EDDYSTONE UHF RECEIVER

MODEL 770S

INTRODUCTION

The EDDYSTONE Model 770S is a specialised double conversion receiver of advanced design covering the UHF band of frequencies in the range 500 - 1000 Mc/s. Provision is made for reception of AM, FM and Pulse signals and the unit operates directly from all standard AC mains supplies.

The tuning system which is employed provides either 'coarse' tuning over the entire range or alternatively 'fine' tuning over any 20 Mc/s portion thereof. The latter facility is achieved by tuning the input to the 2nd Mixer over the broadbanded 1st IF which has a bandwidth of 20 Mc/s centred on a nominal frequency of 160 Mc/s.

Low impedance outputs are provided at both 1st and 2nd Intermediate Frequencies together with a Video Output which has a level response of from 20 c/s to 3 Mc/s. Audio outputs are available for connection to an external loudspeaker, telephones and remote lines. A built-in monitor speaker is fitted and this will be found extremely useful when the receiver forms part of a rack-mounted installation.

A sensitive meter operates in conjunction with a suitable amplifier to give a visual indication of correct tuning when receiving FM signals. An indication of relative carrier level is given on AM signals and the meter is calibrated for this purpose in arbitrary divisions 0-10. Other features include a built-in Crystal Calibrator and provision for feeding externally derived audio signals to the AF Stages. HT and LT supplies are available to power small ancillary units.

The receiver is strongly made, attractively finished and is suitable for rack or table mounting. All controls are located for convenience in operation their functions being clearly marked on the panel. The 770S is suitable for continuous operation in all areas under extreme climatic conditions.

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

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These diagrams are filed separately.

The Company reserve the right to vary without notice any information contained in this publication.

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TECHNICAL DATA

GENERAL

Frequency Coverage.

500-1000 Mc/s. The tunable 1st IF provides bandspread over any frequency range not exceeding 20 Mc/s wide within this range. Tuning rate is constant at all frequencies under these conditions.

Intermediate Frequencies.

1st IF . .	Broadbanded to cover 150-170 Mc/s and tunable over this range at the input to the 2nd Mixer Stage.
2nd IF . .	Fixed tuned to 46.5 Mc/s.

Valve Complement.

A total of 30 valves, 10 germanium diodes and 8 silicon diodes is employed in the Model 770S. Their types and functions are detailed in the Table on the following page.

Input and Output Impedances.

Aerial Input . .	50-75Ω unbalanced.
IF Outputs . .	50Ω nominal (unbalanced). Both outputs are suitable for termination in resistive loads of between 50 and 300Ω.
Video Output . .	10,000Ω nominal. External stray capacity must not exceed 25pF if the response is to be maintained. The video circuits are DC coupled throughout.
Audio Input . .	0.1 MΩ (approx).
Audio Outputs . .	Loudspeaker : 2.5/3Ω. Lines : 600Ω balanced or unbalanced. Telephones : Nominally 2000Ω but suitable for a wide range of impedances.

Power Supply.

100/125V or 200/250V AC (40-60 c/s). Consumption : 150VA.

Accessory Supplies.

The following supplies are available for connection to external units.

HT . .	225V @ 15mA.
LT . .	6.3V @ 1.5A. (one side of supply is earthed).
LT . .	6.3V @ 0.5A. (balanced heater supply, free from earth and with centre-tap brought out).

VALVE AND DIODE COMPLEMENT

Ref	Type		Circuit Function
V1 & V2	A2521	(CV2453)*	Push-pull RF Amplifier (grounded-grid).
D1 & D2	GEX66	(CV2290)	Push-pull 1st Mixer Stage.
V3	DET22	(CV273)	1st Local Oscillator.
V4	ECC189	(CV5331)	Cascode Head Amplifier (160 Mc/s).
V5	ECC189	(CV5331)	Cascode Amplifier (160 Mc/s).
V6-V8	E180F	(CV3998)	IF Amplifiers (160 Mc/s).
V9	6U8	(CV5065)	IF Amplifier/Cathode Follower (160 Mc/s).
V10	6AK5	(CV850)	2nd Mixer Stage.
V11	6AF4A	(CV5074)	2nd Local Oscillator.
V12-V15	6AM6	(CV138)	46.5 Mc/s IF Amplifiers.
V16	6AM6	(CV138)	FM Buffer Amplifier.
V17	6AM6	(CV138)	AM Buffer Amplifier/Cathode Follower (46.5 Mc/s).
D3	GEX13	(CV425)	AGC Rectifier.
D4	GEX23	(CV448)	AM/Video Detector.
V18	6AM6	(CV138)	Anode Follower.
V19	6AU6	(CV2524)	Meter Amplifier.
V20	6U8	(CV5065)	Video Amplifier/Cathode Follower.
V21	6AM6	(CV138)	FM Limiter Driver Stage.
D5 & D6	GEX13	(CV425)	1st (Common) FM Limiter.
V22	6AM6	(CV138)	2nd FM Limiter (FM Wide).
D7 & D8	GEX13	(CV425)	FM Discriminator (FM Wide).
V23	6AM6	(CV138)	2nd FM Limiter (FM Narrow).
D9 & D10	GEX13	(CV425)	FM Discriminator (FM Narrow).
V24	6AU6	(CV2524)	Audio Amplifier (FM).
V25	12AU7	(CV491)	Audio Amplifier and Driver Stage.
V26	6AM5	(CV136)	Audio Output.
V27	6AM6	(CV138)	Crystal Oscillator (Calibrator).
D11-D14	DD006		Negative HT Rectifier.
V28 & V29	OB2	(CV1833)	Negative HT Stabiliser.
D15-D18	DD006		Positive HT Rectifier.
V30	OA2	(CV1832)	Positive HT Stabiliser.

* A2521 : Ih = 0.3A.
CV2453 : Ih = 0.37A.

PERFORMANCE

(All figures are typical)

Sensitivity.

Of the order 20-30μV for a 10dB signal-to-noise ratio.

Noise Factor.

Better than 25dB throughout the entire frequency range.

Image and Spurious Response.

20-35dB down.

IF Breakthrough.

1st IF (160 Mc/s) . . Of the order 20-30dB down.

2nd IF (46.5 Mc/s) . . Greater than 80dB down.

IF Bandwidth.

1st IF . . 20 Mc/s centred on 160 Mc/s (level within 3dB).

2nd IF . . 3 Mc/s at 46.5 Mc/s (level within 3dB).

Deviation Acceptance.

Narrow FM . . 250 kc/s.

Wide FM . . 1 megacycle.

IF Output.

(1) 160 Mc/s . . 1mV into 50Ω for an input of 150μV.

(2) 46.5 Mc/s . . 50mV into 50Ω for an input of 100μV.

Video Output.

10V into 10,000Ω.

AGC Characteristic.

The audio output level does not change by more than 16dB for an increase in carrier level of 50dB above 50μV.

Audio Output and Response.

The 2.5Ω and 600Ω outputs will each deliver 0.5 watt when used independently. The audio response is level within ±3dB over the range 100 c/s to 10 kc/s.

Distortion.

Not greater than 10% at 0.5 watt output (1000 c/s).

Calibration Accuracy.

Within 1%. Frequency setting is possible to within 0.1% when using the built-in Crystal Calibrator (50 Mc/s markers).

Frequency Stability.

The tune frequency does not change by more than 1 part in 10^4 per $^{\circ}C$ change in ambient temperature. A ±5% change in the mains supply voltage will not alter the tune frequency by more than 3 parts in 10^5.

CIRCUIT DESCRIPTION

Principle of Tuning.

Two separate tuning controls are provided on the Model 770S - one is referred to as the 'COARSE' and the other as the 'FINE' tuning control. Their respective functions are best understood if the latter control is considered first.

The 'FINE' control tunes both Mixer and Oscillator in the second frequency conversion stage (V10 and V11), the tuning range being restricted to cover 10 Mc/s above and 10 Mc/s below the nominal 1st IF of 160 Mc/s. The scale is calibrated with a centre zero corresponding to an IF of 160 Mc/s while the extreme markings are 10 Mc/s 'HIGH' (at 150 Mc/s) and 10 Mc/s 'LOW' (at 170 Mc/s).

The reason for the 'reversed' tuning range is that both oscillators in the dual conversion arrangement operate above the signal frequency and as a direct result of this, a 'mirror image' of the signal appears after the first stage of conversion.

The 2nd Oscillator, tracking on the high side, covers the band 196.5 Mc/s to 216.5 Mc/s and gives a 2nd IF of 46.5 Mc/s.

Gang-tuned by the 'COARSE' control are the butterfly tuner which couples the RF and 1st Mixer Stages and the coaxial line tuner used in the 1st Local Oscillator Stage. The scale associated with this control is marked at intervals of 10 Mc/s. Calibration figures are given every 20 Mc/s up to 700 Mc/s and every 50 Mc/s above this frequency.

From the above it can be seen that if the 'FINE' control is set to '0', continuous 'COARSE' tuning is possible over the entire range of the receiver, the 'FINE' control being used as a form of vernier adjustment if this is found necessary.

For more exacting applications, the 'COARSE' control should be adjusted to the calibrated frequency nearest to the desired frequency, while the 'FINE' tuning is set 'HIGH' or 'LOW' by the number of megacycles required to obtain the correct channel.

E.G.	Desired signal frequency	745 Mc/s.
	'COARSE' tuning to	740 Mc/s.
	'FINE' tuning to	5 Mc/s 'HIGH'.

The butterfly tuner can be adjusted independently of the line oscillator by means of a further control which is mounted concentric with and at the rear of the 'FINE' tuning control. The butterfly can be peaked with this control to ensure correct alignment when the 1st IF is detuned from its nominal value. When the receiver is used for search purposes the butterfly tuning can be checked at intervals of 50 or 100 Mc/s by switching in the Crystal Calibrator.

The RF Section.

This portion of the receiver comprises V1, V2 and V3 together with the two germanium diodes D1 and D2.

V1 and V2 operate in push-pull as a grounded-grid amplifier, the aerial input being taken to the cathodes via wideband unbalance to balance transformer. which forms an integral part of the RF Section assembly. The control grids of the two triodes (A2521) are connected directly to the vertical screen which is positioned between the input and output circuits of the amplifier. The screen is insulated from chassis by strips of mica (C'x' - C'x') and is maintained at 1.5V negative with respect to chassis by the voltage divider R166/R167 which is connected across the negative HT supply (HT4). This provides the bias for V1 and V2 and allows the cathodes to be directly earthed within the input transformer. Grounding of the control grids at signal frequency is achieved by the feedthrough capacitors C19, 20, 23 and 24 together with the built-in capacity provided by the mica strips at the foot of the screen.

The heater circuits are extensively decoupled by small ferrite chokes and feedthrough capacitors which are attached to the central screen referred to above. Close integration of electrical and mechanical design ensures useful gain and low noise throughout the entire tuning range.

The butterfly tuner which couples the output from the RF Stage to the 1st Mixer Stage is shunt fed via two small built-in capacitors (mica strip) and HT is applied to the anodes of V1 and V2 via two UHF chokes CH11 and CH14. Extensive decoupling is included in the HT feed to the anodes which are supplied from the HT1 rail.

The two GEX66 diodes in the 1st Mixer position are effectively tapped down the butterfly tuner to reduce loading effects, and though providing no gain, this stage does not degrade the noise figure of the amplifier which precedes it. Oscillator injection is developed across the coil L1 and the IF output is coupled through a broadbanded ferrite transformer to the cascode head amplifier V4 (ECC189).

A disc seal triode (DET22) is used in the 1st Local Oscillator Stage with a coaxial line circuit covering the range 660-1160 Mc/s, i.e. tracking 160 Mc/s high of the signal frequency. Scale calibration is dependent on the square-law characteristic of the line tuner and the butterfly is operated from the same drive through a cam corrected tuning device.

The line circuit is tuned by means of non-contacting plungers and output is taken through an electrostatic screen which forms part of the outer cylinder. The pick-up probe is a low value resistor which serves to terminate the coaxial cable feeding the 1st Mixer. The position of the probe can be altered to permit accurate adjustment of the injection level.

A negative HT supply (HT4) of 216V stabilised is used for the 1st Local Oscillator and this allows direct grounding of the outer anode tube.

The 160 Mc/s IF Stages.

Six valves operate at the 1st IF of 160 Mc/s, all interstage circuits being stagger-tuned to achieve a total bandwidth of 20 Mc/s. The head amplifier (V4) uses an ECC189 double-triode in a neutralised series cascode circuit and is mounted adjacent to the 1st Mixer Stage to which it is coupled by means of a wideband ferrite transformer.

The remaining stages are accommodated on a separate chassis and comprise one cascode (ECC189, unneutralised) and four pentode stages. The first three pentode stages are E180F and the last stage which is effectively a buffer stage utilises the pentode portion of a 6U8 (V9B). This stage provides a low impedance output for connection to the 2nd Mixer Stage. A double-screened coaxial cable is used to interconnect the two stages.

The triode portion of V9 functions as a wideband cathode follower and gives an IF output of 160 Mc/s ±10 Mc/s at low impedance (nominally 50Ω but suitable for terminating impedances up to 300Ω). If desired, output can be taken from this source to an external converter and IF amplifier which provides greater selectivity than that available in the Model 770S.

AGC and/or Manual Gain Control are applied to the cascode stages V4 and V5 while the other stages operate at constant gain. Manual control is effected by the variable resistor RV1 (IF GAIN (1)) which is connected in series with the common DC cathode return of the two cascode stages.

Second Frequency Conversion Stages.

V10 and V11 operate as a tunable converter covering the complete bandwidth of the 1st IF and provide output at the 2nd IF of 46.5 Mc/s. Tuning is accomplished by means of the 'FINE' tuning control and this permits a sweep of 10 Mc/s above and below the selected signal frequency.

A pentode connected 6AK5 functions as a low noise mixer and is transformer coupled to provide a low impedance 46.5 Mc/s output which is taken via a low pass filter having a cut-off frequency of approximately 70 Mc/s. This filter prevents generation of spurious responses due to harmonics of the 2nd IF mixing with the output from the 2nd Oscillator.

The 2nd Oscillator employs a 6AF4A in an ultraudion circuit and is fed from the 150V stabilised HT supply (HT3) to prevent frequency change due to variation in the applied mains voltage. The oscillator tracks on the high side covering the range 196.5-216.5 Mc/s.

The complete 2nd Mixer Section (including the filter) is housed in a double-screened box to prevent direct pick-up of the 2nd Oscillator signal by any of the previous stages. Extensive filtering and decoupling is employed for the same reason.

The 46.5 Mc/s IF Amplifiers.

The greater part of the amplification at the 2nd IF of 46.5 Mc/s comes from the first four stages V12-V15 (4 x 6AM6). All four stages operate with AGC and/or Manual Gain Control, the latter being by means of a separate control from that used for V4 and V5. A small amount of current derived negative feedback is applied to each stage to reduce detuning effects due to variation of bias with gain adjustment.

Provision is made in the form of S1 to apply cut-off bias to the cathodes of V12-V15 so desensitising the receiver during standby periods. Output from V15 is taken to two Buffer Amplifiers (V16 and V17, 2 x 6AM6) which serve to isolate from each other, the FM and AM/Video channels.

The AM Stages.

The Buffer Amplifier V17 feeds the AM/Video Detector and the AGC Rectifier. V17 also serves as a cathode follower for IF output at 46.5 Mc/s.

The AM/Video Detector (D4, GEX23) has a response in excess of 3 Mc/s and its output is taken direct to the Video Amplifier V20 and also to the grid of the Anode Follower V18 (6AM6). Extreme top cut is applied to this latter stage which passes audio to the AF Stages via one section of the Mode switch (S3f).

AGC is provided by the shunt rectifier (D3, GEX13) for the first two 160 Mc/s IF Stages and the first four 46.5 Mc/s Stages. The AGC Switch (S2) provides two AGC time constants together with an 'off' position. Extensive filtering is included in the AGC circuit to prevent interstage coupling effects.

The FM Stages.

These comprise V16, 21, 22, 23 and 24 together with the six germanium diodes D5-D10. As mentioned above, V16 is an isolation stage and its output is taken to the Limiter Driver Stage V21 which feeds the common 1st Limiter D5 and D6. All valves in the FM Section are 6AM6 except V24 which is 6AU6.

The two 2nd Limiters (V22 and V23) are both driven continuously and provision is made for measuring the Limiter grid current at JK1. The two Limiters are coupled to two separate Discriminators, both of the Foster-Seeley type. Mode switching is arranged such that HT is applied to the Limiter Driver and the 1st Limiter only in the two FM positions and selection of the desired deviation acceptance is by application of HT to the appropriate 2nd Limiter. Audio output from the selected channel is routed via S3e to the grid of V24 which provides additional audio amplification to equalise the signal level on the FM channels with that on the AM channel. It should be noted that V24 is operated from the 150V stabilised HT supply only to allow the use of physically smaller components.

The Audio Stages.

Output from V24 or from V18 (for AM reception) is routed via S3f to the AF Gain Control RV5. A closed circuit jack socket is incorporated in the lead to the Gain Control and this allows connection of audio signals obtained from an external source. Under this condition of operation, the AF Gain functions in the usual way and normally received signals are interrupted by the auxiliary contact on the jack socket. A 12AU7 serves as the main audio amplifier and driver stage (V25) and is resistance-capacity coupled to the 6AM5 in the output stage (V26).

The 6AM5 amplifier has negative feedback applied and this together with the high quality output transformer provides a response level within ±3dB over the audio range 100 c/s to 10 kc/s. Two secondary windings are available on the output transformer, one of 600Ω (centre-tapped) for line use and the other of 2.5Ω for the built-in monitor speaker or an external unit if this is preferred. The monitor speaker can be switched on or off from the panel (S4) while the external speaker output is interrupted automatically when either or both of the two telephone sockets are in use.

The telephone outputs are derived from the resistive divider R154/R155 which is fed from the anode of V26 via the 0.01µF blocking capacitor C181. The auxiliary contacts on the two telephone sockets are wired so that when telephones are in use, the output transformer speaker winding is loaded with a 10Ω wirewound resistor (either R156 or R157 depending on which socket(s) is/are in use). The line output is uninterrupted when using telephones and the monitor speaker can be used under any condition of operation.

The Meter Amplifier.

A triode-connected 6AU6 is used in this stage (V19) and functions as a conventional DC amplifier.

On AM the control grid of V19 is DC coupled to the output of the AM/Video Detector D4. Under these conditions S3a arranges the meter circuit so that by adjustment of RV4 the meter needle can be set to zero at the left-hand end of the scale (no-signal conditions, aerial input terminated). The meter will now register relative carrier level on a linear scale calibrated in arbitrary divisions 0-10.

When the Mode switch is moved to either of the FM positions, S3a introduces the other zero control RV3 which allows the meter needle to be set to centre scale (coincident with the vertical red line). This adjustment should be made as detailed in the Section dealing with 'Operation'. S3b takes output from the appropriate Discriminator and applies it to the grid of the Meter Valve.

On tuning across an FM signal the meter needle will swing away from the centre line as the signal is tuned in, back to centre at the correct tuning point and then away from centre in the opposite direction as the signal is tuned out.

The Video Amplifier.

This stage (V20) is brought into operation by closing S6 which completes the heater supply to the 6U8 which is used in this position.

The pentode portion of the 6U8 is used as the amplifier and triode portion as a cathode follower. DC coupling is employed throughout. Video output is available at the pin socket SKT6 and care should be taken to keep stray capacity on this output below 25pF if the response is to be maintained up to 3 Mc/s.

The Crystal Calibrator.

The main scale calibration can be checked at 50 Mc/s intervals when the internal crystal calibrator is brought into operation by closing S5.

The crystal oscillator (V27) employs a 6AM6 in a series mode overtone circuit using a 50 Mc/s crystal. A resistive divider network R161/R162 is connected across the heater supply to the oscillator valve to allow a small AC voltage to be tapped off for application to the control grid of the valve. This serves as a form of modulation and allows the calibrator markers to be readily identified.

Output from the calibrator is capacity coupled via C187 to the central screen associated with the grounded-grid stage V1/V2. The small inductance between the connection to the screen and the point(s) at which the screen is earthed, together with a small earthed probe close to one of the RF valves is sufficient to develop adequate injection voltage at all marker points up to 1000 Mc/s.

The Power Supply.

The power supply section of the receiver operates from AC mains voltages in the ranges 100/125V and 200/250V and provides three positive HT supplies, one negative HT supply, one negative bias supply and five separate LT supplies.

Two separate mains transformers are employed each providing LT supplies and feeding separate HT rectification circuits. Silicon rectifiers are used in both HT circuits to improve efficiency and reduce heating effects.

The positive HT rectifier provides two main HT rails HT1 and HT2 both of 225V. Separate smoothing chokes and capacitors are used and a third HT supply of 150V is derived from the OA2 stabiliser V30 which is fed from HT2.

The other rectifier circuit produces a negative HT supply (HT4) which is stabilised at 216V by two OB2 stabilisers V28 and V29. This supply has a positive earth and feeds the line oscillator stage V3.

A divider network across the HT4 line provides a negative bias of 1.5V for the grounded-grid RF Stage.

The distribution of the various LT supplies is as follows:-

LT1	: 6.3V @ 3A	. .	Supplies V1, V2, V4-V9 and V27.
LT2	: 6.3V @ 1A	. .	Supplies the line oscillator V3.
LT3	: 6.3V @ 6A	. .	Supplies V10-V26.
LT4	: 6.3V @ 3A	. .	Supplies the two dial lamps and is also available as an accessory supply (1.5A.).
LT5	: 6.3V @ 0.5A	. .	Accessory supply only.

CONSTRUCTION

General.

The Model 770S can be supplied either as a standard rack-mounting unit (770S/RM) or as a table mounting unit. Either version can be converted to the other by removing certain parts of the existing cover and fitting plates etc. for the desired method of mounting.

Overall Dimensions and Weight.

Table Model	Width	:	19½" (49.5 cm.)	Depth	:	20⅛" (51.1 cm.)
	Height	:	9.7/16" (23.9 cm.)	Weight	:	99 lb. (44.9 kg.)
Rack Model	Width	:	19" (48.3 cm.)	Depth	:	20⅛" (51.1 cm.)
	Height	:	8¾" (22.2 cm.)	Weight	:	87 lb. (39.5 kg.)

Chassis Layout.

The mechanical construction of the Model 770S is best understood if the rack-mounting version is considered first.

Construction commences with the complete drive assembly which is built up between two heavy gauge steel plates. Mounted centrally on the back of the rearmost plate is a screened enclosure which extends the full length of the cabinet and houses the complete RF Section, the 1st IF Unit and the Crystal Calibrator.

Attached to the left-hand side of the central screened unit is the main IF/AF chassis. This is supported at the front by a flange forming part of the strong steel side-plate which is secured to the drive plate by means of a shock absorbent mounting.

A similar side-plate on the right-hand side of the receiver provides fixing points for the positive HT pack which is located in the rear right-hand corner of the assembly.

In the remaining space between the positive HT pack and the drive plate are located the 2nd Mixer Unit and the negative HT pack one above the other. Both are supported by the drive plate with the power supply in the lower position.

A metal plate extending the full width of the receiver cabinet supports the rear edges of the IF chassis, power unit chassis and central screening box. It also provides mounting positions for the various sockets, terminals etc. located at the rear of the receiver.

The side-plates extend forward of the drive plate assembly and serve to support the front panel which is of $\frac{1}{8}$" sheet steel. All electrical connections to the panel (except the mains switch) are made by means of miniature connectors to facilitate panel removal should this be necessary.

The Cover.

The cover assemblies used on the two models have much in common. The side-plates, front panel and the separate rear and bottom covers are fitted as standard parts irrespective of the method of mounting. The top covers differ slightly in dimensions and method of fixing but in both cases are made entirely of perforated material. In rack-mounted models the top cover is held in place by 10 2BA pan-head screws, while on a table model two quick-release 'Oddie' fasteners situated at the rear of the cover provide a convenient method of fixing.

The main difference between the two models lies in the addition of the panel escutcheon and specially shaped side-plates on the table model (the normal side-plates remain in position). The addition of these two items slightly increases the overall height and width but at the same time gives the cabinet a styled appearance. Polythene mounting feet are fitted to prevent marking of the surface on which the receiver is placed.

Ventilation areas in the main side-plates are duplicated in the shaped plates to avoid obstructing the air circulation. The complete cabinet as a whole is very well ventilated with the top and bottom surfaces both made entirely from perforated material. Further ventilation areas are included in the rear cover.

One section of the top cover, common to both models but not visible in the table model is the drive cover. This in addition to preventing the accumulation of dust on the drive mechanism, also serves to carry the two festoon bulbs which are used for dial illumination. The LT supply for the two bulbs is fed via a small two-way connector mounted at the right-hand end of the drive cover. Care should be taken to uncouple this connector before removing the cover.

A removable cover in the side-plate at the right-hand side of the receiver allows access to the negative HT power pack.

Tuning Drives and Dial Mechanism.

The 'COARSE' tuning control requires 60 revolutions to cover the entire range and provides two separate drive outlets together with a gear drive for the calibration disc. Mechanical drive stops are fitted at each end of the tuning range and the disc bears calibration marks at intervals of 10 Mc/s.

The two main outlets mentioned above are arranged to drive (1) a threaded spindle carrying a spring-loaded traverse-nut which actuates the plunger carriers to tune the coaxial line oscillator and (2) a specially shaped cam which tunes and tracks the butterfly unit against the square-law frequency characteristic of the line oscillator.

The 'FINE' tuning control drives the two-gang split-stator tuning capacitor in the 2nd Mixer Unit by means of a spring-loaded split-gear system which also operates the pointer drive pulleys. The control knob requires 24 revolutions to carry the pointer from end to end of its total traverse, a distance of some ten inches. The scale is calibrated '10 HIGH' - 0 - '10 LOW' (Mc/s) and mechanical stops are fitted as on the 'COARSE' control. Great care has been taken to eliminate backlash on both drives.

INSTALLATION

GENERAL

The Model 770S is supplied complete with all valves either as a table mounting unit or in a form suitable for rack-mounting. When rack-mounted the receiver occupies $8\frac{3}{4}$" of height in a standard rack of 19" width. An area $19\frac{1}{2}$" x $20\frac{1}{8}$" is required when the receiver is table-mounted.

Four standard fixing slots are provided when the receiver is intended for use in a rack but no fixing is necessary when the receiver is table-mounted. Small plastic inserts along the lower edge of the shaped side plates prevent marking of the table surface.

EXTERNAL CONNECTIONS

Mains.

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

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

BEFORE CONNECTING TO THE LOCAL AC MAINS SUPPLY, CHECK THAT THE TAPPINGS FOR THE TWO MAINS TRANSFORMERS ARE SET CORRECTLY AS DETAILED IN THE TABLE AT THE END OF THIS SECTION.

External Power Supplies.

HT and LT supplies of restricted rating are available at the 12-way socket (SKT8) at the rear of the receiver and can be used to power small ancillary units which may be used with the 770S.

Connection is made with a 12-way plug (supplied with the receiver) wired as PL4 on the Circuit Diagram at the rear of the Manual. Current drains must not exceed the figures given below:-

HT	..	225V @ 15mA	..	pin 10 (-) and pin 12 (+).
LT	..	6.3V @ 1.5A	..	pin 4 (EARTH) and pin 6.
LT	..	6.3V @ 0.5A	..	pins 1, 2 and 3. (Balanced supply with unearthed centre-tap (pin 2) brought out)

Aerial.

The aerial feeder should be terminated in the standard Type 'N' coaxial plug to mate with the socket SKT1 which forms an integral part of the input transformer and is accessible through a clearance hole at the rear of the cabinet. The input impedance approximates to 50/75Ω throughout the entire tuning range and care should be taken to ensure that the feed impedance lies within this range. The feeder run should be kept as short as possible using semi-air-spaced cable to keep losses to a minimum.

Reference should be made to any reliable aerial manual for design data on aerial systems suitable for use in the range 500-1000 Mc/s.

Earth.

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

Loudspeaker.

Connection should be made to the two spring-loaded terminals marked 2.5Ω. The left-hand terminal, looking at the rear of the set is the earthy side of the output. Connection of an external speaker does not preclude use of the internal monitor speaker.

Telephones.

Two telephone outputs are provided, both connected in parallel. Auxiliary contacts on the telephone sockets interrupt the speaker output and load the transformer secondary winding when 'phones are in use. The monitor speaker facility and the line output are not interrupted when 'phones are used.

Line Output. (600Ω)

This can be balanced or unbalanced as required. When a balanced output is called for, the middle terminal (CT) should be strapped to the earth terminal at the receiver.

IF Output. (160 Mc/s and 46.5 Mc/s)

The 1st IF Output is located on the front panel while the 46.5 Mc/s output is at the rear of the set. BNC connectors are used for both outputs which are suitable for termination in resistive loads of 50-300Ω.

AF Input.

External audio signals can be introduced at the jack socket marked 'AF INPUT' at the rear of the set. Insertion of the jack plug, the sleeve of which is the earthy connection, automatically disconnects the Detector or Discriminator output so preventing interference from normal signals. Video and IF Outputs are still available when the receiver is used in this way.

Limiter Grid.

Connection is by means of a standard jack plug, the sleeve being the earthy connection. By shunting the jack with a 50,000Ω resistor, a DC voltage will become available for connection to an oscilloscope which may be used in conjunction with a sweep generator for checking the IF response.

This facility is only available in the FM positions of the Mode switch since HT is removed from the FM Stages when switched to AM.

Video Output.

A small pin jack is provided for connection to this output. Care should be taken to keep stray capacity below 25pF to maintain the HF response. The shortest possible connecting lead should be used.

MAINS VOLTAGE ADJUSTMENT

When despatched from the factory, both mains transformers are adjusted for operation from 240V AC mains supplies. For other voltages, the tappings on T14 and the voltage selector associated with T13 should be set as indicated in the Table on the following page. The T13 selector is mounted above the chassis of the positive HT unit (i.e. adjacent to T14).

TRANSFORMER ADJUSTMENTS

Voltage	T14		T13
	strap	input to	Selector
100V	C & D E & H	C & H	110V
110V	C & D F & G	C & G	110V
115V	A & B E & H	B & H	110V
125V	A & B F & G	A & G	110V
200V	D & E	C & H	200V
210V	D & F	C & H	200V
220V	D & F	C & G	200V
230V	A & E	B & H	230V
240V	A & E	B & G	230V
250V	A & F	B & G	230V

OPERATION

CONTROL FUNCTIONS

Coarse Tuning.

This is the main tuning control of the receiver and tunes the butterfly unit associated with the RF Stage together with the line oscillator which feeds the 1st Mixer.

Fine Tuning. (1)

Tunes the Mixer and Oscillator in the 2nd frequency conversion stage. When used in conjunction with the coarse control, a sensibly constant tuning rate is available throughout the complete coverage.

Fine Tuning. (2)

Mounted concentrically with the Fine control above, this control allows correction of the butterfly tuning when the 1st IF is detuned from its nominal frequency.

IF Gains 1 and 2.

IF Gain 1 controls the gain of the two cascaded cascode stages at the head of the 160 Mc/s IF chain. As the first gain control in the circuit, IF Gain 1 takes the place of the more usual RF Gain.

IF Gain 2 is more conventional in that it functions as a normal IF gain control permitting adjustment of the amplification in the first four stages operating at the 2nd IF.

AF Gain.

Conventional audio volume control controlling the level of input to the audio section of the receiver. This control functions normally when external audio signals are fed in at JK2.

Signal Mode Switch.

Selects AM or FM (Wide or Narrow) as required by suitably routing output from the detector or appropriate discriminator to the audio section and meter amplifier. HT is completely removed from the FM stages when switched to AM. FM Narrow is labelled 'FM' and FM Wide 'FMW'.

Video On/Off.

This switch completes the LT supply to the Video Amplifier Stage. Normal valve warm-up time must be allowed before the output becomes available.

AGC Switch.

Provides a choice of either automatic and/or manual gain control of the IF amplifiers. Two AGC time constants are available.

Standby Switch.

Applies cut-off bias to the first four stages operating at the 2nd IF so muting the receiver on 'standby'. The HT supplies remain on the oscillators to ensure that drift is negligible during periods when the receiver is not required but must be available for immediate use.

Calibrator Switch.

Brings into operation the internal crystal calibrator which provides markers at intervals of 50 Mc/s. The calibrator signal is modulated at 50 c/s to simplify identification of the signal.

Mains.

Breaks both sides of the mains to both transformers when placed in the 'off' position.

Meter Zero Controls.

Two separate potentiometers which allow the meter needle to be set to suit the mode of reception; i.e. to normal zero for AM and centre-zero for FM.

Dial Lamp Brilliancy.

A pre-set control located at the rear of the receiver to permit adjustment of the scale illumination.

TUNING INSTRUCTIONS

Check that an AC mains supply is available and that all external connections are correctly made. Ascertain that an aerial suitable for the frequency or frequencies to be used is connected to the socket at the rear. Either switch on the monitor speaker, connect an external loudspeaker, or, if speaker reception is not required, plug in a pair of telephones at either of the sockets on the front panel.

Next place the Mains switch to 'on'. An indication that the receiver is operative is given by illumination of the tuning scales. The brilliancy of this lighting can be set as required by adjustment of a pre-set control at the rear of the receiver (left-hand side).

The receiver can be tuned in two ways, either of which may take advantage of the built-in Crystal Calibrator when precise adjustment is required. For general 'search' tuning the Fine control should be set to the '0' mark at the centre of the scale. The Coarse control can then be used to tune over the complete range, scale accuracy being checked against the Calibrator at intervals of 50 or 100 Mc/s as required. Under these conditions the Calibrator signal can also be used to check the alignment of the butterfly tuner.

To check the calibration, switch on the Calibrator and move the Mode switch to FM. Tune to the appropriate calibration point and adjust the Coarse control so that the needle on the tuning meter is coincident with the red line on the meter scale. If the adjustment has been made correctly, tuning in either direction should now cause the meter needle to swing away from centre. The butterfly tuner can be peaked by ear using the fine adjustment provided (concentric with and at the rear of the 'main' Fine tuning control). Tuning can now proceed normally with the Calibrator left 'on' or switched 'off' as convenient and the Mode switch returned to the appropriate position.

The Fine tuning control can be used at any time as a form of 'vernier' adjustment or, if desired, to correct any minor calibration error on the Coarse tuning scale.

Under certain conditions it may prove more convenient to set the Coarse control to the nearest calibration point to the frequency required and then tune 'high' or 'low' on the Fine control to obtain the desired frequency. Always check that the butterfly is peaked correctly by means of the independent control.

The type of reception can be selected rapidly with the Signal Mode switch at the left-hand side of the panel. AGC should be switched on when required and under these conditions both IF Gain controls should be set near maximum to secure best AGC action. If manual control is used, run IF Gain (1) at maximum unless the strength of the signal is such that adequate gain reduction cannot be obtained with IF Gain (2).

It should be noted that the 160 Mc/s IF Output level is not affected by IF Gain (2) but that all other outputs can be set at the desired level by adjustment of either IF Gain, preferably keeping IF Gain (1) near maximum as mentioned above. Limiter grid current can only be measured when the Mode switch is at either FM position.

Adjustment of the Meter Zero Controls.

Proper operation of the built-in meter will only be obtained if the two pre-set zero adjustments are set correctly. The AM zero should be adjusted first using the following procedure.

With the Signal Mode switch at AM, disconnect the aerial feeder and terminate SKT1 with a non-inductive load equal to the feeder impedance (50-75Ω). Tune to approximately 500 Mc/s and adjust the AM zero until the meter needle is coincident with the '0' at the left-hand end of the meter scale. Now reconnect the aerial and tune to a steady carrier (preferably unmodulated). Adjust the tuning control for maximum deflection of the meter needle and then move the Mode switch to FM. Without touching any other controls, adjust the FM zero so that the meter needle takes up a position on the vertical red line at the centre of the meter scale. The meter is now correctly adjusted for both AM and FM reception.

NOTE: On FM, under 'no-signal' conditions, the meter needle may not lie on the red line. This does not indicate maladjustment of the FM zero but is a function of the ambient noise level and the actual setting of the input tuning.

MAINTENANCE

GENERAL

The Model 770S is 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.

All switches used in the receiver are of the self-cleaning type and should therefore require no attention. All moving parts are lubricated with a permanent lubricant (molybdenum disulphide) so that regular lubrication is entirely unnecessary. If after the equipment has been in use for a considerable period of time it is felt that additional lubrication is necessary, this can be carried out with any light mineral oil suited to the temperature conditions under which the receiver is operated.

As with any piece of electronic equipment, periodic dust removal should be carried out, taking care not to disturb any of the pre-set adjustments. External connections, especially telephone leads should be checked from time to time to ensure complete serviceability.

Dial Lamp Replacement.

The two dial lamps (festoon type) are located on the underside of the drive cover and are readily accessible for ease of replacement.

In the case of a table mounted installation, all that is necessary is to release the two 'Oddie' fasteners at the rear, take off the top cover and then remove the drive cover by taking out the two retaining screws. The drive cover should be lifted carefully to avoid damage to the dial lamp supply connector which is located to the right-hand side of the assembly. The connector must be un-plugged to allow complete removal of the cover.

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

The procedure is the same in the case of a rack-mounted unit except that removal of the top cover is not necessary if the drive cover is tilted whilst being removed.

6V 3W 'Festoon' bulbs should be used as spares.

Fuse Replacement.

The mains input to both power transformers is fused with a single fuse rated at 3 Amps. Standard 1¼" cartridge type fuses (mag nickel preferred) should be used as spares; two are retained in clips on top of the inner screening box (RF Unit). The fuseholder is located at the rear of the receiver near the external power supply plug and is wired in series with the live supply lead.

If a replacement fuse blows as soon as the receiver is switched on, or fuses fail repeatedly over short periods of operation, immediate checks should be made to determine the cause. In this event, fault finding may be simplified if the two power units are isolated by breaking the mains supply to one unit while checking the other.

The mains input to the negative HT pack can be disconnected by unsoldering the two grey leads (sleeved blue and green) which run from the negative pack to the small stand-off tags near the electrolytic capacitors on the positive HT chassis. The positive HT pack remains in operation in the normal way and the input fuse can be reduced temporarily to one rated at 2 Amps.

Valve Replacement.

All valves used in the Model 770S receiver are standard CV types and no difficulty should be experienced in obtaining spares should the need arise. Most of the valves are conveniently located for replacement whilst a minority are more difficult of access as a result of the extensive screening which is essential in a receiver of this type.

V12-V26 and V30 can be removed without any operation other than opening the lid (or taking off the top cover in the case of a rack-mounted version). To gain access to V1, V2 and V4-V9 it is necessary to take off the top cover from the central screened enclosure. The cover plate is held in place by twelve screws which are disposed two at each end and four on either side.

Also located in the central unit is V3, the disc-seal triode in the 1st Local Oscillator Stage. This is not accessible from the top but can be changed by taking off the rear cover of the receiver (6 screws). It is suggested that the receiver is placed face-down on the panel handles to simplify the operations entailed in changing V3.

Removal of the rear cover will reveal a large circular hole near the centre of the back plate. A large knurled dome is visible through this aperture and this should be unscrewed carefully (turn anti-clockwise) and then lifted clear. The 'anode end' of the DET22 will now be seen and this should be gripped carefully withdrawn with a direct pull. It is important to avoid exerting any sideways strain since this could possibly distort the contact springs.

When fitting a replacement valve, care is necessary to avoid damage to the heater pin at the base. The anode disc must be properly seated on the anode contact flange in the end of the line before replacing the knurled dome which must be tightened securely to ensure good contact with the anode disc.

Changing V3 may call for slight adjustment of the main scale calibration disc. A check can be made by using the 50 Mc/s markers as a guide and if adjustment is required refer to the notes on re-alignment later in this Section.

The 6AK5 and 6AF4 in the 2nd conversion stage (V10 and V11) are housed in the silver plated double screened box at the right-hand side of the receiver. To gain access to these valves, first take out the four screws at the corners of the outer lid. The lid can then be removed to reveal the inner screening box. Any resistance felt in removing this lid is due to the spring earthing strip along the inner edges.

The inner box has two top covers, one being a push-fit type and the other being hinged at the centre where the two covers meet. The latter cover is towards the rear of the unit and need not be opened for the purpose of changing valves. The front lid is removed by gripping it on two sides and pulling upwards (earthing strip is fitted as on the outer lid). V10 is towards the rear of the unit when the set is viewed from the front.

When replacing the covers, ensure that the edges which carry no earthing strip are towards the rear of the unit.

The two stabilisers (V28 and V29) in the Negative HT pack are accessible through the removable side plate in the right-hand side of the receiver.

NOTE: In the case of table models it is necessary to remove the shaped side cover to gain access to the removable side plate. Slacken off the three 2BA screws at the rear of the cover and the two $\frac{1}{4}$" BSF socket types situated behind the panel handle. The shaped side cover is provided with slots which locate with the fixing points and allow it to be lifted clear without removing the screws completely.

Valve tongs or a suitable extraction tool will be required to remove and replace the two OB2's used in this position. In the absence of a suitable tool, V28/29 can be changed easily when the bottom cover is taken off the receiver.

Cleaning the Dial Glass and Scale Plate.

The dial glass can be removed by taking out the four 'Phillips' retaining screws at the corners of the dial escutcheon. The window is best cleaned by using one of the various domestic cleaning products which are specially designed for this purpose. Care should be taken not to finger-mark the inside of the glass after cleaning.

The scale plate can be cleaned by wiping lightly with a soft lint-free cloth which has been very slightly moistened in warm water. A gentle rub over with a dry cloth will remove all traces of moisture before the dial glass is replaced.

REMOVAL OF UNITS

Removing the Butterfly Unit.

NOTE: To remove this unit the top and bottom covers must be removed from the central screened enclosure and also the rear cover plate from the receiver. It may be desirable to take out the A2521's to avoid the possibility of damage during removal.

1. Release the tension spring attached to the cam follower. (This is accessible from the underside of the chassis and can be freed quite easily with a pair of narrow nosed pliers.)
2. Unsolder (a) secondary connections of L2 to L3 and (b) earthing strip from 160 Mc/s Head Amplifier sub-chassis to butterfly assembly.
3. Remove the pick-up probe from the Line Oscillator by slackening the locking screw on the side of the probe chimney.
4. Remove the Calibrator Unit. (see separate instructions)
5. Remove the Calibrator support plate by taking out the two screws at the rear.
6. Unplug the miniature 6-way connector which feeds the supplies to the butterfly unit.

7. Locate and remove the four 2BA pan-head screws which are situated at the corners of the butterfly support plate.

8. Lift the butterfly assembly clear of the chassis.

Removing the 160 Mc/s IF Chassis.

1. Remove PL1 from SKT3.

2. Unplug the miniature 6-way connector which feeds the supplies to the 160 Mc/s IF Unit.

3. Unsolder (a) secondary connections of L2 to L3 and (b) earthing strip from 160 Mc/s Head Amplifier sub-chassis to butterfly assembly.

4. Place the receiver on its left-hand side and remove the three hexagon-headed screws which secure the 160 Mc/s Unit to the side of the central screening box.

5. Lift the unit free, making sure that the three fixing screws are left in position for convenience in replacing the unit.

Removing the Crystal Calibrator Unit.

1. Locate the lead which runs from the underside of the Calibrator Unit to the screen across the grounded-grid RF Stage.

2. Remove the screw which secures the solder tag to which this lead is attached. Replace the screw to avoid loss and then place the lead in a position which will allow it to pass freely through the hole in the Calibrator support plate when the unit is removed.

3. Free PL3 from SKT7.

4. Remove the two screws which retain the earthed injection probe at the right-hand end of the Calibrator Unit.

5. Lift the probe clear and then remove the two screws at the other end of the Calibrator Unit.

6. The unit is now free and can be lifted clear. Lift slowly whilst feeding the injection lead through the hole in the support plate.

Removing the Negative Power Unit Chassis.

1. Turn the receiver upside down and remove the bottom cover.

2. Unplug the miniature 6-way connector which is situated on the underside of the positive HT power supply chassis.

3. Unsolder the leads in the cable form which links the positive and negative power supply chassis.

4. Unsolder the leads from the negative power supply chassis to the group of feed-through capacitors on the side of the central screened enclosure.

5. Remove the four 2BA pan-head screws (at front and rear of unit) and lift the chassis clear.

Removing the Front Panel Assembly.

1. Remove the top cover, drive cover and bottom cover.

*2. Slacken the four $\frac{1}{4}$" BSF socket screws which are located behind the panel handles. Remove the shaped side covers after slackening the three 2BA screws on each side at the rear of the set.

*3. Remove the socket screws completely, take off the panel handles and remove the panel escutcheon.

4. Remove the finger plate by proceeding as follows:-

(i) Remove all control knobs and the Fine Tune adjustor.
(ii) Remove the tuning meter after disconnecting the two leads at the rear. (Leads are colour coded orange : positive and purple : negative.)
(iii) Remove the switch rings from the Standby Switch and Mains Switch. Remove the panel nut from the Lim. Grid jack socket.
(iv) Take out the four 'Phillips' screws at the corners of the dial escutcheon so that this can be removed complete with the dial glass.
(v) Remove the panel handles. (Already removed if table model.)
(vi) The finger plate is now free and can be lifted away from the front panel.

5. Unplug the 10-way connector and the three 6-way connectors at the rear of the front panel (lower edge). These connectors carry all panel wiring except the leads to the Mains Switch. This control should be eased through the panel hole and then positioned in the clear to avoid fouling the panel on removal.

6. Take out the six panel retaining screws and remove the panel.

*Table model only.

DRIVE CORD REPLACEMENT

In the unlikely event of the pointer drive cord either breaking or slipping from the pulley grooves, the procedure outlined below should be adopted in re-stringing. If the cord is unbroken it may be possible to replace it correctly without removing the panel. Relevant information can be extracted from the instructions which follow:-

1. Remove the front panel assembly. (See separate instructions.)

2. Take off the scale plate to allow complete access to the drive cord system.

3. Remove the pointer.

4. Remove the old drive cord by slackening the 6BA 'ti-off' screws in the two drive pulleys.

5. Rotate the Fine Tuning control in a clockwise direction as far as it will go.

6. Secure one free end of the replacement cord to the 6BA screw in the left-hand drive pulley. Check that the slot in the pulley is at about 1 o'clock and then slide the cord through the slot and into the second groove from the rear of the pulley (cord leaving pulley from right to left).

7. Take the free end of the cord across to the guide pulley at the left-hand side of the set; pass the cord under and over the pulley and back across towards the right-hand side of the set.

8. Hold the free end of the cord in one hand and rotate the Fine Tuning control twenty-four revolutions in an anti-clockwise direction (i.e. until it reaches the end stop). This operation will automatically wind approximately three complete turns of drive cord onto the left-hand drive pulley and tension must now be maintained on the free end to prevent these turns from slipping out of the pulley grooves.

9. Pass the free end of the drive cord around the jockey pulley in a clockwise direction.

10. Lay the cord in the front groove of the right-hand drive pulley and apply sufficient tension to cause the jockey pulley to take up a position approximately $\frac{1}{8}$" from the side plate.

11. Wind approximately half a turn anti-clockwise and then pass the cord through the pulley slot and secure to the 6BA screw.

12. Rotate the drive through its full travel and check that the cord runs smoothly in the pulley grooves.

13. Replace the scale plate and set the Fine Tuning control to the fully clockwise position.

14. Fit the pointer at the right-hand end of the scale plate. Again check the drive for smooth running.

15. Replace panel assembly etc.

FAULT LOCATION

Despite the comparatively involved nature of some of the circuitry found in the 770S receiver, fault location can be classed as a relatively simple procedure. Reference to the Block Schematic Diagram rather than to the Circuit Diagram will show that there are a number of well defined signal paths which tend to divorce many of the later stages in the receiver. As a result of this, faults occuring in this portion of the receiver will exhibit fairly obvious symptoms and will therefore allow a more or less immediate diagnosis to be made.

For example, assume that the receiver performs normally in both the 'FM' positions but is inoperative on 'AM'. A glance at the block diagram will identify three stages in which the fault could possibly lie, namely V17, D4 and V18. The Buffer Stage (V17) can be vetted rapidly by checking for IF output (46.5 Mc/s) at the BNC socket on the back of the set. If this stage is functioning properly, a normal output should be obtained and a check on the AGC line with a valve voltmeter should show a detectable voltage in the presence of a carrier.

Assuming that V17 is functioning normally then the check can be switched to the Detector D4. If this stage is operative an output should be obtained from the Video Amplifier and this can be checked by connecting a pair of telephones to the Video Output socket. (The output should be blocked to DC by connecting a 0.01μF capacitor in series with the telephones). If 'phones are not available, it is possible to link the Video Output via a 0.01μF capacitor to the AF Input socket at the rear of the set and in this case the built-in monitor speaker would be used to provide the necessary indication.

A further check on the operation of the Detector is to observe the built-in tuning meter while tuned to a carrier with the Mode switch in the 'AM' position. Under these conditions the Meter Amplifier is connected directly to the Detector output and a deflection of the meter needle will give an indication that this stage is functioning normally.

If both the Buffer Stage and Detector are proved to be working normally, the investigation should be transferred to V18. Voltage checks are probably the best line of attack in this case and the appropriate voltage readings can be extracted from the comprehensive Table at the rear of the Manual (App 'B'). If V18 appears to be normal then the fault may possibly lie in the Mode switch wafer S3f or in the wiring to it.

A similar example which again shows the rapidity with which an assessment can be made is lack of output on both 'FM' channels while the 'AM' channel is working normally. At first sight this could be a fault in any of the following stages - V16, V21, D5/D6 or V24. The first three stages can be eliminated immediately if, in the presence of a carrier, normal operation of the tuning meter is obtained.

Complete loss of output on both 'AM' and 'FM' channels could be due to a fault in the Audio Stages V25/26 or in any one of the stages prior to the FM/AM division at the output of V15. Proper operation of the Audio Section can be verified very simply by injecting an audio signal at the Audio Input socket at the rear of the set. An output of 50mW will be obtained for an input of 16.5mV if all stages are working normally. If no fault is detected by this test it is most likely that the fault is ahead of V15, but a check should be made on the operation of the tuning meter because it may be that the fault is in the Mode switching to the Audio Section.

SKT4 provides a convenient point of entry for checks on the 46.5 Mc/s amplifiers V12-V15 and a signal generator tuned to the IF channel will provide an immediate indication as to whether the stages after this point are working correctly. Faults occuring in the 46.5 Mc/s Stages are most easily located by carrying out voltage checks and all points are readily accessible for this purpose after removal of the under-chassis screen.

Normal signal tracing techniques can be applied to the earlier stages, suitable connection points for the generator being at the grid of V10 and at each of the trimmers on the 160 Mc/s IF chassis.

Operation of the 1st Local Oscillator can be checked by making up a temporary probe using a suitable diode to operate a sensitive μAmmeter. Checks on the cathode current of the oscillator can also be made as explained in the Section on 'Re-alignment'.

General.

The initial factory alignment of the Model 770S will hold good for a long period and no attempt should be made to alter the alignment adjustments unless there is a clear indication that this is in fact necessary. Degradation of performance after the receiver has been in use for any length of time is more likely to be due to a valve or component failure than to misalignment of the various tuned circuits. Sensitivity and noise measurements will quickly reveal whether or not the equipment is performing correctly.

If re-alignment is found to be necessary, full instructions will be found in the pages which follow. Adjustments should be carried out by personnel who are experienced on this type of equipment and an adequate range of test instruments must be available if the task is to be completed satisfactorily. Each sequence should be followed in full exactly as detailed.

Re-alignment of the 46.5 Mc/s Stages.

Test Equipment: Standard Signal Generator modulated 30% at 400c/s having a 75Ω output and covering the range 43.5-49.5 Mc/s.

Frequency Meter or Crystal Calibrator to check the accuracy of the Generator calibration.

Output Meter matched to 2.5/3Ω.

Centre-zero μAmmeter scaled 50μA - 0 - 50μA.

Trimming Tools. (a) Neosid Type H.S.l.
(b) Small insulated screwdriver.

Before commencing re-alignment it is important to check the accuracy of the Generator scale calibration since the IF centre frequency must be set accurately to within 100 kc/s. A suitable Frequency Meter or Crystal Calibrator should be used in conjunction with a monitor receiver to ensure that at least this degree of accuracy is achieved.

The first step in the alignment procedure is to tune all the IF transformers except those associated with the FM Stages and the transformer T1 which is located in the 2nd Mixer Unit. To do this, PL2 is removed from SKT4 on the main IF chassis and the output lead from the Signal Generator is connected at SKT4. The lead must be terminated with a standard Belling Lee coaxial plug Type L.734 to mate with this socket. An Output Meter matched to 2.5/3Ω should be wired to the external loudspeaker terminals at the rear of the receiver and the controls should be set initially as follows. (The built-in speaker can be used to provide aural monitoring during alignment but must be switched off when checking sensitivities.)

IF Gain 1	Minimum.	Video	Off
IF Gain 2	Maximum.	AGC	Off
AF Gain	Maximum.	Calibrator	Off
Mode Switch	'AM'.	Standby	On (i.e. dolly towards coaxial socket)
Monitor L.S.	On.		

Arrange the Signal Generator to provide an output of between 150-200μV (modulated 30% at 400 c/s) and tune it in turn to each of the spot frequencies listed in the Table below. Adjust the appropriate circuits for maximum output. All circuits have single tuned windings and are adjusted from the top using the Neosid Type H.S.l. hexagonal tool. Reference should be made to the plan view of the receiver for identification of the individual transformers.

Freq.	Adj.	Freq.	Adj.
47.6 Mc/s	T8	48.8 Mc/s	T4
44.6 Mc/s	T6	48.8 Mc/s	T3
46.0 Mc/s	T5	47.0 Mc/s	T2

Once the circuits listed above have been set to the frequencies indicated, check that the sensitivity measured from SKT4 is of the order 150μV at 46.5 Mc/s for an output of 50mW and then proceed with alignment of the FM Stages. It should be noted that the IF response is checked later in the procedure after Tl has been adjusted.

In alignment of the FM Stages, the first step is to adjust the output circuits of the FM Buffer Stage (V16) and the Limiter Driver Stage (V21). These two stages are aligned by observing the grid current as measured at the Limiter grid jack on the front panel of the receiver. The 50 - 0 - 50 μAmmeter which is specified for Discriminator alignment can be used for this purpose and should be wired to a suitable jack plug to mate with the jack socket on the panel. If a plug is not available connection can be made quite easily to the socket wiring behind the panel but in this case but in this case it will be necessary to ensure that the shorting contacts on the jack are open-circuited. Screened lead with the braid connected to earth should be used to make connection to the meter.

Tune the Signal Generator to 46.5 Mc/s and adjust the attenuator to give an unmodulated output of the order 500μV. Now, with the Mode switch set to 'FM', peak the cores in T7 and T9 for maximum reading in the μAmmeter. If the sensitivity on the FM Channel is within its specification a reading of the order 10μA should be obtained for an input of 200μV at SKT4.

Disconnect the μAmmeter from the Limiter grid and proceed with alignment of the two Discriminators. The 'Narrow' Discriminator is adjusted first by adopting the following procedure.

Connect a 0.1 megohm resistor in series with the 50 - 0 - 50 μAmmeter and earth one side of the meter. Connect the free end of the 0.1 megohm resistor via screened lead to tag 4 on the miniature 6-way connector which is immediately behind the front panel. The lead to tag 4 is easily identified by its end sleeve coding which is 'yellow-blue' (reading from the end of the lead). When connected in this way, the meter is wired directly across the output load of the Narrow FM Discriminator and this obviates the need for removing the underside screen from the IF chassis to gain access to this point.

Now remove completely the top core from Tll and with the Generator tuned to 46.5 Mc/s (Mode switch at 'FM') trim the bottom (primary) core of Tll on its outer tuning point for maximum reading on the μAmmeter. Replace the top core (taking care to fit the rubber locking string) and adjust on its outer tuning point for zero reading on the μAmmeter. Once this adjustment has been made, check the linearity of the Discriminator output by off-tuning the Generator by equal amounts to either side of the centre frequency. It is suggested that checks are made at ±50, ±100, ±200 and ±250 kc/s. If the current readings for equal deviations are within 10% then the adjustment can be considered complete; otherwise a further slight adjustment of the primary (bottom) core will be required for better linearity. (The bottom core can be adjusted from above chassis by passing the trimming tool through the bore of the upper core). If the primary core has to be re-adjusted always re-check the secondary core for zero reading before finally checking the linearity.

The same basic procedure is used to align the 'Wide FM Discriminator' T10 except that in this case there is no need to remove the secondary core. Instead, the core should be set initially so that it is flush with the top of the screening can. Linearity checks should be made at ±100, ±500, ±1000 and ±1500 kc/s. Greater output will be required from the Generator when aligning the 'Wide' Discriminator and the μAmmeter should be connected to tag 5 of the miniature 6-way connector (lead is coded blue/yellow).

The FM Channel sensitivity can now be checked from SKT4 by injecting 46.5 Mc/s and swinging the Generator tuning over ±250 kc/s in FM 'Narrow' and ±1.5 Mc/s in FM 'Wide'. An input of 600μV in the 'Narrow' position should produce a Discriminator output of the order 30μA - 0 - 30μA. In FM 'Wide' a 2mV input should give a swing of 10μA - 0 - 10μA.

At this stage, the Generator output lead is disconnected from SKT4. PL2 should be re-connected and the 46.5 Mc/s alignment continued by adjustment of the 2nd Mixer anode circuit T1.

It is necessary to remove the covers from the 2nd Mixer Unit to gain access to T1. Take out the four screws in the corners of the outer lid and lift off to reveal the inner cover. Any resistance felt in removing the lid is due to the sprung earthing strip around the inner edges. The inner cover is in two parts and only the front section is removed; earthing strip is fitted as on the outer cover.

The Generator output is fed to the grid of the 2nd Mixer V10 and a convenient point to make connection is at the tag at the rear of the Mixer assembly to which is connected the 0.47 megohm grid resistor R50.

Tune the Generator to 47.5 Mc/s with the modulation set at 30% (400 c/s) and peak T1 for maximum reading on the Output Meter. Now re-tune to 47.0 Mc/s and re-adjust T2 since this may be slightly detuned by the Mixer output filter which was not connected during the previous phase of the alignment. The filter is pre-set and will not require adjustment.

Having re-tuned T2, next check the IF response over the band 45-48 Mc/s, ensuring that the Generator output is held constant at a level of some 400μV. If the alignment procedure has been followed precisely as indicated, it is probable that the low frequency side of the response will exhibit a drop of more than 3dB. Should this be the case, then adjustment of T8 will even up the output across the passband. No other circuits need be touched. At this stage in the alignment procedure, the sensitivity at 46.5 Mc/s from the grid of V10 should be of the order 400μV for an output of 50mW.

Re-alignment of the 160 Mc/s Stages and 2nd Conversion Unit.

Test Equipment — Standard Signal Generator modulated 30% at 400 c/s having a 75Ω output and covering the range 145-175 Mc/s.

Frequency Meter or Crystal Calibrator to check the accuracy of the Generator calibration.

Output Meter matched to 2.5/3Ω.

Trimming Tools.
(a) Small insulated screwdriver.
(b) Phillips concentric type.
(c) Neosid Type H.S.1.

Alignment of the stagger-tuned 1st IF Stages is most conveniently carried out by disabling the 1st Mixer Stage and introducing the Signal Generator (tuned to the 1st IF band) at the aerial input socket at the rear of the receiver. This approach is preferable to injecting directly at the Head Amplifier (V4) because of the difficulties involved in providing a well screened connection at this point. Neutralisation of the 1st cascode stage is also made easier because of the reduction in signal leak-through which gives a more definite indication of the correct adjustment.

As with alignment of the 46.5 Mc/s Stages it is important to verify the accuracy of the Generator scale calibration. An accuracy of better than 500 kc/s is called for.

The output of the broadband 1st IF is tuned over the range 150-170 Mc/s by the Fine Tuning control and a check must be made to ensure that this coverage is correct before proceeding with adjustment of the stagger-tuned stages.

Adjust the Fine Tuning control so that the pointer reads '0' and inject a modulated signal on a frequency of 160 Mc/s at the grid of V10. (Connection should be made to the tag at the rear of the Mixer assembly to which is attached the 0.47 megohm grid resistor R50). Approximately 0.6mV will be required to give a 50mW reading on the Output Meter which should be connected to the 2.5Ω terminals at the rear. With the controls set as for alignment of the 46.5 Mc/s Stages (Mode switch at 'AM'), trim C77 for maximum output.

Now tune the Generator to 150 Mc/s and swing the Fine Tuning control around the 10 Mc/s point at the 'HIGH' end of the tuning scale. At this stage the main concern is that this frequency is within the tuning range and no attempt should be made to correct any error which may be present. Repeat the check with the Generator tuned to 170 Mc/s and the receiver set to 10Mc/s 'LOW'. (It should be remembered that the 'FINE' scale is calibrated in reverse to compensate for the inversion which is common to any double conversion system with a tunable 1st IF in which both local oscillators operate on the same side of the signal).

Once the coverage of the 2nd Oscillator has been checked as described above, disconnect the Signal Generator and re-connect its output lead to the aerial input socket at the rear of the receiver. Slacken the retaining screw in the side of the output chimney at the end of the line oscillator and withdraw the pick-up probe to disable the 1st Mixer Stage. Now set IF Gain 1 at maximum and tune the receiver to '0' on the Fine scale. Arrange the Generator to provide a modulated output on 160 Mc/s and then peak the trimmer C84 in the 2nd

Mixer grid circuit for maximum reading on the Output Meter. (An attenuator setting of about 500µV will be required to give an output of 50mW when the Generator is connected at the aerial input.

Alignment of the stagger-tuned stages can now be commenced. Set the Generator to each of the spot frequencies indicated in the Table below, tune in the signal with the Fine Tuning control and then adjust the appropriate trimmer or core for maximum output. It may be found that the adjustments of L7 and C49 will interact to some extent and these should be repeated as necessary to ensure correct tuning.

Freq.	Adj.	Freq.	Adj.
165 Mc/s	C74	171 Mc/s	C40
151 Mc/s	C69	160 Mc/s	C31
152 Mc/s	C61	150 Mc/s	L5
171 Mc/s	C55	150 Mc/s	L7
171 Mc/s	C49		

Next, check the response over the complete IF band. The Generator should be tuned in 1 Mc/s steps and the Fine Tuning control adjusted to peak the signal as observed on the Output Meter. Keep a careful check on the Generator output to ensure that it remains constant throughout the range and note the receiver output at each 1 Mc/s point. If, on completion of the check, any point(s) is/are greater than 3dB down relative to the greatest output, adjust C61 to level up the response. No other adjustment will be required.

The next step is to improve the noise factor in the 160 Mc/s IF strip by neutralising the cascode amplifier V4. It is necessary to remove the HT from this stage while the neutralising adjustment is being made and the most convenient point at which to break this supply is at the feed-through capacitor C71. This is located on the top of the 160 Mc/s IF chassis and examination will reveal that there are two red leads connected to it. One of these is the feed direct from the miniature 6-way connector which supplies the main 160 Mc/s IF Stages; the other is a continuation of this lead (feeding V4) and it is this wire which must be unsoldered. Do not remove both leads because the remaining 160 Mc/s Stages must be fully operative while the neutralising is carried out.

The adjustment should be made in the centre of the IF band (i.e. with the Generator tuned to 160 Mc/s and the Fine Tuning control set to '0'). The Generator output must be increased considerably to give a reasonable reading on the Output Meter and it may be found advantageous to swing the Fine Tuning control for maximum signal.

With the receiver operating under these conditions all that is required to effect neutralisation is to adjust L4 for minimum signal. The dip should occur well within the coverage of the core. Re-connect the HT on completion of the adjustment.

It is now in order to proceed with alignment of the 2nd Local Oscillator to ensure accurate calibration of the 'Fine' tuning scale. This phase of the alignment is most conveniently carried out by using a modulated crystal calibrator having outputs at 1 Mc/s and 10 Mc/s intervals over the range 150-170 Mc/s. If such an instrument is not available then it will be necessary to use a standard signal generator but the time taken to complete the checks will be longer because of the need for continual re-tuning and checking of the signal generator calibration. (The accuracy must be better than 500 kc/s).

The Calibrator should preferably be introduced at the aerial input socket but if the unit has insufficient output it will be necessary to inject at L3 on the Head Amplifier sub-chassis. In this case care must be taken to ensure that a well screened connection is used. The control settings should be as for alignment of the 160 Mc/s Stages and for greatest accuracy it is best to use the Output Meter as an indication of the correct tuning point.

Before commencing the check, examine the tuning gang and ensure that this is set so that the vanes are about 10^{o} out of mesh when the Fine Tuning control is at 10 Mc/s 'HIGH'.

It is doubtful whether there would be any need to alter the inductance of the oscillator coil L14 once this has been set accurately during the initial factory alignment and correction of minor errors should be possible by adjustment of C77 alone. C77 should be adjusted to bring in the 170 Mc/s marker with the Fine Tuning control set to 10 Mc/s 'LOW'. After doing this, tune to the '0' point at the centre of the scale and also to 10 Mc/s 'HIGH'; note the errors at these points.

The errors should not exceed 500 kc/s for the scale readings to be within the limits laid down. If it should be found that the accuracy only falls out of limits towards the 10 Mc/s 'HIGH' part of the scale, it may be possible to re-adjust C77 slightly to compensate for this error and so give a more constant degree of accuracy over the whole band.

If the adjustment afforded by C77 will not fully compensate for the inaccuracy that is present, L14 must be adjusted either by opening up or closing together the turn spacing to obtain the required inductance. It should be noted that the coil has been treated with polystyrene cement after initial alignment and this must be removed to permit adjustment. Care should be taken to avoid breaking the tap which connects to the 6,800Ω resistor R47, and also to avoid damaging the trimmer C77 which is situated immediately above the coil. This trimmer is of miniature construction with very close vane spacing and could easily be damaged if inadvertently knocked or subjected to accidental pressure.

L14 should be adjusted to tune in the 150 Mc/s marker at 10 Mc/s 'HIGH' on the 'Fine' tuning scale. It should be remembered that adjustment of the inductance value will call for re-adjustment of the trimmer and repeated checks should therefore be made until the inevitable interaction is balanced at the correct tuning points. The turn spacing on L14 will require only very slight alteration to correct for what would be a very minor error in inductance value. Once the end points and centre calibration mark are correct, switch to 1 Mc/s markers and make a final check of the accuracy at all calibration points on the scale.

This completes the IF alignment; the coil should be treated with polystyrene cement and the two oscillator covers replaced before continuing with checks on the RF Section.

A final check on the IF sensitivity measured from the aerial input socket with the 1st Mixer Stage disabled should give a figure of the order 500µV for 50mW output at all frequencies in the range 150-170 Mc/s.

RF Adjustments.

Test Equipment	Standard Signal Generator modulated 30% at 400 c/s having a 75Ω output and covering the range 500-1000 Mc/s.
	Output Meter matched to 2.5/3Ω.
	Milliameter : 100mA f.s.d.

The first step in adjustment of the RF Section is to re-insert the pick-up probe in the output chimney at the end of the line oscillator. The position of the probe should be such that it is well down in the chimney with the 68Ω resistor at right-angles to the grating. Make sure that the set-screw and locking nut are made secure.

After positioning the probe, check the cathode current of the DET22 by connecting a 100mA meter in series with the cathode resistor R7. This is the 82Ω resistor which, when the receiver is inverted, is located below the miniature 6-way connector which links the supplies to the line oscillator. R7 is wired across two of the nine feed-through capacitors which are located near the miniature connectors in the central screening box.

Unsolder the end of R7 which is connected to the fourth feed-through capacitor counting from the rear of the set. Connect the positive side of the meter to the free end of the resistor and the negative lead to the feed-through capacitor. It should be noted that these points are at something like 200V negative with respect to chassis and care must therefore be taken to avoid accidental shorting of the wires to ground.

Once the meter has been connected, observe the reading at 500 Mc/s and then tune over the complete range with the 'Coarse' tuning control. The current reading at 500 Mc/s should be 55mA and this will reduce gradually as the receiver is tuned HF. At 1000 Mc/s the reading should be not less than 30 mA.

If the reading is not 55mA at 500 Mc/s, it will be necessary to re-set the line feedback adjustor to ensure correct injection voltage throughout the range. The feedback adjustor is located on the side of the line quite close to the output chimney. It should be set for the specified current at 500 Mc/s and then locked. Re-check at 1000 Mc/s to see that the current is above 30mA and then disconnect the meter.

Now proceed to check the calibration accuracy over the entire tuning range. The internal Crystal Calibrator can be used for this purpose and the scale marks at the 50 Mc/s points should show an accuracy of between 5 and 10 Mc/s depending on which part of the scale is being checked (i.e. the overall accuracy is 1%). The Fine Tuning scale should be set to '0' while this check is being made.

If a constant positive or negative (angular) error is detected, it can be corrected by slackening the two socket screws to allow rotation of the calibration disc independently of the main drive system. The screws are most easily accessible from the underside of the receiver and should be tightened securely after re-setting the disc.

If it is necessary for any reason to disturb the settings of the line plungers, these must be re-set initially by actual measurement of the plunger position taken from the rear of the line. To make this check, first remove the anode dome, take out the DET22 and then remove the anode support flange at the end of the line (unscrew anti-clockwise). This will reveal the outer plunger which is not visible when the support flange is in place. Measurements are taken from the exposed end of the anode line using any convenient form of depth gauge.

Although figures are given for both 500 Mc/s and 1000 Mc/s it will be found easier to make the check at the higher frequency because the plungers are then nearest to the end of the line. The actual measurements should be as follows:-

Inner Plunger		Outer Plunger	
500 Mc/s	1000 Mc/s	500 Mc/s	1000 Mc/s
4. 27/32" 123.03 mm.	2. 23/32" 69.05 mm.	4. 7/32" 107.12 mm.	2. 3/32" 53.17 mm.

The plunger drive rods (three for the outer and two for the inner plunger) are retained by socket screws in the plunger drive disc at the front end of the line assembly. These screws must be slackened to allow independent adjustment of the plungers and care must be taken to ensure that the screws are securely tightened after the plungers have been re-set. The calibration disc should be adjusted to correspond with the line oscillator setting.

The final stage of RF adjustment is to check the tracking of the butterfly tuner. The procedure is as follows:-

First tune to 510 Mc/s and set the Fine Tuning control to '0' (i.e. 1st IF = 160 Mc/s). Inject a signal at 510 Mc/s and swing the butterfly lever adjustment for maximum signal output.

Now re-tune the Generator to 500 Mc/s and tune in the signal with the Fine Tuning control (10 Mc/s 'LOW', i.e. 1st IF = 170 Mc/s) and check that the correct tuning point for this input frequency lies within the range of the lever adjustment. Repeat the check at 520 Mc/s (Fine Tuning control to 10 Mc/s 'HIGH', 1st IF = 150 Mc/s).

Repeat the checks above at 40 Mc/s intervals throughout the range of the Coarse Tuning control, checking that the butterfly adjustment is adequate to correct for the misalignment caused by off-tuning the 1st IF. Make up a list of any spot frequencies at which complete off-tune correction is either not possible or alternatively is only just within the range of the lever control.

If it is found that errors exist it will be necessary to alter the cam position slightly to effect a correction. Any change in cam position should be made in small steps and each adjustment should be followed by checks at those frequencies which as indicated by the initial check are most likely to be affected by a change in cam position. These will usually be the lower frequencies in the range where a bigger movement of the butterfly is required for off-tune correction.

Final checks should indicate an overall sensitivity of between 20-30μV and a noise factor of better than 25dB. Checks should be made at 100 Mc/s intervals.

APPENDIX 'A'

LIST OF COMPONENT VALUES, TOLERANCES AND RATINGS

Capacitors.

Ref	Value	Type	Tol.	Wkg. V.
C1	100pF	Tubular Ceramic	10%	750V
C2	100pF	Tubular Ceramic	10%	750V
C3	100pF	Tubular Ceramic	10%	750V
C4	100pF	Tubular Ceramic	10%	750V
C5	100pF	Tubular Ceramic	10%	750V
C6	100pF	Tubular Ceramic	10%	750V
C7	1500pF	Tubular Ceramic Feed Through	20%	500V
C8	91pF	Tubular Ceramic Feed Through	20%	750V
C9	91pF	Tubular Ceramic Feed Through	20%	750V
C10	1500pF	Tubular Ceramic Feed Through	20%	500V
C11	91pF	Tubular Ceramic Feed Through	20%	750V
C12	91pF	Tubular Ceramic Feed Through	20%	750V
C13	1500pF	Tubular Ceramic Feed Through	20%	500V
C14	91pF	Tubular Ceramic Feed Through	20%	750V
C15	91pF	Tubular Ceramic Feed Through	20%	750V
C16	1500pF	Tubular Ceramic Feed Through	20%	500V
C17	1500pF	Tubular Ceramic Feed Through	20%	500V
C18	1500pF	Tubular Ceramic Feed Through	20%	500V
C19	1500pF	Tubular Ceramic Feed Through	20%	500V

Ref	Value	Type	Tol.	Wkg. V.
C20	1500pF	Tubular Ceramic Feed Through	20%	500V
C21	1500pF	Tubular Ceramic Feed Through	20%	500V
C22	1500pF	Tubular Ceramic Feed Through	20%	500V
C23	1500pF	Tubular Ceramic Feed Through	20%	500V
C24	1500pF	Tubular Ceramic Feed Through	20%	500V
C25	1500pF	Tubular Ceramic Feed Through	20%	500V
C26	1500pF	Tubular Ceramic Feed Through	20%	500V
C27	1500pF	Tubular Ceramic Feed Through	20%	500V
C28	1500pF	Tubular Ceramic Feed Through	20%	500V
C29	1500pF	Tubular Ceramic Feed Through	20%	500V
C30	0.001µF	Tubular Ceramic	+50 -25%	750V
C31	3-30pF	Air Trimmer	-	-
C32	20pF	Tubular Ceramic	10%	750V
C33	100pF	Tubular Ceramic	10%	750V
C34	0.001µF	Tubular Ceramic	+50 -25%	750V
C35	0.001µF	Tubular Ceramic	+50 -25%	750V
C36	0.001µF	Tubular Ceramic	+50 -25%	750V
C37	1500pF	Tubular Ceramic Feed Through	20%	500V
C38	0.001µF	Tubular Ceramic	+50 -25%	750V
C39	20pF	Tubular Ceramic	10%	750V
C40	3-30pF	Air Trimmer	-	-
C41	1500pF	Tubular Ceramic Feed Through	20%	500V
C42	1500pF	Tubular Ceramic Feed Through	20%	500V
C43	0.001µF	Tubular Ceramic	+50 -25%	750V
C44	0.001µF	Tubular Ceramic	+50 -25%	750V
C45	3pF	Tubular Ceramic	0.5pF	750V
C46	1500pF	Tubular Ceramic Feed Through	20%	500V
C47	0.001µF	Tubular Ceramic	+50 -25%	750V
C48	100pF	Tubular Ceramic	10%	750V
C49	3-30pF	Air Trimmer	-	-
C50	0.001µF	Tubular Ceramic	+50 -25%	750V
C51	0.001µF	Tubular Ceramic	+50 -25%	750V
C52	0.001µF	Tubular Ceramic	+50 -25%	750V
C53	100pF	Tubular Ceramic	10%	750V
C54	0.001µF	Tubular Ceramic	+50 -25%	750V
C55	3-30pF	Air Trimmer	-	-
C56	0.001µF	Tubular Ceramic	+50 -25%	750V
C57	0.001µF	Tubular Ceramic	+50 -25%	750V
C58	0.001µF	Tubular Ceramic	+50 -25%	750V
C59	100pF	Tubular Ceramic	10%	750V
C60	0.001µF	Tubular Ceramic	+50 -25%	750V
C61	3-30pF	Air Trimmer	-	-
C62	0.001µF	Tubular Ceramic	+50 -25%	750V
C63	0.001µF	Tubular Ceramic	+50 -25%	750V
C64	0.001µF	Tubular Ceramic	+50 -25%	750V

Ref	Value	Type	Tol.	Wkg. V.
C65	0.001µF	Tubular Ceramic	+50 -25%	750V
C66	100pF	Tubular Ceramic	10%	750V
C67	50pF	Tubular Ceramic	10%	750V
C68	0.01µF	Tubular Ceramic	+80 -20%	250V
C69	3-30pF	Air Trimmer	-	-
C70	0.001µF	Tubular Ceramic	+50 -25%	750V
C71	1500pF	Tubular Ceramic Feed Through	20%	500V
C72	0.001µF	Tubular Ceramic	+50 -25%	750V
C73	100pF	Tubular Ceramic	10%	750V
C74	3-30pF	Air Trimmer	-	-
C75	1500pF	Tubular Ceramic Feed Through	20%	500V
C76	22pF	Tubular Ceramic	10%	750V
C77	2-12pF	Air Trimmer	-	-
*C78	2-8pF	Air Spaced Variable	-	-
C79	20pF	Tubular Ceramic	10%	750V
C80	1500pF	Tubular Ceramic Feed Through	20%	500V
C81	1500pF	Tubular Ceramic Feed Through	20%	500V
C82	0.001µF	Tubular Ceramic	+50 -25%	750V
C83	50pF	Tubular Ceramic	10%	750V
C84	2-12pF	Air Trimmer	-	-
*C85	2-8pF	Air Spaced Variable	-	-
C86	0.003µF	Metallised Paper	20%	350V
C87	3pF	Tubular Ceramic	0.5pF	750V
C88	20pF	Tubular Ceramic	10%	750V
C89	60pF	Tubular Ceramic	10%	750V
C90	70pF	Tubular Ceramic	10%	750V
C91	20pF	Tubular Ceramic	10%	750V
C92	0.01µF	Metallised Paper	20%	150V
C93	0.003µF	Metallised Paper	20%	350V
C94	0.003µF	Metallised Paper	20%	350V
C95	0.003µF	Metallised Paper	20%	350V
C96	100pF	Tubular Ceramic	10%	750V
C97	0.003µF	Metallised Paper	20%	350V
C98	0.01µF	Metallised Paper	20%	150V
C99	0.003µF	Metallised Paper	20%	350V
C100	0.003µF	Metallised Paper	20%	350V
C101	100pF	Tubular Ceramic	10%	750V
C102	0.003µF	Metallised Paper	20%	350V
C103	0.01µF	Metallised Paper	20%	150V
C104	0.01µF	Metallised Paper	20%	150V
C105	0.003µF	Metallised Paper	20%	350V
C106	100pF	Tubular Ceramic	10%	750V
C107	0.003µF	Metallised Paper	20%	350V
C108	0.01µF	Metallised Paper	20%	150V
C109	0.01µF	Metallised Paper	20%	150V

*ganged.

Ref	Value	Type	Tol.	Wkg. V.
C110	0.003µF	Metallised Paper	20%	350V
C111	100pF	Tubular Ceramic	10%	750V
C112	0.003µF	Metallised Paper	20%	350V
C113	1500pF	Tubular Ceramic Feed Through	20%	500V
C114	0.01µF	Metallised Paper	20%	150V
C115	0.003µF	Metallised Paper	20%	350V
C116	100pF	Tubular Ceramic	10%	750V
C117	0.003µF	Metallised Paper	20%	350V
C118	0.003µF	Metallised Paper	20%	350V
C119	0.01µF	Metallised Paper	20%	150V
C120	1500pF	Tubular Ceramic Feed Through	20%	500V
C121	1500pF	Tubular Ceramic Feed Through	20%	500V
C122	0.5µF	Metallised Paper	25%	150V
C123	40pF	Tubular Ceramic	10%	750V
C124	100pF	Tubular Ceramic	10%	750V
C125	6pF	Tubular Ceramic	0.5pF	750V
C126	6pF	Tubular Ceramic	0.5pF	750V
C127	12pF	Tubular Ceramic	1pF	750V
C128	6pF	Tubular Ceramic	0.5pF	750V
C129	32 + 32µF	Tubular Electrolytic	+50 -20%	350V
C130	1500pF	Tubular Ceramic Feed Through	20%	500V
C131	0.01µF	Tubular Ceramic	+80 -20%	250V
C132	0.01µF	Tubular Ceramic	+80 -20%	250V
C133	0.01µF	Tubular Ceramic	+80 -20%	250V
C134	0.01µF	Metallised Paper	20%	150V
C135	1500pF	Tubular Ceramic Feed Through	20%	500V
C136	1500pF	Tubular Ceramic Feed Through	20%	500V
C137	0.01µF	Metallised Paper	20%	150V
C138	1500pF	Tubular Ceramic Feed Through	20%	500V
C139	390pF	Polystyrene	5%	125V
C140	0.5µF	Metallised Paper	25%	150V
C141	0.01µF	Tubular Ceramic	+40 -20%	350V
C142	0.01µF	Tubular Ceramic	+80 -20%	250V
C143	0.01µF	Tubular Ceramic	+80 -20%	250V
C144	0.001µF	Tubular Ceramic	+50 -25%	750V
C145	0.01µF	Metallised Paper	20%	150V
C146	10pF	Tubular Ceramic	1pF	750V
C147	10pF	Tubular Ceramic	1pF	750V
C148	0.001µF	Tubular Ceramic	+50 -25%	750V
C149	0.001µF	Tubular Ceramic	+50 -25%	750V
C150	0.001µF	Tubular Ceramic	20%	750V
C151	1500pF	Tubular Ceramic Feed Through	20%	500V
C152	0.01µF	Tubular Ceramic	+80 -20%	250V
C153	0.01µF	Tubular Ceramic	+80 -20%	250V
C154	25pF	Tubular Ceramic	10%	750V

Ref	Value	Type	Tol.	Wkg. V.
C155	20pF	Tubular Ceramic	10%	750V
C156	12pF	Tubular Ceramic	10%	750V
C157	100pF	Tubular Ceramic	10%	750V
C158	0.01μF	Tubular Ceramic	+80 -20%	250V
C159	0.01μF	Tubular Ceramic	+80 -20%	250V
C160	25pF	Tubular Ceramic	10%	750V
C161	50pF	Tubular Ceramic	10%	750V
C162	1500pF	Tubular Ceramic Feed Through	20%	500V
C163	1500pF	Tubular Ceramic Feed Through	20%	500V
C164	30pF	Tubular Ceramic	10%	750V
C165	100pF	Tubular Ceramic	10%	750V
C166	1500pF	Tubular Ceramic Feed Through	20%	500V
C167	0.5μF	Metallised Paper	25%	150V
C168	0.01μF	Tubular Ceramic	+80 -20%	250V
C169	0.001μF	Tubular Ceramic	20%	750V
C170	0.001μF	Tubular Ceramic	20%	750V
C171	0.01μF	Tubular Ceramic	+80 -20%	250V
C172	1500pF	Tubular Ceramic Feed Through	20%	500V
C173	1500pF	Tubular Ceramic Feed Through	20%	500V
C174	0.01μF	Moulded Mica	20%	350V
C175	8μF	Tubular Electrolytic	+100 -20%	275V
C176	0.01μF	Tubular Ceramic	+40 -20%	350V
C177	30μF	Tubular Electrolytic	+100 -20%	15V
C178	30μF	Tubular Electrolytic	+100 -20%	15V
C179	0.01μF	Tubular Ceramic	+40 -20%	350V
C180	25μF	Tubular Electrolytic	+100 -20%	25V
C181	0.01μF	Tubular Ceramic	+40 -20%	350V
C182	1500pF	Tubular Ceramic Feed Through	20%	500V
C183	100pF	Tubular Ceramic	10%	750V
C184	20pF	Tubular Ceramic	10%	750V
C185	40pF	Tubular Ceramic	10%	750V
C186	0.01μF	Metallised Paper	20%	150V
C187	100pF	Tubular Ceramic	10%	750V
C188	0.001μF	Tubular Ceramic	+50 -25%	750V
C189	0.001μF	Tubular Ceramic	+50 -25%	750V
C190	0.001μF	Tubular Ceramic	+50 -25%	750V
C191	0.001μF	Tubular Ceramic	+50 -25%	750V
C192	20pF	Tubular Ceramic	10%	750V
C193	0.001μF	Tubular Ceramic	+50 -25%	750V
C194	1500pF	Tubular Ceramic Feed Through	20%	500V
C195	1500pF	Tubular Ceramic Feed Through	20%	500V
C196	0.001μF	Tubular Ceramic	+50 -25%	750V
C197	0.001μF	Tubular Ceramic	+50 -25%	750V
C198	0.001μF	Tubular Ceramic	+50 -25%	750V
C199	0.001μF	Tubular Ceramic	+50 -25%	750V

Ref	Value	Type	Tol.	Wkg. V.
C200	0.001μF	Tubular Ceramic	+50 -25%	750V
C201	0.001μF	Tubular Ceramic	+50 -25%	750V
C202	1500pF	Tubular Ceramic Feed Through	20%	500V
C203	0.01μF	Metallised Paper	20%	150V
C204	0.01μF	Metallised Paper	20%	150V
C205	0.01μF	Metallised Paper	20%	150V
C206	0.01μF	Metallised Paper	20%	150V
C207	1500pF	Tubular Ceramic Feed Through	20%	500V
C208	0.01μF	Metallised Paper	20%	150V
C209	0.01μF	Metallised Paper	20%	150V
C210	0.01μF	Metallised Paper	20%	150V
C211	0.01μF	Metallised Paper	20%	150V
C212	0.01μF	Metallised Paper	20%	150V
C213	1500pF	Tubular Ceramic Feed Through	20%	500V
C214	0.01μF	Metallised Paper	20%	150V
C215	0.01μF	Metallised Paper	20%	150V
C216	0.01μF	Metallised Paper	20%	150V
C217	1500pF	Tubular Ceramic Feed Through	20%	500V
C218	0.01μF	Metallised Paper	20%	150V
C219	0.5μF	Metallised Paper	25%	150V
C220	50μF	Tubular Electrolytic	+50 -20%	450V
C221	50μF	Tubular Electrolytic	+50 -20%	450V
C222	32 + 32μF	Tubular Electrolytic	+50 -20%	350V
C223	50μF	Tubular Electrolytic	+50 -20%	450V

Resistors.

Ref	Value	Tol.	Rating	Ref	Value	Tol.	Rating
				R10	1,800Ω	5%	6 watt
R1	100Ω	10%	½ watt	R11	47,000Ω	10%	½ watt
R2	100Ω	10%	½ watt	R12	100Ω	10%	½ watt
R3	100Ω	10%	½ watt	R13	2,200Ω	10%	1 watt
R4	270Ω	10%	½ watt	R14	0.1MΩ	10%	½ watt
R5	270Ω	10%	½ watt	R15	0.1MΩ	10%	½ watt
R6	270Ω	10%	½ watt	R16	47,000Ω	10%	½ watt
R7	82Ω	10%	½ watt	R17	100Ω	10%	½ watt
R8	500Ω	5%	6 watt	R18	2,200Ω	10%	1 watt
R9	68Ω	10%	½ watt	R19	0.1MΩ	10%	½ watt

Ref	Value	Tol.	Rating
R20	0.1MΩ	10%	$\frac{1}{2}$ watt
R21	15,000Ω	10%	$\frac{1}{2}$ watt
R22	2,200Ω	10%	1 watt
R23	2,200Ω	10%	$\frac{1}{2}$ watt
R24	100Ω	10%	$\frac{1}{2}$ watt
R25	15,000Ω	10%	$\frac{1}{2}$ watt
R26	2,200Ω	10%	1 watt
R27	2,200Ω	10%	$\frac{1}{2}$ watt
R28	100Ω	10%	$\frac{1}{2}$ watt
R29	15,000Ω	10%	$\frac{1}{2}$ watt
R30	2,200Ω	10%	1 watt
R31	2,200Ω	10%	$\frac{1}{2}$ watt
R32	100Ω	10%	$\frac{1}{2}$ watt
R33	6,800Ω	10%	$\frac{1}{2}$ watt
R34	150Ω	10%	$\frac{1}{2}$ watt
*R35	1,000Ω	10%	1 watt
R36	2,200Ω	10%	1 watt
R37	200Ω	10%	$\frac{1}{2}$ watt
R38	4,700Ω	10%	1 watt
R39	47,000Ω	10%	$\frac{1}{2}$ watt
R40	68Ω	10%	$\frac{1}{2}$ watt
R41	1,000Ω	10%	$\frac{1}{2}$ watt
R42	47,000Ω	10%	1 watt
R43	0.1MΩ	10%	1 watt
R44	330Ω	10%	$\frac{1}{2}$ watt
R45	150Ω	10%	$\frac{1}{4}$ watt
R46	22,000Ω	10%	$\frac{1}{4}$ watt
R47	6,800Ω	10%	$\frac{1}{2}$ watt
R48	27,000Ω	10%	$\frac{1}{2}$ watt
R49	27,000Ω	10%	$\frac{1}{2}$ watt
R50	0.47MΩ	10%	$\frac{1}{2}$ watt
R51	1MΩ	10%	$\frac{1}{2}$ watt
R52	2,200Ω	10%	$\frac{1}{2}$ watt
R53	2,200Ω	10%	$\frac{1}{2}$ watt
R54	68Ω	10%	$\frac{1}{2}$ watt
R55	2,200Ω	10%	$\frac{1}{2}$ watt
R56	2,200Ω	10%	$\frac{1}{2}$ watt
R57	6,800Ω	10%	$\frac{1}{2}$ watt
R58	47,000Ω	10%	$\frac{1}{2}$ watt
R59	47,000Ω	10%	$\frac{1}{2}$ watt
R60	470Ω	10%	$\frac{1}{2}$ watt
R61	47Ω	10%	$\frac{1}{2}$ watt
R62	6,800Ω	10%	$\frac{1}{2}$ watt
R63	12Ω	10%	$\frac{1}{2}$ watt
R64	2,200Ω	10%	$\frac{1}{2}$ watt

Ref	Value	Tol.	Rating
R65	2,200Ω	10%	$\frac{1}{2}$ watt
R66	47Ω	10%	$\frac{1}{2}$ watt
R67	470Ω	10%	$\frac{1}{2}$ watt
R68	47,000Ω	10%	$\frac{1}{2}$ watt
R69	6,800Ω	10%	$\frac{1}{2}$ watt
R70	12Ω	10%	$\frac{1}{2}$ watt
R71	2,200Ω	10%	$\frac{1}{2}$ watt
R72	2,200Ω	10%	$\frac{1}{2}$ watt
R73	47Ω	10%	$\frac{1}{2}$ watt
R74	470Ω	10%	$\frac{1}{2}$ watt
R75	6,800Ω	10%	$\frac{1}{2}$ watt
R76	12Ω	10%	$\frac{1}{2}$ watt
R77	2,200Ω	10%	$\frac{1}{2}$ watt
R78	2,200Ω	10%	$\frac{1}{2}$ watt
R79	47Ω	10%	$\frac{1}{2}$ watt
R80	470Ω	10%	$\frac{1}{2}$ watt
R81	10,000Ω	10%	$\frac{1}{2}$ watt
R82	150Ω	10%	$\frac{1}{2}$ watt
R83	2,200Ω	10%	$\frac{1}{2}$ watt
R84	2,200Ω	10%	$\frac{1}{2}$ watt
R85	2,200Ω	10%	$\frac{1}{2}$ watt
R86	2,200Ω	10%	$\frac{1}{2}$ watt
R87	6,800Ω	10%	$\frac{1}{2}$ watt
R88	10,000Ω	10%	$\frac{1}{2}$ watt
R89	47,000Ω	10%	$\frac{1}{2}$ watt
R90	150Ω	10%	$\frac{1}{2}$ watt
R91	0.1MΩ	10%	$\frac{1}{2}$ watt
R92	0.27MΩ	10%	$\frac{1}{2}$ watt
R93	4,700Ω	10%	$\frac{1}{2}$ watt
R94	1MΩ	10%	$\frac{1}{2}$ watt
R95	270Ω	10%	$\frac{1}{2}$ watt
R96	4,700Ω	10%	1 watt
R97	2,200Ω	10%	$\frac{1}{2}$ watt
R98	22,000Ω	10%	1 watt
R99	1,000Ω	10%	$\frac{1}{2}$ watt
R100	47,000Ω	10%	1 watt
R101	330Ω	10%	$\frac{1}{2}$ watt
R102	47,000Ω	10%	1 watt
R103	47,000Ω	10%	1 watt
R104	100Ω	10%	$\frac{1}{2}$ watt
R105	15,000Ω	10%	1 watt
R106	0.1MΩ	10%	$\frac{1}{2}$ watt
R107	100Ω	10%	$\frac{1}{2}$ watt
R108	330Ω	10%	$\frac{1}{2}$ watt
R109	0.47MΩ	10%	$\frac{1}{2}$ watt

*May be 2 x 2,200Ω in parallel.

Ref	Value	Tol.	Rating
R110	10,000Ω	10%	1 watt
R111	6,800Ω	10%	½ watt
R112	47,000Ω	10%	1 watt
R113	4,700Ω	10%	½ watt
R114	2,200Ω	10%	½ watt
R115	150Ω	10%	½ watt
R116	100Ω	10%	½ watt
R117	0.47MΩ	10%	½ watt
R118	100Ω	10%	½ watt
R119	0.18MΩ	10%	½ watt
R120	47,000Ω	10%	1 watt
R121	3.3MΩ	10%	½ watt
R122	47,000Ω	10%	1 watt
R123	15,000Ω	10%	½ watt
R124	0.1MΩ	10%	½ watt
R125	0.1MΩ	10%	½ watt
R126	0.1MΩ	10%	½ watt
R127	0.1MΩ	10%	½ watt
R128	3.3MΩ	10%	½ watt
R129	3.3MΩ	10%	½ watt
R130	47,000Ω	10%	1 watt
R131	15,000Ω	10%	½ watt
R132	0.1MΩ	10%	½ watt
R133	4,700Ω	10%	½ watt
R134	6,800Ω	10%	½ watt
R135	0.1MΩ	10%	½ watt
R136	0.1MΩ	10%	½ watt
R137	1MΩ	10%	½ watt
R138	1MΩ	10%	½ watt
R139	0.47MΩ	10%	½ watt
R140	1MΩ	10%	½ watt
R141	0.27MΩ	10%	½ watt
R142	8.2MΩ	10%	½ watt
R143	6,800Ω	10%	½ watt
R144	0.47MΩ	10%	½ watt
R145	0.27MΩ	10%	½ watt
R146	10,000Ω	10%	1 watt
R147	0.27MΩ	10%	½ watt
R148	6,800Ω	10%	1 watt
R149	3.3MΩ	5%	½ watt

Ref	Value	Tol.	Rating
R150	6,800Ω	10%	½ watt
R151	0.47MΩ	10%	½ watt
R152	680Ω	10%	½ watt
R153	47,000Ω	10%	½ watt
R154	4,700Ω	10%	½ watt
R155	10Ω	10%	3 watt
R156	10Ω	10%	3 watt
R157	22,000Ω	10%	½ watt
R158	4,700Ω	10%	½ watt
R159	100Ω	10%	½ watt
R160	47,000Ω	10%	½ watt
R161	2,200Ω	10%	½ watt
R162	2,200Ω	10%	½ watt
R163	68,000Ω	10%	½ watt
R164	3.3MΩ	10%	½ watt
R165	330Ω	10%	½ watt
R166	47,000Ω	10%	1 watt
R167	1,800Ω	5%	6 watt
R168	500Ω	5%	6 watt
R169	140Ω	5%	6 watt
R170	140Ω	5%	6 watt
R171	3,300Ω	5%	6 watt
R172	140Ω	5%	6 watt
R173	140Ω	5%	6 watt
R174	140Ω	5%	6 watt
R175	140Ω	5%	6 watt

Potentiometers.

Ref	Value	Type
RV1	10,000Ω	Wirewound.
RV2	10,000Ω	Wirewound.
RV3	1,000Ω	Carbon.
RV4	1,000Ω	Carbon.
RV5	0.5MΩ	Carbon.
RV6	5Ω	Wirewound.

APPENDIX 'B'

TABLE OF VOLTAGE VALUES

The following 'Table of Voltage Values' will prove useful in the event of the receiver developing a fault which necessitates carrying out voltage checks.

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

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

IF Gain 1	Maximum.	Video	On.
IF Gain 2	Maximum.	AGC	Off.
AF Gain	Minimum.	Calibrator . .	On.
Standby	On. (i.e. dolly towards coax socket)	Mode	'AM' except where indicated.

Readings are taken between the point indicated and chassis and are +ve except where noted otherwise.

Ref	Pin	Anode	Pin	Screen	Pin	Cathode	Note
V1	-	153V	g1	-1.5V	-	-	NOTE 1.
V2	-	153V	g1	-1.5V	-	-	NOTE 1.
V3	-	-	-	-	-	-	NOTE 2.
V4A	6	110V	-	-	8	2.1V	NOTE 3.
V4B	1	185V	2(g1)	107V	3	110V	
V5A	6	110V	-	-	8	2.1V	NOTE 3.
V5B	1	185V	2(g1)	107V	3	110V	
V6	7	163V	9	145V	1	1.5V	
V7	7	163V	9	145V	1	1.5V	
V8	7	163V	9	145V	1	1.5V	
V9A	1	160V	-	-	8	2.0V	
V9B	6	162V	3	88V	7	0.7V	
V10	5	143V	6	120V	2	-	NOTE 4.
V11	1	26V	-	-	5	-	NOTE 5.
V12	5	220V	7	218V	2	3.1V	NOTE 6.
V13	5	220V	7	218V	2	3.1V	NOTE 6.

Ref	Pin	Anode	Pin	Screen	Pin	Cathode	Note
V14	5	220V	7	218V	2	3.1V	NOTE 6.
V15	5	220V	7	218V	2	3.1V	NOTE 6.
V16	5	200V	7	195V	2	1.5V	
V17	5	153V	7	195V	2	1.4V	
V18	5	180V	7	180V	2	1.8V	
V19	5	153V	7	153V	2	3.0V	NOTE 7.
V20	-	-	-	-	-	-	NOTE 8.
V21	5	208V	7	152V	2	1.0V	NOTE 9.
V22	5	195V	7	52V	2	0V	NOTE 10.
V23	5	195V	7	52V	2	0V	NOTE 11.
V24	5	30V	6	20V	7	0V	
V25A	6	65V	-	-	8	3.7V	
V25B	1	65V	-	-	3	3.7V	
V26	5	220V	7	210V	2	10.5V	
V27	5	208V	7	145V	2	0V	NOTE 12.
V28	1	0V	-	-	7	-108V	
V29	1	-108V	-	-	7	-216V	
V30	1	150V	-	-	7	0V	

NOTE 1. Measure anode voltage at straps from butterfly tuner.
Measure grid voltage between grounded grid screen and chassis.

NOTE 2. V3 is totally enclosed and is therefore inaccessible for direct voltage checks. Supply voltages can be checked at the three filters near the base of the line.

Orange lead . . HT -VE . . -194 to chassis.
Green and Yellow leads . . LT supply . . 6.3V AC across these two lines.

NOTE 3. Cathode voltage increases to 9.8V with IF Gain 1 at minimum setting.

NOTE 4. Anode voltage can be measured at T1.
The screen grid connection is not accessible but a check can be made at the valve socket (pin 6) with the valve removed. Reading : 120V.

NOTE 5. Anode voltage can be measured at the rotor connection of trimmer C77.
The cathode connection is not accessible but a resistance check can be made at the valve socket (pin 5) with the valve removed.
Resistance reading : 150Ω to chassis.

NOTE 6. Cathode voltage increases to 4.4V with IF Gain 2 at minimum setting. With the Standby switch at 'Standby' a further increase to 70 volts should be observed.

NOTE 7. Voltages quoted are mean values only. Some variation will be noted dependent on the actual setting of the AM Zero control.

NOTE 8. The Video Stage is inaccessible for direct voltage checks unless a B9A valve base adaptor is available. In this case readings are as follows:-

Pin 6	Anode (p)	135V
Pin 3	Screen (p)	225V
Pin 7	Cathode (p)	5.2V
Pin 1	Anode (t)	225V
Pin 9	Grid (t)	110V
Pin 8	Cathode (t)	115V

NOTE 9. The Mode switch must be set to FM or FMW while checking this stage.

NOTE 10. The Mode switch must be set to FMW while checking this stage.

NOTE 11. The Mode switch must be set to FM while checking this stage.

NOTE 12. The Calibrator Unit must be removed to allow voltages to be taken.

APPENDIX 'C'

SPARES

The following list details all major spares for the Model 770S receiver. Spares should be ordered by quoting the Circuit Ref. (where applicable), the written description given in the list and the part number in the right-hand column.

All orders should be addressed to STRATTON & CO., LTD., SALES & SERVICE DEPT., ALVECHURCH ROAD, WEST HEATH, BIRMINGHAM, 31, ENGLAND. In cases of extreme urgency, ring PRIory 2231/4, cable 'STRATNOID', BIRMINGHAM or use TELEX 33708.

Inductors.

L1	1st Mixer injection coil	D2890
L2	1st Mixer output coil	D2886
L3	1st Cascode input coil (160 Mc/s)	D2852
L4	1st Cascode neutralising coil	D2881
L5	1st Cascode output coil (160 Mc/s)	D2842
L6	2nd Cascode input coil (160 Mc/s)	D2834
L7	2nd Cascode output coil (160 Mc/s)	D2882
L8	V6 input coil (160 Mc/s)	D2835
L9	V7 input coil (160 Mc/s)	D2835
L10	V8 input coil (160 Mc/s)	D2835
L11	V9 input coil (160 Mc/s)	D2835
L12	V9 output coil (160 Mc/s)	D2834
L13	2nd Mixer input coil	D2859

Inductors. (cont'd.)

L14	2nd Oscillator coil	D2860
L15-L20	2nd Mixer filter coils. Not available separately - order complete filter unit	D2861
L21	Crystal Calibrator grid coil	D2868

Transformers.

T1	2nd Mixer output transformer (46.5 Mc/s)	D2857
T2	1st 46.5 Mc/s IF transformer	D2847
T3	2nd 46.5 Mc/s IF transformer (includes C96)	D2845
T4	3rd 46.5 Mc/s IF transformer (includes C101)	D2845
T5	4th 46.5 Mc/s IF transformer (includes C106)	D2845
T6	5th 46.5 Mc/s IF transformer (includes C111)	D2846
T7	FM Buffer output transformer (46.5 Mc/s) (includes C116) . .	D2843
T8	AM Detector transformer (46.5 Mc/s) (includes D4 and C125/126)	D2844
T9	Limiter transformer (46.5 Mc/s) (includes D5/D6, R116/117 and C146/147)	D2848
T10	Wide FM Discriminator transformer (46.5 Mc/s) (includes D7/D8, R133/136 and C154/156) . .	D2849
T11	Narrow FM Discriminator transformer (46.5 Mc/s) (includes D9/D10, R125/127, C160/161 and 164) . .	D2850
T12	Audio Output transformer (2.5Ω and 600Ω CT)	D1951/1
T13	Mains transformer (Neg. HT pack)	3536P
T14	Mains transformer (Pos. HT pack)	5339/1P

Chokes.

CH1-CH4	Line Oscillator chokes	D2821
CH5-CH10	Ferrite filter chokes	D2854
CH11	RF Amp. anode choke	D2889
CH12 & CH13	Ferrite filter chokes	D2854
CH14	RF Amp. anode choke	D2889
CH15-CH27	Ferrite filter chokes	D2854
CH28 & CH29	Ferrite beads	6282P
CH30	Ferrite filter choke	D2854
CH31 & CH32	AM Detector filter chokes	D2866
CH33	Ferrite filter choke	D2854
CH34	Ferrite bead	6282P
CH35-CH45	Ferrite filter chokes	D2854
CH46	Crystal Calibrator cathode choke	D2922
CH47-CH62	Ferrite filter chokes	D2854
CH63	Ferrite bead	6282P
CH64	Ferrite filter choke	D2854
CH65 & CH66	Ferrite beads	6282P
CH67 & CH68	Ferrite filter chokes	D2854
CH69 & CH70	HT smoothing chokes	D2451

Crystal.

XL1	QC327, 50Mc/s ± 0.0015% at 25°C. (25pF)	6284P

Variable Capacitors, Trimmers etc.

C78/C85	*Two-gang air-spaced variable 2-8pF	LP2761
C77/C84	Miniature air-spaced trimmers 2-12pF	4743P
C31, C40, etc.	Concentric air-spaced trimmers 3-30pF	6074P

* This item is an integral part of the 2nd Mixer/Oscillator tuning assembly and it will probably be found more convenient to order the complete tuner ready wired. Order 'Tuner Unit' : LP2648.

Potentiometers.

RV1	10,000Ω wirewound (Plessey Type E2377)	5937P
RV2	10,000Ω wirewound (Plessey Type E2377)	5937P
RV3	1,000Ω carbon (Plessey Type MP404/1/00142/102)	6076P
RV4	1,000Ω carbon (Plessey Type MP404/1/00142/102)	6076P
RV5	0.5MΩ carbon (Plessey Type E)	4103PA
RV6	5Ω wirewound (Colvern Type CLR/1106/9S)	6078P

Switches.

S1	Standby. S.P.S.T. Toggle type	4771P
S2	AGC. S.P.3.W. Wafer type	5613P
S3	Mode. 6.P.3.W. Wafer type	5959P
S4	Monitor Speaker. S.P.D.T. Wafer type	5178P
S5	Calibrator HT. S.P.D.T. Wafer type	5178P
S6	Video LT. S.P.D.T. Wafer type	5178P
S7	Mains. D.P.D.T. Toggle type	4772P

Control Knobs.

Coarse Tuning	D2831
Fine Tuning (1)	D2831/1
Fine Tuning (2) (Butterfly Fine Adj.)	D2955
Small knobs as Mode switch, Cal. HT, etc.	5816P

Plugs.

PL1	Coaxial	6079P
PL2	Coaxial	6079P
PL3	B7G (Calibrator Plug)	6100P
PL4	12-way female	6080P
-	Video Connector	6283P
-	Miniature plugs as used for chassis interconnection:	
-	2-way	6089P
-	6-way	6081P
-	10-way	6285P
-	Aerial plug	6288P

Sockets.

SKT1	Aerial socket. (Part of wideband input transformer)	-
SKT2	Coaxial	6085P
SKT3	Coaxial	6087P
SKT4	Coaxial	6087P

Sockets. (cont'd.)

SKT5	Coaxial	6085P
SKT6	Pin socket (Video O/P)	D2499
SKT7	B7G (Calibrator socket)	6086P
SKT8	12-way male	6088P
JK1	Jack socket (Limiter Grid)	6090P
JK2	Jack socket (Audio Input)	6090P
JK3	Jack socket (Tels 1)	6091P
JK4	Jack socket (Tels 2)	6091P
-	Miniature sockets as used for chassis interconnection:	
-	2-way	6083P
-	6-way	6082P
-	10-way	6286P

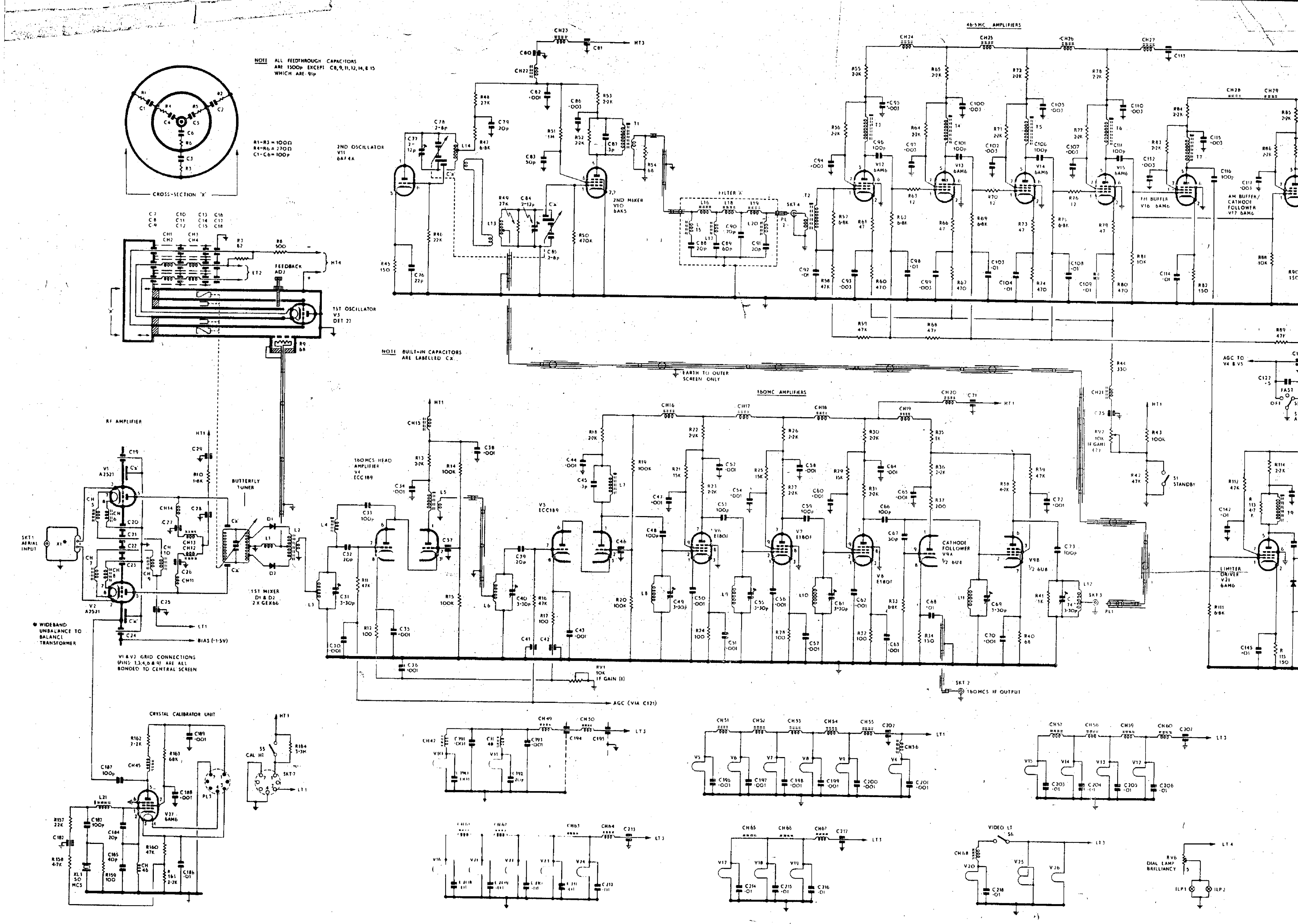
Drive Assembly.

Complete drive assembly	LP2638

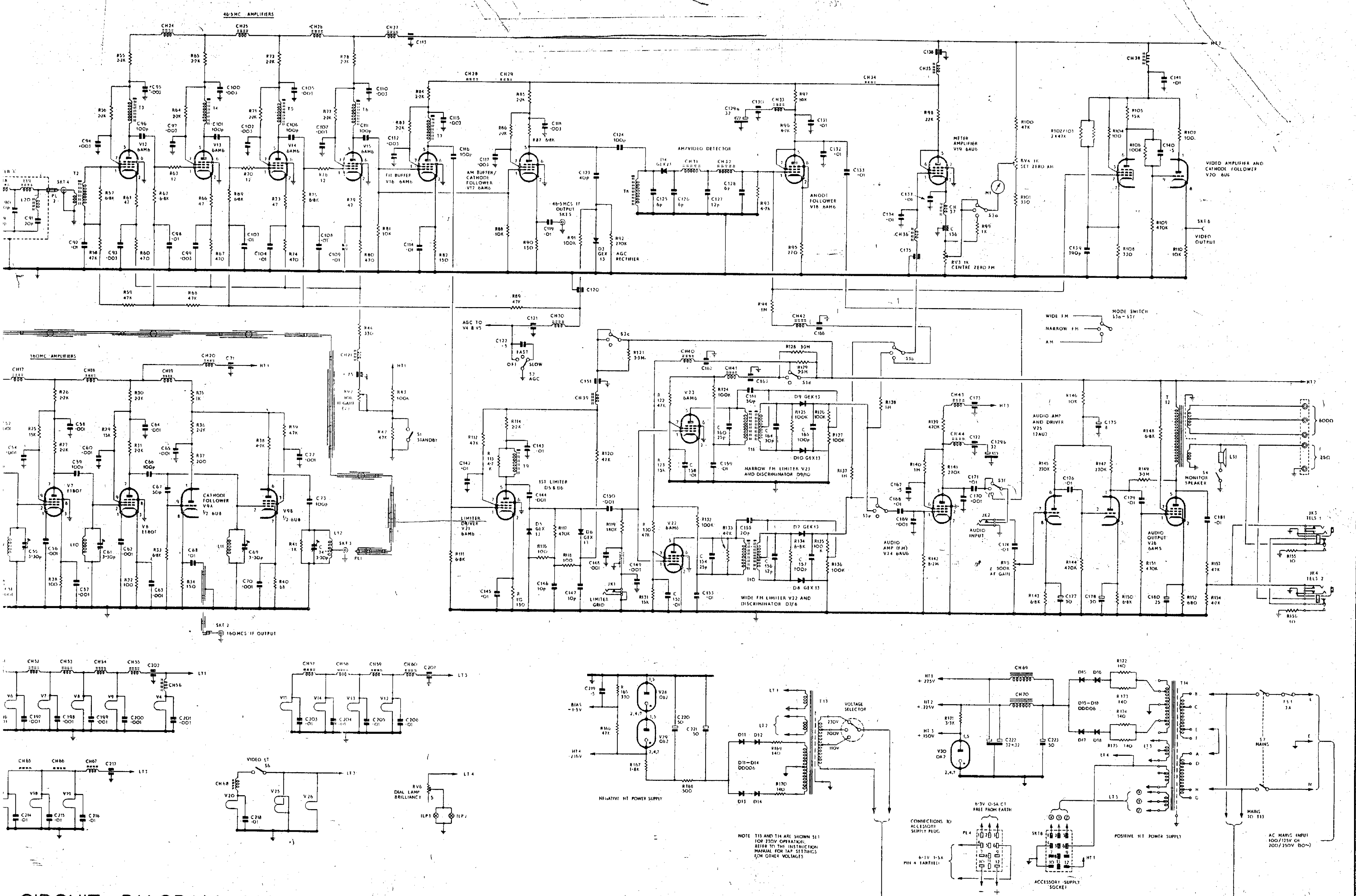
Note: Replacement of this item will be on an exchange basis in which a complete drive assembly will be despatched on receipt of a faulty unit. Charges will cover the u/s components only.

Miscellaneous.

Protecting handles (panel)	5826P
Protecting handles (small)	5923P
Flexible coupler (drive to 'Fine Tuning' capacitors)	D2871
Tuning meter	5931/1P
Speaker grille	5933P
Loudspeaker (2" 3Ω)	6101P
Finger plate (panel)	6135P
Glass window	5922P
Finger plate (P.U.)	6147P
Finger plate (I.F.)	5920P
Fuseholder	6103P
Fuse (3A)	6287P
Festoon Lamps (6V 3W)	3131P
Clip for meter	5932P
Terminal (as used for 600Ω output etc.)	6102P
Scale plate with pointer carrier strip	5907P
Pointer assembly	D2841
Coarse tuning disc with hub	5908P/D2921
Scale escutcheon	5918P
Panel escutcheon	5621PA
Rear cover	5924/1P
Bottom cover	5924/3P
Lid (table model)	5925P
Top cover (rack model)	5939P
Shaped side cover (L.H.)	5622/1P
Shaped side cover (R.H.)	5622P
Drive cover	5926P
Voltage selector	4183P



CIRCUIT DIAGRAM – MODEL 770S



CIRCUIT DIAGRAM - MODEL 770S

BP1060.

ISSUED 13 JUN 19..

EDDYSTONE RADIO LTD.

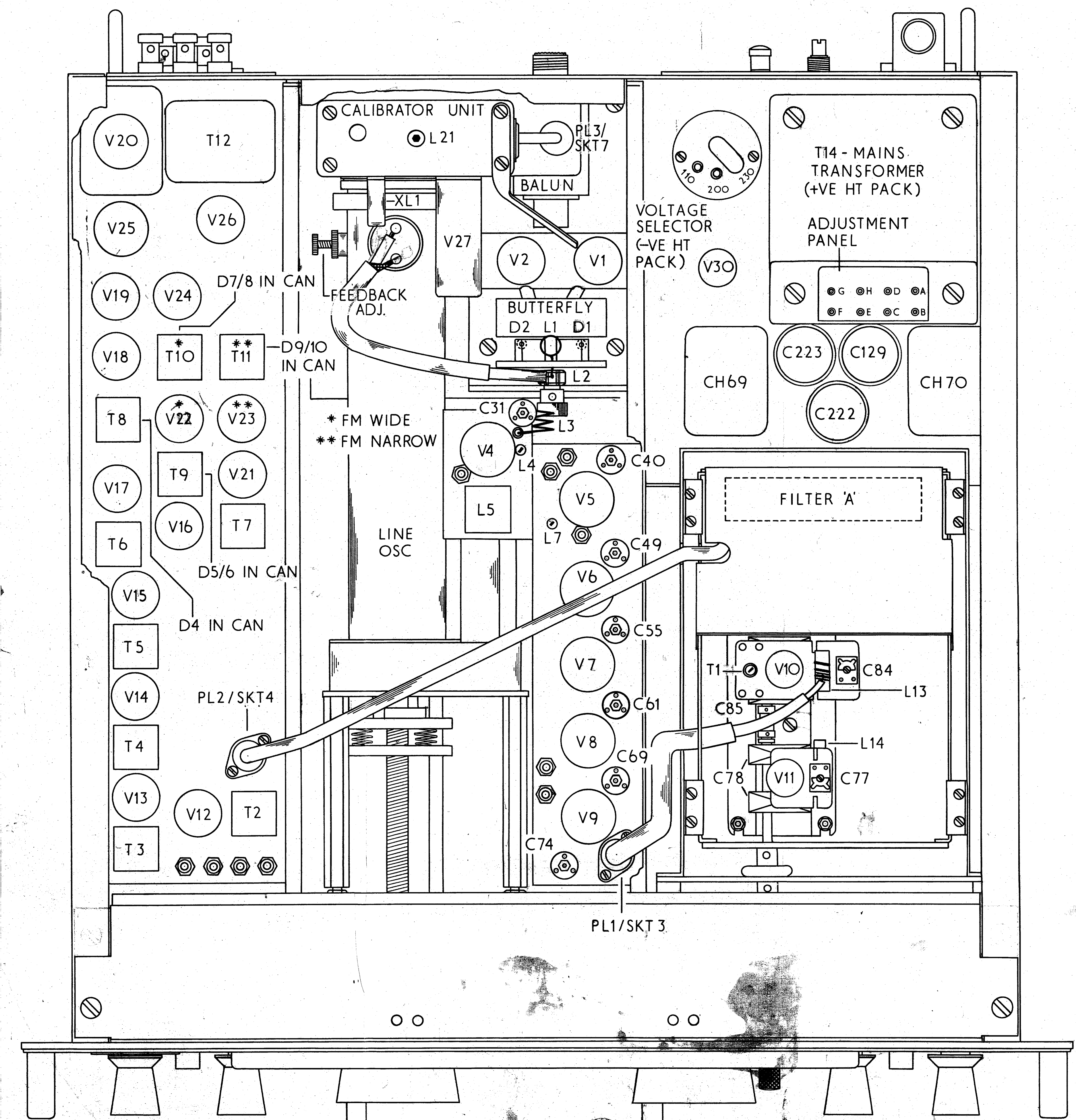
~~STRATTON & CO. LTD.~~

BIRMINGHAM 31,

ENGLAND.

DRAWING No.	BP1060
DRAWN	J. BRATBY
TRACED	S.M.I.
CHECKED	[illegible]
APPROVED	
DATE	2-4-[illegible]

REVISIONS.



PLAN VIEW OF MODEL 770S. SHOWING MAJOR COMPONENTS AND ALIGNMENT POINTS.

BP 1063.

ISSUED 13 JUN 1972

EDDYSTONE RADIO LTD.
~~STRATTON & CO LTD.~~
BIRMINGHAM 31,
ENGLAND.

DRG. No.	BP 1063
DRAWN	J. BRATBY.
TRACED	SMJ 19-6-62
CHECKED	
APPROVED	
DATE	19 - 6 - 62