Eddystone

Model EA12

Eddystone Radio

A MARCONI COMMUNICATION SYSTEMS COMPANY

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EDDYSTONE MODEL EA12

HIGH STABILITY

AMATEUR BAND COMMUNICATIONS RECEIVER

The EDDYSTONE Model EA12 is a high performance communications receiver built to professional standards but designed specifically for amateur use on the 10, 15, 20, 40, 80 and 160 metre bands. Reception facilities cover CW, AM and SSB and provision is made for operating the receiver in conjunction with the Eddystone Model EP20 Panoramic Display Unit when visual signal analysis is required. Both receiver and display unit incorporate AC power supplies and though mainly intended for home station use can also be powered from a suitable DC/AC converter if portable operation is a requirement.

Thirteen valves and five silicon diodes are used in the double conversion circuit which employs a crystal controlled converter followed by a tunable 1st IF. Nine tuning ranges provide a high degree of bandspread and give complete coverage of the whole 10 metre allocation. Tuning is by a precision geared drive mechanism which gives a sensibly constant tuning rate with substantially linear frequency scales on all bands. A built-in crystal calibrator (100 kc/s) is fitted and frequencies can be read to an accuracy of one kilocycle.

The many refinements incorporated in the receiver include both crystal and audio filters for CW working, continuously variable selectivity, a versatile slot filter, separate detector and noise limiter circuits for CW/SSB, a large calibrated "S" meter and an internal loudspeaker. A telephone output is available and the circuit arrangements permit connection of an external loudspeaker should the need arise. Muting facilities are provided and terminals allow connection to external transmit/receive control circuits.

Rugged construction and high quality components of the latest types are employed throughout, dimensions are compact and styling in keeping with modern trends. Conversion to rack-mounting is possible and the receiver is suitable for continuous operation under adverse climatic conditions.

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Sole Manufacturers:- EDDYSTONE RADIO LTD., ALVECHURCH ROAD, BIRMINGHAM 31, ENGLAND

Issue 2. November 1966.

TECHNICAL DATA

GENERAL

Frequency Coverage.

The receiver covers all amateur bands from 10-160 metres in nine ranges, four of which are used for the 10 metre band.

Range 1	. .	29.4 - 30.0 Mc/s (10M).	Range 6	. .	13.9 - 14.5 Mc/s (20M).
Range 2	. .	28.9 - 29.5 Mc/s (10M).	Range 7	. .	6.9 - 7.5 Mc/s (40M).
Range 3	. .	28.4 - 29.0 Mc/s (10M).	Range 8	. .	3.4 - 4.0 Mc/s (80M).
Range 4	. .	27.9 - 28.5 Mc/s (10M).	Range 9	. .	1.8 - 2.4 Mc/s (160M).
Range 5	. .	20.9 - 21.5 Mc/s (15M).			

Intermediate Frequencies.

1st IF . . Tunable over the range 1.1 - 1.7 Mc/s. The local oscillator tracks on the low side covering the band 1.0 - 1.6 Mc/s.

2nd IF . . 100 kc/s with crystal filter, slot filter and continuously variable selectivity. The BFO provides a swing of ± 3.5 kc/s in the CW positions and ± 100 c/s at SSB.

Valve Complement.

The double conversion circuit employs a total of 13 valves together with five silicon diodes, two of which are used as rectifiers in the power supply.

Ref	Type	Circuit Function
V1	ECC189 or 6ES8 (CV5331)	RF Amplifier.
V2	ECH81 or 6AJ8 (CV2128)	1st Mixer and 1st Osc. Amp./Dblr.
V3	EC90 or 6C4 (CV133)	1st Oscillator (crystal controlled).
V4	ECH81 or 6AJ8 (CV2128)	2nd Mixer and 2nd Osc. Isolation Amp.
V5	EC90 or 6C4 (CV133)	2nd Oscillator (VFO).
V6	EF93 or 6BA6 (CV454)	1st 100 kc/s IF Amplifier.
V7	EF93 or 6BA6 (CV454)	2nd 100 kc/s IF Amplifier.
V8	EB91 or 6AL5 (CV140)	AM Detector and AGC Rectifier.
V9	ECC83 or 12AX7 (CV492)	Cathode Follower and Audio Amplifier.
V10	EK90 or 6BE6 (CV453)	CW/SSB Detector.
V11	EL90 or 6AQ5 (CV1862)	Audio Output.
V12	150C2 or OA2 (CV1832)	HT Stabiliser.
V13	EF94 or 6AU6 (CV2524)	Crystal Calibrator.
D1	DD006 - -	AM Noise Limiter.
D2/3	DD006 - -	CW/SSB Noise Clipper.
D4/5	DD058 - -	HT Rectifier.

Input and Output Impedances.

Aerial Input . . 75Ω unbalanced (coaxial socket).

IF Output . . 250Ω (nominal) unbalanced to coaxial socket. Suitable for terminating impedances in the range 75-300Ω.

Audio Output . . Loudspeaker : 3Ω (internal or external).
Telephones : Nominally 2,000Ω but suitable for use with telephones of most standard impedances.

Power Supply.

Single-phase AC mains 100/125V and 200/250V (40-60 c/s). Consumption : 85VA.

Fusing.

The live side of the mains input is fused at 1.5 Amps ($1\frac{1}{4}$" x $\frac{1}{4}$" cartridge fuse).

TYPICAL PERFORMANCE FIGURES

Sensitivity.

AM sensitivity with an IF bandwidth of 6 kc/s is 2μV for a 10dB s/n ratio. On CW the sensitivity is 0.5μV for a 20dB s/n ratio with an IF bandwidth of 1.3 kc/s.

Image Rejection.

Better than 50dB at the highest frequency under the worst condition of the 1st IF tuning.

IF Breakthrough.

Breakthrough at the 1st IF is greater than 90dB down at 2 Mc/s on Range 9 and greater than 100dB down on all other ranges. Breakthrough at the 2nd IF is greater than 110dB down on all ranges.

IF Selectivity.

The overall bandwidth at 6dB down is continuously variable from a maximum of 6 kc/s down to 1.3 kc/s and is narrowed to 50 c/s when using the 100 kc/s crystal filter.

The slot filter provides a steep-sided rejection notch which is tunable across the IF passband by use of a panel control. A "T" notch circuit is employed and rejection exceeds 40dB.

Markings on the selectivity control indicate the appropriate settings for the different signal modes. Corresponding bandwidths are as follows:-

Position	-6dB	-50dB
CRYSTAL (N)	50 c/s	2 kc/s
CW	1.3 kc/s	5 kc/s
SSB	3 kc/s	8 kc/s
AM	6 kc/s	12 kc/s

Calibration and Re-setting Accuracy.

Scale accuracy is of the order 0.5% when the cursor shift is set so that the cursor is at its mid-travel position. Frequencies can be set to within one kilocycle when the scales are standardised against the built-in 100 kc/s crystal calibrator.

Frequency Stability.

Drift does not exceed 100 c/s in any one hour period. The thermal inertia of the receiver is high and short-term drift is not greater than 20 c/s for temperature changes of up to 20°C. A 10% variation in the applied mains voltage does not affect the tune frequency by more than 100 c/s.

AGC Characteristic.

The audio output level does not change by more than 9 dB when the carrier level is increased 90dB above 5µV. (Taken at 7 Mc/s with an IF bandwidth of 3 kc/s.)

Two AGC time constants are provided and the AGC delay is automatically reduced when taking SSB signals.

Audio Output and Response.

The maximum audio output is 2.5 watts to a standard 3Ω loudspeaker. An output of 1 watt is available at 5% distortion.

The audio response on AM is level within 3dB over the range 400 c/s to 7 kc/s. On CW and SSB a low pass filter modifies the response such that it is 10dB down at 500 c/s and 30dB down at 5 kc/s. The filter configuration is changed in the "CW FILTER" position to give a 6dB bandwidth of 300 c/s centred on approximately 800 c/s.

IF Output.

An input of 2µV at the aerial socket will produce an output of 100mV across a terminating resistor of 75Ω. (AGC off, gains at max. and IF bandwidth at 3 kc/s).

C I R C U I T   D E S C R I P T I O N

The RF Section.

This portion of the receiver comprises V1 (ECC189), V2 (ECH81) and V3 (EC90) which make up a nine-range crystal-controlled front-end with output in the band 1.1-1.7 Mc/s.

The RF Amplifier (V1) features a cascode circuit and provides greater protection against cross modulation and blocking than does the more conventional pentode amplifier usually found in this position. Improved signal-to-noise figures are also obtained especially on the 10M and 15M bands where the performance of the pentode is somewhat inferior to the double-triode arrangement using the ECC189.

A high degree of front-end selectivity is achieved by using three signal frequency circuits, two of which take the form of a tuned bandpass coupling between the aerial input and the RF Stage. The third circuit couples the RF Stage to the 1st Mixer and all three circuits are tuned by a three-gang capacitor (C11, C13 and C34) which is adjusted independently of the main TUNING by the PEAK RF control. Separate coils are used for each of the six amateur bands, the PEAK RF coverage being restricted to 600 kc/s on all ranges except 10M where the tuning range is extended to 2 Mc/s to allow coverage of the complete band with a single set of coils.

The aerial circuit includes a high-pass filter (L1-L6) to reduce the possibility of breakthrough at the 1st IF when using the lower frequency bands. The filter increases effective attenuation below 1.7 Mc/s to some 90dB or greater but has negligible insertion loss within the tuning range of the receiver. Aerial input impedance is closely matched to 75Ω on all bands.

Control over the gain of the cascode stage is effected by varying the bias applied to the first triode section V1A which is a grounded -cathode amplifier. Both triodes are in series so any increase in the bias on V1A is automatically transmitted to V1B by the reduction in anode current which it brings about. This has the effect of making the cathode of V1B more positive and since its grid potential is fixed by the divider network R6/R7 the result is an increase in the bias applied. The second triode operates as a grounded-grid amplifier, its grid being grounded to signal frequencies by the two capacitors C23 and C24. R2 (grid stopper on V1A) prevents parasitic oscillation in the VHF region and so contributes to the overall stability of the cascode stage.

Manual gain control is provided by adjustment of RV1 (RF GAIN) and AGC when in use is applied to V1A through the grid resistor R1. The range of control which RV1 provides is extended by supplying a bleed current from the main HT rail via the 47,000Ω resistor R3. In effect, R3 and RV1 form a potential divider across the HT supply and give a rapid increase in bias at low settings of the gain control (i.e. when the valve current is reduced to such a small value that it produces little significant increase in bias). One section of the CALIBRATOR switch (S2a) is included in series with the cathode return and is arranged to introduce an additional bias resistor (R5) when switched to "CALIBRATE". This reduces the gain of the RF Stage independently of the RF GAIN control and limits interference from outside signals when checking the accuracy of the dial calibration against the built-in crystal calibrator.

Provision is made for muting the RF Stage (and the 1st 100 kc/s IF Amplifier) so that outgoing transmissions can be monitored when using the receiver in conjunction with an associated transmitter. This facility can be controlled either by the STANDBY switch (S4) or by an external control circuit wired to the MUTE terminal at the rear of the set. Placing S4 in the "STANDBY" position removes the direct earth from the common cathode return of the RF and 1st IF Stages and instead takes this circuit to earth through the pre-set MUTING LEVEL control RV4. This control is effectively a combined RF/IF gain control, providing a variable bias (due mainly to the bleed currents through R3 and R53) and can be set to give any desired level of muting.

The heptode portion of an ECH81 is used as the 1st Mixer Stage (V2A), signal input being to g1 and oscillator injection to g3. AGC is applied through R15. Damping resistors (R11-R14) are included across the primary windings of the tuned circuits coupling the cascode and mixer stages on the 160, 80, 40 and 20M bands. Their values have been chosen to give constant overall gain on all ranges and so maintain the same "S" meter calibration when changing from band to band.

The other half of V2 (V2B) is included in the associated local oscillator section and is driven by the Crystal Oscillator (V3 : EC90) which runs in the fundamental mode and employs a separate crystal for each range. On 10M and 15M, the injection frequency to the 1st Mixer is equal to twice the crystal frequency and on the five ranges covering these two bands V2B serves as a frequency doubler. On the other four ranges injection is at the fundamental crystal frequency and V2B then operates as a straight amplifier. The oscillator injection is above the signal frequency on all ranges with the result that the IF spectrum becomes a mirror image of the input spectrum, i.e. the highest signal frequency occurs at the low end of the tunable IF range.

Crystal switching is arranged so that all crystals which are not in use are shorted to eliminate spurious responses while injection is set to the optimum level by fitting damping resistors (R24-R32) in shunt with the crystals. These resistors are selected during test and also prevent the possibility of exceeding the specified crystal dissipation when using high activity crystals. Output from the triode portion of the ECH81 (V2B) is broadly tuned by L21-L25 and coupled to the injection grid via C57. HT for V3 and V2B is derived from the 150V stabilised HT supply (HT2) while the anode and screen of the 1st Mixer are fed from the main HT rail.

The Tunable 1st IF.

The 1st and 2nd Mixer Stages are coupled by a bandpass circuit which is tuned over the range 1.1-1.7 Mc/s by two sections of a three-gang capacitor. The remaining section of the gang tunes the associated local oscillator V5 which tracks on the low frequency side of the tunable IF range. Great care has been taken in the design of the IF band-pass circuit to achieve (1) a high degree of adjacent channel selectivity, (2) accurate tracking with the 2nd Local Oscillator, and (3) constant gain over the coverage of the tunable IF.

A high degree of adjacent channel selectivity is an important factor at this point in the circuit since it reduces the possibility of cross modulation occurring at the 2nd Mixer and also limits the level of spurious beats generated by the mixing process. High Q "Vinkor" type inductors (L19/L20) and very loose coupling (C44 : 1pF) between the primary and secondary circuits provide the required degree of selectivity.

Accurate tracking and constant gain are equally important and are closely related features of the circuit. Close tolerance capacitors (C43 and C45) are included in series with the tuning capacity to correct the tracking at the low frequency end of the IF range, while normal air-spaced trimmers serve for adjustment at the high end. The 1pF capacitor which couples the primary and secondary circuits is wired directly between the stators of the tuning capacitors to give automatic control over the degree of coupling and therefore of the gain throughout the tuning range. Coupling increases as the circuit is tuned towards the high frequency end of the range due to the reduced value of tuning capacity across which the coupling is connected.

Output from the bandpass circuit is fed via C49 to g1 of the 2nd Mixer (V4A) which is the heptode portion of another ECH81. AGC is applied through R21 and the oscillator injection is to g3 via C68. HT for this stage is derived from the main HT supply.

The triode portion of the ECH81 (V4B) serves as an Isolation Amplifier for the variable frequency 2nd Local Oscillator V5 (EC90) which employs a tuned-anode oscillator circuit covering the range 1.0-1.6 Mc/s. Output is taken from the grid of V5 through a very small capacitor (C64 : 3pF) to further improve the isolation provided by V4B. This makes it possible to apply AGC to the 2nd Mixer without the danger of pulling the oscillator frequency when handling high level inputs.

V5, contrary to normal practice, is fed from the unstabilised HT supply since this results in greater freedom from frequency drift with variation in the applied mains voltage. A reduction in HT voltage due to a drop in the AC supply causes the oscillator to drift but is compensated by a drift in the opposite direction due to the lower LT voltage. If the HT was taken from the stabilised supply, drift due to the change in LT would not be counteracted. Normal temperature compensation is included (ceramic capacitor C62) and the oscillator stability is of an extremely high order. Thermal inertia of the receiver is very high and short-term drift almost negligible.

The drive mechanism which tunes the 1st IF and 2nd Local Oscillator circuits incorporates a specially designed linearising arm to give sensibly straight-line frequency calibration and a more or less constant tuning rate throughout the entire range.

The 100 kc/s IF Amplifiers.

Output from the 2nd Mixer is fed via T1 to a two-stage 100 kc/s Amplifier which comprises V6 and V7 (2 x EF93). Both stages operate with AGC and the gain of the first can also be controlled manually by adjustment of the IF GAIN (RV3). The range of adjustment provided by this control is extended as in the case of the RF GAIN by supplying a bleed current through R53.

RV3, like the RF GAIN control (RV1) is returned to ground through the variable resistor RV4 across which the muting bias is developed under transmit conditions. RV4 is brought into circuit by moving the STANDBY switch S4 into the "STANDBY" position but the circuit is arranged so that this function can be performed by an external transmit/receive control system if this should be more convenient for a particular installation. In this case the STANDBY switch is left permanently in the "STANDBY" position and a controlling switch or relay contact is wired between earth and the MUTE terminal at the rear of the set. The external circuit must be arranged to open on transmit. Alternatively, where control of the external transmitter switching system is required from the STANDBY switch on the receiver, this can be achieved by wiring the external circuit between earth and the RELAY terminal. The circuit is completed by the other section of S4 when this is at "STANDBY."

The 100 kc/s IF Amplifier has a total of seven tuned circuits and incorporates a selective crystal filter for CW reception. A close tolerance crystal is employed and the phasing is pre-set during initial alignment (by C73) to give a symmetrical response with a 6dB bandwidth of the order 50 c/s. The crystal filter is backed up by a slot filter which will be found considerably more flexible in operation than the normal panel phasing control usually associated with the crystal circuit. The slot frequency is controlled from the panel by a knob which drives a fine-threaded adjusting screw carrying a ferrite core which tunes the high Q "Vinkor" inductor (L27). The steep-sided rejection notch produced by this circuit can be positioned at any point in the IF passband and is moved to the extreme edge of the IF response when the control is set to "OFF". RV2 is pre-set during initial alignment to give the greatest possible rejection. This is in excess of 40dB and no attempt should be made to re-adjust RV2 unless proper test equipment is available.

Variable selectivity is achieved at the 2nd IF by physical movement of the secondary coils in the three IF transformers T1, T3 and T4. The SELECTIVITY control gives any 6dB bandwidth within the limits 1.3 - 6 kc/s with positive stops in the 1.3 and 3 kc/s positions (marked "CW" and "SSB" respectively). Advancing the control past the "CW" setting (i.e. to "N") automatically introduces the crystal filter by actuating the microswitch S3.

The 2nd 100 kc/s IF Amplifier (V7) provides a controlling voltage to operate the built-in "S" meter when using AGC. The meter circuit is interrupted by S5a in the AGC "OFF" position and this prevents random movement of the meter needle which would occur if the last IF Stage is overloaded when tuned to a fairly strong signal.

The meter is connected between the cathode of V7 and the slider of the potentiometer (RV5) which forms part of a potential divider across the main HT supply. RV5 provides a means of setting the meter needle to zero under "no-signal" conditions and is actually one leg of a bridge circuit. It is adjusted so that the slider voltage is equal to the voltage at the cathode of V7 and since there is no voltage across the meter under these conditions, the meter reads zero. On receipt of a signal (with AGC in use) the grid of V7 is driven negative and this causes a reduction in the cathode current through V7. The voltage across R59 decreases, unbalancing the bridge circuit and so causing the meter to read. Deflection of the meter needle is dependent on the degree of unbalance and the meter is scaled in "S" points, each being equivalent to an approximate change of 6dB in carrier level. Above "S9" the meter is calibrated directly in dB.

AM Detector, AGC and Cathode Follower.

The functions of AM Detector and AGC Rectifier are shared by a 6AL5 double-diode (V8A and V8B). The Detector (V8A) employs a normal series circuit and incorporates a silicon diode Noise Limiter (D1 : DD006) with audio taken from the cathode via C98. Output is routed to the AF Amplifier (V9B) through one section of the MODE switch (S6f) and the circuit is arranged so that the limiter can be switched out when not required. This function is performed by S5c which short-circuits D1 in the three "OFF" positions.

AGC is produced by the other diode (V8B) which is fed from the signal diode via C100. Bias is developed across the load resistor R65 and applied via the filter circuit R64/C97 to the AGC line which controls the RF Amplifier, the two Mixers and both 100 kc/s IF Stages.

A delay is introduced in the AGC circuit by returning the cathode of the diode to the junction of R67/R69 which are connected across the main HT supply. This puts a positive bias on the cathode of V8B and prevents it conducting at low signal levels. The delay is reduced with the MODE switch at "SSB" and this compensates for the lower average sideband power available for producing AGC when using this mode. The switching operation is performed by S6a which places R68 in parallel with R67.

Two AGC time constants are provided, these being selected by the combined AGC/NL switch (S5). S5b introduces a 2μF capacitor (C96) when set to "SLOW" and directly earths the AGC line in the "OFF" position. Additional decoupling on the line is by C86 (0.1μF).

The AGC line is brought out to a terminal at the rear of the set and so provides an alternative method of muting. An externally derived negative muting bias is required and is connected between earth and the AGC terminal. The AGC switch should be at "FAST" to ensure rapid operation when using this arrangement and the system may be more convenient in some installations than the normal muting facility controlled by the STANDBY switch. AGC terminals should be linked together if two EA12 receivers are used in diversity.

V9A (½ ECC83) is wired as a cathode follower and provides a 100 kc/s IF output for connection to external ancillary units. The Eddystone EP20 Panoramic Display Unit can be fed from this point and will further increase the usefulness of the receiver. (Full details of the EP20 are available on request). The IF output is taken to a coaxial socket at the rear (SKT2) and external units should be arranged to present an input impedance in the range 75-300Ω. The output is not affected by the receiver MODE switching.

CW/SSB Detector.

An EK90 pentagrid (V10) is employed for CW and SSB detection. It functions as a product detector and incorporates a high stability oscillator circuit which serves the dual purpose of beat oscillator for CW reception and carrier insertion oscillator for SSB. HT is derived from the 150V stabilised supply (HT2) and the stage is disabled by S6c when this is set to the "AM" position.

The oscillator circuit is arranged so that with the MODE switch in either of the two "CW" positions, the oscillator frequency is adjustable over the range 100 kc/s ± 3.5 kc/s, while at "SSB" the coverage is restricted to ± 100 c/s centred on the appropriate insertion frequency for the sideband in use. The switching required to provide these facilities is performed by S6b which in the "CW" positions places the BFO PITCH capacitor (C110/C111) directly across the oscillator tuned circuit. When the switch is moved to "SSB", the effective capacity of C110/C111 is reduced by introducing a 40pF series capacitor (either C108 or C109). At the same time either C106 (200pF) or C107 (130pF) is switched across the oscillator circuit to pre-tune it to the appropriate frequency. High-stability close-tolerance capacitors are employed in this circuit and any slight error in the insertion frequency will be well within the 200 c/s swing provided by the BFO PITCH control.

Examination of the circuit diagram will reveal that it is the 200pF capacitor which is introduced in the "LOWER" sideband position and the 130pF capacitor when "UPPER" sideband is selected. This may at first sight appear to be incorrect since it means that the oscillator runs on the low side of the IF when taking a lower sideband signal and on the high side when receiving upper sideband. The explanation lies in the fact that all signals are inverted at the 1st Mixer Stage (V2A) because this operates with its local oscillator on the high side of the signal. An upper sideband signal at the aerial input is therefore converted to a lower sideband signal at the 1st IF and since inversion does not occur in the 2nd Mixer (due to its local oscillator being on the low side of the IF), it remains a lower sideband signal at the 2nd IF. The approximate carrier insertion frequencies for upper and lower sideband reception are 101.5 kc/s and 98.5 kc/s respectively, and the panel marking "UPPER" and "LOWER" is of course correct for the signal as seen at the aerial input.

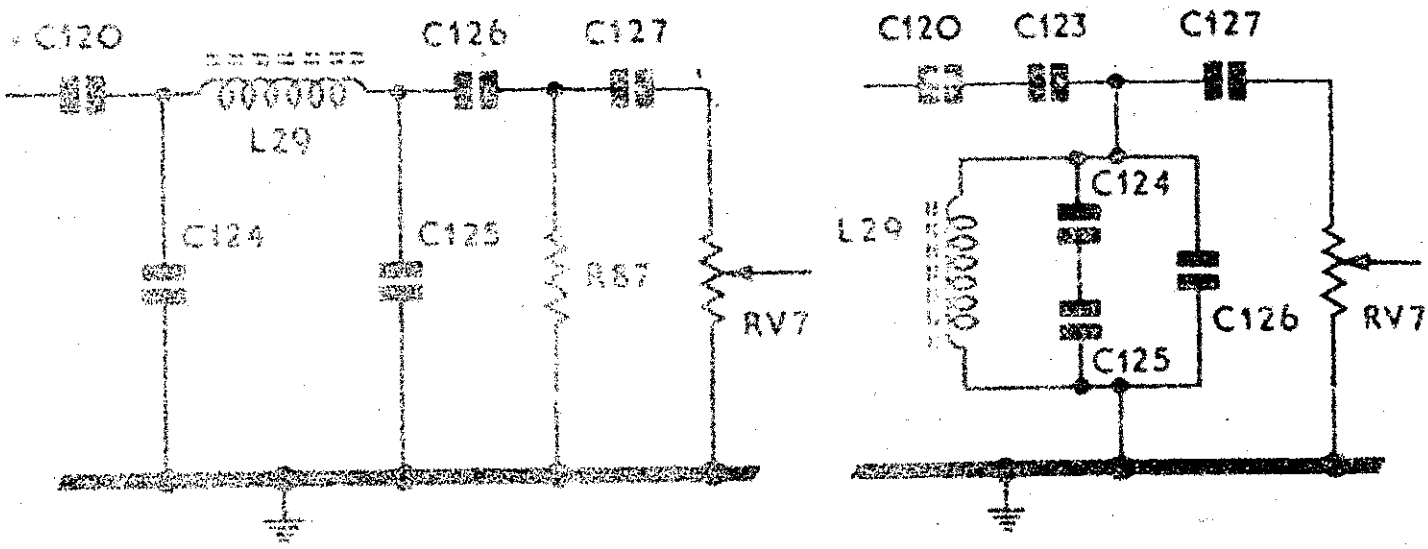
Audio output from the CW/SSB Detector is taken to a diode Noise Clipper (D2/D3 : 2 x DD006) which is brought into circuit when the combined AGC/NL switch is set to NL "ON". The switching operation is performed by S5d and the operation of the circuit is explained on the following page.

The 0.47MΩ resistor R84 serves as a load across which output from the CW/SSB Detector is developed, C121 completing its earth return for audio frequencies. D2 and D3 are connected in parallel with R84, the D2 circuit being completed by R86 and the D3 circuit by R85. These two resistors also form a potential divider and with S5d at "ON" are connected directly across RV6 which itself is part of a divider network across the main HT supply. RV6 functions as a threshold control and provides a means of setting the circuit conditions so that signals of average level pass through the circuit without clipping taking place. This adjustment is made as part of the test procedure during manufacture and should not be altered unless absolutely essential. Reducing the amount of resistance in circuit will increase the clipping action but it should be noted that the same effect can be obtained in normal operation by the simple expedient of increasing the pre-detector gain to give a bigger voltage across R84.

The voltages developed across R85 and R86 are equal and their polarity such that both diodes are biased in the reverse direction (i.e. non-conducting). In this condition the diodes appear as a high impedance across R84 and have no effect on normal audio signals which are coupled via C120 to the audio stages of the receiver. On receipt of a noise pulse however, the large voltage which it produces across R84 drives one of the diodes into a conducting state since the reverse bias set by RV6 is overcome. The diode which is conducting appears as a very low impedance across R84 and the output is considerably reduced for the duration of the pulse. Both negative and positive pulses are suppressed by the circuit since D2 conducts when the top end of R84 is negative and D3 when it is positive. Moving S5d to NL "OFF" increases the reverse bias across the diodes and prevents them from conducting even under pulse conditions.

After passing through the clipper circuit the audio signal is switched by S6d which, together with three other sections of the MODE switch (S6e, S6f and S6g) introduces a low-pass audio filter (L29/C124/C125) when set to "CW" or either of the two "SSB" positions. This reduces the audio bandwidth and gives a response which is 10dB down at 500 c/s and 30dB down at 5 kc/s. Moving the MODE switch to "CW FILTER" alters the circuit configuration and the same inductor (L29, "Vinkor" type) is then used as a tuned audio filter with a 6dB bandwidth of 300 c/s centred on 800 c/s. This gives an additional selectivity position for CW working, intermediate between the 1.3 kc/s and 50 c/s bandwidths provided by the SELECTIVITY control. The "CW FILTER" position can also be used with the SELECTIVITY control at the 50 c/s setting when an effective increase in skirt selectivity will be obtained.

Fig. 1. Simplified Circuits of CW/SSB Filters.



(A) With MODE switch at "CW" or "SSB". (B) With MODE switch at "CW FILTER".

The Audio Stages and Power Supply.

Audio from the appropriate detector (V8A or V10) is fed via S6f to the AF GAIN control (RV7) and so to the grid of the AF Amplifier V9B. The remaining half of the ECC83 is used in this position and output is resistance-capacity coupled to the AF Output Stage V11 (EL90). This stage provides output for the 3Ω loudspeaker which is fitted internally but provision is made for feeding an external loudspeaker if this facility should be required. A telephone output is also available and though designed primarily for use with telephones of 2,000Ω impedance, it will nevertheless give quite satisfactory results with a wide range of telephone impedances. A spare contact on the telephone socket is arranged to interrupt the loudspeaker circuit when telephones are in use.

The power supply circuit employs a pair of silicon diodes (D4/D5 : 2 x DD058) in a full-wave circuit giving a main HT supply of 250V (HT1). A neon stabiliser (V12 : 150C2) is fed from this line through R99 and gives a 150V supply (HT2) for V2B, V3 and V10. Three separate LT supplies are available, only one of which (LT1) is used. The centre-tap of the LT1 secondary is earthed and a balanced circuit is used to feed the heaters of all the valves and also the three pilot lamps (ILP1-3) which are used for dial illumination.

Fusing is by means of a 1.5 Amp fuse in the live line to the primary of the power transformer and the switching (S7) is arranged to break both the live and neutral lines when the receiver is switched off. CH1/CH2 and C136/C137 make up a mains filter to reduce hum modulation when monitoring an associated transmitter.

The Crystal Calibrator.

This stage employs a close tolerance 100 kc/s crystal housed in an evacuated glass envelope and provides marker signals for checking the accuracy of the dial calibration. An EF94 high-slope pentode (V13) is used as the oscillator and the harmonic output is introduced at the grid of the 2nd Mixer Stage (V4A) by proximity coupling from a small injection probe adjacent to the tuning capacitor on the primary side of the bandpass circuit L19/L20. The fundamental crystal frequency also appears at the grid of V4A and since it coincides with the 2nd IF of the receiver this obviates the need for using the BFO when making a calibration check. Crystal markers are not injected at the 1st Mixer Stage since the oscillator associated with it is itself crystal controlled.

Calibrator switching is performed by a push-button switch (S2b) which grounds the cathode of V13 in the "CALIBRATE" position. With S2b open, the cathode is returned to the junction of R103/R104 and the voltage developed at this point is sufficient to bias off the valve and so prevent the calibrator from operating. The other section of the CALIBRATOR switch (S2a) is included in the cathode return of the RF Stage (V1A) and reduces its gain to limit interference from outside signals when making a calibration check. The crystal can be standardised against an external frequency standard by adjustment of C142 which allows slight pulling of the crystal frequency.

MECHANICAL CONSTRUCTION

Dimensions and Weight.

Width	$16\frac{3}{4}$"	42.5 cm.
Width with rack-mounting brackets	19"	48.3 cm.
*Height	$8\frac{3}{4}$"	22.2 cm.
†Depth	$13\frac{5}{8}$"	34.6 cm.
†Depth behind brackets (rack-mounting)	$11\frac{7}{8}$"	30.2 cm.
Weight (standard EA12)	49 lb.	22.2 kg.
Weight (EA12/RM)	50 lb.	22.7 kg.

*The support strip when in use lifts the lower edge of the panel some $1\frac{3}{4}$" above the surface on which the receiver is placed.

†Excluding projections at rear of cabinet. An additional $2\frac{1}{2}$" (6.35 cm.) should be allowed for plugs, leads etc.

Cabinet.

Two types of cabinet are available for use with the EA12 receiver. These are the standard cabinet which is fitted to surface-mounted receivers and a modified cabinet for use when the receiver is to be rack-mounted. In the case of the latter form of mounting, specially shaped brackets are attached to the rear of the panel and these then allow the receiver to be mounted directly in a standard 19" rack. The fixing slots in the brackets conform to the Post Office standard for racks of this width.

The modified cabinet is identical to the standard one except that cut-outs are provided in the leading edges of the two vertical sides to afford clearance for the two rack-mounting brackets.

Either form of cabinet has extensive perforation to ensure adequate ventilation and has three apertures in the back to allow access to the pre-set controls, terminals, etc. mounted at the rear of the receiver chassis. Cabinets are stove enamelled and are fabricated from rust-proofed steel.

All standard receivers are supplied with a support strip which can be fitted to the underside of the cabinet to tilt the panel away from the operator and so give a more convenient operating position.

Front Panel.

The front panel is an aluminium diecasting and contributes great mechanical strength to the receiver as a whole. All controls with the exception of the CURSOR SHIFT and CALIBRATOR switch are located along the lower half of the panel and their functions are indicated on a clearly marked finger plate. Panel handles are fitted for convenience in lifting the receiver and for protection of the panel controls when it is placed in a face-down position as for example when removing the cabinet.

Chassis Assembly.

The various sections of the receiver are divided between three separate chassis, the largest of which is the one carrying the RF and tunable IF stages. This takes the form of a rugged aluminium diecasting and is mounted centrally behind the panel. It provides excellent screening and its rigidity ensures a high degree of mechanical stability in the VFO associated with the 2nd Mixer. A close fitting aluminium cover plate serves to screen the underside and the components on top of the chassis are protected by a "U" shaped cover. The Crystal Calibrator is a separate unit and is housed in a small diecast box which is located beneath this cover and on top of an inner cover which screens the 2nd Mixer Stage.

A heavy gauge steel chassis to the left of the central unit carries all the 2nd IF and AF circuitry with the exception of the CW/SSB Detector and its associated audio filter. These are located at the right-hand side of the receiver on a steel chassis which carries the power supply components. Strong steel end plates serve to support the IF/AF and Power Supply chassis which are also attached to the diecast RF unit. This in turn is mounted on four large lugs at the rear of the panel casting. The complete assembly is extremely strong and ensures the minimum possible chassis distortion when handling the receiver with the cabinet removed.

Dial and Drive Assembly.

The TUNING control drives a spring-loaded split-gear system which provides a reduction ratio of approximately 140-1 and incorporates a linearising arm to give a substantially straight-line frequency calibration. Cursor travel is some 10½ inches for complete coverage of each range and the tuning rate is of the order 12 kc/s per knob revolution. The tuning drive is flywheel-loaded, substantially free from backlash and ensures consistent re-setting accuracy. Scale correction when calibrating is by means of the CURSOR SHIFT control which permits limited lateral movement of the cursor independently of the TUNING control.

INSTALLATION

MOUNTING

Unless otherwise stipulated the EA12 receiver is supplied complete with a standard cabinet in a form suitable for surface-mounting only. A rack-mounting version is available (designated EA12/RM) and accessories can be supplied for converting existing standard receivers already in service. Part Nos. and full instructions for carrying out the conversion will be found on the following page.

All standard receivers are supplied with a support strip which can be attached to the underside of the cabinet to tilt the panel backwards to give a more convenient operating position. Screws for attaching the strip will be found in the carton. The support strip can be used as a control panel for associated equipment, sufficient height being available for fitting standard toggle switches, miniature potentiometers, pilot lights etc. If advantage is taken of this facility, it is suggested that all external control circuits are terminated in plugs to mate with suitable sockets mounted at the extreme end(s) of the strip. This will give a much neater layout and at the same time does not restrict removal of the receiver should this be required.

The rack-mounting version of the receiver is identical to the standard model except that the cabinet has cut-outs to clear two brackets which are attached to the extreme ends of the panel. A built-in loudspeaker is fitted as on the standard receiver but this may not be usable if the set is installed in an enclosed rack. Two terminals at the rear permit connection to a suitable speaker which could be mounted on an adjacent rack panel. In some rack-mounted installations it sometimes happens that the receiver must be mounted in close proximity to other equipment which is operating at elevated temperatures. In such cases it may be found advantageous to install the receiver minus its cabinet since this will considerably improve the ventilation.

Instructions for installing the EA12 receiver with a Panoramic Display Unit Model EP20 will be found in the Instruction Manual for the latter unit. An EA12 receiver when combined with the EP20 and associated accessories is designated the EPR28 Panoramic Display Installation. Abbreviated data on the EP20 will be found on page 39 and more detailed information is available on request.

Converting a Standard EA12 to EA12/RM.

1. Remove the existing cabinet (four large screws at the rear) and store for use in the event of the receiver being required as a surface-mounting unit at a later date.

2. Place the receiver on its left-hand side and remove the two screws that hold the right-hand panel handle (an 18" screwdriver will be required for this operation).

3. Remove the two spacing washers from between the spacing pillars and the panel (store with the cabinet).

4. Slide one of the two angled brackets behind the outside edge of the panel and re-fit the spacing pillars and handle fixing screws.

5. Turn the receiver up the other way and repeat the operations described above in fitting the angle bracket at the left-hand side of the panel.

6. Fit the replacement cabinet.

NB Part Nos. to be quoted when ordering rack-mounting cabinets and brackets are D3377/2 and 5912P respectively.

ACCESSORIES

The EA12 receiver is supplied complete with all valves and crystals together with the following accessories.

1. Mains connector with 6' lead.
2. Two standard B/L coaxial plugs.
3. Support strip. (with fixing screws).
4. Two spare fuses (rated at 1.5 Amps).

EXTERNAL CONNECTIONS

Mains.

One end of the mains lead is left free and should be wired to a plug of a type suitable for connection to the local mains supply. The lead is colour coded as follows:- Red : Live, Black : Neutral, Green : Earth.

The receiver leaves the factory with the Voltage Selector set in the 230V position which is suitable for operation from AC supplies in the range 220/250V. For other voltages the Selector must be set as follows:-

100/125V . . . . . 110V position. 200/220V . . . . . 200V position

The Voltage Selector is located on the side of the power transformer and is accessible through an aperture in the end plate after removal of the cabinet.

UNDER NO CIRCUMSTANCES SHOULD THE RECEIVER BE CONNECTED TO A DC MAINS SUPPLY.

Aerial.

The aerial input impedance is closely matched to 75Ω on all ranges and optimum performance will be obtained when the aerial system is matched to this impedance. If a valve T/R switch is used to feed the receiver it should be arranged to provide a low impedance output. Careful thought must be given to the choice of a suitable valve and circuit for use in the T/R switch. An excellent switch can be designed around the 6J6 double triode with the first section operated as a cathode follower and the second as a grounded-grid amplifier.

Earth.

A direct earth connection to a properly installed earth rod or plate will assist in reducing local noise pick-up especially on the 160 and 80 metre bands.

I.F. Output

Ancillary units requiring drive at 100 kc/s can be fed from this output which is available at a coaxial socket on the back of the set. Matching is not critical and the output can be terminated in any impedance in the range 75-300Ω. Maximum 6dB bandwidth is 6 kc/s and an output in excess of 100mV is available for a 2μV signal at the aerial input.

External Loudspeaker.

An external 2.5/3Ω loudspeaker can be connected in lieu of the internal unit. The external speaker should be connected to the 2.5Ω terminals at the rear which are normally wired directly to the internal unit. The internal speaker should be disconnected when using an external speaker and it should be noted that a matching transformer is not required. Suitable speaker units in the Eddystone range are detailed in Data Sheet D.S.123, a copy of which is available on request.

Telephones.

The circuit is arranged to give optimum results with telephones of 2,000Ω total impedance but will perform satisfactorily with all standard impedances. Insertion of the telephone plug automatically interrupts the speaker output (either internal or external). Matching telephones can be supplied to special order.

Mute, Relay and AGC Terminals.

These three terminals are wired in such a way that the EA12 receiver is compatible with almost any type of transmit/receive switching system. Control circuits of this kind differ considerably from one equipment to another but are usually arranged so that changeover from receive to transmit is effected by throwing a single switch. Advanced systems for "break-in" working using key or voice control do not fall into this category and will therefore be dealt with separately.

Single switch changeover systems can be divided into two separate types (1) direct control circuits and (2) relay control circuits. The former employ multi-section switches wired directly to the appropriate transmitter circuits but usually incorporate spare switch sections to control external aerial changeover relays and receiver muting circuits. In systems of this type connection can be made to the MUTE terminal on the receiver so that muting is controlled by the transmitter switch and not by the STANDBY switch. The transmitter switch must be arranged to earth the muting line in the "receive" condition, while the STANDBY switch must be left permanently at "STANDBY" or otherwise the line will be earthed continuously within the receiver so rendering the muting system inoperative.

The same arrangement can be used with relay control systems provided that a spare pair of relay contacts are available to perform the switching operation described above. Alternatively where it is not convenient to include an additional relay it may be possible to substitute a double-pole switch in place of the existing one used to control the relay circuit.

In some installations employing relay controlled changeover, it may be an added convenience to operate the relay circuit from the receiver STANDBY switch. This can be arranged quite easily by wiring the external circuit to the RELAY terminal at the rear of the set. The control line will be directly earthed when the switch is set to the "STANDBY" position. Receiver muting is controlled by the same switch so there is then no need to provide an external line to the MUTE terminal.

Control of the transmitter from the STANDBY switch is not possible in the case of direct control systems unless these are extremely simple and require completion of one circuit only in the transmit condition.

It should be noted that an earth return is required from the control circuit to the receiver when using the arrangements described on the previous page. In most installations this will already exist since it is usual practice from the point of view of safety to ground all units to a common earthing point. In this case however, it is recommended that a separate earth wire is installed between the external control unit and the receiver EARTH terminal to avoid the possibility of electric shock. This could be a danger in some installations where a common earth return is employed since a voltage could exist between the earth lead and the receiver chassis when the earth lead is disconnected. The additional earthing connection should be made with insulated wire, as a further safety precaution.

Changeover systems which are actuated by voice control or keying may employ a number of relays, a fully "electronic" system using valves, or a combination of both. The receiver STANDBY switch will not be used when such systems are employed but it is important to note that it must be left permanently in one position or the other depending on the muting arrangements provided by the external circuit.

In a relay control system, muting can be achieved in exactly the same way as previously described, i.e. wire a relay to short the MUTE terminal to earth when the external circuit is in the receive condition. The STANDBY switch in this case is left permanently in the "STANDBY" position.

Valve controlled changeover circuits are becoming increasingly popular and usually incorporate a DC Amplifier arrangement which develops a negative muting voltage for application to the AGC line of the receiver. An AGC terminal is provided on the EA12 receiver to facilitate connection to the external circuit. A voltage of the order 50V is sufficient to completely mute the receiver and it is usual to incorporate an external MUTING LEVEL control so that the applied voltage can be adjusted to suit the strength of the transmitted signal.

The AGC switch should be set to the "FAST" position when using this form of muting because the longer time constant in the "SLOW" position will tend to make the operation somewhat sluggish. The system cannot be used with AGC at "OFF" because in this position the AGC line is directly earthed within the receiver. The STANDBY switch can be used to provide independent muting but will normally be left in the "RECEIVE" position. RF and IF GAIN controls function normally when using AGC muting.

It must be appreciated that break-in systems (especially for CW working) require very careful design if smooth operation is to be obtained. A separate receiving aerial or an efficient valve T/R switch is most essential since conventional aerial changeover relays will not operate satisfactorily at the high speeds likely to be employed. Transmitter designs, keying systems, control circuits and muting arrangements vary so widely from one station to another that it is impossible to specify one particular layout as being superior to all the others. The reader is referred to the various amateur radio publications where a variety of arrangements will be found. It should be remembered however that a suitable design can only be arrived at after much practical experiment involving checks on all the bands for which the facility is required.

One other application of the AGC terminal is to permit the AGC lines of two EA12 receivers to be linked when operating in diversity. This form of operation is seldom encountered in the average amateur station but is widely used in the commercial radio field. Two (or more) receivers are operated from separate aerial systems and the advantage gained is greater freedom from fading on the received signal. AGC lines are linked so that the receiver taking the strongest signal will suppress the noise output from the other receiver(s). Audio outputs are combined in a suitable matching network and fed to a common loudspeaker or telephones.

OPERATION

CONTROL FUNCTIONS

Tuning.

This control tunes the input to the 2nd Mixer Stage and its associated local oscillator. The drive is through spring-loaded gears and is flywheel-loaded to permit rapid movement from one part of the dial to another. A mechanical linearising device is incorporated in the drive mechanism and this provides a sensibly constant tuning rate (of the order 12 kc/s per knob revolution) and substantially linear frequency scales on all ranges. The drive reduction ratio is approximately 140-1.

Wavechange.

Selects the appropriate inductors for the signal frequency circuits and also the corresponding crystal for the 1st Local Oscillator. Ranges are numbered 1-9, the numbering appearing at the left-hand end of the tuning scales. Band distribution is as follows:-

10M	Ranges 1-4.	40M	Range 7.
15M	Range 5.	80M	Range 8.
20M	Range 6.	160M	Range 9.

Peak RF Control.

The PEAK RF control functions in much the same way as the "Aerial Trimmer" found on other receivers but tunes all the signal frequency circuits and not just the aerial circuit alone. Thus, whereas one setting of the "Aerial Trimmer" will usually suffice for complete coverage of any one Amateur Band this is not so in the case of the PEAK RF control. Re-adjustment will be required for relatively small changes of frequency when using the 160M band, a shift of the order 20 or 30 kc/s giving a very marked change in signal level. On 80M some 40 or 50 kc/s of the band can be covered before re-tuning becomes necessary while on the HF bands re-adjustment is required when the receiver is tuned more than 100 kc/s from the frequency at which the control has been peaked.

The coverage of the PEAK RF control (except when using the 10M band) is a little more than the band of frequencies indicated by the dial calibration for the range in use. The control can be tuned over the whole 2 Mc/s of the 10M band when switched to any one of the four ranges which cover this allocation. This arrangement allows some simplification in the range switching for the 10M band but retains the relatively broad tuning characteristic found on the 15 and 20M bands.

A 2-1 reduction drive makes for ease of tuning on all ranges and the direction of knob rotation is the same as for the main TUNING control (i.e. clockwise for a decrease in frequency).

Mode Switch.

This control brings about the circuit changes required for each mode of reception. It has five positions as follows:-

"AM" - "CW" - "CW FILTER" - "SSB UPPER" - "SSB LOWER"

A conventional envelope detector is used for "AM" reception but in the "CW" and "SSB" positions this is switched out and a pentagrid product detector is brought into operation. Other functions performed by the MODE switch include modification of the audio response to suit the type of signal being received and reduction of the AGC delay to give improved AGC performance in the "SSB" mode. The range of adjustment provided by the BFO PITCH control is also changed when moving from "CW" to "SSB" and reference should be made to the appropriate paragraphs devoted to the function of this control.

AGC/NL Switch.

The AGC/NL switch combines the functions of AGC and NL switching in one control, the circuit being arranged so that the AGC can be in operation with the NL either "ON" or "OFF". The switching does not provide for the NL to be used with AGC "OFF" but this condition can be achieved by operating the receiver below the AGC threshold (low setting of RF/IF gain) with the AGC "ON".

Two AGC time constants are provided, AGC "FAST" (0.15 sec.) and AGC "SLOW" (4.5 sec.). the latter position being very suitable for both CW and SSB reception. The "S" meter is operative with AGC at "FAST" or "SLOW" and can therefore be used to indicate carrier level in all three modes. The meter is taken out of circuit when the AGC is switched to "OFF".

The receiver employs two separate noise limiter circuits, one for AM and the other for CW/SSB. On/off switching is performed by separate sections of the AGC/NL switch, the circuit being arranged so that the correct limiter becomes operative when the switch is set to either "ON" position. Selection of the correct limiter is a function of the MODE switch.

Selectivity Control.

Selectivity is varied by physical movement of the coils in the 100 kc/s IF transformers. The control provides continuous adjustment with positive selection of the 3 kc/s bandwidth for "SSB" reception and the most selective "CW" bandwidth (1.3 kc/s). The SELECTIVITY control also serves as the crystal filter switch, the filter coming into circuit when the knob is set to "N" ("Narrow"). Bandwidth in this position is of the order 50 c/s at the 6dB points with a symmetrical response.

The MODE switch can be set to the "CW FILTER" position to provide a degree of selectivity intermediate between that which obtains at the most selective "CW" setting of the SELECTIVITY control and that with the crystal filter in circuit. The latter control should be at "CW" when using the "CW FILTER" position which provides a 6dB bandwidth of the order 300 c/s. It is recommended that use is made of the "CW FILTER" facility when it is necessary to increase selectivity beyond that which obtains in the "CW" position of the SELECTIVITY control since moving directly to the crystal filter may result in complete loss of the signal unless the receiver is very accurately tuned. Once the signal has been carefully tuned in the "AF FILTER" position, and a further increase in selectivity is found necessary, this can be achieved by moving the SELECTIVITY control to "N".

Slot Filter Control.

Interference from adjacent signals which lie within the IF passband can be reduced by adjusting the SLOT FILTER control to tune the filter to coincide with the interfering frequency. The tunable slot provided by this filter will be found to be fairly sharp and careful adjustment is required to produce optimum results. Slot depth is of the order 40dB and a little practice will rapidly develop the "touch" required for precise handling of this control.

The slot filter can be used at any setting of the SELECTIVITY control and in this respect is considerable more flexible than the tunable notch provided by the phasing control associated with a crystal filter. (On this receiver the crystal phasing is pre-set to give a symmetrical IF response when the crystal filter is switched into circuit.) The slot facility will be found equally useful in all modes of reception and when taking "SSB" signals it can be used to steepen the carrier side of the passband when not required for actual interference suppression. More precise adjustment of the carrier insertion frequency will be required when using the filter in this manner which will tend to give a rather more faithful reproduction of the speech modulation. One further application of the slot filter is for notching out the carrier of an "AM" signal which can then be taken as a normal "SSB" transmission. This often reduces phase distortion etc. and is known as "exhalted carrier" reception.

When using the slot filter for interference suppression it is most important to appreciate that adjusting the TUNING control will shift the position of the interfering signal relative to the IF response and may therefore call for re-adjustment of the SLOT FILTER control.

All normal tuning should be carried out with the SLOT FILTER control set to the "OFF" position to avoid possible confusion resulting from the notch which otherwise exists within the IF passband. Setting the control to "OFF" places the rejection notch on the extreme edge of the widest achievable passband (i.e. that which obtains with the SELECTIVITY control in the "AM" position).

The slight forward and backward motion of the control knob when adjusting the slot frequency is quite normal since the control operates a ferrite core through a micrometer threaded drive arrangement.

Gain Controls.

Independent RF, IF and AF controls are provided to facilitate adjustment of the overall gain to suit all conditions of reception. The RF and IF controls are operated by concentric knobs, the outer one (with red index) being the RF GAIN.

Standby Switch.

Moving this switch to the "STANDBY" position (dolly up) increases the bias on the RF and 1st IF Amplifiers to reduce the overall sensitivity so that overloading does not occur when an associated transmitter is in operation. The level to which the sensitivity is reduced can be adjusted by means of the pre-set MUTING LEVEL control at the rear of the receiver. Its range of adjustment is sufficient to allow comfortable monitoring of any "CW", "AM" or "SSB" transmission.

The circuit arrangements are such that the RF Stage will always be biased off before the IF Stage and this prevents overload of the two Mixer Stages and the signal distortion which often results when this occurs.

The STANDBY switch can be used to control an external relay circuit associated with the transmit/receive changeover arrangements employed in the station. Details will be found on page 14 which also explains how the standby switching can be controlled from an external circuit.

BFO Pitch Control.

This control provides normal pitch adjustment in "CW" reception (total swing of ± 3.5 kc/s) and gives fine control of the carrier insertion frequency when taking "SSB" signals.

In the latter mode, the oscillator is pre-tuned to within 100 c/s of the required insertion frequency by switching a close tolerance fixed capacitor across the oscillator circuit. At the same time the range of adjustment provided by the BFO PITCH control is reduced to ± 100 c/s to facilitate precise adjustment to the exact frequency. In normal operation it will be found unnecessary to adjust the control which can be left at the mid-travel setting. The control will however be found extremely useful when taking "SSB" signals with the SELECTIVITY set to "CW" to provide greater rejection of adjacent channel signals. In this case the slope of the IF response is much steeper and the exact setting of the insertion frequency becomes of greater importance. The same applies when using the slot filter to steepen the carrier side of the passband as suggested earlier. Ease of adjustment when using the control in this mode is assured by the 5-1 reduction drive. It must be appreciated that some deterioration of the speech quality will occur when using greater selectivity than that provided at the "SSB" setting of the SELECTIVITY control.

It is necessary to re-tune the receiver slightly when sidebands are switched at the transmitter or a check is to be made on the level of a stations unwanted sideband. Moving the MODE switch to the opposite sideband setting merely ensures that the carrier insertion oscillator lies on the correct side of the IF passband for the sideband to be received. The receiver must be tuned to cause the required sideband to fall within the passband.

Calibrator Switch.

This is the push-button switch which is located above the dial aperture at the left-hand side of the receiver. Pressing the button brings the Crystal Calibrator into operation and at the same time reduces the gain of the RF Amplifier to limit interference from outside signals.

Crystal check-points occur at 100 kc/s intervals and provide a means of checking the scale accuracy of the variable oscillator in the 2nd Mixer Stage. Harmonics of the 100 kc/s crystal are introduced after the 1st Mixer Stage (i.e. at the tunable IF) and the fundamental crystal frequency is fed into the 2nd IF. Thus it is not necessary to have the BFO in operation when carrying out a calibration check since the crystal harmonics will beat with the fundamental crystal frequency.

When calibrating on the low frequency bands, harmonics of the calibrator crystal may be sufficiently strong to leak into the 1st Mixer Stage of the receiver. If this occurs a very low pitched beat may be heard in the background when tuned to a crystal check frequency. The pitch of the beat will remain constant as the tuning is altered slightly above and below the calibration point. This effect should give no cause for concern since the beat which is heard merely indicates a very slight inaccuracy in the frequency of the 1st Oscillator crystal. The error which this introduces will be less than 500 c/s and is therefore well within the specified accuracy of the receiver. On a typical receiver errors of 80 c/s, 140 c/s and 120 c/s were noted on the three low frequency bands.

Cursor Shift.

This control provides lateral movement of the cursor independently of the TUNING control so that scale error can be corrected when checked against the crystal markers. The control is located above the dial aperture on the opposite side to the CALIBRATOR switch. Receiver drift is held within very close limits and frequent scale checking will be found entirely unnecessary. Further, since the calibration markers are introduced at the 1st IF, checking the accuracy on one band automatically corrects all other bands at the same time.

Mains Switch.

Normal supply switch which breaks both live and neutral lines to the receiver when set to the "OFF" position.

Pre-Set Controls.

Three pre-set controls are fitted, two at the rear of the receiver and one on the IF chassis. This latter control is the threshold adjustment associated with the CW/SSB Noise Clipper (marked NL ADJ) and is set during initial factory tests. The two remaining controls are the MUTING LEVEL potentiometer and the METER ZERO potentiometer.

Muting Level.

Provides independent adjustment of the RF and IF gain when the receiver is muted during transmission. The control is fitted with a small knob for ease of adjustment and can be set to suit the power output and proximity of the associated transmitter so that comfortable monitoring is available on CW, AM or SSB.

Meter Zero.

The METER ZERO control forms one leg of the bridge circuit in which the "S" meter is connected. It is adjusted under "no-signal" conditions to balance the bridge circuit and so establish the zero of the "S" meter calibration. A slot is provided in the control spindle to permit adjustment with a small screwdriver and the setting will hold good over a long period of operation.

NL Adj.

Adjustment of this control calls for removal of the receiver cabinet. It is most unlikely that the initial factory setting will need to be changed but the user will no doubt wish to manipulate the control to determine the effect which it has on the operation of the circuit. Advancing the control will increase the effectiveness of the clipping but will, if carried too far introduce excessive distortion giving poor quality on "SSB" reception. On "CW" there will be a tendency for the characters to run together due to the square shaping of the keying envelope.

The NL ADJ control has no effect on the AM Noise Limiter which is an entirely separate circuit and is carrier controlled.

CALIBRATION CHECK

Scale checking is carried out with the MODE switch in the "AM" position. The RF and IF GAINS can be left at their normal operational settings and the procedure to be employed is as follows:-

1. Press the CALIBRATOR switch and tune in the appropriate crystal marker by using the TUNING control. (Markers appear at 100 kc/s intervals, i.e. 1.8 Mc/s, 1.9 Mc/s etc.)
2. Adjust the TUNING control until the marker signal is at zero-beat.
3. Leave the TUNING control at this setting and rotate the CURSOR SHIFT control to position the cursor coincident with the appropriate calibration mark on the scale.
4. Release the CALIBRATOR switch and tune to the required channel.

METER ZERO ADJUSTMENT

Before using the "S" meter for signal reporting, it is first necessary to ensure that the meter needle lies on the "O" mark with the aerial disconnected and the input socket terminated with a non-inductive 75Ω resistor. The AGC must be "ON" when checking this adjustment because the meter is disconnected when AGC is not in use. Proceed as follows:-

1. Disconnect the aerial feeder and terminate the aerial socket with a 75Ω resistor.
2. Check that the AGC is "ON" (either position) and that the RF and IF GAINS are set to maximum.
3. Select the mid-frequency of any range, set the PEAK RF control to give maximum noise and then adjust the METER ZERO control at the rear so that the meter needle lies on the "O" mark at the left-hand end of the scale.
4. Remove the 75Ω resistor, reconnect the aerial feeder and tune the receiver to the required working frequency.

NB Each "S" point on the meter scale is equal to an approximate change of 6dB in the strength of the received carrier. "S1" corresponds to an input of the order 2μV at the aerial socket and above "S9" the meter is calibrated directly in dB. This calibration only applies with the RF and IF GAINS at maximum; at other settings the meter provides a relative indication only.

M A I N T E N A N C E

GENERAL

The EA12 receiver is suitable for continuous use under arduous operating conditions and should require very little in the way of routine maintenance over quite long periods of operation in normal Amateur service. All components (with the exception of valves and semiconductors) are guaranteed by the Manufacturer for a period of one year from the date of purchase, while the excluded items are covered by a separate guarantee.

As with all Eddystone receivers, the EA12 can be returned to the Manufacturer at any time should major servicing become necessary. The receiver can be sent direct or via one of the many Eddystone Agents, the latter course often being the most convenient since the Agent will usually have a suitable packing case in which to despatch it. If there is no Eddystone Agent in your area and it is therefore necessary to send direct to the Manufacturer, prior arrangements should be made before despatch. It is most important to see that the receiver is well protected against damage during transit and the reader is referred to the Guarantee card for further information on this point.

Receivers returned for servicing are carefully inspected on receipt and if required an assessment of the probable charges will be submitted before any work is undertaken. Charges are very reasonable and every endeavour is made to return the set with the minimum delay. Spares for user-servicing can be supplied at very competetive prices and helpful advice will be freely given where necessary.

Consideration should be given to the advantages gained by returnung the receiver to the Manufacturer after it has been in service for some 3-5 years even though there may be no apparant fault. It frequently occurs that a gradual falling-off in performance passes unnoticed in day to day use but becomes immediately obvious when the receiver is subjected to a series of standard checks carried out by a trained technician with a wide knowledge of this and other similar receivers.

Any enquiries relating to servicing should be directed to the "Sales and Service Department" at our usual address.

The following paragrapgs are devoted to minor servicing and will be found useful if it is necessary to replace valves, dial bulbs etc. Periodic cleaning of the receiver should be carried out as a matter of course, care being taken to avoid displacing preset components when cleaning the interior. Full instructions for carrying out realignment will be found later in this Section.

Lubrication.

The gear drives and other mechanical arrangements will not normally require attention since these are treated with a permanent lubricant during initial assembly. If additional lubrication should be thought necessary after the receiver has been in use for a prolonged period of time, this can be carried out with a light mineral oil suited to the temerature conditions under which the equipment is operating. Care should be taken to use only the smallest amount of oil and to avoid at all costs getting oil on the stainless steel drive disc which forms part of the main tuning mechanism.

Replacing a faulty fuse.

A single fuse is fitted on the EA12 receiver and is wired in series with the live side of the mains input to the power transformer. The fuseholder is located at the rear of the set and is accessible without the need for removal of the receiver cabinet. A standard 1¼" cartridge fuse rated at 1.5 Amps should be used as a replacement in the event of failure and appropriate checks should be made if the replacement fails immediately or after a short period of operation.

Changing Valves.

All valves employed in the EA12 receiver are standard "CV" types and no difficulty should be experienced in obtaining replacements. Direct equivalents can be used where these are already available and any valve can be changed without necessitating re-alignment of its related circuits.

Access to V1, V2, V5 and V13 calls for removal of the outer cover over the RF chassis while V3 and V4 will be found inside the inner cover which also houses the nine 1st Oscillator crystals and the 1st IF tuning gang. All other valves are immediately accessible after removal of the cabinet.

Replacing a faulty dial bulb.

The three dial bulbs are standard bayonet types with a rating of 6.5V @ 0.3A. To change a bulb it is necessary to first remove its holder from the support strip at the rear of the scale plate. The holders are a spring fit in suitably shaped cut-outs and are withdrawn by squeezing together and pulling away from the panel. Always check on the possibility of poor contact in the holder before disposing of the suspected bulb.

Cleaning the scale and scale window.

Provision is made for removing the glass window to allow it to be cleaned and also for ease of access to the scale should cleaning be required. The window can be cleaned with one of the many domestic products available for this purpose, care being taken to avoid finger marking the inner side of the glass when replacing it. A soft lint-free cloth slightly moistened in warm water will be found ideal for cleaning the scale. All traces of moisture should be removed before replacing the glass. The procedure to be adopted in removing the glass window is as follows:-

1. Locate the two captive screws which retain the small shaped castings at the extreme ends of the dial aperture. These screws have elongated heads and are accessible through small cut-outs in the side-plates. A 4BA spanner is required and the screws should be turned in an anti-clockwise direction to free the side castings from the main panel assembly.
2. Set the cursor to the centre of the window, i.e. immediately below the middle of the EDDYSTONE badge.
3. Free the CALIBRATOR switch from the panel by removing its panel nut.
4. Slacken the four contersunk 6BA screws along the top edge of the panel and slide the glass retaining strip towards the rear of the set.
5. The glass is now free and can be removed by lifting the bottom edge clear of the lip on the panel casting.
6. Reverse the procedure detailed above when replacing the glass after cleaning.

Instructions for fittings a replacement cursor drive wire.

In the unlikely event of the drive wire either breaking or slipping out of the pulley grooves and therefore becoming damaged by contact with the gearing, replacement will be much simplified if the new wire is made slightly longer than the actual length required. This is approximately 4' (122cm.) and a length of say 4' 6" (137cm.) will be found just about ideal from the point of ease of handling. The surplus wire is cut off on completion of the job. Fitting a new wire is quite straightforward and will present no difficulties if the instructions given below are followed carefully step by step. It should be noted that in these instructions, left-hand and right-hand are as viewed from the rear of the set.

1. Remove the old wire by slackening the 8BA screws in the two drive pulleys and un-soldering from the cursor carrier.

2. Set the CURSOR SHIFT control to its fully clockwise position. This corresponds to maximum movement of the cursor towards the high frequency end of the scale and the SHIFT control should be left at this setting until completion of (10) below.

3. Rotate the TUNING control in an anti-clockwise direction to the full limit of its travel.

4. Attach one end of the new wire to the 8BA screw in the left-hand drive pulley. The screw should lie at approximately "2 o'clock" with the TUNING control set as in (3) above.

5. Feed the wire through the pulley slot and into the groove nearest to the panel so that it leaves the pulley from right to left. Do not attempt to wind the wire round the pulley at this stage.

6. Pass the wire under the cursor shift pulley and then up and over the guide pulley which is immediately above it.

7. Lay the wire across the dial between the cursor guide rods (passing <u>under</u> the cursor carrier) and while holding the free end in tension, rotate the TUNING control in a clockwise direction to the full limit of its travel so that approximately three complete turns of wire are wound onto the left-hand drive pulley.

8. Pass the wire over the spring-loaded jockey pulley at the right-hand side of the scale and then across towards the right-hand drive pulley on the main drive unit. Tension must be maintained to prevent the wire from slipping out of the various pulley grooves.

9. Lay the wire in the second groove from the edge of the right-hand drive pulley which is furthest from the panel. Feed the wire along the groove and through the pulley slot. The slot should lie at approximately "10 o'clock" with the TUNING control set as in (7) above.

10. Apply sufficient tension to the free end of the wire to cause the jockey pulley to take up a position roughly 3/16" away from the cursor guide rod support bracket. Maintain this tension and secure the free end of the wire to the 8BA screw in the right-hand drive pulley. Cut off any surplus wire.

11. Operate the CURSOR SHIFT control and check for free movement of the jockey pulley.

12. Set the CURSOR SHIFT to its fully anti-clockwise position.

13. Slide the cursor to the low frequency end of the scale and position it so that the red line lies coincident with the extreme ends of the horizontal scale lines. Solder the cursor carrier to the drive wire at this setting.

14. Check the drive for free and normal operation and rotate the CURSOR SHIFT to verify that it provides the required amount of independent cursor movement (approximately 1/4").

15. Check the scale accuracy by reference to the built-in crystal calibrator.

<u>Removing the cabinet.</u>

First place the receiver in a face-down position resting on its handles and remove the retaining screws located in the four corners of the cabinet. Place the palms of the hands flat against the two long sides of the cabinet with the fingers pointing upwards and apply simultaneous inward and upward pressure to pull the cabinet away from the rear edge of the panel. If slightly greater pressure is required to free the cabinet this can usually be achieved by striking a glancing blow with the palm of one hand while steadying the opposite side of the cabinet with the other. Failing this, leverage can be applied by using a screwdriver in the two slots provided in the leading edge of the underside of the cabinet.

RE-ALIGNMENT

General.

The initial factory alignment of the receiver will hold good for a long period of time and re-alignment should only be carried out if there is a clear indication that such adjustment is in fact required. Adjustments should be made only by individuals with a sound knowledge of the procedures involved and an adequate range of reliable test equipment must be available if the task is to be completed satisfactorily.

Comprehensive instructions covering all phases of the alignment procedure are given here for the sake of completeness but in most cases it will only be found necessary to re-adjust one or possibly two circuits to compensate for normal component ageing or replacement. The relevant instructions can be extracted as required and it should be noted that all dust cores are self-locking (rubber string and silicone core retaining compound) so that there is no need to use wax etc. to lock them after adjustment. The trimming capacitors likewise are self-locking types.

Re-alignment of the 100 kc/s IF Amplifiers and Crystal Filter.

Test Equipment

Standard Signal Generator covering the IF of 100 kc/s. Output impedance in the range 10-75Ω and with provision for modulation at 400 c/s (30%).

Valve Voltmeter (f.s.d. 1V).

Output Meter matched to 2.5/3Ω.

Trimming Tools. (1) Insulated screwdriver.
(2) Small tommy bar (5/64" diameter).

Switch on the receiver, signal generator and valve voltmeter and allow half an hour to reach operating temperature. Set the receiver controls as follows:-

SELECTIVITY	..	"N" (Crystal).	AGC/NL SWITCH	..	"OFF".
MODE SWITCH	..	"AM".	SLOT FILTER	..	"OFF".
IF GAIN	..	Maximum.	STANDBY SWITCH	..	"ON" (i.e. dolly down).

Remove the two covers from the RF chassis and connect the output lead from the signal generator to the stator of C48 (middle section of tunable IF gang). The valve voltmeter should be connected direct to the IF Output socket (SKT2) without a terminating resistor. (If a valve voltmeter is not available, it is possible to use the "S" meter but the indication obtained will be somewhat inferior. The AGC/NL switch must be set to "AGC FAST" if this approach is employed.)

When the equipment has reached operating temperature, set the signal generator (with unmodulated output) to approximately 100 kc/s and tune slowly across the IF passband. A sharp rise in output will be observed when the generator frequency coincides with that of the filter crystal and the tuning should be adjusted very carefully to this peak. Adjust the attenuator to give an output reading of the order 500mV on the valve voltmeter or a reading of approximately "S5" if the "S" meter is used.

Now proceed to trim the cores in T1, T2, T3 and T4. The top cores (T1, T3 and T4) tune the primary windings of these transformers and all cores are set to their "outer" peak, i.e. the one that occurs when the core is furthest from the opposite coil. The generator output should be reduced as necessary to keep the output reading below 500mV throughout the alignment.

Once the transformers have been accurately aligned to the centre-frequency, check on the symmetry of the response by increasing the generator output and de-tuning it by equal amounts above and below the peak setting. Any loss of symmetry is likely to be slight and it is doubtful whether the rejection notch due to the crystal would be visible. If the response is assymmetrical correction can easily be obtained by slight re-adjustment of the pre-set crystal phasing capacitor C73. This is accessible on the side of T2 nearest to the central RF Section and can be adjusted with a small tommy bar slipped into one of the holes in the spindle extension that protrudes from the side of the can.

In making the adjustment, the initial setting of C73 should be changed slightly first in one direction and then in the other to determine which gives an improvement in the response. Once the direction is known, C73 should be adjusted by small increments until a symmetrical response is obtained. Care should be taken not to over-correct since this will result in the response becoming tilted in the opposite direction and if carried far enough will re-introduce the rejection notch due to the crystal.

On completion of these adjustments, set the SELECTIVITY control to "AM" and tune the generator slowly through the IF passband to determine whether the nose of the response is reasonably flat. If it should be found to be a little assymmetrical, re-adjust T2 slightly to give a flatter response. The change in core position to achieve this will be very small and will not affect the response in the other selectivity positions.

This completes alignment of the 100 kc/s Amplifiers and it is convenient at this stage to make a check on the 2nd IF sensitivity. The generator should be connected as before (i.e. to stator of C48) but with its output modulated to a depth of 30% at 400 c/s. The SELECTIVITY control should be moved to "CW", the AF Gain set to maximum and the output meter connected in place of the internal loudspeaker. Tune the generator for maximum reading on the output meter and then adjust the output to 50mW by means of the attenuator. A sensitivity of the order 4-5µV indicates normal operation of the Amplifier and the following stages.

If the sensitivity is lower than this figure, stage by stage checks can be made with the generator applied directly to the grid of each IF Stage in turn. The grid connection in each case is pin 1 and the following approximate sensitivities can be expected with the SELECTIVITY control at "CW."

Generator applied at grid of V6	.. ..	90µV for 50mW output.
Generator applied at grid of V7	.. ..	7mV for 50mW output.

The audio sensitivity should be checked if it is found that the IF sensitivity is low when measured from the grid of V7. This test should be carried out with a 1,000 c/s signal, the generator being connected directly across the AF GAIN control. An input of the order 30mV should give an output of 50mW.

<u>Checking adjustment of the Slot Filter.</u>

The SLOT FILTER control provides a rejection notch which is tunable over the whole IF passband at any setting of the SELECTIVITY control. Its control knob carries a stop to prevent it from being turned through more than one revolution and the index is set so that the 12 o'clock position corresponds with the slot filter being tuned to the exact centre of the IF passband. A small ferrite core is used to tune the filter.

Two independent adjustments are provided for setting the ferrite core in the right position relative to the control knob setting. One of these adjustments is employed only during initial alignment. With normal use it should not require any further adjustment and is therefore securely locked before the receiver leaves the factory.

If during subsequent use the control knob is removed (as for example when cleaning the finger plate), it is most important to ensure that it is replaced correctly. The other adjustment is used for this purpose and the procedure to be employed is detailed on the following page.

1. Set the SELECTIVITY control to "N" and introduce an unmodulated 100 kc/s signal as in IF alignment, tuning the generator to the crystal peak. Output indication can be with either a valve voltmeter, the receiver "S" meter or an audio output meter wired across the loudspeaker terminals. In the case of the latter, the MODE switch must be set to the "CW" position with the BFO adjusted to give a suitable beat.

2. Rotate the SLOT FILTER control spindle very slowly until a null is obtained in the output reading. This indicates that the slot is set to the centre of the IF pass-band and the knob should now be replaced with its index in the 12 o'clock position. Take care not to upset the setting of the control spindle when fitting the knob, securely tighten the grub screw and then check that the stop is operative with both clockwise and anti-clockwise rotation of the control.

3. Change the SELECTIVITY control to the "AM" position, check that the slot can be tuned to any frequency within the IF passband and that it lies slightly more than 3 kc/s from the centre frequency when set to "OFF".

Re-alignment of the BFO.

1. Check that the index on the skirt of the BFO PITCH control is set correctly in relation to the panel marking.

2. Introduce an unmodulated 100 kc/s signal as during IF alignment, set the SELECTIVITY control to "N" and then tune the generator to the crystal peak. The "S" meter can be used to give an indication of the correct tuning point.

3. Alter the SELECTIVITY to "SSB" and set the BFO PITCH control to mid-travel (i.e. the index on the skirt should lie in the 12 o'clock position). Select "SSB UPPER" and "SSB LOWER" and compare the pitch of the beat note obtained in each position. The beats should be identical, but if not, L28 should be adjusted slightly and the check then repeated again. Repeat the adjustment of L28 as required until identical beats are obtained.

4. Select each "SSB" position in turn and check that the BFO PITCH control provides a swing of the order ± 100 c/s. The generator can be de-tuned to zero-beat to simplify this check but must be re-set to the crystal peak before proceeding.

5. Re-set the BFO PITCH control to mid-travel and then select the "CW" position on the MODE switch. This should give the zero-beat condition and the complete tuning swing should now be checked to ensure that the tuning rates on either side of zero-beat are substantially the same. The "CW FILTER" position can be used to provide two easily identifiable "markers" of approximately 800 c/s.

6. If zero-beat is not obtained in (5) above, it is necessary to make a slight change in the setting of the split vanes on the pitch capacitor since further adjustment of the core in L28 will upset the adjustments already made in the two "SSB" positions. It is unlikely that this course of action will be required since the capacitor vanes have been set very accurately during initial factory alignment, not only to produce zero-beat at the mid-travel position but also to ensure a balanced tuning rate on either side of this setting.

Re-alignment of the Tunable IF Section.

Test Equipment: Standard Signal Generator covering the range 1.1-1.7 Mc/s with provision for modulation at 400 c/s (30%) and with an output impedance of 10-75Ω.

Crystal controlled harmonic generator providing 100 kc/s and 10 kc/s markers throughout the range 1.1-1.7 Mc/s.

Output Meter matched to 2.5/3Ω.

Trimming Tools:- (1) Insulated screwdriver. (2) Mullard TCT01. (3) Mullard DT2047 (for adjustment of Vinkors).

This phase of the alignment procedure can be subdivided into two distinctly separate operations namely (1) Re-alignment of the 2nd Local Oscillator and (2) Re-alignment of the bandpass coupling circuit between the 1st and 2nd Mixer Stages.

NB In the unlikely event of the main tuning gang having to be removed for any reason, take out the three screws which secure it to the rear of the "U" shaped bracket. Avoid removing the two screws with which the bracket is attached to the drive plate. These are fitted through elongated holes to allow accurate positioning of the gang (height) during initial alignment. If the initial setting is disturbed, it will be necessary to re-set the gang position before commencing alignment. The correct setting obtains when the centre-to-centre spacing of the two spindles is equal to 3/32" with the gang spindle above the drive spindle.

Re-alignment of the 2nd Local Oscillator.

The overall scale accuracy of the receiver is dependent on correct alignment of the 2nd Local Oscillator and the circuit has therefore been built around high stability close tolerance components. Temperature compensation is included as a standard feature and the oscillator is capable of extremely good long-term stability. It follows that any re-alignment which may be required will be of a very minor nature and a check should be carried out to determine whether re-alignment is in fact necessary before any attempt is made to alter the existing settings in the oscillator circuit.

First set up the receiver for normal "CW" reception with the BFO PITCH control at the mid-travel position. Connect the output lead from the harmonic generator to the stator of C34 (1st Mixer section of "Peak RF" gang) and arrange the instrument to provide 100 kc/s markers. If a continuous beat is heard at all settings of the TUNING control this is due to the fundamental of the generator (100 kc/s) feeding through to the 2nd IF Stages. In this case the receiver BFO is not required and the MODE switch can be set to "AM".

Rotate the CURSOR SHIFT to its mid-travel setting and tune across the scale with the main TUNING control, noting the accuracy of each 100 kc/s point (use zero-beat as an indication of correct tuning). If the amount of error is found to be well within the range of the CURSOR SHIFT and is also sensibly constant and of the same sign (i.e. always high or always low), re-alignment will not be required. Assuming this to be the case, next standardise the scale at the centre of the tuning range and check the accuracy of the intermediate points by feeding 10 kc/s markers from the generator. In most cases where the calibration has been found sensibly correct at the 100 kc/s points the 10 kc/s points will also be correct because the intermediate calibration is set during initial alignment by adjusting the split vanes on the capacitor.

Re-alignment should only be attempted if excessive errors are noted when carrying out the check detailed above. Normal tracking procedure is employed in correcting the scale accuracy (i.e. the oscillator trimmer is adjusted at the high frequency end of the oscillator range and the core at the low frequency end). It must be remembered that the 2nd Oscillator tunes in the opposite direction to the signal frequency calibration on the main tuning scales. Thus when using the scale for reference when making adjustments the trimmer must be adjusted at the low frequency end and the core at the high frequency end. The actual frequencies employed (using Range 9 for reference) are 2.4 Mc/s (core) and 1.9 Mc/s (trimmer). These frequencies correspond to 1st intermediate frequencies of 1.1 Mc/s and 1.6 Mc/s respectively. The CURSOR SHIFT control must be set to its mid-travel position and left at this setting throughout the complete alignment procedure. It is also important that the cover over the tuning gang and the cover plate on the underside of the RF chassis are in position while the adjustments are carried out.

Commence alignment by tuning to the 1.9 Mc/s calibration mark and tune in the 100 kc/s marker which corresponds to 1.6 Mc/s by adjusting the oscillator trimmer (C61). This is reached through a trimming aperture in the gang cover and should be adjusted for zero-beat.

The oscillator core (L26) must now be adjusted for zero beat with the TUNING set to 2.4 mc/s (corresponding to a 1st IF of 1.1 Mc/s). Repeat the two adjustments alternately until the scale calibration is correct at both frequencies and then check the accuracy of the intermediate 100 kc/s points. If these are in error it will be necessary to alter the setting of the split vanes on the oscillator section of the tuning gang to effect the required correction. This form of adjustment tends to be somewhat tedious and any desire to hurry the procedure should be suppressed or otherwise the error may be increased rather than eliminated.

Once the 100 kc/s points have been checked and corrected as necessary, change to 10 kc/s markers and check the intermediate points. Vane adjustments should be made as before but greater care will be necessary if satisfactory results are to be obtained.

Re-alignment of the 1st IF Bandpass Circuit.

Connect the output lead from the signal generator to the stator of C34 (1st Mixer section of "Peak RF" gang), wire the output meter to the 2.5Ω terminals at the rear and set the receiver controls as follows:-

MODE SWITCH	..	"AM".	AGC/NL SWITCH	..	"OFF".
SELECTIVITY	..	"CW".	SLOT FILTER	..	"OFF"
IF GAIN	..	Maximum.	STANDBY SWITCH	..	"ON" (i.e. dolly down).
AF GAIN	..	Maximum.			

Tune the generator (modulated 30% at 400 c/s) to 1.7 Mc/s and set the receiver TUNING control to 1.8 Mc/s. Note that in this case also the IF tuning is in the opposite direction to the signal frequency calibration and that a dial setting of 1.8 Mc/s coincides with a 1st intermediate frequency of 1.7 Mc/s. Adjust C42 and C46 for maximum output as indicated on the meter. Re-tune the generator to 1.1 Mc/s and the receiver dial to 2.4 Mc/s. Adjust the two "Vinkor" inductors L19 and L20 for maximum output, making sure that a non-magnetic trimming tool is employed (Mullard DT2047).

Repeat the adjustments alternately until no further increase in output can be obtained at either frequency and then compare the sensitivity at both ends of the scale. 50mW output should be obtained with an input of the order 1μV but it will probably be best to work at a level of 5 or 6μV to prevent possible confusion with the noise level. Once a suitable level has been determined at the two "end" frequencies, check that the sensitivity is substantially the same at 50 kc/s intervals across the whole of the dial. If any marked variation in sensitivity is noted this can be levelled out by adjusting the split vanes in the two sections of the tuning gang C40 and C48.

Re-alignment of the RF Circuits.

Test Equipment: Standard Signal Generator covering the range 1.8 - 30 Mc/s with provision for modulation at 400 c/s (30%) and with an output impedance matched accurately to 75Ω.

Output Meter matched to 2.5/3Ω.

Neosid H.S.1 trimming tool.

Connect the output lead from the generator to the aerial input socket, the output meter to the 2.5Ω terminals at the rear and set the receiver controls as for alignment of the 1st IF Bandpass Circuit (see Section above) but with the RF GAIN control at maximum.

Set the PEAK RF control so that its index lies at 10 o'clock and the main TUNING control to the centre 100 kc/s calibration mark on the tuning scale. These settings must be maintained throughout the alignment procedure which is detailed on the following page.

Select Ranges 9, 8, 7, 6, 5 and 2 ~~in that order and peak~~ the cores in the appropriate coils with the generator (modulated 30% at 400 c/s) tuned to the frequencies indicated in the Table below. The top core in each bandpass transformer and all the cores in the mixer coils should be adjusted on their "outer" peak (i.e. the one which occurs with the core nearest to the trimming aperture. The primary cores in the bandpass transformers are adjusted by passing the trimming tool through the upper core and are set to the second peak from the bottom end of the former (i.e. the chassis end). It is suggested that to avoid the possibility of tuning to the wrong peak (three separate tuning points will be found on some ranges) the core is first set to the extreme end of the former and then brought upwards again to allow the peaks to be counted. It is most important that the core is not set to the wrong peak since this will upset the performance of the bandpass circuit.

Range	Generator Frequency	Bandpass Primary	Bandpass Secondary	1st Mixer
9	2.1 Mc/s	Lower core of L7	Upper core of L7	L13
8	3.7 Mc/s	Lower core of L8	Upper core of L8	L14
7	7.2 Mc/s	Lower core of L9	Upper core of L9	L15
6	14.2 Mc/s	Lower core of L10	Upper core of L10	L16
5	21.2 Mc/s	Lower core of L11	Upper core of L11	L17
2	29.2 Mc/s	Lower core of L12	Upper core of L12	L18

The coverage of the PEAK RF control should now be checked on every band. Tune the receiver and generator to the appropriate end frequencies and observe that the reading on the output meter shows a clear peak as the PEAK RF control is tuned to the correct setting. On the 10M band, use 27.9 Mc/s on Range 4 and 30.0 Mc/s on Range 1 as the check frequencies.

<u>Re-alignment of the Aerial Filter.</u>

It is most unlikely that re-alignment of the Aerial Filter will ever be required. Its function is to limit breakthrough of signals in the range below 1.7 Mc/s and since specialised test equipment is required to completely re-align this unit, it is sealed to prevent accidental adjustment.

A check on the operation of the filter can easily be carried out by proceeding as follows. Tune the receiver to 2.0 Mc/s on Range 9 and inject sufficient signal at this frequency to give an output of 50mW. Re-tune the generator to 1.5 Mc/s and increase its output by 90dB. The reading on the output meter should not exceed the reading obtained initially with the generator tuned to 2.0 Mc/s.

The generator must be accurately matched to 75Ω when carrying out this check and if re-alignment is found necessary the receiver should be returned to the factory.

<u>Overall Sensitivity Check.</u>

This is the final phase in the alignment procedure and will to a large extent confirm that the adjustments made in the preceding paragraphs have been carried out correctly. The sensitivity should be checked at the centre of each range in turn, making sure that the PEAK RF control is set accurately and that the RF, IF and AF GAIN controls are at maximum. The SELECTIVITY control should be in the "AM" position. A sensitivity of the order 2µV should obtain for a s/n ratio of 10dB (50mW output, mod. 30% at 400 c/s.

APPENDIX "A"

VOLTAGE ANALYSIS

The following "Table of Voltage Values" will prove useful in the event of the receiver developing a fault which makes it necessary to carry out voltage checks. All readings are typical and were taken with a meter having a sensitivity of 20,000Ω/V. A nominal tolerance of 10% will apply to readings taken with a meter of this sensitivity and the tolerance should be increased accordingly if a meter of lower sensitivity is employed. Readings are quoted on the basis of an applied AC mains supply of 240V with the Voltage Selector in the 230V position.

Checks should be made under "no-signal" conditions with the receiver controls set as follows:-

WAVECHANGE	Range 9.	RF/IF GAIN CONTROLS . .	Maximum.
TUNING	1.8 Mc/s.	AF GAIN CONTROL . .	Minimum.
MODE SWITCH	"AM".	AGC/NL SWITCH . .	Off.
		STANDBY SWITCH . .	On (i.e. dolly down)

Ref	Anode		Screen		Cathode		Note
	Pin	Reading	Pin	Reading	Pin	Reading	
V1A	6	85V	-	-	8	1.5V	NOTE 1
V1B	1	163V	2 (g1)	81V	3	85V	
V2A	6	250V	1	98V	3	1.9V	
V2B	8	78V	-	-	3	1.9V	
V3	1/5	92V	-	-	7	1.2V	
V4A	6	240V	1	108V	3	2.3V	
V4B	8	70V	-	-	3	2.3V	
V5	1/5	98V	-	-	7	-	
V6	5	230V	6	100V	7	1.3V	NOTE 2
V7	5	230V	6	92V	7	1.2V	
V8A	7	-	-	-	1	-	
V8B	2	-	-	-	5	16.0V	NOTE 3
V9A	6	235V	-	-	8	0.8V	
V9B	1	165V	-	-	3	1.9V	
V10	5	-	6	-	2	-	NOTE 4
V11	5	240V	6	240V	2	15.0V	
V12	1/5	150V	-	-	2/7	-	
V13	5	16V	6	150V	7	-	NOTE 5

NOTE 1. Reading quoted is with RF GAIN at maximum. Cathode voltage becomes 48V with RF GAIN at minimum.

NOTE 2. Reading quoted is with IF GAIN at maximum. Cathode voltage becomes 52V with IF GAIN at minimum. Cathode voltage at "STANDBY" with IF GAIN at maximum and MUTING LEVEL fully anti-clockwise (i.e. minimum sensitivity) is 120V.

NOTE 3. Cathode voltage is reduced to 4V when the MODE switch is moved from "AM/CW" to the "SSB" positions.

NOTE 4. Not accessible for direct voltage checks. HT can be measured across C118 on the underside of the chassis. Reading with MODE switch to "CW" is 145V.

NOTE 5. Checks on V13 made with CALIBRATOR switch pressed. Cathode voltage with switch open is 23V.

APPENDIX "B"

LIST OF COMPONENT VALUES, TOLERANCE AND RATINGS.

Capacitors.

Ref	Value	Type	Tolerance	Wkg. V.
C1	0.002µF	Polystyrene	5%	125V
C2	0.0018µF	Polystyrene	5%	125V
C3	590pF	Polystyrene	5%	125V
C4	0.002µF	Polystyrene	5%	125V
C5	500pF	Polystyrene	5%	125V
C6	250pF	Polystyrene	5%	125V
C7	100pF	Polystyrene	5%	125V
C8	50pF	Tubular Ceramic	10%	750V
C9	50pF	Tubular Ceramic	10%	750V
C10	70pF	Polystyrene	5%	125V
C11	12-365pF	Air-spaced variable	-	-
C12	100pF	Silvered Mica	10%	350V
C13	12-365pF	Air-spaced variable	-	-
C14	100pF	Silvered Mica	10%	350V
C15	70pF	Polystyrene	5%	125V
C16	50pF	Tubular Ceramic	10%	750V
C17	50pF	Tubular Ceramic	10%	750V
C18	100pF	Polystyrene	5%	125V
C19	250pF	Polystyrene	5%	125V
C20	500pF	Polystyrene	5%	125V
C21	100pF	Tubular Ceramic	10%	750V
C22	0.1µF	Plate Ceramic	+80%-20%	200V
C23	0.1µF	Plate Ceramic	+80%-20%	200V
C24	0.003µF	Metallised Paper	20%	350V
C25	0.047µF	Polyester	10%	400V
C26	0.047µF	Polyester	10%	400V
C27	0.047µF	Polyester	10%	400V
C28	500pF	Polystyrene	5%	125V
C29	250pF	Polystyrene	5%	125V
C30	100pF	Polystyrene	5%	125V
C31	50pF	Tubular Ceramic	10%	750V
C32	50pF	Tubular Ceramic	10%	750V
C33	70pF	Polystyrene	5%	125V
C34	12-365pF	Air-spaced variable	-	-
C35	100pF	Silvered Mica	10%	350V
C36	100pF	Tubular Ceramic	10%	750V
C37	0.047µF	Polyester	10%	400V
C38	0.047µF	Polyester	10%	400V
C39	0.1µF	Plate Ceramic	+80%-20%	200V
C40	12-365pF	Air-spaced variable	-	-
C41	60pF	Silvered Mica	10%	350V
C42	4-29pF	Air Trimmer	-	-
C43	500pF	Silvered Mica	2%	350V
C44	1pF	Tubular Ceramic	0.25pF	750V

Ref	Value	Type	Tolerance	Wkg. V.
C45	500pF	Silvered Mica	2%	350V
C46	4-29pF	Air Trimmer	-	-
C47	60pF	Silvered Mica	10%	350V
C48	12-365pF	Air-spaced variable	-	-
C49	100pF	Tubular Ceramic	10%	750V
C50	0.047μF	Polyester	10%	400V
C51	0.1μF	Plate Ceramic	+80% -20%	200V
C52	10pF	Tubular Ceramic	10%	750V
C53	10pF	Tubular Ceramic	10%	750V
C54	0.0015μF	Tubular Ceramic	20%	750V
C55	0.01μF	Tubular Ceramic	+80% -20%	250V
C56	100pF	Tubular Ceramic	10%	750V
C57	50pF	Tubular Ceramic	10%	750V
C58	-	Deleted.	-	-
C59	0.047μF	Polyester	10%	400V
C60	600pF	Polystyrene	2%	125V
C61	4-29pF	Air Trimmer	-	-
C62	60pF	Tubular Ceramic	10%	750V
C63	12-365pF	Air-spaced variable	-	-
C64	100pF	Tubular Ceramic	10%	750V
C65	3pF	Tubular Ceramic	0.5pF	750V
C66	100pF	Tubular Ceramic	10%	750V
C67	0.047μF	Polyester	10%	400V
C68	50pF	Tubular Ceramic	10%	750V
C69	0.047μF	Polyester	10%	400V
C70	0.002μF	Polystyrene	5%	125V
C71	0.0047μF	Polystyrene	5%	125V
C72	0.0047μF	Polystyrene	5%	125V
C73	2-10pF	Air Trimmer	-	-
C74	50pF	Silvered Mica	5%	350V
C75	0.002μF	Polystyrene	5%	125V
C76	100pF	Silvered Mica	10%	350V
C77	0.0016μF	Polystyrene	5%	125V
C78	0.0016μF	Polystyrene	5%	125V
C79	100pF	Silvered Mica	10%	350V
C80	0.047μF	Polyester	10%	400V
C81	0.047μF	Polyester	10%	400V
C82	0.002μF	Polystyrene	5%	125V
C83	0.002μF	Polystyrene	5%	125V
C84	100pF	Silvered Mica	10%	350V
C85	0.1μF	Plate Ceramic	+80% -20%	200V
C86	0.1μF	Plate Ceramic	+80% -20%	200V
C87	25μF	Tubular Electrolytic	+100% -20%	25V
C88	0.047μF	Polyester	10%	400V
C89	0.047μF	Polyester	10%	400V
C90	0.047μF	Polyester	10%	400V
C91	0.002μF	Polystyrene	5%	125V
C92	0.002μF	Polystyrene	5%	125V
C93	12pF	Tubular Ceramic	10%	750V
C94	500pF	Metallised Paper	20%	600V
C56a	0.0015μF	Tubular Ceramic	20%	750V

Ref	Value	Type	Tolerance	Wkg. V.
C95	100pF	Tubular Ceramic	10%	750V
C96	2μF	Metallised Paper	25%	200V
C97	0.01μF	Metallised Paper	20%	200V
C98	0.01μF	Tubular Ceramic	+80% -20%	350V
C99	0.1μF	Plate Ceramic	+80% -20%	200V
C100	50pF	Tubular Ceramic	10%	750V
C101	0.01μF	Polyester	10%	400V
C102	6pF	Tubular Ceramic	10%	750V
C103	6pF	Tubular Ceramic	10%	750V
C104	0.047μF	Polyester	10%	400V
C105	0.047μF	Polyester	10%	400V
C106	200pF	Silvered Mica	1%	350V
C107	130pF	Silvered Mica	1%	350V
C108	40pF	Tubular Ceramic	10%	750V
C109	40pF	Tubular Ceramic	10%	750V
C110 C111	17-253pF	Two-gang air-spaced variable	-	-
C112	0.0012μF	Polystyrene	5%	125V
C113	200pF	Polystyrene	5%	125V
C114	0.0015μF	Tubular Ceramic	+50% -25%	750V
C115	10μF	Tubular Electrolytic	+50% -10%	16V
C116	0.047μF	Polyester	20%	250V
C117	0.1μF	Plate Ceramic	+80% -20%	200V
C118	0.047μF	Polyester	10%	400V
C119	0.047μF	Polyester	20%	250V
C120	0.1μF	Plate Ceramic	+80% -20%	200V
C121	0.1μF	Plate Ceramic	+80% -20%	200V
C122	0.047μF	Polyester	10%	400V
C123	0.002μF	Polystyrene	5%	125V
C124	0.0032μF	Polystyrene	5%	125V
C125	0.0032μF	Polystyrene	5%	125V
C126	0.01μF	Tubular Ceramic	+80% -20%	350V
C127	0.01μF	Tubular Ceramic	+80% -20%	350V
C128	0.005μF	Tubular Ceramic	20%	750V
C129	32 + 32μF	Tubular Electrolytic	+50% -20%	350V
C130	25μF	Tubular Electrolytic	+100% -20%	25V
C131	500pF	Metallised Paper	20%	600V
C132	0.0015μF	Tubular Ceramic	20%	750V
C133	25μF	Tubular Electrolytic	+100% -20%	25V
C134	0.01μF	Tubular Ceramic	+80% -20%	350V
C135	0.01μF	Polyester	10%	400V
C136	0.005μF	Disc Ceramic	+80% -20%	3000V
C137	0.005μF	Disc Ceramic	+80% -20%	3000V
C138	50μF	Tubular Electrolytic	+50% -20%	450V
C139	0.01μF	Polyester	10%	400V
C140	20pF	Silvered Mica	10%	350V
C141	6pF	Tubular Ceramic	10%	750V
C142	3-23pF	Air Trimmer	-	-
C143	0.01μF	Metallised Paper	20%	200V
C144	0.01μF	Metallised Paper	20%	200V
C111a	12pF	Tubular Ceramic	10%	750V

Ref	Value	Type	Tolerance	Wkg. V.
C145	0.01µF	Metallised Paper	20%	200V
C146	0.01µF	Metallised Paper	20%	200V
C147	0.01µF	Metallised Paper	20%	200V
C148	0.01µF	Metallised Paper	20%	200V

Resistors.

Ref	Value	Tol.	Rating
R1	0.27MΩ	10%	½ watt
R2	12Ω	10%	½ watt
R3	47,000Ω	10%	1 watt
R4	150Ω	10%	½ watt
R5	4,700Ω	10%	½ watt
R6	0.1MΩ	10%	½ watt
R7	0.1MΩ	10%	½ watt
R8	33,000Ω	10%	1 watt
R9	2,200Ω	10%	½ watt
R10	3,300Ω	10%	1 watt
R11	330Ω	10%	½ watt
R12	820Ω	10%	½ watt
R13	22,000Ω	10%	½ watt
R14	6,800Ω	10%	½ watt
R15	0.47MΩ	10%	½ watt
R16	0.1MΩ	10%	½ watt
R17	150Ω	10%	½ watt
R18	27,000Ω	10%	1 watt
R19	2,200Ω	10%	½ watt
R20	27,000Ω	10%	1 watt
R21	0.47MΩ	10%	½ watt
R22	0.1MΩ	10%	½ watt
R23	150Ω	10%	½ watt
R24) R25) R26) R27) R28) R29) R30) R31) R32)	Values are determined during test. Resistors may be omitted if not required. All are 10% ½ watt.		
R33	47,000Ω	10%	½ watt
R34	220Ω	10%	½ watt
R35	0.1MΩ	10%	½ watt
R36	2,200Ω	10%	½ watt
R37	10,000Ω	10%	1 watt
R37a	10,000Ω	10%	½ watt
R38	10,000Ω	10%	½ watt
R39	2,200Ω	10%	½ watt
R41a	2,200Ω	10%	½ watt

Ref	Value	Tol.	Rating
R40	2,200Ω	10%	½ watt
R41	2,200Ω	10%	½ watt
R42	22,000Ω	10%	½ watt
R43	0.1MΩ	10%	½ watt
R44	10,000Ω	10%	½ watt
R45	22,000Ω	10%	½ watt
R46	33,000Ω	10%	1 watt
R47	33,000Ω	10%	1 watt
R48	2,200Ω	10%	½ watt
R49	47,000Ω	10%	1 watt
R50	2,200Ω	10%	½ watt
R51	0.27MΩ	10%	½ watt
R52	100Ω	10%	½ watt
R53	47,000Ω	10%	1 watt
R54	0.27MΩ	10%	½ watt
R55	100Ω	10%	½ watt
R56	15,000Ω	5%	6 watt
R57	47,000Ω	10%	1 watt
R58	2,200Ω	10%	½ watt
R59	100Ω	10%	½ watt
R60	0.1MΩ	10%	½ watt
R61	0.1MΩ	10%	½ watt
R62	1MΩ	10%	½ watt
R63	2.2MΩ	10%	½ watt
R64	0.47MΩ	10%	½ watt
R65	1MΩ	10%	½ watt
R66	22,000Ω	10%	½ watt
R67	6,800Ω	10%	½ watt
R68	2,200Ω	10%	½ watt
R69	0.1MΩ	10%	½ watt
R70	0.47MΩ	10%	½ watt
R71	220Ω	10%	½ watt
R72	4,700Ω	10%	½ watt
R73	0.47MΩ	10%	½ watt
R74	47Ω	10%	½ watt
R75	0.18MΩ	10%	½ watt
R76	220Ω	10%	½ watt
R77	1,000Ω	10%	½ watt
R78	3,300Ω	10%	½ watt
R79	68,000Ω	10%	½ watt
R77a	3.3k	10%	½ watt

Ref	Value	Tol.	Rating
R80	0.1MΩ	10%	½ watt
R81	0.1MΩ	10%	1 watt
R82	0.1MΩ	10%	1 watt
R83	0.1MΩ	10%	1 watt
R84	0.47MΩ	10%	½ watt
R85	2,200Ω	10%	½ watt
R86	2,200Ω	10%	½ watt
R87	47,000Ω	10%	½ watt
R88	1MΩ	10%	½ watt
R89	6,800Ω	10%	½ watt
R90	10,000Ω	10%	1 watt
R91	0.27MΩ	10%	½ watt
R92	4,700Ω	10%	1 watt
R93	0.47MΩ	10%	½ watt
R94	620Ω	10%	1 watt
R95	2,200Ω	10%	½ watt
R96	0.1MΩ	10%	½ watt
R97	140Ω	5%	6 watt
R98	140Ω	5%	6 watt
R99	4,700Ω	5%	6 watt
R100	22,000Ω	10%	½ watt
R101	0.27MΩ	10%	½ watt
R102	1MΩ	10%	½ watt
R103	0.1MΩ	10%	1 watt
R104	10,000Ω	10%	½ watt

Potentiometers.

Ref	Value	Type
RV1*	10,000Ω	Wirewound
RV2**	0.47MΩ	Carbon
RV3*	10,000Ω	Wirewound
RV4	20,000Ω	Carbon
RV5**	600Ω	Wirewound
RV6**	5,000Ω	Wirewound
RV7	0.5MΩ	Carbon

* Ganged with concentric spindles.
** Pre-set.

NOTE Where specified components are not available, alternative types with identical tolerances and ratings will be fitted.

APPENDIX "C"

SPARES

The following list details all major spares for the Model EA12 receiver. Spares should be ordered by quoting the Circuit Ref. (where applicable), the written description given in the list and the Part No. in the right-hand column. The Serial No. of the receiver should be stated in all communications.

All orders and enquiries should be addressed to:-

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

In cases of extreme urgency, ring PRIory 2231/4, cable STRATNOID Birmingham or use TELEX 33708.

Ref	Description	Part No.
	INDUCTORS.	
L1-L6	Aerial Filter Unit. (Supplied as a complete assembly pre-aligned)	D3340
L7	1.8 Mc/s Bandpass coil.	D3341
L8	3.5 Mc/s Bandpass coil.	D3342
L9	7 Mc/s Bandpass coil.	D3343
L10	14 Mc/s Bandpass coil.	D3344
L11	21 Mc/s Bandpass coil.	D3345
L12	28 Mc/s Bandpass coil.	D3346
L13	1.8 Mc/s Mixer coil.	D3347
L14	3.5 Mc/s Mixer coil.	D3348
L15	7 Mc/s Mixer coil.	D3349
L16	14 Mc/s Mixer coil.	D3350
L17	21 Mc/s Mixer coil.	D3351
L18	28 Mc/s Mixer coil.	D3352
L19	1st IF Bandpass coil (primary).	D3353
L20	1st IF Bandpass coil (secondary).	D3353
L21	1st Oscillator Amp/Dblr coil (A).	D3355
L22	1st Oscillator Amp/Dblr coil (B).	D3356
L23	1st Oscillator Amp/Dblr coil (C).	D3357
L24	1st Oscillator Amp/Dblr coil (D).	D3358
L25	1st Oscillator Amp/Dblr coil (E).	D3358/1
L26	2nd Oscillator (VFO) coil.	D3354
L27	Slot Filter coil. (Supplied as a complete assembly with all associated components except control knob)	D3382
L28	BFO coil. (Not available separately - order BFO Unit)	D3334
L29	Audio Filter coil.	D3333
L30	Crystal Calibrator coil.	D2178
	CHOKES.	
CH1	Mains filter choke.	D2854
CH2	Mains filter choke.	D2854
CH3	HT smoothing choke.	6260P

Ref	Description	Part No.
	TRANSFORMERS.	
T1	1st 100 kc/s IF Transformer.	D2992A
T2	100 kc/s Crystal Filter Unit (less crystal).	D3002
T3	2nd 100 kc/s IF Transformer.	D2993A
T4	3rd 100 kc/s IF Transformer.	D2994A
T5	Output Transformer.	6588P
T6	Power Transformer.	3937P
	CRYSTALS.	
XL1	15,550 kc/s. Style "D" (0.0015% - 25pF - 25°C.)	6717P
XL2	15,300 kc/s. Style "D" (0.0015% - 25pF - 25°C.)	6718P
XL3	15,050 kc/s. Style "D" (0.0015% - 25pF - 25°C.)	6719P
XL4	14,800 kc/s. Style "D" (0.0015% - 25pF - 25°C.)	6720P
XL5	11,300 kc/s. Style "D" (0.0015% - 25pF - 25°C.)	6721P
XL6	15,600 kc/s. Style "D" (0.0015% - 25pF - 25°C.)	6722P
XL7	8,600 kc/s. Style "D" (0.0015% - 25pF - 25°C.)	6723P
XL8	5,100 kc/s. Style "D" (0.0015% - 25pF - 25°C.)	6724P
XL9	3,500 kc/s. Style "D" (0.0015% - 25pF - 25°C.)	6725P
XL10	100 kc/s. Style "E" (0.005% - 25pF - 25°C.)	6099P
XL11	100 kc/s. Style "E" (0.005% - 25pF - 25°C.)	6099P
	SWITCHES.	
S1	Range Switch: Wafers "a" - "h".	D3360
	Wafer "i".	4252P
	Wafer "j".	D3361
	Clicker Mechanism.	6281P
	Extension spindle.	5431P
	Coupler.	5428P
S2	Calibrator Switch DPCO Toggle Type.	6726P
S3	Crystal Filter Switch (microswitch).	6365P
S4	Standby Switch DPDT Toggle Type (long dolly).	4772/1PC
S5	AGC/NL Switch 4P5W Wafer Type.	D3383
S6	Mode Switch 7P5W Wafer Type.	D3384
S7	Mains Switch DPDT Toggle Type.	4772PC
	VARIABLE CAPACITORS, TRIMMERS AND ASSOCIATED ITEMS.	
C11/13/34	Peak RF Tuning Gang, 3 x 12-365pF.	6528P
C40/48/63	1st IF Tuning Gang, 3 x 12-365pF.	6528P
C42/46/61	Concentric Trimmers, 4-29pF.	6597P
C110/111	BFO Tuning Gang 2 x 8.5-126.5pF.	D3363
-	Flexible couplers as used on Peak RF Gang:- long hub.	D3366
	short hub.	D2017
	POTENTIOMETERS.	
RV1/RV3	2 x 10,000Ω wirewound with concentric spindles.	5810P
RV2	0.47 MΩ carbon (pre-set).	6077P
RV4	20,000Ω carbon.	5938P
RV5	600Ω wirewound (pre-set).	6566P
RV6	5,000Ω wirewound (pre-set).	6123P
RV7	0.5MΩ carbon.	4103PB

Ref	Description	Part No.
	PLUGS AND SOCKETS.	
PL1	Calibrator Supply Plug (B7G type)	6100P
-	Standard B/L Coaxial Plug (as used for aerial input)	6079P
-	Mains Plug (polarised with earth connection) and 6' lead	D2311/1
SKT1	Aerial socket	6087P
SKT2	IF Output socket	6087P
SKT3	Mains socket (polarised with earth contact)	D2310/1
SKT4	Calibrator Supply Socket (B7G type)	6086P
JK1	Telephone socket	6660P
	KNOBS.	
	Tuning	5817P
	Wavechange	5817P
	RF Gain	5834P
	IF Gain	5786P
	AF Gain and Peak RF	5816P
	BFO Pitch:- knob	D3321
	skirt	D3320
	Slot Filter	D3385
	Selectivity, Mode and AGC/NL	5780P
	DRIVE ASSEMBLY.	
	Main Drive Unit (excluding Peak RF control spindle, main control spindle, associated bearing and flywheel)	LP2886
	Main control spindle and bearing assembly	6429P
	Flywheel	D2581
	Screw for flywheel	1484P
	Peak RF control spindle (with gear)	D3328
	*Stainless steel driving disc (with gear)	D2642
	*Condenser (output) gear	D2077
	*Peak RF pulley gear assembly	D3388
	*Peak RF output pulley (with grub screw)	D3045
	*Drive belt	D3046B
	*Spring for drive belt	4194P
	Drive pulley (cursor drive wire)	D3329
	Bearing screw for drive pulley	3958P
	Guide pulley (cursor drive wire)	6125P
	Jockey pulley (riveted to replacement meter support plate)	D3325
	Cursor assembly	D3386
	Cursor shift mechanism (less concentric guide pulley)	D3387
	Ratio arm (less main spring and tension springs)	D2694
	Main spring for ratio arm	5852P
	Tension springs for ratio arm	4024P
	Coupling arm	D3389
	Length of drive wire 4' 6"	SKL77
	*Included in Main Drive Unit.	

Ref	Description	Part No.
	MISCELLANEOUS ITEMS.	
	Calibrator Unit (less valve and crystal).	LP2806/1
	Chromium plated panel handles.	5826P
	Crystal holder (Style "D")	6375P
	Dial Glass.	5847P
	Dial glass retaining strip.	6261P
	Dial lamp holder.	6374P
	Dial lamps (6.5V @ 0.3A, bayonet type).	3131P
	Finger plate	6594P
	Fuseholder.	6103P
	Fuses (1.5A x 1¼" x ¼" cartridge).	6104P
	Scale plate.	6677P
	"S" Meter.	6639P
	Terminals.	6102P

APPENDIX "D"

MODEL EP 20 PANORAMIC DISPLAY UNIT

The EDDYSTONE Model EP20 is a general-purpose mains-operated panoramic display unit intended primarily for use with the EDDYSTONE Model 830 HF/MF communication receiver and the Model EA12 High Stability Amateur Band receiver. The unit can be used with other receivers which have an intermediate frequency of 100 kc/s. Operation as a wobbulator is also possible in which mode standard IF's of 100 kc/s, 470 kc/s. 500 kc/s etc. fall within the range of the sweep frequency output.

The maximum display bandwidth of the unit used alone is 30 kc/s. When used with The Eddystone 830 or EA12 receivers as part of the EPR27/28 Panoramic Display Installations, the maximum display bandwidth is reduced to 6 kc/s due to the selectivity of the receiver IF channel. The sweep can be reduced to 100 c/s for detailed analysis with a resolution better than 50 c/s at the slower sweep speeds.

A single conversion circuit is employed with a selective dual-crystal filter in the intermediate frequency stage which operates at 70 kc/s and provides a bandwidth of the order 20 c/s. Manual gain control is included to increase the flexibility of the calibrated attenuator which occurs earlier in the circuit.

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

Advanced design, rugged construction and high quality components are used throughout and the dimensions and styling match those of the 830 and EA12 receivers. Both rack and surface-mounting versions are available. Operation is from any standard AC mains supply and a blower fan is fitted to permit prolonged operation at elevated temperatures.

A detailed specification of the EP20 Display Unit is available on request.

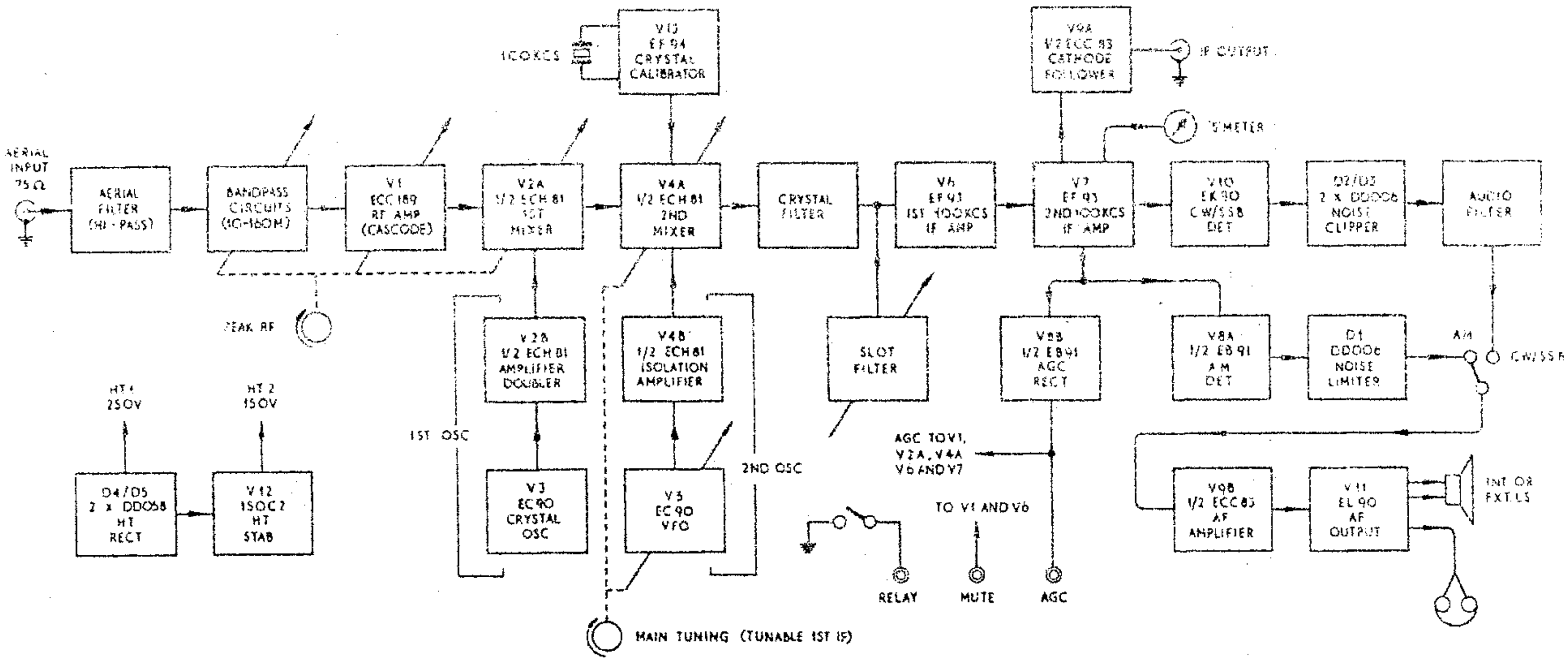


Fig. 2. Block Schematic Diagram of EA12 Receiver.

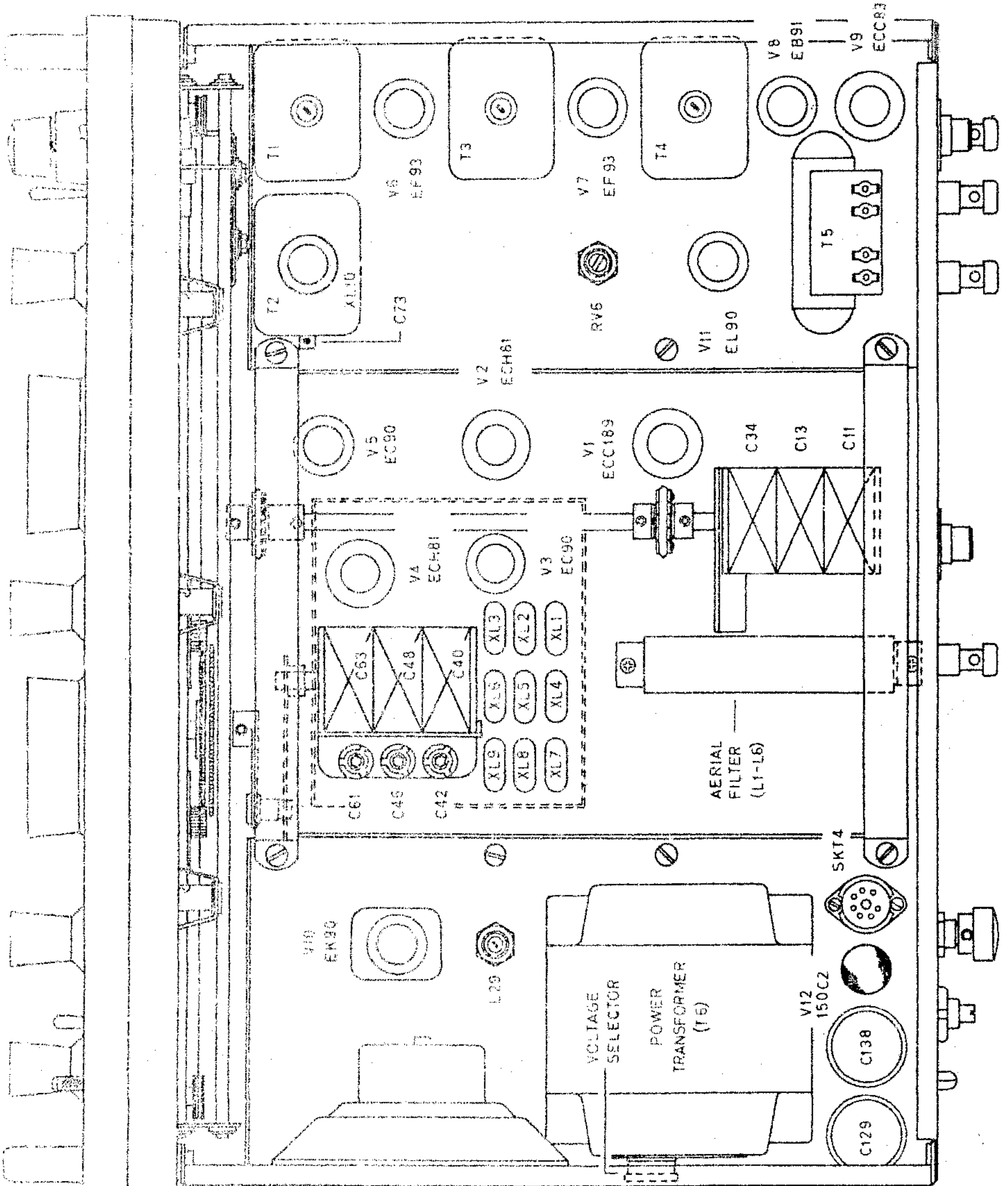


Fig. 3. Plan View of EA12 Receiver.

Model EA12

December 1966

C I R C U I T   R E V I S I O N S

The following corrections should be made to the circuit diagram bound at the rear of this Instruction Manual. Corrections have been incorporated in Appendix "B" and also in the text where this was necessary.

1. Change C41 to read:- "60pF."
2. Change C44 to read:- "1pF."
3. Change C47 to read:- "60pF."
4. Change C52 to read:- "10pF."
5. Change C53 to read:- "10pF."
6. Add:- "C56a 1500pF" connected in parallel with R34.
7. Delete:- "C58." Substitute a "2.2K" resistor in its place (i.e. as on L21, L22 and L23). Allocate reference "R41a" to this resistor.
8. Add:- "C111a 12pF" connected in parallel with C110/C111.
9. Change C126 to read:- "0.01µF."
10. Change C133 to read:- "25µF."
11. Show R3 connected to the other side of S2a (i.e. to junction of R4/R5).
12. Transfer R13 from primary of L15 to primary of L17. Change value to:- "22K."

Model EA12

November 1968

CIRCUIT REVISIONS

The following additional corrections should be made to the circuit diagram bound at the rear of this Instruction Manual, and also in Appendix "B".

1. Change C41 to read:- "50pF"
2. Change C111a to read:- "20pF"
3. Add footnote reading C77 and C78 maybe 1500pF.

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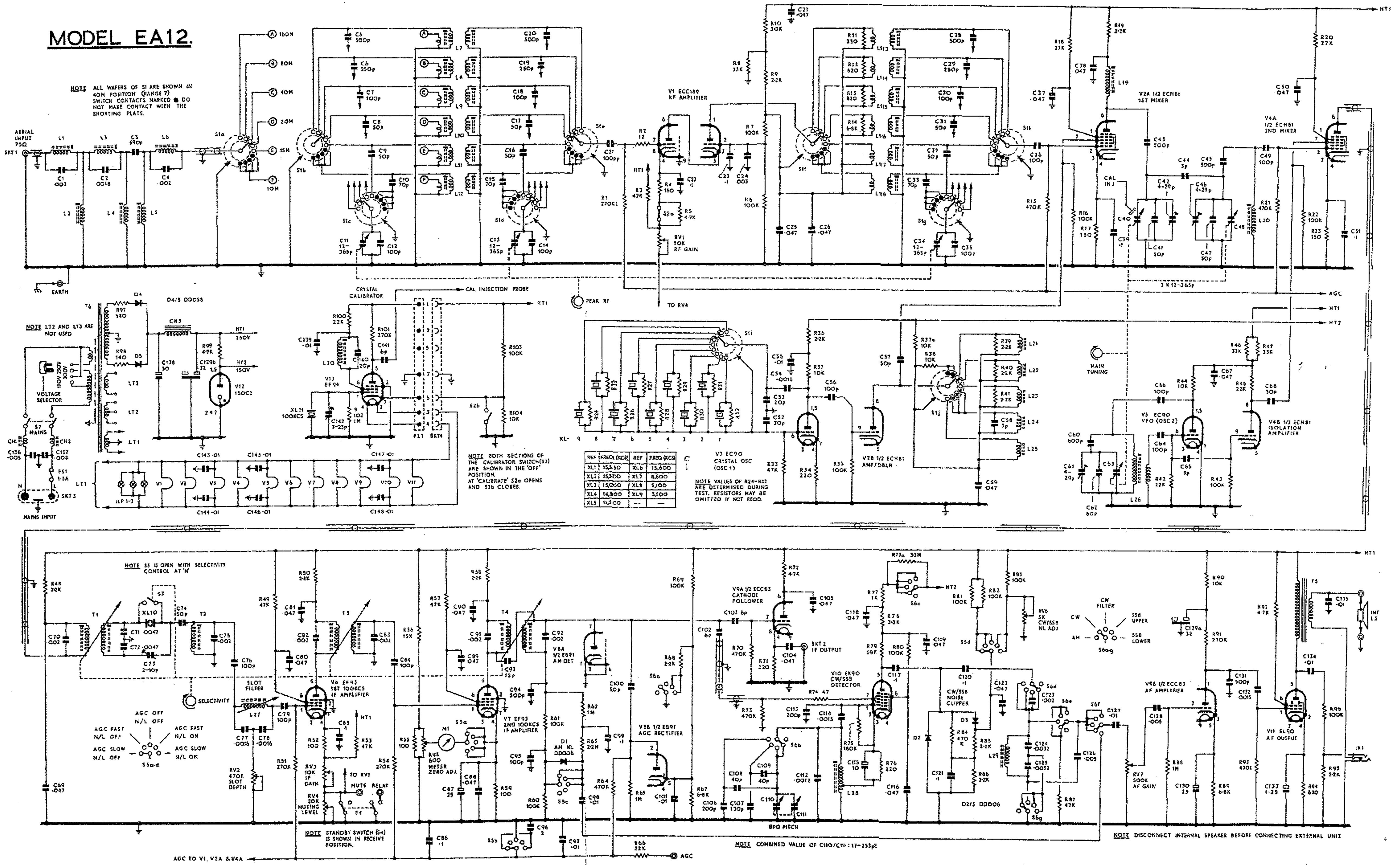
MODEL EA12.



REF	FREQ. (KCS)	REF	FREQ. (KCS)
XL1	15,550	XL6	13,600
XL2	15,300	XL7	8,600
XL3	15,050	XL8	5,100
XL4	14,800	XL9	3,500
XL5	11,300	—	—