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HF/MF COMMUNICATION RECEIVERMODEL 830/7

The EDDYSTONE Model 830/7 is a general-purpose HF/MF communication receiver covering the frequency band 300 kc/s to 30 Mc/s in nine switched ranges. It is the current production replacement for the 830/2 receiver and has complete facilities for CW, AM and SSB reception. Visual signal analysis is possible when the 830/7 is used in conjunction with the Eddystone Model EP20 Panoramic Display Unit.

The basic circuit employs single conversion on the lower frequencies in the tuning range and dual conversion on frequencies higher than 1.5 Mc/s. Intermediate frequencies are 1350 kc/s and 100 kc/s, the former being variable to provide an incremental tuning facility with a coverage of ± 100 kc/s. Provision is made for operating the 1st and 2nd local oscillators with crystal control for fixed frequency working in the range 1.5-30 Mc/s. Eight switch-selected crystals can be in position at any one time.

Separate AM and CW/SSB detectors are employed, the latter being a product type with provision for sideband selection and "fine" adjustment of the carrier insertion frequency when taking SSB signals. IF bandwidth is continuously variable up to a maximum of 6 kc/s with positive selection of the appropriate bandwidth for SSB. A crystal filter is provided for selective CW reception.

Audio outputs are available for connection to external loudspeaker or telephones and a line output makes it possible to locate the receiver at some distance from the listening point. Other facilities include a low impedance IF output (100 kc/s), a carrier level meter, an efficient noise limiter and a built-in crystal calibrator. External connections provide for muting of the receiver when used with an associated transmitter and inter-connection of AGC lines in diversity installations.

An internal power unit permits direct operation either from standard AC mains supplies or from the output of a transistorised DC/AC converter. Consumption is of the order 85VA and as a further alternative it is also possible to operate the receiver from any external source capable of supplying the appropriate HT and LT voltages. Small items of ancillary equipment can be powered from the receiver supply when the latter is mains operated.

The receiver is normally supplied for bench-mounting but can be supplied with a slightly changed cabinet design and attachments for mounting in a standard 19" rack. This version is designated 830/7/RM. Receivers for use in mobile installations can be equipped with special shock-absorbent mountings.

Sole Manufacturers :-

EDDYSTONE RADIO LIMITED, ALVECHURCH ROAD, BIRMINGHAM 31, ENGLAND.

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- Circuit Diagram of 830/7 Receiver	Rear cover

CORRIGENDA

The circuit diagram requires minor modification as detailed below :-

Add FB5 - a small ferrite bead on lead from C79 to 1st IF secondary circuit.

AMENDMENT RECORD

Amend No.	Incorporated by	Date	Amend No.	Incorporated by	Date
1	EDDYSTONE	ON ISSUE	6		
2	EDDYSTONE	ON ISSUE	7		
3	EDDYSTONE	ON ISSUE	8		
4			9		
5			10		

The Manufacturer reserves the right to vary without notice the information contained in this publication.

TECHNICAL DATA

GENERAL

Frequency Coverage

300 kc/s to 30 Mc/s in nine ranges:-

Range 1 18.0 - 30.0 Mc/s.
Range 2 11.0 - 18.0 Mc/s.
Range 3 6.7 - 11.0 Mc/s.
Range 4 4.0 - 6.7 Mc/s.
Range 5 2.5 - 4.0 Mc/s.
Range 6 1.5 - 2.5 Mc/s.

Range 7 860 - 1500 kc/s.
Range 8 480 - 860 kc/s.
Range 9 300 - 520 kc/s.

Ranges 1 - 6 : double conversion

Ranges 7 - 9 : single conversion

Intermediate Frequencies

1st IF .. Nominally 1350 kc/s but variable over the range 1250-1450 kc/s to provide the incremental tuning facility on Ranges 1-6. The 1st IF is not used on Ranges 7, 8 or 9.

2nd IF .. 100 kc/s with crystal filter and continuously variable bandwidth. The BFO control swing is ± 3 kc/s at CW and ± 100 c/s at SSB.

Valve and Semiconductor Complement

Ref	Type	Circuit Function
V1	6ES8 or ECC189 (CV5331)	RF Amplifier (cascode)
V2	6AK5 or EF95 (CV850)	1st Mixer
V3	6AJ8 or ECH81 (CV2128)	2nd Mixer/2nd Osc. Isolation Amplifier
V4	6C4 or EC90 (CV133)	2nd Local Oscillator (VFO & CRYSTAL)
V5	6BA6 or EF93 (CV454)	1st 100 kc/s IF Amplifier
V6	6BA6 or EF93 (CV454)	2nd 100 kc/s IF Amplifier
V7	6AL5 or EB91 (CV140)	AM Noise Limiter
V8	6AU6 or EF94 (CV2524)	Cathode Follower (IF OUTPUT)
V9	6AT6 or EBC90 (CV452)	AM Detector/AGC Rectifier/Audio Amp.
V10	6AQ5 or EL90 (CV1862)	Audio Output
V11	6AU6 or EF94 (CV2524)	Crystal Calibrator
V12	6U8 or ECF82 (CV5065)	1st Local Oscillator (VFO & CRYSTAL)
V13	6BE6 or EK90 (CV453)	CW/SSB Detector
V14	0A2 or 150C4 (CV1832)	HT Stabiliser (1)
V15	0A2 or 150C4 (CV1832)	HT Stabiliser (2)
D1/4	DD006 - -	HT Rectifier
<u>NOTE:</u> 2 x DD058 may be fitted in lieu of 4 x DD006.		

Power Supplies

The receiver can be operated either from single-phase AC mains supplies (100/125V and 200/250V, 40-60 c/s) or from external HT and LT supplies. Consumption is of the order 85VA and the external voltages required are:- HT : 250V @ 160mA and LT : 6.3V @ 4.9A (approx).

When operating the receiver from an AC mains supply, limited HT and LT supplies can be drawn from the receiver to power small ancillary units. Voltages and currents are as follows :- HT : 250V @ 15mA (unsmoothed) and LT : 6.3V @ 1.2A. The LT supply is balanced with centre-tap earthed.

The live side of the mains input is fused at 1.5 Amps by a standard $1\frac{1}{4}$ " x $\frac{1}{4}$ " type thermal-storage delay fuse. External supplies should be switched and fused at their source.

Input and Output Impedances

Aerial Input . . . 75 ohms (nominal) unbalanced.

IF Output . . . 250 ohms (nominal) unbalanced. Suitable for terminating impedances in the range 75-300 ohms.

Audio Outputs . . . Loudspeaker : 2.5/3 ohms.
Lines : 600 ohms (balanced or unbalanced).
Telephones : Nominally 2,000 ohms but suitable for use with most standard telephone impedances.

TYPICAL PERFORMANCE FIGURES

Sensitivity

With an IF bandwidth of 3 kc/s (SSB position), the sensitivity is better than 3uV for a 15dB s/n ratio at all frequencies throughout the range.

IF Selectivity

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

IF Breakthrough

Breakthrough at the 1st IF ($1350 \text{ kc/s} \pm 100 \text{ kc/s}$) is greater than 70dB down except at 1.5 Mc/s on Range 6 where the figure is -60dB.

Breakthrough at the 2nd IF is greater than 85dB down at all frequencies except Range 9 (300-520 kc/s) where a figure of greater than -60dB obtains.

Any given breakthrough at the 1st IF can be eliminated by de-tuning the incremental control and re-setting the main tuning control to re-tune the wanted signal.

Image Rejection

On Ranges 7, 8 and 9 (300 kc/s - 1.5 mc/s) where the image is 200 kc/s removed from the signal frequency, rejection is at least 50dB.

At frequencies in the range 1.5-10 Mc/s the image rejection is greater than 70dB and at 30 Mc/s the figure does not drop below 50dB.

As with breakthrough at the 1st IF, any given image occurring in the band 1.5-30 Mc/s can be eliminated by adjustment of the incremental control.

Calibration and Re-setting Accuracy

The main scale accuracy on all ranges without use of the calibrator and with the cursor adjustor at mid-travel is within 0.5%, provided that on Ranges 1-6 (1.5-30 Mc/s) the 1st IF is set to the centre of its coverage (1350 kc/s).

When the main scales are standardised against the built-in calibrator, frequencies can be set to within one kilocycle by adjustment of the incremental control.

The incremental facility is not available on Ranges 7, 8 or 9 (300-1500 kc/s).

Frequency Stability

After a 10 minute warm-up period, drift with free-running oscillator will be less than 12 kc/s in the first hour at 28 Mc/s. Drift in any subsequent hour will not exceed 4 parts in 10^4 at frequencies above 4 Mc/s and 10 parts in 10^4 below 4 Mc/s. Drift due to changes in ambient temperature will not exceed 1 part in 10^4 per °C.

With crystal control of the 1st Local Oscillator, overall drift during the first 30 minutes will not exceed 150 c/s. Drift in the next hour will be less than 150 c/s and in any subsequent hour less than 50 c/s.

Drift due to changes in ambient temperature will not exceed 3 parts in 10^5 per °C.

AGC Characteristic

Audio output is maintained within 9dB (6dB on Ranges 1-6) when the input carrier level is increased by 90dB from a reference level of 3uV. (Taken with an IF bandwidth of 3 kc/s).

The normal AGC discharge time constant (0.15 sec) becomes 10 seconds when the Mode switch is moved to the SSB positions. AGC delay is reduced in this mode.

AGC is available for diversity working (socket at rear of receiver).

Audio Output and Response

The Audio Output Stage will deliver a maximum output of 2.5 watts at either the 2.5 ohm or 600 ohm outputs when these are used independently.

The audio response is level within 6dB over the range 200 c/s to 6 kc/s.

Distortion

5% at 1 watt in 2.5 ohm at 1000 c/s.

Hum Level

Greater than 50dB down on 2.5 watts.

IF Output

An input of 3uV at the aerial socket will produce an output of at least 50mV across 75 ohms (100 kc/s).

CIRCUIT DESCRIPTION

The RF Section

This portion of the receiver comprises V1 (6ES8/ECC189), V2 (6AK5/EF95) and V12 (6U8/ECF82). The first stage is a high-gain RF Amplifier which uses a low-noise double-triode in a series cascode circuit. This arrangement is used in preference to the more conventional pentode because of its superior performance with respect to blocking, cross modulation etc.

The input tuning arrangements on the six HF ranges (i.e. above 1.5 Mc/s), are of the bandpass type with double tuned circuits. Common inductance coupling is used between each pair of coils and this takes the form of the earth return wiring inductance on the three highest ranges. Small ferrite beads are included in the wiring to give suitable inductance values for Ranges 2 & 3, while on Ranges 4, 5 and 6 separate coupling coils are used, these being wound on the same former as that used for the secondary coil of each pair. On the three lowest frequency ranges (7, 8 and 9 : 300-1500 kc/s) a single tuned circuit is used in place of the bandpass arrangement.

Individual self-locking air-spaced trimming capacitors are used for the tuned windings, all of which have iron dust cores for precise adjustment of inductance value. Absorption effects are overcome by arranging the switching to short-circuit all coils except those actually in use.

Manual RF gain control is effected in the cathode circuit of the first triode V1A. The variable resistor RV1 provides this facility and its range of adjustment is increased considerably by a bleed current derived from the 47,000 ohms resistor R6. Under normal operating conditions RV1 is returned direct* to ground via S2a (normally closed) and the short-circuit across SKT3/1 and SKT3/4.

S2a forms part of the Calibrator switch and its function is to introduce R5 in series with the cathode return of the first triode portion of V1 when the switch is in the "Calibrate" position. The voltage developed across R5 (and RV1) which with R6 form a potential divider across the HT line is sufficient to bias-off the RF Amplifier and so limit interference from outside signals while a calibration check is being carried out.

The two socket connections SKT3/1 and SKT3/4 are for termination of a switch or relay contact forming part of an external send/receive changeover circuit. The switch or relay should be arranged to close the SKT3 circuit for normal operation on "receive" and open to introduce R83 on "transmit". In the latter condition, the voltage developed across this resistor desensitises the RF Amplifier and the two IF Amplifiers so that the receiver is effectively muted while a transmission is in progress. CH2 reduces clicks during keying. If a variable level of muting is required, this can be achieved by the simple expedient of connecting a suitable variable resistor across the SKT3 connections, i.e. in parallel with R83. The variable resistor will function as a combined RF/IF gain control and allow the sensitivity to be set to suit the proximity and power output of the local transmitter.

The stopper (R3) in the grid of the first triode section prevents any tendency towards VHF parasitic oscillations which would affect the operation of the amplifier at its normal working frequencies. AGC is applied to the first grid via R2 and the grid of the second triode derives its bias from the potential divider R8/R9. C34 and C35 are low inductance capacitors which ground the grid of the second triode at signal frequencies and so maintain stability in the cascode stage.

* via CH2 when fitted.

Various forms of coupling are employed between the RF Amplifier and the 1st Mixer Stage V2. On Ranges 1-5 and Ranges 7 and 8, conventional primary windings are used with additional top capacity coupling in the form of C37-C40. Range 6 utilises a straightforward resistance-capacity method while on Range 9 a variation of this system is used in which C52 acts as a common coupling impedance. Self-locking air-spaced trimmers and iron dust cores are used for the secondary windings and the shorting arrangements to prevent absorption effects are the same as on the aerial input circuits.

Full AGC is applied to V2 through R14 and the oscillator injection is to the cathode at low impedance via C159. A coaxial lead is taken from the anode of the Mixer to one section of the Range switch (Slf) which selects the appropriate IF circuit for either single or double conversion operation. Double conversion is used on Ranges 1-6 (1.5-30 Mc/s) and in this case the anode is taken to the tunable IF transformer L34/35. On frequencies below 1.5 Mc/s (Ranges 7, 8 and 9), the switching bypasses the second stage of frequency conversion and the anode feeds directly to the 1st 100 kc/s IF transformer T1.

The 1st Local Oscillator circuit uses a triode-pentode and is arranged as a combined VFO and Crystal Oscillator. The pentode portion (V12A) functions as the VFO with the screen grid working as an anode. Output is taken from the anode proper at low impedance and this arrangement, besides simplifying the injection feeds from V12A and V12B, also contributes a high degree of isolation for the variable oscillator and so limits any possible pulling of the oscillator frequency. Both the variable oscillator and V12B operate at low output to minimise oscillator radiation.

Temperature compensation is applied to the variable oscillator which is a conventional tuned-grid type and tracks on the "high" side of the signal on all ranges. The HT supply is derived from the stabilised line (HT3) and is applied via one section of S6A when this is placed in the "Manual" position. High quality self-locking air-spaced trimmers are used on all ranges and the padding capacitors are high-stability close tolerance types.

The triode portion of V12 is a Colpitt's type oscillator in which the crystal operates at its fundamental frequency. Output is taken from the cathode at low-impedance through C160 to join the VFO output source at the anode of V12A. This arrangement avoids the necessity for switching the oscillator outputs and the changeover from "Manual" to "Crystal" working is thus restricted to a single switch (S6a) which applies HT3 to the appropriate stage.

Multiples of the crystal frequency are generated in the 1st Mixer Stage and this allows the 2nd or 3rd harmonics to be used for mixing. The injection frequency can be chosen either above or below the signal so that a single crystal will provide a total of six different 1st Oscillator frequencies. Eight crystals can be in position at any one time and these are brought into circuit by the Crystal Selector switch S6b which is arranged to short-circuit all crystals except the one actually in use. The incremental tuning facility which will be described later makes for greater flexibility in the choice of crystal frequency because it allows simple correction at the 1st IF for errors of up to ± 100 kc/s in the nominal crystal or harmonic frequency. Reference should be made to the Section dealing with "Operation" on page 23 for more detailed information on the calculation of crystal frequencies.

The Tunable 1st IF

When Ranges 1-6 are selected (receiver operating with double conversion), the anode of the 1st Mixer Stage is connected by Slf to the primary winding of the tunable IF transformer L34/L35. The secondary circuit (L35) then feeds the signal grid of the 2nd Mixer Stage V3A which employs the heptode portion of an ECH81 (6AJ8) triode-heptode.

A further section of the Range switch (Slg) completes the HT3 supply to the associated 2nd Local Oscillator Stage (V4) and also to the Isolation Amplifier V3B which makes use of the triode portion of the Mixer valve. HT for the 2nd Mixer is taken from the main HT rail and is retained on Ranges 7, 8 and 9 when the receiver functions with single conversion and V3/V4 are effectively out of circuit. AGC is applied to the 2nd Mixer and results in a 3dB improvement in the AGC characteristic when using Ranges 1-6. V3B prevents oscillator pulling when AGC is in use.

L34 and L35 are tuned over the range 1250-1450 kc/s by two sections of the three-gang incremental tuning capacitor, the third section of which tunes the 2nd Local Oscillator V4. This stage employs a general-purpose triode (6C4/EC90) in a temperature compensated e.c.o. circuit and tracks on the low side of the 1st IF covering the band 1150-1350 kc/s to give a 2nd IF of 100 kc/s.

Advantages of the Tunable 1st IF

The three main advantages are (1) constant calibrated bandspread is available at all frequencies in the range 1.5-30 Mc/s so allowing frequencies to be read to a high degree of accuracy; (2) a tuning rate comparable with that obtained with the main tuning control on the lower frequencies is available on the high frequency bands, and (3) the choice of crystal for spot frequency control of the 1st Local Oscillator can be anywhere in the range $(fs \pm 1250 \text{ kc/s})$ to $(fs \pm 1450 \text{ kc/s})$. Thus fewer crystals are required for control of the 1st Local Oscillator to give coverage of all frequencies in the range 1.5-30 Mc/s.

An important point which must be borne in mind when using the tunable 1st IF in conjunction with crystal control of the 1st Local Oscillator is that the incremental scale is calibrated to indicate higher and lower signal frequencies on the assumption that the 1st Oscillator frequency is higher than the signal frequency. This is always the case when using "Manual" control but when the 1st Oscillator is crystal controlled the injection frequency can be chosen on the lower side of the signal with the result that the incremental calibration is reversed.

The reason for this can be clarified by taking a typical example. Assume that the receiver is to be crystal controlled to cover the 200 kc/s band 6600-6800 kc/s. Injection can be above or below this range and the appropriate frequencies can be determined by applying the following formula:-

$$\text{INJECTION FREQUENCY} = \text{BAND CENTRE FREQUENCY} \pm \text{NOMINAL 1ST IF}$$

The "band centre frequency" in this example is 6700 kc/s and the nominal 1st IF 1350 kc/s so that applying the formula for both cases will give the following results:

$$6700 + 1350 = \underline{8050 \text{ kc/s}} \quad \text{and} \quad 6700 - 1350 = \underline{5350 \text{ kc/s}}$$

Now consider the effect of de-tuning the 1st IF to its lowest frequency (1250 kc/s). The effective signal frequency at this setting of the incremental tuning control can be determined by calculating as follows:

$$\text{SIGNAL FREQUENCY} = \text{1ST OSCILLATOR FREQUENCY} - \text{1ST IF} \\ \text{(if 1st Oscillator is "high")}$$

$$\text{or SIGNAL FREQUENCY} = \text{1ST OSCILLATOR FREQUENCY} + \text{1ST IF} \\ \text{(if 1st Oscillator is "low")}$$

Continuing the example above will give the following frequencies:

$$8050 - 1250 = \underline{6800 \text{ kc/s}} \quad \text{and} \quad 5350 + 1250 = \underline{6600 \text{ kc/s}}$$

It is immediately obvious that since the effective signal frequency is the same in both cases when the 1st IF is at 1350 kc/s, a reversal must occur when the 1st Oscillator is placed on the LOW side of the signal. The range 6600-6800 kc/s is covered with either crystal but when using the lower channel, allowance must be made for the reversal when reading frequencies from the incremental scale.

This subject is dealt with in greater detail in the Section on "Operation" but it is worth noting at this stage that the basic rule applicable to the tunable IF (assuming that the 1st Oscillator is "high"). is that a decrease in IF is required to produce an increase in signal frequency. This factor has been taken into account in presenting the incremental calibration which is strictly conventional in that a red reading is used to indicate that the receiver is tuned to a frequency higher than that indicated by the main tuning scale; calibration in black denotes a lower frequency.

The misalignment of the RF and Mixer signal circuits which results when the 1st IF is de-tuned from its nominal frequency can be corrected by the "Peak-RF" control. This takes the form of a three-gang variable capacitor of relatively low capacity which is wired in parallel with the signal frequency sections of the main tuning gang. The receiver is aligned with the "Peak-RF" capacitors at half-capacity so that both positive and negative correction is possible in subsequent use.

As an alternative to the incremental facility, the 2nd Local Oscillator can be locked at any frequency in the range 1150-1350 kc/s by removing a link in the oscillator circuit and fitting a suitable crystal in the holder provided. The crystal operates in its series mode and the frequency of oscillation can be pulled slightly by adjustment of the incremental tuning control.

The 2nd IF Amplifiers, AM Detector and AGC

Output from the appropriate Mixer is fed via T1 to the two-stage 100 kc/s IF Amplifier which comprises V5 and V6 (6BA6/EF93). Both stages operate with AGC which is shunt-fed via R28/R31. The first stage can be controlled manually by means of the IF Gain control RV2 which, like the RF Gain, has its range of adjustment increased by a bleed current derived from the main HT rail via R30. The cathode circuits of both IF Stages are returned via SKT3-1/4 to further reduce the overall gain when an associated transmitter is in operation.

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 crystal filter is pre-phased by the trimmer C84 to provide a symmetrical response with a 6dB bandwidth of the order 50 c/s.

The second 100 kc/s IF Amplifier provides a controlling voltage to operate the built-in carrier level meter. This voltage is developed at the junction of the two screen resistors (R34/R35), the meter being connected between this point and the slider of the potentiometer RV3. RV3 is a pre-set control and is adjusted initially under no-signal conditions, (with the RF and IF Gains at maximum and the AGC "ON") to position the meter needle coincident with the zero mark at the left-hand side of the meter scale, i. e. the slider voltage is then the same as the voltage at the junction of R34/R35. On receipt of a signal, AGC applied to the grid of V6 causes a reduction in screen current which results in the voltage at the junction of the two screen resistors going more positive, unbalancing the bridge network and so causing the meter to read. The circuit is quite sensitive and the meter can be used either as a tuning indicator or for comparing the strength of received signals. The scale is calibrated in arbitrary divisions 0-10.

The output circuit of the last 100 kc/s transformer T4 feeds the Cathode Follower (V8), the two diodes of V9 and the CW/SSB Detector V13. The Cathode Follower employs a triode-strapped 6AU6 (EF94) and provides a low impedance output at 100 kc/s for feeding ancillary units (Panoramic Display Unit EP20 is connected at this point). The output can be terminated in any impedance in the range 75-300 ohms.

One diode of the 6AT6 (EBC90) which is used in the V9 position serves as the AM Detector while the other is used for AGC. The detector is conventional and incorporates a series-diode noise limiter (V7) to reduce impulse noise during AM reception. A double-diode (6AL5/EB91) with both diodes strapped is used as the limiter. S4a (part of the combined AGC/NL switch) is arranged to take V7 out of circuit when not required. Audio output from the AM Detector is taken to the "AM" position of the Mode switch wafer S5a for routing to the audio section.

AGC is delayed by the voltage developed across R50 which together with R47 forms a potential divider across the main HT supply. The delay is applied in the cathode of V9 and is reduced by switching R46 into circuit when the Mode switch is moved to the "SSB" positions. This is done to maintain efficient AGC action with the reduced average sideband power available for the production of AGC bias when taking SSB signals. At the same time, the discharge time constant of the AGC circuit is increased to approximately 10 seconds to prevent noise bursts during breaks in transmission. This is achieved by S5b which introduces the 10uF capacitor C112. AGC is applied to the RF Amplifier, the two Mixer Stages and both 100 kc/s IF Amplifiers. The line is brought out at SKT3/3 for diversity applications. S4b grounds the AGC line when manual gain control is being used.

CW/SSB Detector

A 6BE6 (EK90) pentagrid (V13) 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 (HT4) and the stage is disabled by S5d when this is set in the "AM" position.

The oscillator circuit is so arranged that with the Mode switch in the "CW" position the oscillator frequency is adjustable over the range $100 \text{ kc/s} \pm 3 \text{ kc/s}$, while at "SSB" the coverage is restricted to $\pm 100 \text{ c/s}$ centred on the appropriate insertion frequency for the sideband in use. The switching required to provide these facilities is performed by S5e which in the "CW" position places the BFO Pitch capacitor (C190/C191) directly across the oscillator tuned circuit. When the switch is moved to "SSB", the effective capacity of C190/C191 is reduced by introducing a 40pF series capacitor (either C187 or C189). At the same time, either C186 (195pF) or C188 (100pF) 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 control swing provided by the BFO Pitch adjustor. The 195pF capacitor is introduced in the "LOWER" position and the 100pF capacitor in the "UPPER" position giving insertion frequencies of 98.5 kc/s and 101.5 kc/s respectively.*

*NOTE: It may appear at first sight that the frequencies quoted in the text above are incorrect since 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 frequencies given are of course correct and the explanation lies in the fact that all signals are inverted in the 1st Mixer Stage (V2) which operates with its local oscillator on the high side of the signal frequency. Thus an upper sideband signal at the aerial input is converted to a lower sideband signal at the 1st IF and since inversion does not occur at the 2nd Mixer (due to its local oscillator being below the 1st IF), it remains a lower sideband signal at the 2nd IF. The panel marking "UPPER" and "LOWER" is of course correct for the signal as seen at the aerial input.

"UPPER" and "LOWER" must be transposed when operating the receiver with the 1st Local Oscillator crystal controlled with injection on the low frequency side of the wanted signal.

Audio Stages

Output from the appropriate detector is selected by the Mode switch and is applied via C108 to the AF Gain control RV4. The slider of this control feeds the grid of the Audio Amplifier which is the triode section of the double-diode-triode V9. It will be noticed that the grid resistor (R49) is returned to the junction of R50/R51 so that the bias applied is that developed across R51. The junction of the two resistors is grounded to AF by the 25uF electrolytic capacitor C111.

V9 is resistance-capacity coupled to the Audio Output Stage V10 which employs a 6AQ5 (EL90) beam tetrode in a conventional circuit. The output transformer T5 has two secondary windings, one at 2.5/3 ohms to feed an external loudspeaker and the other at 600 ohms for connection to remote lines linking the receiver to a distant listening point. This latter winding is electrostatically screened from the primary and the other secondary and has a centre-tap which can be earthed to provide a balanced output.

The telephone socket (JK1) is tapped into the divider network R58/R59 which is fed direct from the anode of the output valve via the blocking capacitor C118. The arrangement allows telephones of almost any impedance to be used with quite satisfactory results. Optimum performance will be secured with 'phones of about 2000 ohms impedance. A spare contact on JK1 interrupts the speaker output but not the 600 ohms output when telephones are in use.

The Power Supply Section

The main item in the power supply is a high-grade "C" core power transformer which provides three separate LT outputs (only two of which are used) and has a centre-tapped secondary winding giving 250 - 0 - 250 volts. HT rectification is by silicon diodes (either 4 x DD006 or 2 x DD058) which are used in a standard full-wave circuit. Smoothing is provided by the capacity input filter which comprises the choke CH1, the 50uF electrolytic capacitor C209 and one 32uF section of C207. The other section of C207 is fed from the main HT output (HT1) via R99 to provide a well decoupled supply (HT2) for the anode feed to V9.

Two separate stabilised supplies are provided (both of 150V) and are utilised as follows:- HT3 feeds the 1st and 2nd Local Oscillators and the Isolation Amplifier associated with the 2nd Oscillator. HT4 supplies the anode and screen voltage for the CW/SSB Detector.

Both LT supplies provide 6.3V, the main supply (LT1) having an earthed centre-tap and feeding all LT circuits except the heater of the Noise Limiter V7 which is fed from the LT2 supply. The centre-tap of LT2 is returned to the divider network R97/R98 and this maintains the heater of V7 at a few volts above ground to prevent hum being introduced at this point in the circuit. Special selection of the 6AL5 for use in this position is then totally unnecessary.

The low voltage secondary windings on the power transformer are not taken directly to the heater circuits but are wired to four connections on the 12-way male socket SKT5 (Nos. 1 & 2 and 10 & 11). The two heater circuits are terminated at four of the remaining connections of SKT5 (4 & 5 and 7 & 8) and the circuits are completed by links on the female plug PL3 which for normal mains operation must be in position at SKT5. This arrangement provides complete isolation for the transformer secondary windings when an AC supply is not available and the heater circuits are strapped together and fed from an external 6V supply (see wiring of PL2 on circuit diagram). Also terminated at SKT5 is a lead from the input side of the HT smoothing circuit which allows an externally derived HT supply to be fed to the receiver. An earth is provided on pin 12 and it should be noted that the internal smoothing circuit is used to supplement the filtering in the external supply unit.

The same connections referred to in the previous paragraph can also be used for extracting HT and LT supplies from the receiver to power small ancillary units. The plug in this case would be wired as PL3 on the circuit diagram.

The mains input to the power transformer is fused at 1.5 Amps and switched by the double-pole Mains switch S7.

The Crystal Calibrator

A 6AU6/EF94 is used for this stage (V11) which is housed in a small diecast box located on the cover over the main tuning gang. The unit provides markers at 100 kc/s intervals throughout the complete range of the receiver and can also be used to check the accuracy of the incremental scale.

The crystal is of the same frequency as the 2nd IF and sufficient calibrator signal is leaked into this part of the circuit to obviate the need for introducing the BFO when making a calibration check. Harmonic injection is at the grid of the 1st Mixer by proximity coupling to the gang wiring, while injection at the 2nd IF is due to direct radiation of the fundamental within the receiver.

The calibrator is brought into operation by pressing the small button switch S2 which applies HT to the calibrator unit and at the same time introduces R5 in the cathode of the RF Stage to limit interference from outside signals when a calibration check is being carried out. Scale correction is by lateral movement of the cursor independently of the main tuning control.

Supplies are fed to the calibrator via PL1/SKT4 and the harmonic output is from a probe projecting from the underside of the diecast housing. The crystal can be standardised against any frequency standard transmission by adjusting C123 which is wired across the crystal.

MECHANICAL CONSTRUCTION

Dimensions and Weight

Width	. . . . .	. . . . .	16. 3/4"	. . . . .	42.5 cm.
Width with rack-mounting brackets	. . . . .	. . . . .	19"	. . . . .	48.3 cm.
Height	. . . . .	. . . . .	8. 3/4"	. . . . .	22.2 cm.
Height with shock-mounts	. . . . .	. . . . .	9. 7/16"	. . . . .	24.0 cm.
*Depth	. . . . .	. . . . .	13. 19/32"	. . . . .	34.5 cm.
*Depth behind brackets (rack-mounting)	. . . . .	. . . . .	11. 27/32"	. . . . .	30.1 cm.
Weight (standard bench-mounting version)	. . . . .	. . . . .	49 lb.	. . . . .	22.2 kg.
Weight (rack-mounting version)	. . . . .	. . . . .	50 lb.	. . . . .	22.7 kg.
Weight (rack-mounting version less cabinet)	. . . . .	. . . . .	39 lb. 8 oz.	. . . . .	18.1 kg.
Weight (standard version with shock-mounts)	. . . . .	. . . . .	50 lb. 4 oz.	. . . . .	22.8 kg.

Cabinet

The type of cabinet provided with the Model 830/7 depends on the method of mounting which is to be employed. Cabinets are available for rack or bench-mounting. Both types are basically the same but the rack-mounting version has cut-outs along the leading edges of the vertical sides. These cut-outs extend approximately $\frac{1}{2}$ " back from the panel and give clearance for the two angled brackets which are attached to the rear of the panel to allow the receiver to be mounted in the rack. The brackets are provided with fixing slots which conform to the British Post Office standard for racks of 19" panel width.

*Excluding projections at rear
of cabinet (plugs etc.).

If the equipment is to be used in a position which is likely to be subject to excessive vibration (as for example in a mobile installation), shock-absorbent mounts can be attached to anchor points on the underside of the cabinet. This applies to both types of cabinet so that an 830/7/RM can be bench-mounted with shock-absorbers if this should be necessary.

Either form of cabinet has extensive perforation to ensure adequate ventilation. Three apertures at the rear allow easy access to the various sockets and the pre-set meter zero control etc. The cabinet is made of steel, suitably rust-proofed and enamelled.

Front Panel

The front panel is an aluminium diecasting and contributes great mechanical strength to the receiver as a whole. All controls except the cursor adjustor are located along the lower half of the panel, their functions being indicated on a clearly marked finger plate. The chromium-plated panel handles allow the receiver to be lifted easily and also afford protection to the panel controls when the receiver is placed in a "face-down" position as for example when removing the cabinet.

Chassis Assembly

The internal layout of the receiver is dictated mainly by the use of a diecast "coil box" which serves as the chassis for the complete RF Section and is mounted centrally behind the panel. Two sub-chassis occupy the space remaining on either side of the RF Unit, these being attached to the central unit and also to two steel end-plates at the extreme ends of the panel.

When the receiver is viewed from the front, the sub-chassis in the right-hand position carries all the power supply components and also has mounted upon it a small screened box which houses the complete 1st IF and 2nd Local Oscillator Stages. In the left-hand position is the 2nd IF chassis which also includes the audio stages etc. The built-in calibrator is housed in a small diecast box which is mounted on top of the gang cover on the RF chassis.

Main Dial and Drive Assembly

The main tuning control which drives a spring-loaded split-gear system having a reduction ratio of approximately 140:1 gives a tuning rate which varies between 2.5 kc/s per rev. at 300 kc/s and 250 kc/s per rev. at 30 Mc/s. The drive is flywheel-loaded, substantially free from backlash and ensures consistent re-setting accuracy at all frequencies. Total cursor travel on each range is some 13 inches and the scales are calibrated directly in frequency (kc/s below 1.5 Mc/s and Mc/s above this frequency). The cursor can be moved independently by means of a mechanical adjustor which provides scale correction when calibrating against the built-in crystal calibrator.

Incremental Tuning

This control requires approximately 20 revolutions to cover the complete swing of 200 kc/s, so giving an average tuning rate of approximately 10 kc/s per rev. The drive is through spring-loaded split-gears to ensure that backlash is kept within the smallest possible proportions.

The incremental calibration appears in an aperture above the main scales and the "off-tune" direction (i.e. + or -) is indicated by printing the scales in different colours. Calibration in red shows that the receiver is tuned to a frequency higher than that given by the main scales; black figures indicate a lower frequency.

INSTALLATION

MOUNTING

Unless otherwise stipulated, receivers in the 830 Series are supplied complete with a standard cabinet in a form suitable for bench-mounting only. An interchangeable cabinet is available to special order and this has slots to clear the angled brackets which are fitted to the receiver proper to allow it to be mounted in a standard 19" rack. Receivers in the 830 Series supplied initially as rack-mounting units are referred to as 830/RM, 830/1/RM, etc. In rack-mounted installations operating at elevated temperatures it may be an advantage to remove the cabinet to aid ventilation.

If required, either type of cabinet can be attached to shock-absorbent mounts which can be ordered separately by quoting LP2817. Mounts are supplied in pairs complete with all washers and fixing screws and attach to the underside of the cabinet in each case.

Converting a Standard 830/7 to 830/7/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 bench-mounted 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 found most suitable for this operation).
3. Remove the two spacing washers from between the sideplate and panel (store with the cabinet).
4. Slide one of the two angled brackets between the sideplate and the panel and replace the 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 5911/1P and 5912P respectively.

Method of Fitting Shock-Absorbent Mounts

1. Place the receiver upside down.
2. Take the large neoprene washers and place these over the fixing holes in the underside of the cabinet (stepped face uppermost).
3. Lower the channel-shaped mounting brackets onto the washers, keeping the fixing flange towards the outside of the receiver and at the same time making sure that the step on the washers locates with the holes in the brackets.
4. Place the smaller neoprene washers on the inside of the channel and pass the 2BA screws with brass washers through both neoprene washers.
5. Locate screws in hank bushes in cabinet and tighten.
6. Fix channel mounting brackets to bench top with suitable screws.

NB If the brackets are mounted on a metal surface, make sure that they are well bonded to this surface.

EXTERNAL CONNECTIONS

Mains

The AC mains supply is connected to the socket at the rear using the connector provided with the receiver. The earthing wiper on the side of the connector should be wired to the earth pin of the supply plug (green wire).

The receiver leaves the factory with the power transformer set for 240V AC operation. If other supply voltages are to be used, the tapings on the power transformer must be changed as indicated in the Table below. This must be done before the receiver is connected to the supply. Under no circumstances should the receiver be connected to a DC supply.

Voltage	Strap	Input to	Voltage	Strap	Input to
100V	C & D E & H	C & H	200V	D & E	C & H
110V	C & D F & G	C & G	210V	D & F	C & H
115V	A & B E & H	B & H	220V	D & F	C & G
125V	A & B F & G	A & G	230V	A & E	B & H
			240V	A & E	B & G
			250V	A & F	B & G

Shorting Plug

The receiver LT circuits are interrupted at the male socket SKT5 to facilitate operation from external power supplies. These circuits must be completed during normal mains operation by links in a 12-way female connector mating with SKT5. This connector is shown as PL3 on the circuit diagram at the rear of the Manual and is supplied ready-wired with links between connections 1 & 4, 2 & 5, 7 & 10 and 8 & 11.

Ancillary Supplies

If the receiver is operating from the mains, HT and LT supplies are available at PL3 for operating small ancillary units. The available outputs should be limited as follows:-

HT 250V @ 15mA (unsmoothed).

LT 6.3V @ 1.2A (balanced supply with earthed centre-tap).

Connections should be made as follows:-

HT+ pin 9.

HT- pin 12.

LT pins 10 & 11.

External Power Supplies

Provision is made for operating the receiver from externally derived HT and LT supplies when an AC mains supply is not available. The voltages required are 250V @ 160mA for HT and 6V or 6.3V @ 4.9A (approx.) for LT.

The HT can be derived from any convenient source but a transistorised converter is recommended because of its very high efficiency. LT can be taken straight off a 6V accumulator or tapped from a battery of higher voltage.

A 12-way female connector is required to mate with SKT5. If an extended period of operation from external power supplies is envisaged this can be the existing shorting plug provided with the receiver. On the other hand, when the arrangement is for emergency working in the event of mains failure, an extra connector should be obtained. The wiring of the connector is given at PL2 on the circuit diagram at the rear of the Manual and the connections are summarised below:

HT+	..	..	pin 9.	LT+	..	..	pin 4.
HT-	..	..	pin 12.	LT-	..	..	pin 8.

Links must be in position between 4 & 7 and 5 & 8 to combine the two separate LT circuits (LT1 and LT2), while a further link is required between pins 8 & 12 to earth one side of the LT circuit. It should be noted that the LT supply can be operated with a positive earth if this should be found more convenient.

If screened cable is used for the supply leads, the braid can be conveniently earthed at pin 12 of the connector. Heavy gauge wire should be used for the LT connections and both HT and LT supplies should be switched and fused at their source.

Reference to the circuit diagram will show that the external HT is taken via the existing smoothing circuit to supplement the smoothing in the external supply unit. Stabilised HT supplies are available as during normal mains operation.

Aerial

The nominal aerial input impedance is 75 ohms and connection is by means of a co-axial plug which is supplied with the receiver.

The type of aerial system used will obviously depend on the application for which the receiver is required. A dipole aerial fed with 75 ohm coaxial cable can be connected directly at the aerial input socket and will give excellent performance over a wide band centred on the design frequency. Operation of the dipole on its harmonics is also feasible. Coaxial feed without the need for a balun at the aerial end is quite satisfactory, although use of a balun may result in less local noise pick-up on the feeder at frequencies higher than perhaps 20 Mc/s.

When more complex systems, or aerials of random length are used, the feed impedance will most likely be well removed from 75 ohms. Performance under these conditions, although not optimum will in many cases be quite satisfactory and there will be no need to introduce external matching. If however, optimum performance is required, improved results can be obtained with very simple L/C matching circuits. These can be either remotely located at the aerial or situated directly at the receiver input depending on the type of feed employed.

Earth

Although the receiver chassis is grounded as a safety measure by virtue of the "supply earth", the efficiency of this connection may be extremely poor from the point of view of reception. It is recommended therefore that wherever possible a more direct earth is connected to the terminal provided at the rear of the receiver.

A good earth connection will do much to reduce the high level of local noise which can impair reception on the lower frequencies. The earth lead should be kept as short as possible using heavy gauge wire and the outside connection to the earth pin or plate must be well protected against corrosion.

When the receiver is powered from a source which includes an earth leakage trip, a check should be made to see that the operation of this device is not affected by the direct earth connection.

Loudspeaker

An external loudspeaker can be connected to the 12-way male connector PL4 which mates with SKT3 at the rear of the receiver. A standard 2.5/3 ohm speaker is required and this should be wired to connections PL4/7 and PL4/9. PL4/7 is the earthy side of the output which is directly at low impedance to avoid the need for an external transformer. Suitable loudspeaker units in the EDDYSTONE range are covered in Data Sheet No. 123, a copy of which is available on request.

Line Output

A 600 ohm line output is available at PL4/10 and PL4/12 for use when the receiver must be linked to a distant listening position. If necessary, the output can be balanced by connecting the centre-tap of the output winding to earth. This can be done at PL4 by soldering a wire link between connections 7 and 11.

Should an attenuated 600 ohm output be required, this can be arranged by wiring a resistive attenuator inside the plug housing. Connections 2, 5 and 8 are not wired and can be used as anchor points for the components.

To obtain a combined audio output in a dual diversity installation, the Line Output connections should be wired as follows:-

1. Connect a 150 ohm $\frac{1}{2}$ -watt resistor across PL4/10 and PL4/11 of the Control Receiver.
2. Connect a 150 ohm $\frac{1}{2}$ -watt resistor across PL4/11 and PL4/12 of the Slave Receiver.
3. Link PL4/12 of the Control Receiver to PL4/10 of the Slave Receiver and earth this connection to PL4/7 of either receiver if a balanced output is called for.
4. Take output from PL4/11 on both the Control and Slave Receivers.

Diversity AGC

When receivers are operated in diversity it is usual to link their AGC lines together so that the receiver providing the highest signal level will silence the noise output of the other receiver(s).

Provision is made for linking the AGC lines of 830 receivers operating in diversity installations by bringing the AGC out at SKT3. Connection can then be made to the 12-way connector PL4 which mates with SKT3. Screened wire should be used for the interconnecting lead, the inner of which is wired to PL4/3 and the braid to the associated earth at PL4/6.

Muting

When using the receiver in close proximity to an associated transmitter it will be necessary to reduce its gain to prevent overload, feedback etc. while the transmitter is radiating. This can be achieved by incorporating an extra switch or relay contact in the existing send/receive switching system and wiring this to the 12-way connector PL4 which mates with SKT3. The connections are to PL4/1 and PL4/4 (earth) and the external switching should be arranged to close the circuit on "receive" and open on "transmit". In the latter condition an additional resistor is introduced in series with the cathode returns of certain stages, the bias across it being used to effectively mute the receiver.

With this arrangement, monitoring of the outgoing transmission will not be possible and if this facility is required it will be necessary to have some control over the gain reduction obtained in the transmit condition. This can be arranged quite simply by wiring a 50,000 ohm variable resistor in parallel with the external switching. The resistor will function as a combined RF/IF Gain control and will therefore provide a wide variation in the sensitivity.

If the power output and siting of the associated transmitter are such that a voltage greater than 20V appears across the aerial coils, a further relay should be arranged to short down the aerial input and prevent possible damage to the windings.

When the muting facility is not required, PL4/1 and PL4/4 must be linked together with a wire strap to complete the cathode circuits of the RF and IF Stages. If the link is omitted the receiver will be continuously muted.

A small iron-cored inductor (CH2) can be fitted to special order to reduce clicks during keying. Fixing points for CH2 are included as standard so that existing receivers can be modified if required. Spares No. 6461P should be quoted when ordering the choke which is supplied with an instruction sheet giving instructions for fitting.

IF Output

Connection to this output is by means of a standard BNC connector supplied with the receiver. The nominal output impedance is 250 ohms and is suitable for use with terminating impedances in the range 75-300 ohms. The output frequency is 100 kc/s and the maximum bandwidth 6 kc/s at 6dB down. The EP20 Panoramic Display Unit is connected at this point when the receiver forms part of the EPR27 Installation.

Telephones

The output provided for telephone use is suitable for a wide range of impedances so that almost any available pair of telephones will give satisfactory results. If optimum performance is required, telephones of 2000 ohms (total) impedance should be used. An auxiliary contact on the jack socket is arranged to interrupt the loudspeaker output when telephones are in use.

OPERATION

CONTROL FUNCTIONS

Main Tuning

This control is conveniently positioned for ease of operation and will in most cases be used for all general tuning. The main calibration (in kilocycles below 1.5 Mc/s and in megacycles over the range 1.5 - 30 Mc/s), can be read without parallax effect by use of the specially designed cursor.

The drive is flywheel-loaded to allow rapid movement from one end of a range to the other and has a reduction ratio of approximately 140:1 to maintain ease of adjustment even at the highest frequencies where a tuning rate of some 250 kc/s per rev. obtains.

It must be borne in mind that on Ranges 1-6 the receiver operates as a double conversion superhet with a 1st IF that can be tuned over a range 100 kc/s either side of its nominal centre-frequency. When the MAIN TUNING is used alone therefore, it is essential that the INCREMENTAL TUNING is set to the centre of its range or otherwise the main scale calibration will be in error.

Wavechange Switch

Selects the appropriate inductors for the range in use and converts the circuit for double conversion working on Ranges 1-6. Range indication is provided by suitable marking (1-2-3 etc.) on the finger plate concentric with the control knob. This same numbering appears at the left-hand end of the main tuning scales.

Crystal Selector Switch

This is located at the rear of and concentric with the WAVECHANGE SWITCH. It has nine positions which are labelled M - A - B - C - D - E - F - G - H. In the first position (M) the receiver is arranged for normal "Manual" tuning and the Crystal Oscillator is disabled by the switching system. When the switch is moved to any of the other positions, the normal local oscillator is taken out of circuit and one of the eight crystals is brought into operation. Under this condition of operation the MAIN TUNING is used only to align the RF and 1st Mixer circuits on the appropriate signal frequency.

Incremental Tuning

Provides electrical bandspread over a 200 kc/s band centred on any signal frequency in the range 1.5 - 30 Mc/s. The effective tuning rate is constant regardless of the actual signal frequency and the calibration is directly in kilocycles.

Calibration appears in red when the tune frequency is higher than that indicated on the main scale and black when the frequency is lower. The INCREMENTAL TUNING must be set to the centre of its range when the MAIN TUNING is used alone. Failure to observe this rule will result in errors in the main scale readings.

Peak RF Control

This provides a means of correcting the misalignment of the bandpass input and 1st Mixer circuits which occurs when the 1st IF is detuned from its nominal frequency by the INCREMENTAL CONTROL. The control operates three ganged-capacitors which are in parallel with the signal frequency sections of the main tuning gang. The maximum capacity of this additional tuning gang has been kept as low as possible to avoid too sharp a tuning characteristic on Range 1. Full correction can be achieved at all frequencies on Ranges 1-4, above 3 Mc/s on Range 5 and above 2 Mc/s on Range 6.

Gain Controls

Three totally independent gain controls are provided as follows:-

RF GAIN	. . . .	varies the bias on the RF Amplifier V1.
IF GAIN	. . . .	varies the bias on the 1st 100 kc/s IF Amplifier V5.
AF GAIN	. . . .	controls the output from the appropriate detector.

The RF and IF GAIN CONTROLS are operated by means of concentric control knobs; the outside knob (with red index) is the RF GAIN.

Signal Mode Switch

The SIGNAL MODE SWITCH is a four-position control which carries out all circuit changes required for the various modes of reception. The four positions are marked:-

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

In addition to selecting output from the appropriate detector etc. the SIGNAL MODE SWITCH also modifies the AGC arrangements when set to either of the "SSB" positions. Under this condition of operation the delay is reduced to secure better AGC action and the discharge time constant is lengthened to approximately 10 seconds.

BFO Pitch

This control is operative in both the "CW" and "SSB" positions of the SIGNAL MODE SWITCH. At "CW" it provides a swing of approximately ± 3 kc/s and functions as a normal "pitch adjustor", while at "SSB" the control swing is reduced to some 100 c/s on either side of the pre-set carrier insertion frequency. Thus "fine" control of the carrier insertion frequency is available to simplify final tuning adjustment in SSB reception.

Selectivity

The SELECTIVITY CONTROL provides continuously variable adjustment by physical movement of the 100 kc/s IF coils. The control arc is marked "AM" - "SSB" - "CW" so that the bandwidth can be set rapidly to suit the received signal. A click-stop is provided for accurate selection of the correct bandwidth required for "SSB". The extreme "CW" position is marked "N" (narrow) and when the control is set to this mark, the 100 kc/s crystal filter is automatically brought into circuit. A second click-stop ensures positive selection of the 1.3 kc/s "CW" bandwidth.

AGC/Noise Limiter Switch

Combined AGC and Noise Limiter switching is provided by a 3-position switch.

Position 1	AGC : ON,	NL : OFF.
Position 2	AGC : OFF,	NL : OFF.
Position 3	AGC : ON,	NL : ON.

The AGC time constant is fixed for AM/CW reception and is increased by the SIGNAL MODE SWITCH when this is set to "SSB".

The Noise Limiter is only operative when the SIGNAL MODE SWITCH is at "AM". On "CW" and "SSB" a high degree of limiting is inherent with the type of detection employed.

Calibrator Switch

This is a double-pole switch with one "make" and one "break" contact biased to the "off" position. On pressing the toggle, HT is applied to the Calibrator Unit and at the same time the gain of the RF Stage is drastically reduced to limit interference from outside signals.

Crystal controlled markers are available at all 100 kc/s points throughout the entire tuning range of the receiver and also at the 50 kc/s points on the incremental scale. Calibration will normally be carried out with the SIGNAL MODE SWITCH in the AM position, this being possible because the fundamental crystal frequency coincides with the 2nd IF (100 kc/s).

Cursor Adjustor

This is a small knurled control located above the dial aperture. It provides limited lateral movement of the cursor (independently of the MAIN TUNING CONTROL) to allow correction of scale errors when calibrating.

Mains Switch

A double-pole switch which breaks both live and neutral poles of the mains supply to the receiver. The switch performs no function when the receiver is powered from external HT and LT supplies.

Meter Zero

This control is located at the rear of the receiver and provides a means of adjusting the meter needle to zero before making comparative checks on carrier level.

Telephone Output

The telephone output socket is located at the right-hand side of the finger plate and accepts a standard Post Office type telephone plug.

The output impedance is 2000 ohms but the circuit arrangement is such that other impedances can be used quite satisfactorily.

TUNING INSTRUCTIONS

Manual Tuning

1. Set the following controls as indicated:-

CRYSTAL SELECTOR SWITCH	. .	Manual (M).
SIGNAL MODE SWITCH	. . . .	AM - <u>BFO is not required for calibration check.</u>
RF GAIN CONTROL	. . . .	Any setting.
IF GAIN CONTROL	. . . .	Reduce as necessary to prevent detector overload when making the calibration check as described below.
AF GAIN CONTROL	. . . .	Approximately half of maximum setting.
INCREMENTAL TUNING	. . . .	To centre of range ("0"). This step is not required if operation is to be on Ranges 7, 8 or 9.
SELECTIVITY	. . . .	CW.
AGC/NL SWITCH	. . . .	Off (centre position).
PEAK RF CONTROL	. . . .	Index at 12 o'clock.

2. Select the appropriate range with the WAVECHANGE SWITCH and tune to the nearest crystal check point to the required working frequency (MAIN TUNING CONTROL).

NOTE Crystal check points occur at 100 kc/s intervals, e.g. the following frequencies are check points on Range 9 : 300, 400 and 500 kc/s. On Range 6 : 1.5, 1.6, 1.7, 1.8, 1.9 Mc/s etc., etc.

3. Carry out a calibration check by following the instructions given below:-

- (a) Depress the CALIBRATOR SWITCH and tune in the appropriate marker signal with the MAIN TUNING CONTROL.
- (b) Adjust the MAIN TUNING CONTROL until the marker signal is at zero-beat. Do not disturb the setting of this control while continuing as follows:
- (c) Rotate the CURSOR ADJUSTOR to position the cursor coincident with the correct calibration mark on the main scale.
- (d) Release the CALIBRATOR SWITCH and tune with the MAIN TUNING CONTROL to the required working frequency.

NOTE The calibration check can be carried out in the CW mode but the BFO PITCH ADJUSTOR must then be set to the centre of its range. Calibration should not be attempted in the SSB positions of the SIGNAL MODE SWITCH.

4. The receiver is now ready for use. Any re-adjustment of the control settings should be carried out to suit the mode of reception and the conditions prevailing. Further instructions are given later in this Section on the methods to be adopted in tuning SSB signals etc.

Incremental Tuning

The advantages offered by this facility when using "Manual" control in conjunction with the Crystal Calibrator are that (a) frequencies can be set accurately to within one kilocycle, and (b) a constant tuning rate is available at all frequencies within the range 1.5 - 30 Mc/s.

The incremental scale is marked at one kilocycle intervals and has calibration figures every 10 kc/s. Two-colour printing is used to indicate whether the effective tune frequency is higher or lower than that indicated on the main scale. The calibration figures run in the following sequence with those underlined appearing in RED and the others in BLACK. (See top of following page.)

Calibration in RED indicates that the receiver is tuned to a frequency higher than that given by the cursor, while BLACK figures show a lower frequency.

The INCREMENTAL TUNING CONTROL will provide coverage of a 200 kc/s band centred on any frequency in the range 1.5-30 Mc/s. It is suggested however that the "band-centre-frequency" should always be chosen as a crystal check point since this makes initial adjustment easier and furthermore allows frequencies to be read off much more readily than if the centre frequency is a random figure.

Take as an example a receiver tuned to a "band-centre-frequency" of 2.7 Mc/s. The incremental coverage in this case will be the band 2.6-2.8 Mc/s and from the notes given previously it is immediately obvious that if the incremental reading is in BLACK the effective tune frequency must lie in the range 2.6-2.7 Mc/s. The effective tune frequency lies in the range 2.7 - 2.8 Mc/s if the calibration appears in RED.

Calculation of the actual tune frequency at any setting of the incremental control is quite straightforward. If the reading appears in RED it is merely added to the "band-centre-frequency". A BLACK reading is subtracted. Assuming the "band-centre-frequency" to be 2700 kc/s, a reading of "24 BLACK" represents a tune frequency of 2676 kc/s. "94 RED" indicates 2794 kc/s.

When using crystal control of the 1st Local Oscillator, the incremental calibration will be reversed if the injection frequency is chosen below the signal frequency. In this case only, RED readings must be subtracted, black ones added.

As mentioned previously the incremental facility will give coverage of a 200 kc/s range centred on any frequency. A special case which requires consideration is when setting up for coverage of a range, the end frequencies of which fall exactly half way between adjacent crystal check points on the main scale. The band 2650-2850 kc/s is an example in this category.

As in the previous case, the cursor setting must always be to the "band-centre-frequency" which in this example is 2750 kc/s. If the main scale is first calibrated against the crystal marker on 2700 kc/s (with the incremental scale set to "0"), then it will be possible to set the main scale to 2750 kc/s with a fair degree of accuracy by visual interpolation. Re-setting the incremental scale to "50 BLACK" will now give an approximate tune frequency of 2700 kc/s.

Switching on the Calibrator at this stage results in two harmonics of the crystal being heard simultaneously. One is the harmonic at 2700 kc/s and the other is one of the two harmonics which fall within the range of the tunable IF (actually the one at 1400 kc/s).

The IF harmonic can be identified quite easily by de-tuning the MAIN TUNING CONTROL to eliminate the 2700 kc/s marker. It should be appreciated that the appearance of the harmonic at 1400 kc/s is inherent in the design of the receiver and though put to good use in crystal controlled operation (see later) there is no intention that this marker (or the one at 1300 kc/s) should be used during normal working except in as much that they allow a rapid check on the accuracy of the 2nd Local Oscillator alignment. This example is dealt with here only to preclude the possibility of confusion which may arise due to non-familiarity with the equipment. If this situation is encountered in normal operation, set the incremental scale visually to the 50 kc/s mark and ignore the IF marker signal. Any slight error is eliminated when the 2700 kc/s marker signal is adjusted to zero beat with the MAIN TUNING CONTROL.

Peak RF Control

When using the incremental facility as described on the previous page, the MAIN TUNING CONTROL is pre-set to provide a fixed injection frequency to the 1st Mixer Stage. As a result, any off-tuning with the INCREMENTAL TUNING CONTROL will cause misalignment of the signal frequency circuits. These however can be tuned independently by the PEAK RF CONTROL and should always be adjusted for maximum signal in much the same way as when setting the "aerial trimmer" on the other communication receivers.

The value of the "peak-RF" capacitors has been kept as low as possible to avoid too sharp a tuning characteristic on Range 1. Full correction can be achieved at all frequencies on Ranges 1-4, above 3 Mc/s on Range 5 and above 2 Mc/s on Range 6.

On Ranges 7, 8 and 9, the "peak-RF" capacitors remain in circuit and should be set for maximum signal in the usual way.

Crystal Controlled Operation

Receivers in the 830 Series can be operated with either or both Local Oscillators crystal controlled for high stability multi-channel working on frequencies above 1.5 Mc/s.

Crystal control of the 2nd Local Oscillator results in loss of the incremental facility and would normally be contemplated only in the case of an unattended installation operating with full crystal control.

In this case, a standard Style "D" crystal suitable for series mode operation whose frequency falls in the range 1150-1350 kc/s can be fitted in the holder provided. Access to this is by removal of the top cover from the screening box which houses the second conversion stages. The holder is normally shorted by a wire link and this must be unsoldered and removed for crystal operation. It must be replaced should "Manual" operation be required at a later date.

In the unlikely event of the 2nd Local Oscillator being controlled alone, the crystal frequency should be chosen as 1250 kc/s so that the 1st IF lies at the centre of its range (1350 kc/s) to ensure correct calibration of the main scale. With full crystal control this is of no consequence and the 1st IF can be controlled anywhere in its 200 kc/s range.

The Table given below shows the appropriate settings of the incremental scale for various crystal frequencies. The scale must be set as indicated to ensure correct operation of the crystal and also to align the tunable IF circuits to the appropriate channel. The 1st IF is included in the Table as a reminder that this frequency increases for a decrease in effective tune frequency and also for reference when considering crystal control of the 1st Local Oscillator Stage. Slight pulling of the 2nd Oscillator crystal is possible by fine adjustment of the INCREMENTAL TUNING.

Crystal Freq.	Inc. Setting	1st IF
1150 kc/s	100 RED	1250 kc/s
1175 kc/s	75 RED	1275 kc/s
1200 kc/s	50 RED	1300 kc/s
1225 kc/s	25 RED	1325 kc/s
1250 kc/s	0	1350 kc/s
1275 kc/s	25 BLACK	1375 kc/s
1300 kc/s	50 BLACK	1400 kc/s
1325 kc/s	75 BLACK	1425 kc/s
1350 kc/s	100 BLACK	1450 kc/s

The 1st Local Oscillator can be crystal controlled for reception on any frequency above 1.5 Mc/s. At frequencies above 3 Mc/s the injection frequency can be either above or below the signal but below 3 Mc/s the oscillator must be operated on the high side. This is to allow the use of standard crystals and also to avoid placing the oscillator frequency within the coverage of the tunable IF. Crystals are standard Style "D" units for parallel mode working and the injection frequency (except for frequencies in the range 1.5 - 3 Mc/s) is calculated as follows :-

$$\text{INJECTION FREQUENCY} = \text{SIGNAL FREQUENCY} \pm \text{1ST INTERMEDIATE FREQUENCY}$$

Either the fundamental crystal frequency or its 2nd or 3rd harmonic can be used to furnish the injection frequency so that high frequency operation is obtainable with crystals of relatively low frequency.

If the receiver is to be operated with the 2nd Oscillator also crystal controlled, the 1st Intermediate Frequency to be substituted in the formula above is equal to the 2nd Oscillator crystal frequency plus 100 kc/s. (Refer to Table on previous page.)

In most cases the 2nd Oscillator will not be locked with a crystal and this makes the choice of 1st Oscillator crystal much more flexible because the 1st IF can be set to any frequency in the range 1250-1450 kc/s by use of the INCREMENTAL TUNING CONTROL. The method of calculating all possible frequencies which the crystal could have to control a specific signal channel is illustrated in the example below:

EXAMPLE

Determine the range of crystal frequencies which could be used to control a signal frequency of 7025 kc/s.

- (a) The signal channel is higher than 3 Mc/s so there is no restriction on which side the injection frequency must lie.
- (b) First determine the "nominal" injection frequencies. These are the frequencies which will result in a 1st IF of 1350 kc/s, i.e. the nominal 1st IF.

Nominal injection frequencies in this case are:

$$7025 + 1350 = \underline{8375 \text{ kc/s}} \quad \text{and} \quad 7025 - 1350 = \underline{5675 \text{ kc/s}}$$

- (c) The 1st IF coverage extends 100 kc/s to either side of the nominal value so that the injection frequency could lie anywhere in the range 100 kc/s above and below the nominal frequencies determined above.

The range of possible injection frequencies is therefore as follows:

$$(8375 - 100) \text{ to } (8375 + 100) = \underline{8275 \text{ to } 8475 \text{ kc/s.}} \quad (\text{Oscillator "high"})$$

$$(5675 - 100) \text{ to } (5675 + 100) = \underline{5575 \text{ to } 5775 \text{ kc/s.}} \quad (\text{Oscillator "low"})$$

- (d) Assume that a crystal is available for 8350 kc/s. This frequency falls within the "high" range determined above and is 25 kc/s below the nominal value of 8375 kc/s.

Next, determine the incremental setting that will give an effective tune frequency of 7025 kc/s. The setting depends on the actual 1st IF and this is obtained from the formula:

$$\text{1ST INTERMEDIATE FREQUENCY} = \text{INJECTION FREQUENCY} - \text{SIGNAL FREQUENCY}$$

Substituting values:

$$\text{1st IF} = 8350 - 7025 = \underline{1325 \text{ kc/s.}}$$

Reference to the Table on the previous page gives the incremental setting as "25" in the RED sector of the scale.

- (e) In the previous paragraph, operation was considered with injection on the "high" side of the signal. When a "low" injection frequency is chosen, the procedure must be modified as follows:

The formula for determining the 1st IF becomes:

$$\text{1ST INTERMEDIATE FREQUENCY} = \\ \text{SIGNAL FREQUENCY} - \text{INJECTION FREQUENCY}$$

Substituting values on the assumption that a crystal is available for a frequency of 5625 kc/s:

$$\text{1st IF} = 7025 - 5625 = \underline{1400 \text{ kc/s.}}$$

Reference to the Table gives an incremental setting of 50 BLACK and this reveals one important change which occurs when the 1st Oscillator is placed on the "low" side of the signal.

In the previous case (with injection "high") a crystal of frequency lower than the nominal injection frequency was used and the approximate incremental setting lay in the RED sector. In the second example (injection "low"), the crystal chosen was again lower than the nominal value but in this case the incremental setting fell in the BLACK sector.

It is most important that the reason for this is clearly understood and the reader is referred to the worked example which appears on page 8.

The incremental scale is calibrated on the assumption that the 1st Local Oscillator is on the high side of the signal with the result that if a low injection frequency is used then the RED portion of the scale which normally indicates a higher tune frequency actually indicates a lower frequency.

When the receiver is operated with "Manual" control, any small error which may be present in the incremental calibration is automatically corrected when the 1st Local Oscillator is adjusted to correct the main scale calibration. With crystal control of the 1st Oscillator, this automatic correction is not available and it is therefore necessary to determine the incremental scale accuracy by reference to either of the two crystal check points which are available for this purpose. These occur at "50 RED" and "50 BLACK" and, as with calibration of the main scale, any check should be made at the nearest checkpoint to the required setting.

Continuing one of the examples given previously - a setting of "25 RED" was called for and the calibration check would therefore be made at "50 RED". To do this, bring the Calibrator into operation and tune to zero-beat with the crystal harmonic. Note the reading on the incremental scale. Assuming in this case that this is say 51.5, then the incremental scale reading is 1.5 kc/s low and a positive correction must be applied to "25 RED" making it "26.5 RED".

Note that this correction is unaffected by the position of the 1st Oscillator frequency (i. e. whether "high" or "low").

As mentioned previously, detuning the 1st IF from its nominal frequency results in misalignment of the signal frequency circuits. With the 1st Oscillator crystal controlled, the necessary correction can be achieved either by use of the PEAK RF CONTROL or the MAIN TUNING CONTROL since the latter does not in this case have to be set to determine the oscillator frequency. This arrangement allows full correction at all frequencies in the range.

Crystals are installed in a holder assembly which is located at the rear of the front panel to the right of the main tuning gang when the receiver is viewed from the rear with the cover removed.

The eight holders are labelled "A - B - C - etc. " to correspond with the markings of the CRYSTAL SELECTOR SWITCH and it is suggested that a small card is made up to indicate the signal frequency obtaining in each position of the switch. The card can be attached to the equipment for the convenience of the operator and can take the form outlined below:

Position	Signal Freq. kc/s	Incremental Setting	Crystal kc/s
A	7025 kc/s	25 RED	8350 kc/s
B			
C etc.			

AM and CW Reception

Tuning procedures for AM and CW reception are strictly conventional and call for little comment except perhaps to point out that the noise limiter is operative only in the AM position of the SIGNAL MODE SWITCH. The type of detector used for CW/SSB reception has inherent pulse suppression properties and a separate limiter is therefore only required for AM reception. It follows then that with the SIGNAL MODE SWITCH at CW (or SSB), the combined AGC/NL SWITCH is effectively an AGC SWITCH only, moving the control in either direction from the centre position having no effect other than bringing the AGC into operation.

SSB Reception

Several useful features are incorporated in the receiver to simplify the tuning procedure for SSB reception. The SIGNAL MODE SWITCH for example has two SSB positions to eliminate the need for initial "coarse" adjustment of the carrier re-insertion frequency. Selecting either SSB position (marked "UPPER" and "LOWER") automatically places the re-inserted carrier frequency in approximately the right position relative to the centre frequency of the 2nd IF channel. "Fine" adjustment of this initial setting is provided by the BFO PITCH ADJUSTOR which, although having a swing of ± 3 kc/s when the SIGNAL MODE SWITCH is at CW, has a much restricted swing of the order ± 100 c/s when either SSB position is selected.

Before attempting to tune an SSB signal, first make sure that the SELECTIVITY CONTROL is set to SSB. A click-stop is provided to ensure that the correct bandwidth is selected accurately and once set the control should not be disturbed.

During the initial tuning adjustments, the RF and AF GAIN CONTROLS are fully advanced and adjustment of the signal level is by means of the IF GAIN. An adequate range of control adjustment will be found on all but extremely strong signals when the control range of the IF GAIN can be supplemented by adjustment of the RF GAIN. (Once the signal has been properly resolved, the IF GAIN should be fully advanced to secure maximum AGC action and control of the output level will then be with the AF GAIN).

Initial tuning of SSB signals is most conveniently carried out with the SIGNAL MODE SWITCH in the AM position since this permits using the built-in carrier level meter as an indication of correct tuning. This cannot be done at SSB because the AGC discharge time constant is then increased considerably and the meter action is therefore extremely sluggish. In the AM position where the AGC time constant is relatively fast, the meter indication is good except on the weaker signals. This is no real disadvantage because experience shows that weak signals can be tuned quite satisfactorily by ear.

The rapid fluctuation of the meter needle due to the speech or tone on the signal and the unnatural sound of the "garbled" output may cause some confusion at first but this will be rapidly overcome and the ability to tune signals with the required degree of accuracy will quickly develop.

The object is to tune the receiver so that the signal lies in the centre of the IF passband and so falls within the range of the BFO PITCH ADJUSTOR. Once this has been done, the SIGNAL MODE SWITCH is moved from the AM position to SSB UPPER and then to SSB LOWER. Note the position which gives the greatest intelligibility and leave the switch in that position. (If the transmitted sideband is known beforehand, there will be no need to make this check and the switch can be set to the appropriate position straightaway.) Adjusting the BFO PITCH ADJUSTOR in its role as a "fine" tuning control will now allow the signal to be completely resolved to give natural sounding speech.

Carrier Level Meter

The built-in meter serves a dual purpose in that it can be used either as a tuning indicator or as a means of comparing the relative strength of received signals. A pre-set METER ZERO CONTROL is provided at the rear of the receiver and this should be set correctly before using the meter. To adjust this control, proceed as follows:

1. Bring the AGC into operation and set the RF and IF GAIN CONTROLS at maximum.
2. Disconnect the aerial feeder and terminate the aerial socket with a non-inductive 75 ohm resistor.
3. Adjust the METER ZERO CONTROL so that the meter needle takes up a position which is coincident with the "0" mark at the left-hand side of the meter scale.
4. Re-connect the aerial feeder.

The meter reading will be affected by the RF and IF GAIN CONTROL settings and these should not be disturbed while making comparative checks. AGC must be operative to allow use of the meter and any random movement of the meter needle which may occur when the AGC is OFF should be disregarded since it is due entirely to overload of the receiver when tuned to the stronger signals.

MAINTENANCE

GENERAL

Receivers in the 830 Series are suitable for continuous operation in all areas under extreme climatic conditions and should require very little in the way of maintenance over long periods of use. Normal routine maintenance schedules can be drawn up but these should be restricted to such things as "cleaning the exterior", "checking the serviceability of external connections", "checking that full error correction is possible by use of the cursor adjustor", etc.

The geared drive systems and other mechanical arrangements will not normally require attention because initial lubrication during manufacture is carried out with a permanent lubricant (molybdenum disulphide). If additional lubrication should become necessary after the equipment has been in use for a prolonged period of time, this can be carried out with any light mineral oil suitable for the temperature conditions under which the receiver is operated. The lubricant should be applied very sparingly.

NB Receivers can be returned to the Manufacturer for advanced servicing should this become necessary. Prior arrangements should be made before despatching receivers and enquiries should be directed to the "Sales & Service Dept" at our usual address.

Dial Lamp Replacement

Faulty dial bulbs can be changed quite simply after removal of the cabinet. To free a holder from the support strip, merely squeeze its two sides together and pull away from the strip. The bulbs are standard bayonet types with a rating of 6.5V @ 0.3A. - #44

Fuse Replacement

The mains input fuse is located at the rear of the receiver and is readily accessible for replacement in the event of failure. Replacement fuses should be rated at 1.5 Amps and be of the thermal-storage delay type with overall dimensions $1\frac{1}{4}" \times \frac{1}{4}"$.

Valve Replacement

All valves except three are immediately accessible for replacement on removal of the cabinet. The majority are fitted with screening cans and care should be taken to replace these after fitting a new valve.

The three valves which are not immediately accessible are V3, V4 and V13. The first two are located inside the screening box at the right-hand side of the set. The cover can be removed after taking out four retaining screws. V13 (CW/SSB Detector) is also housed in a screened enclosure, this being located towards the rear of the IF/AF chassis at the left-hand side of the gang cover. All three valves are fitted with spring retainers which must be replaced after changing a valve.

Standard CV valve types are used throughout and no difficulty should be experienced in obtaining replacements. Direct equivalents can be used where necessary and any valve can be changed without necessitating re-alignment of the tuned circuits.

Cursor Drive Wire Replacement

In the unlikely event of the drive wire either breaking or slipping out of the pulley grooves, replacement will be much simplified (even when the wire is undamaged) if a new length is obtained. This can be made longer than the length actually needed (this being approximately 4 feet) and will therefore be easier to handle. Fitting a new wire is quite straightforward and will present no difficulties if the instructions given below are followed carefully, step by step.

NB In these instructions, left-hand and right-hand are as viewed from the rear of the receiver.

1. Take off the cabinet.
2. Remove the old drive wire by slackening the 8BA screws in the two drive pulleys and unsoldering from the cursor carrier.
3. Rotate the cursor adjustor in an anti-clockwise direction until its end stop is reached. This corresponds to maximum cursor movement towards the high frequency end of the scale and the adjustor should be left at this setting.
4. Rotate the main tuning control in an anti-clockwise direction until the tuning gang is fully meshed.
5. Attach one end of the new drive wire to the 8BA screw in the left-hand drive pulley. (The screw should be at approximately 2 o'clock).
6. 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.
7. Pass wire round jockey pulley and across main dial between cursor guide rods, passing under cursor carrier.

8. Hold the free end of the wire and rotate the main tuning control in a clockwise direction so that three complete turns are wound onto the left-hand drive pulley. The wire must be held in tension while winding and rotation of the tuning control should continue until the gang is fully un-meshed.
9. Pass the wire clockwise over the right-hand guide pulley and then downwards and under the cursor shift pulley. Maintain tension to prevent wire slipping off drive pulley.
10. Run the wire under the meter and across towards the right-hand drive pulley.
11. Lay the wire in the second groove from the edge of the pulley which is closest to the rear of the receiver. Feed the wire along the groove and through the pulley slot which should lie at about 10 o'clock.
12. Apply sufficient tension to the free end of the wire to cause the jockey pulley to take up a position roughly $1/8$ " from the cursor guide rod support bracket. Secure the wire to the 8BA screw and cut off the surplus wire.
13. Slide the cursor carrier along the guide rod to the high frequency end of the dial. Set the cursor adjustor to mid-travel and then carefully line up the cursor with the extreme ends of the horizontal scale lines. Solder the cursor carrier to the drive wire.
14. Check the drive for free and normal operation and rotate the cursor adjustor to ensure that it provides an independent lateral movement of just under $1/4$ ".
15. Check the scale accuracy against the internal crystal calibrator.

Cleaning the Scale and Scale Window

1. Take off the cabinet.
2. Remove the small side castings at the extremities of the glass window. These are held in place by hexagon-headed screws which are accessible through small rectangular cut-outs near the leading edge of the side-plates. The screws are captive and a standard 4BA spanner is required for removal.
3. Remove the three dial lamp holders from their support strip. These are clipped into position and are easily disengaged from the fixing slots by squeezing together the two sides of the holder.
4. Slacken the four countersunk screws along the top edge of the panel and slide back the long dial lamp strip.
5. This strip also serves to support the top edge of the dial glass which can now be removed by lifting up and tilting back slightly.
6. The dial glass can be cleaned with one of the many domestic products which are available for this purpose. The scale can be cleaned if necessary by rubbing gently with a soft lint-free cloth which has been moistened slightly in warm water. Any surplus moisture should be removed with a dry cloth before replacing the dial glass.

RE-ALIGNMENT

General

In the unlikely event of a complete re-alignment being required, the instructions given on the following pages should be followed step by step in full. In the more usual case of partial re-alignment required to compensate for ageing components etc., the relevant instructions can be extracted as required. It must be stressed that alignment adjustments should not be tampered with unless there is a clear indication that alignment is in fact required, and furthermore adjustments should only be carried out by fully skilled technicians equipped with suitable test instruments.

NB All dust cores are self-locking (rubber string and silicone core-retaining compound) so that there is no need to use wax etc. for sealing purposes. The concentric trimmers likewise are also self-locking.

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 10-75 ohms and with provision for modulation at 400 c/s.

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

Output Meter matched to 2.5/3 ohms.

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

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

WAVECHANGE	..	Range 9.	IF GAIN	..	Maximum.
SELECTIVITY	..	N (Crystal).	AGC/NL	..	Off.
MODE	..	AM.	CRYSTAL		
			SELECTOR	..	Any <u>vacant</u> crystal posn.

Check that a shorting link is in position between PL4/1 and PL4/4.

Remove the gang cover (complete with Calibrator Unit) and connect the output lead from the signal generator to the stator of the Mixer section of the main tuning gang. The valve voltmeter should be connected to the IF Output socket (SKT2). If a valve voltmeter is not available, the built-in carrier level meter can be used (AGC must then be ON) but the indication obtained will be inferior to that obtained with the instrument specified.

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 pass-band. At the point where the generator output frequency coincides with that of the filter crystal, a sharp rise in output reading will be obtained. The generator should be set accurately to this peak and the attenuator adjusted to give an output reading of approximately 500mV as indicated by the valve voltmeter. (Note: SKT2 is unterminated).

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.

Once the transformers have been accurately aligned to the centre-frequency, increase the output from the generator and de-tune it by equal amounts above and below the centre frequency to determine by observation of the output reading whether the response is symmetrical or not. Any loss of symmetry is likely to be slight and it is doubtful whether the rejection notch due to the filter crystal would be visible. If the response is asymmetrical it can easily be corrected by slight re-adjustment of the pre-set crystal phasing capacitor. 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 this adjustment, the initial setting of the phasing capacitor 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, the capacitor 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 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 is found to be a little assymmetrical, re-adjust T2 slightly to give a flatter response. The change in core position 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 but with the output modulated to a depth of 30% at 400 c/s. If an external loud-speaker has been connected this should be removed and the output meter (matched to 2.5/3 ohm) wired in its place, i.e. to PL4/7 and PL4/9. Set the Selectivity Control to the CW position and the AF Gain to maximum and then tune the generator for maximum reading on the meter, adjusting the output to 50mW by means of the attenuator. A sensitivity of the order 6uV should be obtained.

Should the sensitivity appear low, 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 in the CW position.

Generator applied at grid of V5	. . . . .	100uV for 50mW output.
Generator applied at grid of V6	. . . . .	8mV for 50mW output.

If after changing valves, making voltage checks etc., the sensitivity is still low from the grid of V6, make a check on the AF sensitivity. At 1000 c/s with an audio generator connected directly across the AF Gain Control (RV4) this should give a figure of the order 28mV for 50mW output.

Re-alignment of the BFO

Test Equipment	Signal Generator covering the IF of 100 kc/s. Valve Voltmeter.
.....	Insulated screwdriver type trimming tool.

The signal generator and valve voltmeter are connected and the receiver controls adjusted exactly as specified initially in the notes on IF alignment. Allow half an hour for the equipment to reach operating temperature.

Tune the generator accurately to the crystal peak using the valve voltmeter as an indication of correct tuning. Set the BFO Pitch Adjustor so that the white index on the control knob is at 12 o'clock and verify that this setting coincides with the mid-travel position of the tuning capacitor.

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, L38 should be adjusted slightly and the check then repeated again. Repeat the adjustment of L38 as required until identical beats are obtained. (L38 is accessible when the bottom cover is removed from the CW/SSB Detector Unit.) Once the two beats have been "equalised", select each SSB position in turn and check that the BFO Pitch Adjustor provides a swing of approximately ± 100 c/s.

Re-set the BFO Pitch Adjustor to mid-travel and select the CW position of the Mode Switch. This should give the zero-beat condition and the complete tuning swing should now be checked to ensure that the tuning rate on either side of zero-beat is substantially constant. If zero-beat is not obtained at the mid-travel position, 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 L38 will upset the adjustments already made in the two SSB positions.

This course of action is unlikely to be required since the capacitor vanes have been set very accurately during the initial factory alignment.

Re-alignment of the 2nd Mixer Unit

Test Equipment Standard Signal Generator modulated 30% at 400 c/s having an output impedance in the range 10-75 ohms and covering the frequency band 1250-1450 kc/s.

Crystal controlled harmonic generator providing 100 kc/s and 10 kc/s marker signals in the band 1250-1450 kc/s.

Output Meter matched to 2.5/3 ohms.

Trimming Tools (1) Neosid H.S. 1.
(2) Insulated screwdriver.
(3) Mullard TCT01.

First check the accuracy of the incremental scale calibration by feeding the output of the harmonic generator to the grid of the 1st Mixer Stage (i.e. to the stator of the Mixer section of the main tuning gang). The receiver controls should be set as indicated below and a period of at least half an hour should be allowed for the equipment to reach normal operating temperature.

WAVECHANGE	..	Range 6.	BFO PITCH	..	Index at 12 o'clock.
SELECTIVITY	..	CW.	AGC/NL	..	Off.
MODE	..	CW.	CRYSTAL		
IF/AF GAINS	..	Adjust as necessary to give suitable o/p.	SELECTOR	..	To any vacant crystal position.

With the harmonic generator arranged to provide 100 kc/s markers, tune in turn to the two 50 kc/s calibration points on the incremental scale. These correspond to 1st intermediate frequencies of 1300 kc/s in the red sector and 1400 kc/s in the black sector. Determine what error exists and then introduce the 10 kc/s markers to check the accuracy at the centre and extreme ends of the range. If on completion of this check the scale is found to be accurate to within one kilocycle, re-alignment of the 2nd Oscillator will not be required; if otherwise, proceed as follows:-

Remove the cover plate from the side of the 2nd Mixer Unit to reveal the alignment plate which is retained beneath it. The alignment plate has holes to allow access to L36/C168 and should be replaced using two of the screws just removed to hold it temporarily in position while adjustments are carried out.

The alignment points to be used are 10 kc/s in from the extreme ends of the incremental range and will be referred to as the "red alignment point" and the "black alignment point". The frequencies which correspond with these settings are 1260 kc/s and 1440 kc/s respectively, and the generator is therefore arranged to provide 10 kc/s markers.

Set the incremental scale to the "black alignment point" and tune to zero beat with the marker signal at 1440 kc/s by adjustment of the concentric trimmer C168. Now tune to the "red alignment point" and adjust the core in L36 for zero-beat against the marker on 1260 kc/s. Return to the "black alignment point", repeat the adjustment of C168 and then make alternate adjustments to L36 and C168 until both alignment points are correct.

Now check each of the 10 kc/s points throughout the range of the incremental scale to determine the overall accuracy. If any point should be in error by more than one kilocycle, the rotor plates of C169 can be adjusted to effect a correction but it is extremely unlikely that this treatment would be required.

On completion of the adjustments just described, disconnect the harmonic generator and connect the signal generator in its place preparatory to alignment of the tunable IF transformer L34/L35. An output meter should be wired to PL4/7 and PL4/9 and the receiver control settings should be adjusted as indicated on the following page.

SIGNAL MODE SWITCH . .	AM.	AF GAIN CONTROL . .	To any convenient
SELECTIVITY CONTROL . .	CW.		level but to maximum
IF GAIN CONTROL . .	Maximum.		when checking sensitivity.

Tune the generator to 1440 kc/s (modulation 30% at 400 c/s and attenuator at approximately 10uV setting) and set the incremental scale to the "black alignment point". Adjust C72 and C77 for maximum output and then retune the generator to 1260 kc/s. Set the incremental scale at the "red alignment point" and trim the cores in L34/L35. Repeat these adjustments as necessary until correct alignment is obtained.

A check on the sensitivity (generator at 1350 kc/s, incremental scale to "0") should give a figure of the order 1uV for an output of 50mW with the loudspeaker disconnected.

Re-alignment of the RF Section

Test Equipment	Standard Signal Generator modulated 30% at 400 c/s with an output impedance matched to 75 ohms covering the frequencies 300 kc/s-30 Mc/s.
	Crystal controlled harmonic generator providing 1 Mc/s markers up to 30 Mc/s.
	Output Meter matched to 2.5/3 ohms.
	Trimming tools: (1) Neosid H. S. 1.
	(2) Mullard TCT01.
	(3) Insulated screwdriver.

The first step in this part of the alignment procedure is to check the accuracy of the scale calibration to determine whether re-alignment of the 1st Local Oscillator is required. This operation can be carried out by using the built-in 100 kc/s Crystal Calibrator in conjunction with an external generator giving 1 Mc/s markers. The latter will be found invaluable on the higher frequency ranges where there may be some uncertainty as to which 100 kc/s markers fall on the megacycle points. The external calibrator can be conveniently introduced at the aerial socket and the receiver control settings should be as indicated below:

SIGNAL MODE SWITCH . .	AM while using the internal calibrator but to CW when the external calibrator is in use.
RF/IF/AF GAINS	Adjust as necessary to provide suitable output.
SELECTIVITY CONTROL . .	CW.
INCREMENTAL TUNING . .	Set to "0" mark.
CRYSTAL SELECTOR . .	M (Manual).
PEAK RF CONTROL	Index at 12 o'clock.
CALIBRATOR SWITCH . .	ON (except when using 1 Mc/s markers).
CURSOR ADJUSTOR	Mid-travel.
AGC/NL	OFF.

NB All equipment should be allowed at least a half hour warm-up period and both the crystal calibrators should be standardised against a standard frequency transmission before commencing the calibration check.

To prove the scale accuracy, select each range in turn and determine whether or not the correction afforded by the cursor adjustor is sufficient to compensate for any error that may be present. Checks should be made at each 100 kc/s point on Ranges 4-9 and at 1 Mc/s intervals on the other ranges. If alignment is found to be necessary, this should be restricted to the range or ranges which is/are in error. Alignment adjustments should be made at the frequencies listed in the Table which follows. Standard tracking procedure applies, i.e. use trimmers at HF end, cores at LF end. All dust cores are slotted types and should be adjusted with an insulated screwdriver.

The coil box cover must be in place while carrying out alignment.

Range	Frequency	Trimmer	Frequency	Core
1	30.0 Mc/s	C124	18.0 Mc/s	L25
2	18.0 Mc/s	C125	11.2 Mc/s	L26
3	10.8 Mc/s	C126	6.8 Mc/s	L27
4	6.6 Mc/s	C127	4.1 Mc/s	L28
5	4.0 Mc/s	C128	2.55 Mc/s	L29
6	2.45 Mc/s	C129	1.55 Mc/s	L30
7	1480 kc/s	C130	870 kc/s	L31
8	830 kc/s	C131	490 kc/s	L32
9	500 kc/s	C132	300 kc/s	L33

After the scale calibration has been checked and any necessary adjustments have been made to the 1st Oscillator circuits, alignment of the signal frequency circuits can be commenced. Connect the signal generator in place of the 1 Mc/s calibrator and wire the output meter across PL4/7 and PL4/9. The loudspeaker can remain connected as an aural monitor during alignment but must be disconnected when making sensitivity checks. Arrange the generator impedance to match the receiver input (75 ohms), set the modulation to 30% at 400 c/s and then adjust the receiver controls as follows:

RF/IF GAINS	..	..	..	Maximum.
AF GAIN	..	..	..	Any convenient level.
SIGNAL MODE SWITCH	..	..	..	AM.
INCREMENTAL TUNING	..	..	..	Set to "0" mark.
SELECTIVITY CONTROL	..	..	..	SSB.
CRYSTAL SELECTOR	..	..	..	M (Manual).
AGC/NL SWITCH	..	..	..	Off.
PEAK RF CONTROL	..	..	..	Index at 12 o'clock. (Check that this corresponds to the half-capacity setting of the "peak-RF" capacitors).

Alignment adjustments should be made at the frequencies given in the Table below, each adjustment being repeated at least twice to ensure accurate alignment. On completion of the adjustments on each range, make a check on the sensitivity at the mid-band frequency. Remember that the Selectivity must be at SSB for this check which should give figures of the order 3uV or less for an output of 50mW with a s/n ratio of 15dB.

Range	Trimmers				Cores			
	Freq.	Aerial	RF	Mixer	Freq.	Aerial	RF	Mixer
1	30.0 Mc/s	C9	C15	C43	18.0 Mc/s	L1	L7	L16
2	18.0 Mc/s	C10	C16	C44	11.2 Mc/s	L2	L8	L17
3	10.8 Mc/s	C11	C17	C45	6.8 Mc/s	L3	L9	L18
4	6.6 Mc/s	C12	C18	C46	4.1 Mc/s	L4	L10	L19
5	4.0 Mc/s	C13	C19	C47	2.55 Mc/s	L5	L11	L20
6	2.45 Mc/s	C14	C20	C48	1.55 Mc/s	L6	L12	L21
7	1480 kc/s	C21	-	C49	870 kc/s	L13	-	L22
8	830 kc/s	C22	-	C50	490 kc/s	L14	-	L23
9	500 kc/s	C23	-	C51	300 kc/s	*L15	-	*L24

* Use Neosid H. S. 1 trimming tool.

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 20,000 ohms/V and an applied mains voltage of 240V. A nominal tolerance of 10% will apply to all readings taken with a meter of the sensitivity quoted and this tolerance should be increased accordingly if readings are taken with a meter of lower sensitivity.

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

WAVECHANGE	. .	Range 1.	RF/IF GAIN CONTROLS	. .	Maximum.
CRYSTAL SELECTOR	. .	M (Manual).	AF GAIN CONTROL	. .	Minimum.
SIGNAL MODE	. .	CW.	AGC/NL SWITCH	. .	Off.

The link between PL4/1 and PL4/4 must be in position.

Ref	Anode		Screen		Cathode		Note
	Pin	Reading	Pin	Reading	Pin	Reading	
V1A	6	90V	-	-	8	1.5V	NOTE 1
V1B	1	178V	2 (gl)	87V	3	90V	
V2	5	186V	6	40V	2	0.7V	
V3A	6	217V	1	100V	3	2.9V	
V3B	8	90V	-	-	3	2.9V	
V4	1/5	88V	-	-	7	0V	NOTE 2
V5	5	220V	6	95V	7	1.1V	
V6	5	220V	6	95V	7	1.1V	
V7	2/7	10V	-	-	1/5	10V	
V8	5	188V	6	188V	7	2.2V	
V9	7	110V	-	-	2	13V	NOTE 3
V10	5	230V	6	227V	2	12V	
V11	5	30V	6	160V	7	0V	NOTE 4
V12A	6	128V	3	112V	7	0V	
V12B	1	96V	-	-	8	1.2V	NOTE 5
V13	5	135V	6	27V	2	0.17V	
V14	1	150V	-	-	7	0V	
V15	1	150V	-	-	7	0V	

NOTE 1. Cathode voltage increases to 46V with RF GAIN at minimum.

NOTE 2. Cathode voltage increases to 45V with IF GAIN at minimum.

NOTE 3. Cathode voltage decreases to 4.9V when the SIGNAL MODE SWITCH is moved to SSB.

NOTE 4. CALIBRATOR SWITCH to "ON" position. The Calibrator Unit must be removed from the gang cover to allow readings to be taken.

NOTE 5. CRYSTAL SELECTOR SWITCH to any "CRYSTAL" position and with crystal in place.

HT Voltages

HT1	. .	238V.
HT2	. .	226V (MODE SWITCH to CW).
HT3	. .	150V.
HT4	. .	150V.

APPENDIX "B"

LIST OF COMPONENT VALUES, TOLERANCES AND RATINGS

Capacitors

Ref	Value	Type	Tolerance	Wkg. V.
C1	5-50pF	Air-spaced variable	-	-
C2	12-230pF	Air-spaced variable	-	-
C3	60pF	Silvered Mica	10%	350V
C4	60pF	Silvered Mica	10%	350V
C5	50pF	Silvered Mica	10%	350V
C6	30pF	Silvered Mica	10%	350V
C7	50pF	Silvered Mica	10%	350V
C8	10pF	Silvered Mica	10%	350V
C9	4-29pF	Air Trimmer	-	-
C10	4-29pF	Air Trimmer	-	-
C11	4-29pF	Air Trimmer	-	-
C12	4-29pF	Air Trimmer	-	-
C13	4-29pF	Air Trimmer	-	-
C14	4-29pF	Air Trimmer	-	-
C15	4-29pF	Air Trimmer	-	-
C16	4-29pF	Air Trimmer	-	-
C17	4-29pF	Air Trimmer	-	-
C18	4-29pF	Air Trimmer	-	-
C19	4-29pF	Air Trimmer	-	-
C20	4-29pF	Air Trimmer	-	-
C21	4-29pF	Air Trimmer	-	-
C22	4-29pF	Air Trimmer	-	-
C23	4-29pF	Air Trimmer	-	-
C24	0.0015uF	Tubular Ceramic	20%	750V
C25	50pF	Silvered Mica	10%	350V
C26	50pF	Silvered Mica	10%	350V
C27	40pF	Silvered Mica	10%	350V
C28	25pF	Silvered Mica	10%	350V
C29	30pF	Silvered Mica	10%	350V
C30	5-50pF	Air-spaced variable	-	-
C31	12-230pF	Air-spaced variable	-	-
C32	100pF	Silvered Mica	10%	350V
C33	0.1uF	Plate Ceramic	+80% -20%	200V
C34	0.1uF	Plate Ceramic	+80% -20%	200V
C35	0.003uF	Metallised Paper	20%	350V
C36	0.05uF	Tubular Paper	20%	400V
C37	25pF	Tubular Ceramic	10%	750V
C38	6pF	Tubular Ceramic	10%	750V
C39	6pF	Tubular Ceramic	10%	750V

Ref	Value	Type	Tolerance	Wkg. V.
C40	1pF	Tubular Ceramic	0.5pF	750V
C41	6pF	Tubular Ceramic	10%	750V
C42	800pF	Silvered Mica	10%	350V
C43	4-29pF	Air Trimmer	-	-
C44	4-29pF	Air Trimmer	-	-
C45	4-29pF	Air Trimmer	-	-
C46	4-29pF	Air Trimmer	-	-
C47	4-29pF	Air Trimmer	-	-
C48	4-29pF	Air Trimmer	-	-
C49	4-29pF	Air Trimmer	-	-
C50	4-29pF	Air Trimmer	-	-
C51	4-29pF	Air Trimmer	-	-
C52	0.0051uF	Polystyrene	5%	125V
C53	40pF	Silvered Mica	10%	350V
C54	40pF	Silvered Mica	10%	350V
C55	40pF	Silvered Mica	10%	350V
C56	25pF	Silvered Mica	10%	350V
C57	40pF	Silvered Mica	10%	350V
C58	10pF	Silvered Mica	10%	350V
C59	12-230pF	Air-spaced variable	-	-
C60	5-50pF	Air-spaced variable	-	-
C61	100pF	Silvered Mica	10%	350V
C62	0.001uF	Tubular Ceramic	+50% - 25%	750V
C63	0.05uF	Tubular Paper	20%	400V
C63a	10pF	Tubular Ceramic	10%	750V
C64	0.01uF	Metallised Paper	20%	200V
C65	0.05uF	Metallised Paper	20%	400V
C66	0.05uF	Metallised Paper	20%	400V
C67	0.01uF	Metallised Paper	20%	200V
C68	0.0015uF	Tubular Ceramic Feed Through	20%	500V
C69	0.1uF	Polyester	20%	250V
C70	0.0015uF	Tubular Ceramic Feed Through	20%	500V
C71	8-170pF	Air-spaced variable	-	-
C72	4-29pF	Air Trimmer	-	-
C73	300pF	Silvered Mica	1%	350V
C74	15pF	Tubular Ceramic	10%	750V
C75	15pF	Tubular Ceramic	10%	750V
C76	340pF	Silvered Mica	1%	350V
C77	4-29pF	Air Trimmer	-	-
C78	8-170pF	Air-spaced variable	-	-
C79	100pF	Silvered Mica	1%	350V
C80	0.05uF	Tubular Paper	20%	400V
C81	0.002uF	Polystyrene	5%	125V
C82	0.0047uF	Polystyrene	5%	125V
C83	0.0047uF	Polystyrene	5%	125V
C84	2-10pF	Air Trimmer	-	-
C85	50pF	Silvered Mica	5%	350V
C86	0.002uF	Polystyrene	5%	125V
C87	100pF	Silvered Mica	10%	350V
C88	0.1uF	Plate Ceramic	+80% - 20%	200V
C89	0.05uF	Tubular Paper	20%	400V

Ref	Value	Type	Tolerance	Wkg. V.
C90	0.002uF	Polystyrene	5%	125V
C91	0.05uF	Tubular Paper	20%	400V
C92	0.002uF	Polystyrene	5%	125V
C93	100pF	Silvered Mica	10%	350V
C94	0.05uF	Tubular Paper	20%	400V
C95	0.05uF	Tubular Paper	20%	400V
C96	0.002uF	Polystyrene	5%	125V
C97	0.05uF	Tubular Paper	20%	400V
C98	12pF	Tubular Ceramic	10%	750V
C99	0.002uF	Polystyrene	5%	125V
C100	500pF	Metallised Paper	20%	600V
C101	10pF	Tubular Ceramic	10%	750V
C102	0.1uF	Plate Ceramic	+80% -20%	200V
C103	6pF	Tubular Ceramic	10%	750V
C104	50pF	Tubular Ceramic	10%	750V
C105	0.05uF	Tubular Paper	20%	400V
C106	0.04uF	Metallised Paper	20%	250V
C107	500pF	Metallised Paper	20%	600V
C108	0.01uF	Tubular Ceramic	+80% -20%	350V
C109	0.005uF	Tubular Ceramic	10%	750V
C110	10uF	Tubular Electrolytic	+100% -20%	12V
C111	25uF	Tubular Electrolytic	+100% -20%	25V
C112	10uF	Tantalum	20%	25V
C113	0.1uF	Plate Ceramic	+80% -20%	200V
C114	50pF	Tubular Ceramic	10%	750V
C115	100pF	Tubular Ceramic	10%	750V
C116	0.01uF	Tubular Ceramic	+80% -20%	350V
C117	0.005uF	Disc Ceramic	+80% -20%	750V
C118	0.01uF	Tubular Ceramic	+80% -20%	350V
C119	25uF	Tubular Electrolytic	+100% -20%	25V
C120	0.01uF	Tubular Paper	20%	350V
C121	20pF	Silvered Mica	10%	350V
C122	6pF	Tubular Ceramic	10%	750V
C123	3-23pF	Air Trimmer	-	-
C124	4-29pF	Air Trimmer	-	-
C125	4-29pF	Air Trimmer	-	-
C126	4-29pF	Air Trimmer	-	-
C127	4-29pF	Air Trimmer	-	-
C128	4-29pF	Air Trimmer	-	-
C129	4-29pF	Air Trimmer	-	-
C130	4-29pF	Air Trimmer	-	-
C131	4-29pF	Air Trimmer	-	-
C132	4-29pF	Air Trimmer	-	-
C133	25pF	Tubular Ceramic	10%	750V
C134	25pF	Silvered Mica	10%	350V
C135	40pF	Tubular Ceramic	10%	750V
C136	12pF	Tubular Ceramic	10%	750V
C137	50pF	Silvered Mica	10%	350V
C138	60pF	Silvered Mica	10%	350V
C139	60pF	Silvered Mica	10%	350V

Ref	Value	Type	Tolerance	Wkg. V.
C140	80pF	Silvered Mica	10%	350V
C141	20pF	Silvered Mica	10%	350V
C142	20pF	Silvered Mica	10%	350V
C143	25pF	Silvered Mica	10%	350V
C144	2350pF	Silvered Mica	1%	350V
C145	2000pF	Silvered Mica	1%	350V
C146	2300pF	Silvered Mica	1%	350V
C147	1425pF	Silvered Mica	1%	350V
C148	850pF	Silvered Mica	1%	350V
C149	570pF	Silvered Mica	1%	350V
C150	2825pF	Silvered Mica	1%	350V
C151	2000pF	Silvered Mica	1%	350V
C152	1200pF	Silvered Mica	1%	350V
C153	12pF nom.	Tubular Ceramic	10%	750V
C154	12-230pF	Air-spaced variable	-	-
C155	100pF	Tubular Ceramic	10%	750V
C156	100pF	Tubular Ceramic	10%	750V
C157	0.01uF	Metallised Paper	20%	200V
C158	0.01uF	Metallised Paper	20%	200V
C159	0.01uF	Metallised Paper	20%	200V
C160	500pF	Metallised Paper	20%	600V
C161	20pF	Tubular Ceramic	10%	750V
C162	20pF	Tubular Ceramic	10%	750V
C163	0.0015uF	Tubular Ceramic	20%	750V
C164	0.01uF	Metallised Paper	20%	200V
C165	0.0015uF	Tubular Ceramic Feed Through	20%	500V
C166	330pF	Polystyrene	2%	125V
C167	-	Reference not allocated	-	-
C168	4-29pF	Air Trimmer	-	-
C169	8-170pF	Air-spaced variable	-	-
C170	100pF	Silvered Mica	1%	350V
C171	0.047uF	Polyester	20%	250V
C172	0.0015uF	Tubular Ceramic Feed Through	20%	500V
C173	0.0015uF	Tubular Ceramic Feed Through	20%	500V
C174	0.047uF	Polyester	20%	250V
C175	6pF	Tubular Ceramic	10%	750V
C176	50pF	Tubular Ceramic	10%	750V
C177	0.5uF	Tubular Paper	20%	400V
C178	100pF	Tubular Ceramic	10%	750V
C179	0.047uF	Polyester	20%	250V
C180	0.047uF	Polyester	20%	250V
C181	0.1uF	Polyester	20%	250V
C182	200pF	Silvered Mica	2%	350V
C183	0.0014uF	Polystyrene	5%	125V
C184	10uF	Tubular Electrolytic	+100% -20%	12V
C185	0.0012uF	Polystyrene	5%	125V
C186	195pF	Silvered Mica	1%	350V
C187	40pF	Silvered Mica	1pF	350V
C188	100pF	Silvered Mica	1%	350V
C189	40pF	Silvered Mica	1pF	350V

Ref	Value	Type	Tolerance	Wkg. V.
C190) C191)	17-253pF	Two-gang air-spaced variable	-	-
C192	500pF	Metallised Paper	20%	600V
C193	500pF	Metallised Paper	20%	600V
C194	0.005uF	Tubular Ceramic	20%	750V
C195	0.1uF	Plate Ceramic	+80% -20%	200V
C196	0.1uF	Plate Ceramic	+80% -20%	200V
C197	0.0015uF	Tubular Ceramic Feed Through	20%	500V
C198	0.1uF	Polyester	20%	250V
C199	0.1uF	Polyester	20%	250V
C200	0.0015uF	Tubular Ceramic Feed Through	20%	500V
C201	0.1uF	Plate Ceramic	+80% -20%	200V
C202	0.1uF	Plate Ceramic	+80% -20%	200V
C203	0.1uF	Plate Ceramic	+80% -20%	200V
C204	0.1uF	Plate Ceramic	+80% -20%	200V
C205	0.01uF	Metallised Paper	20%	200V
C206	0.01uF	Metallised Paper	20%	200V
C207	32 + 32uF	Tubular Electrolytic	+50% -20%	350V
C208	25uF	Tubular Electrolytic	+100% -20%	25V
C209	50uF	Tubular Electrolytic	+50% -20%	450V
C210	0.05uF	Tubular Paper	20%	250V
C211	0.05uF	Tubular Paper	20%	250V

Resistors

Ref	Value	Tol.	Rating	Ref	Value	Tol.	Rating
R1	1M ohms	10%	$\frac{1}{2}$ watt	R20	0.27M ohms	10%	$\frac{1}{2}$ watt
R2	0.27M ohms	10%	$\frac{1}{2}$ watt	R21	0.27M ohms	10%	$\frac{1}{2}$ watt
R3	12 ohms	10%	$\frac{1}{2}$ watt	R22	0.27M ohms	10%	$\frac{1}{2}$ watt
R4	120 ohms	10%	$\frac{1}{2}$ watt	R23	220 ohms	10%	$\frac{1}{2}$ watt
R5	47,000 ohms	10%	1 watt	R24	0.1M ohms	10%	$\frac{1}{2}$ watt
R6	47,000 ohms	10%	1 watt	R25	3,300 ohms	10%	$\frac{1}{2}$ watt
R7	4,700 ohms	10%	1 watt	R25a	68,000 ohms	10%	1 watt
R8	0.1M ohms	10%	$\frac{1}{2}$ watt	R26	47,000 ohms	10%	1 watt
R9	0.1M ohms	10%	$\frac{1}{2}$ watt	R27	2,200 ohms	10%	$\frac{1}{2}$ watt
R10	560 ohms	10%	$\frac{1}{2}$ watt	R28	0.27M ohms	10%	$\frac{1}{2}$ watt
R11	680 ohms	10%	$\frac{1}{2}$ watt	R29	82 ohms	10%	$\frac{1}{2}$ watt
R12	220 ohms	10%	$\frac{1}{2}$ watt	R30	47,000 ohms	10%	1 watt
R13	1,000 ohms	10%	$\frac{1}{2}$ watt	R31	0.27M ohms	10%	$\frac{1}{2}$ watt
R14	0.47M ohms	10%	$\frac{1}{2}$ watt	R32	10,000 ohms	10%	1 watt
R15	330 ohms	10%	$\frac{1}{2}$ watt	R33	27,000 ohms	10%	1 watt
R16	0.47M ohms	10%	$\frac{1}{2}$ watt	R34	27,000 ohms	10%	1 watt
R17	10,000 ohms	10%	1 watt	R35	22,000 ohms	10%	1 watt
R18	27,000 ohms	10%	1 watt	R36	2,200 ohms	10%	$\frac{1}{2}$ watt
R19	47,000 ohms	10%	1 watt	R37	82 ohms	10%	$\frac{1}{2}$ watt
				R38	1M ohms	10%	$\frac{1}{2}$ watt
				R39	2.2M ohms	10%	$\frac{1}{2}$ watt

Ref	Value	Tol.	Rating
R40	0.1M ohms	10%	$\frac{1}{2}$ watt
R41	0.1M ohms	10%	$\frac{1}{2}$ watt
R42	0.47M ohms	10%	$\frac{1}{2}$ watt
R43	220 ohms	10%	$\frac{1}{2}$ watt
R44	4,700 ohms	10%	1 watt
R45	0.27M ohms	10%	$\frac{1}{2}$ watt
R46	3,300 ohms	10%	$\frac{1}{2}$ watt
R47	0.18M ohms	10%	$\frac{1}{2}$ watt
R48	4,700 ohms	10%	1 watt
R49	1M ohms	10%	$\frac{1}{2}$ watt
R50	6,800 ohms	10%	$\frac{1}{2}$ watt
R51	3,300 ohms	10%	$\frac{1}{2}$ watt
R52	1M ohms	10%	$\frac{1}{2}$ watt
R53	0.27M ohms	10%	$\frac{1}{2}$ watt
R54	0.47M ohms	10%	$\frac{1}{2}$ watt
R55	47 ohms	10%	$\frac{1}{2}$ watt
R56	27,000 ohms	10%	1 watt
R57	330 ohms	10%	$\frac{1}{2}$ watt
R58	2,200 ohms	10%	$\frac{1}{2}$ watt
R59	0.1M ohms	10%	$\frac{1}{2}$ watt
R60	10,000 ohms	10%	$\frac{1}{2}$ watt
R61	22,000 ohms	10%	$\frac{1}{2}$ watt
R62	0.27M ohms	10%	$\frac{1}{2}$ watt
R63	1M ohms	10%	$\frac{1}{2}$ watt
R64	0.1M ohms	10%	$\frac{1}{2}$ watt
R65	2.2M ohms	10%	$\frac{1}{2}$ watt
R66	47,000 ohms	10%	$\frac{1}{2}$ watt
R67	6,800 ohms	10%	$\frac{1}{2}$ watt
R68	1,000 ohms	10%	$\frac{1}{2}$ watt
R69	2,200 ohms	10%	$\frac{1}{2}$ watt
R70	220 ohms	10%	$\frac{1}{2}$ watt
R71	2,200 ohms	10%	$\frac{1}{2}$ watt
R72	6,800 ohms	10%	$\frac{1}{2}$ watt
R73	2.2M ohms	10%	$\frac{1}{2}$ watt
R74	47,000 ohms	10%	$\frac{1}{2}$ watt
R75	47,000 ohms	10%	$\frac{1}{2}$ watt
R76	220 ohms	10%	$\frac{1}{2}$ watt
R77	2.2M ohms	10%	$\frac{1}{2}$ watt
R77a	1,000 ohms	10%	$\frac{1}{2}$ watt
R78	47,000 ohms	10%	$\frac{1}{2}$ watt
R79	10,000 ohms	10%	$\frac{1}{2}$ watt
R80	0.1M ohms	10%	$\frac{1}{2}$ watt
R81	10,000 ohms	10%	$\frac{1}{2}$ watt
R82	2,200 ohms	10%	$\frac{1}{2}$ watt
R83	15,000 ohms	10%	1 watt
R84	0.47M ohms	10%	$\frac{1}{2}$ watt
R85	47,000 ohms	10%	$\frac{1}{2}$ watt
R86	47 ohms	10%	$\frac{1}{2}$ watt
R87	0.1M ohms	10%	$\frac{1}{2}$ watt
R88	68,000 ohms	10%	$\frac{1}{2}$ watt
R89	3,300 ohms	10%	$\frac{1}{2}$ watt

Ref	Value	Tol.	Rating
R90	1,000 ohms	10%	$\frac{1}{2}$ watt
R91	2.2M ohms	10%	$\frac{1}{2}$ watt
R92	47,000 ohms	10%	$\frac{1}{2}$ watt
R93	0.18M ohms	10%	$\frac{1}{2}$ watt
R94	220 ohms	10%	$\frac{1}{2}$ watt
R95	4,700 ohms w.w.	5%	6 watt
R96	3,300 ohms w.w.	5%	6 watt
R97	0.27M ohms	10%	$\frac{1}{2}$ watt
R98	6,800 ohms	10%	$\frac{1}{2}$ watt
R99	10,000 ohms	10%	1 watt
R100	140 ohms w.w.	5%	6 watt
R101	140 ohms w.w.	5%	6 watt

Potentiometers

Ref	Value	Type
RV1*	10,000 ohms	Wirewound
RV2*	10,000 ohms	Wirewound
RV3**	5,000 ohms	Wirewound
RV4	0.5M ohms	Carbon
* Concentric		
** Pre-set		

APPENDIX "C"

SPARES

The following list details all major spares for receivers in the 830 Series. 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:-

Eddystone Radio
In cases of extreme
or use TELEX 33708.

MARCONI INSTRUMENTS
111 CEDAR LANE
ENGLEWOOD, N. J. 07631
TEL: (201) 567-0607

ad, Birmingham 31.
STONE Birmingham

Ref	Description	Part No.
<u>INDUCTORS</u>		
NB : All coils are supplied complete with mounting foot, trimming, tracking and coupling capacitors as applicable and damping resistors where required.		
L1	Range 1 Aerial coil	D3244
L2	Range 2 Aerial coil	D3248
L3	Range 3 Aerial coil	D3252
L4	Range 4 Aerial coil	D3256
L5	Range 5 Aerial coil	D3260
L6	Range 6 Aerial coil	D3264
L7	Range 1 RF coil	D3245
L8	Range 2 RF coil	D3249
L9	Range 3 RF coil	D3253
L10	Range 4 RF coil	D3257
L11	Range 5 RF coil	D3261
L12	Range 6 RF coil	D3265
L13	Range 7 Aerial coil	D3268
L14	Range 8 Aerial coil	D3271
L15	Range 9 Aerial coil	D3274
L16	Range 1 Mixer coil	D3246
L17	Range 2 Mixer coil	D3250
L18	Range 3 Mixer coil	D3254
L19	Range 4 Mixer coil	D3258
L20	Range 5 Mixer coil	D3262
L21	Range 6 Mixer coil	D3266
L22	Range 7 Mixer coil	D3269
L23	Range 8 Mixer coil	D3272
L24	Range 9 Mixer coil	D3275
L25	Range 1 Oscillator coil	D3247
L26	Range 2 Oscillator coil	D3251
L27	Range 3 Oscillator coil	D3255
L28	Range 4 Oscillator coil	D3259
L29	Range 5 Oscillator coil	D3263
L30	Range 6 Oscillator coil	D3267

Ref.	Description	Part No.
	<u>INDUCTORS (contd.)</u>	
L31	Range 7 Oscillator coil	D3270
L32	Range 8 Oscillator coil	D3273
L33	Range 9 Oscillator coil	D3276
L34	1st Mixer Anode coil	D3455
L35	2nd Mixer Grid coil	D3455
L36	2nd Oscillator coil	D3456
L37*	Crystal Calibrator coil	D2178
L38*	Beat Oscillator coil	D3458
	<u>CHOKES AND TRANSFORMERS</u>	
CH1	HT Smoothing Choke	6260P
CH2	Click Suppression Choke	6461P
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 (600 ohm CT and 2.5/3 ohm)	D3004
T6	Power Transformer	5339P
	<u>CRYSTALS</u>	
XL1/2	100 kc/s \pm 0.005% Style "E"	6099P
	<u>SWITCHES</u>	
S1	Range Switch:	
	Wafers a-e, h and i	4252P
	Wafers f and g	D3097
	Clicker mechanism	6281P
	Extension spindle	5431P
	Coupler	5428P
S2	Crystal Calibrator Switch	6891P
S3	Crystal Filter Switch	6365P
S4	AGC/NL Switch : 2P3W complete	D3082
S5	Mode Switch : less wafer in CW/SSB Detector Unit	D3467
S6	Crystal Selector Switch : complete assembly including gearing	D3010
S7	Mains Switch : DPDT Toggle type	4772P
	<u>VARIABLE CAPACITORS AND ASSOCIATED ITEMS</u>	
-	Peak-RF Tuning Gang, 3 x 5-50pF	D3009
-	Aerial/RF sections of Main Tuning Gang, 2 x 12-230pF	5814/1P
-	Mixer/Osc sections of Main Tuning Gang, 2 x 12-230pF	5814/1P
-	Incremental Tuning Gang, 3 x 8-170pF	6822P

Ref	Description	Part No.
	<u>VARIABLE CAPACITORS AND ASSOCIATED ITEMS (contd.)</u>	
-	Flexible coupler as used for Main Tuning Gang	D1680
-	Flexible coupler as used for Peak-RF Gang Short hub:-	D2874
	Long hub:-	D3311
-	Coupler as used for Incremental Tuning Gang	D3084
-	Concentric trimmer, C9 etc., (4-29pF)	6597P
	<u>POTENTIOMETERS</u>	
RV1/2	2 x 10,000 ohms wirewound with concentric spindles	5810P
RV3	5,000 ohms wirewound (pre-set)	6123P
RV4	0.5M ohms carbon	4103PB
	<u>PLUGS AND SOCKETS</u>	
PL1*	Calibrator Supply Plug (B7G type)	6100P
PL2*	External Power Supply Plug (12-way female)	6080P
PL3*	Accessory Supply Plug (12-way female)	6080P
PL4*	Audio Output (etc.) Plug (12-way male)	6705P
-	Aerial Plug with adaptor to suit $\frac{1}{4}$ " o/d coaxial cable	6369P
-	Mains Plug (polarised with earthing connection and 6' lead)	D2311/1
SKT1	Aerial Input Socket	6370P
SKT2	IF Output Socket (BNC)	6085P
SKT3	Audio Output (etc.) Socket (12-way female)	6706P
SKT4	Calibrator Supply Socket (B7G type)	6086P
SKT5	External Supply Socket (12-way male)	6088P
SKT6	Mains Input Socket (polarised with earth contact)	D2310
	<u>DRIVE ASSEMBLY</u>	
-	Main Drive Unit	LP2795/1
-	Main Tuning Control - spindle and bearing assembly	6429P
-	Flywheel	5174P
-	Incremental Tuning Control - spindle assembly	D3086A
	<u>KNOBS</u>	
-	Main Tuning	D3613/1
-	Incremental Tuning	D3613/1
-	RF Gain	D3723
-	IF Gain	D3724
-	Peak-RF, BFO Pitch and AF Gain	D3614
-	Selectivity, Mode and AGC/NL	5780P
-	Wavechange	D4033
	* Supplied complete with removable covers.	

Ref	Description	Part No.
	<u>MISCELLANEOUS</u>	
	Chromium-plated panel handles	5862P
	Scale plate	6257P
	Cursor assembly	D3087
	Glass window	5847P
	Carrier level meter	5956/1P
	Finger plate	6256/1P
	Earth terminal	6371P
	Cursor adjustor assembly	D3088
	Fuseholder	6372P
	Fuses, 1.5A Thermal-storage delay type	6471P
	Incremental scale	D3462/1
	Drive pulleys	5837P
	Guide pulleys	6125P
	Dial lamps (6.5V @ 0.3A)	3131P
	Dial lamp holder	6374P
	Valve screening can (B7G)	6126P
	Valve screening can (B9A)	6127P
	Valve retainer (spring type)	5311PA
	Telephone socket	6090P
	Cursor guide rods	5801P
	Rear finger plate	D3015/1
	Crystal holder (Style "D")	6375P
	Dial glass retaining strip	6261P
	Calibrator Unit (less valve/crystal)	LP2806
	CW/SSB Detector Unit (less valve)	LP2911

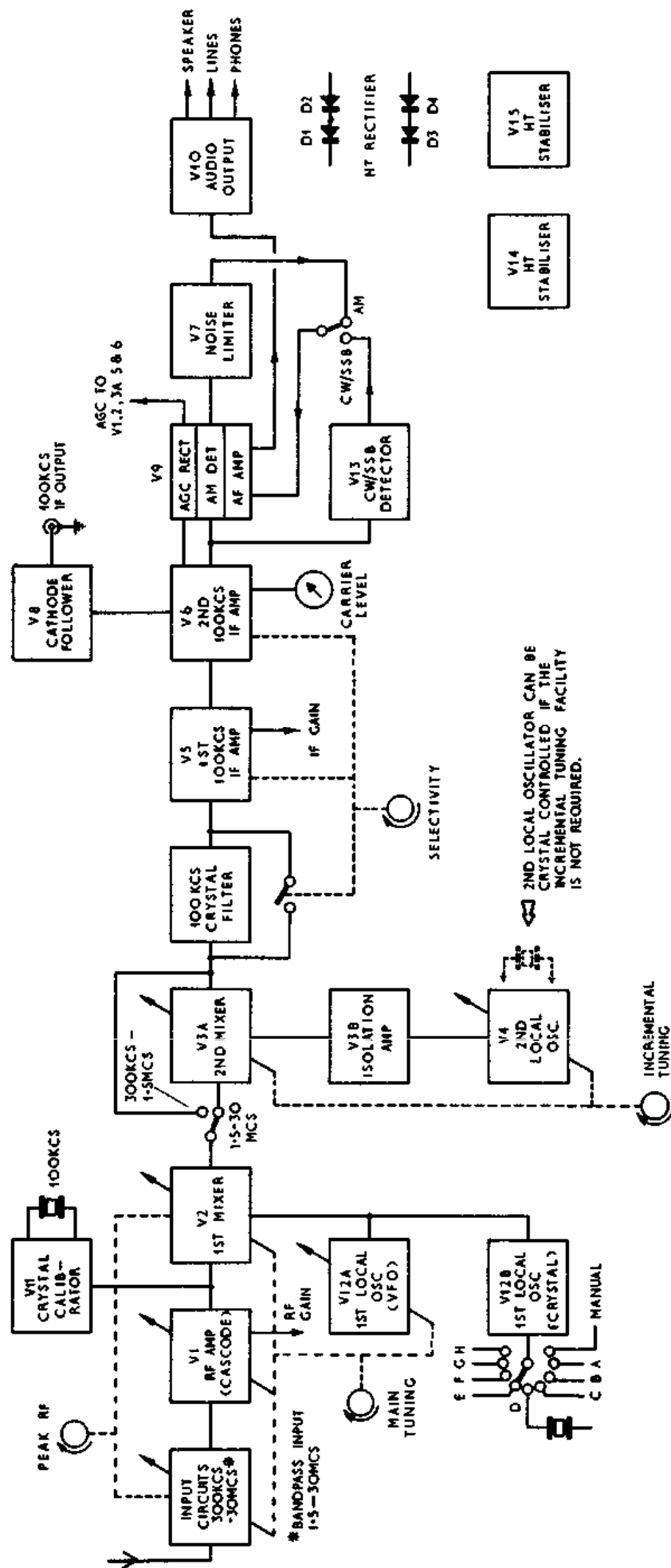


Fig. 1. Block Schematic Diagram of Model 830/7 Receiver

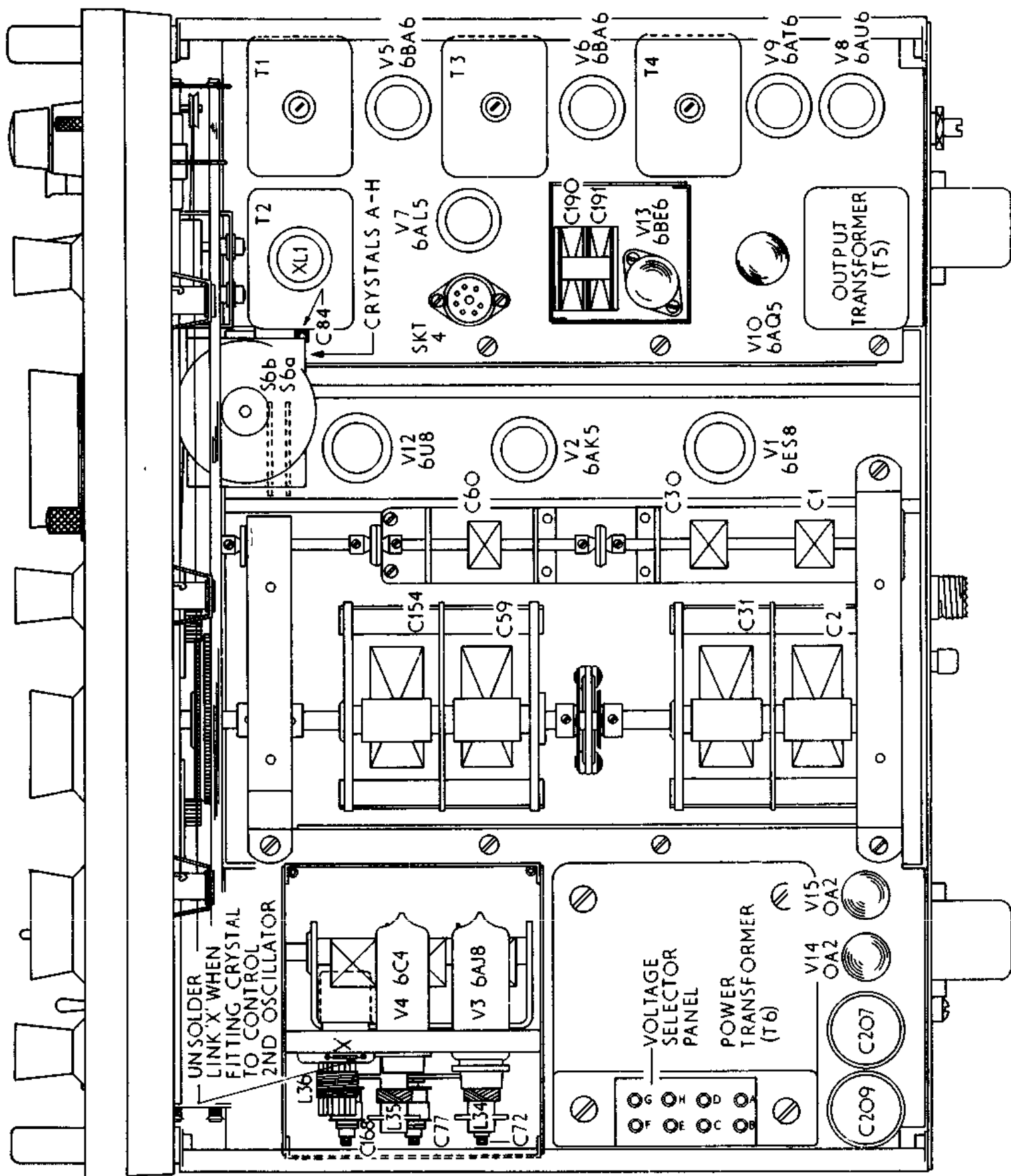


Fig. 2. Plan View of Model 830/7 Receiver

APPENDIX "D"

EDDYSTONE MODELS 830/5 & 830/6

These two variants of the 830 receiver are basically identical to the 830/7 from which they differ in minor detail only. Variations are as follows:-

1. Calibration of the incremental tuning scale is arranged in a progressive manner in lieu of the standard +100 / 0 / -100 scaling used on the 830/7.
2. A different type of mains connector is employed.
3. Both sides of the mains input are fused using a different type of fuse from that on the 830/7.
4. The 830/6 is identical to the 830/5 except for the type of knob fitted to certain panel controls.

AMENDMENTS

Minor amendments are required in the 830/7 Handbook to convert for use with 830/5 and 830/6 receivers.

Pages 4, 12 & 28 Amend fusing to read:- "Standard miniature cartridge fuses 20x5mm rated 2 Amps each. Both sides of the supply are fused."

Page 22 Amend incremental scaling at top of page to read as follows:-
100-90-80 30-20-10-0-90-80-70 20-10-0
Delete Paragraphs 4 and 5. Substitute the following:-

Now because of the manner in which the incremental scale calibration is presented, the effective tune frequency is determined merely by combining the incremental reading with the lowest frequency in the 100 kc/s segment indicated by the colour of the incremental scale. If, for example, the incremental scale reads "24 BLACK", this would show that the receiver is tuned to a frequency 24 kc/s higher than the lowest frequency in the low frequency segment, i.e. the effective tune frequency is 2624 kc/s. Similarly a RED reading of "92" represents an effective tune frequency of 2792 kc/s.

Once an operator becomes familiar with the receiver, calculation will become nothing more than a subconscious process because the "BLACK 0" (continuing the example above) would automatically be accepted as 2600 kc/s and the "RED 0" as 2700 kc/s.

Page 23 Amend the "Incremental Setting" column in the Table at the foot of the page to read as follows:-

100RD - 75RD - 50RD - 0RD - 75BL - 50BL - 25BL - 0BL

Page 25 At the end of Section "(e)", add:-

The figures marked on the scale must also be reversed such that 90 must read 10, 60 must read 40, 30 must read 70, etc., etc. Any possible confusion will disappear after familiarisation on the equipment.

Pages 44 & 45 Amend the following "Spares Nos." under the appropriate headings:-

Plugs & Sockets

Mains plug and socket . . (Not supplied by EDDYSTONE RADIO LTD.)

Knobs

Selectivity, Mode and AGC/NL (for 830/6) . . D3055.

Miscellaneous

Fuseholder . . 6372P. Fuses 2A x 20mm x 5mm . . 6704P
Incremental Scale . . D3462.

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