

**V310, V310C
& V310D**

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& V310D**

MURPHY SERVICE MANUAL

Issued by

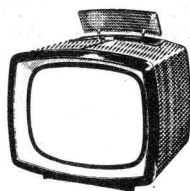
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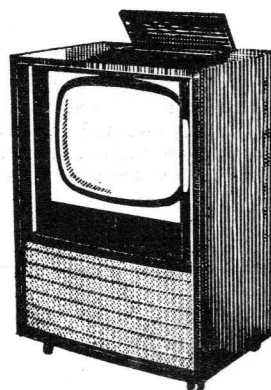
THE V310, V310C & V310D TELEVISION RECEIVERS



V310C



V310



V310D

SPECIFICATION

MAINS SUPPLY:		200-250 volts, 50 c/s a.c., or 200-250 volts d.c.
CONSUMPTION:		160 watts, average
AERIAL INPUT IMPEDANCE:		75 ohms, unbalanced
FREQUENCY RANGE:		Band I and Band III
INTERMEDIATE FREQUENCY:	Vision:	34.65 Mc/s
	Sound:	38.15 Mc/s
VALVES:		One 30L1, one 30C1, four 30F5, two 6D2, two 30FL1, one 6/30L2, one 30P16 (PL82) or 30P12, one 30P4, one U191, one U26
CATHODE RAY TUBE:		CRM172
FUSES:	F1:	2A plain cartridge
	F2:	500mA, Mag-Nickel cartridge
LOUDSPEAKER:	V310, V310C:	Elliptical, 6 in. by 4 in. permanent magnet; 3 ohms impedance
	V310D:	8 in. diameter; permanent magnet; 3 ohms impedance
OVERALL DIMENSIONS:	V310:	17 in. high, 19 in. wide, 21 in. deep
	V310C:	31 in. high, 21 in. wide, 23 in. deep
	V310D:	33 in. high, 22½ in. wide, 21 in. deep
WEIGHT:	V310:	50 lb.
	V310C:	60 lb.
	V310D:	93 lb.
RELEASED:	V310:	February, 1957
	V310C:	April, 1957
	V310D:	July, 1957
PRICE:	V310:	Standard - £51 15s. 6d. plus P.T.
	V310:	Light Wood - £52 2s. 11d. plus P.T.
	V310C:	£60 6s. 10d. plus P.T.
	V310D:	£74 9s. 11d. plus P.T.

INSTALLATION

The aerial system. Connect the aerial to the receiver with 75Ω coaxial cable. Use a crossover unit if two separate aerials are required. Earth the receiver by means of the

upper socket on the aerial escutcheon if time-base radiation is suspected or if local interfering signals are being received.

RECEIVER ADJUSTMENTS

The following checks and adjustments must be made in the Customer's house, without regard to any previous adjustment made elsewhere.

Mains voltage adjustment

A.C. MAINS 200 TO 250V, AND D.C. MAINS 220V TO 250V ONLY.

1. Loosen the small locking knob in the centre of the mains adjustment dial at the rear of the receiver.
2. Rotate the dial so that the desired voltage is against the arrow engraved on the panel.
3. Gently press the dial against the panel, ensuring that the two pips on its underside locate in the holes in the panel.
4. Whilst still maintaining the pressure, tighten up the locking knob.

NOTE: Wherever possible, arrange the mains plug connections so that the chassis is at the mains neutral potential.

D.C. MAINS 200V AND 210V ONLY.

1. Use the procedure described above, but first set the dial to the 220V d.c. position, and correct the polarity of the mains connections if necessary. Then rotate the dial to the 200V or 210V d.c. position as required.

The above procedure is necessary because the rectifier (MR1) is out of circuit on these taps, and the fuse (F1) could easily "blow".

V310 and V310C On-Off Switch. The on-off switch is operated automatically by a spring loaded mechanism when the release button at the top of the cabinet is pressed.

Initial test. Check that the receiver is operating, but do not leave the BRIGHTNESS control turned up if it is suspected that the ion trap magnet is not in its correct position.

Sensitivity adjustment. Connect the aerial and, for optimum signal to noise ratio, proceed as follows:

- (a) Set the STATION SELECTOR to the appropriate position, i.e. B.B.C. or I.T.A., and turn the volume control to maximum (fully clockwise).
- (b) Adjust the local oscillator core through the hole next to the STATION SELECTOR knob using (early sets) a small screwdriver, or (later sets) the plastic trimming tool supplied. Exert sufficient pressure on the tool for it to engage with the oscillator core and then rotate the core for maximum sound output.
- (c) With the CONTRAST control at minimum (anti-clockwise) adjust the appropriate SENSITIVITY control so that the picture is only just synchronising. It will be necessary to increase the brightness so that this can be readily ascertained.
- (d) Set the black level of the picture by means of the BRIGHTNESS control and adjust the CONTRAST control to give a correctly contrasted picture.

In areas of high signal strength, if cross modulation (picture on sound, sound on picture, or heterodyne patterns) occurs, repeat this procedure with the CONTRAST control at approximately half travel instead of fully anti-clockwise, check afterwards that adequate picture brilliance is obtained with the CONTRAST control turned fully clockwise.

NOTE: If the signal is so strong on one channel that it is impossible to adjust the SENSITIVITY control so that the picture is just synchronizing, or if cross modulation is still present, a turret attenuator should be fitted; see page 26.

MAINTENANCE ADJUSTMENTS

To enable the performance to be kept at its best, the adjustments described in the following three sections must be checked and corrected where necessary whenever the receiver is overhauled or repaired. These adjustments should not be necessary on installation.

I. PICTURE ADJUSTMENTS

The procedure is normal but the following points should be noted:

Tilted picture. The cabinet must be removed from the chassis for this adjustment. The scan assembly is locked in position and adjusted by the hexagonal headed brass screw at the top of the housing.

Picture position. This is adjusted by the black insulated lever projecting from the rear of the focus assembly, and through the back of the cabinet. Unscrew the lever by

about one turn and then move it as required to centre the picture. Tighten after use.

Line linearity. With the slider at the top of its travel, i.e. nearest the coil, move the slider down slowly until the equidistant vertical divisions of the picture or test pattern are as near to equal as possible. It should be noted that the correct position for the slider should be near the top; any other position will give reduced line amplitude.

2. MECHANICAL ADJUSTMENTS

Read the preliminary note above

Focus unit position. When a new c.r.t. is fitted, it may be necessary to reposition the focus unit. To do this, slacken the four screws visible through the slots in the side of the large supporting cylinder, and slide the assembly backwards or forwards until the distance between the c.r.t. grid plane and the plate at the rear of the focus unit is approximately $3/4$ in. (see Fig. 1) with the focus adjustment fully clockwise. If the distance is much less, the scanning spot will be large; if it is appreciably greater, uneven focus over the picture area will result.

Before retightening the screws, make sure

that the back plate is at right angles to the c.r.t. neck. Finally, check the adjustment of the ion trap magnet, as described in "Electrical Adjustments" below.

With the focus knob in the position of optimum focus, the fixing lugs for the knob should be more than $3/4$ in. from either end of their maximum travel, as measured around the outside of the cylindrical housing. If the lug is closer to the end of its travel, when the h.t. and e.h.t. voltages are normal, and the unit is correctly positioned, the focus unit may be suspected of having an incorrect flux density.

3. ELECTRICAL ADJUSTMENTS

Read the preliminary note above

Ion trap. To assist in adjusting the ion trap magnet it should be roughly positioned on the neck of the c.r.t. so that the paint spot is towards the rear of the receiver and the two grooves in the rim are approximately 90 degrees anti-clockwise from the c.r.t. e.h.t. connector, looking from the rear of the receiver.

To prevent damage to the c.r.t. when adjusting the position of the magnet, the cathode current must not be allowed to exceed about $10\mu\text{A}$, and the following procedure should be used.

1. Remove the focus adjusting knob.
2. Connect a meter having a full scale deflection of 1mA or less, across R153 (220

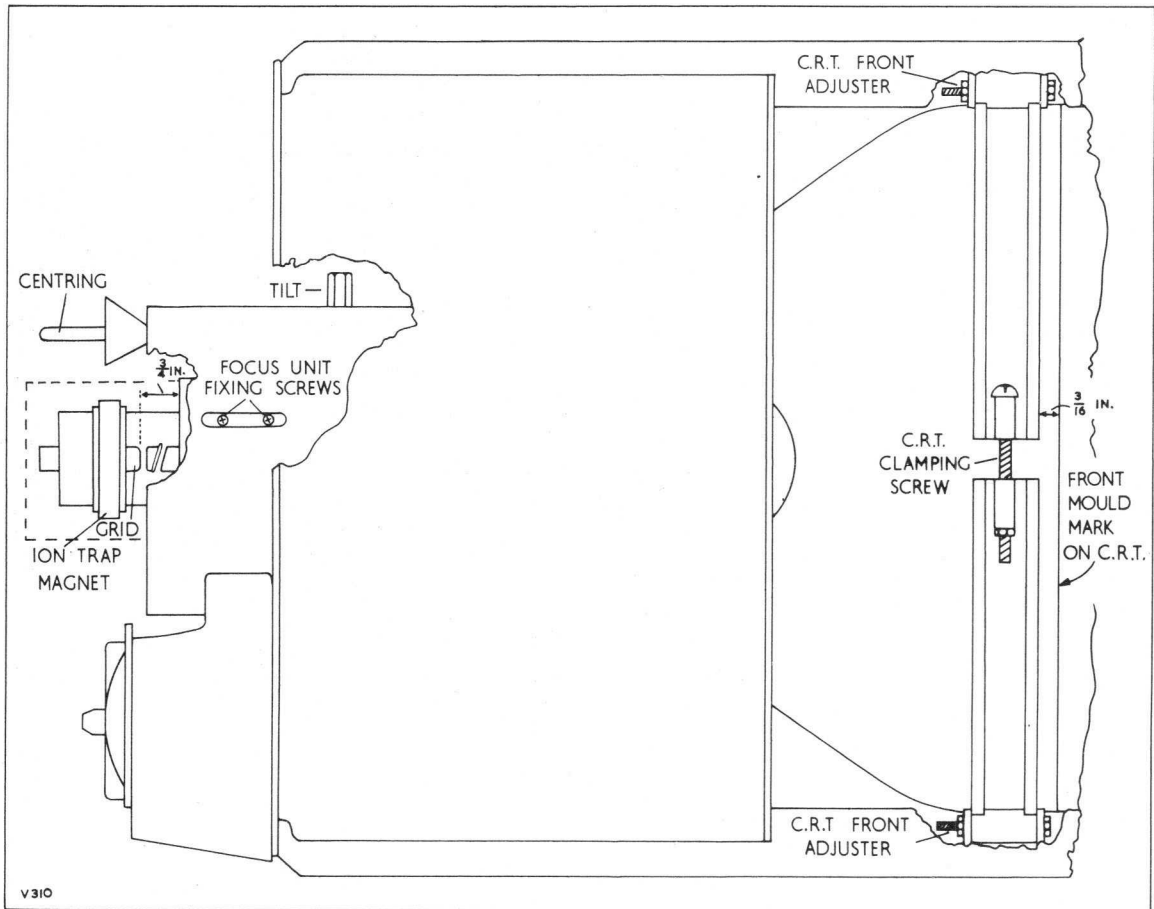


Fig. 1. Side view of the receiver.

KΩ) on the c.r.t. base connector (+ve. lead to pin 11).

3. Turn the BRIGHTNESS control to minimum (fully anti-clockwise).
4. Switch the receiver "On" and allow a few minutes for it to warm up.
5. Rotate the BRIGHTNESS control until the meter reading is about 10μA.
6. Position the ion trap magnet so that its forward edge is just behind the c.r.t. grid plane. Slowly rotate the magnet for maximum screen brightness.
7. Keep the magnet at right angles to the neck of the c.r.t. and move it slightly backwards and forwards to find the position at which maximum screen brightness is produced.
8. Make a final check of the magnet position with the CONTRAST and BRIGHTNESS controls adjusted to give a normal viewing picture.

Receiver oscillator. There is no Fine Tuner on this receiver and the appropriate oscillator core must be adjusted on each channel. If more than one peak is obtained, select

the one which occurs when the core is first entering the coil former. To make this adjustment proceed as follows:

1. Set the VOLUME control to maximum (clockwise).
2. **EARLY SETS.** Insert a small screwdriver in the hole to the right of the STATION SELECTOR knob and adjust for maximum sound. To do this, it will be necessary to exert a slight pressure on the screwdriver and press the oscillator core driver down for a distance of about 3/4 in. Gentle rotation will cause the driver to engage with the slot in the coil core, which can now be tuned for maximum sound output.
LATER SETS. Insert the long plastic trimming tool (Driver, Part No. 77219 supplied to all dealers) into the hole to the right of the Station Selector knob, press it gently downwards and rotate it a little until it engages with the oscillator coil core, and then adjust the core for maximum sound output. Remember to partially withdraw the tool before turning the Station Selector to another position.

MECHANICAL NOTES

Removing the c.r.t. Lay the receiver on its face and remove the cabinet from the chassis. Remove the focus knob, the c.r.t. base connector, the ion trap magnet and the c.r.t. anode connector. Detach the moulded frame with the mask and safety glass, and then return the chassis to its normal upright position. Slacken the two c.r.t. clamping screws and ease the c.r.t. out of the chassis; in some cases it may be necessary to slacken the four screws which secure the c.r.t. clamping ring to the chassis stays.

Refitting the c.r.t. Fit the c.r.t. into the chassis, ensuring that the anode connector is on the same side as the line output transformer, then proceed as follows.

NEW C.R.T.S. Slacken the four screws which secure the c.r.t. clamping ring to the chassis stays, and tighten the c.r.t. clamping ring, checking that the distance between the front edge of the c.r.t. clamping ring cushion and the front "mould" mark on the c.r.t. is 3/16 in. Lay the moulded frame, with the mask and safety glass, on a flat surface, and place the receiver over it, so that the c.r.t. fits into the mask; replace the four fixing screws which secure the frame to the chassis stays. Then move the c.r.t. as required to position it squarely in the mask, so that it makes a dust tight seal and tighten the four screws securing the clamping ring to the chassis stays. Refit the e.h.t. connector, the ion trap magnet, and the c.r.t. base connector.

ORIGINAL C.R.T. Tighten the c.r.t. clamping ring checking that the distance between the front edge of the c.r.t. clamping ring cushion and the front "mould" mark on the c.r.t. is 3/16 in. Lay the frame, with its mask and safety glass on a flat surface, and place the receiver over it, so that the c.r.t. and rubber mask form a dust tight seal. Replace

the four frame fixing screws. Refit the e.h.t. connector, the ion trap magnet, and the c.r.t. base connector.

Removing the line output transformer. Take off V15 polythene anode connector and the top connectors of V13 and V14. Remove V15 and detach its holder complete with mounting panel by removing the single 4BA screw and nut. Unsolder the YELLOW lead from the transformer, and then the 8 remaining leads from the transformer, noting their points of connection. Remove the line output transformer clamp.

The control escutcheon. If the control escutcheon is to be replaced, care must be taken when fitting it, to make sure that the centre line which is visible at the rear of the moulding coincides with the centre line at the top of the fibre back of the cabinet.

The c.r.t. frame. In the event of the thread in a brass insert at a corner of the moulded frame becoming damaged, use a self tapping screw, type PK6Y by 3/8 in. P.R.H. Part No. 103903, in the alternative hole provided.

The top controls. The following information is given to assist in the choice, from existing stocks, of suitable replacements for the variable controls at the top of the receiver.

In Fig. 2, the dimension "A" refers to the overall spindle length and is measured from the end of the spindle to the mounting face, i.e. the face of the control which makes contact with the receiver control panel.

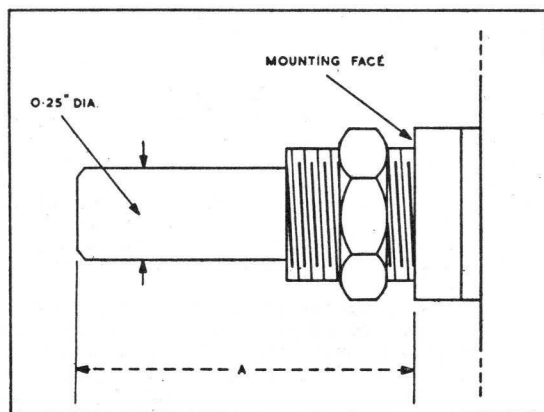


Fig. 2.

CONTROL	DIM. "A"	LAW	RESISTANCE
Brightness (R64)	1 in.	Lin.	100K Ω
Contrast (R28) V310, V310C	1 13/16 in.	Lin.	100K Ω
Contrast (R28) V310D only	1 in.	Lin.	100K Ω
Volume (R96) V310, V310C	1 in.	Rev. log.	250K Ω
Volume, On-Off (R96) V310D only	1 13/16 in.	Log.	250K Ω with d.p. switch

Removing the voltage selector knob. Unscrew the small locking knob and remove the circlip

which is now visible. Unsolder the ORANGE lead from the contact nearest the centre on the underside of the voltage selector panel. Withdraw the dial (knob, printed), complete with its contacts, away from the spindle. To refit, reverse the above procedure.

Removing the focus unit. Withdraw the chassis from the cabinet. Then remove the focus knob, the c.r.t. base connector and the ion trap magnet. Slacken the four focus unit fixing screws (two pairs) which are accessible through the two slots in the upper half of the scan coils housing and withdraw the focus unit complete with the Centring control mechanism.

Removing the scan coils assembly. Withdraw the c.r.t. from the chassis. Then remove the scan coils assembly locking screw at the top of the cylindrical housing, slacken the three brass screws and disengage the mounting ring from the slots in the housing. The scan coils assembly can now be withdrawn and the leads disconnected.

THE TUNER UNIT

The "stray" capacitance of the components and wiring forms a large part of the tuning capacitance across the aerial, r.f.t. and oscillator coils. Every effort must therefore be made, when replacing components or wiring, to ensure that the lengths of the leads and the positions of the components follow the original as closely as possible. Take care also with the "dressing" of leads and fit sleeving wherever necessary to avoid short circuits across tags, particularly on the valve holders.

IMPORTANT. It must be clearly understood that any repair, or the replacement of any component, makes the realignment of any unit essential. Any attempt to carry out work on the unit, without subsequent realignment, can only lead to a deterioration of the performance, particularly on Band III.

To remove the osc. core driver (early sets only, see Modifications). Turn the Station Selector to a position in which there are no coils, remove V6, and then remove the top end of the driver from the plastic guide by pressing it downwards through the wide end of the slot in the slotted arm (**stop for driver, 74786**). Withdraw the lower end of the driver from the guide on the tuner unit, taking care not to lose the brass sleeve (**eyelet, split 4774**). Do not attempt to move the guide on the tuner unit; this has been carefully assembled in the factory so that the driver will always engage with the coil cores.

To remove the tuner unit. Record the lead positions and then proceed in the following manner:

1. Disconnect the six leads and the resistor

from the tags on the outer side of the receiver chassis and the tuner unit.

2. Disconnect the wire from the lead-through capacitor at the end of the unit, and the coaxial lead from the aerial escutcheon. **Do not disconnect any of these leads from within the tuner unit.**
3. Unscrew the switch wafer and withdraw it from the end of the unit; on early sets, remove the osc. core driver as described above.
4. Remove the three fixing screws on the outer side of the receiver chassis and withdraw the unit. Take care not to mislay the link from the Station Selector shaft which becomes disengaged when the tuner unit is removed.

NOTE. When refitting the tuner unit, ensure that the switch wafer and rotor are correctly positioned at the end of the unit. This can be checked by observing that the appropriate Sensitivity control, i.e. B.B.C. or I.T.A., is switched into circuit at the corresponding settings of the Station Selector knob.

Identifying the coil strips. The aerial coil strips have four contacts and are shorter than the oscillator coil strips which have six contacts. According to the frequency channels for which they are intended, the coil strips are marked with spots of coloured paint using the resistor colour code, i.e. BROWN for Channel 1, RED for Channel 2 etc. Channel 10 coils however, will have CH10 printed on the coil strip.

An additional GREEN code spot is added, so that the coils for the V310 series can be identified from those of earlier receivers.

Removing a coil strip. Press back the holding spring and carefully lift out the coil strip by gripping, between the thumb and forefinger, the end remote from the spring.

Fitting a coil strip. Press back the holding spring and fit the coil strip by pressing its slotted end against the holding spring and then guiding its other end into the slot at the middle of the turret.

Turret locating mechanism. To adjust the mechanism while the tuner unit is still in position on the receiver chassis, proceed as follows:

1. Remove the c.r.t. from the chassis as described on page 5.
2. Remove the side screens from the tuner unit, and loosen the screw holding the locating spring (it will be necessary to remove certain valves to gain access to these screws).
3. With the locating roller correctly located in a groove on the turret, slowly turn the turret until the coil contacts are in the middle of the fixed contacts, and then re-tighten the locating spring fixing screw.
4. Turn the turret to all its other positions

to confirm that the location is satisfactory, and then replace the side screens, valves, and c.r.t.

Lead-through capacitors. If a lead-through capacitor has to be replaced, the faulty one can be removed by applying heat to the metal screen immediately around the capacitor body. When the solder is sufficiently soft, withdraw the capacitor from the metal screen, from the same side as the soldered connection to the metal screen.

Trimming capacitors. If a trimmer screw has been accidentally unscrewed fully, or if a trimmer body has to be replaced, the refitting should be carried out as follows:

Thread the trimmer nut on to the trimmer screw, with the convex side of the nut towards the head of the trimmer screw, and engage the screw in the threaded trimmer body. Press the trimmer body against the chassis, making sure that the square end of the trimmer locates with the square hole in the chassis, and turn the trimmer screw until about half of its length is engaged in the trimmer body. While still holding the trimmer body against the chassis, prevent the screw from turning and rotate the nut until it presses tightly against the chassis. While still preventing the screw from turning, increase the pressure of the nut on the screw by rotating the nut one half-turn more in a clockwise direction. The correct degree of pressure is now applied to prevent the trimmer screw from turning when subjected to vibration.

Lubrication. During the course of assembly, the contacts and Station Selector (turret) mechanism on the tuner unit are lubricated. The contacts on the coil strips are smeared with petroleum jelly (Vaseline) and the locator roller and the spindle assembly are treated with a medium-bodied grease.

When servicing the tuner unit, it may be necessary to replenish this lubrication, particularly on the coil-strip contacts which will, no doubt, have been handled and the petroleum jelly thereby removed.

Cleaning the contacts. The indiscriminate application of any of the proprietary brands of switch-cleaning fluid is strongly deprecated. If the cleaning of any of the contacts is necessary, a local application of the cleaner - with a small brush - should be all that is required. Afterwards, a smear of petroleum jelly must be applied to those contacts which have been cleaned.

V310D RECEIVERS

Mains On/Off Switch. This switch is ganged with the volume control in the conventional manner, the top flap on the cabinet serving only as a protective cover for the controls.

C.r.t. position. With the chassis correctly located in the cabinet the corners of the c.r.t. should be just flush with the wooden frame in the cabinet. Ensure that the dust tight seal is in its correct position.

Removing the safety glass. First remove the chassis from the cabinet. Remove the rubber "stops" at the rear of each lower channel and slide back each door to the maximum. Take out the three screws holding the wooden retaining strip at the upper edge of the front of the safety glass and remove the strip. Remove the glass, by lifting its lower edge clear from the retaining groove.

Removing a door (Tambour) or handle. Remove the safety glass, and the c.r.t. surround complete. The handles can then be removed by unscrewing the four fixing screws. Slide out the doors towards the rear, coiling them in the space available. The doors may be replaced in a similar manner.

If the receiver is to remain in use temporarily without the doors, these can be removed without disturbing the safety glass or c.r.t. surround simply by taking out the two rear "stops" and easing the handles through the gap at each side of the front of the cabinet. This process cannot easily be reversed, however.

CIRCUIT DESCRIPTION

This is a superheterodyne type of receiver designed for the reception of any two channels in Band I and any two channels in Band III. It has r.f., frequency changer and 1st i.f. circuits that are common to both the sound and vision signals; channel selection is by means of a four position rotary coil turret

The r.f. stages. A double triode cascode amplifier is employed, followed by a triode pentode frequency changer stage. Since the r.f. coils are adjusted to within very close

limits during manufacture, the circuits are aligned by adjusting the residual capacitances at a single Band III frequency; the alignment then holds for all channels in both bands. A Fine Tuner is not fitted to this receiver, and therefore, the oscillator coils must be carefully tuned on installation. A sound i.f. rejector (L10/C10), which is in circuit on all channels, is included in the tuner unit.

The vision i.f. stages. The first i.f. amp-

lifier after the frequency changer, is common to both sound and vision signals. The Contrast control is in the grid-cathode circuit of this valve, and the sound i.f. signal is taken from the anode. Another stage of vision i.f. amplification follows, and feeds the vision detector. There are three rejectors in the vision i.f. amplifier; L13/C41, L14/C46 (own sound i.f. rejectors), and L15/C50 (adjacent sound i.f. rejector).

The vision detector and video stages. One half of a double diode valve (V5) is used for detection, and the rectified signal is fed via the i.f. stopping choke (L18) and the grid compensating choke (L19) to the grid of the video amplifier valve (V6). The cathode circuit of this valve includes a 3.5 Mc/s rejector circuit (L20, C53) to remove the beat pattern caused by any sound carrier which might pass the i.f. rejectors; fixed video response correction is also provided by C54. The output from the anode of V6 is fed to the vision interference limiter, the cathode of the c.r.t. via a series compensating choke (L21), and the synchronizing signal separator circuit.

The synchronizing signal circuits. The video signal from V6 anode is applied to the control grid of a conventional sync. separator (V7a) which suppresses the picture modulation, so that a "negative going" sync. pulse waveform appears across the anode resistor (R71). The pulse voltage is taken to V13 in the line time-base and, after differentiation by C63 and R79, to the grid of the frame "sync" separator (V7b). A further output is taken to the cathode of V7b via R77, to keep the valve biased back during the picture period. The initial frame pulse charges C66 in V7b anode circuit, so that subsequent pulses are reduced in amplitude. The result is an initial frame synchronizing pulse of high amplitude and having a steep leading edge, with the

remaining pulses markedly reduced. These pulses are fed to the main charging capacitor (C93). D.C. for V7b is obtained from V12 cathode circuit.

The line output stage. A single valve waveform generator and amplifier is used. Its mode of operation is conventional except for the method of increasing the output efficiency. This is achieved in the following manner.

During the "flyback" period a large negative potential is developed in the screen grid winding of T3. This voltage pulse is integrated and fed to the control grid of the line output valve (V13) and holds the valve inoperative for approximately the first third of each line scanning period.

Scanning is obtained during this period by arranging that the efficiency diode (V14) conducts and allows the energy contained in the scan coils to drive a current via V14 into C109. The direction of this current is such as to supply the initial part of the total scan.

Frame time-base. This consists of a multivibrator followed by a pentode output valve. A secondary circuit on the output transformer supplies a suitable waveform for frame flyback suppression, which is applied to the first anode of the c.r.t.

Power supply. A conventional a.c./d.c. power supply circuit is used, and the valve heaters are arranged in a single 0.3 Amp. series chain. On the lower d.c. steps of the mains adjustment switch, the rectifier is removed from the circuit to avoid an unnecessary loss of h.t. voltage. At the same time, the reservoir capacitor is disconnected from the circuit so that there is less surge current to "blow" the mains fuse; see "Installation" on page 2.

VOLTAGE READINGS

General. The voltage readings given in the circuit diagrams and chassis layout diagrams are representative only, and will differ slightly from one set to another.

Procedure for measuring the voltages. To obtain voltage readings corresponding to those quoted in the circuit and chassis layout diagrams, proceed as follows:

1. Adjust the mains adjustment switch, if necessary, to suit the mains input at the time of measurement. See "Installation" on page 2.
2. Adjust the receiver to give a normal picture on a B.B.C. channel.
3. Measure the voltages, using a 20,000 Ω /V meter. If a 20,000 Ω /V meter is not available, a 500 Ω /V meter can be used; those readings which were found to differ appreciably

from the figures on the diagrams, when using such a meter, are given in Table 1.

4. Ascertain whether the variable controls are having the correct effect on the voltages which they influence; follow the procedure outlined in Table 2.

E.h.t. voltage. This was taken with an electrostatic voltmeter. A 10V d.c. meter having a sensitivity of 20,000 Ω /V, with a suitable multiplier such as the AVO 25,000V Multiplier Type 8, can be used.

NOTE: The BRIGHTNESS control must be turned to zero brightness when taking this reading.

Vision and sound i.f. circuits. If instability is experienced when measuring the anode voltages, connect the meter instead to the

h.t. +ve end of the i.f.t. primary winding.

magnitude of the signal, two are quoted in the diagrams and prefixed by the letter W for weak (100µV) and S for strong (10mV).

Strong and weak signal conditions. Where valve electrode voltages are affected by the

TABLE 1

Readings which differ from those given on the circuit and layout diagrams, when taken with a 500Ω/V meter.

VALVE	ELECTRODE VOLTAGE		
	ANODE	GRID 2	CATHODE
V2		pin 3: 94	
V5b			pin 5: 138
V6	pin 7: 138	pin 8: 170	
V7a	pin 6: 75	pin 7: 17	
V7b	pin 1: No useful reading		pin 3: 1.6
V11b	pin 6: No useful reading		
V16 (c.r.t.)	pin 10: 103		pin 11: 95

TABLE 2

Voltages measured whilst receiving a television transmission (including sound) and with all the controls, excepting the one concerned, adjusted as for a normal picture. The figures in brackets were taken with a 500Ω/V meter.

VALVE	CONTROL SETTINGS	ELECTRODE VOLTAGE			
		ANODE	GRID 1	GRID 2	CATHODE
V3	(a) Contrast minimum	205	205	0	4.8 (4.3)
	(b) Contrast maximum	194	200	35 (29)	38
V5	(a) Vision Int. Limiter anti-clockwise	24 (20)			
	(b) Vision Int. Limiter clockwise	146 (140)			
V11b	(a) Frame Amp. anti-clockwise	5.7 (Nil)			
	(b) Frame Amp. clockwise	10.5 (Nil)			
	(a) Frame Hold anti-clockwise	14 (Nil)		-25 (Nil)	
	(b) Frame Hold clockwise	4 (Nil)		-12 (Nil)	
V12	(a) Frame Lin. anti-clockwise	193	204		25
	(b) Frame Lin. clockwise	170	194		19
V16 (c.r.t.)	(a) Brightness minimum			24	
	(b) Brightness maximum			162 (154)	

MODIFICATIONS

All the electrical changes given in this section are included in the circuit and lay-

out diagrams and the following notes should be examined in conjunction with the diagrams