SECTION 1

14-INCH PICTURE MONITOR TYPE MN3/501

Introduction

This is a relatively inexpensive picture monitor developed from the time base, e.h.t. supply, and h.t. supply sections of an Ekco domestic television receiver chassis. There is no clamping circuit, but a d.c.-restoring diode is connected to the grid of the final video amplifier. The monitor is intended for use in situations where quality checking is not required.

Circuit Description

General

The complete circuit diagram is shown in Fig 1.5 For convenience, the maker's original valve and component numbers have been retained in those parts of the circuit which are on the Ekco chassis. For this reason the valve numbers begin at V12 (the picture tube), the resistor numbers at R79 and the capacitor numbers at C92.

Power Supply

The valve heaters are series-connected and a mains-isolating transformer T5 is provided. The original voltage-dropping resistor R134 is retained, but is fed from the secondary of T5. The mains voltage tappings on R134 remain effective as well as the key to the connections inscribed at the back of the chassis. An additional voltage-dropping resistor R163 is included in the heater chain in place of the sound and vision receiver valves which have been dispensed with

The PY32 rectifier V18 provides an h.t. potential of 190 volts at the junction of the choke L35 and the smoothing capacitor C116.

Video Amplifier

The video amplifier has been developed specially for this monitor, and is on a separate sub-chassis. There is a high-impedance input circuit to the first valve, V19A, and two paralleled video input sockets, enabling the video feed to be terminated in the monitor itself, using the 75-ohm plug provided, or alternatively bridged across a video line which is terminated elsewhere. V19A is one half of a 12AT7 double triode, and is a cathode follower. The other half of this valve, V19B, is the first video amplifying stage, and the cathode potential of V19B is stabilised down to a very low frequency by the 1,000-μF capacitor C128. The 1-kilohm contrast control VR9 is connected between the cathodes of V19A and V19B. Because both cathodes are at approximately the same d.c. potential, and the alternating potential of V19B cathode is stabilised by C128, this arrangement enables the contrast control to be effectively connected in the cathode circuit of V19A without carrying appreciable direct current.

V20 is a pentode video amplifier. If for any reason the 100-μH shunt inductor L51 needs to be replaced, a component of exactly the same specially wound type should be used because the frequency response depends critically on the distributed self-capacitance of this component. The two sections A and B of the 30FL1 triode-pentode V21 together form a video output stage of a type which is common in domestic receivers, where a video drive of some 50 volts d.a.p. must be obtained from an h.t. supply of less than 200 volts without excessive current consumption or non-linearity. V21A is a pentode amplifier with a 12-kilohm anode load resistor R155. This produces adequate video voltage, but would suffer from excessive high-frequency loss if connected directly to the cathode of the picture tube. The triode, V21B, is therefore used as a cathode-follower and connected between the anode of V21A and the picture-tube cathode. In this way, only a very small additional capacitance is shunted between the anode of V21A and chassis, and the cathode of V21B provides a low-impedance point for driving the picture tube. Some degree of high-frequency correction is provided by the cathode capacitor C135 of V21A, and also by the screen capacitor C136.

The overall frequency response of the video amplifier is adequate for the purposes for which this monitor was designed. The earlier stages of the amplifier are a.c.-coupled but a d.c.-restoring germanium diode CD1 is connected between the grid of V21A and chassis, and there is full d.c. coupling between this point and the cathode of the picture tube.

Time Bases, E.H.T. Supply, and Synchronising-pulse Separation

These are among the sections of the monitor for which portions of a commercial chassis have been used. The circuits conform generally to present-day domestic receiver practice, as described in Volume 4 of *Television Engineering*.

The negative-going output of the video amplifier is fed through R130 and C123 to the grid of V17A, which is an orthodox synchronising pulse separator. In the line time base, V16 and V17B together form a multivibrator, and V16 is also the line output valve. The main regenerative feedback is taken from a tapping on the line output transformer T3 through C106 to the grid of V17B, and the 47-pF capacitor C107 ensures that the circuit is self-starting. The efficiency diode V15 provides a boosted h.t. supply of about 400 volts for the line output valve, the first anode (pin 10) of the picture tube, and the focusing electrode (pin 6). It may be advantageous to transfer the focusing electrode to the main h.t. line as the tube ages, and an additional lead from the main h.t. line is left unconnected in the tube base. Resistors R103, R110, and R111 are inserted in series with the h.t. supply to the booster circuit and the anode of V16, and can be progressively shorted out by the movable plug shown at 15 in Plate V. This provides a coarse control of picture width, and is also used to compensate for valve ageing in the line output circuit. Fine control of picture width is provided by the sliding core of L53, which is connected in parallel with the line deflection coils. Line-flyback e.h.t. is rectified by the U25 diode V13, and the Metrosil R79 improves the e.h.t. regulation.

Field synchronising pulses are separated by the integrating circuit R118, C112, and the crystal diode MR1. The time constant of the series *RC* circuit is about 14 μsec, which is longer than the duration of the line synchronising pulse (10 μsec), but shorter than the duration of a broad pulse (40 μsec.) Thus, in the waveform appearing at the cathode of MR1, the broad pulses produce a series of negative-going wavefronts which build up to a considerably greater amplitude than the small blips produced by the line synchronising pulses. MR1 is so biased that these blips never drive its cathode into the conducting region, but the broad pulses swing the cathode sufficiently far in the negative direction to make the diode conductive. When this happens, a field synchronising pulse, free of unwanted line-frequency signals, is transmitted to the anode of the field blocking oscillator V14B. V14A is the field output valve. VR7 and VR8 control picture height and vertical linearity respectively.

Mechanical Maintenance

Check that the mains plug is withdrawn before removing or replacing the picture tube.

Removal of Picture Tube

1. Remove the side panels of the cabinet by pulling the knobs at the top edges outwards until the catches are released, and then releasing the lower edges by sliding the panels outwards.
2. Remove the top panel after unscrewing the fixing screws.
3. Remove the front panel after unscrewing the fixing screws.
4. Disconnect the socket from the base of the picture tube, and remove the ion trap magnet.
5. Disconnect the e.h.t. lead at the plug connector in the e.h.t. compartment.
6. Unsolder the six leads from the tags on the scanning yoke.
7. Release the complete tube, mask, and scanning yoke assembly by removing the two bolts shown at 4 in Fig. 1.3 and the two bolts in the corresponding positions on the other side of the cabinet. These bolts engage with hank bushes (12 in Fig. 1.4) in the clamping band surrounding the tube and mask.
8. Ease the tube about an inch rearwards.
9. Turn the tube through a right angle about its central axis.
10. Lift the complete tube assembly through the open top of the cabinet. The e.h.t. Metrosil and its polythene-tube container (11 in Fig. 1.4) can remain attached to the tube assembly during this operation.
11. Loosen the tightening bolts (2 in Fig. 1.4) on each side of the clamp.
12. Remove the tube from the mask and clamp.

Removal of Scanning Yoke Assembly (Fig. 1.4)

1. Loosen the screw 9 of the retaining ring 8.
2. Slip the retaining ring off the neck of the tube, taking care not to lose the plastic strip which is inserted between the ring and the glass.
3. Slip the scanning yoke assembly off the tube without disturbing the setting of the barrel-distortion correcting magnets 14.

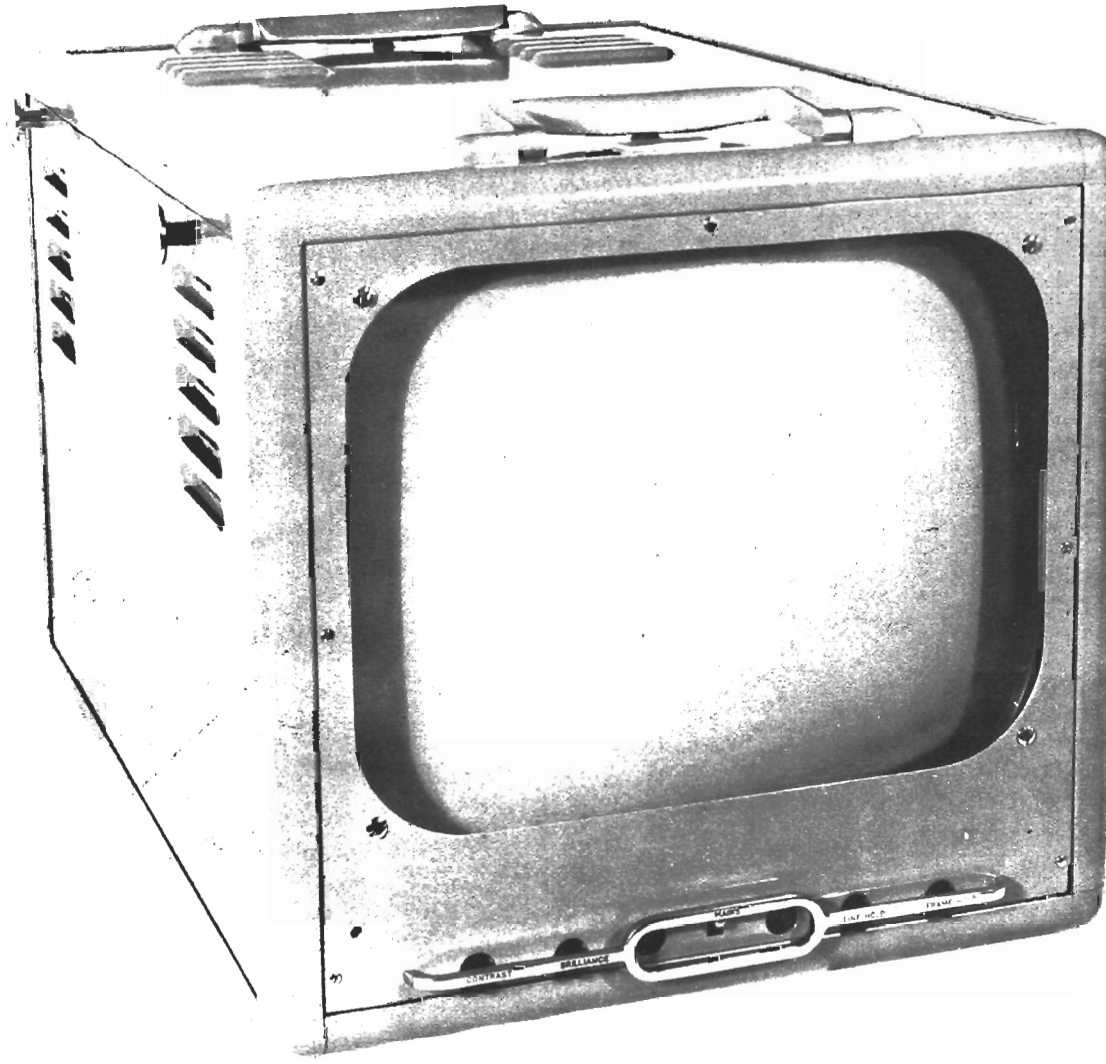


Fig. 1.1. 14-inch Monitor: General View

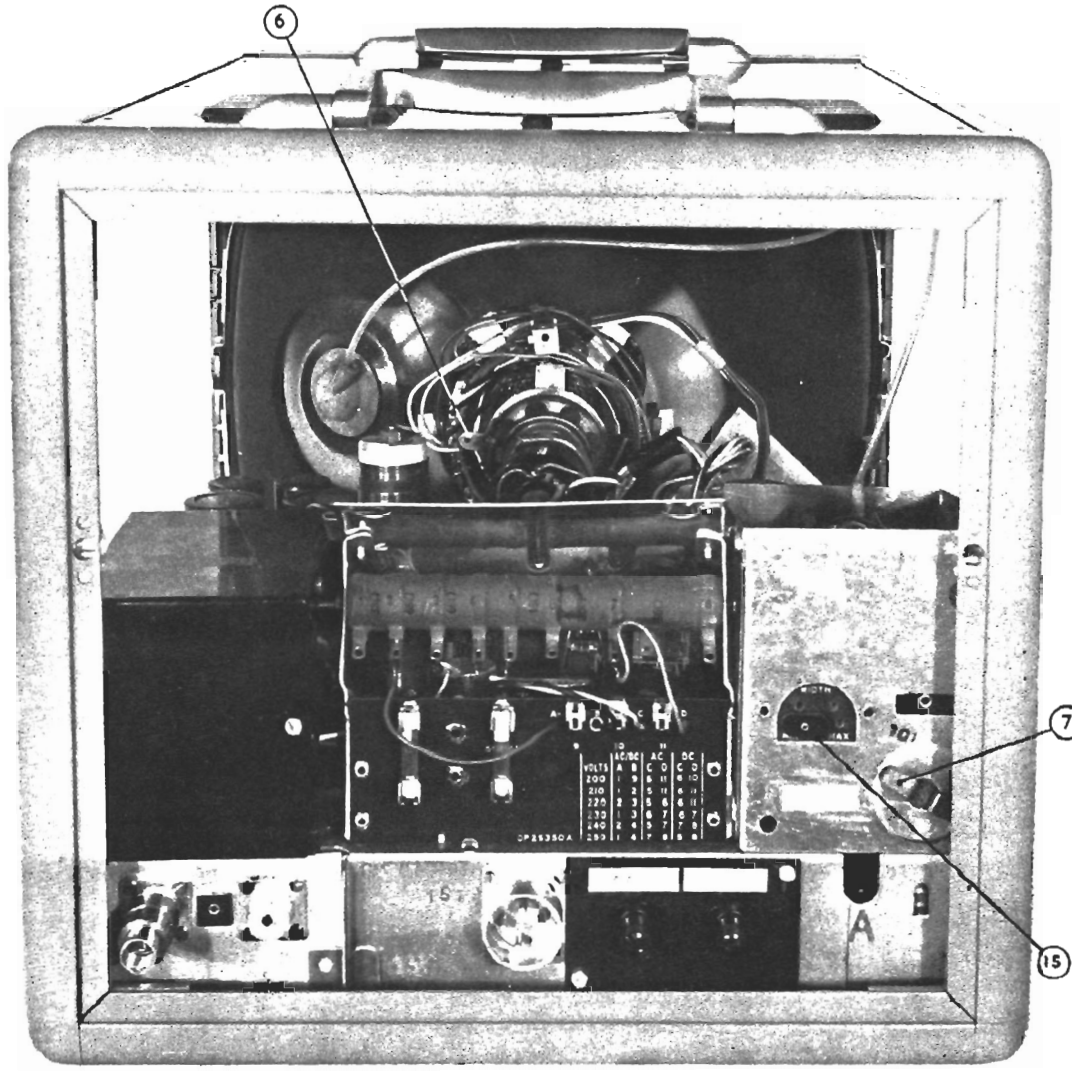


Fig. 1.2. 14-inch Monitor: Rear View with Rear Panel Removed

KEY

6. Picture centring lug on scanning yoke
7. Line linearity adjustment lugs
15. Picture width coarse control

Replacement of Picture Tube and Scanning Yoke Assembly

1. Turn the tube so that the e.h.t. socket is seen on the left when looking at the base of the tube. With the tube in this position, the various attachments will be in their correct positions if they are fitted as detailed in operations 2 to 5 below.
2. Fit the plastic mask with the join uppermost.
3. Fit the clamp band around the mask with the Metrosil uppermost, and screw up the tightening bolts (2 in Fig. 1.4).
4. Slip the scanning yoke over the neck of the tube with the projecting windings nearest the bulb, and the aluminium lug (10 in Fig. 1.4) uppermost. In doing this, do not disturb the setting of the barrel-distortion correcting magnets 14.
5. Wrap the plastic strip around the glass immediately beyond the scanning yoke, and hold the strip in position.
6. Slip the retaining ring (8 in Fig. 1.4) over the neck of the tube and the plastic strip, and locate the small projection on the retaining ring in the slot on the scanning yoke.
7. Tighten the screw 9 while pushing the retaining ring hard against the scanning yoke.
8. Slip the ion trap magnet over the neck of the tube, with the magnet itself on the right and the orange leg uppermost. Allow about a $\frac{1}{4}$-inch gap between the legs and the base of the tube.
9. Loosen (but do not remove) the four 6 B.A. nuts (13 in Fig. 1.4) and the corresponding four nuts on the other side of the clamp.
10. Hold the completed tube assembly with the neck horizontal and the Metrosil on one side.
11. Lower the tube through the open top of the cabinet with the base and screen at the appropriate ends of the cabinet and then turn the tube through a right angle about its central axis to bring the Metrosil uppermost.
12. Ease the lower edges of the mask and clamp over the top of the switch and controls in the front of the cabinet.
13. With the tube held in approximately its correct position, move the hank bushes (12 in Fig. 1.4) into line with the fixing holes in the cabinet, using the play provided by the slots (3 in Fig. 1.4).
14. Screw home the bolts (4 in Fig. 1.3) into the hank bushes.
15. Adjust the tube finally into its correct position.
16. Tighten up the eight 6-B.A. nuts.
17. Reconnect the e.h.t. lead to its socket in the e.h.t. supply unit.
18. Reconnect the tube socket and base.
19. Resolder the six leads to the scanning yoke as follows (looking at the rear of the chassis):

	Chassis Lead	*Tag on Scanning Yoke*
Left-hand Side	Purple	Middle tag (upper end of 10-kilohm resistor)
	Orange	Bottom tag
Right-hand Side	Yellow	Tag connected to yellow lead on the yoke
	Pink	Tag connected to black lead on the yoke
	Brown	Bottom tag connected to 0·001-μF capacitor

Adjustment of Ion Trap Magnet

1. Rotate the magnet and legs alternately in each direction around the neck of the tube until the position of optimum focus is found. In order to minimise the risk of contact with any of the components in the nearby e.h.t. compartment, this operation is best performed with the hand introduced through the open top of the cabinet. If the magnet is a long way from the correct position, the picture becomes dim at the top or the bottom, in addition to being severely defocused.
2. Slide the magnet and legs along the neck of the tube to find the position of maximum brilliance. This should also be performed with the hand introduced from above.

Other Adjustments after Replacement of Picture Tube

1. Adjust picture width by moving the sliding core of L53, shown at 5 in Fig. 1.3. The coarse control (15 in Fig. 1.2) should be used to compensate for valve ageing in the line output circuit.

2. Adjust line linearity by rotating the lugs (7 in Fig. 1.2) at the rear of the e.h.t. compartment.
3. Adjust picture height with the left-hand one of the two control knobs at the rear of the cabinet.
4. Adjust field linearity with the right-hand one of the two control knobs at the rear of the cabinet.
5. Adjust picture centring by the lugs (6 in Fig. 1.4) on the scanning yoke.
6. Repeat any or all of the adjustment 1 to 5 above, until a linear, correctly dimensioned, and correctly centred picture has been obtained by successive approximation.

Representative Test Voltages

Circuit Position	*Test Equipment*	*Voltage Range*	*Average Voltage*	*Remarks*
V19A Anode	Avo 8	250	143	
Cathode		2·5	1·2	
V19B Anode	Avo 8	250	160	
Cathode		2·5	1·25	
V20 Anode	Avo 8	250	145	Contrast at maximum. No input signal.
Screen		250	155	
Cathode		2·5	1·35	
V21A Anode	Avo 8	250	88	
Screen		250	157	
Cathode		2·5	2·2	
V21B Anode	Avo 8	250	175	
Cathode		250	90	
C.R.T. Anode 1	V.V.M. TF1041	1,000	400	Brightness adjusted for just visible raster. No input signal.
Anodes 2 and 4	E.S. Voltmeter		15 kV	
Anode 3	Avo 8	250	190	
Grid	V.V.M. TF1041	100	58	
Time Base H.T. Supply	Avo 8	250	190	
Junction R93, R162	V.V.M. TF1041	300	115	

Signal Limiting Level

50 V d.a.p. at C.R.T. Cathode (signal source: TV/TG/1. Sawtooth output waveform measured on Tektronix oscilloscope).

Alternative method of measurement, using output test point, is given in Section 8(a) of *Performance Specification.*

Performance Specification

1. *Dimension of Picture*
A complete picture of 4:3 aspect ratio should be obtainable on the monitor face.

2. *Scan Linearity and Geometry*
With a correctly dimensioned picture the geometric distortion measured horizontally and vertically shall not exceed ±2 per cent of the picture width or height.

3. *D.C. Component*
The d.c. component shall be maintained at its full value.

4. *Brightness*
A peak white brightness of at least 50 ft-lamberts shall be obtainable on a standard picture (e.g., Test Card C or Test Transparency No. 51).

The impedance of the e.h.t. supply shall be such that the drop in e.h.t. from tube current cut-off to that required for the brightness test shall be less than 7 per cent.

5. *Deflection Defocusing and Astigmatism*
Shall be to good commercial standards.

6. *Synchronisation*
There shall be no detectable inaccuracy of interlace.

There shall be no loss of synchronisation or change of picture position with any changes in picture content.

It should be possible to obtain perfect synchronisation when a 16-μF capacitor is inserted between a 75-ohm signal source and the 75-ohm monitor input.

7. *Stability of Performance*
No readjustment of controls should be necessary after 15 minutes from switching on.

8. *Video Amplifier*
(*a*) *Gain*
The gain shall be such that the application of a picture signal within ±6 dB of the standard

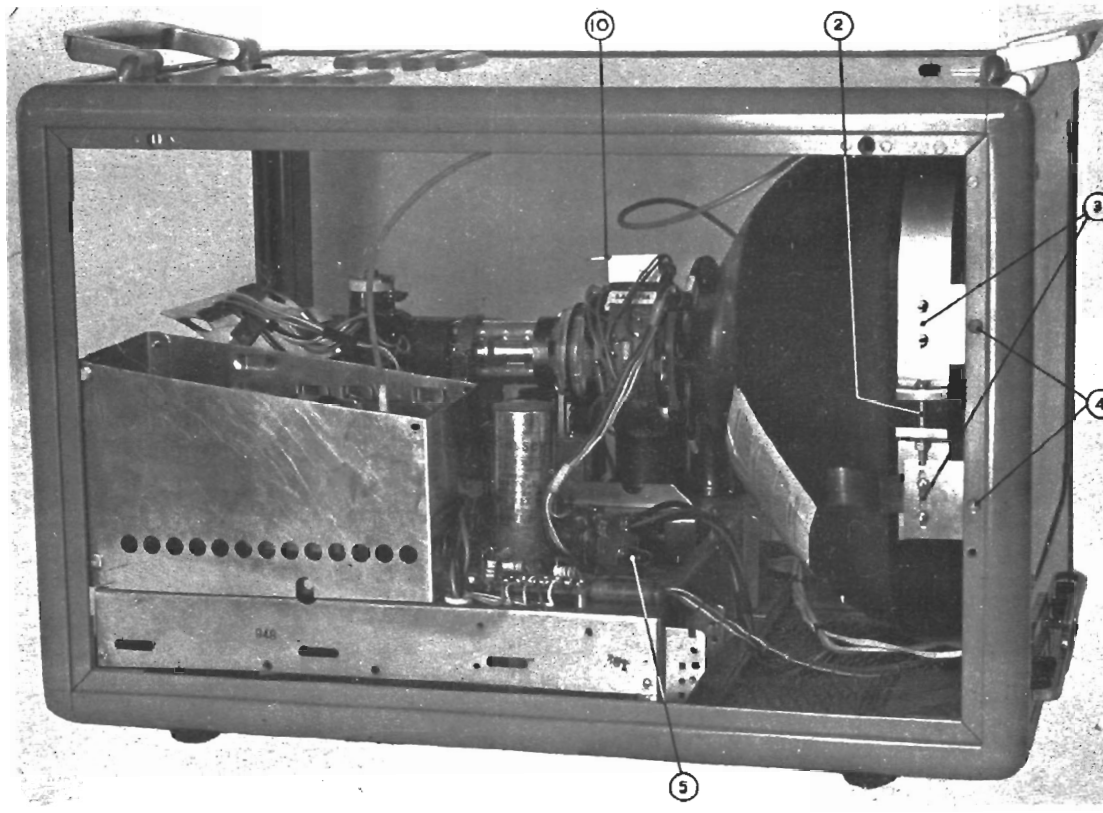


Fig. 1.3. 14-inch Monitor: Side View with Panel Removed

KEY

2. Picture tube clamp tightening bolt
3. Picture tube clamp positioning slots
4. Bolts engaging hank bushes for anchoring picture tube clamp
5. L53 sliding core for picture width fine control
10. Aluminium lug on scanning yoke

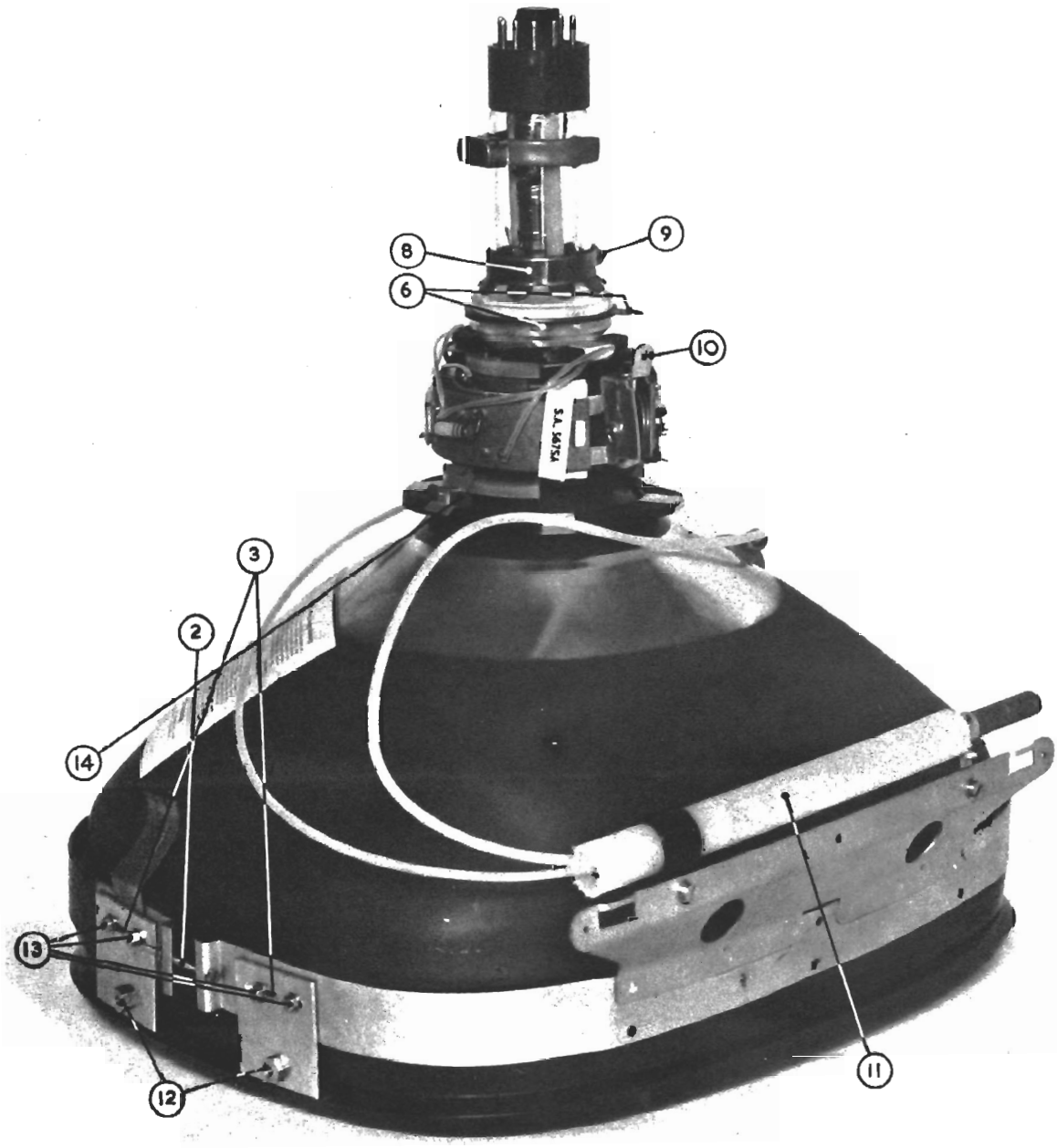


Fig. 1.4. 14-inch Monitor: C.R.T. Assembly Ready for Insertion into Cabinet

KEY

2. Picture tube clamp tightening bolt
3. Picture tube clamp positioning slots
6. Picture centring lugs on scanning yoke
8. Scanning yoke retaining ring
9. Retaining ring screw
10. Aluminium lug on scanning yoke
11. E.H.T. Metrosil in container
12. Hank bushes for anchoring picture tube clamp
13. Four 6-B.A. nuts
14. Barrel-distortion correcting magnet

1 volt d.a.p. will produce a peak white brightness of 50 ft-lamberts within the range of the contrast control.

Alternatively, with the contrast control at maximum an input signal of 0·5-volt d.a.p. line sawtooth will produce 0·6 volt d.a.p. ±0·1 volt at the *Test Point*. The maximum signal available at this point, at the threshold of limiting, should not be less than 0·85 volt d.a.p.

(*b*) *Response*
The K rating of the amplifier as measured at the *Test Point* with a 2T pulse and bar signal should not exceed 1 per cent.*

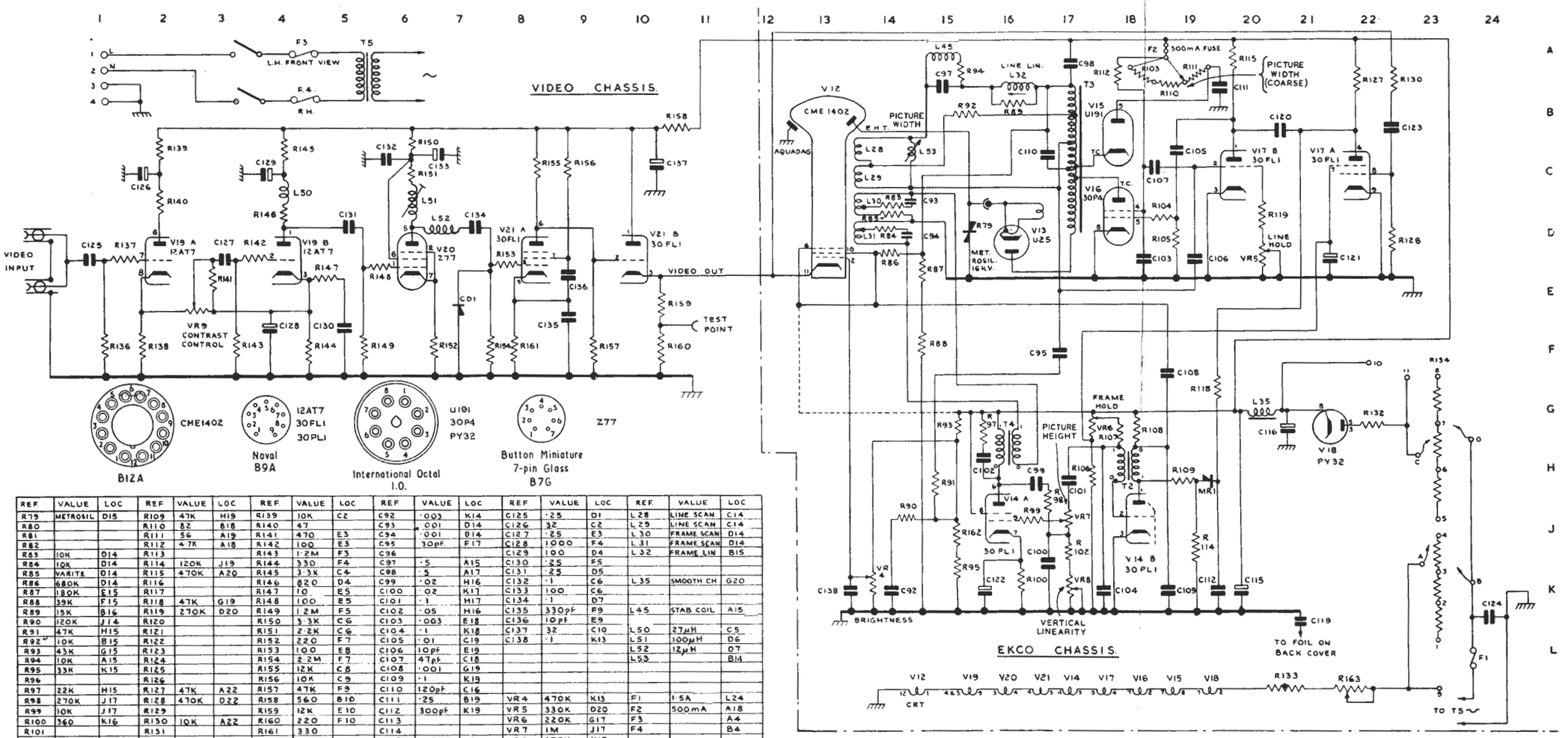
The response above 3 Mc/s shall be such that when a picture is viewed at a distance of four times its height, no ringing is visible.

The low-frequency response shall be such that the slope on a standard frame bar waveform does not exceed 7 per cent.

(*c*) *Linearity*
The response to a line sawtooth waveform of amplitude 0·6 volt d.a.p. at the *Test Point* shall not show appreciable departure from a straight line when displayed on a waveform monitor.

* This refers to a test using the pulse and bar generator. A description of this test signal generator, and the method of using it, will be found in Instruction V.3, Section 10.

See page 1.11 for Fig. 1.5.



REF	VALUE	LOC	REF	VALUE	LOC	REF	VALUE	LOC	REF	VALUE	LOC	REF	VALUE	LOC	REF	VALUE	LOC
R79	METROSIL	D15	R109	47K	H19	R139	10K	C2	C92	·003	K14	C125	·25	D1	L28	LINE SCAN	C14
R80			R110	82	B18	R140	47		C93	·001	D14	C126	32	C2	L29	LINE SCAN	C14
R81			R111	56	A19	R141	470	E3	C94	·001	D14	C127	·25	E3	L30	FRAME SCAN	D14
R82			R112	4·7K	A18	R142	100	E3	C95	30pF.	F17	C128	1000	F4	L31	FRAME SCAN	D14
R83	10K	D14	R113			R143	1·2M	F3	C96			C129	100	D4	L32	FRAME LIN	B15
R84	10K	D14	R114	120K	J19	R144	330	F4	C97	·5	A15	C130	·25	F5			
R85	VARITE	D14	R115	470K	A20	R145	3·3K	C4	C98	·5	A17	C131	·25	D5			
R86	680K	D14	R116			R146	820	D4	C99	·02	H16	C132	·1	C6	L35	SMOOTH CH	G20
R87	180K	E15	R117			R147	10	E5	C100	·02	K17	C133	100	C6			
R88	39K	F15	R118	47K	G19	R148	100	E5	C101	·1	H17	C134	·1	D7			
R89	15K	B16	R119	270K	D20	R149	1·2M	F5	C102	·05	H16	C135	330pF	F9	L45	STAB COIL	A15
R90	120K	J14	R120			R150	3·3K	C6	C103	·003	E18	C136	10pF	E9			
R91	47K	H15	R121			R151	2·2K	C6	C104	·1	K18	C137	32	C10	L50	27μH	C5
R92	10K	B15	R122			R152	220	F7	C105	·01	C19	C138	·1	K13	L51	100μH	D6
R93	43K	G15	R123			R153	100	E8	C106	10pF	E19				L52	12μH	D7
R94	10K	A15	R124			R154	2·2M	F7	C107	47pF	C18				L53		B14
R95	33K	K15	R125			R155	12K	C8	C108	·001	G19						
R96			R126			R156	10K	C9	C109	·1	K19						
R97	22K	H15	R127	47K	A22	R157	47K	F9	C110	120pF	C16						
R98	270K	J17	R128	470K	D22	R158	560	B10	C111	·25	B19	VR4	470K	K13	F1	1·5A	L24
R99	10K	J17	R129			R159	12K	E10	C112	300pF	K19	VR5	330K	D20	F2	500mA	A18
R100	360	K16	R130	10K	A22	R160	220	F10	C113			VR6	220K	G17	F3		A4
R101			R131			R161	330		C114			VR7	1M	J17	F4		B4
R102	120K	K17	R132	22	G22	R162	33K		C115	200	K20	VR8	470K	K17			
R103	82	A18	R133	VARITE	L21	R163	800MAX.		C116	100	K21	VR9	1K	E2			
R104	1K	D19	R134	MAINS RES.	H23				C117								
R105	680K	D19	R135						C118						MR1		H20
R106	150K	H18	R136	12M	F1				C119	1800 pf.	L21						
R107	470K	G18	R137	100	E1				C120	5pf	C20	T2	FRAME OSC.	H18			
R108	27K	G18	R138	330	F2				C121	2	E21	T3	LINE O/P	C17	CD1	CV425	E7
									C122	500	K16	T4	FRAME O/P	H16			
									C123	·1	B22	T5	MAINS	A5			
									C124	·1	L24						

V11/25T

Fig. 1.5. Circuit of the MN3/501