9	Pentode	CV3998	E180F	6688
V10	Pentode	CV138	EF91	6AU6
V11	Heptode	CV453	EK90	6BE6
V12	Pentode	CV138	EF91	6AU6
V13	Heptode	CV453	EK90	6BE6
V14	Pentode	CV454	EF93	6BA6
V15	Pentode	CV454	EF93	6BA6
V16	Pentode	CV454	EF93	6BA6
V17	Pentode	CV454	EF93	6BA6
V18	Double-Diode	CV140	EB91	6AL5
V19	Pentode	CV138	EF91	6AU6
V20	F.W. Rectifier	—	GZ33	5V4G
V21	Double-Diode	CV140	EB91	6AL5
V22	Pentode	CV138	EF91	6AU6
V23	Pentode	CV138	EF91	6AU6

9.7 VALVE AND CRYSTAL HOLDERS

XL1	Crystal Holder		McMurdo	X2/UB
XL2 to XL7	Valve Holder	5935–99–056–0127	,,	—
	Screening Can	5960–99–056–3005	,,	—
V1 and V2	Valve Holder	5935–99–056–0127	,,	—
	Screening Can	5960–99–056–3003	,,	—
V3	Valve Holder	5935–99–056–0131	,,	—
	Screening Can	5960–99–056–0146	,,	—
V4 to V6	Valve Holder	5935–99–056–0127	,,	—
	Screening Can	5960–99–056–3003	,,	—
V4†	Screening Can	5960–99–056–0145	,,	—
V7	Valve Holder	5935–99–056–0131	,,	—
	Screening Can	5960–99–056–0146	,,	—
V8	Valve Holder	5935–99–056–0127	,,	—
	Screening Can	5960–99–056–3003	,,	—
V9	Valve Holder	5935–99–056–0131	,,	—
	Screening Can	5960–99–056–0146	,,	—
V10 to V19	Valve Holder	5935–99–056–0127	,,	—
	Screening Can	5960–99–056–3003	,,	—
V20	Valve Holder	5935–99–056–0149	,,	X8/U
	*Valve Retainer (GZ33)		Electrothermal	VRK31
	*Valve Retainer (GZ34)		Racal	VRY10
	†Valve Retainer (5V4G)		,,	VRK16
V21 to V23	Valve Holder	5935–99–056–0127	McMurdo	—
	Screening Can	5960–99–056–3003	,,	—

9.8 INDUCTANCES

Cct. Ref.	*Description*	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
L1	0–30 Mc/s filter	5950–99–972–9552	Racal	BD4586
L2	Crystal anode coil	–972–9565	,,	AA4768
L3	Common assembly with L1			
L4	Aerial Tuning	–972–9567	,,	AA4770
L5	Aerial Tuning	–972–9575	,,	AA4778
L6	Aerial Tuning	–972–9571	,,	AA4774
L7	Aerial Tuning	–972–9572	,,	AA4775
L8	Aerial Tuning	–972–9573	,,	AA4776
L9	Aerial Tuning	–972–9570	,,	AA4773
L10	Common assembly with L1			
L11	Common assembly with L1			
L12	Common assembly with L1			
L13	Harmonic filter	–972–9553	,,	AD4589
L14	Common assembly with L13			
L15	Common assembly with L1			
L16	Common assembly with L13			
L17	Common assembly with L1			
L18	Common assembly with L13			
L19	Common assembly with L13			
L20	First V.F.O. anode coil (assy. with R18)	–972–9577	,,	AA4780
L21	Common assembly with L13			
L22	Common assembly with L13			
L23	40 Mc/s filter	–972–9560	,,	AA4761
L24	37·5 Mc/s filter	–972–9554	,,	AA4632
L25	40 Mc/s filter	–972–9560	,,	AA4761
L26	37·5 Mc/s filter	–972–9554	,,	AA4632
L27	R.F. Amplifier anode coil	–972–9558	,,	AA4759
L28	37·5 Mc/s mixer anode	–972–9562	,,	AA4763
L29	40 Mc/s filter	–972–9560	,,	AA4761
L30	37·5 Mc/s filter	–972–9554	,,	AA4632
L31	40 Mc/s filter	–972–9560	,,	AA4761
L32	37·5 Mc/s filter	–972–9554	,,	AA4632
L33	37·5 Mc/s amplifier anode	–972–9562	,,	AA4763
L34	40 Mc/s filter	–972–9560	,,	AA4761
L35	37·5 Mc/s filter	–972–9554	,,	AA4632
L36	First V.F.O.	–972–9556	,,	AA4668
L37	40 Mc/s filter	–972–9560	,,	AA4761
L38	37·5 Mc/s filter	–972–9554	,,	AA4632
L39	40 Mc/s filter	–972–9560	,,	AA4761
L40	37·5 Mc/s filter	–972–9554	,,	AA4632
L41	40 Mc/s filter	–972–9560	,,	AA4761
L42	37·5 Mc/s filter	–972–9554	,,	AA4632
L43	Choke	–972–8084	Bulgin	SW68
L44	Filter coil	–972–9555	Racal	AA4655
L45	Choke	–972–8084	Bulgin	SW68
L46	Filter coil	–972–9555	Racal	AA4655
L47	Crystal input transformer	–972–9568	,,	AA4771
L48	Crystal input transformer	–972–9568	,,	AA4771
L49	Crystal input transformer	–972–9568	,,	AA4771
L50	37·5 Mc/s tapped anode coil	–972–9569	,,	AA4772
L51	Second mixer anode choke 10 Mc/s	–972–9550	,,	AA4765
L52	Second mixer trap 37·5 Mc/s (Assy. with C116)	–972–9549	,,	AA4764
L53	Filter	–972–9559	,,	AA4760
L54	Filter	–972–9559	,,	AA4760
L55*	Coil Assy. with R70 and C144	–972–9551	,,	BA10906A
L55†	Coil Assy. with R70 and C144		,,	BA10906C
L56	Choke	–972–8084	Bulgin	SW68

9.8 INDUCTANCES (continued)

Cct. Ref.	*Description*	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
L57	2–3 Mc/s band-pass filter	5950-99-972-9563	Racal	AA4766
L58	2–3 Mc/s band-pass filter	-972-9563	,,	AA4766
L59	2–3 Mc/s B.P. Filter Transformer	-972-9564	,,	AA4767
L60	Common assembly with L59			
L61	First L-C filter stage	-972-9557	,,	BA4758
L61‡	First L-C filter stage		,,	BA10869
L62	Common assembly with L61			
L63	Second L-C filter stage	-972-9579	,,	AA4915
L63‡	Second L-C filter stage		,,	AA10890
L64	Common assembly with L63			
L65	Choke	-972-8084	Bulgin	SW68
L66	Filter coil	-972-9555	Racal	AA4655
L67	Third L-C filter stage	-972-9579	,,	AA4915
L67‡	Third L-C filter stage		,,	AA10890
L68	Common assembly with L67			
L69	0·1 Mc/s coupling coil	-972-9574	,,	AA4777
L70	Common assembly with L69	-972-9574	,,	AA4777
L71	Final L-C filter stage	-972-9578	,,	BA4843
L72, L73, L74	100 kc/s i.f. first stage			pt. of BA4782
L72‡, L73‡, L74‡	100 kc/s i.f. first stage		,,	pt. of BA10892
L75	0·9 Mc/s anode coil	-972-9576	,,	AA4779
L76	I.F. output			pt. of BA4783
L77	100 kc/s i.f. final stage			
L78	100 kc/s i.f. final stage			pt. of BA4942
L79	100 kc/s i.f. final stage			
L80	Smoothing choke	-972-8943	Racal	T1081
L81	150mH choke	-972-9561	,,	pt. of AA4762
L82	B.F.O.	-972-9566	,,	AA4769
L83	Filter coil (Aerial)		,,	AA10420
L84	Filter coil (Aerial)		,,	AA10420
L85	Filter coil (Aerial)		,,	AA10420

9.9 TRANSFORMERS

T1	Mains	5950-99-911-6456	Racal	T1078
T2	Audio Output	-911-6455	,,	T1079
T3	A.F. Line Output	-911-6454	,,	T1080

9.10 RECTIFIER

MR1	Meter Rectifier	6130-99-943-6183	S.E.I. Ltd.	1mA.

9.11 LOUDSPEAKER

	2½" P.M. 3Ω	5965-99-972-9307	Goodmans	T24/201/3

9.12 METER

M1*	200 microamp F.S.D.	6625-99-943-6523	Ernest Turner (with AD4868 Scale)	W909
M1†	200 microamp F.S.D.		Ernest Turner (with AD4936 Scale)	W909

9.13 CRYSTALS

	Description	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
XL1	1 Mc/s ± ·005%	ZDK 1000 kc/s	Cathodeon	Style D
XL2	100,036 c/s ± ·005%	5955-99-972-9799	Brookes	Type G1
XL3	100,110 c/s ± ·005%	-972-9801	„	Type G1
XL4	100,270 c/s ± ·005%	-972-9803	„	Type G1
XL5	99,964 c/s ± ·005%	-972-9800	„	Type G1
XL6	99,964 c/s ± ·005%	-972-9802	„	Type G1
XL7	99,730 c/s ± ·005%	-972-9804	„	Type G1

9.14 FUSE AND FUSEHOLDER

F1	Mains Fuse, 2A	5920-99-059-0110	Belling Lee	L/1055
	Mains Fuseholder	-059-0100	„ „	L/356

9.15 LAMP AND HOLDER

ILP1	Mains indicating 8V 1·6W M.E.S.	6240-99-995-1201	Luxram	983
	Lampholder	6250-99-943-6863	Bulgin	M.E.S.5S

9.16 VOLTAGE SELECTORS

	*Voltage selector socket with plug	Racal	AD11999
	*Voltage selector plug	„	AD11999/A
	*Voltage selector socket	„	AD11999/B
	*Two voltage selector sockets with plugs and label	5935-99-972-9651	

9.17 SUPPLEMENTARY COMPONENTS AND SUB-ASSEMBLIES

	Audio Output Terminal Block (12-way)	Carr Fastener	Series 77/903/12
	H.T. Adaptor Terminal Block (2-way)	„ „	Series 77/903/2M
	Knobs, tuning (Mc/s and Kc/s)	5355-99-943-4816	Racal	BD6781
	Knobs, control (AE TUNE, and I.F. Gain)	-943-4818	„	AA6817
	Knobs, control (A.V.C., and A.F. Gain)	-943-4819	„	AA6742
	Knobs, control (B.F.O.; AE ATT; AE RANGE; BANDWIDTH; and System)	-943-4799	„	AD6735
	Film Scale	5820-99-943-5022	„	BD9562
	Chain (63 links)		„	CA4798/17
	Escutcheon, tuning, with windows		„	BA12009
	Escutcheon, loudspeaker	5965-99-972-9121	„	AD4848
	Slider (Kc/s tuning)	5355-99-943-5043	„	AD4568
	Clip and pointer assy. (Kc/s tuning)	-943-5020	„	AA4566
	Cable, UR70	6145-100298	„	CA4789/46
	Trimming tool (AD7955)		„	DA4500/65
	Allen Key $\frac{1}{16}$″ A.F.		„	DA4500/66
	Allen Key $\frac{3}{16}$″ A.F.		„	DA4500/67
	Allen Key 0·050″ A.F.		„	DA4500/69
	Cabinet	5957-99-972-8566	„	DA5795
	Knob, tuning lock	5355-99-943-4820	„	AD6762
†	Knob, Meter Switch		„	AD6735
	Cover Assembly	5820-99-943-5048	„	CA4640
	Baseplate		„	BD4580
	Gusset Assembly R.H.	5820-99-943-5021	„	BA4509
	Gusset Assembly L.H.	-943-5049	„	BA4508
	Screen Assembly (37·5 Mc/s Filter—long)	5999-99-972-8946	„	BA4602

9.17 SUPPLEMENTARY COMPONENTS AND SUB-ASSEMBLIES

Description	*Joint Service No.*	*Manufacturer and Type or Drawing No.*	
Screen Assembly (37·5 Mc/s Filter—short)	5999–99–972–8947	Racal	BA4603
Screen Assembly (2nd Mixer)	–972–8948	,,	BA4604
Screen Assembly (40 Mc/s Filter—long)	–972–8949	,,	BA4605
Screen Assembly (40 Mc/s Filter—short)	–972–8950	,,	BA4606
Screen Assembly (Harm. Gen.)	–972–8951	,,	BA4560
Screen Assembly (Ae-Att. Sw.)	–972–8952	,,	AA4755
Screen Assembly (1stV.F.O.)	–972–8944	,,	CA4582
Screen Assembly (2nd V.F.O.)	–972–8945	,,	BA4581
First I.F.T. Assembly	5950–99–940–3481	,,	BA4782
Final I.F.T. Assembly	–940–3480	,,	BA4942
I.F. O/P T. Assembly	–940–3482	,,	BA4783
B.F.O. Assembly	5820–99–943–3457	,,	CA4802
Crystal Filter Assembly	5915–99–972–8569	,,	CA4800
L-C Filter Assembly	–972–8570	,,	CA4801

9.18 MAIN SUB-UNITS

Main Chassis Assembly (with screening covers)	5820–99–943–3456	Racal	AA11241
First V.F.O. (Mc/s Drive)	–943–3458	,,	CA10844
Second V.F.O. (Kc/s Drive)	–943–3459	,,	CA10828
100 kc/s i.f. strip (inc. B.F.O.)	–943–3455	,,	CA10884
Crystal calibrator unit	6625–99–943–3461	,,	CA10845
Front Panel Assembly		,,	CA4833**

VALVES & CRYSTALS	
RESISTORS	
CAPACITORS	
INDUCTANCES & TRANSFORMERS	
SWITCHES	
MISCELLANEOUS	

CRYSTAL FILTER

100kc/s FILTER

I.F. OUTPUT

B.F.O.

AUDIO OUTPUT

2nd. MIXER

3rd. MIXER

1st. I.F. AMP.

2nd. I.F. AMP.

A.V.C. & T.C.

DETECTOR & NOISE LIMITER

A.F. OUTPUT

40Mc/s B.P.F.

37·5Mc/s B.P.F.

37·5Mc/s AMP.

2nd. V.F.O.

CALIBRATOR

XTAL FILTER

100kc/s FILTER

A.F. LEVEL

R.F. LEVEL

NOTES

1 ALL RESISTORS ARE ½W WATT RATING UNLESS OTHERWISE STATED

2 CAPACITOR VALUES ONE OR DECIMAL ARE MFD UNLESS OTHERWISE STATED

3 CAPACITOR VALUES GREATER THAN ONE ARE MMFD UNLESS OTHERWISE STATED

4 C123 C125 C129 C139 ARE GANGED

5 S1A & S1B ARE GANGED

6 S2A,B,C & D ARE GANGED

7 S5A,B,C & S4A,B,C,D ARE GANGED

8 S5A,B,C,D,E & S5F ARE GANGED

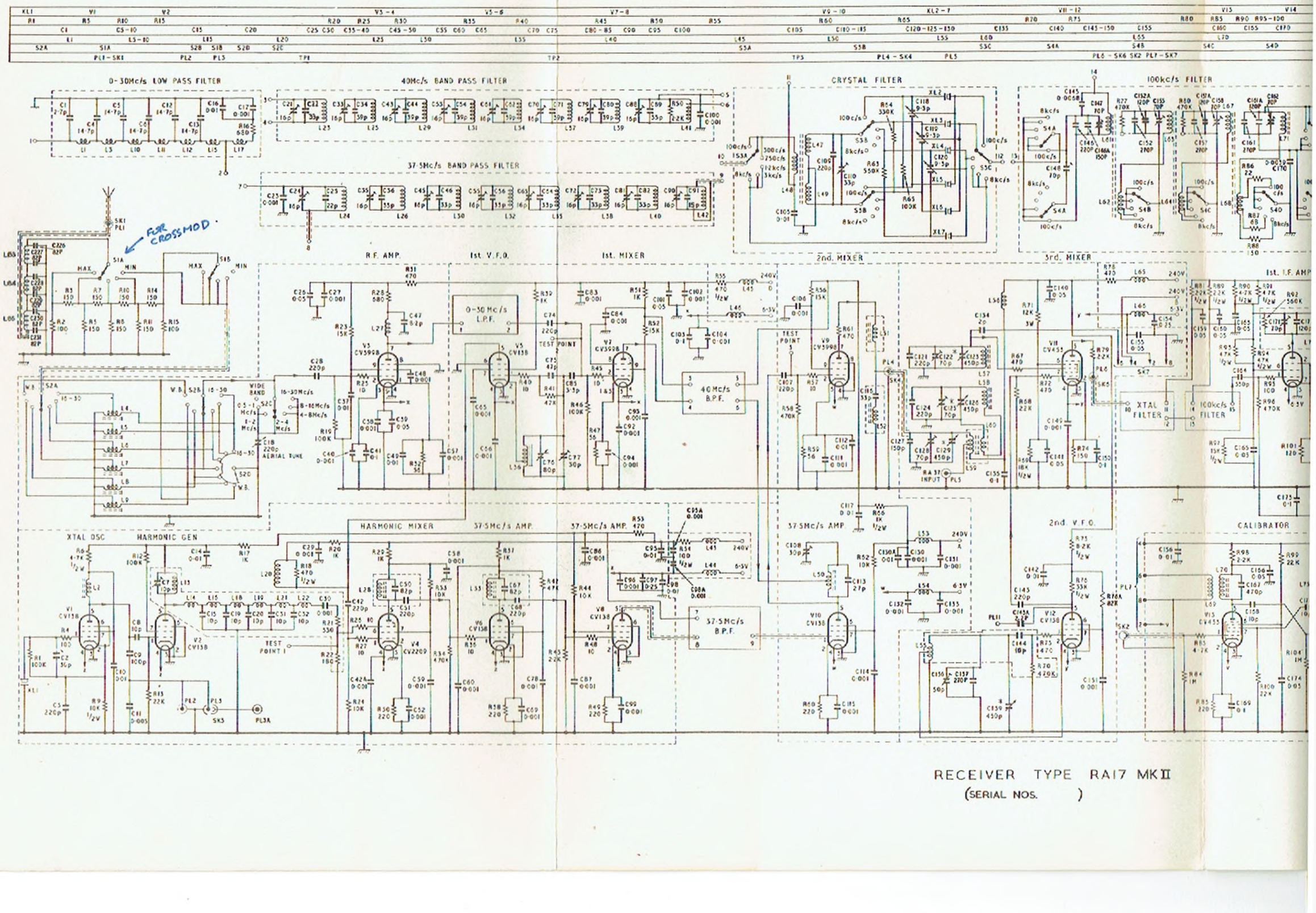
ORG No. EC 4500/2

DRN	E.W.M.	CHK'D.	APP'D.	DATE 18.11.58

RACAL ENGINEERING LTD. BRACKNELL, BERKS, ENGLAND. So2065

RECEIVER TYPE RA17 MKII

(SERIAL NOS.)



RECEIVER TYPE RA17 MKII

(SERIAL NOS.)