"HIS MASTER'S VOICE"

SERVICE MANUAL

for

CHASSIS TYPES

PM, PP (Series 2 and 3)

PQ, PR

■

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INTRODUCTION

This service manual is intended to provide all relevant information for servicing "H.M.V" 110° television receivers type PM, PP Series 2 and 3, and PQ, PR remote control versions.

Models PM, PP (Series 3) differ from Series 2, only by the use of the new shelbond picture tube.

Series 2 and 3 chassis (PM and PP) differ in the following respects from Series 1. The differences are noted in greater detail in the appropriate sections:

(1) Dual detection is employed for video and intercarrier sound, after the video I.F. channel to provide better signal to noise characteristics in the sound section under fringe conditions.

(2) The relays in the remote control section have been modified and certain wiring changes made to provide better DC filtering to eliminate the buzz in the hearing aid output when the mute button is operated.

(3) Wiring changes in the audio output result in better filtering in the screen circuit of the sound output valve.

One basic chassis, employing either automatic or manual operation, is used in all four types of cabinet. The receiver consists of a 15-valve plus diodes, high performance chassis with or without transistorised remote control.

The basic chassis is fitted to either a large or a small baseboard to suit, respectively, the metal wrap cabinet for PM and PQ chassis, or the wooden cabinet of PP and PR chassis.

An aerial selection switch facility is available as an optional extra.

The models covered in this manual are:

Styling		*Chassis Type*
Consolette (metal wrap) (9A)		PM
Consolette (metal wrap) (9A)	Remote Control.	PQ
Console (AE)		PP
Console (AE)	Remote Control.	PR
Lowboy (BD)		PP
Lowboy (BD)	Remote Control.	PR

CAUTION

The normal B + voltages in these receivers are dangerous. Use extreme caution when servicing. The high voltage at the picture tube anode (16,000 volts) will give an unpleasant shock but does not supply enough current to give a fatal burn or shock. However, secondary human reactions to otherwise harmless shocks have been known to cause injury.

Always discharge the picture tube anode to the chassis or to its aquadag coating before handling the tube. The picture tube is highly evacuated and if broken it will violently expel glass fragments. When handling the picture tube, always wear goggles.

SPECIFICATIONS

POWER SUPPLY:
230, 240, 250 volts, A.C., 50 c.p.s.

CONSUMPTION:
All receivers: 175 watts.

AERIAL INPUT:
300 ohms balanced.

INTERMEDIATE FREQUENCIES:
Vision Carrier: 36.875 Mc/s.
Sound Carrier: 31.375 Mc/s.

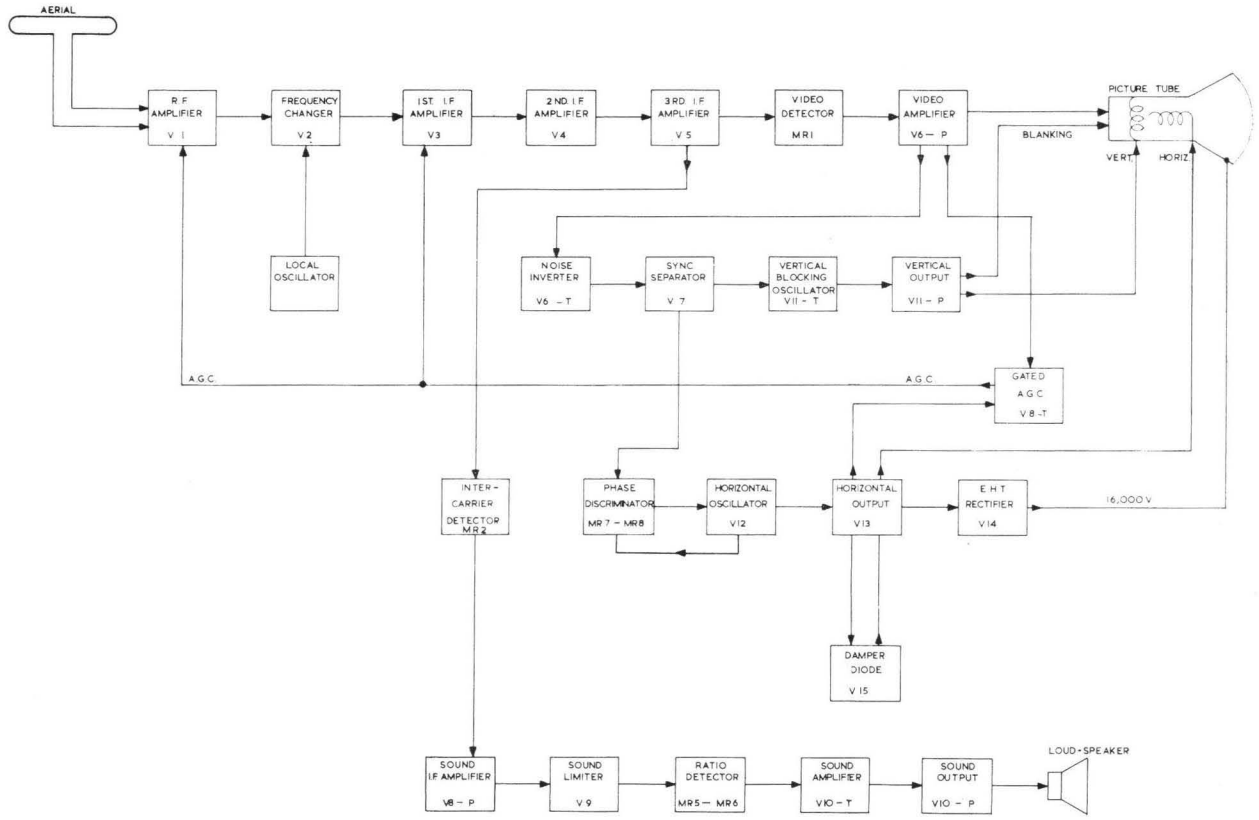
FUSES:
Mains (2): 1.5 Amps. (Black and White).
H.T.1: 1.5 Amp. (Yellow).
H.T.2: 250 mA (Red).

VALVE COMPLEMENTS

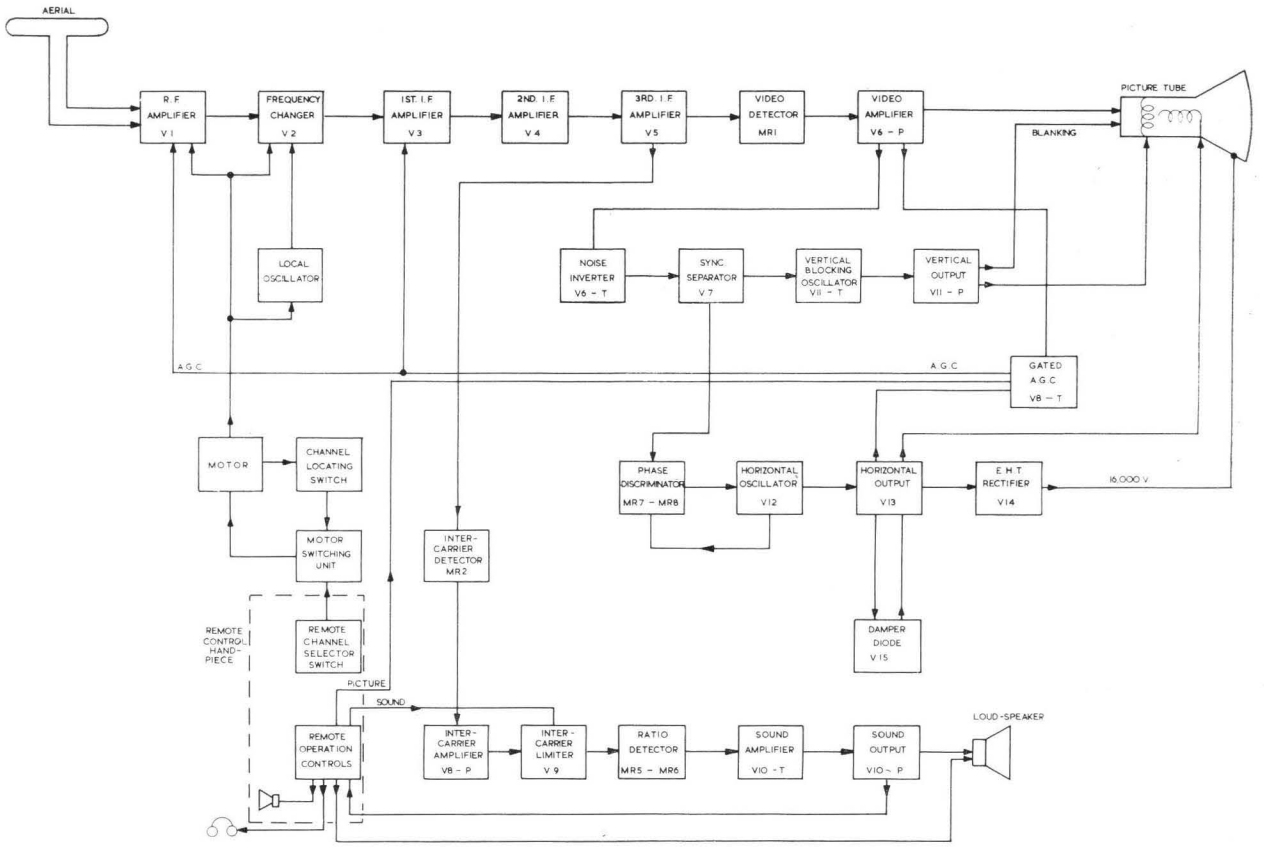
V1	6ES8	R.F. Amplifier
V2	6HG8	Frequency Changer
V3	6BY7	1st I.F. Amplifier
V4	6EJ7	2nd I.F. Amplifier
V5	6EJ7	3rd I.F. Amplifier
V6	6DX8	Video Amplifier and Noise Inverter
V7	6CS6	Noise Gated Sync. Separator
V8	6U8	Sound I.F. Limiter and Gated A.G.C.
V9	6BX6	Intercarrier Amplifier
V10	6GW8	Audio Driver and Audio Output
V11	6BM8	Blocking Oscillator and Vertical Output
V12	12AU7	Horizontal Multivibrator
V13	6CM5	Horizontal Output
V14	1S2	EHT Rectifier
V15	6AL3	Damping Diode
MR1	OA90	Vision Detector
MR2	OA90	Intercarrier Detector
MR3	OA210	Mains Rectifier
MR4	OA210	Mains Rectifier
MR5	M3	Clamping Diode
MR6	AA119	Ratio Detector
MR7	AA119	Ratio Detector
MR8	OA91	Phase Discriminator
MR9	OA91	Phase Discriminator
MR10, MR11	(BS1/100) (or OA610) (or IN2859)	Remote Control Mains Rectifiers
MR12	OA91	Clipper
TRANSISTOR		
	AC128	Remote Control Motor Relay Operating Switch

PICTURE TUBE TYPES

Bonded face-plate type	AWV ..... 23CP4 — 23HP4 PHILIPS ..... 23CRP4 THOMAS ... 23HP4
Shelbond type	THOMAS. (Type number not available at time of printing).



BLOCK DIAGRAM — PM-PP (Series 2 and 3)



BLOCK DIAGRAM — — PQ-PR
(WITH REMOTE CONTROL)

SUMMARY OF FEATURES

These features are common to all types of receiver unless otherwise stated.

1. The turret tuner has a pre-set fine tuning facility, which individually adjusts the oscillator tuning on each channel.

2. Linear phase treatment of the IF response ensures the best possible definition with freedom from overshoot or smearing, allowing non-critical fine tuning control.

3. The overall frequency response of the system is within 6 db from D.C. up to 4.7 Mc/s.

4. Separate diode detectors for video and intercarrier are employed after IFT3. The use of a separate detector for the sound section enables better signal to noise characteristics to be obtained, ensuring good quality sound under adverse conditions.

5. DC coupling from the video detector through to the picture tube ensures that a true black is retained and that all shades retain their true relationship to black. This prevents fading to grey and gives accurate portrayal of night-time scenes.

6. Time - gated AGC is employed, giving immunity from the effects of impulse noise and has a fast action to cope with rapid fading from "aircraft flutter." A variable delay on the tuner is provided to maintain full RF gain on weak to moderate signals, thus minimising frequency converter noise. This delay can be adjusted for best results when the receiver is first installed.

7. A noise inverter is used, before the sync. separator, giving protection to the input circuit and preventing paralysis of the sync. separator action following large bursts of impulse noise.

8. The audio amplifier with ample feedback gives excellent quality sound with ample power. A compensated volume control maintains tonal balance at all volume settings.

A variable tone control is fitted and frequency response can be adjusted from full and normal to attenuated high and low frequencies simultaneously. This system is used rather than accentuated or attenuated bass or treble, so that the intelligibility of the signal in "fringe" conditions will be retained.

9. The horizontal hold circuit is a multivibrator employing a stabilising coil in the oscillator anode circuit and this, together with the cathode coupling employed, gives a stable oscillator virtually unaffected by large HT variations. This stability, together with an adequate pull-in range, renders a front horizontal hold control unnecessary. A pre-set control is provided on the back of the receiver.

10. A linearity control of the horizontal deflection circuit that can be adjusted by an indication on a multimeter gives the advantage that the linearity can be set without the need for a transmitted test pattern.

11. Vertical retrace lines are eliminated by Vertical Flyback Blanking.

12. The picture tube is of the bonded faceplate or shelbond type and does not readily attract dust. Furthermore, it may be very easily cleaned when fingermarked. The reduction in the number of reflecting surfaces improves the rendition of picture black, i.e., scattered light, which otherwise illuminates black areas of the picture and reduces contrast.

13. The user controls are reduced to the minimum necessary to ensure correct operation, which is made as simple as possible. There are no interacting controls, and since the receiver is completely DC coupled then the Brightness control will vary the light output of the picture tube and the picture control will vary the depth of shades without any interaction between them.

14. Silicon Junction Diodes are used in a voltage doubler full-wave power supply. These diodes are noted for their robustness, economy of power and high surge rating. Since they have no heated cathode they cannot be damaged by operation on low mains voltage as is the case with valve rectifiers. Thermistor protection is included in the power supply on all models, to ensure that diodes and electrolytic condensers are not subjected to large surges when first switching on the receiver.

15. The chassis is hinged and can be swung down to give ready access for servicing in the home. If it is necessary to remove the chassis for workshop servicing, the chassis may be lifted straight out of its hinged supports.

If desired, the complete chassis and picture tube assembly may be removed as a complete working unit.

16. A noise-gated sync. separator is used to give the best synchronisation obtainable, necessary for receivers operating under "fringe" conditions.

17. To keep impulse interference to a minimum in the audio output and when operating under adverse conditions, a sound IF amplifier is included before the sound limiter. This gives a substantial increase in gain and gives virtually noise-free sound, even under extreme "fringe" conditions.

18. Current feedback to keep a constant deflection current in the coils is used in the vertical deflection circuit. This feature holds the height constant as the deflection coils warm up.

19. Transformer-coupled dynamic focusing is employed to ensure good overall edge - to - edge focus. Degradation of definition due to change in spot shape across the tube is thus obviated.

20. Facilities can be provided for the automatic switching of up to three different aerials, depending on frequency and transmission polarisa-

tion, to the aerial terminals on the tuner, by means of a multi-aerial connector block and a wafer switch on the channel-changing mechanism.

21. Full remote control facility using a transistor circuit is provided in the remote control version.

The receiver may be switched on or off from a remote location; channel selection and adjustment of picture and sound can also be made. The sound output may be transferred from the receiver cabinet to the remote control unit and volume adjusted at either location.

Facilities are also provided in the remote control unit for connection of hearing aids with and without local or remote speakers operating. Volume in the hearing aid may be controlled separately.

Muting of the sound and picture is carried out whenever channels are changed.

No warm-up time is required before channel changing may be affected because of the use of a transistor.

With the remote control unit connected to the receiver, normal functioning of the manual controls on the receiver still exist.

CIRCUIT DESCRIPTION

RF INPUT

The input to the turret tuner is to a centre-tapped transformer which presents an impedance of 300 ohms (balanced).

RF amplification is achieved with a type 6ES8, double triode (V1), in a cascode circuit. The two sections of this stage are connected in series for DC. The grounded cathode input section is neutralised and is also controllable by AGC from the main chassis. Because of the series DC connection of the two portions, AGC voltage to one section also effects control on the other section.

Coupling between the two sections of the cascode is direct and the coil between the two maintains amplification on the high frequency channels.

Inductive coupling is used between the cascode and mixer. V2, a type 6HG8, combined triode-pentode, is used as oscillator and mixer. The oscillator is a Colpitts circuit operating above signal frequency. Injection to the mixer input is by capacitive coupling. The fine tuning variable capacitor is connected directly across the oscillator inductance. The capacitor is spring-loaded at one end and adjustment of range is determined by a range determining screw located on the front end of the tuner.

Adjustment on each channel is provided by means of an adjustable screw operating a cam to vary the fine tuning capacitor. The adjustable screw is varied by depressing the fine tuning knob, located within the channel selector knob, and rotating it in either direction. The extent of rotation is approximately 3 to 4 complete turns.

The intermediate frequency output of the tuner (vision 36.875 Mc/s., sound 31.375 Mc/s.) is coupled to the IF channel of the main chassis through a capacitor C10.

The heater circuit is filtered by a Ferrite bead through which a heater wire is passed. The bead concentrates the field around the wire, increasing its self-inductance so that it acts as a choke.

IF AMPLIFIER

The tuner IF output is coupled to the grid of the first IF Amplifier V3 via the bottom end of the coil L21. There are three IF amplifying stages and AGC voltage is applied to V3.

V5 is coupled to the video detector MR1 and the intercarrier detector MR2 by inductive coupling via IFT3.

Trap circuits of L22, with L24 (coupled to L23) and L26 (Coupled to L25) attenuate the carriers of adjacent vision at 29.875 (L22), the adjacent sound 38.375 (L24) and sound at 31.375 (L26).

The adjacent vision trap (L22) is set in the factory to approximately 28.375 Mc/s., which is further removed from the main response than the nominal adjacent vision carrier frequency 29.875. This allows for the fact that, in fringe areas, receivers are seldom tuned to the correct nominal frequencies and are usually tuned for maximum contrast by shifting intermediate frequencies lower than normal. The slug of this trap is accessible at the rear of the chassis and may be adjusted on site to minimise an interfering carrier on the low frequency side of IF. (High frequency side at RF).

V3 has a small unbypassed cathode resistor R23, to minimise detuning of the grid circuit with varying input levels.

VIDEO AMPLIFIER

The detected video output of the germanium diode MR1 is amplified by the pentode V6.

Peaking coils L28, L29, L33 and L34 compensate for stray capacities, sync. separator and noise inverter loading to maintain a constant gain in the video stage for all signals from DC up to 5.5 Mc/s.

The 5.5 Mc/s. component is removed by the trap, IFT4.

INTERCARRIER SOUND

L31 is coupled to the IF coil L27 inductively and also directly to the output of IFT3 via R35.

Sound and vision frequencies in the video IF pass band are mixed in the rectifier MR2, the resulting 5.5 Mc/s. frequency being fed via L32 to the grid of V9 intercarrier amplifier.

L33, C41 combination is a load, tuned to 5.5 Mc/s., providing a high impedance signal

source to the grid of V9 intercarrier amplifier.

A full margin of sound gain is provided so that 1.9 watts undistorted output is obtained from sound signals which do not fully modulate the carrier. Moreover, the sound output stage has a controlled overload characteristic which does not "paralyse" but merely clips the peaks and so remains comparatively free from audible distortion.

NOISE INVERTER

The anode load of the noise inverter is formed by the resistor coupling the sync. separator to the video output. The valve is biased such that it cannot conduct on the positive sync. tips. However, noise pulses appearing more positive at its grid will drive the valve into conduction, causing current to flow and a voltage drop across this resistor. Consequently a noise pulse will appear less positive, at the anode of the noise inverter, than a sync. tip and the sync. separator will not conduct on the noise pulse since the pulse will now fall outside of the sync. separator's grid base.

NOISE-GATED SYNC. SEPARATOR

Video signal, with sync. tips positive, is applied to the second control grid of a 6CS6 from the output of the video amplifier. At the same time, video signal with sync. tips negative, is applied to the first control grid of this valve, via R56, R57, running it into grid current which clamps this input at earth potential over the whole normal excursion of the signal. However, when a noise pulse with greater negative amplitude than the sync. tips occurs at the first control grid, then the current through the valve is cut off and the anode voltage will rise to HT, giving no spurious sync. output. Double protection is thus afforded by the Noise Inverter and the Noise-gated Sync. Separator.

GATED AGC

Video signals with sync. tips positive are fed from the Video Amplifier anode to the grid of the AGC valve, and the valve is biased so that it will only conduct on sync. tips. During line flyback, a positive pulse is applied to its anode via the 68 pF coupling capacitor and the valve will conduct when this pulse at its anode and a sync. tip at its grid coincide. The valve cannot, therefore, conduct in the period between sync. pulses and is thus immune to noise pulses appearing in the period between sync. pulses.

The AGC valve has a short grid base, and therefore over the control range the AGC system, the sync. tip potential on the grid is maintained within a few volts of the 50V. cathode potential.

Variations of the grid return voltage with the contrast control are compensated by variations of the AGC produced and consequently receiver gain, which in turn, adjusts video output to maintain the sync. tip potential on the grid. Thus to increase contrast, the grid return voltage is reduced, lowering the AGC voltage, so raising the receiver gain. An increase of signal strength would also vary the sync. tip potential and the AGC voltage increases to compensate for the increased signal and maintain the output substantially constant.

The ratio of IF AGC voltage to Tuner AGC voltage is important and the ratio can be adjusted by means of RV3. If the ratio is too small then, even on large signals, the tuner will be biased back, the IF amplifier will be operating at an unnecessarily large gain, and converter noise will be evident in the picture. If the ratio is too large, then no controlling bias will be applied to the tuner and it will be held at the clamping voltage and all control will be made in the IF amplifiers. This can cause severe overloading of the IF amplifier.

VERTICAL DEFLECTION CIRCUITS

Vertical sync. pulses from the sync. separator are used to synchronise the blocking oscillator, T3 and the triode portion of the valve. "Height" is adjusted by varying the DC potential fed to the blocking oscillator anode and "Vertical Hold" is adjusted by varying the time constant of the blocking oscillator grid circuit. The sawtooth waveform from the blocking oscillator is applied to the grid of the output amplifier and a sawtooth current waveform appears in the vertical output transformer. A feedback voltage is developed across R117, R118, from the current in the deflection coils. This voltage is stepped up to the input grid of the vertical output valve. A potentiometer, RV10, is provided for adjustment of linearity.

HORIZONTAL OSCILLATOR AND AUTOMATIC PHASE CONTROL

Automatic frequency and phase control is obtained by means of a DC controlled, cathode-coupled, stabilised multivibrator controlled by a germanium diode phase discriminator.

Sync. pulses from the sync. separator are fed into the centre of the discriminator and a sawtooth waveform from the multivibrator output is fed across the diode loads.

During "in lock" conditions, the large negative going sync. pulse clamps a part of the sawtooth to earth. If the oscillator is correctly phased, this part of the sawtooth is already at zero potential, and there is no output from the discriminator. If the sync. pulse arrives earlier or later, a negative or positive output will be obtained, zero output indicating correct phasing or absence of either sync. pulse or sawtooth. This latter condition is used in setting up the Horizontal Hold circuit in the "Adjustments" section of this manual.

Due to normal multivibrator action, the

anode current in the first half of V12 is cut-off at the end of scan, and the anode rises to HT from a potential dictated by the discriminator input voltage on its grid (pin 2). A positive increase in this grid voltage causes a greater excursion in the anode which is coupled to the grid of the second half of V12 (pin 7). The length of the scan period is determined by the time taken for the grid circuit of the second half of V12 to discharge to the cut-on potential of this valve. When this grid receives a larger waveform coupled from the first anode, it draws more grid current, charging the coupling capacitor more negatively, thereby increasing the time taken for the grid circuit to discharge, and lengthening the scan period. Thus a positive output from the discriminator lowers, and a negative output raises the repetition frequency of the oscillator.

HORIZONTAL DEFLECTION CIRCUITS

The horizontal oscillator produces a negative pulse output which is timed to cut off the horizontal output valve at the end of a scan. When cut off sharply, the magnetic field that has been established in the horizontal output transformer during the scan collapses and the oscillatory circuit comprised of the transformer inductance and stray capacitances tends to "ring." However, after one-half cycle of oscillation the damping diode starts to conduct. During the "flyback" time the magnetic energy has established itself in the reverse direction, and the picture tube spot has returned to the left-hand side of the screen.

When the damper diode conducts, it permits current to flow at a controlled rate through part of the transformer. This current, passed by the auto-transformer into the deflection coils, forms the initial part of the horizontal scan. As the damper ceases to conduct the line output valve takes over and supplies the necessary current to complete the scan, at which point a further negative pulse on the grid starts the cycle over again.

During flyback a high voltage pulse is produced at the anode of the EHT rectifier, which is peak - rectified and then smoothed by the capacitance between inner and outer bulb coatings of the picture tube, and supplies EHT of approximately 16,000 volts.

Energy recovered by the damper diode produces a boosted HT voltage of 830 volts, which is divided down to 560 volts to supply the G2 electrode voltage of the picture tube.

The sawtooth scanning current in the primary winding of the focus transformer, T7, produces in the secondary a large parabolic voltage waveform which is fed direct to the focus electrode of the CRT and the cold end of the secondary is connected to a voltage adjusted by the focus control, to give good overall focus.

REMOTE CONTROL

The remote control unit is connected to the receiver by fitting a small 9-pin plug (PL3) into the socket (SKT3) at the rear of the chassis on the L.H. end of the mains and fuse panel and accessible through the hole in the back. With mains power connected and the receiver mains switch "on," the receiver may be switched "on" or "off" by the slide switch on the side of the remote handpiece, which completes the circuit from the full wave rectifier MR15, MR16, through the relay winding RLB back to earth. Power is supplied to RLB winding which closes and makes contact B1, completing the primary circuit for the receiver mains transformer T1; B2, which supplies an AC voltage from the secondary of the remote operation mains transformer T8 to the indexing transformers T9 and T10, and the pilot lamp in the handset; B3, which earths the resistor network in the picture tube grid; B4, which adds filter capacity to the supply voltage for the transistor and RLB.

A condition now exists when channel changing may take place.

In this condition of "rest" or "normal" the base of the transistor is held at a very low potential and there is little or no potential difference between the emitter and the base.

OPERATING SEQUENCE

After selection of the appropriate channel by the remote control channel switch, if the "mute-start" push-button in the handpiece is operated, the following steps take place:

PSA-1 makes and shorts the limiter HT to earth, via R90, thus muting the sound.

PSA-2 makes and shorts the emitter of the transistor to earth, causing heavy current to flow through the transistor and the coil of RLA.

When RLA operates:

Contacts A1 close and supply AC mains power to the channel changing motor.

Contacts A2 close and short-circuit main switch contacts holding RLB.

Contacts A3 close and short PSA-1 contacts, holding the muting on the sound, while channel changing.

Contacts A4 close and short the picture tube grid to earth via R155 resistor, thus muting the picture.

All actions occur simultaneously.

Since unequal voltages will appear at the base and emitter of the transistor when a change of tapping has been made on the indexing transformers, current will flow in the collector circuit and the relay RLA will be held closed until the voltages are equalised.

Simultaneously, with the closing of A1 contacts when relay RLA is operated, the tuning motor commences to operate and the cam-operated contacts MSB close. This shorts the RLA relay to earth, by-passing the transistor. This is a sensing device and stops the channel switching

motor at a precise position when it opens at the selected channel. At such time there will be no unequal voltages applied to the base and emitter of the transistor, no current will flow through the relay RLA and it will cease to operate, opening the "A" contacts. The contacts of MSB open at each channel position, but if heavy current is flowing through the transistor due to unequal voltages applied to the base and emitter, this holds RLA closed, and the motor will continue to operate until the selected position has been reached.

When the relay RLA ceases to operate:

Contacts A4 open and remove short and picture appears.

Contacts A3 open and remove short and sound is restored.

Contacts A2 open and remove short on PSA-2, Mute-Start switch.

Contacts A1 open and remove mains supply from motor.

All actions occur simultaneously.

When the "on-off" switch (SD) in the handpiece is switched "off," relay RLB operates and opens contacts:

B4, to remove the additional filter across the relay and transistor supply voltages.

B3, to remove the earth from the CRT grid voltage divider, immediately placing a high bias on the grid, and preventing a bright spot appearing on the screen.

B2, to remove AC voltage from the indexing transformers in the remote control unit.

B1, to remove power from the receiver mains transformer.

A pin in the centre of the plug PL3, when inserted into the socket SKT3, open-circuits three leaf spring contacts which are used for the following purposes:

MSA1 contacts are in parallel with the mains "on-off" switch (SD) on the remote control unit.

MSA2 completes the speaker transformer secondary.

MSA3 earths the picture control voltage divider network.

When the plug PL3 is inserted:

MSA1 contacts open and the remote control "on-off" switch (SD) becomes operative.

MSA2 removes the earth on the picture control circuit and substitutes the remote control picture control potentiometer.

MSA3 transfers the sound output for the speaker circuit into the remote control unit where selection of speakers and/or hearing-aid outlet is made, together with control of sound.

Channel selection may be effected immediately the receiver is switched on, unlike previous models when a delay was entailed while the valves reached operating temperatures.

Sound of the receiver may be adjusted at the remote handpiece for both local and remote speakers by variation of the sound limiter HT, using the remote sound control.

Two sockets are available on the side of the remote handpiece for hearing-aid plugs. Insertion of the hearing-aid plug into SKT4 with the "local-remote" speaker switch in the remote position, removes sound from the speaker and supplies sound to the hearing-aid only. If SKT5 is used, sound is supplied to the hearing-aid and the remote speaker. A separate volume control is provided for hearing-aid adjustment; however, no hearing-aid sound will be available if the main or remote speaker sound control is turned to minimum position.

Hearing-aid sound is available, either with remote or local speakers operating, with separate control of sound.

For the remote controls to be fully effective, the receiver sound and picture controls should be well-advanced.

INSTALLATION

The receivers are shipped from the factory with all pre-set controls adjusted for normal operation.

For chassis type PM and PP it should only be necessary to ensure that the mains tapping is correctly adjusted for the mains voltage existing in the particular area and a suitable aerial connected to the aerial terminals.

For chassis types PQ and PR it will be necessary to unpack the remote control unit and fit the plug into the socket at the rear of the cabinet. All adjustments can then be made from the remote control unit after the various controls have been set on the receiver front and rear where necessary.

In cases where more than one aerial is intended or installed, for reception from diverse directions or from differently polarised transmissions, a kit (type AS2) is available. Comprising a 14-position switch, with coupling unit and bracket, this assembly is mounted on the rear of the tuner and coupled to the turret spindle.

By this means, the appropriate aerial may be switched, via a 3-pair aerial terminal panel, and fed into the tuner aerial input terminals, to suit the channel selected.

In very strong signal areas it may be necessary to use an attenuator in the aerial lead to avoid overloading the receiver.

The various operating controls should be checked for proper operation, and their use demonstrated to the purchaser as described in the installation manual. It is necessary to remove the back of the cabinet to gain access to the mains adjustment plug.

PICTURE SHIFT

Small shifts in position of the picture may occur due to the effect of the earth's magnetic field

in different locations. The picture may be re-centred by rotating the two shift magnets on the tube neck behind the deflection yoke.

Rotate the centring magnet assembly to shift the picture in the required direction, and move one of the magnets with respect to the other to change the strength of the field and hence the amount of picture shift.

PICTURE TILT

If the picture is not square with the edges of the mask, the deflection coils should be rotated until the picture is squared up. It may be necessary after this operation to centre the picture by means of the shift magnets.

AGC

The AGC control is normally pre-set in the factory but if it is necessary to adjust it at any time the procedure is to turn the control to the maximum anti-clockwise position. Then, observe the picture and advance the control until the noise or "snow" in the picture is no longer reduced. The receiver should then be checked on all channels to ensure that no overloading is evident, which may be due to the control being adjusted too far in a clockwise position, and that the minimum noise condition has been achieved for all signals. This control may need adjustment in strong signal areas to remove "herringbone" pattern.

FUSES

Four fuses are provided, two in the mains circuit and two in the HT circuits. Ensure that they are replaced with similar types in their respectively colour-coded holders.

NOISE INVERTER

The cathode bias of the noise inverter can be adjusted on installation (if necessary) by means of a pre-set control on the rear panel of the receiver. Tune to the strongest signal and turn picture control to maximum. Turn the Noise Inverter control in an anti-clockwise direction until the picture tends to go out of lock. Turn control slightly clockwise so that picture returns to lock. Check that receiver locks quickly on all channels when changing channels.

ADJACENT CHANNEL TRAP CIRCUIT

If interference in the form of herringbone pattern, or other interference pattern is visible on picture, it may respond to manipulation of the trap circuit L22. This is located in the top R.H. corner of the chassis.

Normally the trap is adjusted in the factory to approximately 28.375 Mc/s. near the adjacent channel vision frequency.

SERVICING

The vertical chassis of these receivers has been specially designed to make servicing as easy as possible.

All valves, test points and components are accessible for service with the back removed and the chassis in either its normal or swing-down position. This includes the tuner and associated controls.

To prepare the chassis for service, press down firmly on aerial terminal panel with thumb. The aerial terminal will then spring out, allowing removal of the back without disconnecting leads. Remove the screws securing the metal back to the cabinet. Remove back by lifting out, first at base.

Loosen the wing-nuts at the top corners of the chassis and the wing-nut on the tuner tail strap and swing the chassis down. The tuner and associated leads are long enough to allow free movement.

The yoke and EHT leads are also long enough and the chassis will operate satisfactorily in this position for service, when required.

To gain access to the tuner, pull off the front channel selector and fine tuning knobs. Then remove the PK screw securing the L.H. side of the tuner to the cabinet front as viewed from rear.

Loosen the wing-nut on the L.H. side of the chassis and withdraw the tuner and bracket assembly.

With automatic tuners, in addition to the above, it is necessary to remove the two screws which secure the tuner rear mounting bracket to the cabinet.

Having withdrawn the tuner, it may be dropped parallel to the chassis. With the special safety catch lug fitted into a slot in the chassis, the tuner may be clamped to the chassis by tightening the thumbscrew.

Where necessary, the chassis may be removed for bench service, by first unplugging the picture tube and yoke and raising the chassis to approximately 45°. The chassis may then be lifted clear of its pivotal mounts.

To reassemble, the above operations are simply reversed. Care should be taken that the yoke and EHT leads are positioned correctly and that they are not clamped under any components, when the chassis is returned to its original position. Also, the earthing braid bonding the chassis to the cabinet back should be replaced on the R.H. chassis clamp.

DISMANTLING

Chassis Types PP and PR in Cabinet Types AE and BD

Remove the aerial terminal panel.

Unscrew the two back-securing screws and then lift off the back.

Proceed as described under the heading of "Servicing" (see page 11) to swing the chassis down. In this position, the two 5/16-inch bolts, which secure the chassis mounting board to the cabinet base, can be removed.

Unscrew the two machine screws holding the picture tube clamp to the top front of the cabinet, and then replace and clamp the chassis in its normal position.

Remove the speaker plug from the chassis.

Slide the complete assembly from the rear of the cabinet.

SPEAKERS IN CABINET TYPE AE

To remove the speakers, the baffle must be taken off first.

Two wood screws are accessible under the front centre rail to remove the grille. The backing for the grille is slightly bowed over a strain block on the speaker baffle board. When the two wood screws are removed, they may be used as grips to ease the top of the grille forward and then it may be lifted out of the groove at the bottom of the cabinet.

The speakers are secured to the baffle board by wood screws, accessible from the front.

A cement block, contained in a plastic bag, is bolted to the bottom of the cabinet, for balance when the chassis is removed. This block is accessible from the front of the cabinet, through the speaker holes in the baffle board.

SPEAKERS IN CABINET TYPE BD

These speakers are mounted in a similar fashion to those in AE cabinets. The speaker grille must first be removed by undoing two screws (one in later versions) located underneath the front of each speaker compartment. The screws securing the speakers are then accessible from the front of the cabinet.

DEFLECTION YOKE

Withdraw the picture tube socket and then loosen the clamp-fixing screw on the rear of the yoke assembly. Remove the yoke plug from the socket on the rear of the EHT assembly and slide the yoke over the neck of the tube. When replacing the yoke, do not use force. Also, do not tighten the clamping screw until the set has been put into operation and the picture squared up.

REMOVAL OF PICTURE TUBE

Bonded Face Type

Having removed the chassis and picture tube from the cabinet, remove the chassis from its baseboard and remove the yoke from the picture tube. Take care that the picture tube does not fall forward on its face, when the chassis is lifted from its baseboard. Place the rest of the assembly containing the picture tube face down on a soft, clean surface on the floor. Remove the spring which rests against the aquadag coating on the rear of the picture tube. Slacken the nut at the side of the tube which secures the retaining strap and ease the tube out carefully while supporting it around the mounting ring. The rubber mounts may be eased over the ears at the tube face corners and then the tube may be withdrawn from the strap.

Shelbond Type

The chassis, tuner and picture tube are removed from the cabinet as described previously. The chassis is then removed from the baseboard along with the yoke from the picture tube. Take care that the picture tube does not fall forward on its face when the chassis is lifted from its baseboard.

Place the rest of the assembly containing the picture tube face down on a soft, clean surface on the floor. Remove the spring which rests against the aquadag coating on the rear of the picture tube.

Remove the $\frac{1}{4}$-inch Whit. screws, nuts and washers, holding the diagonal brackets on the picture tube metalwork. The brackets may then be swung back out of the way.

The four OBA screws at each corner of the picture tube should be removed. This releases the picture tube from the two side brackets, and the tube may be carefully lifted away.

A new picture tube may be fitted by reversing the above procedure.

IMPORTANT: Make sure, when fitting the new tube, that the anode connection is placed to the right, as viewed from the rear.

Note: The tubes are heavy, and particular care in handling is necessary. It is recommended that protective goggles, apron and gloves be worn by personnel handling picture tubes. This is to prevent personal injury shoud an implosion occur, due to mishandling, or for any other reason. The tube should never be placed on a surface where the face is likely to be scratched. Always ensure that it is placed face down on a soft, clean surface, such as a piece of felt. Wherever possible, keep tubes in the original manufacturer's carton.

Chassis Types PM and PQ in Cabinet Type 9A

REMOVAL OF CABINET

Disconnect the aerial leads and remove the aerial panel from the metal back.

Remove the cabinet back, fixed by five screws. The nuts for the screws are fitted to securing straps around the cabinet edge. These straps should be levered clear of the cabinet.

Remove four PK screws located underneath, two at each end of the cabinet, securing cabinet wrap to baseboard.

Remove cabinet wrap.

REMOVAL OF FRONT ESCUTCHEON

Pull off channel selector and fine tuner knobs.

Unscrew the two PK screws securing escutcheon to baseboard runners (underneath at front).

Unscrew four PK screws holding the picture tube top support brackets to the escutcheon.

Disconnect the five securing straps fixed to the edge of the escutcheon.

Remove the escutcheon.

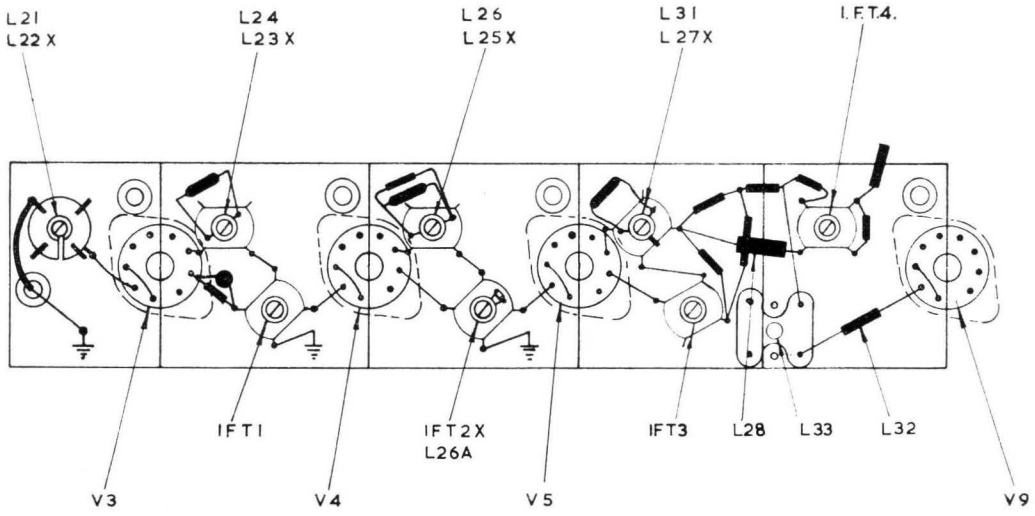
During the course of production of these receivers, the Company reserves the right, without notice, to make any modifications or improvements in design which may be necessary to meet prevailing conditions.

Information concerning changes, which are likely to be of benefit to retailers and servicemen, will be notified as far as possible by issuing a Technical Data Sheet.

Any further service information may be obtained by addressing an inquiry to "The Service Division," E.M.I. (Australia) Limited, 575-577 Parramatta Road, Leichhardt (Telephone 560-8444); or Interstate Branches as below:

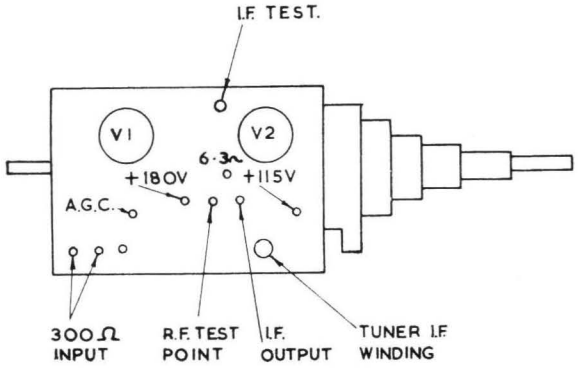
E.M.I. (Australia) Limited

109 Burwood Road, Hawthorn, Victoria.
Emitron House, 105 Port Road, Hindmarsh, South Australia.
457 Beaufort Street, Highgate, Western Australia.
252 Argyle Street, Hobart, Tasmania.
17 The Quadrant, Launceston, Tasmania.
Bramble's Building, National Park Street, Newcastle West, N.S.W.
83 Robertson Street, Fortitude Valley, Brisbane, Queensland.
C/- A. Leenders, 13-17 Murray Street, Rockhampton, Queensland.

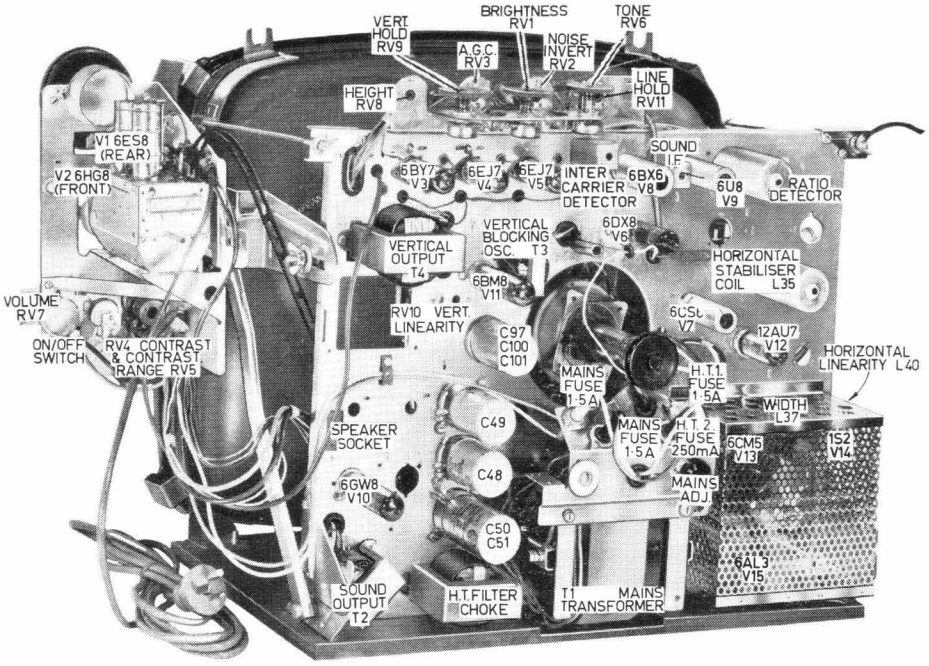


LOCATION OF COILS FROM UNDERSIDE OF CHASSIS

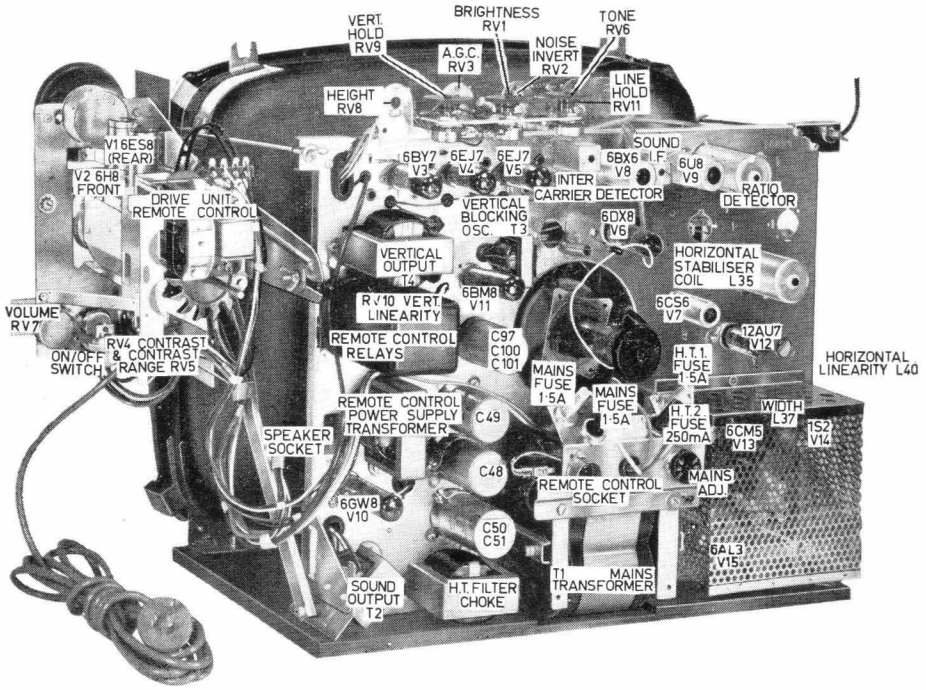
X INDICATES COIL NEAREST CHASSIS



TUNER TYPE NT3011



REAR VIEW — 15-VALVE CHASSIS — MODELS PM and PP



REAR VIEW — 15-VALVE CHASSIS WITH REMOTE CONTROL
MODELS PQ and PR

ADJUSTMENTS

HORIZONTAL LINEARITY

A typical multimeter employing a 100 ohm 1 mA fullscale deflection meter, when on 100 mA range, has a total resistance of 1 ohm. If such a meter is connected from pin 8 of the Horizontal Output valve to earth, *i.e.,* across the 1 ohm metering resistor, it will indicate half of the current flowing in the cathode of the valve. The Horizontal Linearity control should be adjusted to reduce this current to a minimum.

HORIZONTAL HOLD

Disconnect sync. pulses by removing the sync. separator valve, V7, 6CS6. Short-circuit the Horizontal Stabilising coil. (Note: The chassis must be swung down. See "Service Notes" for access to the horizontal stabilising coil. The exercise may be continued with the chassis in this condition). Adjust the Horizontal hold control so that the picture "floats" or locks weakly. Remove the short across the stabilising coil and adjust the core of this coil so that the picture again floats or locks weakly. Replace the sync. separator valve.

CONTRAST RANGE

Turn the Contrast Control to its maximum clockwise position and adjust the Contrast Range control to give sync. tips at 190 volts at the Video anode, read on a DC coupled oscilloscope.

The contrast range control is on the rear of the contrast or picture control and may be adjusted using a long, thin screwdriver inserted down the shaft of the picture control after the knob has been removed. Alternatively, it may be adjusted from the rear.

ALIGNMENT

VISION IF

To align the vision IF amp., a sweep generator and a marker generator, both covering the range 28 to 38.5 Mc/s are required, together with a display unit. The marker generator may be a signal generator and the display unit a C.R.O. These instruments should be interconnected as described in the instructions supplied with the sweep generator. The sweep generator should be terminated with a resistor equal to its output impedance and connected to the receiver as shown in Fig. 1.

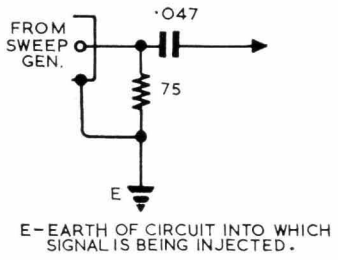


Fig. 1.

Because of the high gain of the receivers, care should be taken to ensure that all components replaced are on short leads and are placed in exactly the same position as the original part.

Care must also be taken to prevent feedback in interconnecting leads of the alignment equipment.

OPERATION 1.

(a) Connect a bias supply of 18 volts across IF AGC smoothing capacitor C59.

(b) Connect display unit between L29 and R38 junction and earth.

(c) Remove cores from L24, L26, L26A and L31.

NOTE: (1) Throughout the alignment, the display should be adjusted so that the response is accurately set between the reference level and the base line from a signal of about 2 volts peak-to-peak. The output of the IF strip should be maintained at that level by varying the output from the sweep generator and not the gain of the display unit.

NOTE: (2) Coupling between stages will not require adjusting, unless either IFT1, IFT2 or IFT3 has been replaced.

NOTE: (3) Cores in L21, L24, L26, L26A, IFT3 and L31 are set in the position furthest from the chassis.

Cores in L22, L23, IFT1, L25 and L26 are set in position nearest the chassis.

OPERATION 2.

(a) Using the termination network as shown in Fig. 1, connect sweep output between pin 2 of V5 and earth.

(b) Adjust the cores of L27 and IFT3 to obtain the response of Fig. 3 (Stage 1).

(c) If IFT3 has been replaced it will be necessary to adjust the coupling by closing the spacing of the two windings until desired bandwidth is achieved.

(d) If a dip appears in the response, remove it by screwing the core in L25 away from the chassis.

OPERATION 3.

(a) Remove the sweep from V5 and connect it as shown by Fig. 1 to pin 2 of V4.

(b) Maintaining the level of the display unit constant by varying the sweep output, adjust the cores of L25 and IFT2 to obtain the response of Fig. 3 (Stage 2).

(c) If a dip appears in the response, remove it by screwing the core in L23 away from the chassis.

(d) If IFT2 has been replaced, it will be necessary to adjust the coupling by closing the spacing between the two windings of IFT2 until the desired bandwidth is achieved.

OPERATION 4.

(a) Remove the sweep from V4 and connect it to pin 2 of V3.

(b) Adjust the cores of L23 and IFT1 to obtain the response of Fig 3 (Stage 3).

(c) If a dip appears in this response, remove it by shorting-out the coaxial lead from the tuner.

(d) If IFT1 has been replaced, it will be necessary to adjust the coupling by closing the spacing of the windings of IFT1 until the desired bandwidth is achieved.

OPERATION 5.

(a) Remove sweep from V3 and connect it to the IF test point on tuner, located adjacent to the converter valve. Switch tuner to the position between Channel 11 and Channel 0.

(d) Adjust the cores in L11 (IF output coil, located adjacent to V2 on the tuner), and L21 to obtain the response of Fig. 3)Stage 4).

OPERATION 6.

(a) Insert a core into L24 and adjust to a minimum at 38.375 Mc/s. by varying the spacing between L23 and L24. Ensure that the response at 38.375 Mc/s. is at least 60 dB below peak response. To do this, increase the sweep generator output by 40 dB, reset the base line with the vertical shift control if necessary, and the 20 dB will represent the —60 dB point required below the reference level.

(b) Adjust the core in L22 to read a minimum at 28.375 Mc/s.

(c) Insert a core in L26 and adjust together with the spacing of L25 and L26 to ensure that the response at 31.375 Mc/s. is between 25 and 28 dB below the peak response. Use method described in (a) but increase output by only 20 dB.

(d) Insert a core in L31 and adjust by varying the coupling between L31 and L27 so that the response at 29.875 Mc/s. is 35 db below the peak response. Use method described in (a) but increase output by only 20 dB.

(e) Adjust L26A on former IFT2, such that it widens the trap response of L24, but at the same time, care must be taken to ensure that it leaves the main response shape substantially unchanged.

(f) Remove bias battery, and check that the response curve remains substantially unchanged.

(g) Replace bias and connect display unit to test point on L33. Check to see that the response to the sound IF detector is similar to response of Fig. 3 (Stage 6).

(h) Seal the coils of L24, L26, L26A, L31 and also IFT1, IFT2 and IFT3 with a light application of adhesive.

SOUND I.F. ALIGNMENT

The following equipment is necessary to carry out this procedure:

(i) A C.W. Oscillator accurately tuned to 5.5 Mc/s. by a crystal controlled reference.

(ii) A 20,000 ohm / volt meter (Model 8, AVO or similar type).

(iii) A DC V.T.V.M.

(iv) A peak-to-peak detector as shown.

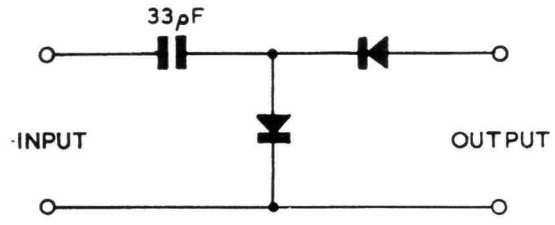


FIG. 2: Peak-to-Peak Detector.

5.5 Mc/s. NULL TRAP (IFT4)

IFT4 is a combined null trap and transformer, working at 5.5 Mc/s. When tuned in the factory, both primary and secondary cores are tuned together to give a zero output at 5.5 Mc/s. at the video grid, and a maximum transfer to the intercarrier amplifier. This can only be done accurately with a sweep oscillator and a suitable display unit having a high gain at 5.5 Mc/s. Once set, however, it should not need re-tuning unless quite large circuit alterations have been made.

Should it be necessary to re-tune IFT4, the following procedure should be adopted:

(1) Inject 5.5 Mc/s. at approximately 100 mV between the junction L28 and MR1 diode and earth (disconnecting the diode).

(2) Connect the input of the peak-to-peak detector illustrated (Fig. 2) to CRT cathode, pin 7. Connect the output of the peak-to-peak detector to a 20,000 ohm/volt meter on the 50 micro-amp. range.

(3) Adjust primary core of IFT4 (nearest chassis) to give zero reading on meter. If the IFT is replaced, it is necessary to adjust both cores to give a zero reading at 5.5 Mc/s.

(4) Withdraw both cores from former. Screw in primary core (nearest chassis) to give a minimum reading.

(5) Screw in secondary core until meter reading rises slightly and then adjust primary core until a new minimum is obtained.

(6) Repeat adjustment of primary and secondary cores until meter reads zero.

SOUND IF AMPLIFIER

Disconnect the oscillator as in (1) above and reconnect between junction of L31 and diode MR2 (OA90). Connect VTVM across R89 and adjust the slug in L33, and then both primary and secondary cores in IFT5 for maximum response. This adjustment and the preceding one may be carried out using an off air signal as previously.

RATIO DETECTOR TRANSFORMER (IFT6)

With the oscillator connected as above, adjust the secondary core (nearest chassis) so that a positive or negative reading is obtained on a DC VTVM connected between the junction of the diode load resistors and earth. Adjust the primary (top of coil) so that this reading shows a maximum. Then adjust the secondary core so that this reading is zero volts. This adjustment may also be carried out, again using an off air signal.

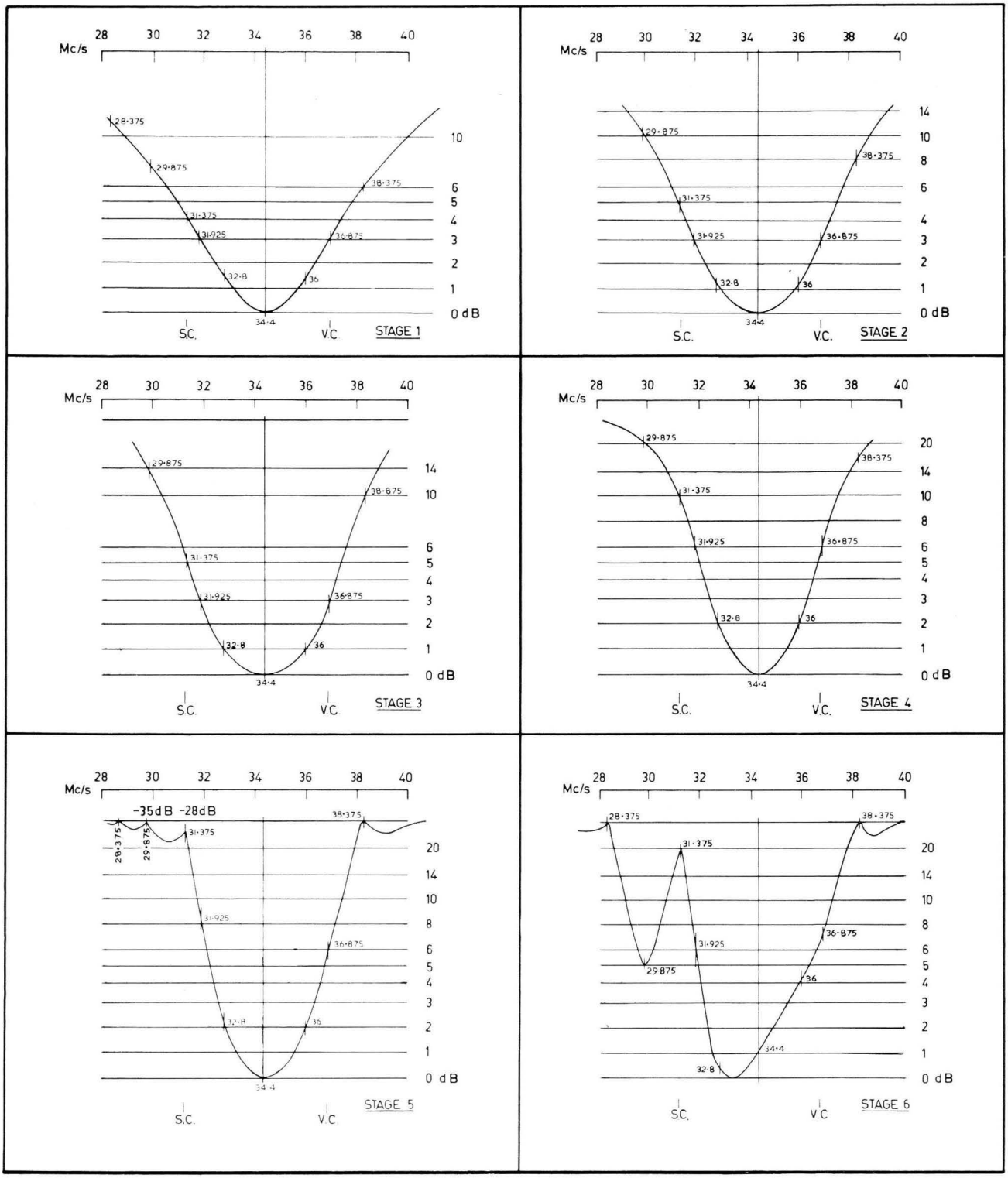


FIG. 3

I.F. RESPONSE CURVES

PARTS LIST - CHASSIS PM, PP (Series 2 and 3)

RESISTORS

REF.	PART NO.	DESCRIPTION
R21	740-0412	820 ohms ± 10% ½W.
R22	740-0032	2.2K ohms ± 10% ½W.
R23	740-0483	56 ohms ± 10% ½W Morganite
R24		
R25	742-0512	2.2K ohms ± 10% 1W.
R26	740-0702	56K ohms ± 10% ½W.
R27		
R28	740-0412	820 ohms ± 10% ½W.
R29	740-0273	150 ohms ± 10% ½W. Morganite
R30	742-0512	2.2K ohms ± 10% 1W.
R31	740-0412	820 ohms ± 10% ½W.
R31a	740-0062	3.9K ohms ± 10% ½W.
R32	740-0273	150 ohms ± 10% ½W. Morganite
R33	749-0342	1.5K ohms ± 10% 2W.
R34	742-0992	300K ohms ± 5% 1W.
R34a	740-0042	2.7K ohms ± 10% ½W.
R35	740-0322	1.2K ohms ± 10% ½W.
R36	740-0732	12K ohms ± 10% ½W.
R37	740-0042	2.7K ohms ± 10% ½W.
R38	740-0022	1K ohm ± 10% ½W.
R39	750-0472	3.6K ohms ± 5% 6W. Metox
R39a	740-0653	100 ohms ± 10% ½W. Morganite
R40	740-0182	470K ohms ± 10% ½W.
R41	740-0732	12K ohms ± 10% ½W.
R42	740-0142	100K ohms ± 10% ½W.
R43	742-0162	390K ohms ± 10% 1W.
R44	740-0122	47K ohms ± 10% ½W.
R45		
R46	750-0291	250 ohms ± 5% 5W. Cemcoat
R47	749-0142	1K ohm ± 20% 2W.
R48	749-0252	12K ohms ± 10% 2W.
R49	742-0062	27K ohms ± 10% 1W.
R50	740-0142	100K ohms ± 10% ½W.
R51	740-0162	220K ohms ± 10% ½W.
R52	740-0162	220K ohms± 10% ½W.
R53	740-0242	33K ohms ± 10% ½W.
R54	740-0162	220K ohms ± 10% ½W.
R55	740-0242	33K ohms ± 10% ½W.
R56	740-0122	47K ohms ± 10% ½W.
R57	740-0112	27K ohms ± 10% ½W.
R58	742-0772	3.9M ohms ± 10% 1W.
R59	740-0202	2.2M ohms ± 10% ½W.
R60	742-0122	150K ohms ± 10% 1W.
R61	749-0232	27K ohms ± 10% 2W.
R62		
R63	742-0172	470K ohms ± 10% 1W.
R64	742-0772	3.9M ohms ± 10% 1W.
R65	742-0772	3.9M ohms ± 10% 1W.
R66	742-0892	2.2M ohms ± 10% 1W.
R67	742-0192	1M ohm ± 10% 1W.
R68	740-0092	15K ohms ± 10% ½W.
R69	740-0782	120K ohms ± 10% ½W.
R70	740-0702	56K ohms ± 10% ½W.
R71	740-0782	120K ohms ± 10% ½W.
R72	749-0182	22K ohms ± 10% 2W.
R73	740-0252	1.5K ohms ± 10% ½W.
R74	740-0082	10K ohms ± 10% ½W.
R75	740-0292	270 ohms ± 10% ½W.
R76	740-0022	1K ohm ± 10% ½W.
R77	740-0142	100K ohms ± 10% ½W.
R78		
R79		
R80	740-0242	33K ohms ± 10% ½W.
R81	740-0082	10K ohms ± 10% ½W.
R82	742-0092	47K ohms ± 10% 1W.
R83	740-0022	1K ohm ± 10% ½W.
R84		
R85	740-0112	27K ohms ± 10% ½W.
R86	740-0112	27K ohms ± 10% ½W.
R87	740-0122	47K ohms ± 10% ½W.
R88	740-0082	10K ohms ± 10% ½W.
R89	740-0082	10K ohms ± 10% ½W.
R90	740-0152	150K ohms ± 10% ½W.
R91	740-0152	150K ohms ± 10% ½W.
R92	740-0702	56K ohms ± 10% ½W.
R93		
R94	742-0132	220K ohms ± 10% 1W.
R95	740-0052	3.3K ohms ± 10% ½W.
R96	740-0292	270 ohms ± 10% ½W.
R97	740-0392	330K ohms ± 10% ½W.
R98	740-1062	680K ohms ± 20% ½W.
R99	740-0052	3.3K ohms ± 10% ½W.
R100	742-0302	6.8K ohms ± 20% 1W.
R101	740-0663	82 ohms ± 10% ½W. Morganite
R102	742-0112	100K ohms ± 10% 1W.
R103	740-0112	27K ohms ± 10% ½W.
R104	740-0082	10K ohms ± 10% ½W.
R105	740-0082	10K ohms ± 10% ½W.
R106	740-0122	47K ohms ± 10% ½W.
R107	740-0082	10K ohms ± 10% ½W.
R108	742-0172	470K ohms ± 10% 1W.
R109	740-0082	10K ohms ± 10% ½W.
R110	740-0232	39K ohms ± 10% ½W.
R111	742-0022	4.7K ohms ± 10% 1W.
R112	740-0202	2.2M ohms ± 10% ½W.
R113	740-0122	47K ohms ± 10% ½W.
R114	740-0302	1.8K ohms ± 10% ½W.
R115	750-0482	1K ohm ± 5% 4W. Metox
R116	742-0823	270 ohms ± 10% 1W.
R117	740-1043	27 ohms ± 10% ½W. Morganite
R118	740-1043	27 ohms ± 10% ½W. Morganite
R119	740-0172	270K ohms ± 10% ½W.
R120	740-0392	330K ohms ± 10% ½W.
R121	740-0043	2.7K ohms ± 10% ½W. Morganite
R122	740-0182	470K ohms ± 10% ½W.
R123	740-0142	100K ohms ± 10% ½W.
R124	740-0102	22K ohms ± 10% ½W.
R125	742-0042	15K ohms ± 10% 1W.
R126	742-0472	1.8K ohms ± 10% 1W.
R127	740-0702	56K ohms ± 10% ½W.
R128	740-0112	27K ohms ± 10% ½W.
R129	742-0092	47K ohms ± 10% 1W.
R130	742-0172	470K ohms ± 10% 1W.
R131	740-0022	1K ohm ± 10% ½W.
R132	750-0362	2.7K ohms ± 10% 5W. PW5
R133	746-0242	1 ohm ± 10% ½W. BW½
R134	742-0262	2.7K ohms ± 10% 1W.
R135	part of 908-0383	1.5 ohms Resistance Wire
R136	742-0492	68K ohms ± 10% 1W.
R137	742-0112	100K ohms ± 10% 1W.
R138	742-0772	3.9M ohms ± 10% 1W.

CAPACITORS

REF.	PART NO.	DESCRIPTION
C20	271-0941	8.2 pF ± ½ pF NPO Disc
C21	271-0911	.003 uF 500V. Ceramic
C22	271-0911	.003 uF 500V. Ceramic
C23	271-0621	.001 uF lead thru Ducon CAC 100
C24	273-0591	68 pF ± 2½% M.S. Mica
C25	271-0911	.003 uF 500V. Ceramic
C26		
C27	271-0281	.022 uF 100V. Ceramic Disc
C28	271-0591	.0027 uF ± 10% K2000 Ceramic Disc
C29	273-0591	68 pF ± 2½% M.S. Mica
C30	271-0911	.003 uF 500V. Ceramic
C31	271-0731	.047 uF +30% —20% 25V. Redcap
C32	271-0591	.0027 uF ± 20% K2000 Ceramic Disc
C33	273-0591	68 pF ± 2½% M.S. Mica
C33a	271-0351	33 pF ± 5% NPO Tube
C34	271-0911	.003 uF 500V. Ceramic
C35	271-1021	.001 uF +100% —20% type AZ Ceramic Disc
C36	271-0911	.003 uF 500V. Ceramic
C37	271-0591	.0027 uF ± 20% K200 Ceramic Disc
C38	273-0591	68 pF ± 2½% M.S. Mica
C39	271-1091	12 pF ± 20% N330 Ceramic
C40	271-0121	5.6 pF ± ¼ pF NPO Ceramic
C41	271-0311	27 pF ± 5% NPO Ceramic
C42	271-0941	8.2 pF ± ½ pF NPO Disc
C42a	271-1061	15 pF ± 10% N330 Tube
C43	271-0621	.001 uF lead thru Ducon CAC 100
C44	283-1701	.047 uF ± 10% 400V. Polyester
C45	283-1541	.0022 uF ± 10% 400V. Polyester
C46	283-1661	.022 uF ± 10% 400V. Polyester
C47	269-0211	8 uF 300V. Electro
C48	269-0521	100 uF 150VW. Insulated Electro
C49	269-0521	100 uF 150VW. Insulated Electro
C50) C51)	269-0901	(60 uF + 275 VW. Electro (200 uF
C52	271-0911	.003 uF 500V. Ceramic
C53	271-0911	.003 uF 500V. Ceramic
C54	283-1661	.022 uF ± 10% 400V. Polyester
C55	269-0611	4 uF 300V. Electro
C56	280-1791	220 pF ± 10% 600V. Styroseal
C57	273-0921	68 pF ± 10% M.S. Mica
C58	283-1741	.1 uF ± 10% 400V. Polyester
C59	283-1281	.22 uF ± 10% 125V. Polyester
C60	271-1021	.001 uF +100% —20% Ceramic Disc
C61	283-2361	1 uF ± 20% 125V. Polyester
C62	271-0901	68 pF ± 10% Ceramic Disc

PARTS LIST - CHASSIS PM, PP (Series 2 and 3)

CAPACITORS — *continued*

REF.	PART NO.	DESCRIPTION
C63	283-1281	.22 uF ± 10% 125V. Polyester.
C64	271-0731	.047 uF +30% —20% 25V. Redcap
C65	271-0591	.0027 uF ± 20% K2000 Ceramic Disc
C66	271-0681	12 pF ± 5% NPO Ceramic Disc
C67		
C68		
C69		
C70	271-0471	6.8 pF ± ¼ pF NPO Ceramic Disc
C71	271-0681	12 pF ± 5% NPO Ceramic Disc
C72	271-0591	.0027 uF ± 20% K2000 Ceramic Disc
C73	271-0591	.0027 uF ± 20% K2000 Ceramic Disc
C74	271-0801	10 pF ± 5% NPO Ceramic Disc
C75		
C76	271-0771	100 pF ± 5% NPO Ceramic Disc
C77	280-1501	100 pF ± 5% 600V Styroseal
C78	280-1501	100 pF ± 5% 600V Styroseal
C79	283-1501	.001 uF ± 10% 400V. Polyester
C80	269-0781	4 uF 25V. Electro
C81	283-1581	.0047 uF ± 10% 400V. Polyester
C82	280-1841	560 pF ± 10% 600V. Styroseal
C83	283-1121	.01 uF ± 10% 125V. Polyester
C84		
C85	269-0701	10 uF 12V. Electro
C86	283-1641	.015 uF ± 10% 400V. Polyester
C87	271-1061	15 pF ± 10% Ceramic Tube
C88	269-1001	60 uF 300V Electro, Type ET5F
C89	269-0221	25 uF 25V Electro, Type ET1B
C90	283-1661	.022 uF ± 10% 400V Polyester
C91	283-1541	.0022 uF ± 10% 400V Polyester
C92	283-2361	1 uF ± 20% 125V. Polyester
C93	283-1701	.047 uF ± 10% 400V Polyester
C94	283-1541	.0022 uF ± 10% 400V Polyester
C95	283-1541	.0022 uF ± 10% 400V Polyester
C96	283-1721	.068 uF ± 10% 400V Polyester
C97	part of 269-0981	50 uF 300V Electro with C100 and C101
C98	283-1121	.01 uF ± 10% 125V Polyester
C99	283-1281	.22 uF ± 10% 125V Polyester
C100	part of 269-0981	24 uF 300V Electro with C97 and C101
C101	part of 269-0981	100 uF 25V Electro with C97 and C100
C102	271-1081	82 pF ± 5% Ceramic Tube
C103	271-0951	47 pF ± 10% Ceramic Tube
C104	283-1521	.0015 uF ± 10% 400V Polyester
C105	283-1501	.001 uF ± 10% 400V Polyester
C106	283-1581	.0047 ± 10% 400V Polyester
C107	280-1751	100 pF ± 10% 600V Styroseal
C108	283-1321	.47 uF ± 10% 125V Polyester
C109	282-0561	.0033 uF ± 10% 400V Polyester
C110	280-1851	680 pF ± 10% 600V Styroseal
C111	271-1081	82 pF ± 5% Ceramic Tube
C112	280-1781	180 pF ± 10% 600V Styroseal
C113	283-1581	.0047 ± 10% 400V Polyester
C114	part of 908-0383	82 pF Ceramic Tube
C115	284-0661	.022 uF ± 20% 600V Polyester
C116	part of 908-0383	150 pF Ceramic Tube
C117	284-1281	.22 uF ± 20% 1000V Polyester
C118	284-1281	.22 uF ± 20% 1000V Polyester
C119	284-2701	.047 uF ± 10% 1000V Polyester
C120	283-1781	.22 uF ± 10% 400V Polyester

COILS

REF.	PART No.	DESCRIPTION
L21	259-1321	1st I.F. Grid Coil
L22		28.375 Mc/s. Trap
L23	259-1391	1st I.F. Anode Coil
L24		38.375 Mc/s. Trap
L25	259-1401	2nd I.F. Anode Coil
L26		31.375 Mc/s. Trap
L26a	part of 906-0631	38.375 Mc/s. Trap
L27	part of 259-1411	3rd I.F. Anode Coil
L28	259-0955	Grid Peaking Choke
L29	259-1431	Choke
L30	259-1431	Choke
L31	part of 259-1411	29.875 Mc/s. Trap
L32	259-1431	Choke
L33	259-1421	Intercarrier Detector Coil
L33a	259-1083	Peaking Coil — Shunt
L34	259-1093	Peaking Coil — Series
L35	259-1363	Horizontal Stabiliser Coil
L36	259-0045	Anti-Parasitic Coil
L37	259-0904	Width Coil
L38	259-0045	Anti-Parasitic Coil
L39	259-0045	Anti-Parasitic Coil
L40	259-0924	Horizontal Linearity Coil

TRANSFORMERS

REF.	PART NO.	DESCRIPTION
T1	904-0412	Mains Transformer
T2	905-0541	Audio Output Transformer
T3	908-0662	Blocking Osc. Transformer
T4	905-0551	Vertical Output Transformer
T5	908-0671	Vertical Feedback Transformer
T6	908-0383	Horizontal Output Transformer
T7	908-0692	Focus Transformer
IFT1	906-0621	Vision IFT
IFT2	906-0631	Vision IFT
IFT3	906-0641	Vision IFT
IFT4	906-0651	5.5 Mc/s. Trap
IFT5	906-0382	Sound IFT
IFT6	906-0324	Ratio Detector

POTENTIOMETERS

REF.	PART NO.	DESCRIPTION
RV1	677-1103	500K ohms Curve 'A'—Brightness
RV2	677-0171	25K ohms Curve 'A,' Type E.C.— Noise Inverter
RV3	677-0911	1M ohm Curve 'A,' Type E.C. — A.G.C.
RV4	677-1152	(25K ohms Curve 'A' — Picture (Contrast (50K ohms Curve 'A' — Contrast (Range
RV5		
RV6	677-1113	1M ohm 'Reverse C' — Curve — Tone
RV7	677-1092	1M ohm Curve 'A' Tapped 500K ohms — Volume
RV8	677-0921	50K ohms Curve 'A,' Type E.C. — Height
RV9	677-1103	500K ohms Curve 'A' I.R.C. — Vertical Hold
RV10	677-0511	10K ohms Curve 'A,' Type E.C. — Vertical Linearity
RV11	677-0921	50K ohms Curve 'A,' Type E.C. — Horizontal Hold
RV12	677-0891	2 Mohms ± 25% — Focus.

PARTS LIST - CHASSIS PM, PP (Series 2 and 3)

VALVES

REF.	PART NO.	DESCRIPTION
V1	932-1161	6ES8 — R.F. Amplifier
V2	932-1921	6HG8 — Frequency Changer
V3	932-0881	6BY7 — 1st I.F. Amplifier
V4	932-1221	6EJ7 — 2nd I.F. Amplifier
V5	932-1221	6EJ7 — 3rd I.F. Amplifier
V6	932-1081	6DX8 — Video Amplifier and Noise Inverter
V7	932-1091	6CS6 — Sync. Separator
V8	932-1101	6U8 — A.G.C. and Limiter
V9	932-0521	6BX6 — Intercarrier Amplifier
V10	932-1771	6GW8 — Audio Driver and Audio Output
V11	932-0511	6BM8 — Blocking Oscillator and Vertical Output
V12	932-0481	12AU7 — Horizontal Oscillator
V13	932-0531	6CM5 — Horizontal Output
V14	932-0771	1S2 — E.H.T. Rectifier
V15	932-1151	6AL3 — Damping Diode
	932-1171	Lamp — 6.3V., 0.32A.

DIODES

REF.	PART NO.	DESCRIPTION
MR1	932-0971	OA90 — Video Detector
MR2	932-0971	OA90 — Intercarrier Amplifier
MR3	932-1071	} OA210, 1N1763 or 1N2094
MR4	932-1071	} Voltage doubler diodes
MR5	932-0992	M3 — A.G.C. Clamp
MR6 } MR7 }	932-2081	} 2 — A A119 (Matched Pair) Ratio Detector
MR8	932-2031	OA91 } Phase Discriminator
MR9	932-2031	OA91 }

MISCELLANEOUS

REF.	PART No.	DESCRIPTION
CH1	232-0321	HT Choke
RT1	752-0061	Thermistor CZ11
VDR1	750-0281	Voltage Dependent Resistor Type E298GD/260 (Blue Spot)
FS1	431-0081	Fuse, 1.5A (Mains)
FS2	431-0081	Fuse, 1.5A (Mains)
FS3	431-0081	Fuse, 1.5A (HT)
FS4	431-0031	Fuse, 250 mA (HT2)
Tuner	224-1512	Tuner—Philips NT3011
Yoke	259-1051	Philips AT1009T/93 or AT1009T/96
SA	855-0601	D.P. Push-Push, Mains On/Off Switch
	824-1021	Lamp Socket 733—3—7
	160-0151	Tuner Mounting Bush
	220-0001	Pointer Drive Chain
	224-0881	Chain Sprocket Retaining Clips
	517-2081	Knob — rear pre-sets — Tone, Brightness, Vertical Hold
	518-5051	Chain Socket Kit
	617-0191	3/16-inch wing-nut—top chassis fixing
	617-0211	¼-inch wing-nut—tuner bracket fixing
	617-0641	Pointer
	840-0851	Chain Tensioning Spring
CRT	932-1591	23CP4, 23CRP4, 23HP4

PARTS LIST - CHASSIS PQ, PR

as for PM, PP, except —

DELETE

REF.	PART NO.	DESCRIPTION
R34		300K ohms ± 5% 1W.
R34a		2.7K ohms ± 10% ½W.
R43		390K ohms ± 10% 1W.
R44		47K ohms ± 10% ½W.
R82		47K ohms ± 10% 1W.
R83		1K ohm ± 10% ½W.
C47		8 uF 300V. Electro.

ADD

RESISTORS

REF.	PART No.	DESCRIPTION
R43a	742-0122	150K ohms ± 10% 1W.
R43b	742-0722	560K ohms ± 10% 1W.
R44a	740-0382	6.8K ohms ± 10% ½W.
R44b	742-0122	150K ohms ± 10% 1W.
R69a	740-0362	390K ohms ± 10% ½W.
R69b	740-1062	680K ohms ± 20% ½W.
R72a	740-0752	68K ohms ± 10% ½W.
R72b	740-0102	22K ohms ± 10% ½W.
R82a	749-0052	47K ohms ± 20% 2W.
R83a	740-0032	2.2K ohms ± 10% ½W.
R154	740-0653	100 ohms ± 10% ½W.
R155	742-0512	2.2K ohms ± 10% 1W.
R156	740-0092	15K ohms ± 10% ½W.
R157	742-0112	100K ohms ± 10% 1W.
R158	740-0262	560 ohms ± 10% ½W.
R159	740-0412	820 ohms ± 10% ½W.
R160	749-0362	150 ohms ± 10% 2W.

CAPACITORS

REF.	PART No.	DESCRIPTION
C47a	269-0611	4 uF 300V Electro
C62a	271-0911	.003 uF 500V Ceramic
C133	271-0781	.035 uF 2KVW. Double Disc Ceramic
C134	271-0781	.035 uF 2KVW. Double Disc Ceramic
C135	269-0761	25 uF 50VW. Electro
C136	269-1091	10 uF 50VW. Electro

POTENTIOMETERS

REF.	PART No.	DESCRIPTION
RV14	677-0971	1.5K Curve 'F' — Hearing Aid Volume
RV15	677-1191	250K ohms Curve 'F' — Remote Control "Picture"
RV16	677-1011	250K ohms Curve 'G' — Remote Control Volume

TRANSFORMERS

REF.	PART No.	DESCRIPTION
T10	904-0381	Remote Control Power Transformer
T11	908-0571	Indexing Transformer
T12	908-0571	Indexing Transformer

DIODES

REF.	PART No.	DESCRIPTION
MR15	932-2191	BSI/10 or IN2859
MR16	932-2191	BSI/10 or IN2859
MR17	932-2031	OA91

TRANSISTOR

REF.	PART No.	DESCRIPTION
	932-2211	AC128

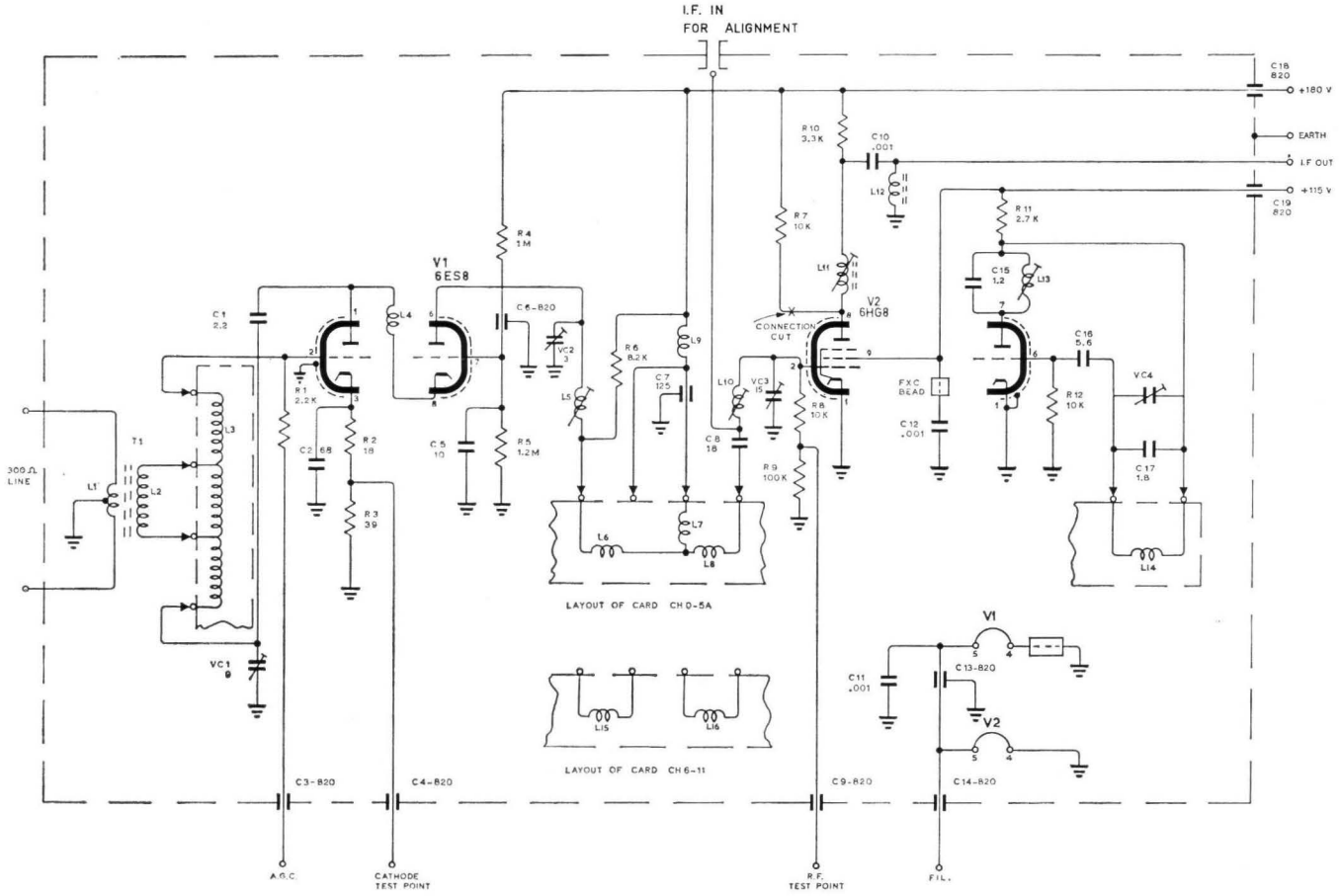
MISCELLANEOUS

REF.	PART No.	DESCRIPTION
RLA	735-0041	Relay 300 ohms coil, 4-pole, normally open
RLB	735-0051	Relay 600 ohms coil, 4-pole, normally open
MSA-1)		(On/Off Control) Leaf switch
MSA-2)	855-0651	(Speaker Control) opened by remote
MSA-3)		(Contrast Control) control plug
MSB	855-0481	Muting Switch (cam-operated)
SB	855-0531	Switch Wafer—1-pole, 14-position
SC	855-0441	Switch Local/Remote Speaker, MSP77
SD	855-0441	Switch—Remote On/Off MSP77
SE	855-0451	Switch—Remote Channel Selector OAK—CK14
	577-0111	Motor, 240V.
	577-0121	Motor + Driving Dog
	306-0111	Cutch — Driving Dog
	306-0101	Clutch — Driven Dog
	837-0531	Spindle — Driven Dog and Pinion Mounting
	447-0051	Pinion
	664-1731	Rear Bearing Plate Assembly, plate with bearings, driven dog, pinion and spindle.
	447-0061	Idler Gear
	447-0071	Crank Driving Gear
	654-0623	Crank with Pin
	263-0051	Crank Pin Collar
	244-0811	Circlip SCO1916, crank pin collar retaining
	664-1801	Front Bearing Plate Assembly
	954-0271	Geneva Wheel Assembly
	224-0771	Circlip SCO1960/17/0, Geneva wheel assy. retaining
	306-0131	Tuner Coupling — Driving
	306-0121	Tuner Coupling — Driven
	263-0061	Collar — Driven Tuner Coupling
	824-1091	Socket — Remote Control Mc-Murdo Type 782a.

REMOTE CONTROL HANDPIECE

REF.	PART No.	DESCRIPTION
	190-2501	Cabinet Back
	224-0491	Circlip, ASCO/8169/17/0
	814-0961	Captive 4BA Screw held by 244-0491
	190-2491	Cabinet Front
	794-1301	Scale—Channel Indicator
	664-1701	Plate—Scale Backing
	372-0181	Disc—Channel Indicator
	517-1631	Knob—Pre-Selector
	840-0731	Spring—Pre-Selector Knob
	517-1641	Knob—Channel Selector
	517-1891	Knob
	794-1261	Scale—Hearing Aid Volume
	794-1271	Scale—Picture
	794-1281	Scale—Volume
	453-1291	Speaker Grille
	661-0231	Grille Backing Strip
	831-1391	Speaker, 2-inch MSP Type 2MB, 15 ohms
	757-0181	Speaker Mounting Rubber Ring
	824-0841	Hearing-Aid Socket
	831-1331	Hearing-Aid Earpiece, 15 ohms, with lead and plug
	852-0221	Handset Support
	770-0361	Anti-skid Rubber Balls
	961-0761	25ft. 9-Core Beige Cable
	826-0001	Sleeve
	668-0581	Plug—9-pin, XLM9/UTP1
	294-0971	Cover—9-pin Plug, 10B
PLP	932-1791	Lamp—12V., 2W. Philips, Type 12829.

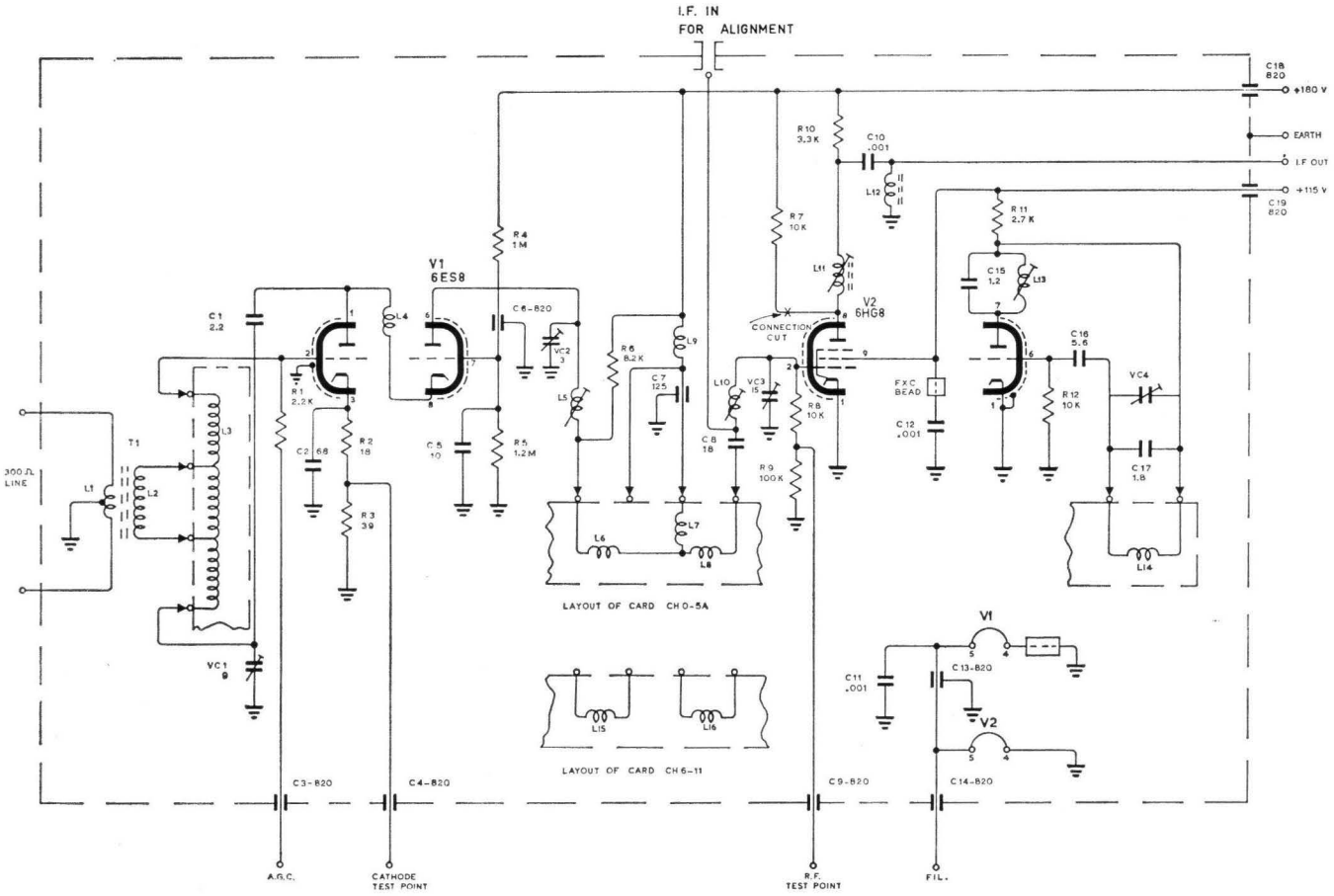
H. CLARK PTY. LTD.
Printers
MARRICKVILLE, N.S.W.



TUNER TYPE NT3011

"H.M.V." CHASSIS TYPES PM, PP

(SERIES 2 AND 3)



TUNER TYPE NT3011

"H.M.V." CHASSIS TYPES PQ, PR

"H.M.V." CHASSIS TYPES PM, PP

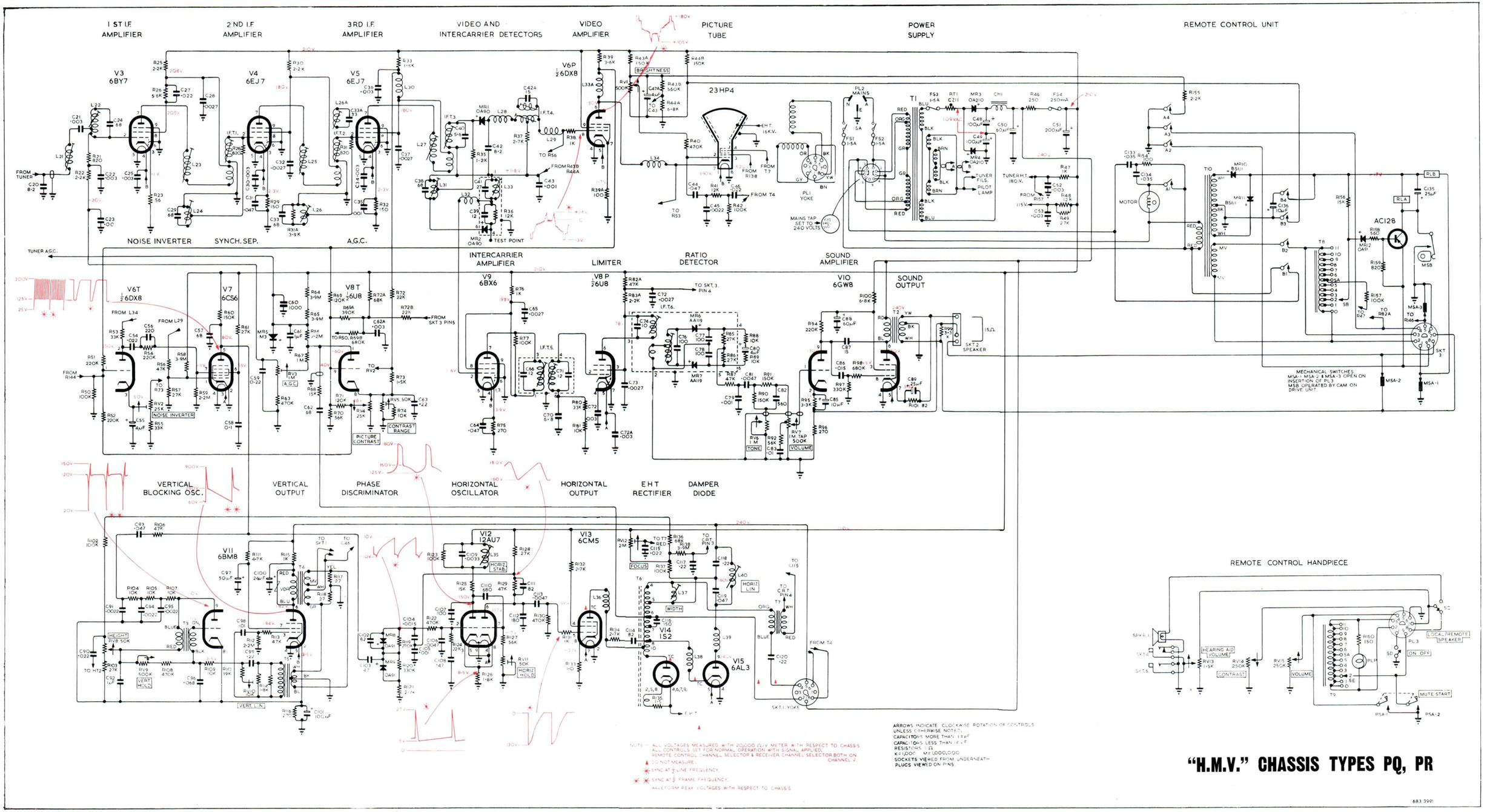
(SERIES 2 AND 3)

1ST I.F. AMPLIFIER
2ND I.F. AMPLIFIER
3RD I.F. AMPLIFIER
VIDEO AND INTERCARRIER DETECTORS
VIDEO AMPLIFIER
PICTURE TUBE
POWER SUPPLY
V3 6BY7
V4 6EJ7
V5 6EJ7
V6P 6DX8
23HP4 OR SHELBOND
NOISE INVERTER
SYNC. SEP.
A.G.C.
LIMITER
RATIO DETECTOR
SOUND AMPLIFIER
SOUND OUTPUT
INTERCARRIER AMPLIFIER
V6T ½ 6DX8
V7 6CS6
V8T ½ 6U8
V9 6BX6
V8P ½ 6U8
V10 6GW8
VERTICAL BLOCKING OSC.
VERTICAL OUTPUT
PHASE DISCRIMINATOR
HORIZONTAL OSCILLATOR
HORIZONTAL OUTPUT
E.H.T. RECTIFIER
DAMPER DIODE
V11 6BM8
V12 12AU7
V13 6CM5
V14 1S2
V15 6AL3

NOTE – ALL VOLTAGES MEASURED WITH 20,000 Ω/V. METER WITH RESPECT TO CHASSIS. ALL CONTROLS SET FOR NORMAL OPERATION WITH SIGNAL APPLIED.

▲ DO NOT MEASURE.
✳ SYNC. AT ½ LINE FREQUENCY.
✳✳ SYNC. AT ½ FRAME FREQUENCY.
WAVEFORM PEAK VOLTAGES WITH RESPECT TO CHASSIS.

ARROWS INDICATE CLOCKWISE ROTATION OF CONTROLS
UNLESS OTHERWISE NOTED
CAPACITORS MORE THAN 1 μμF
CAPACITORS LESS THAN 1 μF
RESISTORS Ω
K 1000 M 1000,000
SOCKETS VIEWED FROM UNDERNEATH
PLUGS VIEWED ON PINS


1 ST I.F. AMPLIFIER
2 ND I.F. AMPLIFIER
3RD I.F. AMPLIFIER
VIDEO AND INTERCARRIER DETECTORS
VIDEO AMPLIFIER
PICTURE TUBE
POWER SUPPLY
REMOTE CONTROL UNIT
V3 6BY7
V4 6EJ7
V5 6EJ7
V6P ½6DX8
23HP4
NOISE INVERTER
SYNCH. SEP.
A.G.C.
INTERCARRIER AMPLIFIER
LIMITER
RATIO DETECTOR
SOUND AMPLIFIER
SOUND OUTPUT
V6T ½6DX8
V7 6CS6
V8T ½6U8
V9 6BX6
V8P ½6U8
V10 6GW8
TUNER A.G.C.
VERTICAL BLOCKING OSC.
VERTICAL OUTPUT
PHASE DISCRIMINATOR
HORIZONTAL OSCILLATOR
HORIZONTAL OUTPUT
E H T RECTIFIER
DAMPER DIODE
V11 6BM8
V12 12AU7
V13 6CM5
V14 1S2
V15 6AL3
AC128
REMOTE CONTROL HANDPIECE
MECHANICAL SWITCHES MSA-1 MSA-2 & MSA-3 OPEN ON INSERTION OF PL3 MSB OPERATED BY CAM ON DRIVE UNIT.
ARROWS INDICATE CLOCKWISE ROTATION OF CONTROLS UNLESS OTHERWISE NOTED.
CAPACITORS MORE THAN 1 IS μF
CAPACITORS LESS THAN 1 IS μF
RESISTORS Ω
K=1,000 M=1,000,000
SOCKETS VIEWED FROM UNDERNEATH
PLUGS VIEWED ON PINS.
NOTE — ALL VOLTAGES MEASURED WITH 20,000 Ω/V METER WITH RESPECT TO CHASSIS
ALL CONTROLS SET FOR NORMAL OPERATION WITH SIGNAL APPLIED.
REMOTE CONTROL CHANNEL SELECTOR & RECEIVER CHANNEL SELECTOR BOTH ON CHANNEL 2.
DO NOT MEASURE.
SYNC AT ½ LINE FREQUENCY.
SYNC AT ½ FRAME FREQUENCY.
WAVEFORM PEAK VOLTAGES WITH RESPECT TO CHASSIS
"H.M.V." CHASSIS TYPES PQ, PR
683 3991