

MELFORD

MELFORD.	DU-1 SERIES.
MELFORD.	DUI-11.
MELFORD.	DUI-12.
MELFORD.	DUI-15,
MELFORD.	DUI-15RM.
MELFORD.	DUI-20.
MELFORD.	DUI-24.

INTRODUCTION

The DUL series are high performance, all solid state, general purpose monochrome television monitors, suitable for use in broadcasting, educational, industrial and data applications.

The all-metal case offers a lightweight yet rugged construction, with a finish equally suited to both office and industrial environments.

The electronic circuits are on plug-in fibre-glass laminate printed circuit boards. The boards are clearly identified to show the location of components, circuit boundaries, (i.e. Field Scan, Video Amplifier, etc) and many test points with voltages.

Protection is provided by a 1 Amp anti-surge fuse mounted on the rear panel.

The monitor has a black level clamp, stabilised scan circuits and fully stabilised internal supply voltages. Novel circuitry gives a bright contrasty picture of a standard normally expected from more expensive monitors. The cathode ray tube is fully implosion protected with push through presentation.

To facilitate ease of maintenance, the cathode ray tube is withdrawn from the front.

Natural convection cooling is used, offering quiet and cleaner operation.

Dual video inputs, and remote control of brightness, contrast, and input selection are optionally available on the DUL series monitors. For further details of these and other options, contact the sales office.

TELEVISION MONITOR TYPE DU1-11 and DU1-12

SPECIFICATION

TECHNICAL DATA

SYSTEMS	625 lines 50 fields per second or 525 lines 60 fields per second or as agreed
POWER SUPPLY	200 - 250V 50 Hz (No tap changing required) Nominally 60VA consumption. 100 - 125V 60Hz version available.
BRIGHTNESS	100 ft. Lamberts
DISPLAY AREA (MAX.)	DU1-11 229 mm x 171 mm (9.01 x 6.73 inches) DU1-12 257 mm x 195 mm (10.12 x 7.67 inches)
VIDEO INPUT	1 Volt composite \pm 6dB, bridging or 75 ohms switched termination
H.F. RESPONSE	\pm 1dB to 6MHz $\overline{-}$ 3dB at 12 MHz
L.F. RESPONSE	Less than 2% tilt measured with a 50Hz square wave. A Black level clamp is incorporated.
LINEARITY AND GEOMETRY	Total positional error not greater than 2.5%, smoothly distributed over the picture area. Scan Linearity better than 1.5% (Measured with normal picture size)
OPERATING TEMPERATURE	-20°C to +45°C
WEIGHT	12.5 Kilos (27.5 lbs)
OVERALL DIMENSIONS	Height of case including handle and feet 283mm (11.14 ins) Height of case excluding handle and feet 263mm (10.35 ins) Width 319mm (12.56 ins) Depth 307mm (12.09 ins)
CONNECTORS	Video S0239 (UHF) (Mating connector type PL259 only supplied to order) POWER: Belling Lee type L1436B/S (Mating connector Belling Lee type L1436A/P supplied)
CRT	DU1-11 M28-13 WA DU1-12 M31-184W

TELEVISION MONITOR TYPE DUI-15 RM

SPECIFICATION

TECHNICAL DATA

SYSTEMS	626 lines 50 fields per second or 525 lines 60 fields per second or as agreed.	
POWER SUPPLY	200-250 Volts 50 Hz (No Tap changing required) Nominally 60VA Consumption 100-125 Volt 60 Hz version available	
BRIGHTNESS	75 ft. Lamberts, measured with peak white over $\frac{1}{2}$ of picture area	
DISPLAY AREA	308mm x 229mm (12.1 x 9 inches)	
VIDEO INPUT	1 Volt composite \pm 6dB, bridging or 75 ohms switched termination.	
H.F. RESPONSE	\pm 1 dB to 10 MHz -3 dB at 12 MHz	
L.F. RESPONSE	Less than 1% tilt measured with 50 Hz square wave	
LINEARITY AND GEOMETRY	Total positional error not greater than 2% smoothly distributed over the picture area. Scan Linearity better than 1% (Measured with normal picture size).	
OPERATING TEMPERATURE	-20°C to $+50^{\circ}\text{C}$	
WEIGHT	15.5 kilos (34 lbs)	
OVERALL DIMENSIONS	The monitor is constructed for 19" Rack Mounting and has an overall maximum height of 267 mm (10.5 inches) and a front to back dimension of 420 mm (16.5 inches). The maximum projection in front of the front panel is 44 mm (1.75 inches).	
CONNECTORS	Video	S0239 (UHF) (Mating connector type PL259 only supplied to order)
	Power	EP4-14 Alternative BNC Video and XLR-LNE 32 supply connectors available on request.

TELEVISION MONITOR TYPE DUI-20

SPECIFICATION

TECHNICAL DATA

SYSTEMS	625 lines 50 fields per second or 525 lines 60 fields per second or as agreed
POWER SUPPLY	200-250 Volts 50 Hz, or 100-125 Volts 60 Hz (approximately 60VA)
BRIGHTNESS	50 ft. Lamberts, measured with peak white over $\frac{1}{4}$ of picture area.
DISPLAY AREA (MAX.)	394mm x 308mm (15.5 ins. x 12.1 ins.)
VIDEO INPUT	1 Volt composite \pm 6db bridging or 75 ohms switched termination.
H.F. RESPONSE	\pm 1db to 6 MHz -3db at 12 MHz
L.F. RESPONSE	Less than 2% tilt measured with a 50 Hz square wave. A black level clamp is incorporated.
LINEARITY AND GEOMETRY	Total positional error not greater than 2.5%, smoothly distributed over the picture area. Scan linearity better than 1.5% (measured with normal picture size).
OPERATING TEMPERATURE	-20°C to +50°C
WEIGHT	22 kilos (48 lbs).
OVERALL DIMENSIONS	Height of case including handle and feet 432mm (17 ins) Height of case excluding handle and feet 406mm (16 ins) Width 482mm (19 ins) Depth 381mm (15 ins)
CONNECTORS	Video: S0239 (UHF) (Mating connector type PL259 only supplied to order). Power: Belling Lee type L1436 B/S (Mating connector Belling Lee type L1436 A/P supplied).
OPTIONAL FACILITIES:	Dual Video Inputs Remote Control of Brightness, Contrast and input selection.

MELFORD ELECTRONICS LIMITED, reserve the right to modify this specification without notice.

TELEVISION MONITOR TYPE DU1-24

SPECIFICATION

TECHNICAL DATA

SYSTEMS	625 lines 50 fields per second 525 lines 60 fields per second or as agreed
POWER SUPPLY	200-250 Volts 50Hz or 100-125 Volts 60Hz (approximately 60VA)
BRIGHTNESS	50 ft. Lamberts, measured with peak white over $\frac{1}{4}$ of picture area.
DISPLAY AREA (MAX)	481mm x 375mm (18.94 ins. x 14.76 ins.)
VIDEO INPUT	1 Volt composite + 6dB bridging or 75 ohms switched termination
H.F. RESPONSE	+ 1dB to 6MHz -3dB at 10MHz
L.F. RESPONSE	Less than 2% tilt measured with a 50Hz square wave. A black level clamp is incorporated.
LINEARITY AND GEOMETRY	Total positional error not greater than 2.5%, smoothly distributed over the picture area. Scan Linearity better than 1.5%. (Measured with normal picture size).
OPERATING TEMPERATURE	-20°C to +50°C
WEIGHT	32.0 kilos (70 lbs)
OVERALL DIMENSIONS	Height of case including handle and feet 480mm (19 ins.) Height of case excluding handle and feet 460mm (18 ins.) Width 560mm (22 ins) Depth 430mm (17 ins).
CONNECTORS	Video: S0239 (UHF) (Mating connector type PL259 only supplied to order). Power: Belling Lee type L1436B/S (Mating connector Belling Lee type L1436A/P supplied)

OPERATING INSTRUCTIONS

1. Examine monitor for any damage in transit; any deficiency or damage should be reported promptly.
2. Note: unless ordered specifically otherwise, the monitor will be delivered set for use with AC supply of 200V to 250V RMS at 50 to 60Hz. This means that the two halves of the primary winding of the mains transformer are connected in series (see circuit diagram). For operation with 100V to 125V RMS at 50 to 60 Hz, the parallel connection should be used as indicated on the circuit diagram.
3. Connect IV composite video to the UHF input socket and unless looping on to further equipment (with a UHF "T" piece), terminate the video input cable by sliding the switch adjacent to the input socket as indicated.
4. Connect AC power (note: The power mating connector pins are labelled L N and E indicating LIVE, NEUTRAL and EARTH).
5. Switch on by rotating switch on front panel clockwise gently till it clicks.
6. Set brightness and contrast controls mid way.
7. Allow 15 to 30 seconds for CRT heater to achieve working temperature, then set brightness and contrast for normal picture.
8. WARNING

If a stationary picture of high contrast/brightness is displayed for long periods, local ageing of the CRT phosphor may occur. This would result in some slight loss of brightness in the areas affected, compared with rest of CRT face.

9. Apart from occasionally wiping the CRT face with a soft cloth (to remove dust attracted by the EHT), the monitor should require little routine maintenance.

OPTIONAL FACILITIES

1. Without remote control connector plugged into monitor (at rear), the monitor will function normally using input A.
2. Remote control connections:- see circuit diagram no. 2
3. When EXTERNAL SYNC facility is not in use, switch to INTERNAL.

CIRCUIT DESCRIPTIONS

MAIN PCB (SEE CIRCUIT DIAGRAM)

POWER SUPPLY/STABILISER The power transformer primary connections are adjusted to suit the supply voltage to be used - see circuit diagram for details. The stabiliser is conventional in concept with T2 and T4, a compound emitter follower driven by T1 and T3, a comparator amplifier long tailed pair. T6 with R24 provides a current limit of 1.8 amps at +30V falling to 470 mA at short circuit. The reference voltage is provided by the zener diode Z1, but in place of the more usual resistive potential divider for the base of T3, an R-C potential divider (R17 and C4) is used in conjunction with T5 (driven by line drive pulses) to provide constant line scan and EHT with varying sync pulse frequency.

LINE FLYWHEEL COMPARATOR T7, T8, T11 and T12 are supplemented by T9, out of lock detector, and T10 a time-constant switch (driven by T9) to give a wide pull-in range and good noise immunity.

LINE MULTIVIBRATOR T13 and T14 gives 18V square wave output (see waveform on circuit diagram) via output emitter follower T15.

LINE DRIVE OUTPUT transistor T16 feeds line drive power to the line drive transformer W1 on the EHT printed circuit board (described later). T16 is driven by T15, but also takes an input from the flyback pulse on the line scan output transistor T3. This provides protection of the line drive pulse in the event of EHT spark-over within the CRT.

INPUT EMITTER FOLLOWER T33 provides a high impedance low capacity input for the composite video signal and drives the video amplifier via the CONTRAST control and also feeds the SYNC SEPARATOR.

THE VIDEO AMPLIFIER is in two stages. T17, T18, T19 is a ring of three, non-inverting feed-back amplifier with a gain of 15 and a low output impedance C36 (with R96) forms part of the arrangements for shaping the high frequency response.

CLAMP T20 provides the required black level stability. It uses separated sync pulses direct to produce the effect of a back porch clamp pulse of 3uS duration (see waveform at C41 on circuit diagram).

THE VIDEO AMPLIFIER second stage T22 is an inverting resistance amplifier with a gain of 10 (approx). It is driven by emitter follower T21.

LINE BLANKING AND FIELD BLANKING are mixed in with the video at the emitter of T22 via R113 and D16.

L2, and C42 with R117 control the high frequency response.

R123 with D18 and C43 provide a beam current limit for the cathode ray tube.

T22, via L2 and the beam current limit circuit, drives the CATHODE of the CRT.

BRIGHTNESS control P4, drives the CRT GRID, via R126

SAFETY CIRCUIT C45, D19, D20, R119, R121 protects the CRT phosphor from SPOT burn on SWITCH OFF.

WARNING: See page 10.

WARNING: never interfere with this circuit or with grid or cathode connections until after switching off and waiting 1 minute for EHT energy stored in CRT to leak away through EHT rectifier. Failure to heed this warning could result in spots burned on the CRT face.

SYNC SEPARATOR transistors T23 and T25 are preceded by the sync separator CLAMP T24.

SEPARATED SYNC at the collector of T25 is 20V negative going and at the monitor pin is 6V see waveform on circuit diagram.

FIELD SYNC SEPARATOR T26 uses the integrator on its base to provide a 12.5V positive pulse from the first broad pulse (see base and collector waveforms on circuit diagram).

FIELD MULTIVIBRATOR T28 and T29 is set to free run at 23 mS (by P5) and is triggered (at 20mS) by the pulse from T26.

FIELD BLANKING GENERATOR T27 is driven by T28 collector and provides blanking pulses for insertion at the video amplifier output transistor T22.

FIELD SAWTOOTH GENERATOR is T29 collector, discharging C67/C68 via D28 during field flyback period, and R176 charging C67/C68 during picture time to make FIELD SAWTOOTH.

FIELD SCAN OUTPUT amplifier T30, T31 and T32 is a conventional ring of three feed-back amplifier converting the voltage of the FIELD SAWTOOTH to a controlled sawtooth of current in T32. This current reproduces the field sawtooth voltage waveform across R187 R191 for feed-back to T30 and sends this same current via 'S' correction capacitors C72 and C73 into the FIELD SCAN COILS.

FIELD LINEARITY is controlled by P7/R177 converting a little of the output voltage sawtooth to a parabolic sum component at C68.

EHT P.C.B. (CIRCUIT DIAGRAM)

EHT STABILISER T2 (of the EHT circuit) adjusts the effective value of C5/C16 (part of the flyback tuning capacitor C8/C17) by adjusting the voltage at which D2 conducts. T1 is an emitter follower interpreting the interaction between the CRT beam current via R3, and the voltage across R1.

EHT AND LINE SCAN OUTPUT transistor T3 is a switch driven via DRIVE TRANSFORMER W1 by T16 on the main PCB. T3 together with D4 (commutating diode), W2 (EHT TRANSFORMER), C9/C10 (LINE "S" CORRECTION) L2 (HORIZONTAL LINEARITY control) and the LINE SCAN COILS forms a conventional line scan output circuit.

EHT TRANSFORMER, W2 provides 6.3V or 11.5V RMS for the CRT HEATER (depends upon CRT type), +110V supply for the video amplifier and +580V supply for CRT FOCUS and A1 supply. -28V supply is derived via D5 from scan coil waveform. CRT CONNECTIONS include RING-TRAP SPARK PROTECTION in conjunction with R13, R124, R128 and the DAG/case connections. W3 FOCUS MODULATION TRANSFORMER adds a 500V parabolic corner focus correction waveform.

REMOTE CONTROL MODULE (CIRCUIT DIAGRAM No. 2)

REMOTE BRIGHTNESS, CONTRAST AND DUAL INPUT MODULE.

This option provides a second signal input socket, and remote control of input selection, brightness and contrast.

A/B SWITCH T1, 2, 3, 4 & 5.

INPUT EMITTER FOLLOWERS T1 & T4 provide high input impedance and low output impedance to drive T2 and T5.

A/B SWITCH T2 and T5 are controlled by the DC potential at the junction of R5 and R9. When input "A" is selected (remote control switch S2 open circuit) this potential is approximately +9V. T2 is forward biased and connects input A signal at T1 emitter to the base of T3 while T5 is reverse biased and hence substantially open circuit.

When input "B" is selected by closing the remote control switch, the control potential is approximately +1V and input B is connected to T3 while T2 is reverse biased.

EMITTER FOLLOWER T3 provides suitable impedance matching between the A/B switch and the coaxial cable to the main PCB of the monitor.

REMOTE CONTRAST CIRCUIT T6, 7, 8, 9, 10 & 11.

+14V STABILISER T6 is an emitter follower fed by potential divider R26/R27.

VARIABLE GAIN CIRCUIT T7, 8, 9, 10 takes a current derived via R33 from the signal voltage at the wiper of the front panel control (contrast) as its input. A fraction of this current emerges via the collector of T9, to build up a replica of the input signal across R42. The magnitude of this fraction (& hence of the output signal) is controlled by the potential at the emitter of T8 (emitter follower) which is driven by the wiper of the remote contrast control.

EMITTER FOLLOWER T11 provides a suitable impedance match between R42 and the co-axial cable taking the signal to the main video amplifier (on the monitor main PCB).

REMOTE BRIGHTNESS CONTROL P1 wiper has a range of approximately +29V to -28V. It connects to the CRT GRID via R46 2.2M Ohms. Since the front panel BRIGHTNESS potentiometer connects to the grid via 1M Ohms, both controls will operate in parallel to determine the grid potential and hence control the brightness of the CRT display.

SEPARATE SYNC OPTION (CIRCUIT DIAGRAM No.3)

T1 SYNC INPUT EMITTER FOLLOWER (on the additional small PCB A4-002-073/4) is very similar to the video input emitter follower T33 (on main PCB).

When used, this additional circuit derives its power supply rails from the main PCB via pins A (-28v), B (+20V), and C (0V).

Pin E the input to the sync separator (main PCB) derives its sync either internally from the composite video input at T33 emitter (pin D main PCB) or from the external sync input at T1 emitter (pin 4 sync PCB).

INTERNAL PRE-SET CONTROLS

These have been set at the factory and should not require further adjustment.

1. FOCUS this is P1, the slider control on the EHT UNIT (the small PCB at the top of the monitor).

WARNING this control operates on 600V therefore, touch only the black plastic slider knob, not any other part of this control or the printed circuit board.

This control is very "flat" in operation, i.e. it is not possible to de-focus much. A medium bright (rather than very bright) picture should be displayed when adjusting FOCUS.

2. WIDTH/EHT

WIDTH is adjusted by means of P1 (+30V pre-set potentiometer) on the main PCB.

At full width, EHT should be approximately 16 KV. Never set EHT higher than 17 KV.

TO SET EHT RANGE

If full width does not correspond with an EHT of between 15 and 17 KV the EHT may be increased or decreased by adjustment of C8 and or C17 on the EHT PCB. To reduce EHT, switch off monitor, un-plug EHT PCB and increase the sum of C8 and C17 by say 2nF. Any capacitors fitted in this position must be of correct type and voltage to withstand stresses i.e. C296 type, 400V. If C17 is reduced to increase EHT, change capacitor in small increments (not more than 2 or 3 nF, and turn P1 (main PCB) anticlockwise before switching on.

WARNING Before attempting adjustment of EHT, connect an EHT meter (by slipping EHT probe under the soft plastic shroud on the CRT EHT connector with the monitor switched off. Set EHT with caution since high EHT can be dangerous to you and can damage semiconductor circuits. Do not allow EHT to spark to case or CRT DAG coating.

3. HORIZONTAL LINEARITY is adjusted by means of L2 on the EHT PCB.

Horizontal and vertical linearity and scan coil geometry should be set using an accurate cross hatch test signal.

4. VERTICAL LINEARITY is adjusted by P7 (centre top) on main PCB

5. HEIGHT P6 (main PCB top right) adjust as necessary for normal picture.

6. HORIZONTAL AND VERTICAL PICTURE POSITION adjusted by means of the two hard magnetic-rubber rings round the CRT neck at the back of the scanning coils. Do not use force, since these rings can be easily broken.

7. LINE PERIOD is adjusted by P2. With picture monitor synchronised to crystal controlled picture source (e.g. off-air signal), immobilise line sync separator by carefully connecting base of T7 to its emitter with tip of small screwdriver. Then set P2 for as near as possible horizontally synchronised picture. Typical pull-in range will be 54 to 74uS.
8. FIELD PERIOD is set by P5 and monitored on the test pin adjacent to P5. To ensure accuracy calibrate oscilloscope on the required range. Then immobilise field sync separator by shorting base of T26 to its emitter with tip of small screwdriver, and set FIELD PERIOD to 23mS.

TO CHANGE CATHODE RAY TUBE

1. After switching off supply, disconnect power input plug.

WARNING:

Wait at least 3 minutes for EHT stored in cathode ray tube, to reduce to a low value via the leakage of the selenium EHT rectifier stick D6 (TV 18S), before attempting any internal disconnection inside the monitor.

2. Disconnect line scan and field coils from the EHT UNIT and MAIN PCB respectively by pulling off the Hellerman sockets from their respective pins. Always pull the sockets never pull the wires. Do not exert excessive sideways force on the pins.
3. Disconnect CRT base socket.
4. Disconnect CRT EHT connector and carefully short-circuit CRT EHT pin to the CRT dag coating to discharge remaining EHT.
5. Pull off control knobs (at front of monitor).
6. Remove CRT black aluminium surround mask by removing the two 6 BA chrome screws at the top. Take care not to bend it.
7. Unscrew the top left hand nut and release the spring earthing the CRT graphite 'dag' coating.
8. Slacken slightly the four bolts securing the CRT.
9. Lay the monitor on its back, remove the CRT complete with the scanning coils and place the CRT face down in front of you with the EHT connector away from you.
10. Place the new CRT face down alongside it on a non-scratch surface again with the EHT connector away from you.
11. Slacken the scan coil clamp, then after noting orientation of coils transfer coils to new CRT maintaining same orientation. Push coils firmly fully onto CRT. Tighten clamp.

12. Place new CRT into monitor (still on its back) and place fixing bolts washers and nuts in position, but do not tighten.
13. Place mask in place to correctly centralise CRT, then remove it without disturbing CRT position and tighten CRT fixing bolts, and replace dag spring.
14. Replace mask and control knobs.
15. Re-connect EHT connector, CRT base (take care, pins are soft metal) and scan coils.

Note that the black field coil lead (black/grey pair) goes to the bottom of the two Hellermann pins, and the black line coil lead (thick white/black pair) goes to LN on the EHT board.

Make sure the Hellerman sockets are securely onto their pins.

16. Reconnect power, switch on and allow to warm up for $\frac{1}{2}$ min.
17. Inspect the picture, if it requires rotating to make top and bottom edges horizontal, slacken scan coil clamp and rotate coils on CRT neck as necessary keeping coils well towards front of CRT. Tighten clamp.
18. Set VERTICAL and HORIZONTAL POSITION, and FOCUS, as described under PRESET CONTROLS, (see page 12), if necessary.

FIRST LINE REPAIR PROCEDURE

For fast on-site remedy, replace the faulty monitor with a working spare monitor.

When Monitor servicing is carried out in the field with limited time and apparatus the following procedure is strongly recommended.

1. Switch off monitor, and wait 1 minute (to allow EHT to decay).
2. Remove the P.C.B.'s, test all four rear panel/heat sink transistors (see 'How to test transistors'), and replace any which are faulty. After replacing a transistor, always check isolation of collector from heat sink.

NOTE: In the event of T4 (main stabiliser) or its mica washer failing, do not attempt to re-use original main P.C.B. without first checking its R5, R6 and T2.

3. Fit replacement MAIN P.C.B. (and 'remote control' P.C.B. if applicable).
(Make sure flying lead sockets are firm fit on their pins).
4. Switch on, and set +30V rail to 20 volts.

5. Switch off, and fit replacement EHT P.C.B.
6. Connect E.H.T. probe to EHT cap on CRT, switch on, and set width and EHT using EHT-WIDTH preset. At full width, EHT should be between 15 and 17 KV. If not, see 'To set EHT range'. Never set EHT higher than 17 KV. If EHT meter is not available, an approximate setting can be achieved by carefully adjusting width to just fill screen horizontally. Do not allow overscan. Check EHT at earliest subsequent convenient opportunity.
7. Set height, using HEIGHT preset.
8. The monitor should now be operational. If the fault persists, second line maintenance is necessary.

HOW TO TEST TRANSISTORS

One of the many commercially available transistor testers used in accordance with the manufacturer's instructions is the recommended method. However, an indication can be obtained using an Ohm-meter (e.g. AVO 8MK V on middle range) comparing the transistor under test with a known good one of the same type. Make seven measurements:

- | | | | |
|----|---|---|---------------|
| 1. | base-emitter diode, forwards | : | 1.3K approx. |
| 2. | reverse | : | open circuit. |
| 3. | collector-base diode, forwards | : | 1.3K approx. |
| 4. | reverse | : | open circuit. |
| 5. | collector-emitter | : | open circuit. |
| 6. | emitter-collector | : | open circuit. |
| 7. | collector to heat sink
(mica washer) | : | open circuit. |

A convenient point at which to make these tests is at the P.C.B. edge connector sockets. See circuit diagram for connections.

WARNING. SEMICONDUCTORS can be easily damaged when soldering.

1. Clean and tin soldering iron using fresh solder and flux.
2. Quickly tin semiconductor leads/pins. Do not overheat. Do not apply heat for any longer than is necessary (2 to 3 seconds at most). Allow to cool.

If leads/pins do not tin easily, clean them carefully with fine glasspaper.

3. Solder connections quickly using clean iron, fresh solder and flux.

TO SET EHT RANGE

See page 12, paragraph 2.

BOARD REPAIR/REPLACEMENT SERVICE

Faulty P.C.B.'s should be returned (properly packed) to Melford Electronics Limited. These will be repaired (or replaced at Melford's discretion), within 24 hours, and returned by post.

PARTS LIST

REAR PANEL COMPONENTS

Resistor Termination	R80	75 ohms 1%	Electrosil
Switch "	S2	Slide SPST T216	Arcoelectric
Transistors	T4	2N3055	Mullard
	T32	2N3055	Mullard
	T3/EHT	BU142	Thomson C.S.F.

Mica Washers (T03) & Bushes (for T4, T32, & T3/EHT)

	T2/EHT	MJE 340	Motorola
(Mounted with nylon bolt, mica washer (6BA hole), and domed washer).			
Diode D9	SF4 M3		Westinghouse
(Mounted on T3/EHT)			Brake & Signal
EHT Transformer	W2/EHT	A2-002-010	Melford
			Electronics
Signal Socket	SK2	UHF/S0239	McMurdo
Power Socket	SK1	L1436 B/S.	Belling & Lee
Mating Plug	PL1	L1436 A/P	" "
Fuse	F1	1A Antisurge 20mm TDG 123	K. Beswick
Holder (For F1)		E6011	Belling & Lee
Edge Connector Socket	22 way	Nylon Duotyne 280019-0	Amp.
Inserts		66088-2	"

CASE MOUNTED COMPONENTS

Resistor R1	2.2K 5% 5W WW	R.S.
(On Mains Transformer)		Components
Capacitor	C1	2,200uF 63V 071
(on base plate)		Mullard
Clip (for C1)		30mm vertical DT2402
Mains Transformer W1		A2-002-008
(on Base Plate)		Melford
Diodes D1-4	IN 4820	Electronics
(on mains transformer)		Westinghouse
Potentiometers	P3	Contrast 500 ohms 20%
		LIN 1/4 W Type 45 Delrin
		with Flat 2" FMF
	P4	Brightness 1M
		with Flat 2" FMF
Switch	S1	Power On/Off DTST Type
		AY
Knobs (For P3,P4 and S1)		K7, round+Flat,Black
Field Choke	L3	A4-002-009
EHT Rectifier D6/EHT		TV 18S
Socket (For D6/EHT)		9.009-G7 (Without lead)
		Klar &
		Beilschmidt
Top Cap. "		9.009-W7
Edge Connector Socket	22 way	Nylon DuoTyne 280019-0
Inserts		66088-2
		Amp
		"

CASE MOUNTED COMPONENTS (CONT.)

CRT	11" Illuminant D	M28-13 WA	Thorn Radio Valves & Tubes
	12" TV White	M31-184W	"
	15" 90°	M38-103	"
	15" 110°	M38-121	"
	20"	M50-120	"
	24"	M61-120	"

WARNING: to ensure continued Protection of Viewer and circuits, CRT with correct part number must be fitted.

HANDLES

FEET (DU1-11 & 12)	Type 713 Grey	Engineering Enterprises
(DU1-15, 20 & 24)	162 Grey	"

CRT MOUNTED COMPONENTS

Scanning Coils	A2-002-028	Melford Electronics
Hellerman Sockets (for Scan coils)	HC Brass 7432	Hellerman
CRT Base	B 8 H R41-81303	United Carr.
Cover (for Base)	R41-81212	"
Resistors R124	330 ohms/½W Moulded Carbon	R.S.
(mounted on CRT Base)		
R128	330 ohms	" "
(mounted on CRT Base)		
Capacitor C14	2.2nF 1KV	Durolit Wima Wacom
EHT Connector (CRT)		

MAIN P.C.B. PARTS LIST

Circuit				Circuit			
Ref.	Value	Type	Manf.	Ref.	Value	Type	Manf.

RESISTORS

All are 5% ¼ W unless otherwise stated. Preferred types are UPM 033 Iskra, and CR 25 Mullard.

R1(On mains transformer, page 17)	R21	22 ohms
R2 10 ohms	R22	470 ohms
R3 15K	R23	10K
R4 100 ohms	R24	0.68 ohms 5% 6W W22 Welwyn
R5 0.47 ohms 5% 6W W22 Welwyn	R25	10K
R6 15 ohms	R26	82 ohms W21
R7 100 ohms	R27	15K A.O.T.
R8 6.8 K	R28	not used
R9 22K	R29	" "
R10 Not used	R30	8.2K
R11 470 ohms	R31	15K
R12 1K	R32	39K
R13 100 ohms	R33	10K
R14 100 ohms	R34	1K
R15 2.2K	R35	10K
R16 220 ohms	R36	10K
R17 4.7K	R37	4.7K
R18 1K 5% 3W W21 Welwyn	R38	10K
R19 220 ohms	R39	100K
R20 2.2K	R40	2.2K

MAIN P. C. B. PARTS LIST (Cont.)

<u>Circuit Ref.</u>	<u>Value</u>	<u>Type</u>	<u>Manf.</u>	<u>Circuit Ref.</u>	<u>Value</u>	<u>Type</u>	<u>Manf.</u>
R41	33K			R92	3.3K		
R42	10K			R93	2.2K		
R43	33K			R94	270 ohms 5%		
R44	10M (10% acceptable)				$\frac{1}{2}$ W	UPM050	Iskra
R45	1M			R95	150 ohms		
R46	180 ohms			R96	220 ohms		
R47	1.5K			R97	220 ohms		
R48	330 ohms			R98	2.2K		
R49	10K			R99	220 ohms		
R50	Not Used			R100	2.2K		
R51	6.8~			R101	6.8~		
R52	2.2K			R102	47 ohms		
R53	1M			R103	150K		
R54	2.2K			R104	47K		
				R105	1K		
R55	680 ohms			R106	22 ohms		
R56	33K			R107	3.3K		
R57	330K			R108	1K		
R58	15K			R109	100 ohms		
R59	33K			R110	2.2K		
R60	Not used			R111	10 ohms		
R61	15K			R112	10K		
R62	330K			R113	3.3K		
R63	680 ohms			R114	2.2K 5% 4W	FS75	Welwyn
R64	1.5K			R115	220 ohms		
R65	150K			R116	220 ohms		
R66	120K			R117	150 ohms		
R67	120K			R118	470 ohms		
R68	150K			R119	47K		
R69	680 ohms			R120	220K		
R70	4.7K			R121	33K		
R71	1.5K			R122	0 ohms (LINK)		
R72	100 ohms			R123	560K		
R73	4.7K			R124			
R74	1K				(on CRT base, page18)		
R75	680 ohms			R125	10M		
R76	10K			R126	1M		
R77	10 ohms			R127	330K		
R78	10 ohms			R128	(on CRT base, page18)		
R79	10 ohms			R129	4.7 ohms		
R80				R130	3.3K		
	(on rear panel, page17)			R131	1K		
R81	330K			R132	4.7K		
R82	15K			R133	47 ohms		
R83	330 ohms			R134	1K		
R84	0 ohms (link)			R135	330K		
R85	1K			R136	1K		
R86	220 ohms			R137	3.3K		
R87	150 ohms			R138	2.2K		
R88	3.3K			R139	22K		
R89	10K			R140	1K		
R90	220 ohms			R141	1K		
R91	10 ohms			R142	22K		
				R143	470 ohms		

MAIN P.C.B. PARTS LIST (Cont)

Circuit Ref.	Value	Type	Manf.	Circuit Ref.	Value	Type	Manf.
R144	1K			POTENTIOMETERS			
R145	10 ohms			P1	10K 20% $\frac{1}{4}$ W	H15	A.B.
R146	15K			P2	10K "	"	Electronics
R147	0 ohms (link)			P3	(on front panel, page 17)		
R148	0 ohms (link)			P4	(" " " 17)		
R149	2.7K			P5	100K 20% $\frac{1}{4}$ W	H15	"
R150	Not used			P6	470K " "	H15	"
R151	0 ohms (link)			P7	22K " "	H15	"
R152	4.7K			CAPACITORS			
R153	10 ohms			C1	(on base plate, page 17)		
R154	4.7K			C2	470uF 6.3V 016		Mullard
R155	10 ohms			C3	0.47uF 250V C280		"
R156	Not used			C4	22nF 10% 250V 344		"
R157	" "			C5	2.2nF 630		"
R158	" "			C6	Not used		
R159	" "			C7	" "		
R160	" "			C8	" "		
R161	100 ohms			C9	" "		
R162	10K			C10	10uF 25V 015		Mullard
R163	100 ohms			C11	220pF 5% 63V	KSN	Iskra
R164	1.5K			C12	330pF 5% 500V	AOT	"
R165	680 ohms			C13	10nF 250V	C280	Mullard
R166	1.5K			C14	100nF	C280	"
R167	100K			C15	100nF	C280	"
R168	100K			C16	4.7nF 5% 125V	KSN	Iskra
R169	100K			C17	10nF 250V	C280	Mullard
R170	Not used			C18	10uF 25V	015	"
R171	47K			C19	100uF 25V	016	"
R172	680 ohms			C20	Not used		
R173	1.5K			C21	1.5nF 5% 125V	KSN	Iskra
R174	15 ohms			C22	100pF 5% 125V	"	"
R175	22 ohms			C23	1nF 5% 125V	"	"
R176	330K			C24	100pF 5% 125V	"	"
R177	6.8K			C25	100nF	C280	Mullard
R178	100 ohms			C26	47nF	C280	"
R179	10K			C27	470uF 40V	017	"
R180	1.2M			C28	22nF	C280	"
R181	220 ohms			C29	10nF	C280	Mullard
R182	6.8K			C30	22nF 250V	C280	"
R183	390 ohms			C31	47uF 10V	015	Mullard
R184	100 ohms			C32	0.22uF	C280	Mullard
R185	220 ohms			C33	15uF 40V	015	"
R186	220 ohms			C34	33uF 16V	015	"
R187	4.7 ohms 5% $\frac{1}{4}$ W UPM075		Iskra	C35	15uF 40V	015	"
R188	3.3K			C36	47pF 5% 125V	KSN	Iskra
R189	1.5K 5% 1W W21		Welwyn	C37	47uF 25V	016	Mullard
R190	10 ohms						
R191	10 ohms 5% $\frac{1}{4}$ W UPM050		Iskra				

MAIN P.C.B. PARTS LIST (Cont.)

Circuit Ref.	Value	Type	Manf.	Circuit Ref.	Value	Type	Manf.
C38	0.1uF	C280	Mullard	T12		BC307B	Siemens
C39	47uF 10V	015	"	T13		BC237B	"
C40	Not used			T14		BC237B	"
C41	470pF 5% 125V	KSN	Iskra	T15		BC237B	"
C42	150pF 5% 125V	KSN	Iskra	T16		MA8003	Micro Electronics
C43	0.68uF	C280	Mullard	T17		BC237B	Siemens
C44	15uF 160V	211	I.T.T.	T18		BC237B	"
C45	47uF 63V	016	Mullard	T19		BC237B	"
C46	100nF	C280	Mullard	T20		2N3704	Texas
C47	0.47uF 100V	B32540	Siemens	T21		BC307B	Siemens
C48	0.47uF 100V	B32540	"	T22		BF178	Mullard
C49	470pF 5% 125V	KSN	Iskra	T23		BC307B	Siemens
C50	Not used			T24		2N3704	Texas
C51	47uF 10V	015	Mullard	T25		BC237B	Siemens
C52	330pF 5% 125V	KSN	Iskra	T26		BC307B	"
C53	47uF 10V	015	Mullard	T27		BC237B	"
C54	47uF 10V	"	"	T28		BC237B	"
C55	Not used			T29		BC237B	"
C56	10nF	C280	Mullard	T30		BC237B	"
C57	22uF 25V	015	"	T31		BC307B	"
C58	Not used			T32	(on heat sink, page 17)		
C59	Not used			T33		BC237B	Siemens
C60	Not used						
C61	0.1uF	C280	Mullard				
C62	10nF	"	"	HEATSINKS			
C63	33nF 250V	344	"				
C64	10nF	C280	"	(For T2)	5C		Redpoint
C65	1.5uF 10%	C280	"	(For T22)	5C		"
C66	10nF	C280	"				
C67	1uF 10%	C280	"	DIODES			
C68	1uF 10%	C280	"				
C69	470uF 40V	017	"	D1	(on mains transformer, page 17)		
C70	22pF	C333	"	D2			
C71	22uF 100V	B41283	Siemens	D3			
C72	68uF 63V	017	Mullard	D4			
C73	AOT 63V	016	"	D5		IN4820	Westinghouse Electric
C74	22uF 63V	016	"	D6		IN4148	
TRANSISTORS				D7		IN4148	
T1		BC237B	Siemens	D8		IN4820	Westinghouse Electric
T2		MA8003	Micro Electronics	D9		IN4820	"
T3		BC237B	Siemens	D10	Not used		
T4	(on rear panel, page 17)			D11		IS921	Texas
T5		BC237B	Siemens	D12	Not used		
T6		BC237B	"	D13		IN4148	
T7		BC237B	"	D14		IN4148	
T8		2N5163	Amelco	D15		IN4148	
T9		BC307B	Siemens	D16		IN4148	
T10		2N5163	Amelco	D17		IN4148	
T11		BC307B	Siemens	D18		IN4148	

MAIN P.C.B. PARTS LIST (Cont.)

Circuit

<u>Ref.</u>	<u>Value</u>	<u>Type</u>	<u>Manf.</u>
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DIODES

D19		IN4820	Westinghouse Electric
D20		IS922	
D21		IN4148	
D22		IN4148	
D23		IN4148	
D24		IN4820	Westinghouse Electric
D25		IN4148	
D26	Not used		
D27		IN4148	
D28		IS921	Texas
D29		IN4820	Westinghouse Electric
D30	Not used		

ZENER

Z1	3.9V	BZY88	Mullard
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INDUCTORS

L1	6.8 μ H	SC10	Sigma Prod.
L2	22 μ H	"	" "
L3	FIELD CHOKE (on support screen, page 17)		

EHT P.C.B. PARTS LIST

Circuit Ref.	Value	Type	Manf.	Circuit Ref.	Value	Type	Manf.
RESISTORS (All 5% $\frac{1}{4}$ W unless otherwise stated)				C11	4.7nF 5%		
R1	680K				125V	KSN	Iskra
R2	330K			C12	15 μ F 160V	211	I.T.T.
R3	100 ohms			C13	22nF 1KV	MKS	Wima
R4	22K						Wacom
R5	3.3K 5%			C14 (on CRT base, page 18)			
	$\frac{1}{2}$ W	050	Iskra	C15	1 μ F 100V	344	Mullard
R6	1K			C16	Not used		
R7	33 ohms			C17	AOT 400V	C296	Mullard
R8	47 ohms			C18	10nF 400V	C296	"
R9	1.5K			C19	AOT	C280	"
R10	22 ohms			C20	22nF 1K	MKS	Wima
	5% $\frac{1}{2}$ W	050	Iskra	C21	4.7 μ F 63V	015	Mullard
R11	100K	Moulded	R.S.	C22	AOT 250V	C280	"
	5% $\frac{1}{2}$ W	Carbon		TRANSISTORS			
R12	3.3M	"	"	T1		BC237B	Siemens
	5% $\frac{1}{2}$ W			T2 (on heat sink, page 17)			
R13	22K	"	"	T3 (on heat sink, page 17)			
	5% $\frac{1}{2}$ W			DIODES			
R14	330 ohms	UPM050	Iskra	D1		IN4148	
	5% $\frac{1}{2}$ W			D2		SF4M1	
R15	2.2 ohms					Westinghouse Brake & Signal	
Note: On early P.C.B.'s R15 consists of two 1 ohm resistors one in series with each leg of C6				D3		IN4820	
POTENTIOMETERS						Westinghouse Elec.	
P1	3.3M 20% PCB Mounting			D4		SF4M1	
Slider Preset (500V) Insulated Control						Westinghouse Brake & Signal	
PCH 82C/HV		AB		D5		IN4820	
		Electronics				Westinghouse Elec.	
CAPACITORS				D6 (on support screen, page 17)			
C1	2.2 μ F	C280	Mullard	D7		BY184	Mullard
C2	22nF	C280	"	D8		SF2M1	
C3	100nF	C280	"			Westinghouse Brake & Signal	
C4	15nF			D9 (mounted on T3, page 17)			
	400V	C296	"				
C5	22nF						
	400V	C296	"				
C6	100nF	C280	"				
C7	47 μ F 63V	016					
C8	22nF						
	400V	C296					
C9	2.2 μ F 10%						
	250V	C280	"				
C10	2.2 μ F 10%						
	250V AOT	C280	"				

EHT P.C.B. PARTS LIST (Cont.)

Circuit

<u>Ref.</u>	<u>Value</u>	<u>Type</u>	<u>Manf.</u>
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INDUCTORS

L1	(Antiring)	A4-002-026	Melford Electronics
L2	(H LIN)	A4-002-0XX	" "
L3	(W/Height)	A4-002-027	" "

SCAN COILS (see page 18)

CRT SOCKET (see page 18)

TRANSFORMERS

W1 (Drive)	A4-002-013	Melford Electronics
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W2 (EHT)	(on rear panel, page 17)
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W3 (Focus Modulation)	A4-002-081	Melford Electronics
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REMOTE CONTROL MODULE PARTS LIST

PCB MOUNTED COMPONENTS

Circuit Ref.	Value	Type	Manf.
RESISTORS			
R1 (on rear panel. page 26)			
R2	68K (5% or	UPM033 CR25	I skra Mullard)
R3	100K		
R4	330 ohms		
R5	470 ohms		
R6	8.2 ~		
R7	220 ohms		
R8	2.2K		
R9	56K		
R10	47 ohms		
R11	10K		
R12	22 ohms		
R13	4.7K		
R14	22 ohms		
R15	75 ohms 1% TR5	Electrosi	1
R16	68K 5% UPM033	I skra	
R17	100K		
R18	330 ohms		
R19	8.2 ~		
R20	22K		
R21	220 ohms		
R22	2.2K		
R23	10K		
R24	8.2 ~		
R25	22K		
R26	3.3K 5% UPM033	I skra	
R27	3.3K		
R28	47 ohms		
R29	1K		
R30	470 ohms		
R31	470 ohms		
	5%	UPM050	I skra
R32	4.7K	UPM033	
R33	470 ohms		
R34	15K		
R35	15K		
R36	150K		
R37	Not used		
R38	2.2K		
R39	15K		
R40	Not used		
R41	22 ohms		
R42	1.5K		
R43	220 ohms		
R44	3.3K		
R45	10K		
R46	2.2M		
R47	10K		
R48	27 ohms		

Circuit Ref.	Value	Type	Manf.
POTENTIOMETERS			
P1*	4.7K 20% 1/4W	Type 45	A.B. Electronics (Remote Contrast)
P2*	1M 20% 1/4W	Type 45	A.B. Electronics (Remote Brightness)

* Note:
These components are NOT on the Unit but are included for reference.

CAPACITORS			
C1	47uF 10V	015	Mullard
c2	Not used		
C3	47uF 25V	016	"
c4	47uF 10V	015	"
C5	47uF 25V	016	"
C6	22uF 25V	015	"
C7	47uF 25V	016	"
C8	10uF 25V	015	"
C9	220uF 4 V	016	"
C10	47 u F 10V	015	"
C11	100uF 4 0 V	016	"
C12	47 u F 10V	015	"

INDUCTORS			
L1	10uH	SC10	Sigma Prod.

TRANSISTORS			
T1		BC237B	Siemens
T2		BC237B	"
T3		BC307B	"
T4		BC237B	"
T5		BC307B	"
T6		BC237B	"
T7		BC237B	"
T8		BC307B	"
T9		2N2369A	N K T
T10		2N2369A	N K T
T11		BC237B	Siemens

DIODES			
D1		IN4148	
D2		IN4148	
D3		IN4148	

REMOTE CONTROL REAR PANEL PARTS

Circuit
Ref.

Value

Type

Manf.

RESISTORS

R1	75 ohms 1%	TR5	Electrosil
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R15	75 ohms 1%	TR5	Electrosil
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SWITCHES

S1 & S2 (slide) DPDT Type T216 Arcolectric

SOCKETS SKA & SKB UHF (S0239)

SKC 12 way Multicon Plessey

EDGE CONNECTOR

EDGE CONNECTOR SOCKET

22 way Nylon Duotyne	Amp
280019-0	"

INSERTS 66088-2

EXTERNAL SYNC MODULE PARTS LIST

PCB MOUNTED COMPONENTS

<u>Circuit</u> <u>Ref.</u>	<u>Value</u>	<u>Type</u>	<u>Manf.</u>
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RESISTORS

R1	330K 5%	UPM033	Iskra
R2	15K	"	"
R3	330 ohms	"	"
R4	(on rear panel)		
R5	1K	UPM033	"
R6	220 ohms	"	"
R7	680 ohms	"	"
R8	3.3K	"	"

CAPACITORS

C1	47uF 10V	015	Mullard
C2	22uF 25V	015	"

TRANSISTOR

T1		BC237B	Siemens
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REAR PANEL PARTS

RESISTOR

R4	75 ohms 1%	TR5	Electrosil
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SWITCHES

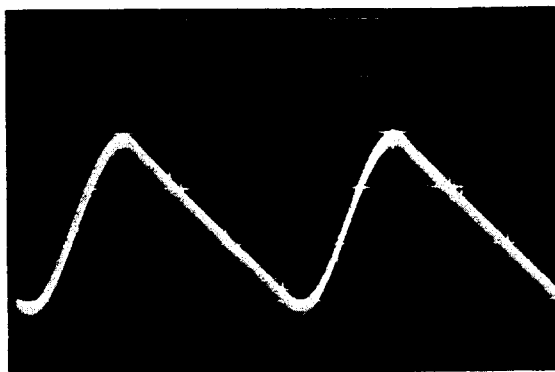
S1 & S2 (slide) DPDT	Type 216	Arcoelectric
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SOCKETS

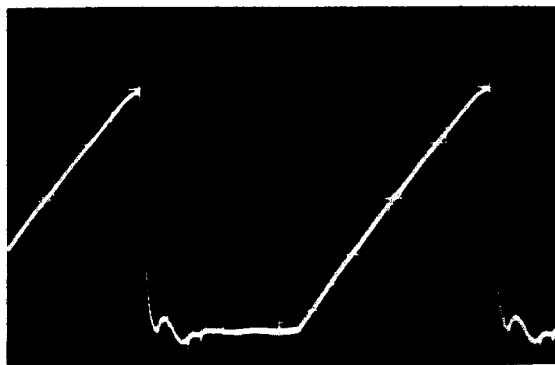
SK1 & SK2	BNC 75 ohms or UHF (S0239)
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PARAMETERS WHICH DEPEND UPON CRT TYPE

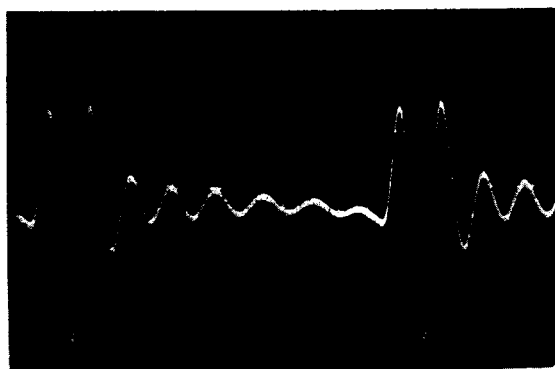
CRT TYPE	M28-13WA	M31-184W	M38-103	M50-120	M61-120W
SCREEN DIAGONAL	11"	12"	15"	20"	24"
DEFLECTION ANGLE	90"	110"	90"	110"	110"
HEATER VOLTAGE (RMS)	11.5V	6.3V	11.5V	6.3V	6.3V
FEATURE	Illuminant D	TV White	Cropped lugs	-	TV White
MAINS TRANSFORMER TAP	B	B	B	C	C
EHT TRANSFORMER TAP	Pink	Red	Pink	Red	Red
L1 EHT PCB	More	Less	More	Less	Less
L2 EHT PCB	XPS211	XPS204	XPS211	XPS204	XPS204
L3 EHT PCB	More	Less	More	Less	Less
EHT (TYPICAL)	15KV	15.5KV	16KV	17KV	17KV



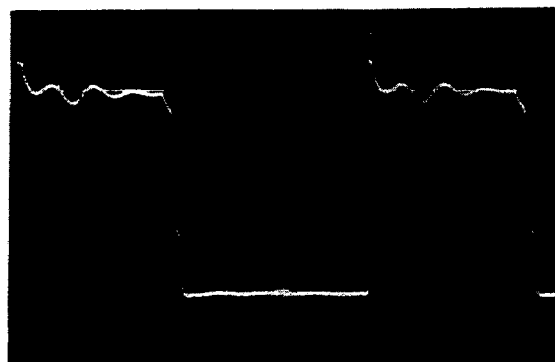
C1 +VE
2mS/cm , 1v/cm.



T3 Base.
10uS/cm , 1v/cm



+30
10uS/cm , 0.5v/cm



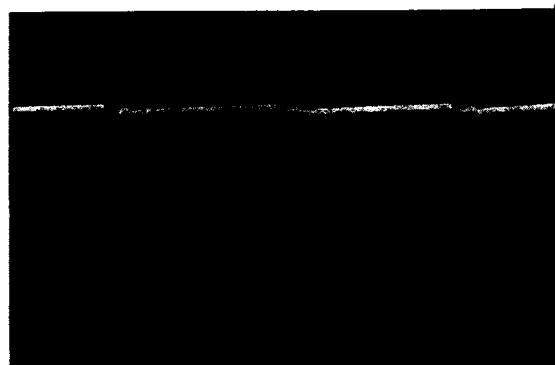
T5 Base.
10uS/cm , 0.2v/cm



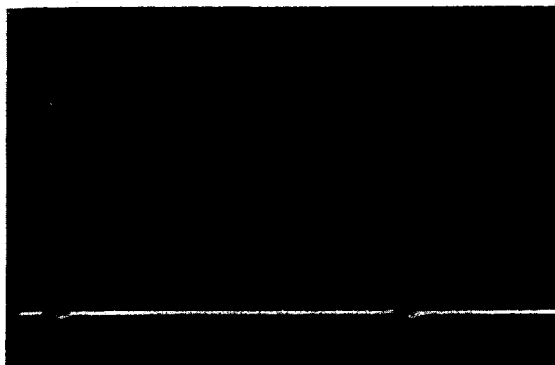
T2 Base.
10uS/cm , 0.2v/cm



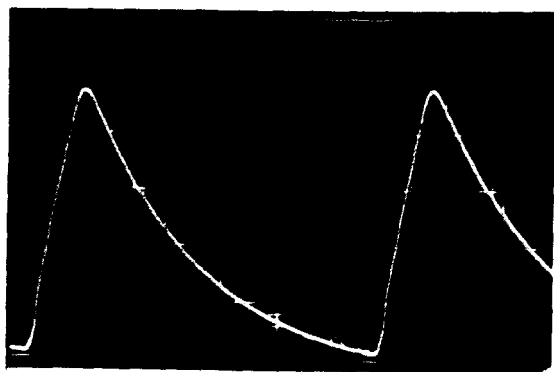
T7 Base.
10uS/cm , 0.5v/cm



T3 Collector
20uS/cm , 5v/cm



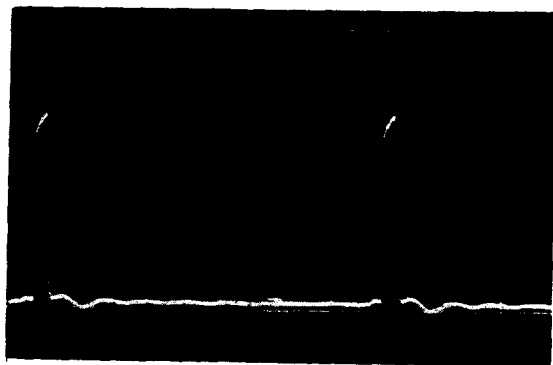
T7 Collector
10uS/cm , 10v/cm
3uS Pulse



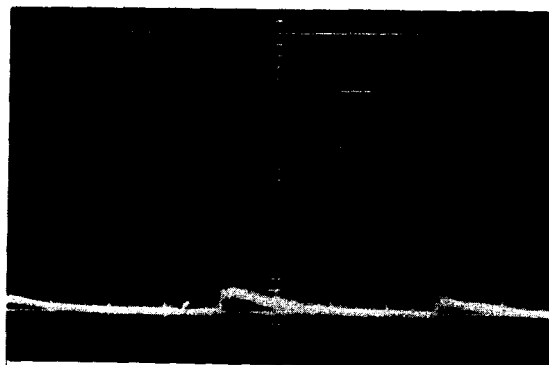
T8 Source.
10uS/cm , 2v/cm



T9 Base
10uS/cm , 0.5v/cm



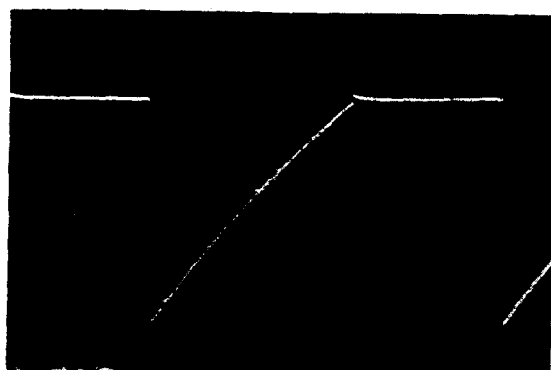
T8 Gate
10uS/cm , 5v/cm



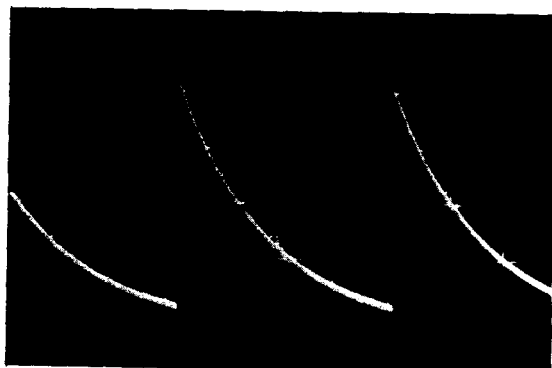
T9 Collector
5mS/cm , 5v/cm



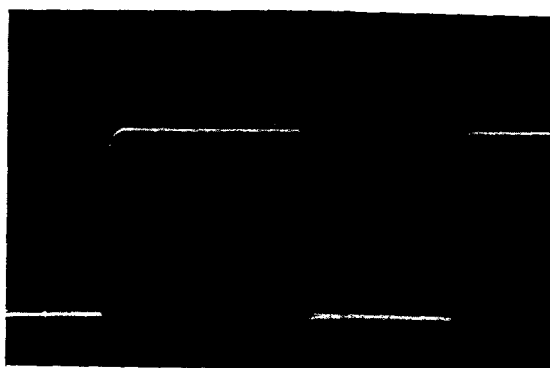
T8 Drain
10uS/cm , 0.5v/cm



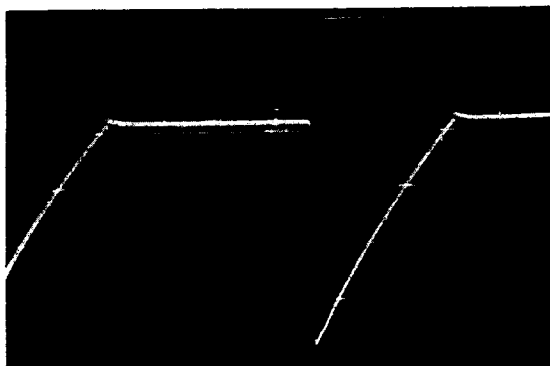
T13 Base
10uS/cm , 1v/cm



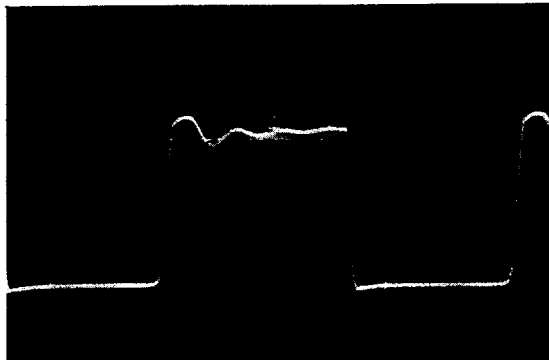
R44 - R53
5mS/cm , 0.5v



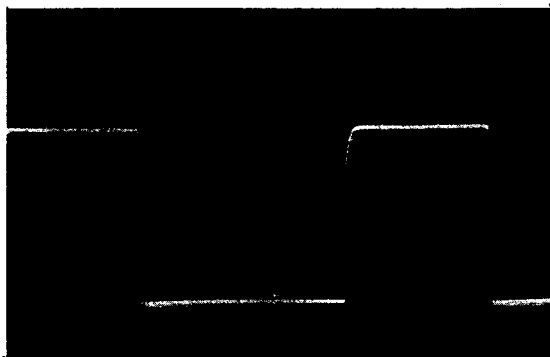
T13 Collector
10uS/cm , 5v/cm



T14 Base
10uS/cm , 1v/cm

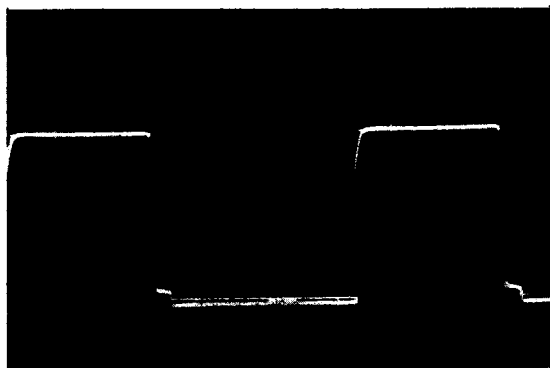


T16 Collector
10uS/cm, 10v/cm

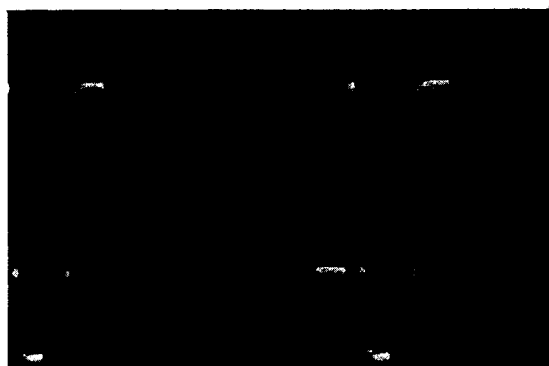


T14 Collector
10uS/cm , 5v/cm

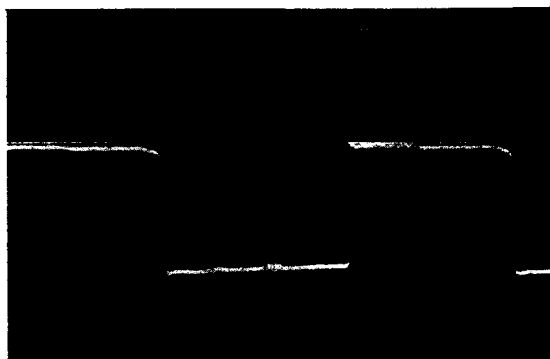
Low capacitance Probe
used where indicated (P)



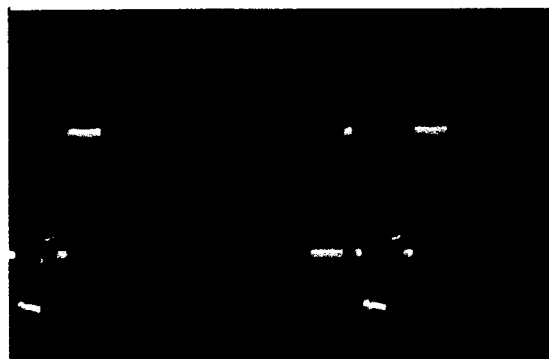
T15 Emitter
10uS/cm , 5v/cm



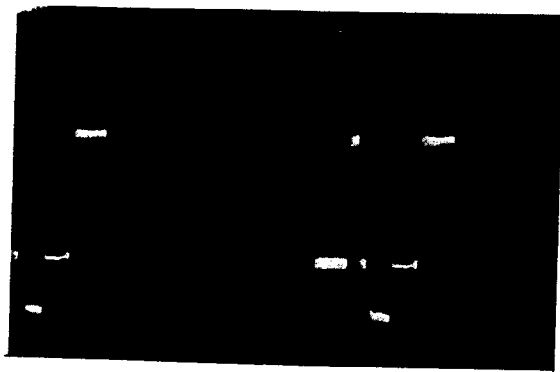
T33 Base (P)
10uS/cm , 0.2v/cm



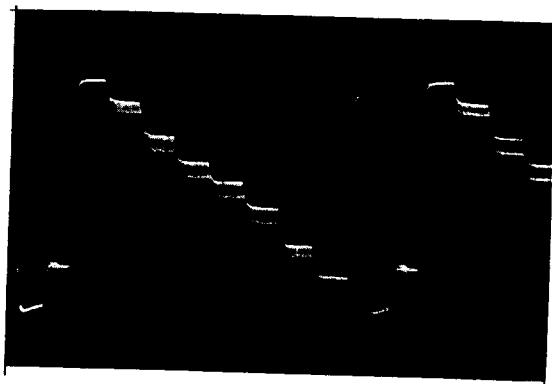
T16 Base
10uS/cm , 1v/cm



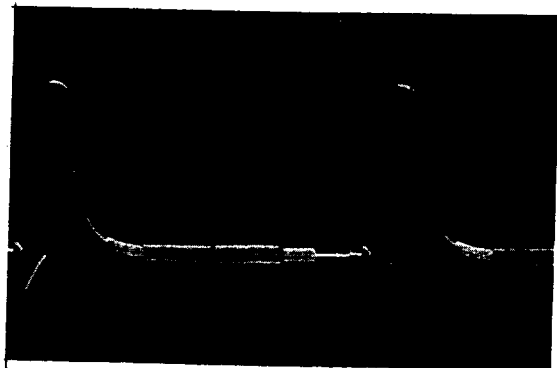
T21 Base (P)
10uS/cm, 1v/cm



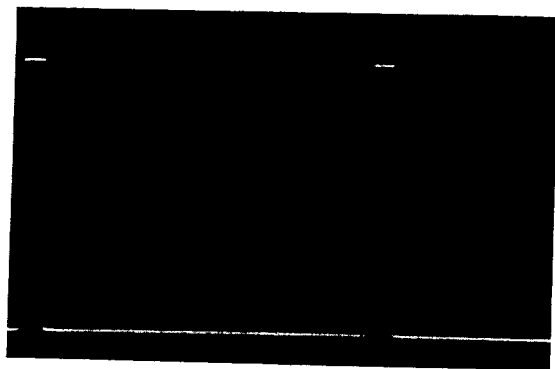
T20 Collector
10uS/cm , 1v/cm



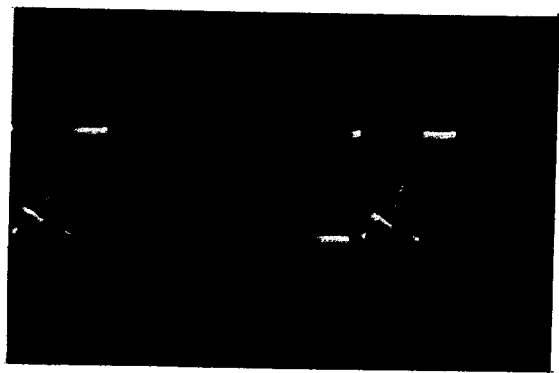
T23 Base (P)
10uS/cm , 0.2V/cm



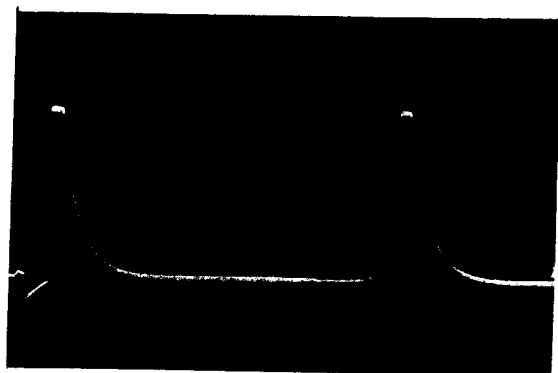
T20 Base (P)
10uS/cm , 1v/cm
3uS PULSE



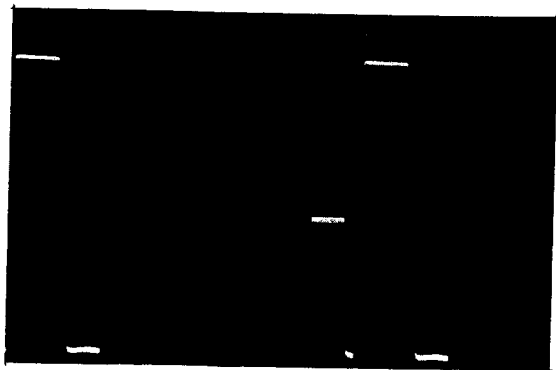
T23 Collector (P)
10uS/cm , 1v/cm



T22 Emitter (P)
10uS/cm , 1v



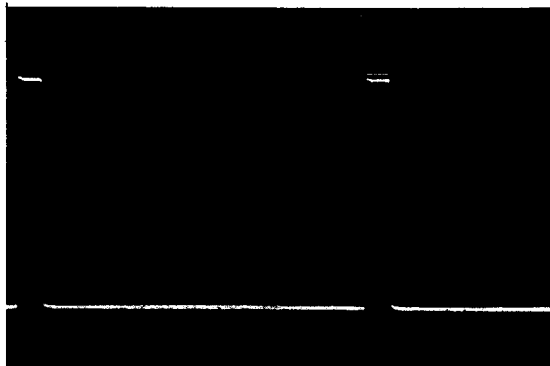
T24 Base (P)
10uS/cm , 1v/cm



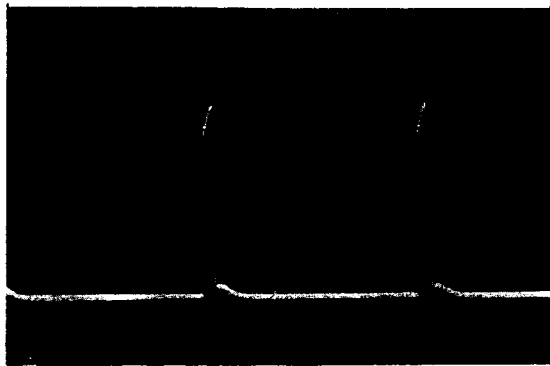
T22 COLLECTOR (P)
10uS/cm , 10v/cm
BLACK IS AT +80V



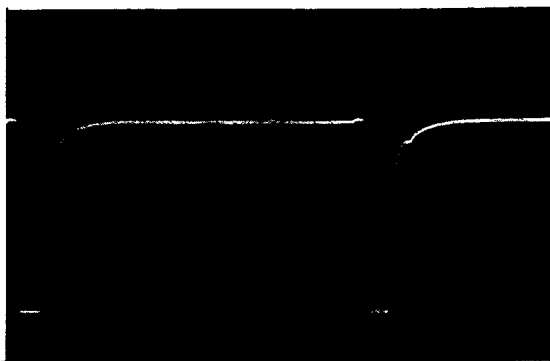
T24 Collector (P)
10uS/cm , 0.2v/cm



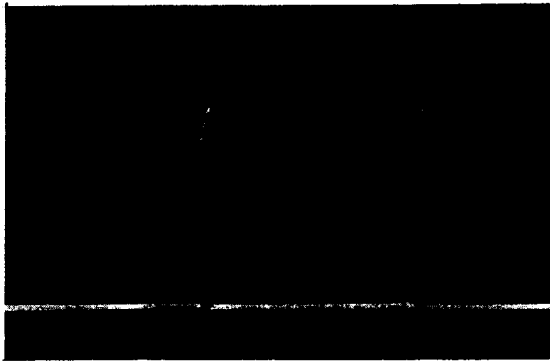
T25 Base (P)
10uS/cm , 1v/cm



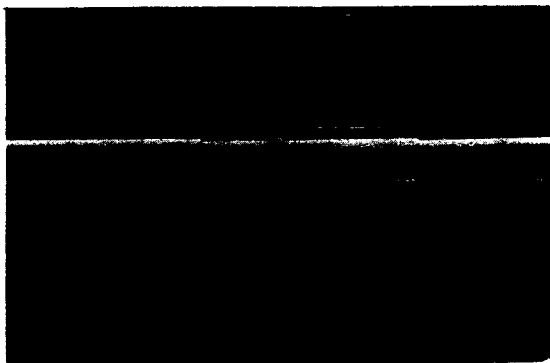
T27 Emitter
5mS/cm 5v/cm



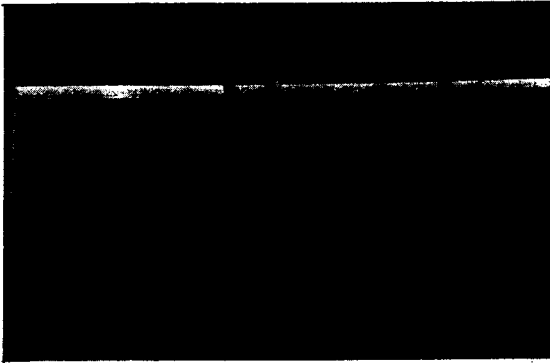
T25 Collector (P)
10uS/cm , 5v/cm



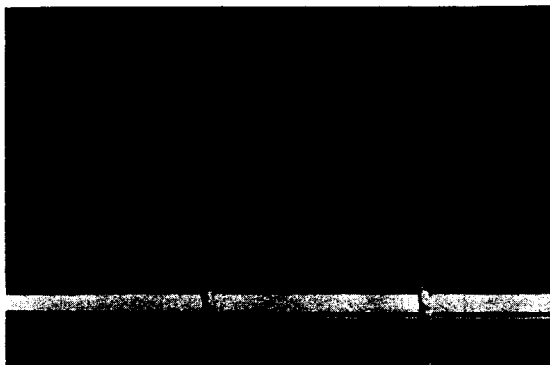
T27 Base
5ms/cm , 5v/cm



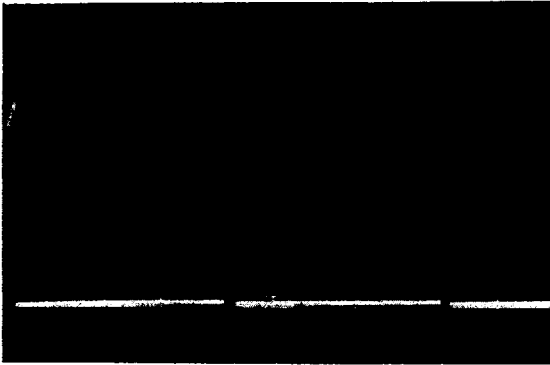
T26 Base
5mS/cm , 0.5v/cm



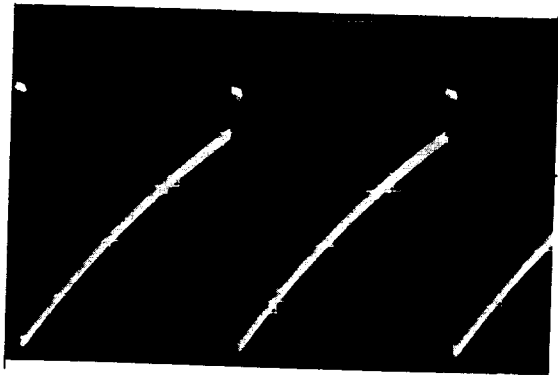
T28 Base
5mS/cm , 1v/cm



T26 Collector
5mS/cm , 2v/cm



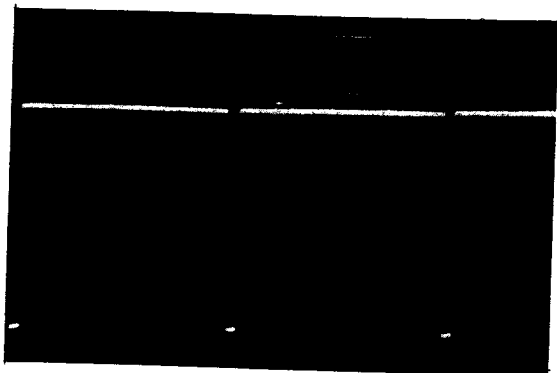
T28 Collector
5mS/cm , 5v/cm



T29 Base
5mS/cm , 1v/cm



T31 Base
5mS/cm , 0.5v/cm



T29 Collector
5mS/cm , 5v/cm



T31 Collector
5mS/cm , 2v/cm



T30 Base
5mS/cm , 0.5v/cm



T32 Base
5mS/cm , 1v/cm

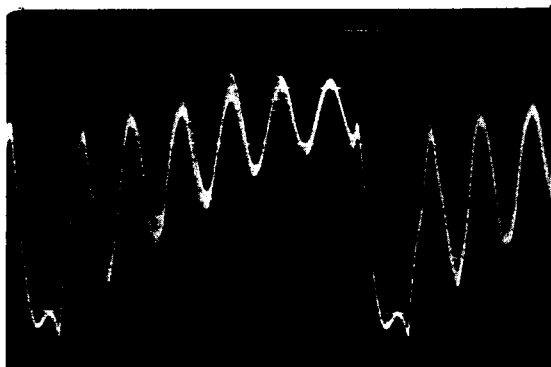


T32 Collector
5mS/cm , 10v/cm

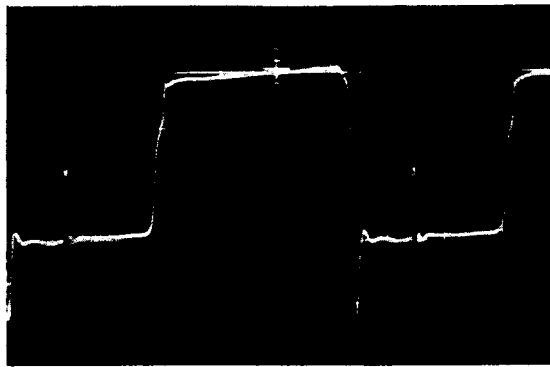


FL pin
5mS/cm , 10v/cm

EHT BOARD WAVEFORMS



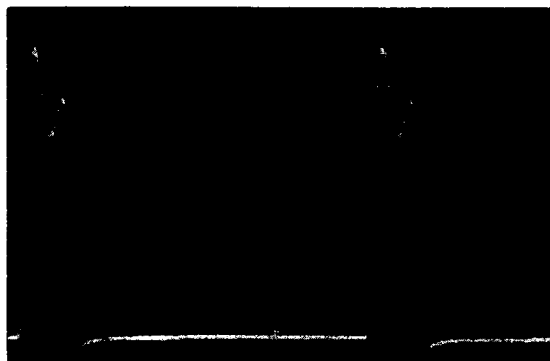
T1 Base
10uS/cm , 0.5v/cm



T3 Base
10uS/cm, 1v/cm



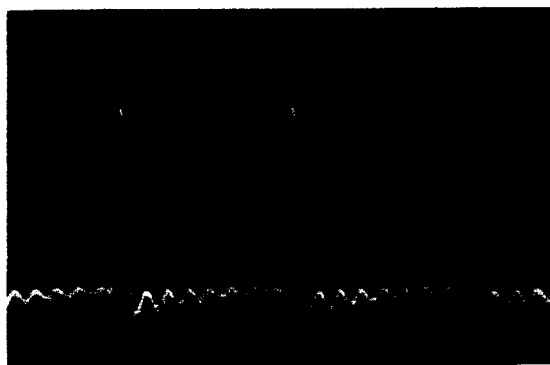
T1 Emitter
10uS/cm , 0.5v/cm



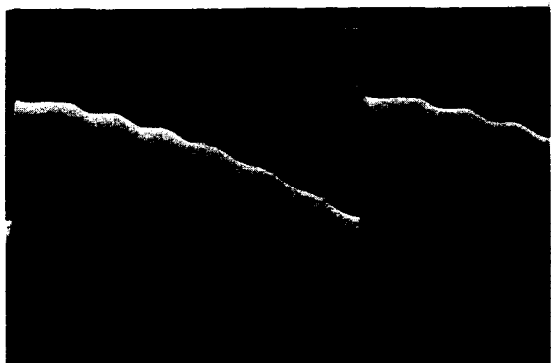
T3 Collector
10uS/cm , 50v/cm



T2 Emitter
10uS/cm , 0.5v/cm



20uS/cm , 2v/cm
EHT PICK UP AS SEEN
2.1 cm from over-wind.

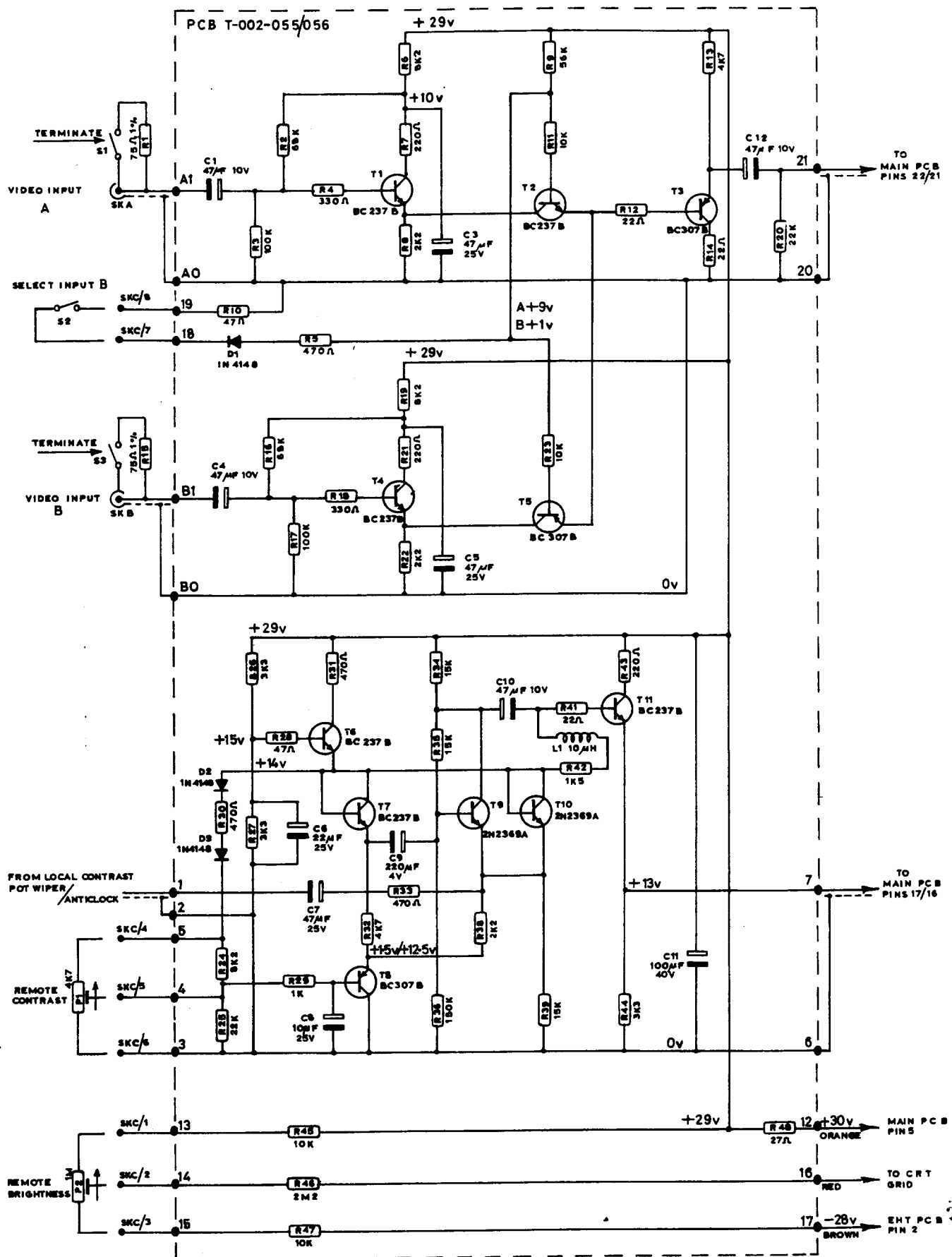


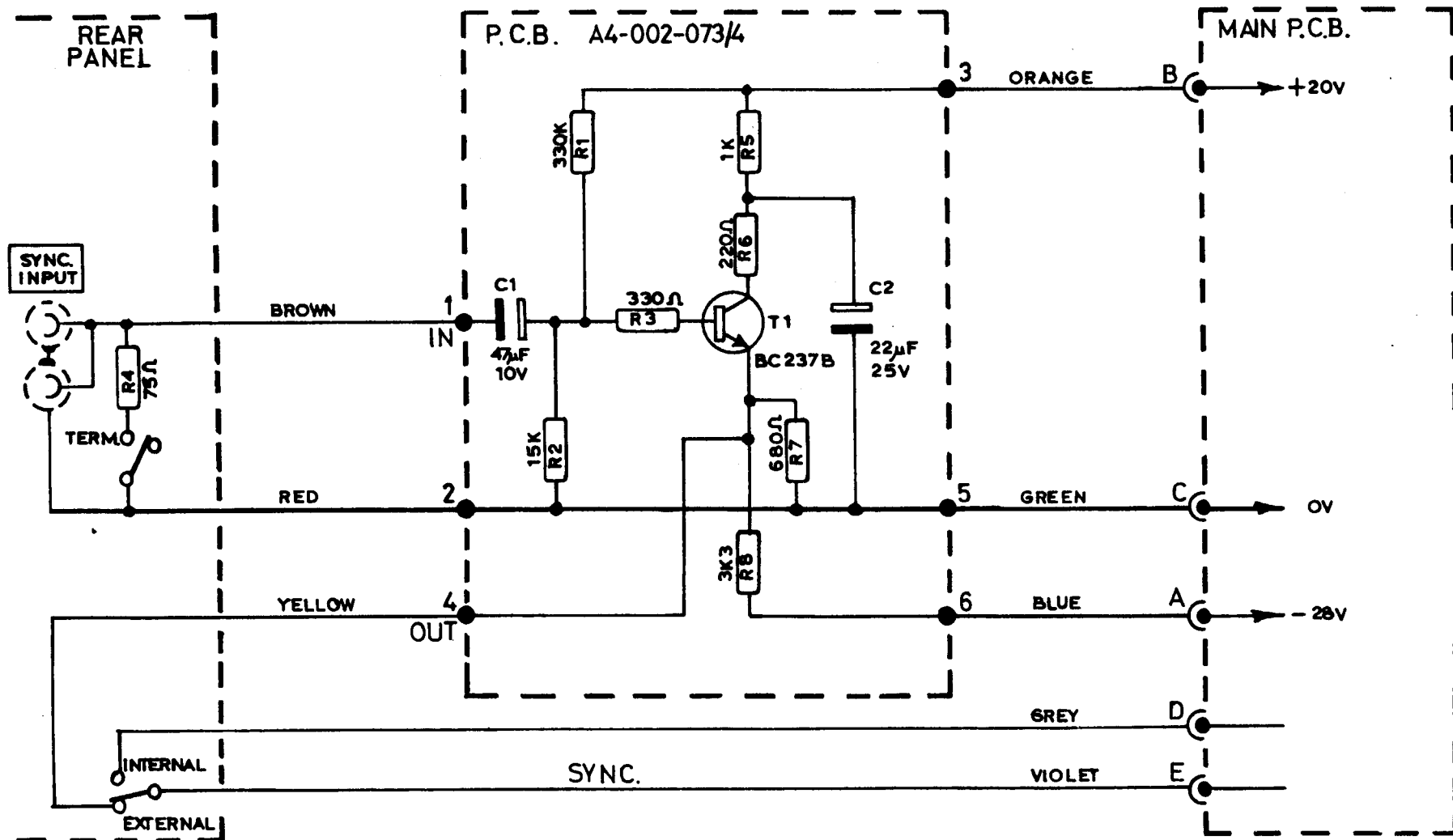
T2 Collector
10uS/cm , 5v/cm
+75v AT LOW BEAM
+150v AT HIGH BEAM



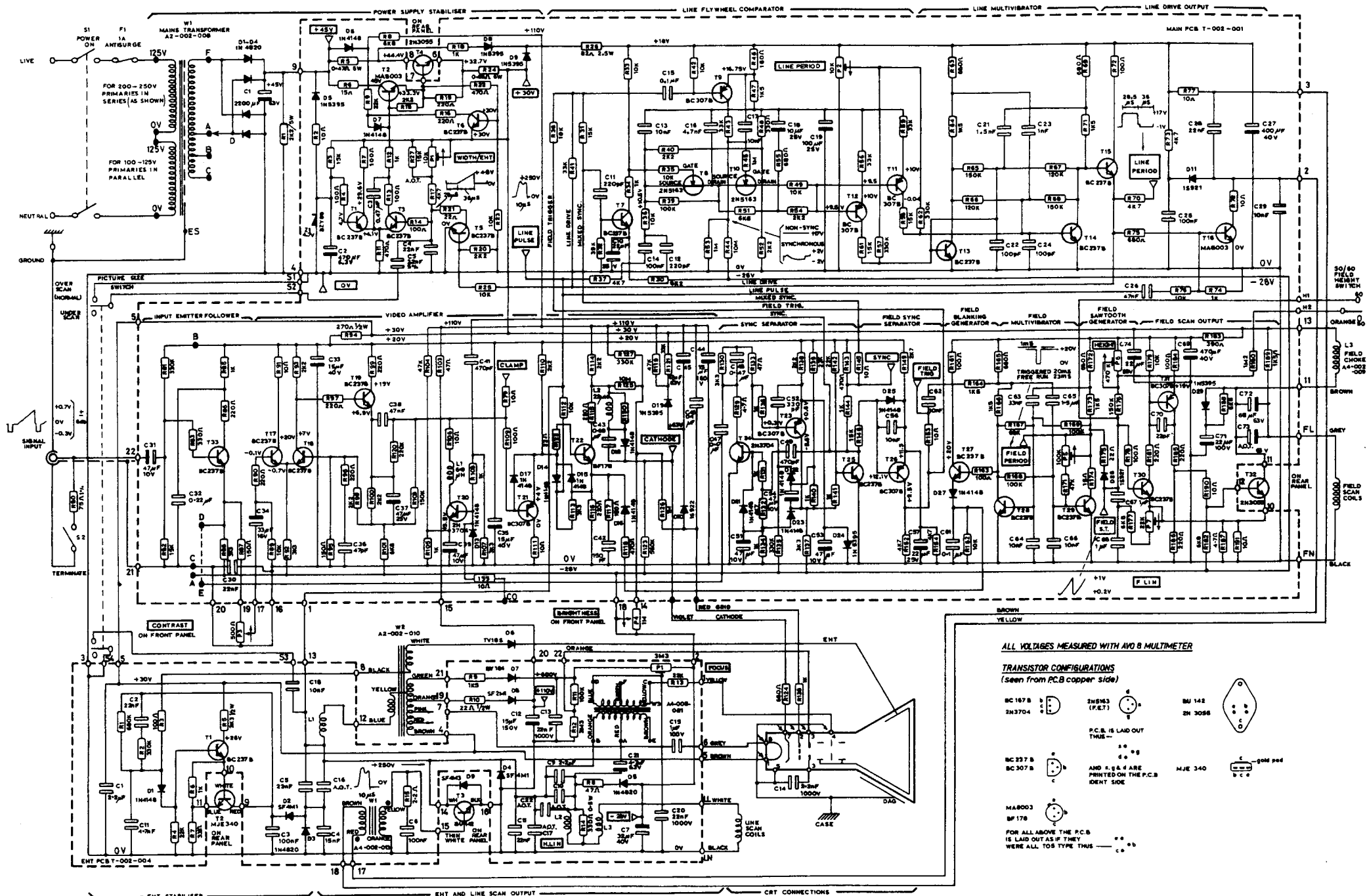
T19 Emitter
10uS/cm , 1v/cm.

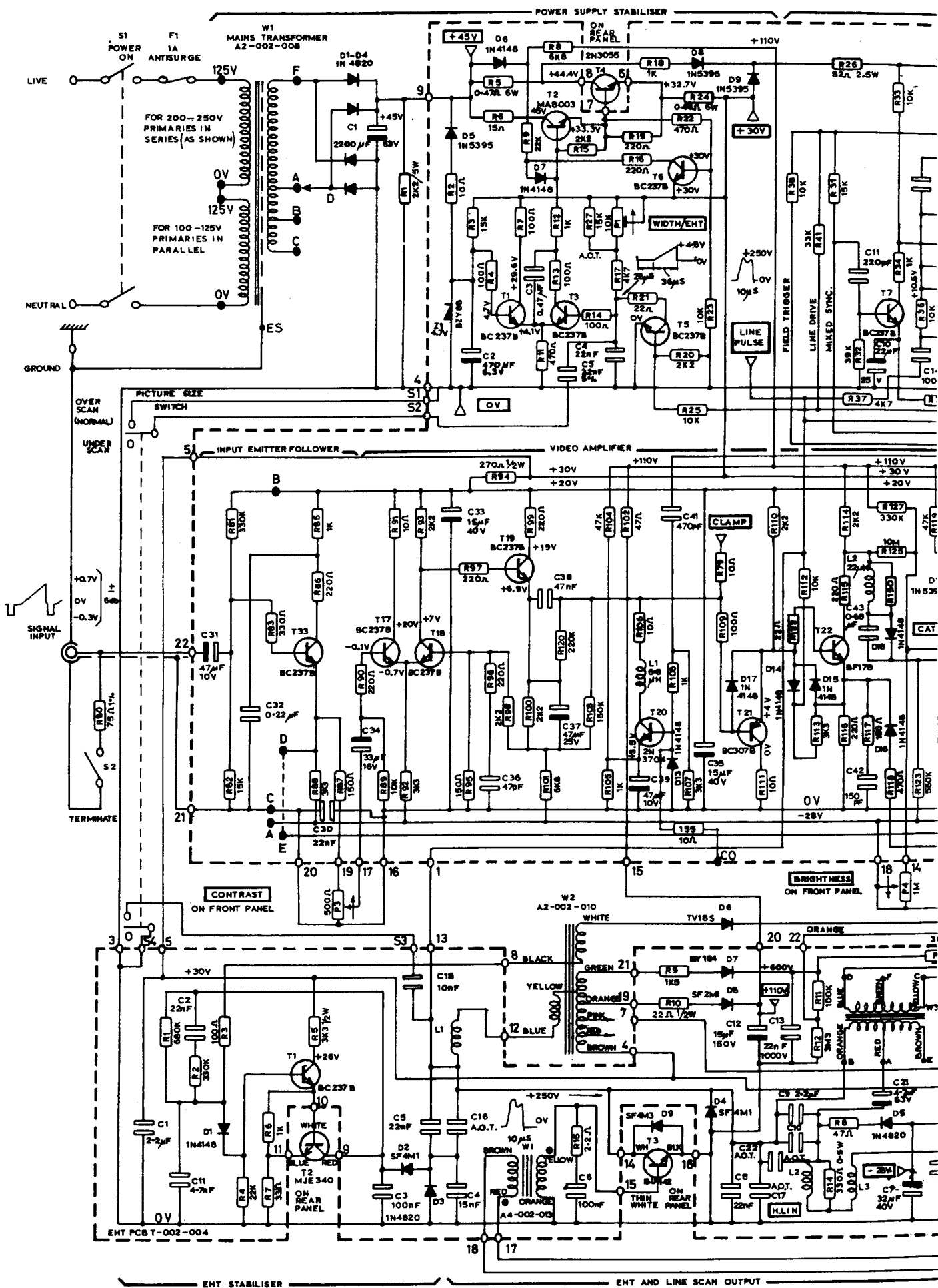
REMOTE BRIGHTNESS AND CONTRAST AND DUAL INPUT OPTION

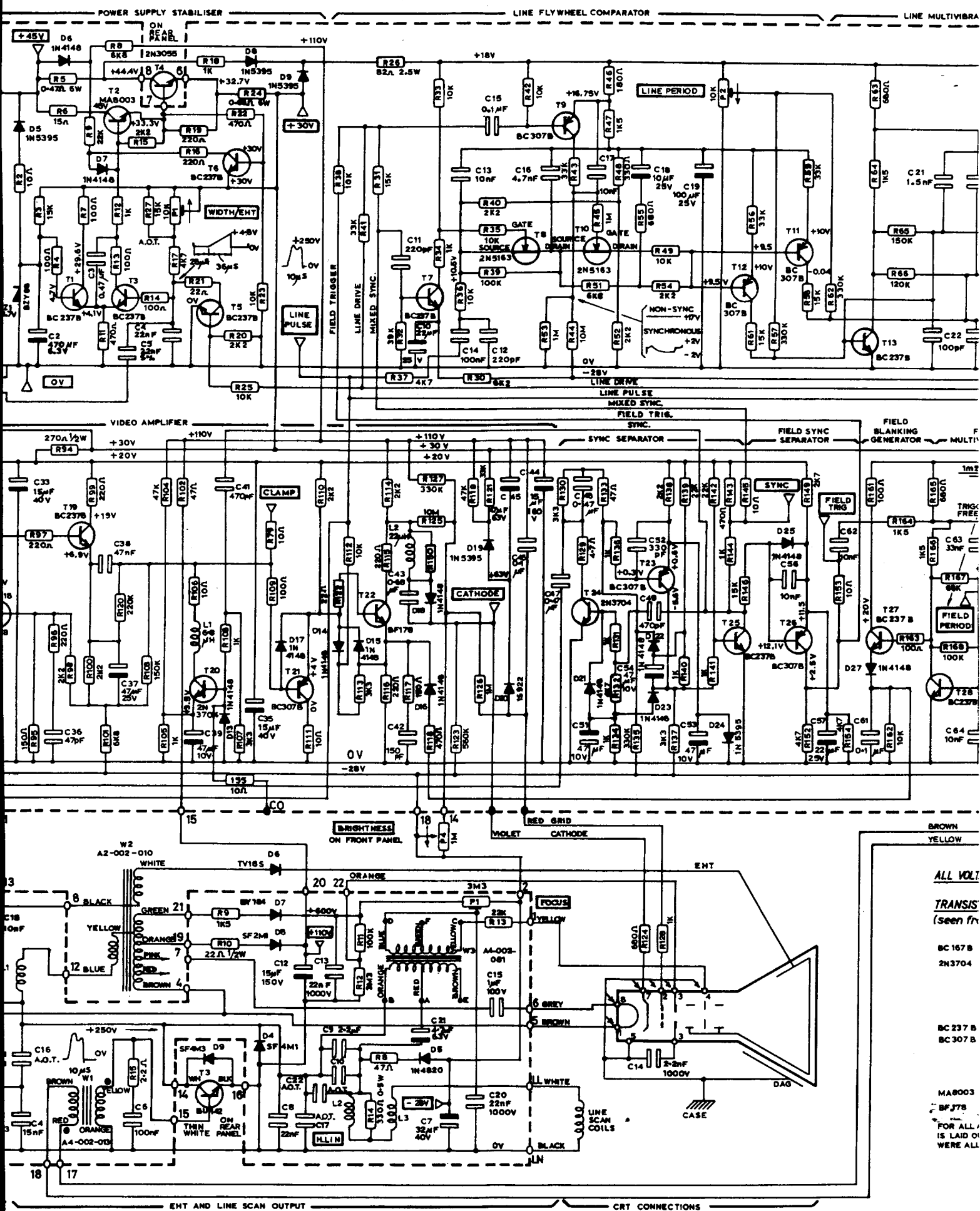


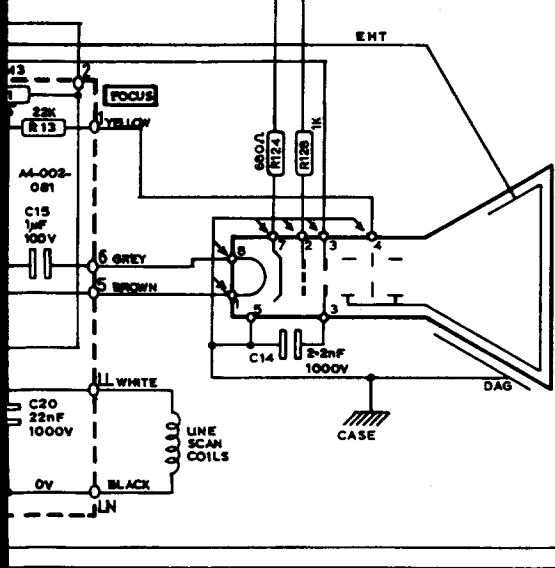


SEPARATE SYNC. OPTION









FOR ALL ABOVE THE P.C.B
IS LAID OUT AS IF THEY
WERE ALL TOS TYPE THUS ———

CRT CONNECTIONS