

HANTAREX MDU 1231 MONOCHROMATIC VIDEO DISPLAY

Theory of Operation, Schematics and Components

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HANTAREX MDU 1231 MONOCHROMATIC VIDEO DISPLAY

Theory of Operation, Schematics and Components

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PREFACE

This manual is intended for laboratory technicians repairing a MDU1231 HANTAREX monochrome video display unit, connected to an Olivetti Personal Computer.

SUMMARY

This manual is composed of three chapters and two appendixes: the first chapter contains the theory of operation of the video display unit, the second chapter describes regulations and adjustments and the last chapter presents the checks. The first appendix contains schematics and the second appendix contains the parts list.

REFERENCES:

To install video display unit, refer to the documentation regarding the Personal Computer.

SECTOR RANGE PRODUCT: S5 M380 M290 P500
S4 M240
S3 M250

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INTRODUCTION

The Hantarex MDU 1231 is a self-powered display using a 12" monochrome cathode ray tube with paper white type phosphor. On the front of the unit are the brightness and contrast control knobs (figure 1-1).

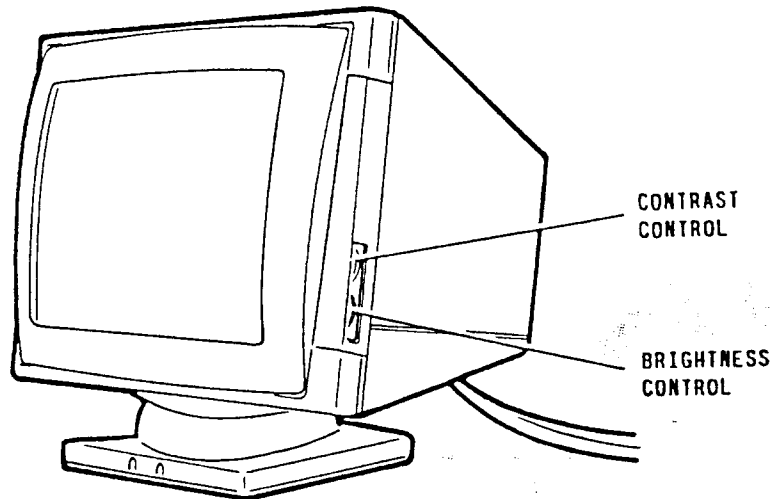


Fig. 1-1 Video Front View

At the rear of the unit, there are two cables:

- The video signals connector cable
- The video power cable.

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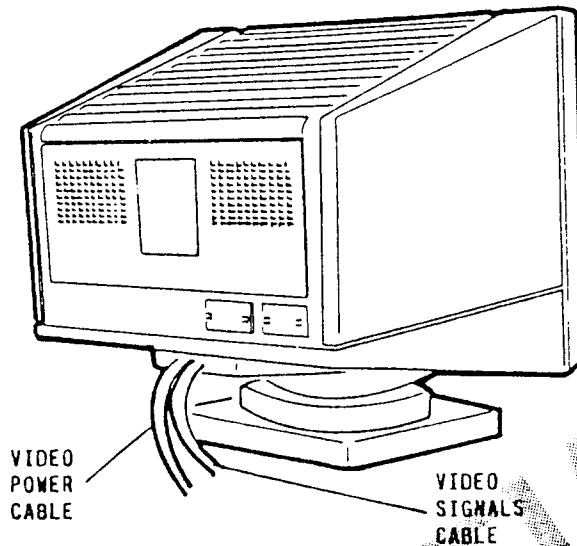


Fig. 1-2 Video Rear View

The display unit is switched on and off with the ON/OFF switch on the Personal Computer. It can operate with two different voltage ranges, 85-132 Vac (115 Vac nominal) or 170-264 Vac (220 Vac nominal). The video unit receives its inputs of mains power and video signals through the Personal Computer system module. The signals are given in the following figures.

PIN	SIGNAL DESCRIPTION	CONNECTOR
1	220 V phase	
2	Ground	
3	220 V neutral	

Fig. 1-3 Power Supply Signals

PIN	SIGNAL DESCRIPTION	CONNECTOR	
1	N.C.		
2	VIDEO INPUT		
3	N.C.		
4	N.C.		
5	SELF-TEST		
6	N.C.		
7	VIDEO GROUND		
8-9	N.C.		
10	DIGITAL GROUND		
11	N.C.		
12	DIGITAL GROUND		
13	H-SYNC		
14	V-SYNC		
15	N.C.		

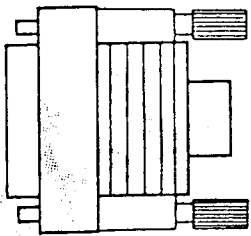
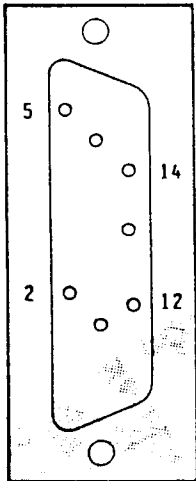


Fig. 1-4 Video Signals

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The main components of the video are illustrated in figure 1-5.

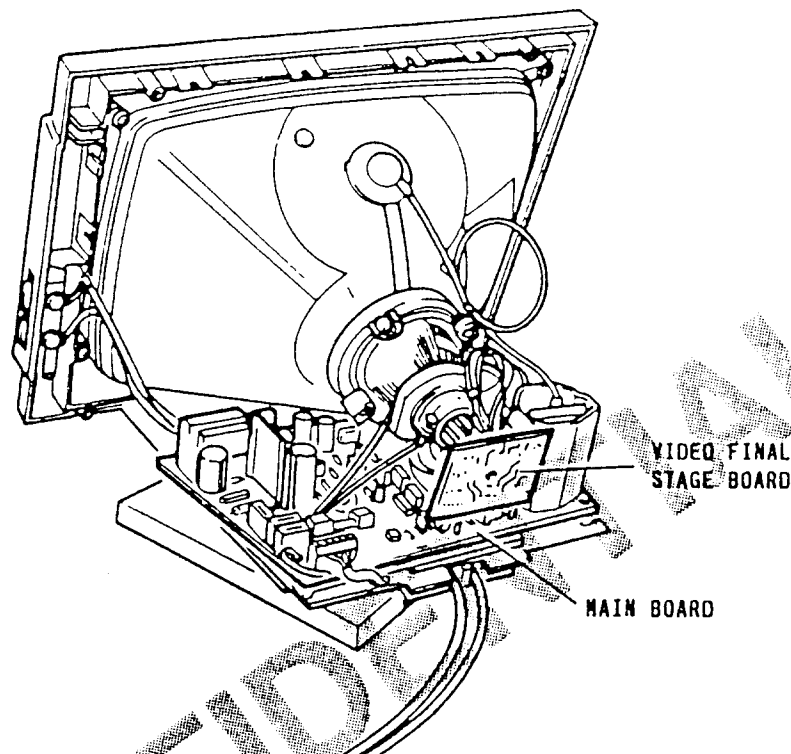


Fig. 1-5 Video Main Components

The display unit electronics is mounted on two printed circuit boards:

- The first, or main board, mounts the power circuitry, horizontal and vertical deflection, and vertical mode circuit.
- The second, or video final amplifier board, is mounted directly on the cathode ray tube and has the video amplification and tube grids bias circuits.

Note: For casing disassembly instructions, see the section entitled "Disassembly Instructions".

SAFETY INSTRUCTIONS

WARNING: Before undertaking any form of intervention, read the following instructions carefully:

- When the video is operating, its elements are subject to high voltages (up to 13 kV) so all maintenance work must be performed with extreme caution.
- Always discharge the anode of the CRT on the outer frame before removing the anode cover to ensure the serviceman is protected from residual electric discharges. The discharge procedure is described in the section "Disassembly Instructions".
- When changing a fuse, always use a fuse of the same brand as before (the brand is specified in the spare parts list).
- Check all solder points, loose cables and sheathes for damage. Remove all foreign matter.
- If replacing a high power resistor, always leaves a gap of at least 10 mm between the resistor and the board.
- Respect the established cables routes, avoiding contact with parts at high temperature or dangerous voltage levels.
- The video unit mains power supply range is: 90-136 Vac at 60Hz (110 V) and 198-264 Vac at 50 Hz (220 V).
- The PHILIPS manufactured cathode ray tube used on this unit has the anti-implosion feature (protection against inward explosion caused by the vacuum); care must still be taken, however, to avoid scratching, damaging or breaking the tube when working in the vicinity.

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X-RAYS (FIRE AND DISCHARGE HAZARDS)

1. Sources of high voltage may emit dangerous X-rays so it is important to ensure the high voltage in the video does not exceed the limits. The high voltage in this video has a nominal value of 13 kV. Each time maintenance is performed on the video, the voltage level must be checked using the High Voltage check method described below.
2. The only source of X-rays in the video is the cathode ray tube (CRT). For guaranteed protection against radiation, when replacing a CRT, be sure to use only a PHILIPS tube, as specified in the spare parts list.
3. A number of components of this video have special X-ray protection characteristics. For continued protection, always consult the Product Safety Warnings, given below, before replacing any parts.
4. During maintenance, always check that the jackets of cables and terminals are in perfect condition.
5. It must always be remembered to set all protections back in their original positions.

HIGH VOLTAGE CHECKING

It is important that the measurement apparatus is precisely calibrated, accurate and reliable:

1. Use a high voltage voltmeter; connect the negative terminal to the CRT outer coating and the positive to the anode of the CRT (see figure 1-30).
2. Turn the brightness knob fully anti-clockwise.
3. The voltage reading obtained should not exceed 13 kV.
4. If, however, the meter shows a voltage of over 13 kV (the voltage must never go above 17 kV), the unit must be serviced immediately to avoid premature component breakdown.

ELECTRIC SAFETY 'COLD' CHECKING

- MEASUREMENT OF INSULATION RESISTANCE

Measure the resistance between the mains power conductors and easy-to-access, metallic parts of the unit as follows: apply a d.c. voltage of 500 V between the two shorted leads of the power cord (phase - neutral) and unit metal parts for one minute.

The resistance reading, with the switch "ON", must be over 2 Mohm.

ELECTRIC SAFETY 'HOT' CHECKING

These tests must be performed on a stabilized monitor (20 minutes after being turned on) in operating environment with a temperature of 10-35 °C and a relative humidity of 10-90%.

- DIELECTRIC STRENGTH TEST

With this test, check that there are no electric discharges between parts under voltage and metal parts as described: apply an a.c. voltage of 1250 V at 50-60 Hz between the two shorted leads (phase - neutral) of the power cord and open, metal parts for one minute.

- MEASUREMENT OF GROUND CIRCUIT RESISTANCE

Measure the resistance between the ground lead of the power cord and open, metal parts using a voltage generator to send out a current of 12.5 A. The resistance read must be under 0.1 ohm.

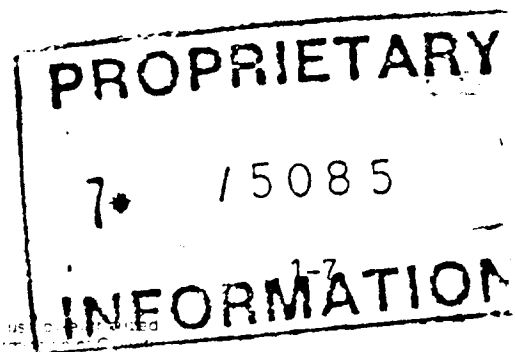
- MEASUREMENT OF LEAKAGE CURRENT

Read the leakage current in extreme conditions (Vac nom. +10%) between the two power cord terminals and the ground conductor. The reading should not be greater than 0.5 mA.

Product Safety Warnings

Some of the video electrical and mechanical parts have special safety characteristics, which may not always be obvious to the observer.

When replacing one of these components, consult first the spare parts list. Use of components which do not have the same safety characteristics as specified in the list may result in emission of X-rays.



DISPLAY UNIT CHARACTERISTICS

ELECTRICAL CHARACTERISTICS

- Input voltage: 90-136 Vac
198-264 Vac
- Input frequency: 50-60 Hz
- A.C. ripple: less than 100 mV
- Power absorption: 28 W max.
- D.C. power voltages: +5 V, +12 V, +50 V
- Terminal input:
 - . Cable with 15-pin, D-shell connector for video signals
 - . Cable with 3-pin plug for power supply
- Video input signal: Width 0-0.7 V (analog and positive type)
Rise/fall times 8 ns max.
- Vertical signal: Width 5 Vp-p ± 0.25 V
Blanking time 3.175 ms - 1.587 ms min.
Frequency 60-70 Hz
- Horizontal signal: Width 5 Vp-p ± 0.25 V
Blanking time 6.3 μ s min.
Frequency 31.5 kHz
- Video output signal: Bandwidth 28 MHz min.
Rise/fall times 23 ns max.

THEORY OF OPERATION

ENVIRONMENT CHARACTERISTICS

- Temperature: Operating 10-35 °C
 Non-operating -10-60 °C
 In shipping -30-65 °C
- Relative humidity: 10-98 % (no condensation)
- Altitude: 3,000 m

PHYSICAL CHARACTERISTICS

- Dimensions: Height 316 mm
 Width 341.5 mm
 Depth 296 mm
 Weight 6.9 Kg
- Cathode Ray Tube: Model W31-340WR-E
 Size 12 inch
 Gun In-line
 Deflection angle 90 °C
 Phosphor P4M (paper white)
 Screen Anti-glare
- Tilt angle: 10 °C
- Active video area: 205 mm x 154 mm

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INTERFACE SIGNALS

This unit has an analog type video interface and can operate with several vertical modes with the same horizontal resolution.

There are two separate sync lines so as to provide the drive for the deflection circuits and for the four combinations of polarity of these signals.

Another input enables the monitor to display an internally-generated test pattern when the signals cable is disconnected.

The two output lines are used to identify the type of video connected to the controller.

To summarize, the video unit requires the following signals:

- a. Video signals
 - 1. VIDEO INPUT (video input)
- b. Sync signals
 - 2. HSYNC (horizontal sync)
 - 3. VSYNC (vertical sync)
- c. SELF-TEST signals
 - 4. SELF-TEST (enable/disable self-test)

In turn, it provides the following signals:

- d. Video identification signals
 - 5. LOGIC GROUND (logic ground)
 - 6. IDENT. OUTPUT (connected to pin 10 of logic ground)

ELECTRICAL REQUIREMENTS

The video controller guarantees the display unit the following features:

- a. Video signals (termination on 75 ohm $\pm 1\%$)
 - Level Analog (0 ± 0.7 V)
 - Polarity Positive
 - Switching time < 8 ns
 - Gamma correction Not applicable

- b. Sync signals
 - Level TTL
 - V (ol) < 0.4 V, 5 mA max.
 - V (oh) > 2.4 V, -2 mA min.
 - Polarity Negative or positive
 - Switching time < 20 ns

- c. Self-Test signals
Connected to ground (the self-test function is enabled when the video signals cable is disconnected).

The video signals have a ground insulation of 75 ohm. Low level on TTL signals range from 0.0 to 0.7 V and high level from 2.1 to 5.25 V.

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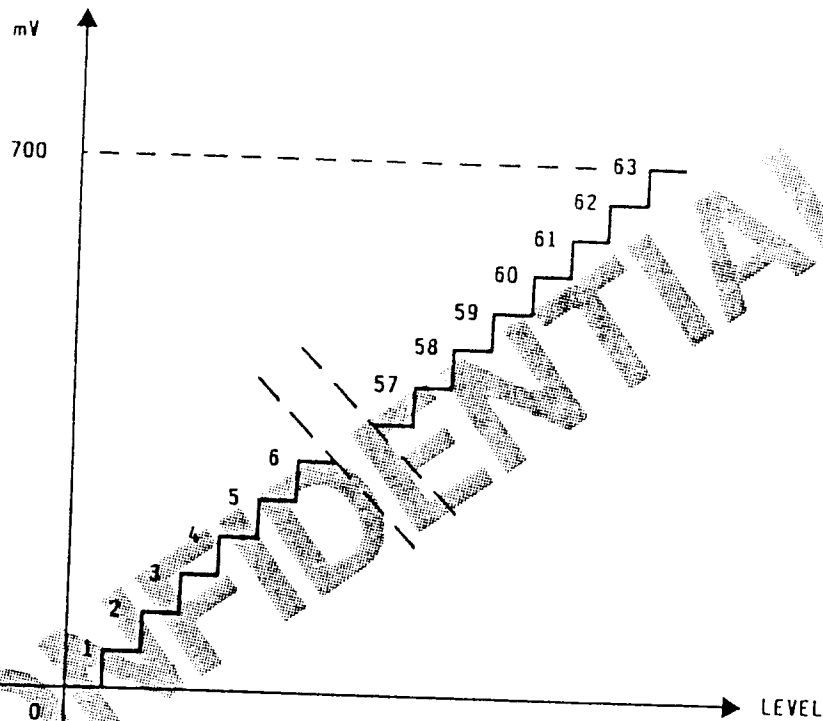
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COLOUR FUNCTION

The display can produce 64 different shades of grey by associating an analog input (VIDEO INPUT) with the video final amplifier circuit.

The following figure is a linear view of the different shades of grey that can be produced on the display.



Note: Each level = 11.1 mV

Fig. 1-6 Shades of Grey

TIMINGS

The display can work with 3 different vertical resolutions (350, 400 and 480 lines) while maintaining a scan frequency between 50-70 Hz.

The vertical mode is selected by decoding polarity of the HSYNC and VSYNC signals as illustrated in the figure below.

DATA AREA (Scan lines)	ACTIVE AREA (Scan lines)	HSYNC (Polarity)	VSYNC (Polarity)
350	362	Positive	Negative
400	414	Negative	Positive
480	496	Negative	Negative
Not defined	Not defined	Positive	Positive

Fig. 1-7 Vertical Mode Decoding

Note: The data area lies in the centre of the video display area.

The default timings for each of the operating modes are described in detail on the following pages.

TIMINGS (with vertical resolution of 350 lines/70 Hz)

Scan frequency:	Horizontal (Fh)	31.469 KHz
	Vertical (Fv)	70.08 Hz
Total video period:	Horizontal	31.778 μ s
	Vertical	14.268 ms
Video active period:	Horizontal	26.058 μ s
	Vertical	11.504 ms
Video blank period:	Horizontal	5.720 μ s
	Vertical	2.764 ms
Rising edge:	Horizontal	0.318 μ s
	Vertical	0.985 ms
Falling edge:	Horizontal	1.589 μ s
	Vertical	1.716 ms
Sync:	Horizontal	3.813 μ s
	Vertical	0.064 ms
Pixel period:		39.722 ns
Pixel frequency (fc):		25.175 Mhz
Scan mode:		Non-interlacing

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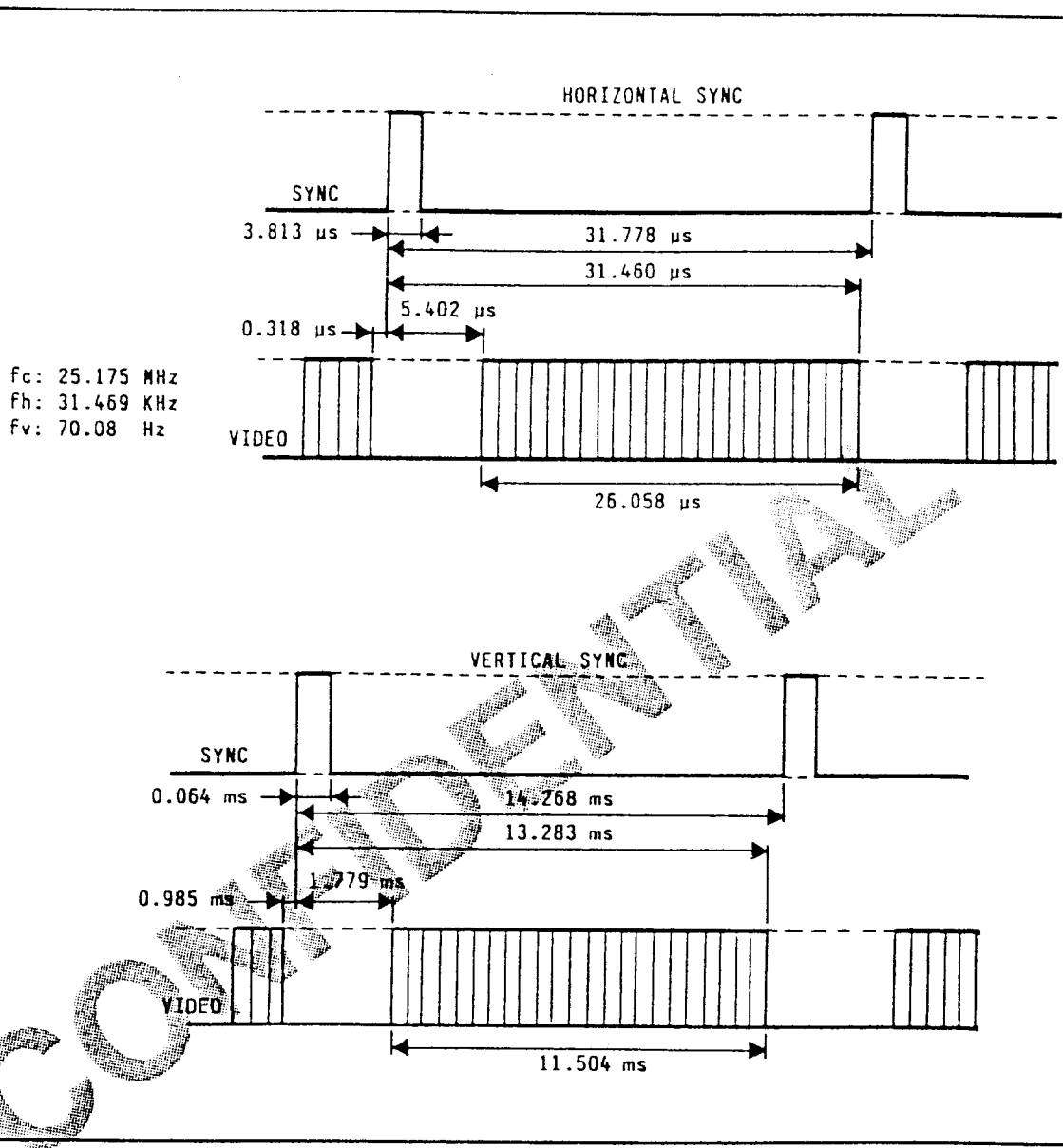


Fig. 1-8 Timing Diagrams

THEORY OF OPERATION

TIMINGS (with vertical resolution of 400 lines/70 Hz)

Scan frequency:	Horizontal (Fh)	31.469 KHz
	Vertical (Fv)	70.08 Hz
Total video period:	Horizontal	31.778 μ s
	Vertical	14.268 ms
Video active period:	Horizontal	26.058 μ s
	Vertical	13.156 ms
Video blank period:	Horizontal	5.720 μ s
	Vertical	1.112 ms
Rising edge:	Horizontal	0.318 μ s
	Vertical	0.159 ms
Falling edge:	Horizontal	1.589 μ s
	Vertical	0.890 ms
Sync:	Horizontal	3.813 μ s
	Vertical	0.064 ms
Pixel period:		39.722 ns
Pixel frequency (fc):		25.175 MHz
Scan mode:		Non-interlacing

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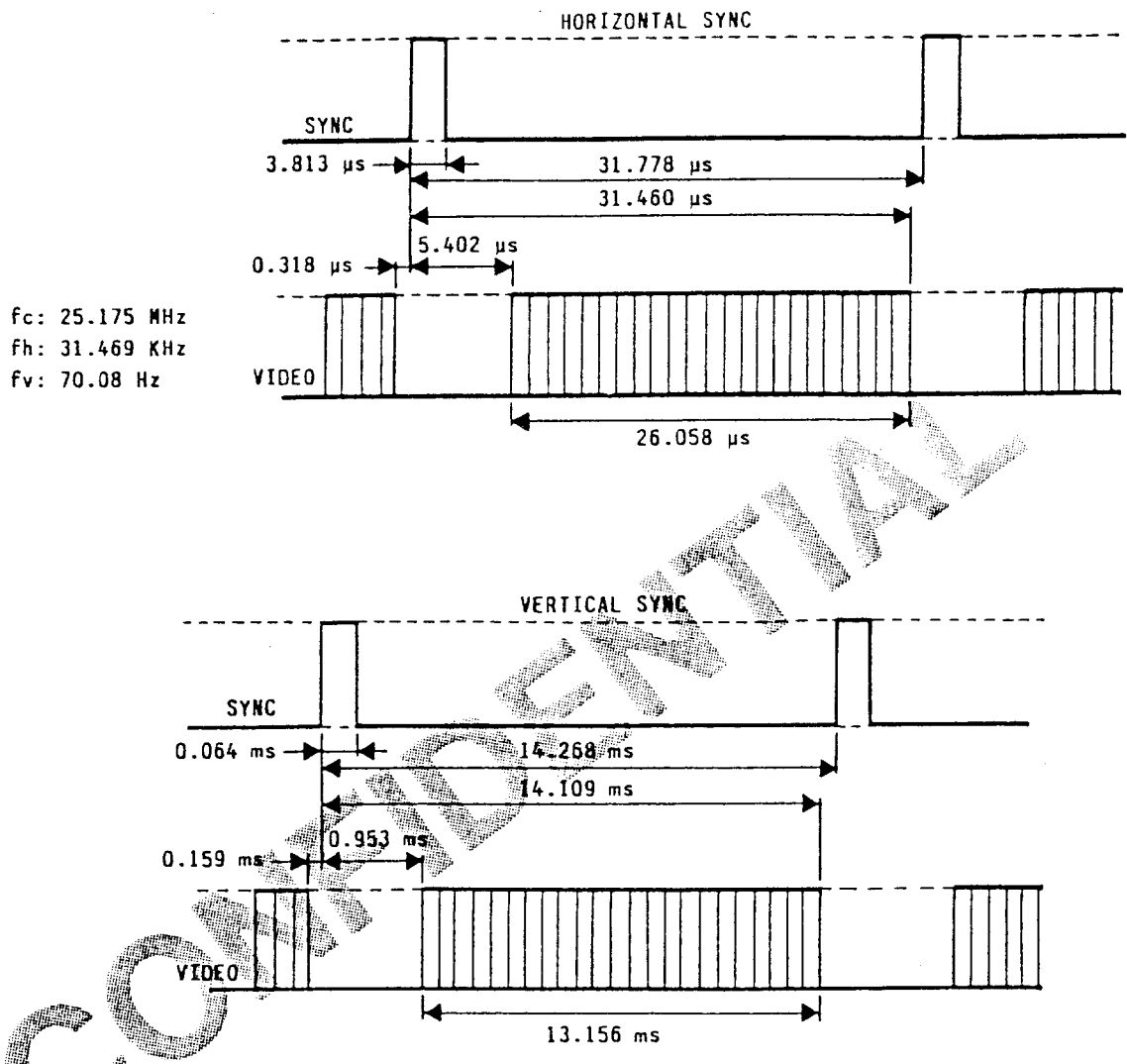


Fig. 1-9 Timing Diagrams

TIMINGS (with vertical resolution of 480 lines/60 Hz)

Scan frequency:	Horizontal (Fh)	31.469 KHz
	Vertical (Fv)	59.94 Hz
Total video period:	Horizontal	31.778 μ s
	Vertical	16.683 ms
Video active period:	Horizontal	26.058 μ s
	Vertical	15.762 ms
Video blank period:	Horizontal	5.720 μ s
	Vertical	0.921 ms
Rising edge:	Horizontal	0.318 μ s
	Vertical	0.064 ms
Falling edge:	Horizontal	1.589 μ s
	Vertical	0.793 ms
Sync:	Horizontal	3.813 μ s
	Vertical	0.064 ms
Pixel period:		39.722 ns
Pixel frequency (Fc):		25.175 MHz
Scan mode:		Non-interlacing

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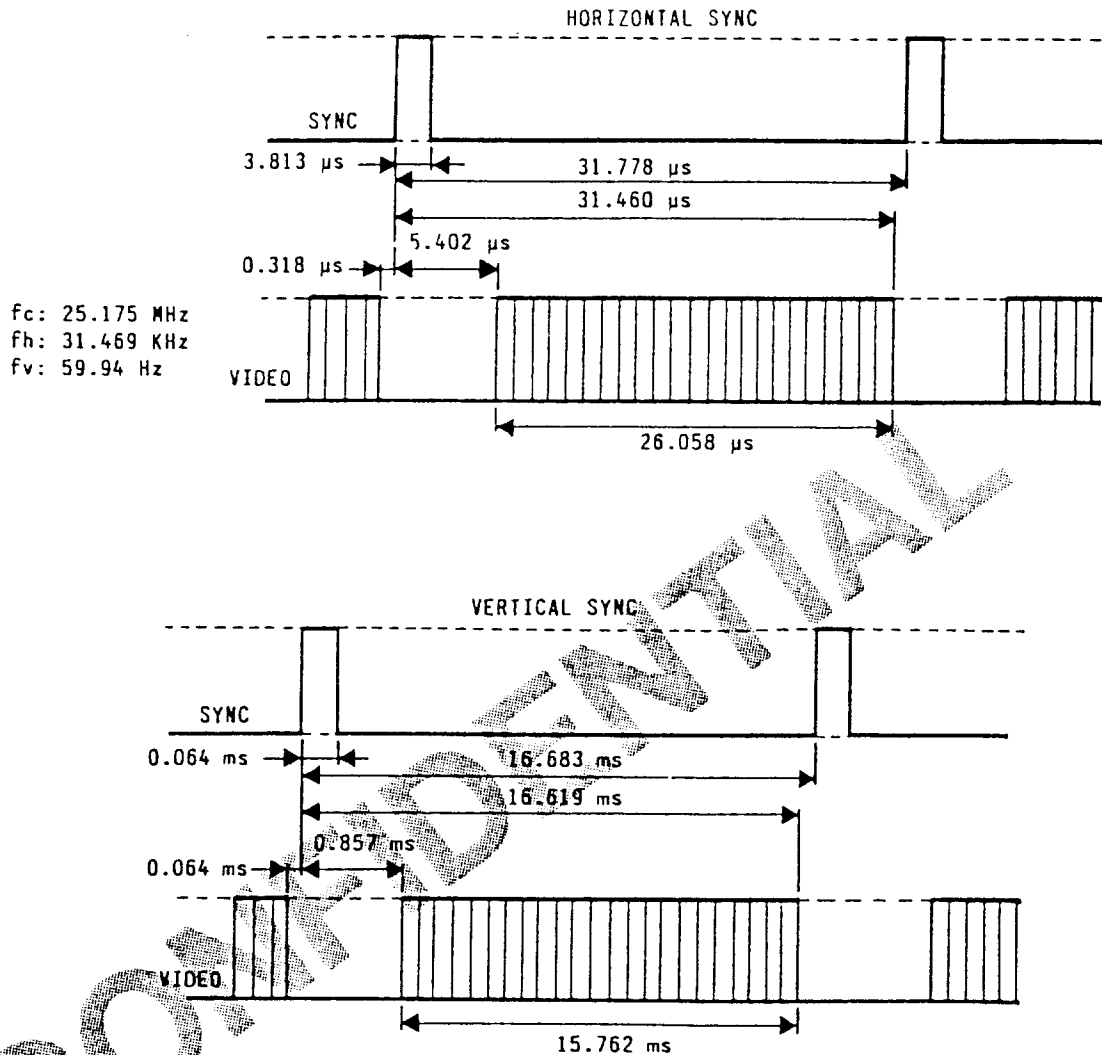


Fig. 1-10 Timing Diagrams

VIDEO CHARACTERISTICS

DATA AREA (Columns)	VIDEO ACTIVE HORIZONTAL (Columns)	DATA AREA (Lines)	VIDEO ACTIVE VERTICAL (Lines)
640	656	350	362
640	656	400	414
640	656	480	496

Fig. 1-11 Video Resolution

Note: Adjustments of video dimensions, linearity, centering and distortion must be made with the 640 x 480 video resolution.

Video dimension and centering adjustments on the vertical plane, however, may also be made with the following combinations:

- 640 x 350/70 Hz
- 640 x 400/70 Hz
- 640 x 350/50 Hz

Where not otherwise specified, the unit standard settings under test conditions are as follows:

- Vertical resolution: 480 lines/60 Hz
- Input voltage level: 467 mV
- Brightness: Default value
- Luminescence: 136 Nit (in centre of pattern)
- Test pattern: As required

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Video Dimensions

Dimensions of the data area on the screen horizontal and vertical axes must be as follows:

Horizontal 207 ± 2 mm (when measured at 136 Nit)
 Vertical 180 ± 4 mm (when measured at 136 Nit)

Picture Centering

With reference to the following figure, ensure that these conditions are met:

$$L = R = A1 = A2 = A3 = A4$$

$$U = D = B1 = B2 = B3 = B4$$

Maximum variation of picture position must respect the following conditions:

$L - R$	$< 4\text{mm}$	$U - D$	$< 4\text{mm}$
$A1 - A2$	$< 4\text{mm}$	$B1 - B2$	$< 4\text{mm}$
$A3 - A4$	$< 4\text{mm}$	$B3 - B4$	$< 4\text{mm}$
$A1 - A3$	$< 2\text{mm}$	$B1 - B3$	$< 2\text{mm}$
$A2 - A4$	$< 2\text{mm}$	$B2 - B4$	$< 2\text{mm}$

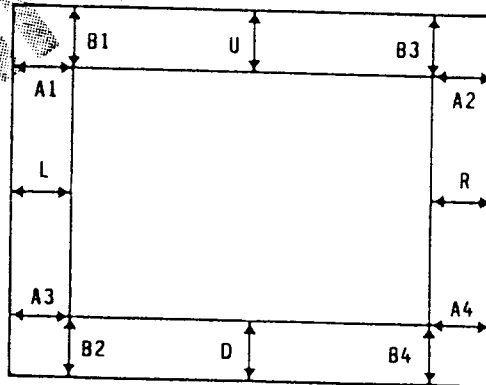


Fig. 1-12 Picture Centering

Geometric Distortion

Some geometric distortion, such as pincushion, trapezoid, rhombus, etc., is tolerated, provided within the limits shown in figure 1-13, where A = 2 mm and B = 2 mm.

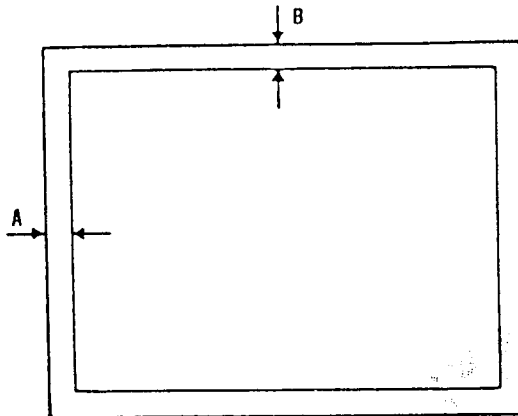


Fig. 1-13 Geometric Distortion Limits

Linearity

With reference to the following figure, linearity of the picture on display must correspond to the following criteria:

A - B < 2 mm	E - F < 2 mm
B - C < 2 mm	F - G < 2 mm
C - D < 2 mm	E - G < 2 mm
D - B < 2 mm	
C - A < 2 mm	
A - D < 2 mm	

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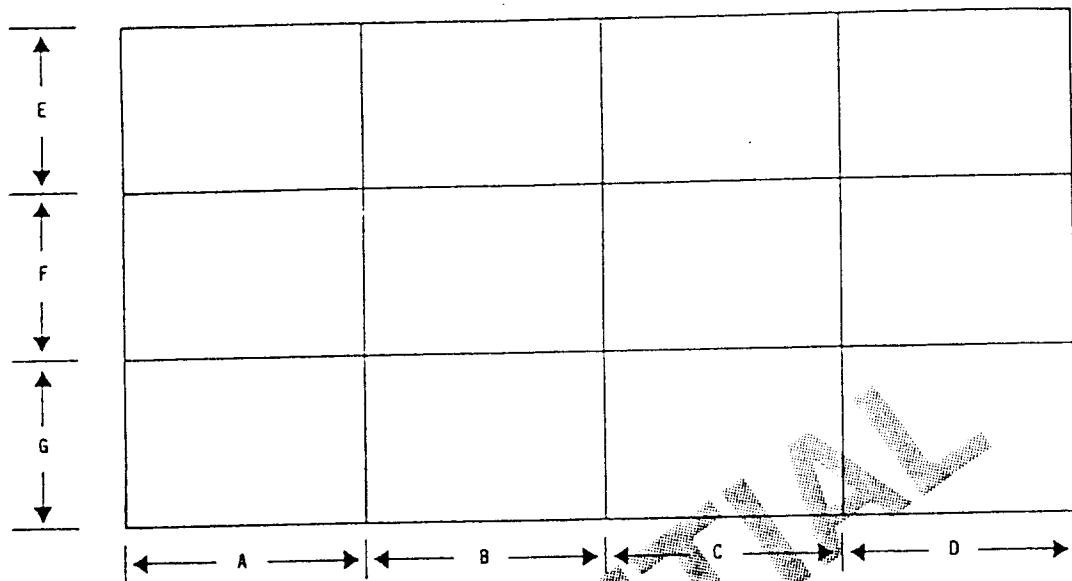


Fig. 1-14 References for Linearity Conditions

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VIDEO GENERAL DESCRIPTION

Figure 1-15 provides a block diagram of the video.

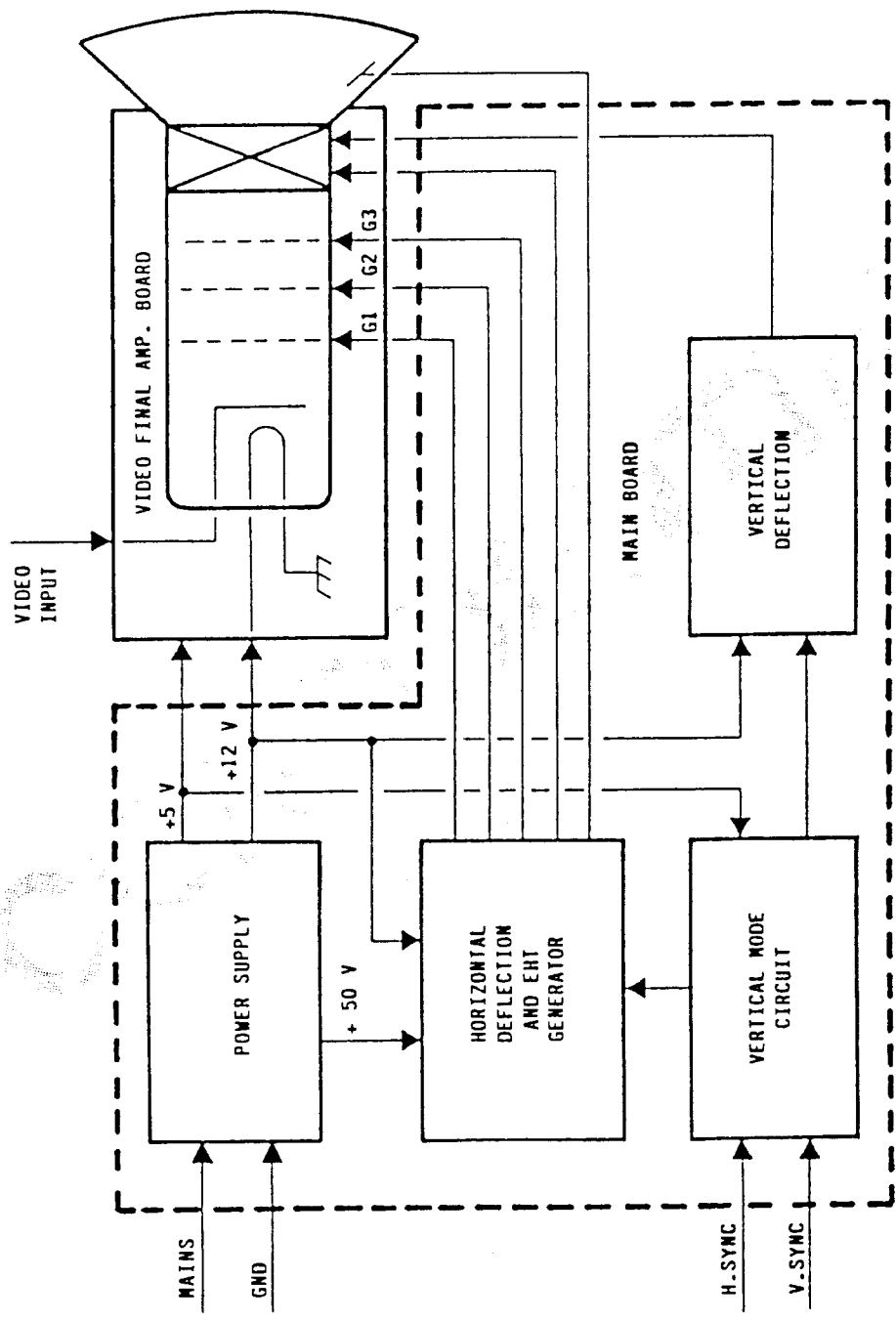


Fig. 1-15 Video Block Diagram

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The main component parts of the block diagram are:

- Cathode ray tube
- Power supply
- Horizontal deflection circuit and EHT transformer
- Vertical deflection circuit
- Mode circuit
- Video final amplifier circuit.

A detailed description of these blocks is given on the following pages.

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CATHODE RAY TUBE

The main component of the display is the 12" monochrome cathode ray tube, with a deflection angle of 90° . The electrical configuration of this component is illustrated in the figure below

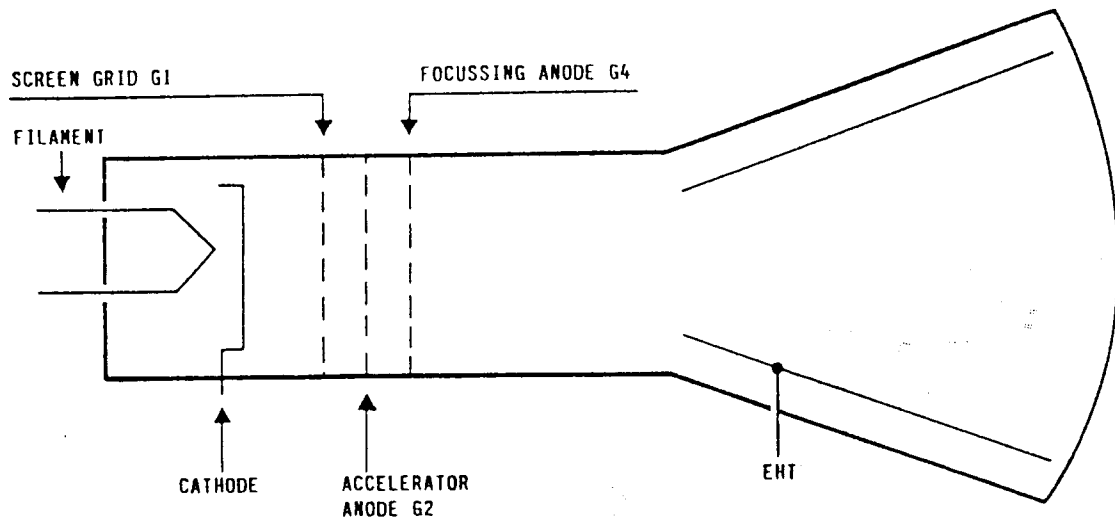


Fig. 1-16 Cathode Ray Tube

The surface of the cathode is heated indirectly by the filament and emits a cloud of electrons, which is controlled, focussed and accelerated by the electrodes of the tube, to all of which a like potential is applied. On the accelerator electrode surrounding the tube neck, there is a voltage of approximately 12 kV.

The voltage is supplied to this anode by the high voltage section of the circuit (transformer TH2) and produces a strong acceleration of the electrons. The concentrated and accelerated beam of electrons (Spot) strikes the phosphor surface which emits energy in the form of light.

By regulating the potential of the control grid G1, the amount of electrons going to strike the phosphor can be varied, and, hence, the light intensity of the dot. Control grid G1 is negatively polarized with respect to the cathode so that the more negative the voltage, the fewer are the electrons that reach the screen and vice versa. On the basis of this principle, by varying the voltage of the grid, the electron beam is modulated from white to black, thus reproducing all the shades of grey forming the pictures on the screen.

The first accelerator anode (G2), together with focussing anode G3, constitutes an electronic lens designed to concentrate the electrons into a spot of reduced dimensions.

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POWER SUPPLY

The monitor has an switching type power supply (see figure 1-17) and converts the mains a.c. voltage into the stabilized d.c. voltages needed for the various sections of circuitry. The input voltage range with which the power supply can operate is (85-264 Vdc), at 50-60 Hz.

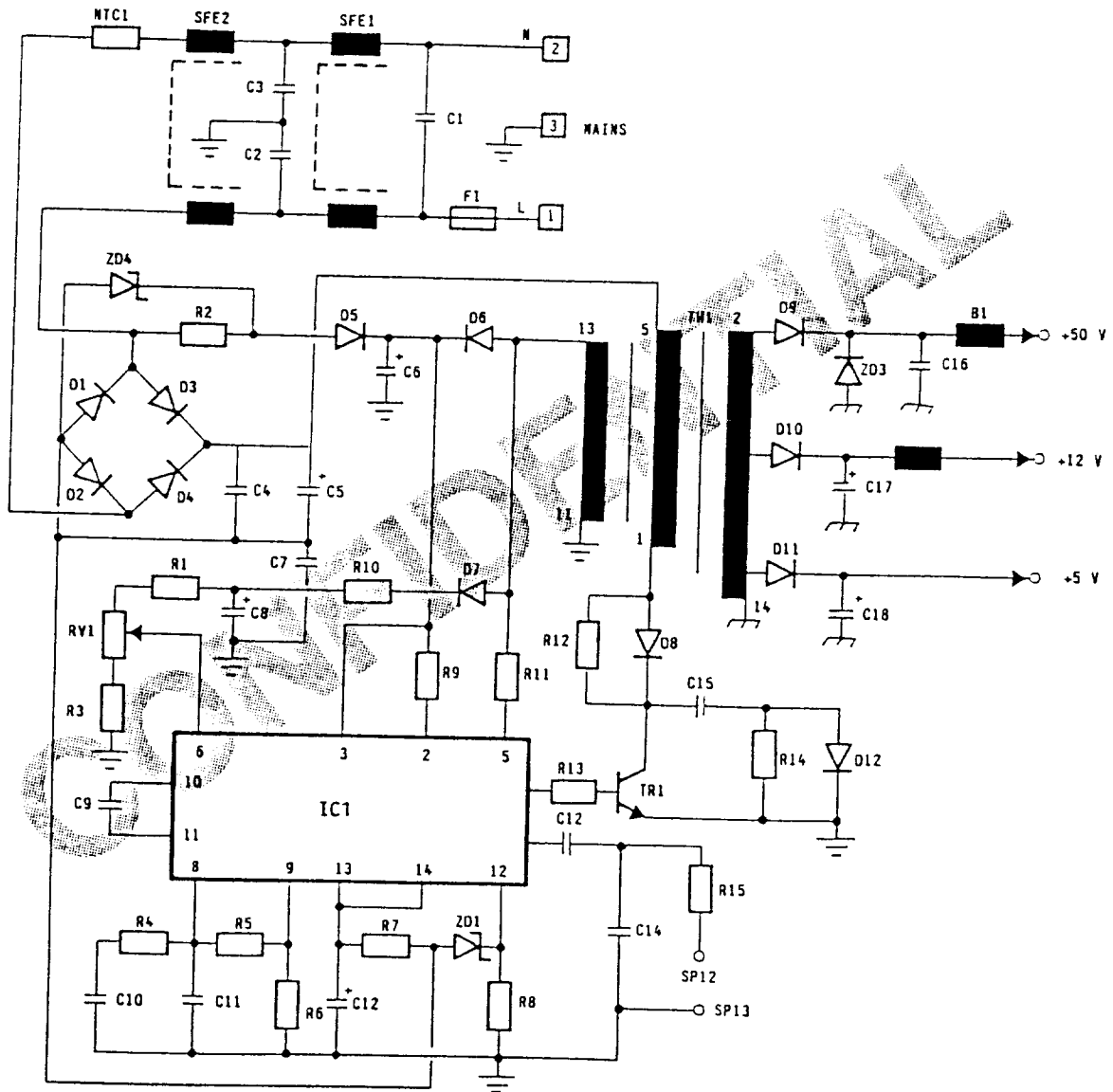


Fig. 1-17 Switching Power Supply

The main circuits comprising the power supply are:

- Mains rectifier and filter circuit
- Switching and overload protection circuit
- Control and sync circuit.

The various circuits are described below.

Mains Rectifier and Filter

To avoid the transients generated by operation of the power supply from being propagated throughout the power network, a filter has been inserted in the power supply circuit (figure 1-17).

This filter consists of coils SFE1 and SFE2, with capacitors C1, C2 and C3, where SFE1 acts in the high range and SFE2 in the low range of the switching-generated noise.

Fuse F1 provides mains protection, whereas NTC1, with its rectifier diodes, is designed to limit inrush current peaks when the unit is switched on. Power is provided for the autostart control circuit by way of R2, D5 and C6 on switching on.

When this initial period is over, zener ZD4 acts as a voltage limiter while C4 and C5 smooth the voltage provided for the switching phase.

Switching and Overload Protection Circuit

As seen above, this power supply is of the flyback or switching type and has a relatively simple principle of operation.

Transistor TR1 (figure 1-17) acts as an electronic switch with variable duty cycle, controlled by integrated circuit IC1. During conduction, the secondary windings of TH1 draw no energy and, thus, the current flowing in the primary causes TH1 to be degaussed.

When TR1 is open, the energy stored by TH1 in the form of magnetic energy generates a phase voltage suitable for transfer of energy to the TH1 secondaries, degaussing the core of TH1.

The +12 V adjustment network supplies the integrated control circuit (IC1) with the information it requires to establish the TR1 open and close times.

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The amount of energy transferred will be sufficient to keep the +12 V constant, in spite of load and mains variations.

Regulation of this circuit is of the indirect type, in that it is performed on the primary (so as to obtain mains insulation); however, mutual coupling of the transformer windings is of a sufficiently high level as to guarantee properly regulated secondary voltages.

The components associated with the TR1 collector are designed to protect this device from the overvoltages liable to be created on the collector at the time of opening (clamping network). IC1 current on switching-on is approx. 1 mA, the size of the current being determined by components R2 and D5. The trigger value on pin 3 is approx. 6 V, above which value the integrated circuit starts to demand more current.

Voltage on pin 3 (and on capacitance C6) starts dropping, until another current flows through D6. If the voltage is already below 4.9 V, the integrated circuit returns to starting conditions.

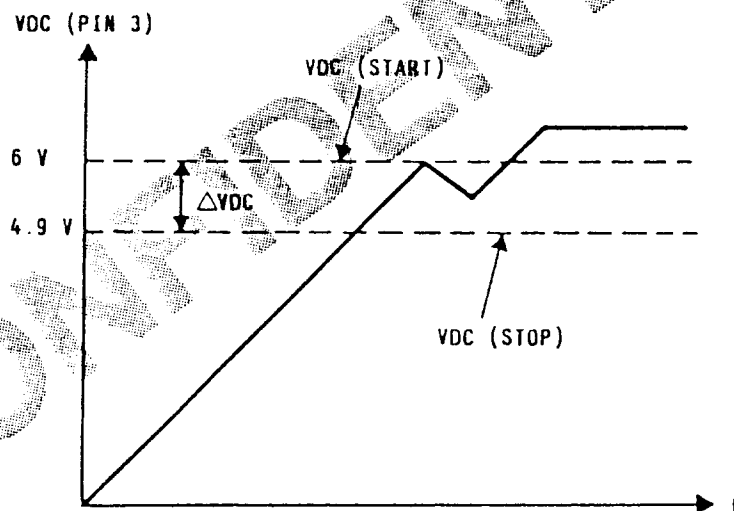


Fig. 1-18 Behaviour of Voltage on IC1 Pin 3

R11 allows IC1 to perform TR1 switching only when the core is demagnetized. R1 is the control resistor, limiting current by way of TR1, whereas ZD1, connected to the negative pole of the rectifier bridge, supplies the TR1 emitter the negative polarity of 2-3 V guaranteeing it stays shut down.

D7, R10, C8, RV1 and R3 form a network to rectify, control and filter the IC1 reference voltage. The output voltages are regulated by way of RV1.

Control and Sync Circuit

The control circuit consists of integrated circuit IC1 (figure 1-19), which, as has already been seen, builds the signals for TR1 opening and closing in function of the regulation circuit (pin 6), power limiter (pin 5) and external sync (pin 7).

In addition, IC1 also provides the base TR1 current (pin 1), ensuring it stays in a zone of safety by way of its inbuilt, heat protection.

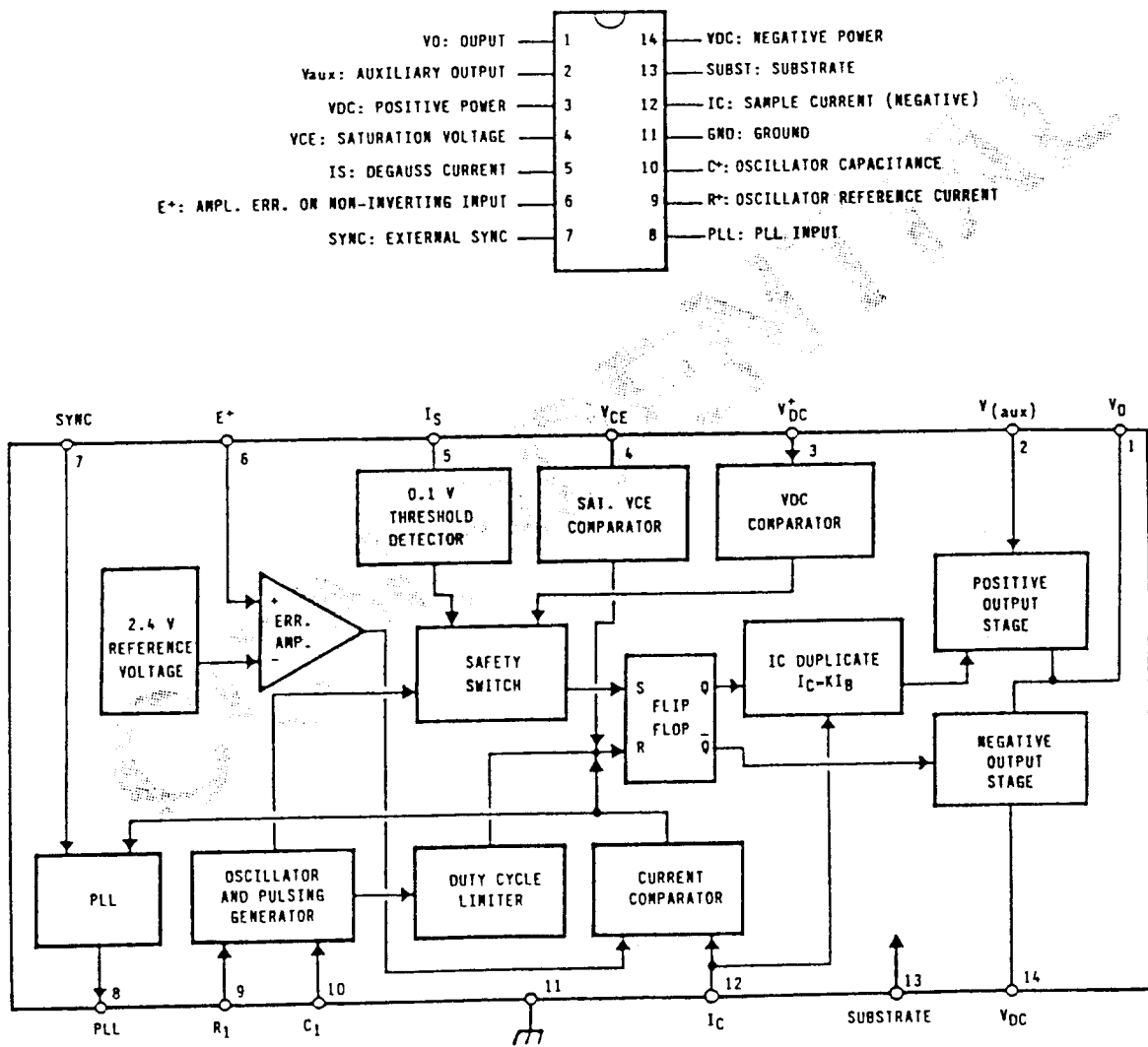


Fig. 1-19 Block Diagram of Integrated Circuit TEA2019 (IC1)

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To avoid noise, caused mainly by electromagnetic induction, from affecting the picture on the screen, TR1 switching is performed during the horizontal flyback time.

For this purpose, the blanking pulse is picked up by way of a turn coupled to the row transformer, and brought, by way of R15 and C13, to the sync circuit (pin 7) of IC1, which has phase control provided by an internal loop.

In the absence of sync (pins 10 and 11), oscillation frequency is set by C9, while the PLL circuit is completed by a network brought to pins 8 and 9.

DEFLECTION CIRCUITRY OR RASTERING

The operations described up to now lead to production of a dot of light in the centre of the screen.

To be able to obtain a picture on the screen, the electron beam must be moved from one side of the screen to the other.

In this way, a line of light will be displayed across the screen.

This is the function performed by the "Horizontal Deflection Circuit".

Similarly, the beam may be moved from the bottom towards the top so as to display lines of light all over the screen.

This is the function of the "Vertical Deflection Circuit".

When the whole process is performed with a certain rapidity, the entire screen area is illuminated.

This process is known as "rastering", whereas the dimly lit screen, with no information or data present, is known as the "raster".

The deflection yoke is a series of electromagnetic coils wound in a certain horizontal and vertical fashion around the neck of the tube and is the main means of deflecting the electron beam.

HORIZONTAL DEFLECTION AND EHT TRANSFORMER CIRCUIT

This circuit comprises the following elements:

- Horizontal phase adjustment
- Drive circuit
- Power circuit
- EHT transformer.

Low Power Circuits

The first two functions described above are performed by integrated circuit IC4 (TDA2593) which handles all the functions inherent in horizontal sync signal processing, transforming it into a signal fit to drive the power stage for horizontal deflection.

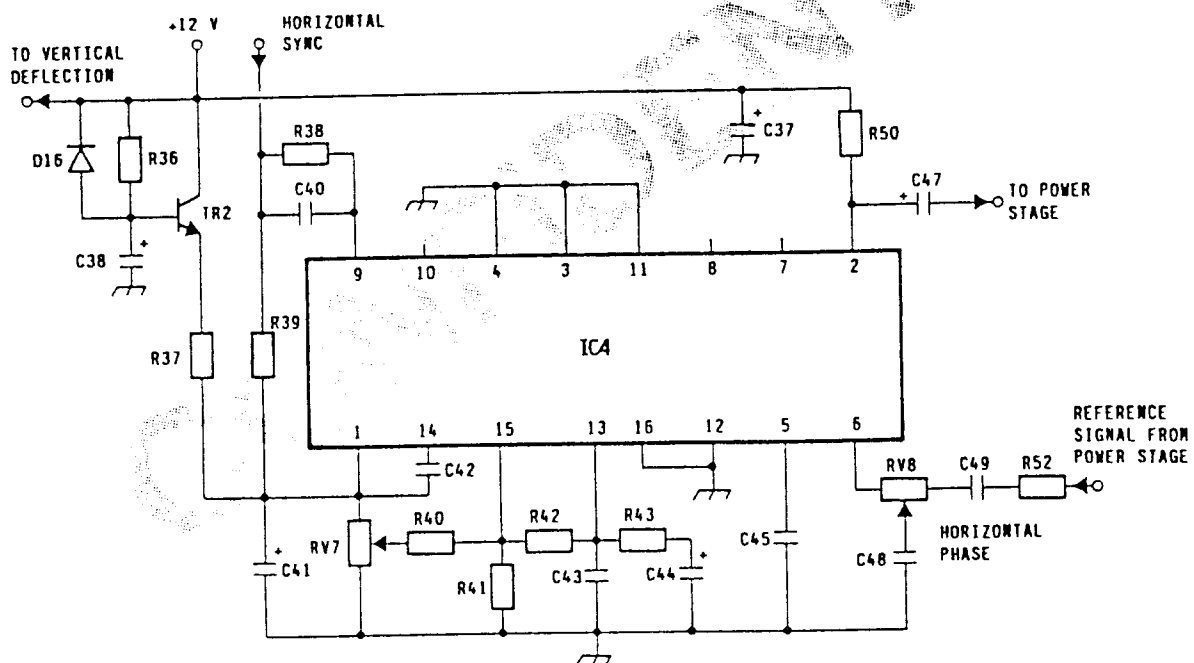


Fig. 1-20 Horizontal Deflection Drive Signal

The sync signal is brought to pin 9 by way of components R38 and C40, which form a filter network eliminating any high frequency components. Resistor R39 is responsible for polarizing the sync amplifier input.

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The +12 V power is brought to pin 1 of IC4 by TR2 which, together with its associated components (R36, D16 and C38), acts as an electric filter (anti-ripple) and powers that part of the processing which needs a filtered, noise-free voltage.

The output signal is to be found on pin 2, from where it is brought by way of C47 to the base of TR4, which constitutes the horizontal deflection circuit power stage.

The reference signal, coming from the power stage, is taken to pin 6 and is input to a phase comparator together with the signal coming from the oscillator. The whole system forms part of an integrated circuit internal loop, bringing the reference signal phase back to a constant value with respect to the sync, and thus compensating for thermal drift and component tolerances.

RV8 and C48 form a variable phase shifter, by means of which the phase difference between the deflection and the sync can be regulated, using RV8, so that the picture can be centered horizontally.

Potentiometer RV7 is used to set the free oscillation frequency when there is no sync. The components connected on pins 5, 13, 14 and 15 are part of the phase comparator and loop described earlier.

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Power and EHT Transformer Circuit

These two sections perform the following functions:

- Generation of the sawtooth current needed to produce the horizontal deflection.
- Generation of the EHT of approx. 13 kV (extra high tension) needed to power the second anode of the CRT.
- Generation of the other voltages needed for tube polarization and video amplification.

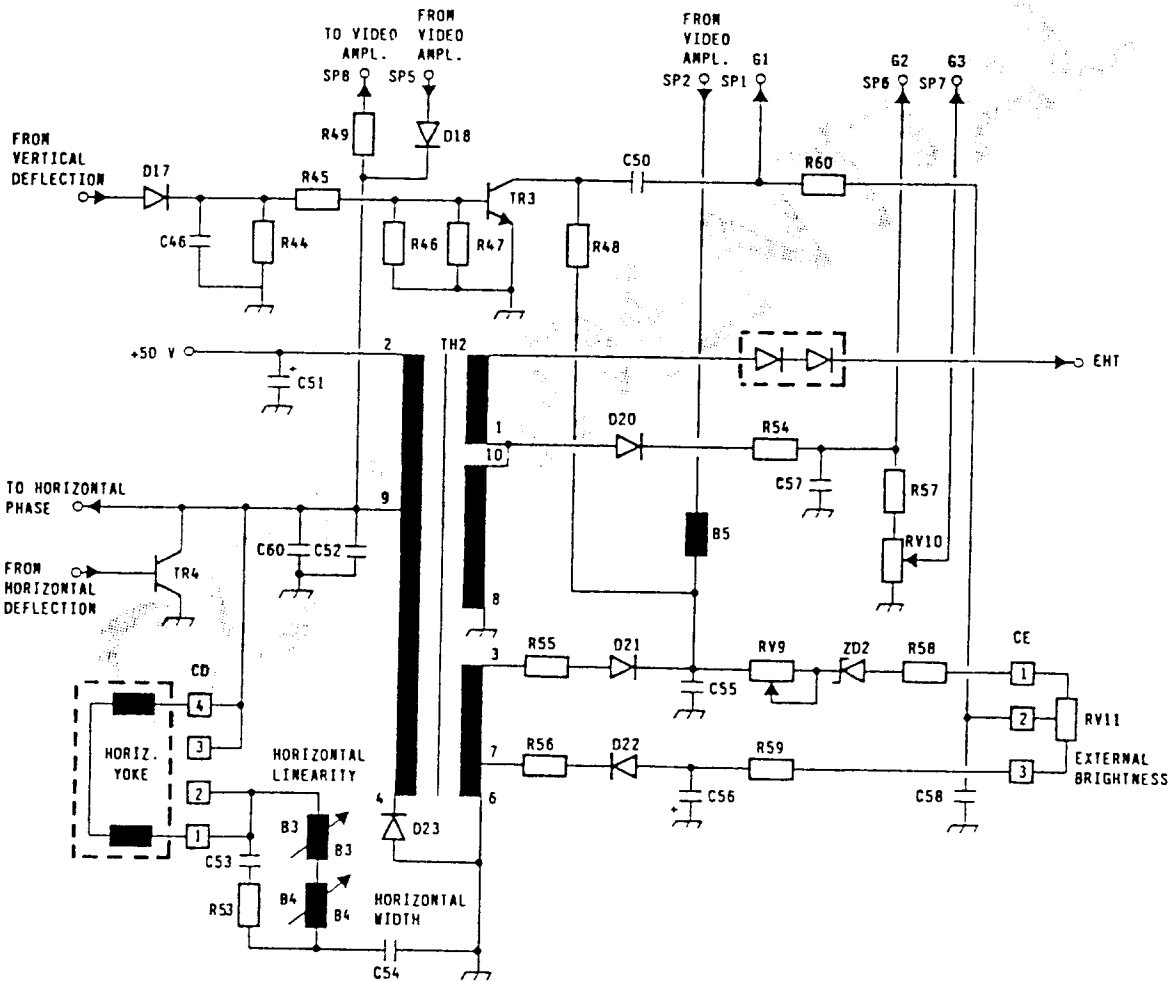


Fig. 1-21 Power and EHT Generator Circuit

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A. Sawtooth current generation

The sawtooth current is generated by transistor TR4, which acts as a switch on the inductive load (deflection yoke and EHT transformer primary), aided by diode D23.

When transistor TR4 is driven into conduction by the inductance of the yoke and row transformer TH2, there is an almost linear increase in current, forming a part of the sawtooth (from the centre of the tube to one side), and, at the same time, a corresponding amount of magnetic energy is stored by the yoke and the transformer.

When TR4 opens, the energy connected to the circuit is transferred to C60 and C52 (parallel with yoke and TH2) in a time of about 2 us, so that a voltage of about 500 V is set up on the terminals, while the current in the yoke and transformer is cancelled out in a similar time, thus bringing deflection back to the centre of the tube.

The voltage on C60, C52 and, thus, on the transformer TH2 primary, is manipulated to produce, with the right turns ratio, the voltages needed for power supply of the tube, the EHT in particular. Energy stored up by C60 and C52 is, at this point, sent back into the magnetic circuit, inverting the current sign.

In a time again of approx. 2 us, the voltage on the terminals of C60 and C52 drops to zero and the yoke current reaches its negative peak (deflection from centre of tube to the other side).

Deflection is thus produced from one side of the tube to the other in a time of about 4 us. This period coincides with the sawtooth return time and is practically invisible as the electron beam is off during this stage.

In series with the deflection yoke are coils B3, B4 and capacitor C54. The coils are used for linearity and deflection width correction, respectively, while the capacitor performs the S-correction on the current needed to produce the right speed/deflection angle ratio at the edges of the screen.

B. EHT generation

Transformer TH2 has a secondary with a high turns ratio and an inbuilt, high voltage rectifier diode.

The impulse voltage of approx. 500 V on the primary during the sawtooth current return is picked up and rectified by this winding and brought up to the value of approx. 13 kV needed by the tube anode. This voltage is levelled as required by the tube's own capacitance.

C. Auxiliary voltage generation

The other secondaries of TH1, together with associated components, see to generation of the voltages needed for tube and video bias as follows:

- By way of D20, R54, C57, a voltage of approx. 500 V is obtained for the first anode of the tube (grid G2).
- With variable divider R57, RV10, the voltage is obtained to polarize the focus grid (G3) of the tube from zero to 450 V approx.
- R55, D21, C55 rectify and smooth a voltage of 65 V approx. to supply the video amplifier and B5 decouples the above circuit from the power network of the control grid (G1) comprising RV9, ZD2, R58, RV11 and R59.
- RV9 allows the grid to be given the base that corresponds to raster switching-off (RV11 set to maximum) whereas RV1 (external to circuit) regulates brightness of the video picture.
- D22 and C57 are used to obtain a negative voltage to allow RV10 to work in the correct adjustment field.
- ZD2 is designed to protect the CRT phosphor when the monitor is switched off, by interrupting the grid power supply circuit when the voltage on its terminals drops below 33 V, thus leaving the grid hanging on to the C56 negative potential.
- TR3, together with associated components, is designed to form a pulse at the end of each vertical deflection cycle and then, through R60, to sum a pulse of about 30 V to the grid controlling the vertical retrace switch-off.
- The base of TR3 is connected to the vertical deflection amplifier output by way of a signal delay and divider network made up of D17, C46, R44, R45 and R46.
- R47 and R48 divide the TR3 power supply voltage while C50 and R60 couple the signal to the grid circuit.
- From the collector of TR4, the impulse signal corresponding to the video amplifier retrace is picked up. This signal has a dual purpose: to switch off the video during the retrace period and to re-establish the correct amplifier direct current level on each horizontal scan line.

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VERTICAL DEFLECTION CIRCUIT

The function of this circuit is to generate a sawtooth current in the vertical deflection coil, in sync with the horizontal deflection current.

The sync comes from the vertical mode circuit, which sees that integrated circuit IC3 has the right sync and adjusts deflection width in function of frequency. The circuit in question is illustrated in the figure below.

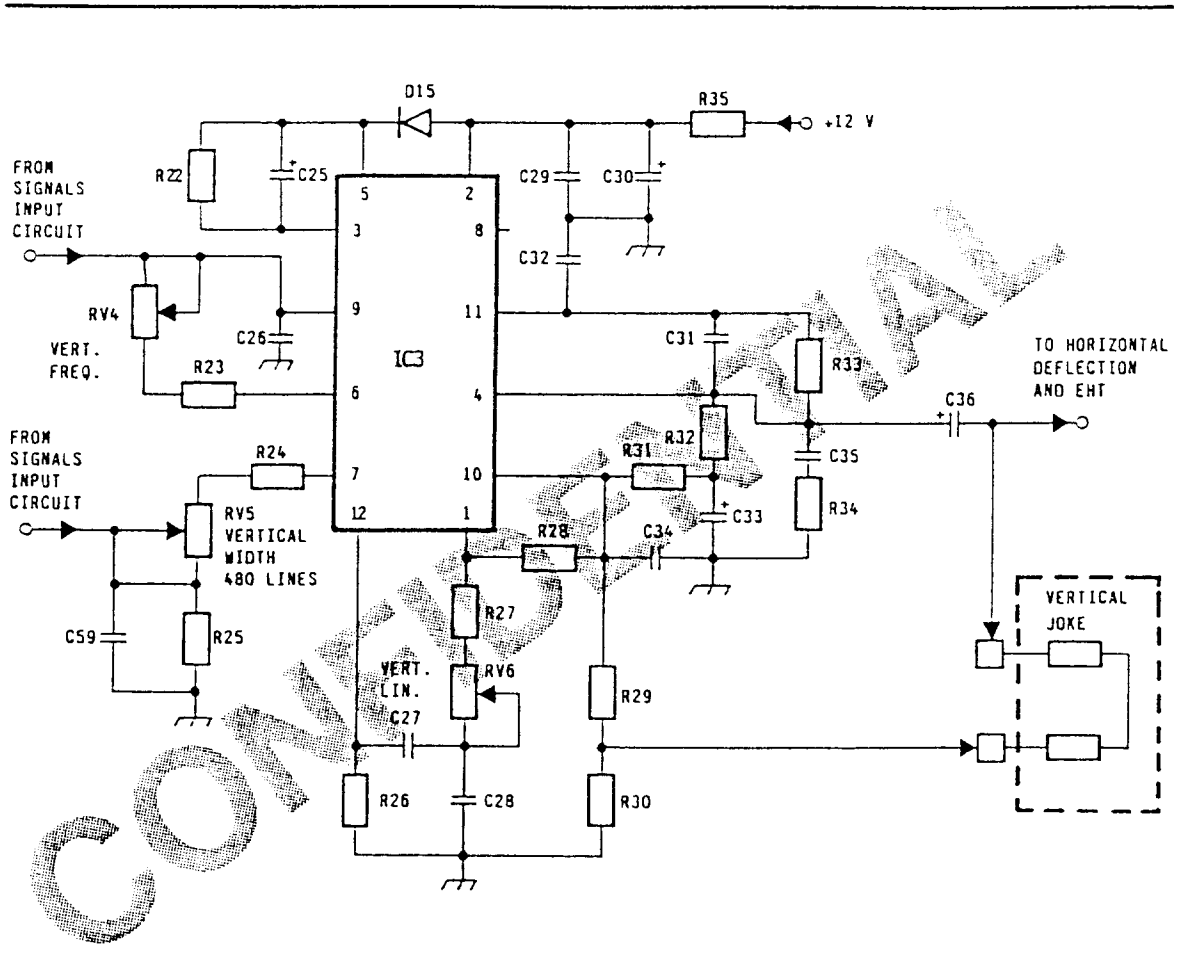


Fig. 1-22 Vertical Deflection Circuit

THEORY OF OPERATION

The oscillator takes its sync from the signal coming from integrated circuit IC2. While the network consisting of C26, R23, RV4 is used to establish a free-running oscillation frequency in the absence of sync. RV4 will be set so that this frequency coincides roughly with a frequency of 46 Hz.

Stage amplification is the work of components RV5, R24 and R25, which establish the amount of current lifted from pin 7 and, thus, vertical width. In the 480 line standard, linearity correction is provided by RV6, whereas, in the 350 and 400 line modes, the correction values are summed to RV5 by the vertical mode circuit described below.

R26, C27, C28 form the network establishing the S-correction factor. Deflection current is provided by IC3 itself, within which the power stage is to be found. Associated to the power stage are the components connected to pins 4, 10, 11 and 5, and which perform the following functions:

- C35, R34, C31 and C32 grant the amplifier stability at high frequencies
- R33, R32, C33 and R31 see that there is d.c. stabilization of the work dot
- C36 couples the deflection coil return while R29 and R30 form an a.c. feedback network
- D15, C25 and R22 are used to produce a shorter flyback time.

IC3 power is decoupled by R35, C30 and C29.

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VERTICAL MODE CIRCUIT

As already stated, the monitor can operate at three different vertical deflection frequencies (350, 400, 480 lines). Information on the three different operating standards is handled by the computer and is contained in the polarity of the sync signals.

Two separate horizontal and vertical sync lines of different bias mean that there are four different combinations, decoded by way of the circuit shown in the figure below.

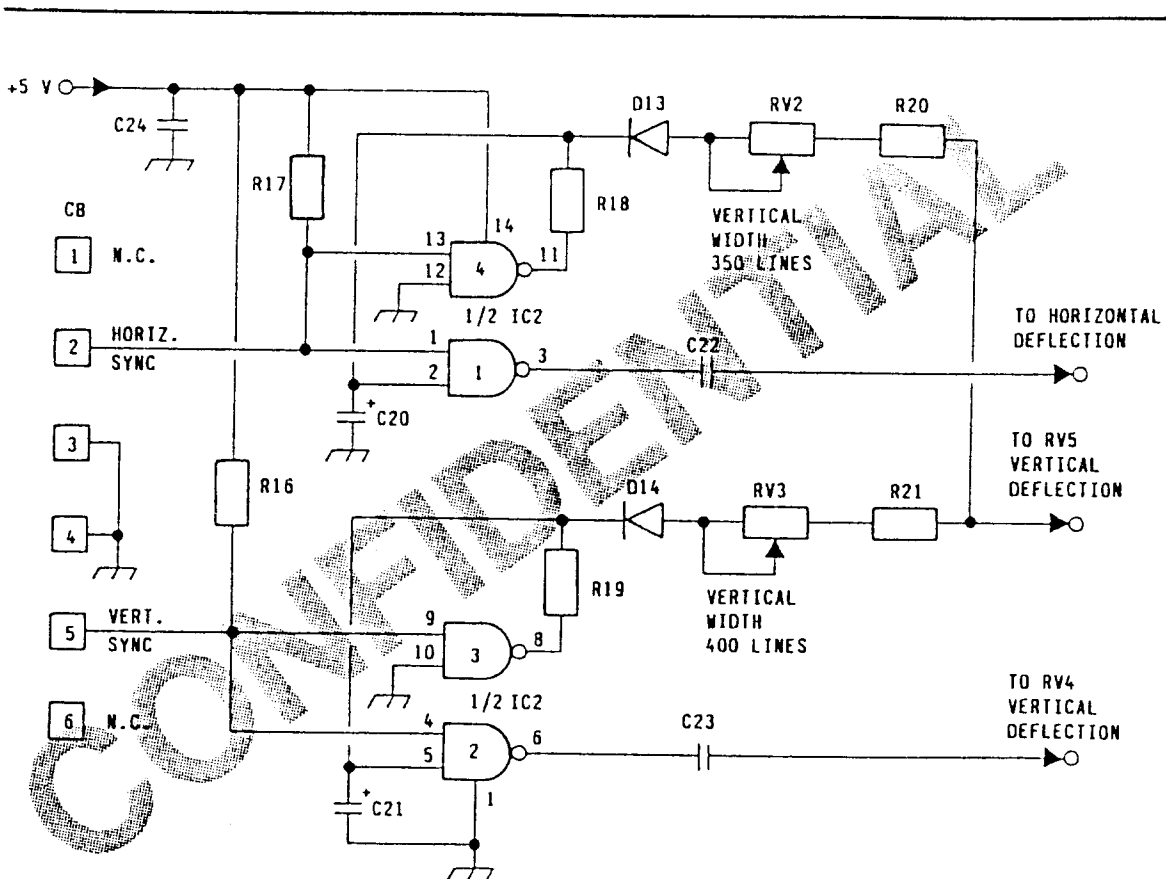


Fig. 1-23 Vertical Mode Circuit

By way of RV2, R20, RV3 and R21, the circuit also provides vertical deflection width correction, in the function of the sync sent out.

The figure below shows how the operating standards are encoded.

LINES	HORIZONTAL SYNC	VERTICAL SYNC
350	Positive	Negative
400	Negative	Positive
480	Negative	Negative
Not defined	Positive	Positive

Fig. 1-24 Operating Standards Encoding

Integrated circuit IC2 is an exclusive OR gate so that sections 1 and 2 switch with both negative and positive sync signals (irrespective of the output status of sections 3 and 4), in this way synchronizing the relative amplifiers by way of C22 and C23.

Section 4, by way of D13 and R18, takes RV2 and R20 (in parallel with RV5 in vertical deflection circuit) to ground when the horizontal sync is positive (350 lines), and vice versa.

Section 3 performs a similar role by way of D14, RV3 and R21 when the vertical sync is positive (400 lines).

When both the sync signals are negative (480 lines), no correction is performed in parallel with the vertical width control circuit (outputs of sections 3 and 4 high, with D13 and D14 off).

VIDEO FINAL AMPLIFIER CIRCUIT

The video final stage (figure 1-25) is mounted on a circuit connected directly to the CRT socket, thereby not only reducing stray capacitance, which could narrow the video band, but also making it easier to implement more effective circuits offering protection against discharges occurring between the CRT internal electrodes (flashover phenomenon).

Such high potential discharges, even if brief, are lethal for the components of connected circuits if they are not quenched and absorbed by air or gas surge arresters, aided by resistors to clip any flyback currents. This protection function is entrusted to components SC101, SC102, SC103, R128, R129, R130 and a number of air dischargers.

Signals coming from the video interface are amplified by the circuit to a level of approx. 30 Vp-p, the value needed to obtain black and white levels. For this purpose, a cascode type circuit is used because of its wide passband feature.

As the same amount of current flows through transistors TR107 and TR108, the stage gain is roughly equivalent to the R126/R122 ratio.

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From the time the TR108 emitter is referred to ground, when the input signal is brought to zero volts, there will be no current flow in TR107 or TR108 and, as a result, no drop in the potential of R126. In this way, the cathode is polarized at +65 V, this being the CRT off condition (black level).

If, on the other hand, a positive signal is brought to the TR108 input, a proportional current will flow in the transistor, causing a drop on R126, and the cathode voltage will drop in value (white level). This is the opposite condition to the previous one, to which corresponds the electron beam maximum intensification.

Normally, the input signal is easily held within these limits by the interface circuit preceding this stage and which is designed to handle the video signal.

A brief description of components associated with the circuit, together with their functions, is given below:

- R121 avoids oscillations at high frequencies while R125 and C109 provide gain compensation in the same range;
- R122, together with R126, sets the power stage gain;
- R119, R120 and C108 provide TR107 with d.c. bias;
- R118, D102 and D18 (in horizontal deflection circuit) form a video switch-off circuit during horizontal flyback;
- R126, B101 constitute the TR107 load impedance; in addition, B101 is adjusted to compensate for loss in amplification at high frequencies;
- C110 decouples the power supply;
- D103 is a diode protecting TR107 and TR108 against CRT internal discharges (flashover). It prevents the voltage on TR107 from exceeding the power supply voltages limit level (65 V).

The video interface consists of the whole series of circuits preceding the video amplifier just described; it performs the following functions:

- TR106 is an impedance adapter stage coupling the signal to the video amplifier;
- TR105 is a d.c. restorer stage, whose input is connected by R49 to the horizontal deflection circuit; it re-establishes the video amplifier d.c. bias level during the row return period, thus maintaining the black level at a constant value;
- TR104, IC101 and TR101 and associated components constitute a differential video pre-amplifier stage, with d.c. gain regulation possibility. Gain is, in fact, regulated by varying the differential stage bias currents; this can be performed by the contrast d.c. network made up of RV101, RV102, R108, C102, R107 and C101;

THEORY OF OPERATION

- D102 is used to switch off horizontal flyback by way of D18 (horizontal deflection amplifier). What happens during flyback, is that D18 has a back bias and D102, through R188, polarizes TR107 into the off state.
- TR102 and TR103 are used to sum a self-test signal on the video input when the video signals connection cable is disconnected (otherwise, pin 5 is connected to ground and the circuit is thus inhibited). The self-test signal is obtained from the formation of a series of pulses in sync with the horizontal deflection and designed to keep the raster on when the connection with the computer is interrupted.

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UNAPPROPRIATE INFORMATION

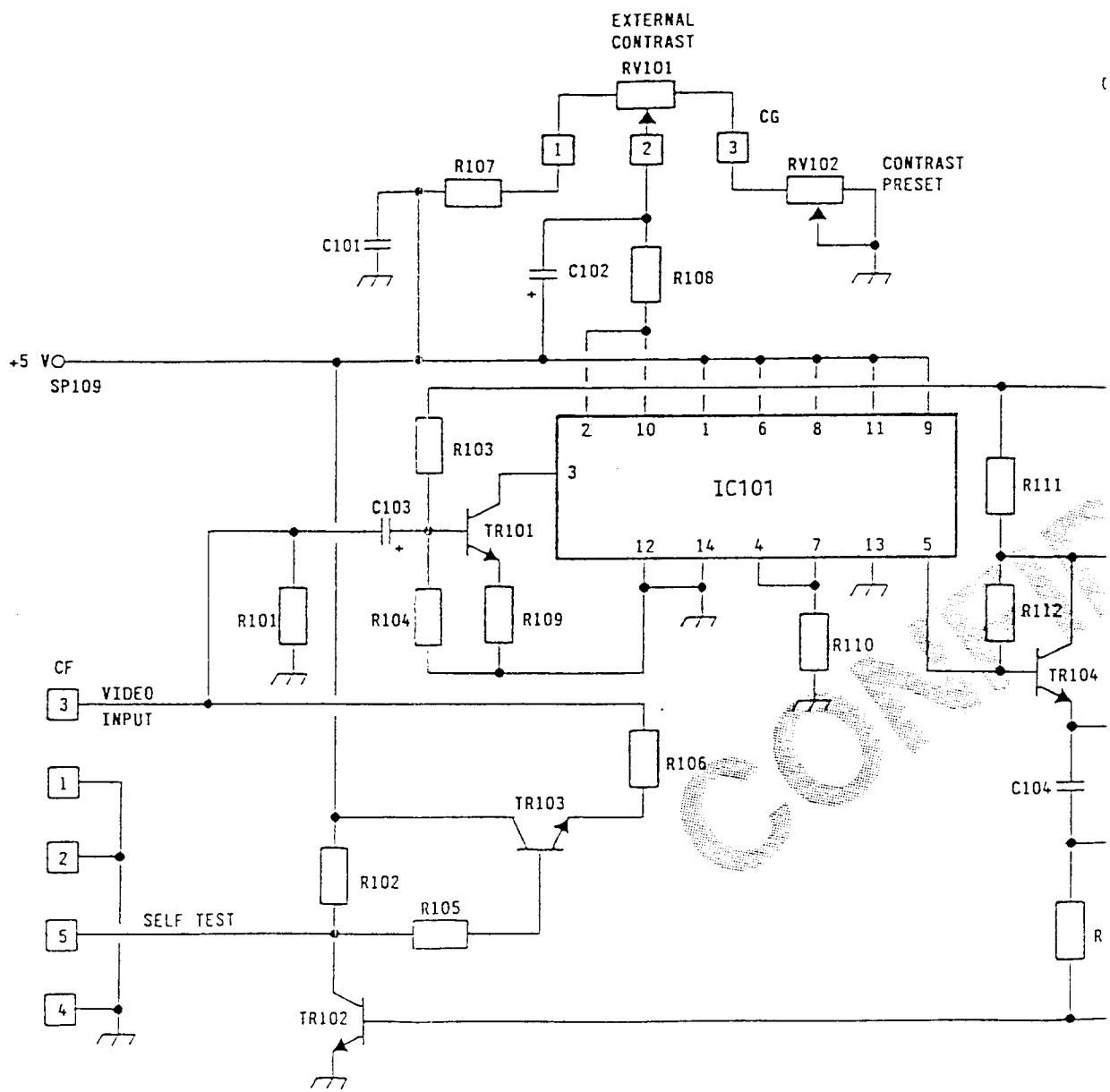
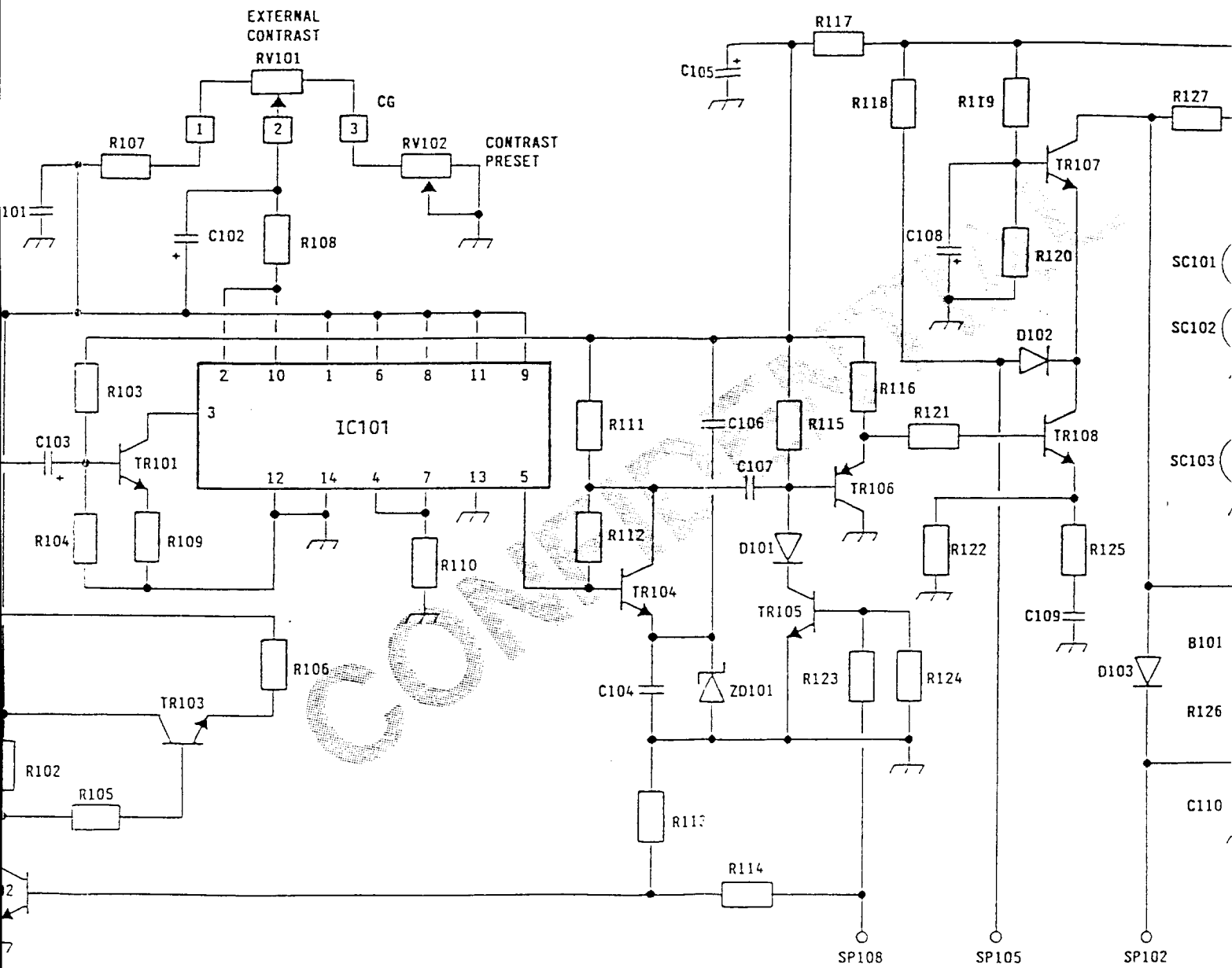
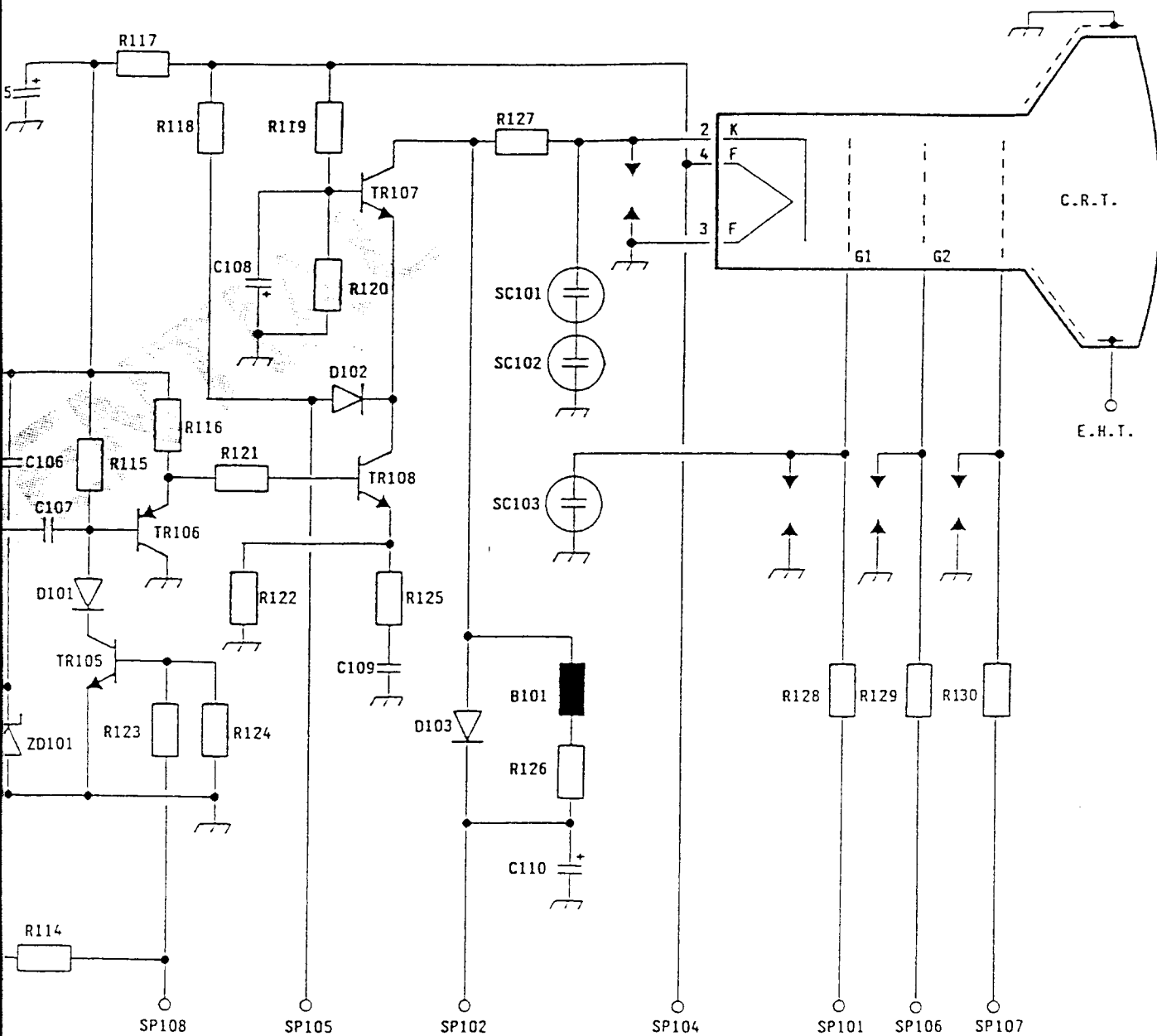


Fig. 1-25 Video Final Amplifier Circuit



lifier Circuit

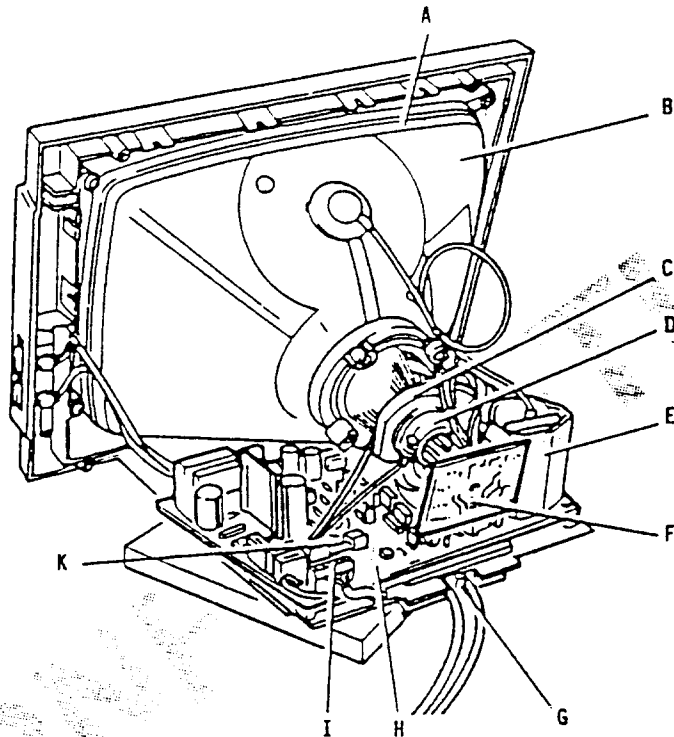


HANTAREX - MDU 1231 Monochromatic Video Display

LOCATION OF COMPONENTS

For disassembly instructions, see the section "Disassembly Instructions".

VIDEO COMPONENTS



- | | | | |
|---|---------------------|---|-------------------------|
| A | DEGAUSS COIL | F | VIDEO FINAL BOARD |
| B | CRT | G | INPUT SIGNALS CONNECTOR |
| C | CONVERGENCE YOKE | H | MAIN BOARD |
| D | DEFLECTION YOKE | I | TERMINAL STRIP (CE) |
| E | FLYBACK TRANSFORMER | K | FUSE |

Fig. 1-26 Video Components

The following figures illustrate layout of the video final amplifier board and of the main board.

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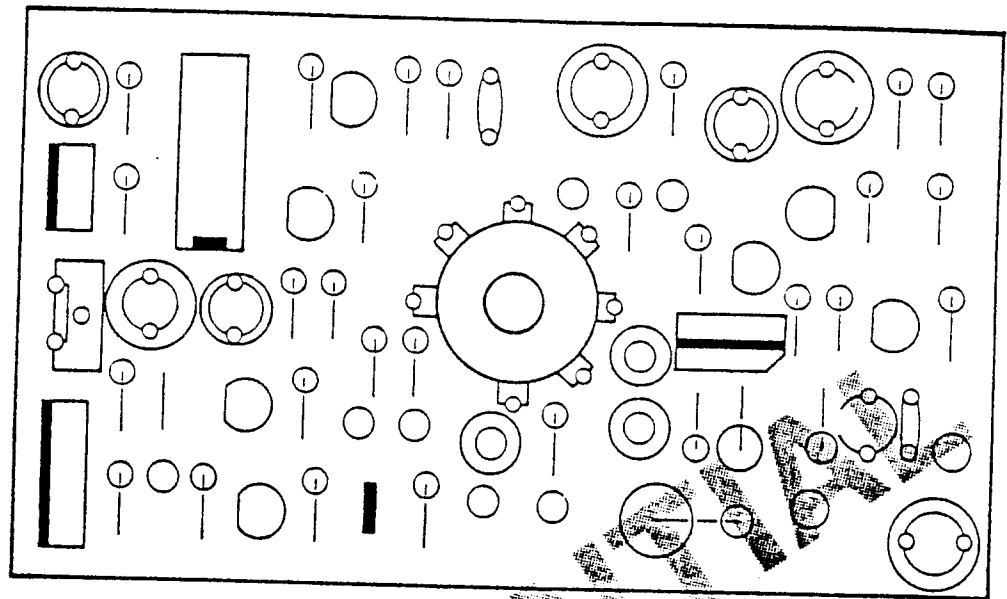


Fig. 1-27 Video Final Amplifier Board Layout

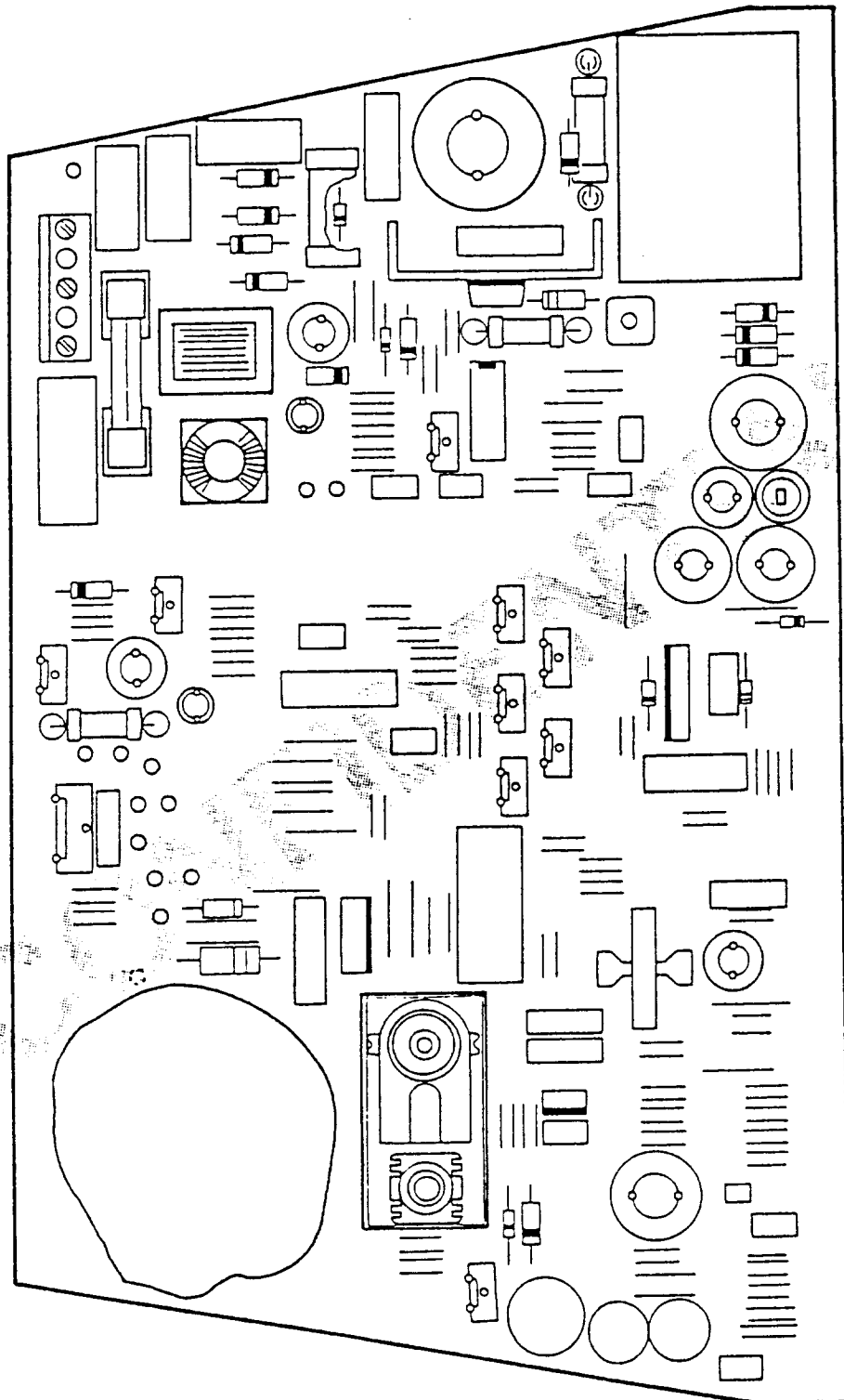


Fig. 1-28 Main Board Layout

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DISASSEMBLY INSTRUCTIONS

WARNING: Before proceeding to remove boards, check that the power supply is switched off and that the anode discharge procedure described below has been carried out.

ANODE DISCHARGE

Use a cable with crocodile clips at both ends and a long, thin screwdriver with insulated handle.

1. Remove the casing as described in the relative section and then connect the cable with crocodile clips as follows:

- One end to the screwdriver
- The other end to the video metal frame (ground) (figure 1-27).

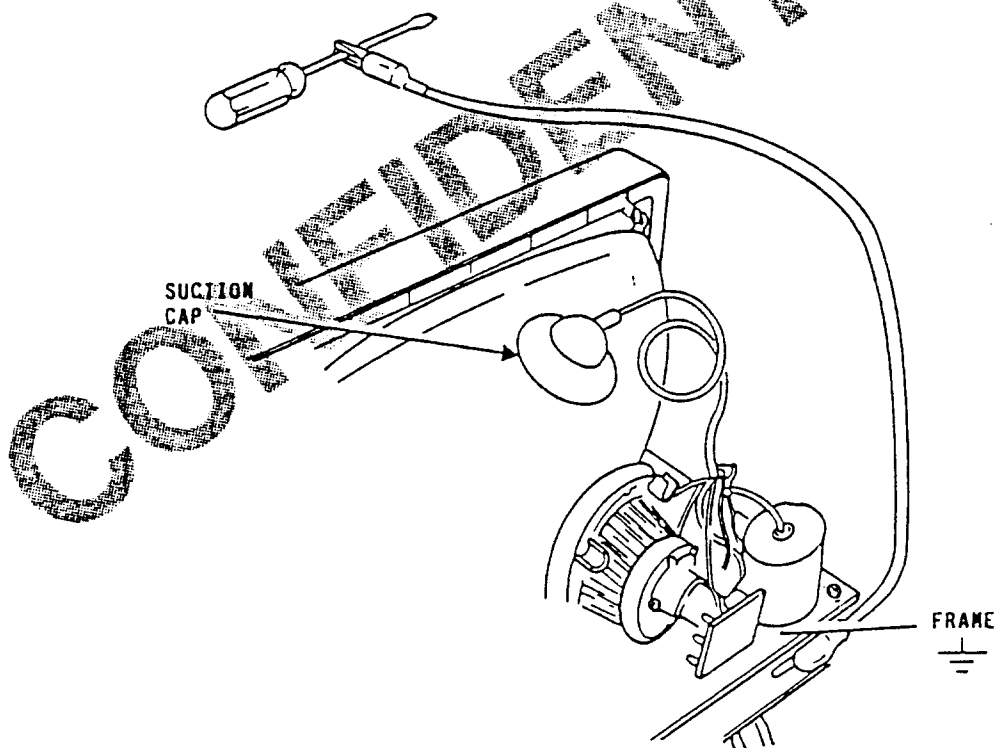


Fig. 1-29 Connection of Cable with Crocodile Clips

Note: Do not touch any metal parts with the screwdriver. You are advised to perform the procedure using one hand only and not to touch the video with your free hand.

THEORY OF OPERATION

2. With the tip of the screwdriver under the suction cap, push upwards slightly to remove cap from cathode ray tube. Touch the tube anode with the tip of the screwdriver. A spark will be seen indicating the tube is discharged.

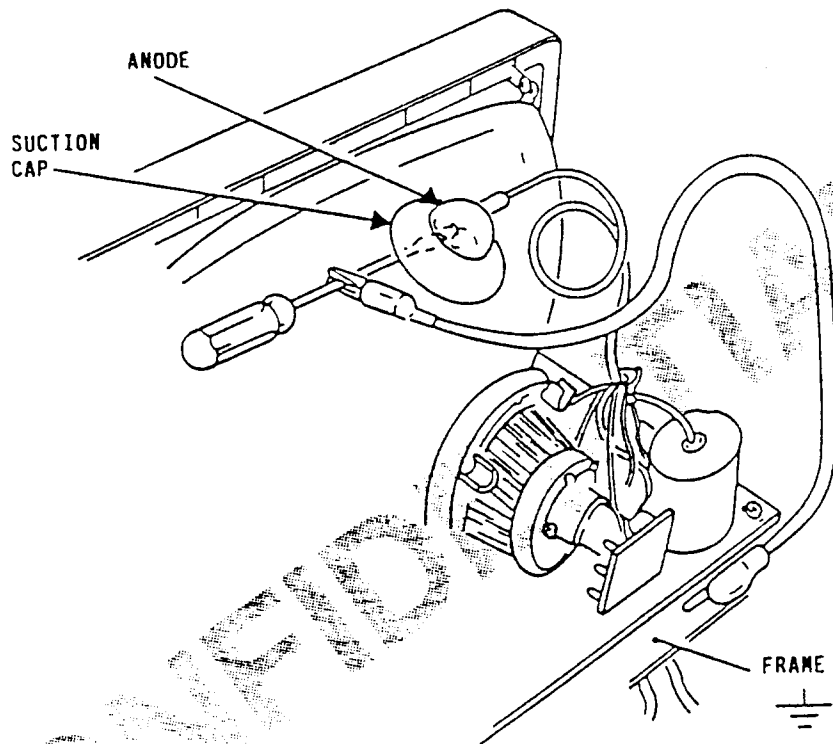


Fig. 1-30 Discharging the Cathode Ray Tube

REMOVING THE CASING

1. Switch off power. Remove the power cable and the video signals cable from the system module and unscrew the 4 screws V on the rear of the casing.

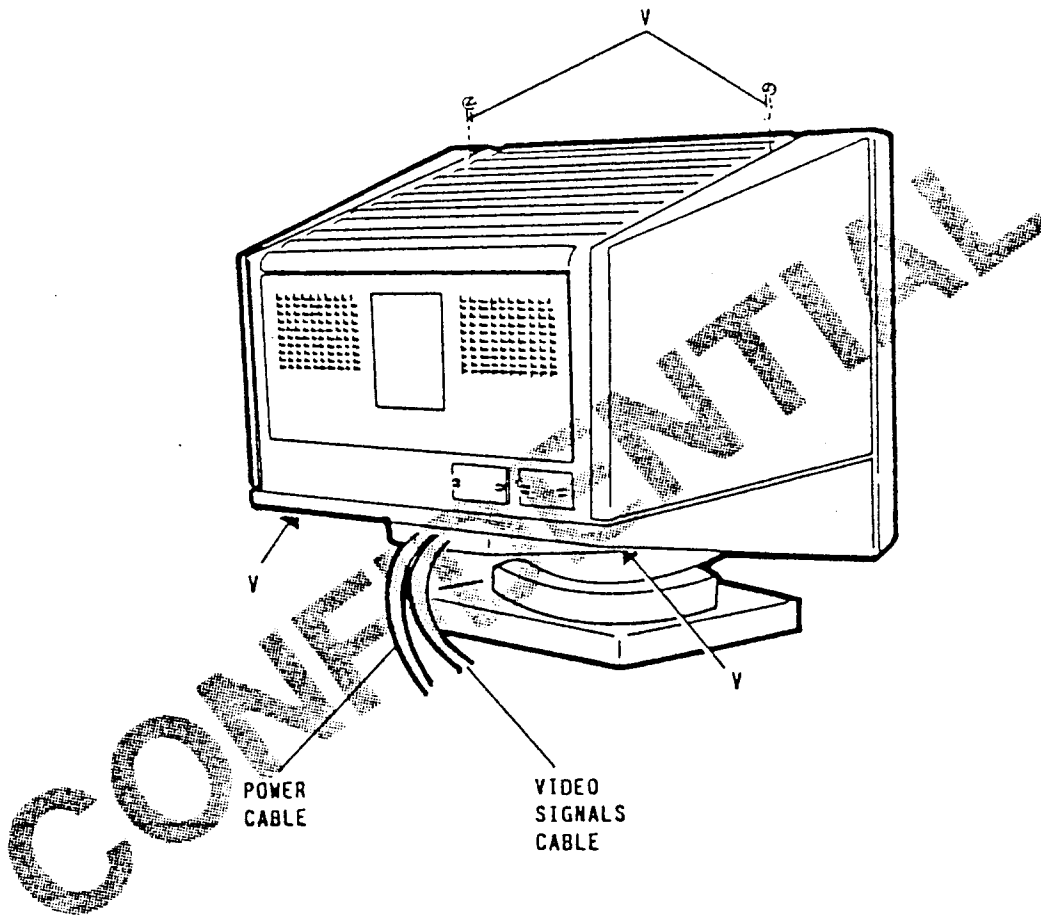


Fig. 1-31 Disconnecting Power and Video Signals Cables and Removing Screws V

2. Remove the casing.

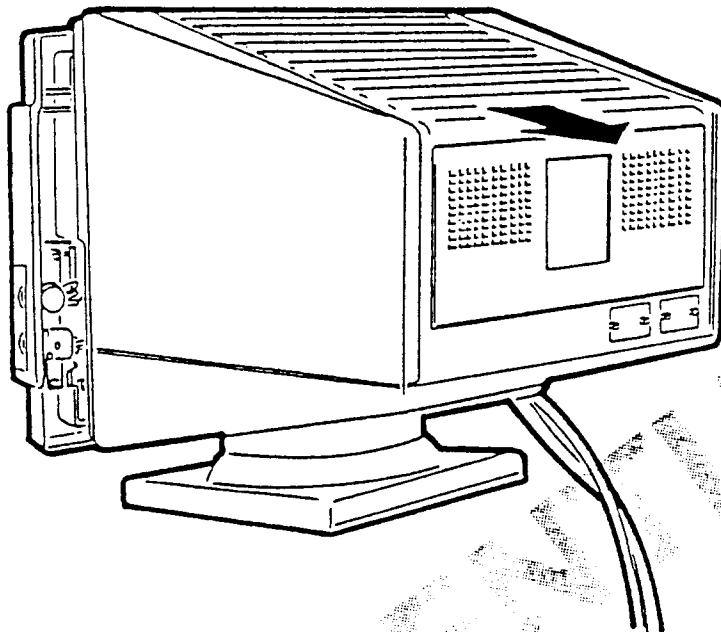
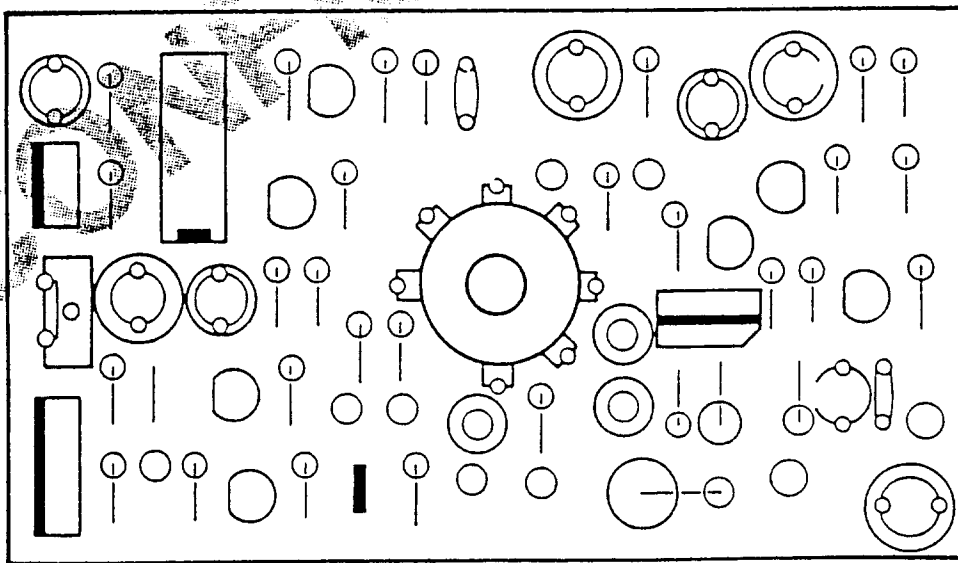
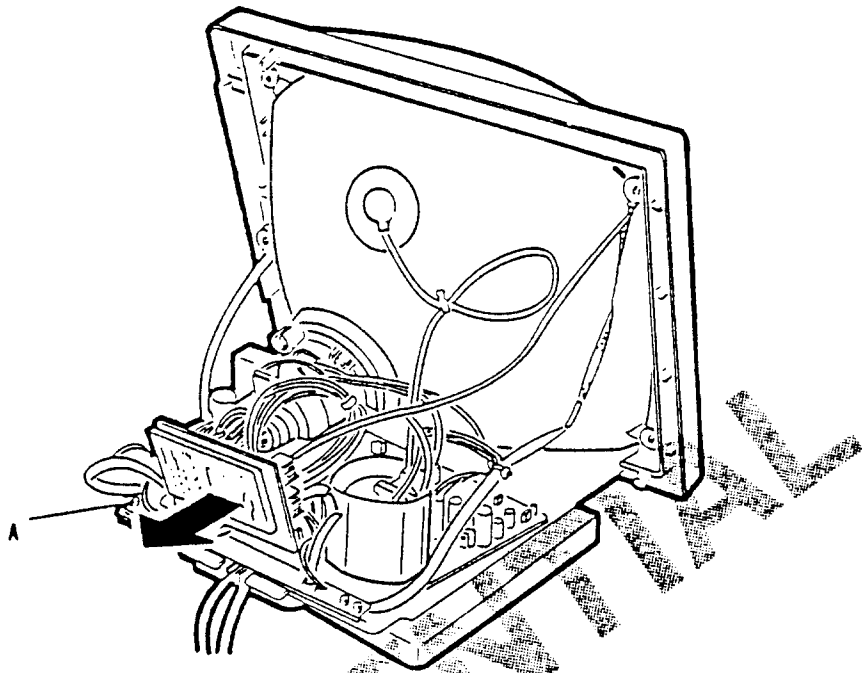


Fig. 1-32 Removing the Casing

REMOVING THE VIDEO FINAL AMPLIFIER BOARD

WARNING: Before removing the suction cap over the anode, be sure to discharge the anode as described earlier.

1. Remove the casing as described in the previous section and then remove the video final amplifier board from the CRT socket in the direction of the arrow (figure 1-33 a).
2. Disconnect fastons SP101-SP109 and FS101 to release the board (figure 1-33 b).



b

Fig. 1-33 Removal of Video Final Amplifier Board

THEORY OF OPERATION

The colours of the wires making connections to the main board are illustrated below.

WIRE COLOUR	NAME ON BOARD
Yellow	SP101
Red	SP102
Black	SP103
Orange	SP104
White	SP105
Green	SP106
Blue	SP107
Violet	SP108
Brown	SP109
Black (wider cross-section)	FS101

Fig. 1-34 Correspondance of Colours

3. Loosen screw A attaching the ground cable on the video chassis (figure 1-33 a).
4. Finally, remove the board.

REMOVING THE CRT

WARNING: Before removing the suction cap over the anode, be sure to discharge the anode as described earlier.

1. Remove the casing and then bend back the plastic part of the anode suction cap. Using the screwdriver, unhook the anode fastening spring.

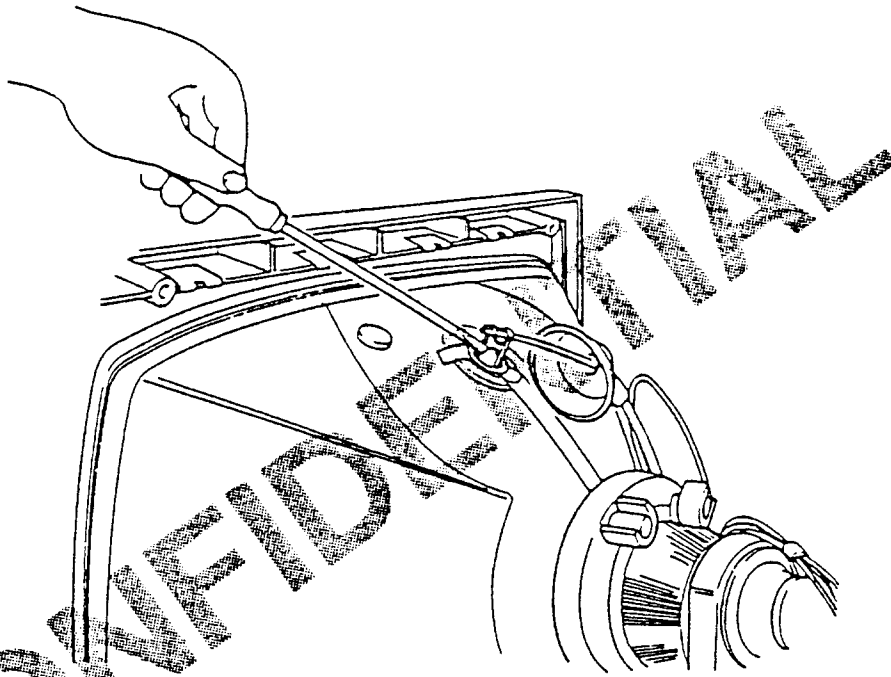


Fig. 1-35 Removal of Anode

2. Remove the video final amplifier board from the CRT socket as described in the section entitled "Removing the Video Final Amplifier Board".

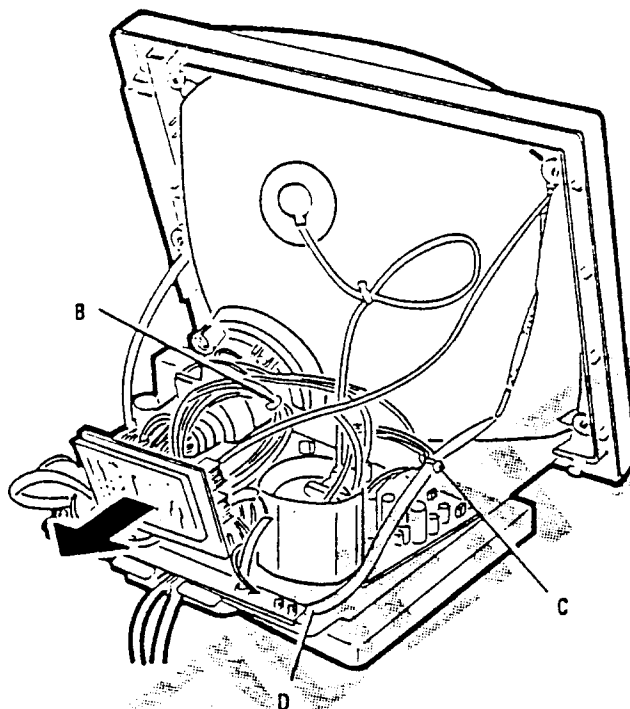


Fig. 1-36 Removal of Video Final Amplifier Board

3. Remove the cable retaining cords B and C and the ground cable D from the chassis (see figure above).

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4. Disconnect all the wires of the main board complicating the task of removing the CRT.
5. Set the video with the screen facing down and loosen the 4 screws (V1) that secure the CRT to the frame. Remove the CRT gently.

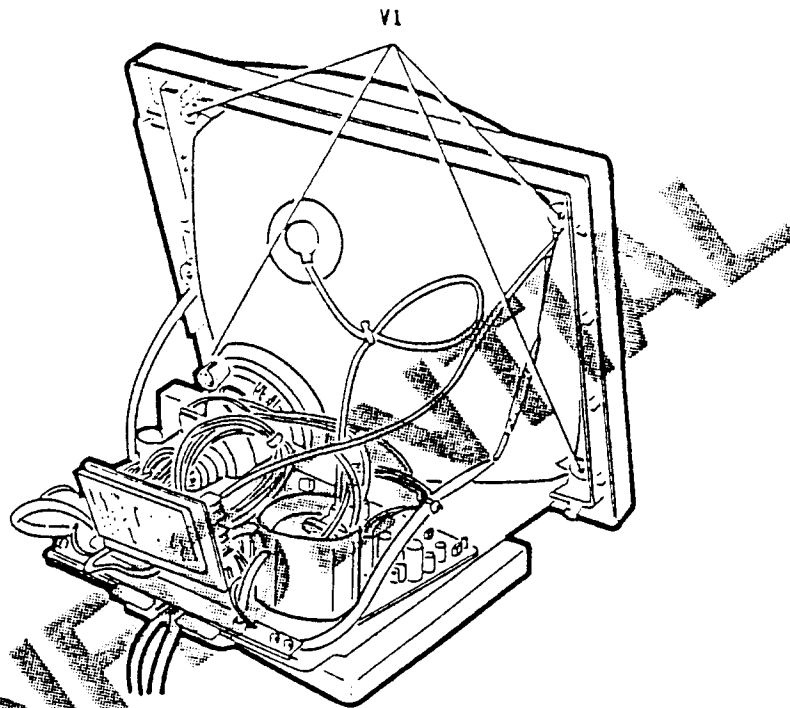


Fig. 1-37 Identifying 4 Screws V1

REMOVING THE MAIN BOARD

WARNING: Before removing the suction cap over the anode, be sure to discharge the anode as described earlier.

1. Proceed with the operations described in the sections "Removing the CRT" (steps 1 and 2).
2. The procedure now differs, depending on what exactly is to be removed:
 - Main board together with video final stage board. Carry out the procedures described in steps 2 and 3 of the section "Removing the CRT".
 - Main board. Carry out the instructions described in "Removing the Video Final Stage Board" and then the instructions given below.
3. Remove the following connectors: vertical yoke (CC), brightness adjustment (CE), video signals input (CB), vertical yoke (CD); remove fastons SP10 and SP11 and unscrew the power cables from connector CA (see figure 1-38).

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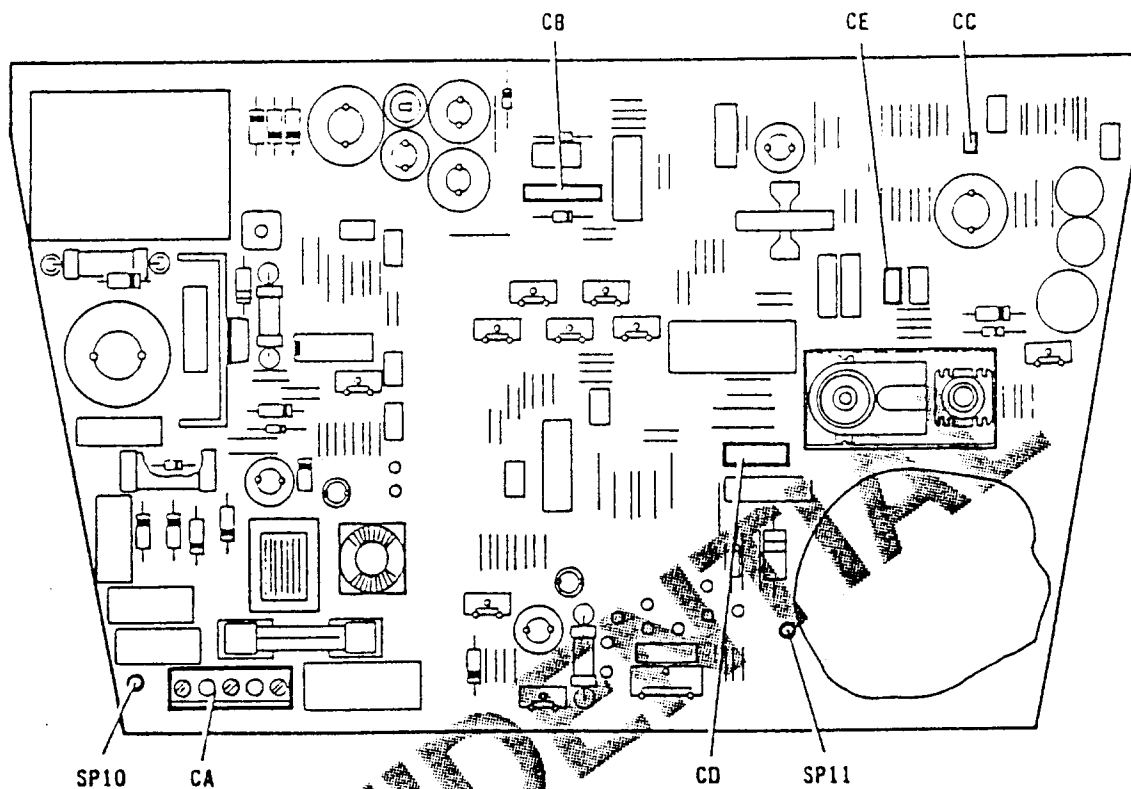


Fig. 1-38 Removal of Main Board Connectors and Fastons

4. Remove the board.

The figure below illustrates the correspondance between the colours of the power supply wires and the contacts on the main board terminal strip (CA).

POWER CABLE COLOUR	CONTACT ON TERMINAL STRIP
Yellow/green	(Ground)
Blue	(Neutral)
Brown	(Phase)

Fig. 1-39 Correspondance of Colours

REMOVING THE EXTERNAL CONTRAST-BRIGHTNESS REGULATION BLOCK

1. Disassemble the casing as described earlier, then remove connectors CE (brightness adjustment) on the main board (see figure 1-38) and CG (contrast adjustment) on the video final amplifier board (figure 1-40).

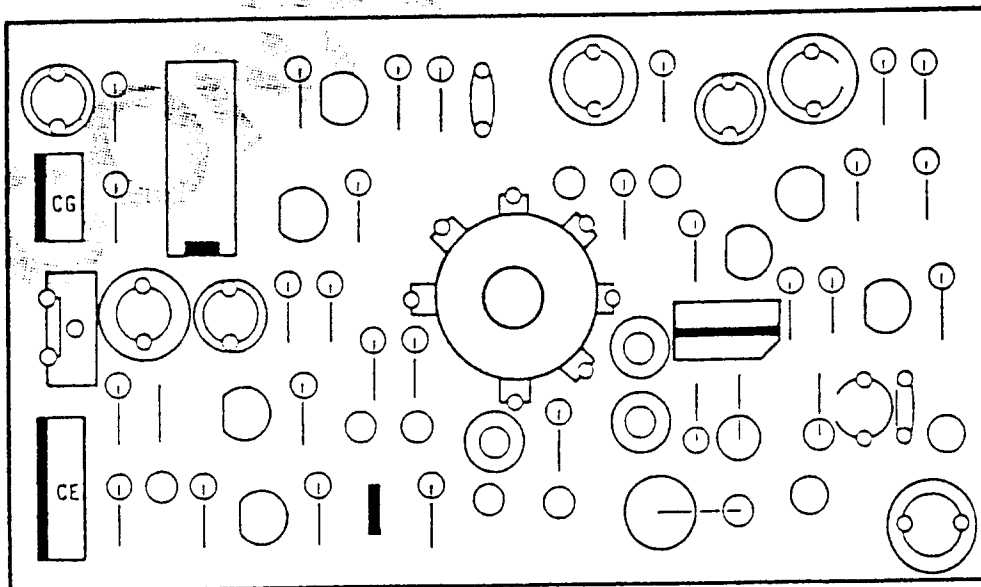


Fig. 1-40 Removal of Contrast Connector

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Unscrew and remove the two screws (V3) attaching the contrast-brightness regulation block to the frame (figure 1-41).

2. With a screwdriver through the slots in the side of the frame, prise off the potentiometers from the brightness and contrast knobs M. Then remove regulators block R.

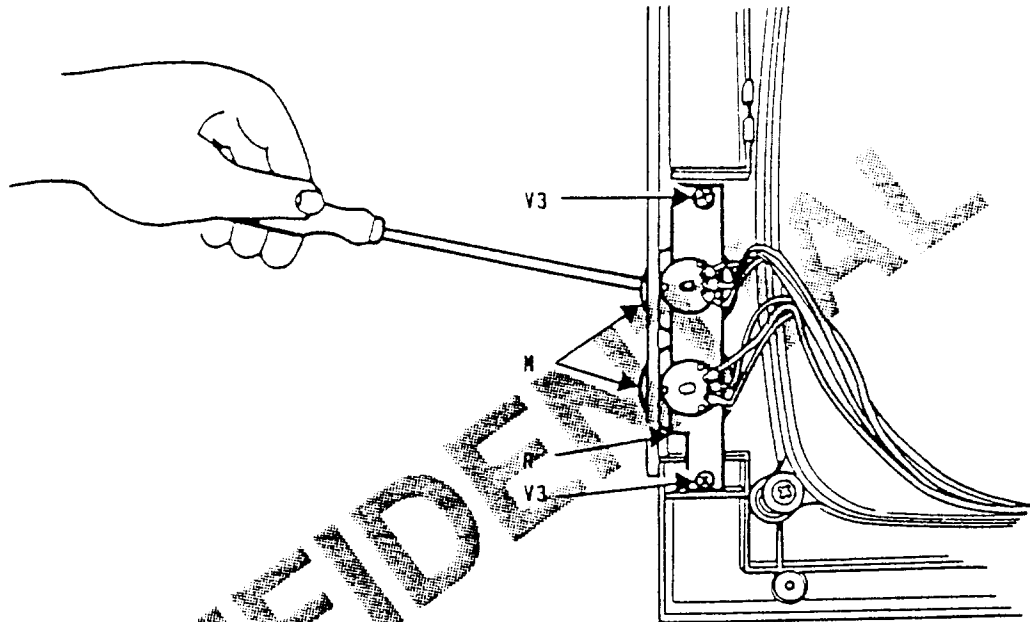


Fig. 1-41 Removal of Screws V3 and External Regulation Block

REMOVING AND CHANGING THE FUSE

1. Disassemble the casing as described earlier. The fuse (250 Vac, 1.25 A delay fuse 6.3 x 2 mm) is mounted on the main board as shown in the following figure.

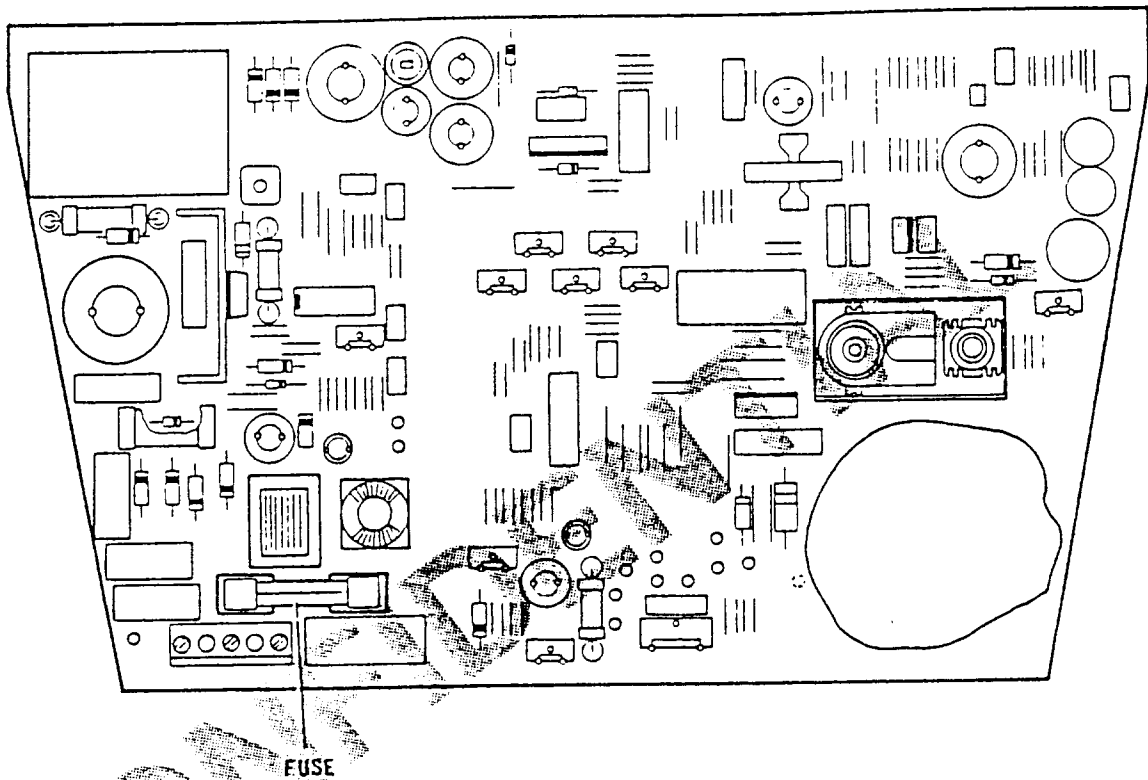


Fig. 1-42 Locating the Fuse

REASSEMBLY INSTRUCTIONS

To reassemble components, follow the disassembly instructions in reverse order.

When remounting the video final amplifier on the rear of the CRT, remember to apply a coat of silicone glue to secure the board to the CRT.

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REGISTRATION

INTRODUCTION

This chapter examines the adjustments and checks, both mechanical and electrical, to be made to ensure the proper operation of the HANTAREX MDU 1231 video.

ALIGNMENT PROCEDURE

The monitor has been set in the factory to give the best possible picture. These settings may, however, need to be repeated following repair work on the unit.

If this is the case, follow the video realignment procedure, given below, in its two main categories:

1. Electrical regulation (regulation of potentiometers, inductors, etc.)
2. Mechanical regulation (regulation of deflection yoke and associated components).

If a complete realignment is required, you are advised to firstly perform a rough electrical adjustment, a mechanical adjustment, then a more exact electrical adjustment, the definitive mechanical adjustment and then a final check of the electrical adjustments.

This is necessary because a number of mechanical settings impinge upon the electrical settings (the vertical and horizontal widths, for example, are influenced by the potentiometers and by position of the geometric correction magnets, respectively).

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INFORMATION

ELECTRICAL ADJUSTMENTS

INTERNAL ADJUSTMENTS

Internal adjustments that may be performed on the boards of the unit are listed in the figure below:

COMPONENT	NAME	DESCRIPTION
RV1	+12 V ADJ.	+12 V adjustment
RV2	V. AMP.	350 line vertical width adjustment
RV3	V. AMP.	400 line vertical width adjustment
RV4	V. FREQ.	Vertical frequency adjustment
RV5	V. AMP.	480 line vertical width adjustment
RV6	V. LIN.	Vertical linearity adjustment
RV7	H. FREQ.	Horizontal frequency adjustment
RV8	H. PHASE	Horizontal phase adjustment
RV9	BRIGHT PRESET	Brightness pre-adjustment
RV10	FOCUS	Focus adjustment
RV11	EXT. BRIGHT	External brightness adjustment
RV101	EXT. CONTRAST	External contrast adjustment
RV102	CONTR. PRESET	Contrast pre-adjustment
B3	H. LIN.	Horizontal linearity adjustment
B4	H. AMP.	Horizontal width adjustment

Fig. 2-1 Internal Adjustments

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REGULATIONS AND ADJUSTMENTS

The figures below illustrate the main board and the video final amplifier board, indicating the test points on which the electrical adjustments are to be made.

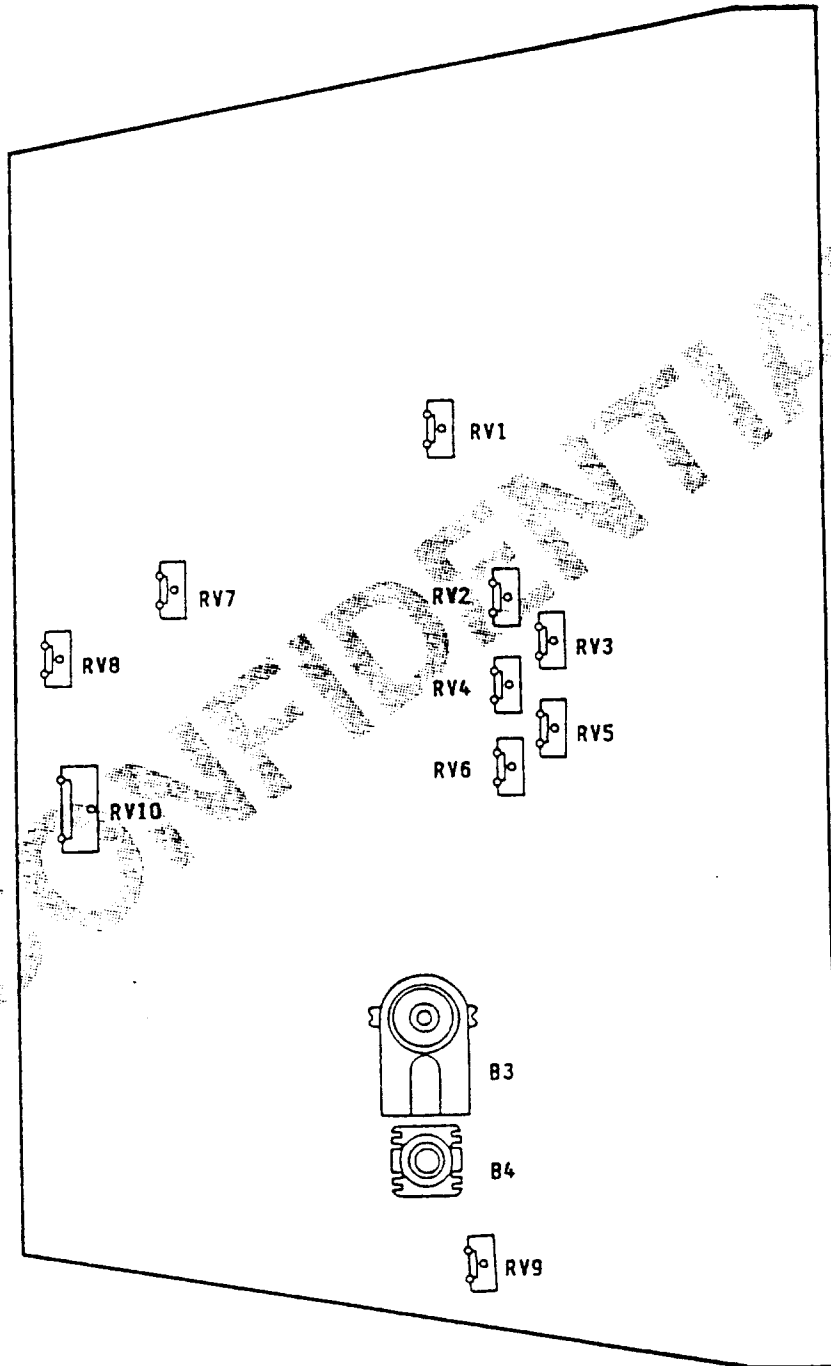


Fig. 2-2 Main Board Test Points

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INFORMATION

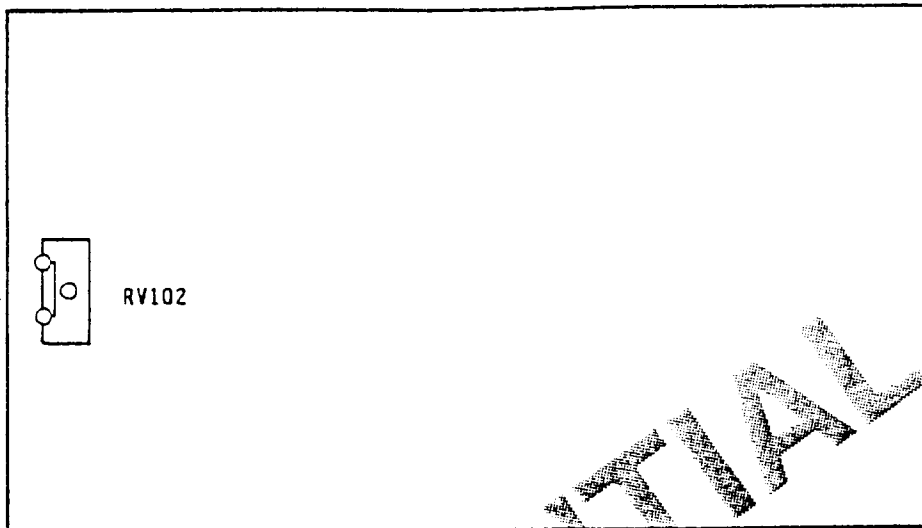


Fig. 2-3 Video Final Amplifier Board Test Points

The video electrical setting procedures are listed on the following pages. A disk of unit diagnostic programs must be available when performing the procedures.

WARNING: After the video is connected to the system module, it must be degaussed from the outside using a degauss coil. You are also advised to use only insulated screwdrivers for these procedures to avoid the risk of dangerous electrical discharges.

Execution of adjustments

1. Set all controls in an intermediate position.
2. Switch on monitor after connecting to the computer. Insert the diagnostic test disk and select the first test grid.
3. Adjust RV1 to give a voltage of 50 V on diode D9 (mounted on power supply circuit).
4. Shorting pin 9 of integrated circuit TDA2593 to ground, adjust RV7 (horizontal frequency) to give as stable a picture as possible.
5. Adjust RV4 (vertical frequency) to give a stable picture.
6. Adjust RV3 (horizontal phase) so that the picture is in the centre of the raster.

REGULATIONS AND ADJUSTMENTS

7. Carry out a rough adjustment of the deflection yoke magnets to give the best picture geometry before carrying out the width pre-settings described in the mechanical adjustments.
8. Adjust RV6 and B3 respectively for optimum vertical and horizontal linearity.
9. Adjust B4 to set a horizontal width of 207 mm and adjust RV10 to give best picture focus.
10. Select the second test grid from the diagnostic test disk (480 line grid) and adjust RV5 (480 line vertical width) for a vertical width of 155 mm.
11. Select the third test grid from the diagnostic test disk (350 line grid) and adjust RV2 (350 line vertical width) for a vertical width of 155 mm.
12. Still using the third test grid, adjust RV3 (400 line vertical width) to give a width of 155 mm.
13. Set the picture level to zero and the external brightness control to the point where it is about to click, then adjust RV9 (brightness preset) so as to switch the raster off. Then check that, with the brightness control at maximum, the raster has a luminosity of between 5 and 15 nits.
14. Select, from the diagnostic test disk, the level 7 picture. Set the external brightness control to its click point and the external contrast to maximum; adjust RV102 (contrast preset) to give a picture of luminosity of over 150 nits, then checking that, when contrast is turned down to minimum, the picture luminosity goes to below 30 nits.
15. Check also that, when the two external controls for brightness (RV101) and contrast (RV102) are turned, the picture disappears completely.
16. Check that (with video signals cable out, external brightness control about to click, and external contrast at maximum) the raster brightness is 40 nits (self-test).

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2-5

External Controls

The externally performed regulations are shown in the following figure. Figure 2-5 then illustrates the positions of the external control potentiometers.

POTENTIOMETER	NAME	DESCRIPTION
RV101	EXT. BRIGHT	Brightness adjustment
RV11	EXT. CONTRAST	Contrast adjustment

Fig. 2-4 Externally Performed Regulations

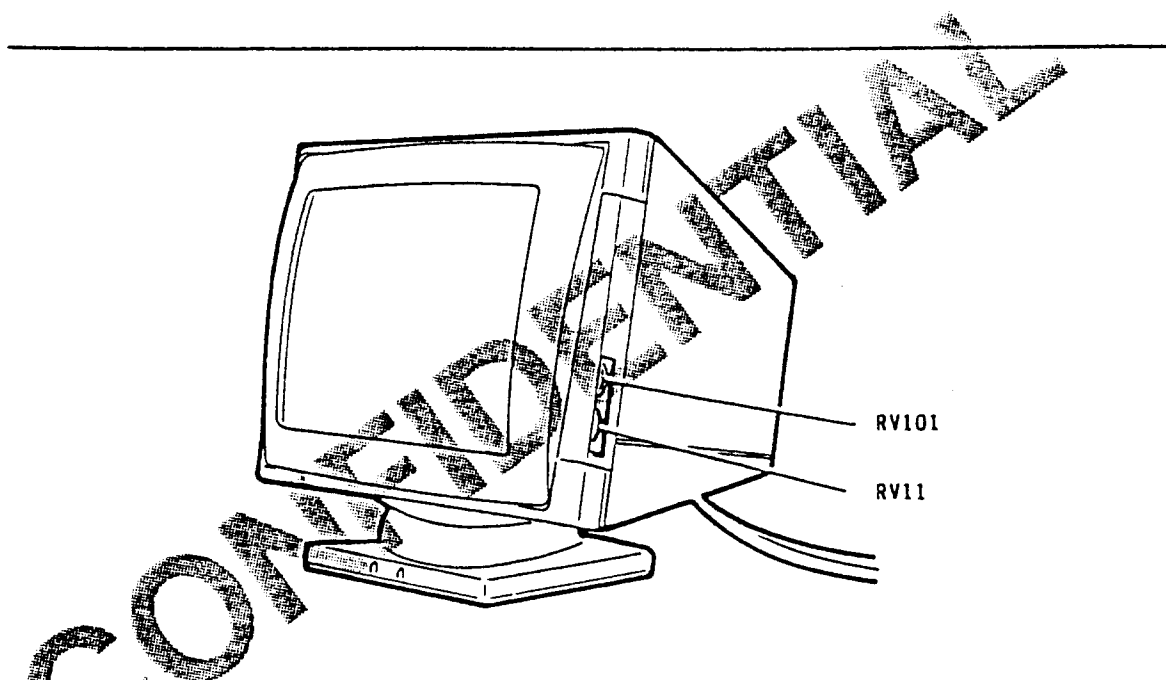


Fig. 2-5 Position of External Control Potentiometers

MECHANICAL ADJUSTMENTS

Perform the operations described and illustrated below in order, with the monitor connected to the personal computer and with the first test page from the diagnostic test diskette.

PICTURE TILT ADJUSTMENT

Loosen the screw on the deflection yoke and turn the yoke to give a properly aligned character area (figure 2-6).

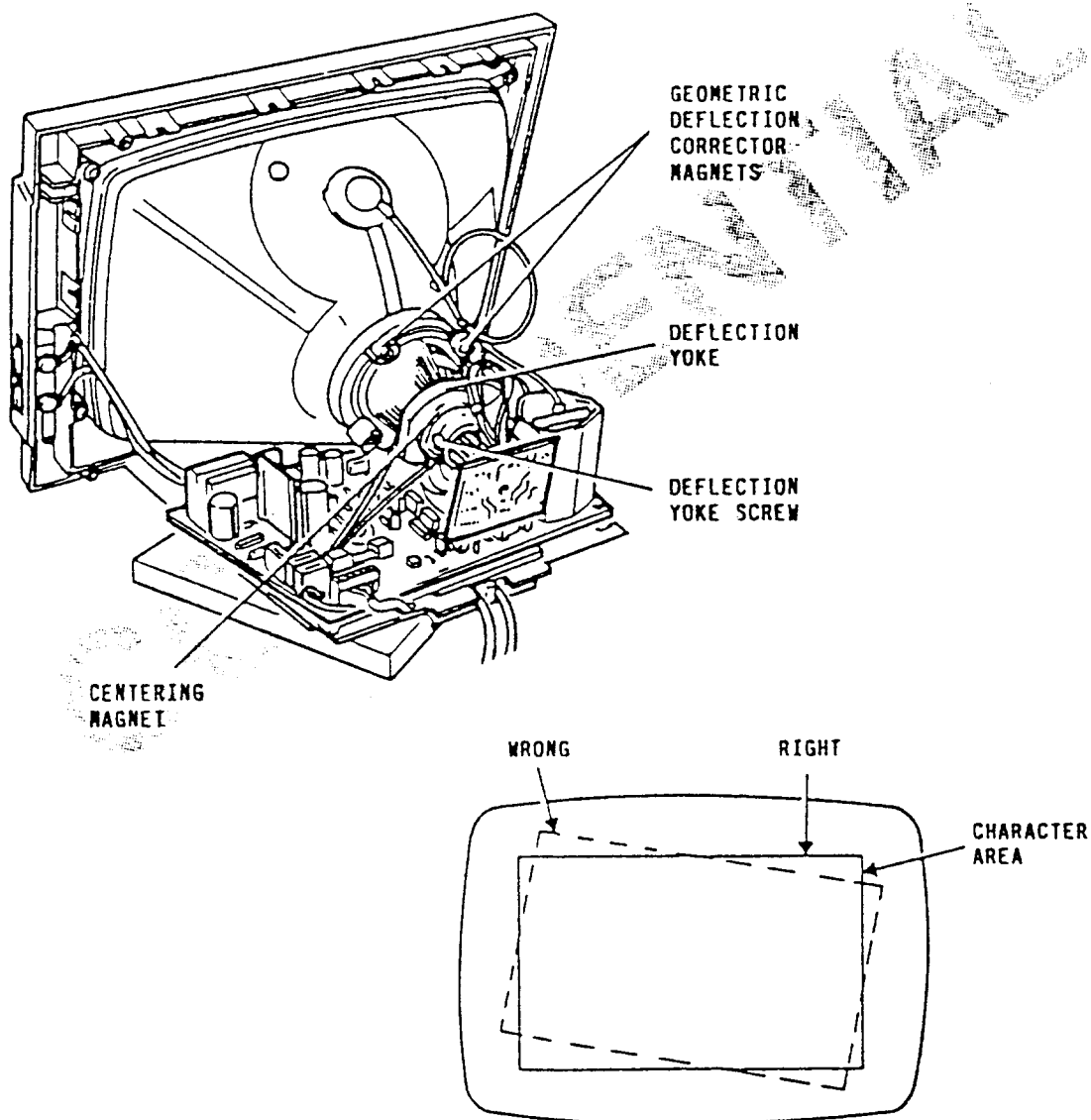


Fig. 2-6 Picture Tilt Adjustment

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2-7
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CENTERING MAGNETS ADJUSTMENT

Turn the centering magnets in opposite directions until the raster is properly centered as shown in the following figure.

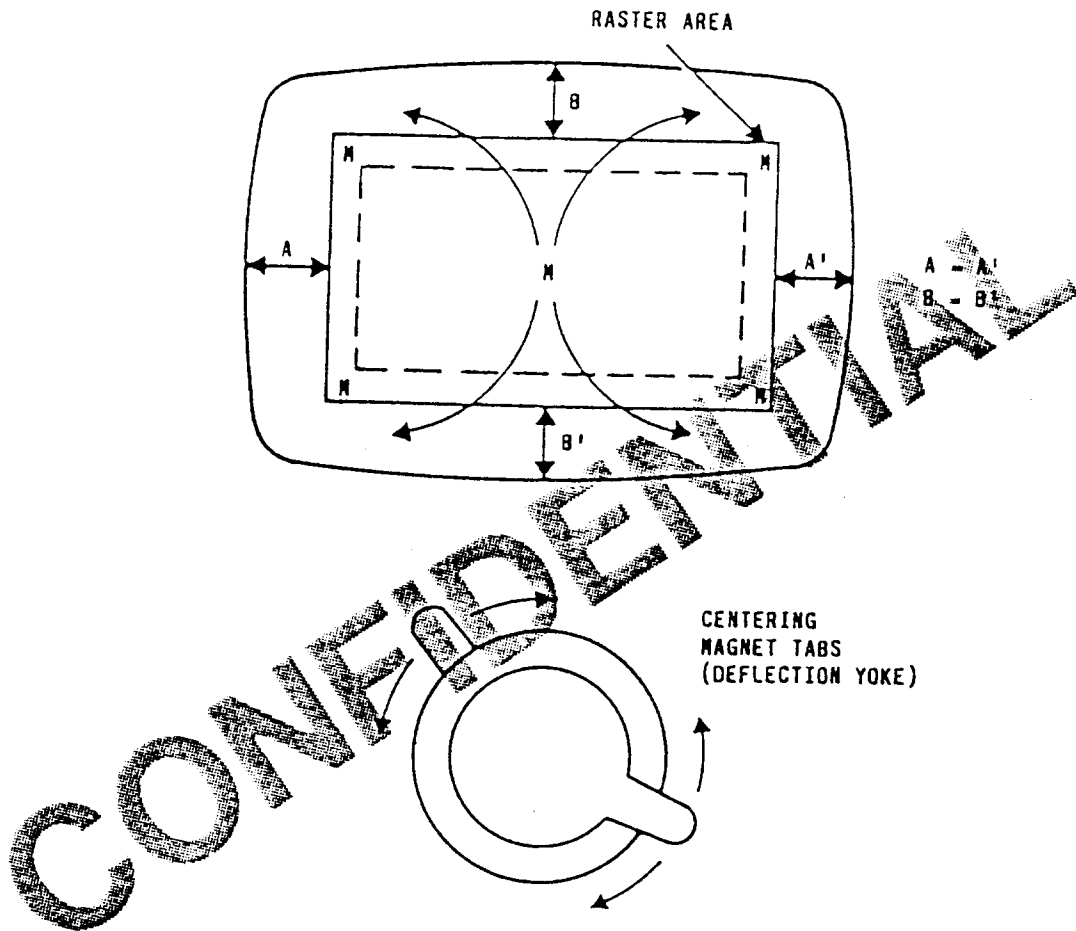
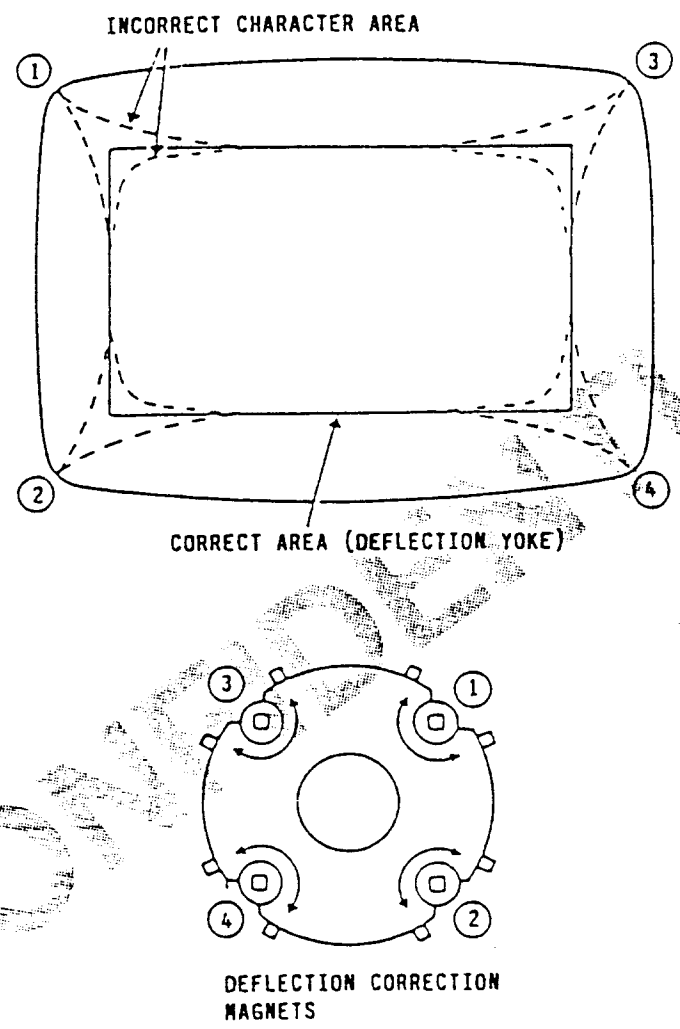


Fig. 2-7 Centering Magnets Adjustment

GEOMETRIC DISTORTION MAGNETS ADJUSTMENT

Adjust each distortion correction magnet until the picture is as rectangular as possible, with reference to the following figure.



NOTE: THIS ADJUSTMENT MUST ONLY BE MADE IN A LABORATORY EQUIPPED WITH SPECIFIC INSTRUMENTS.

Fig. 2-8 Geometric Distortion Magnets Adjustment

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POSITION OF BOARD CONNECTORS

The following figures illustrate the position of the connectors on the two boards in the unit.

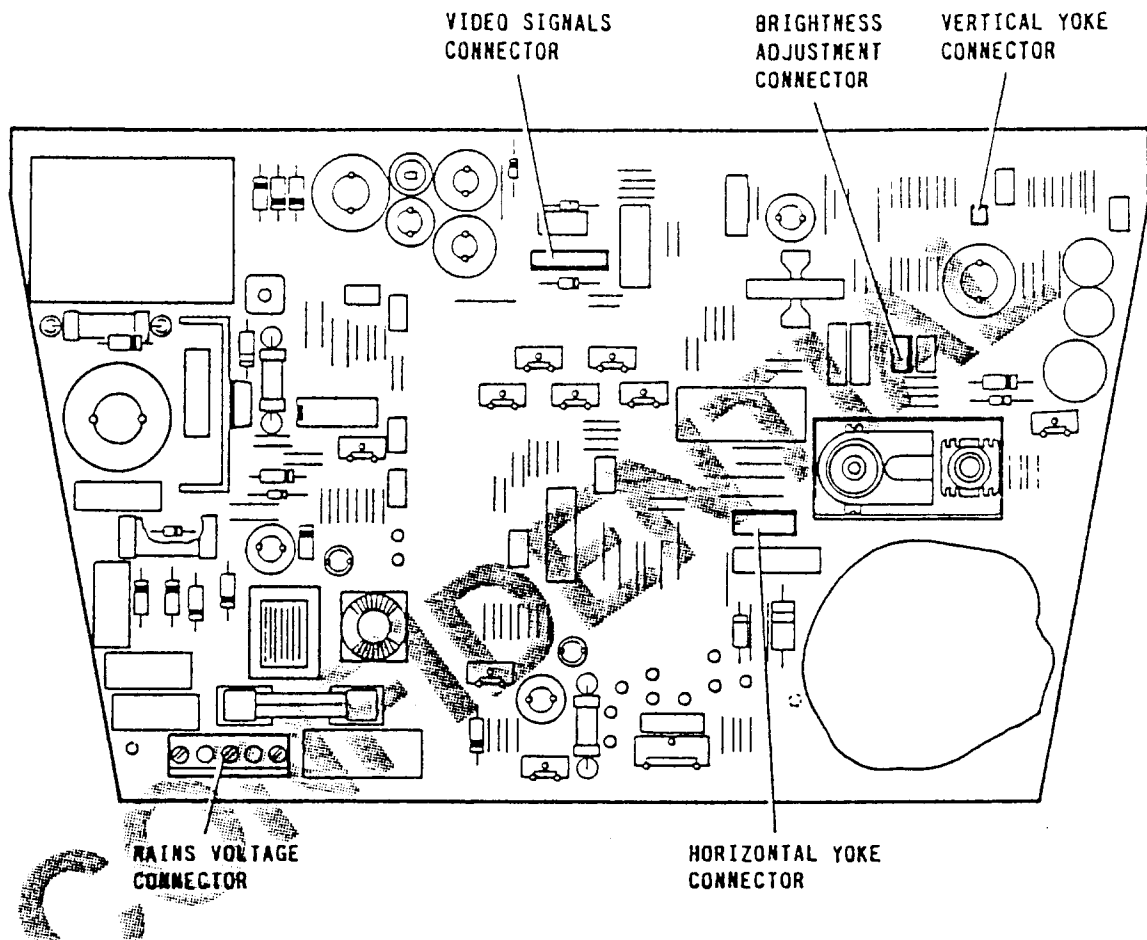


Fig. 2-9 Main Board Connectors

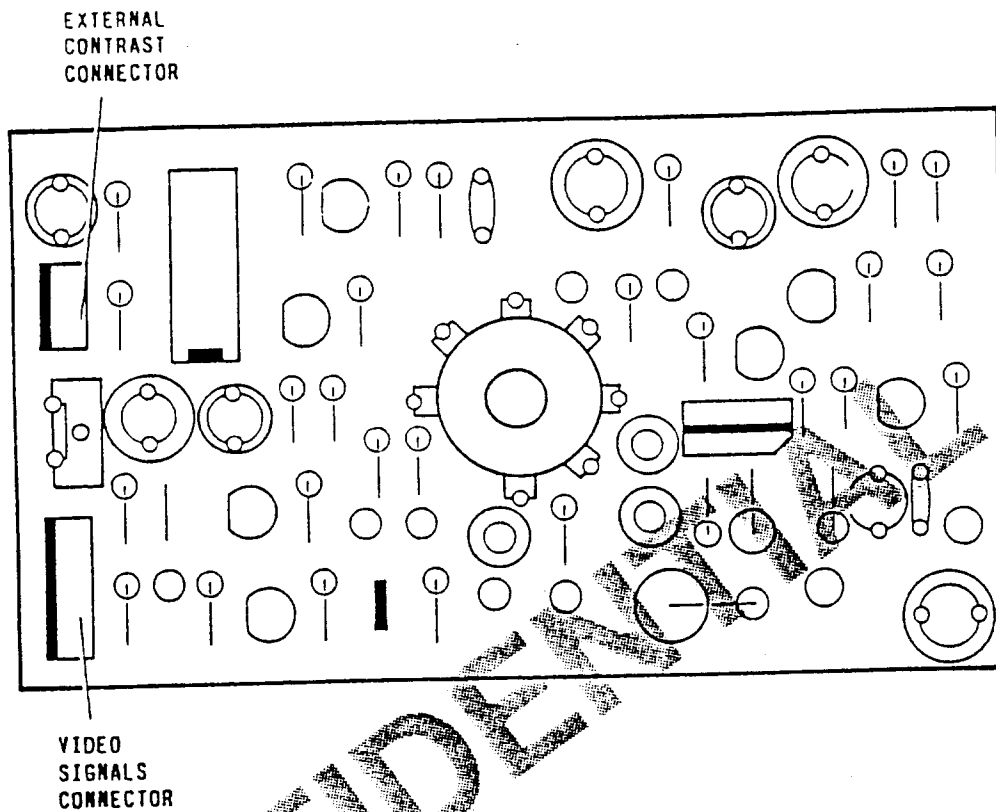


Fig. 2-10 Video Final Amplifier Board Connectors

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2-11
INFORMATION

TEST POINTS

With reference to the wiring diagrams of "SCHEMATICS", the waveforms of each test point are provided.

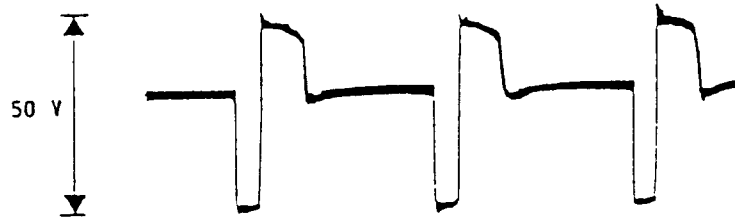


Fig. 3-1 Test Point No. 1

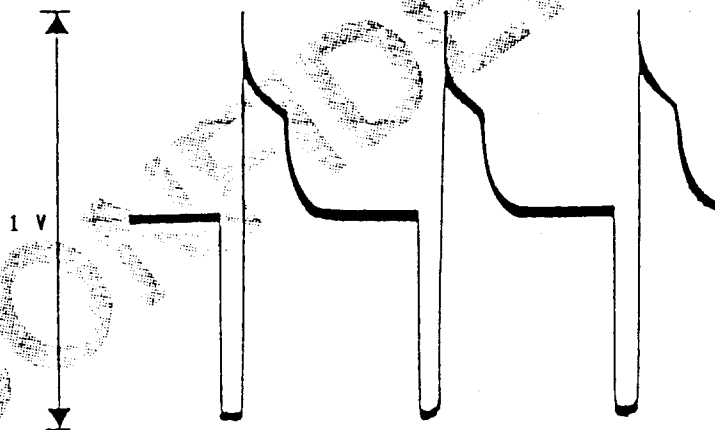


Fig. 3-2 Test Point No. 2

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2 V



Fig. 3-3 Test Point No. 3

5 V

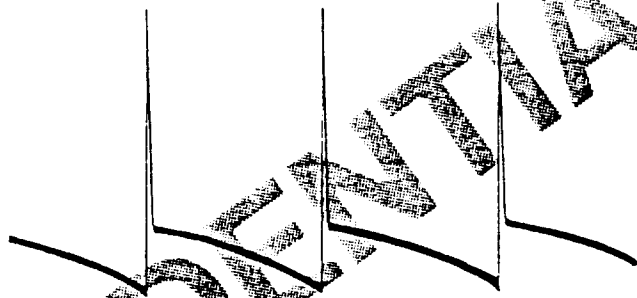


Fig. 3-4 Test Point No. 4

2 V

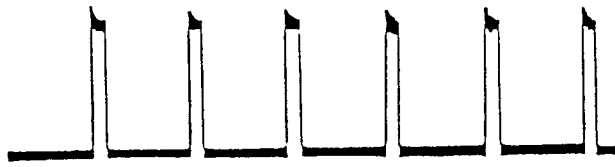


Fig. 3-5 Test Point No. 5

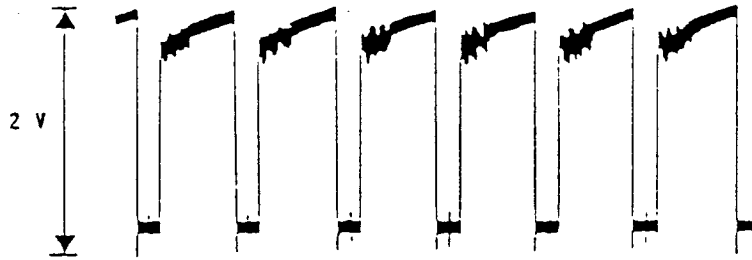


Fig. 3-6 Test Point No. 6

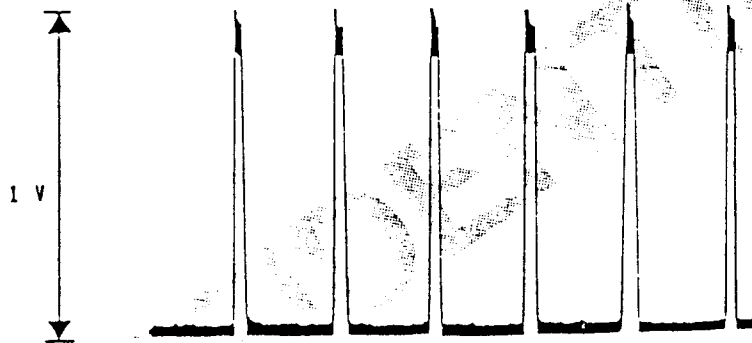


Fig. 3-7 Test Point No. 7



Fig. 3-8 Test Point No. 8

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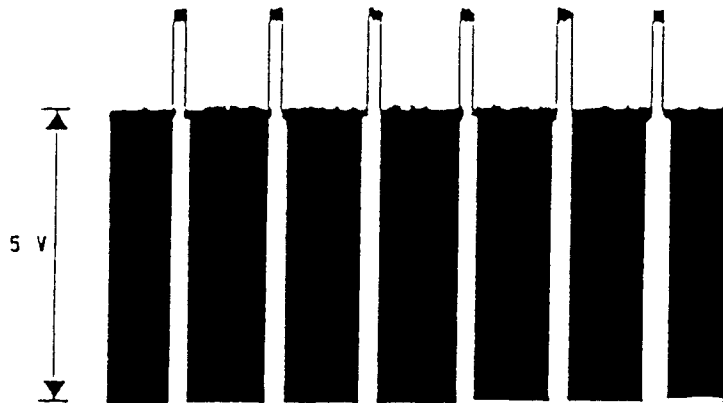


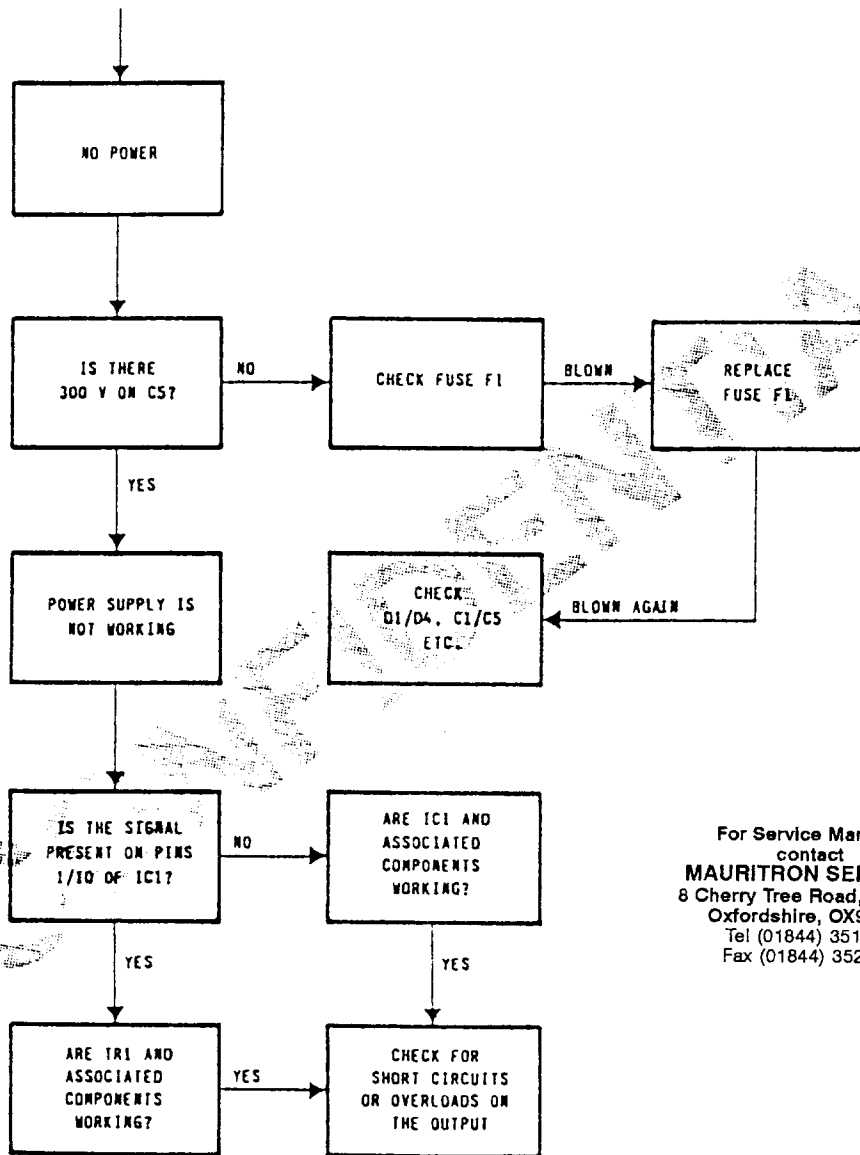
Fig. 3-9 Test Point No. 9



Fig. 3-10 Test Point No. 10

TROUBLESHOOTING

This section is a guideline for trying to locate the causes of problems which may occur during normal video operation.

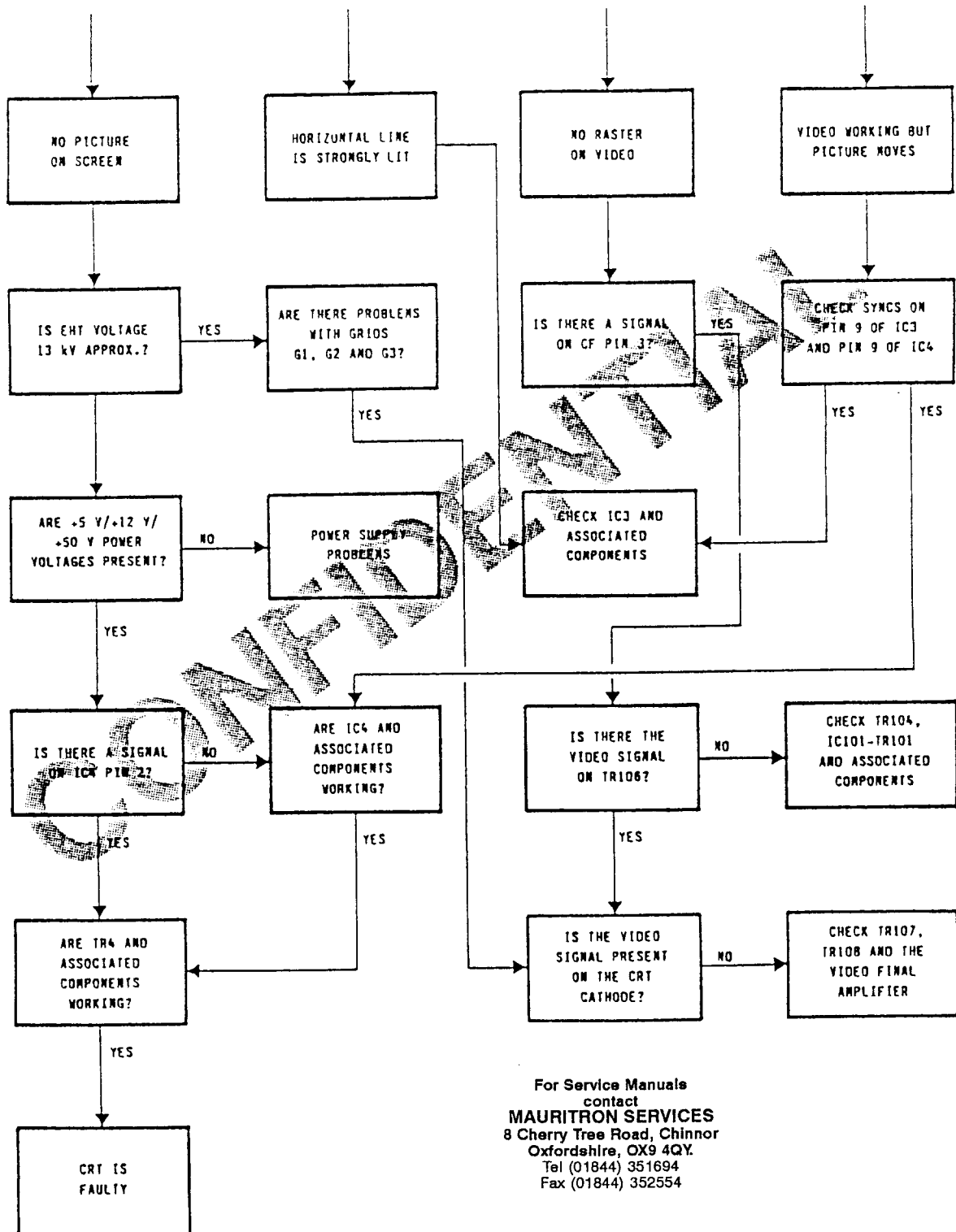


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Oxfordshire, OX9 4QY.
Tel (01844) 351694
Fax (01844) 352554

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Telex: 210030 - Fax: 39 (0) 125 521122

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ELECTRONIC COMPONENTS LIST

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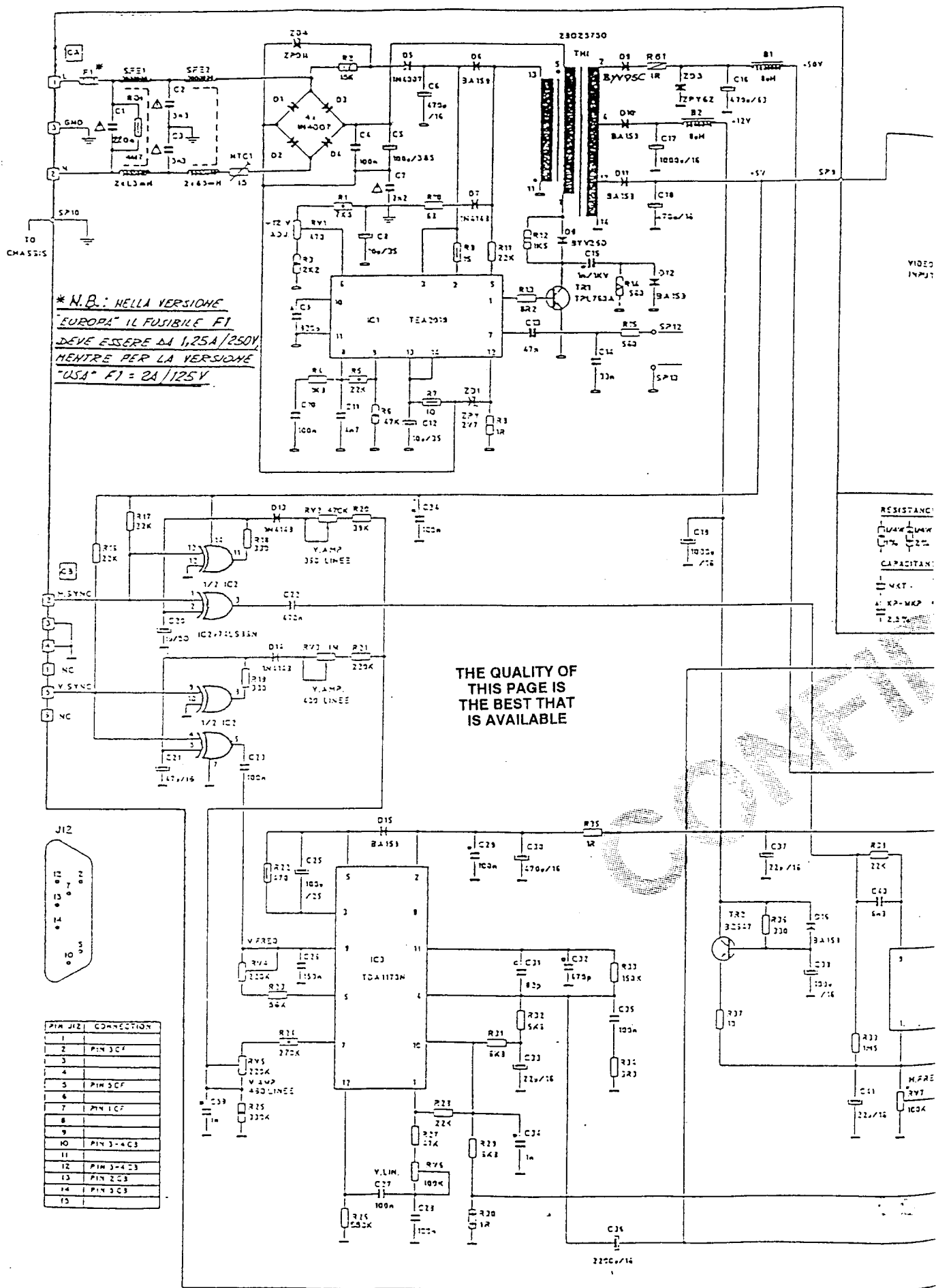
02209100 N

CODE	DESCRIPTION	QTY	NOTES
140020 D	CAPACITOR 1 uF 50V ELECTR.	1	
140829 H	I.C. ZTK33	1	
141164 T	CAPACITOR 1000 uF 16V ELECTR.	2	
141165 U	CAPACITOR 470 uF 63V ELECTR.	1	
142734 X	DIODE BY584	1	
142735 Y	DIODE RGP30G	1	
142739 C	DIODE ZENER ZPD5.1 1/2W 5.1V	1	
142769 J	CAPACITOR 10 uF 160V ELECTR.	1	
143108 E	TRANSISTOR BC547B	3	
143421 P	COIL CHOKER 8MH ON FERR.UTF16	3	B
143423 R	COIL LIN. SAREA 250012 UTF21	1	B
143676 E	LAMP. NEON EKULIT BN15616H	3	
143686 Z	DIODE ZENER BZX85C 1.3W 2.7V	1	
143702 H	NTC PHILIPS 232261012159	1	
143704 B	COIL COGEMA 6.8 mH	1	B
143820 T	CAPACITOR 1 nF 1000V POLIES.	1	
143823 J	CAPACITOR 10 uF 100V ELECTR.	1	
143830 V	TRANSISTOR BC558B	1	
144228 E	COIL AMPL. UTF68	1	B
144234 U	TRANSISTOR PH2369	1	
144469 G	I.C. TDA2593	1	
144466 H	I.C. TEA2019	1	
144672 B	CAPACITOR 47 uF 100V ELECTR.	1	
144974 S	TRANSISTOR T1PL 760A	1	
145057 X	DIODE BYV26D	1	
145060 E	DIODE ZENER ZPY18 1.3W	1	
145222 Z	I.C. CA3046	1	
145404 Z	TRANSISTOR 8F859	1	
145405 S	TRANSISTOR BU826	1	
145406 T	TRANSFORMER EHT 10720524-12120013	1	B
145407 U	TRANSFORMER SWITCH SEMAR 17015053	1	B
145408 D	CRT 12" PW PHIL.M31-340WR/ED CP	1	B
145409 E	POTENTIOMETER 100 kOhm UTH2760	1	B
145410 S	DIODE ZENER ZPY62 1.3W	1	
145411 P	POTENTIOMETER 470 Ohm UTH2761	1	B
145412 Q	DEFLECTION YOKE ELDOR 3011.2080	1	B
145413 R	DIODE ZENER ZPD11 1/2W	1	
145414 J	CAPACITOR 2.2 uF 1000V POLIES.	1	
4800152 S	DIODE 1N4148	5	
4800240 N	DIODE 1N4007	5	
4800788 B	DIODE 8A159	11	
4804662 B	DIODE BYV95/C-600	1	
4849515 N	TRANSISTOR 8C337	1	

CODE	DESCRIPTION	QTY	NOTES
4849532 T	TRANSISTOR 9C548B	3	
4854820 G	I.C. TOA1170N	1	
4866285 U	I.C. SN74LS86N	1	
4911073 X	RESISTOR 10 Ohm 1/2W 5% CARBON	1	
4911193 S	RESISTOR 470 Ohm 1/2W 5% CARBON	1	
4912043 G	RESISTOR 10 Ohm 1/4W 5% CARBON	3	
4922858 Q	RESISTOR 68 Ohm 1/4W 5% CARBON	1	
4923310 N	RESISTOR 180 Ohm 1/4W 5% CARBON	2	
4923431 T	RESISTOR 270 Ohm 1/4W 5% CARBON	2	
4923710 W	RESISTOR 470 Ohm 1/4W 5% CARBON	1	
4923790 E	RESISTOR 560 Ohm 1/4W 5% CARBON	1	
4923870 P	RESISTOR 680 Ohm 1/4W 5% CARBON	3	
4924070 L	RESISTOR 1 kOhm 1/4W 5% CARBON	4	
4924150 B	RESISTOR 1.2 kOhm 1/4W 5% CARBON	1	
4924230 B	RESISTOR 1.5 kOhm 1/4W 5% CARBON	2	
4924312 Q	RESISTOR 1.8 kOhm 1/4W 5% CARBON	1	
4924392 Y	RESISTOR 2.2 kOhm 1/4W 5% CARBON	1	
4924778 Q	RESISTOR 5.6 kOhm 1/4W 5% CARBON	2	
4924849 C	RESISTOR 6.8 kOhm 1/4W 5% CARBON	2	
4925058 M	RESISTOR 10 kOhm 1/4W 5% CARBON	2	
4925290 M	RESISTOR 18 kOhm 1/4W 5% CARBON	1	
4925370 D	RESISTOR 22 kOhm 1/4W 5% CARBON	5	
4925690 V	RESISTOR 47 kOhm 1/4W 5% CARBON	2	
4926058 Z	RESISTOR 100 kOhm 1/4W 5% CARBON	1	
4926131 J	RESISTOR 120 kOhm 1/4W 5% CARBON	1	
4926210 R	RESISTOR 150 kOhm 1/4W 5% CARBON	1	
4926390 T	RESISTOR 220 kOhm 1/4W 5% CARBON	1	
4926630 T	RESISTOR 390 kOhm 1/4W 5% CARBON	1	
4931040 M	RESISTOR 1 Ohm 1/4W 5% CARBON	1	
5000781 R	CAPACITOR 470 nF 63V POLIES.	1	
5037955 V	CAPACITOR 100 uF 25V ELECTR.	5	
5053303 P	CAPACITOR 22 uF 16V ELECTR.	4	
5053384 G	CAPACITOR 2200 uF 16V ELECTR.	1	
5053597 Z	CAPACITOR 4.7 uF 25V ELECTR.	2	
5053613 J	CAPACITOR 47 uF 16V ELECTR.	3	
5053615 B	CAPACITOR 10 uF 25V ELECTR.	1	
5056316 E	CAPACITOR 10 uF 50V ELECTR.	2	
5056365 X	CAPACITOR 470 uF 16V ELECTR.	3	
5057903 M	CAPACITOR 220 uF 63V ELECTR.	1	

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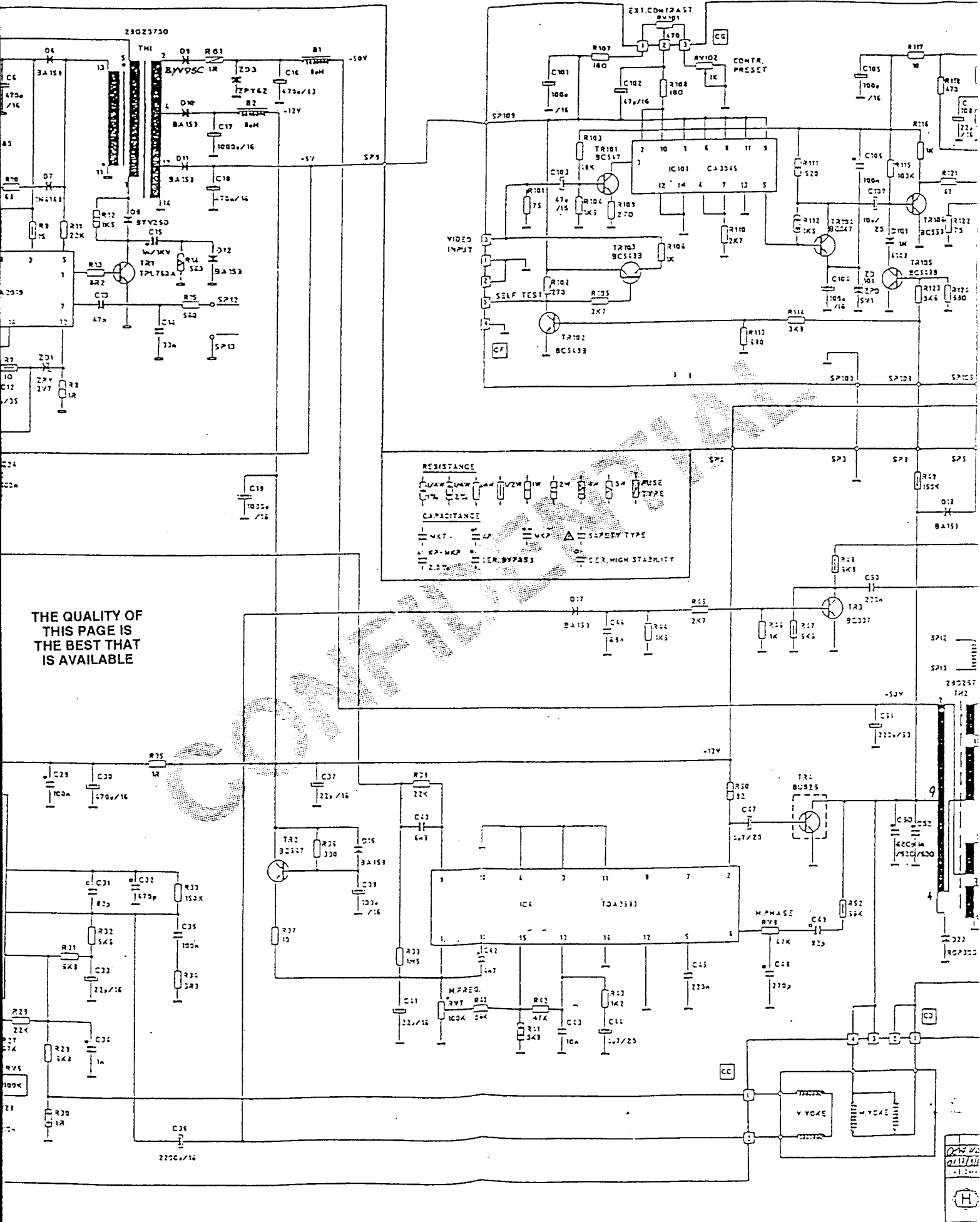


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PIN J12	CONNECTION
1	
2	PIN 3CF
3	
4	
5	PIN 3CF
6	
7	PIN 1CF
8	
9	
10	PIN 3-4CS
11	
12	PIN 3-4CS
13	PIN 2CS
14	PIN 3CS
15	

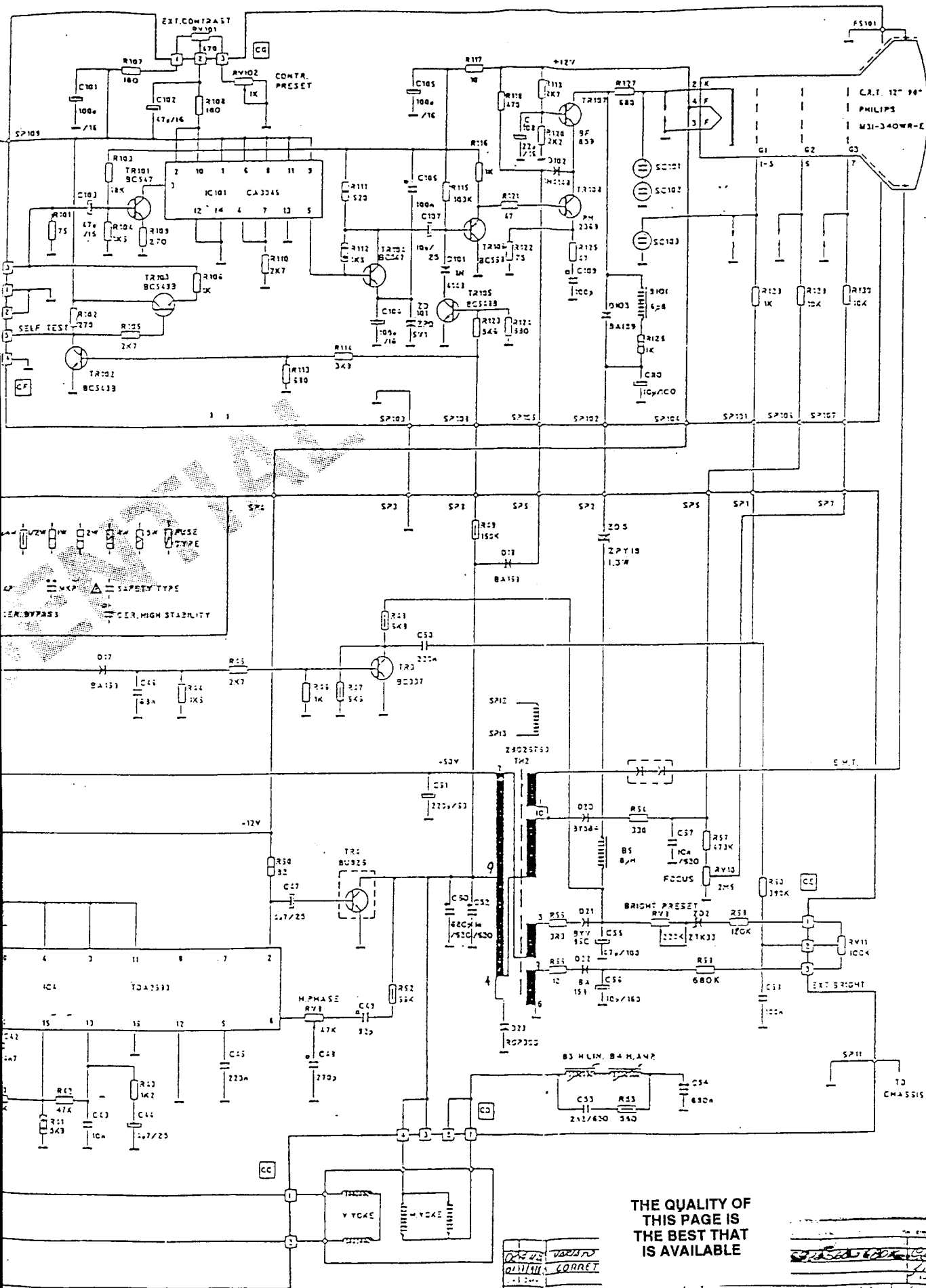
RESISTANCE:
 □ 1/4W 1/4W
 □ 1/2W 1/2W
 CAPACITANCE:
 □ 4KT
 □ KP-MKP
 □ 2.5%



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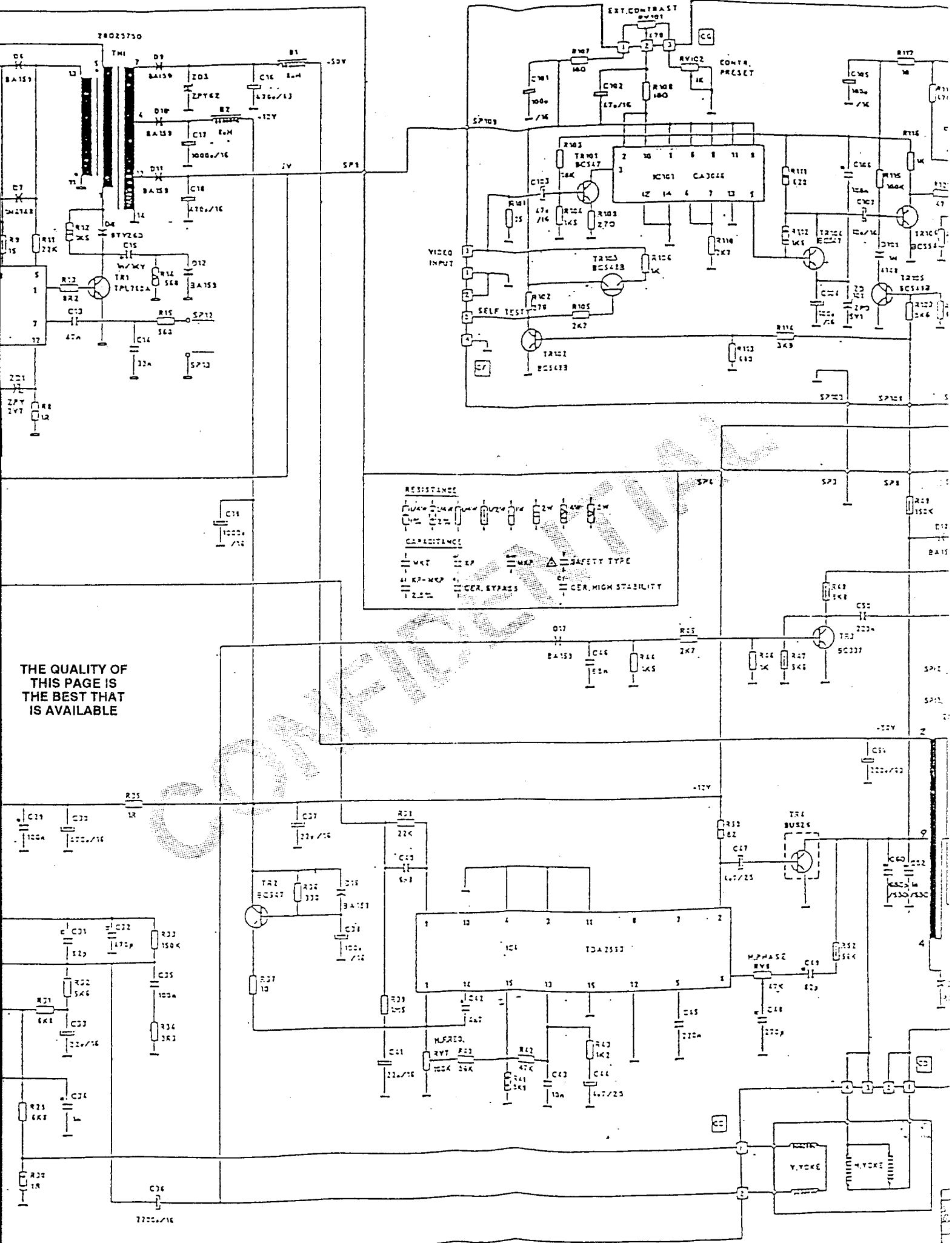
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	2% TOLERANCE
	5% TOLERANCE
	10% TOLERANCE
	20% TOLERANCE
	50% TOLERANCE
	100% TOLERANCE
	FUSE TYPE

CAPACITANCE	
	MKT
	KP-MKP
	2.5% TOLERANCE
	BYPASS
	SAFETY TYPE
	HIGH STABILITY



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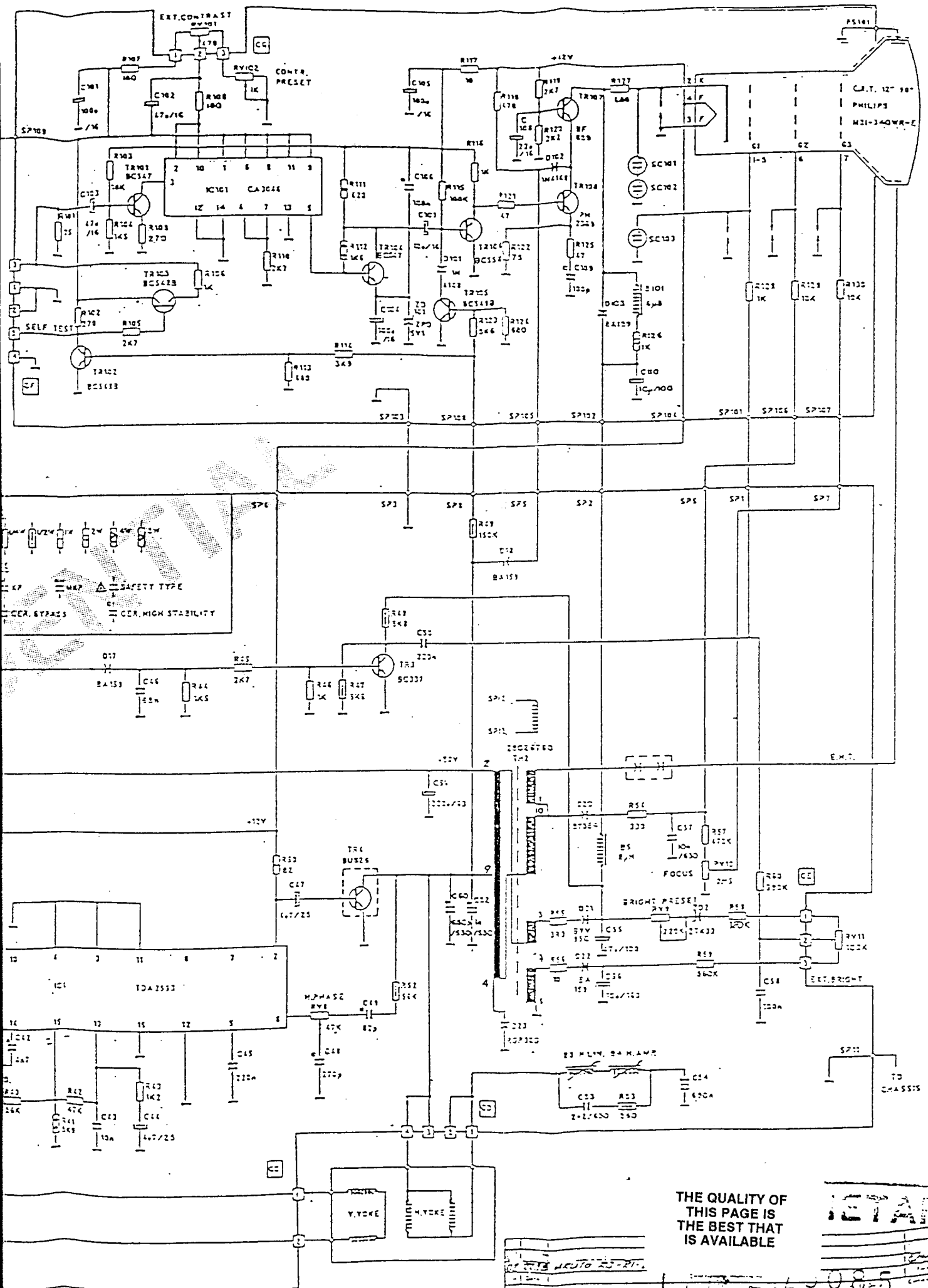
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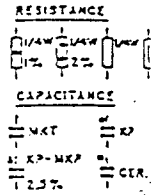
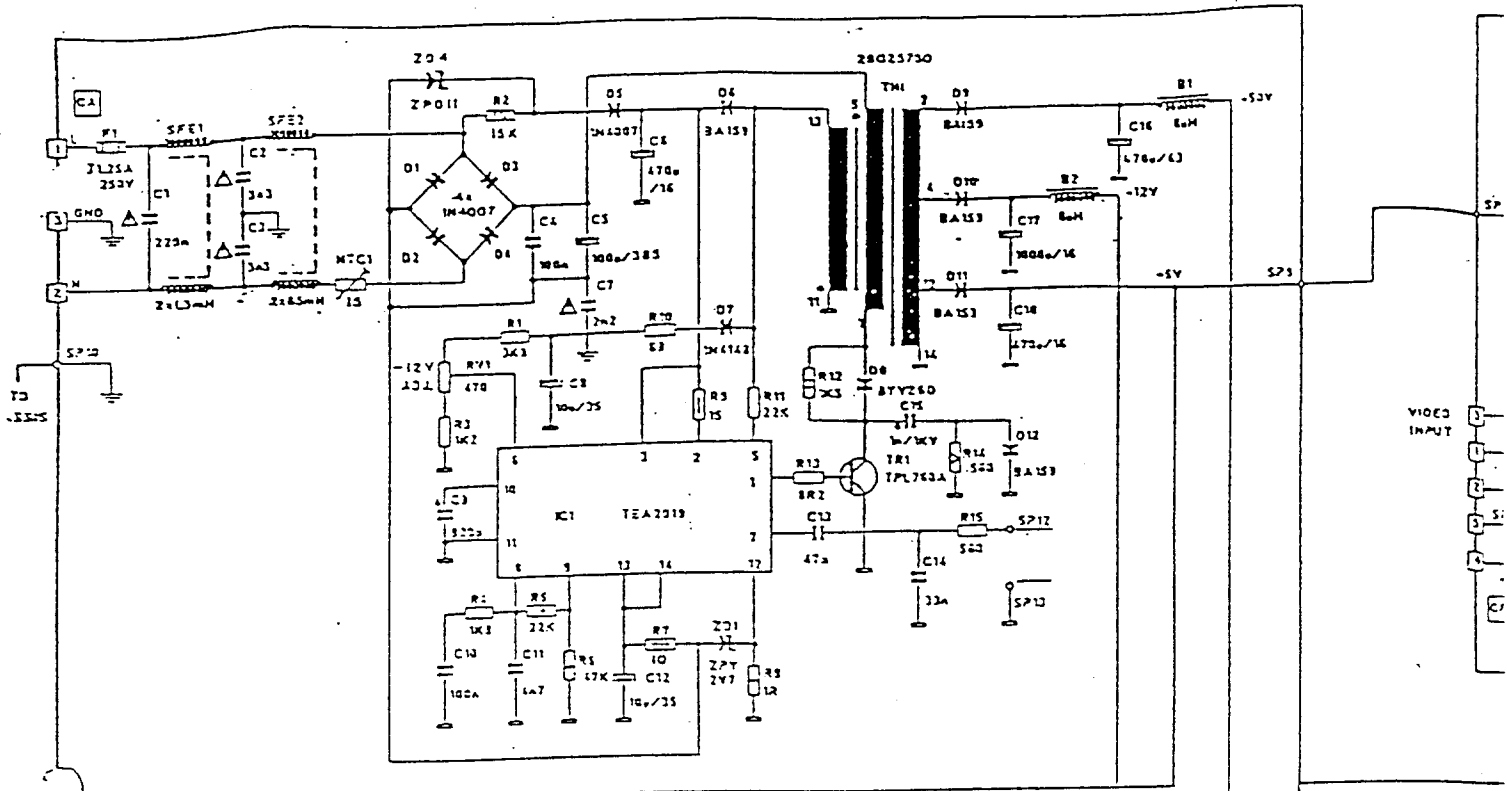


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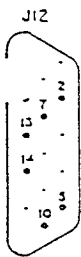
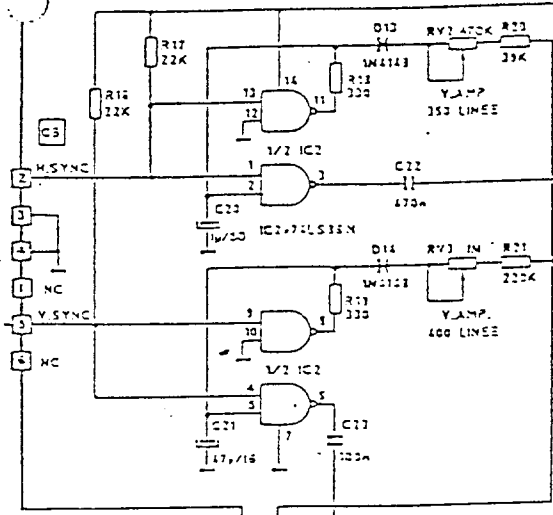
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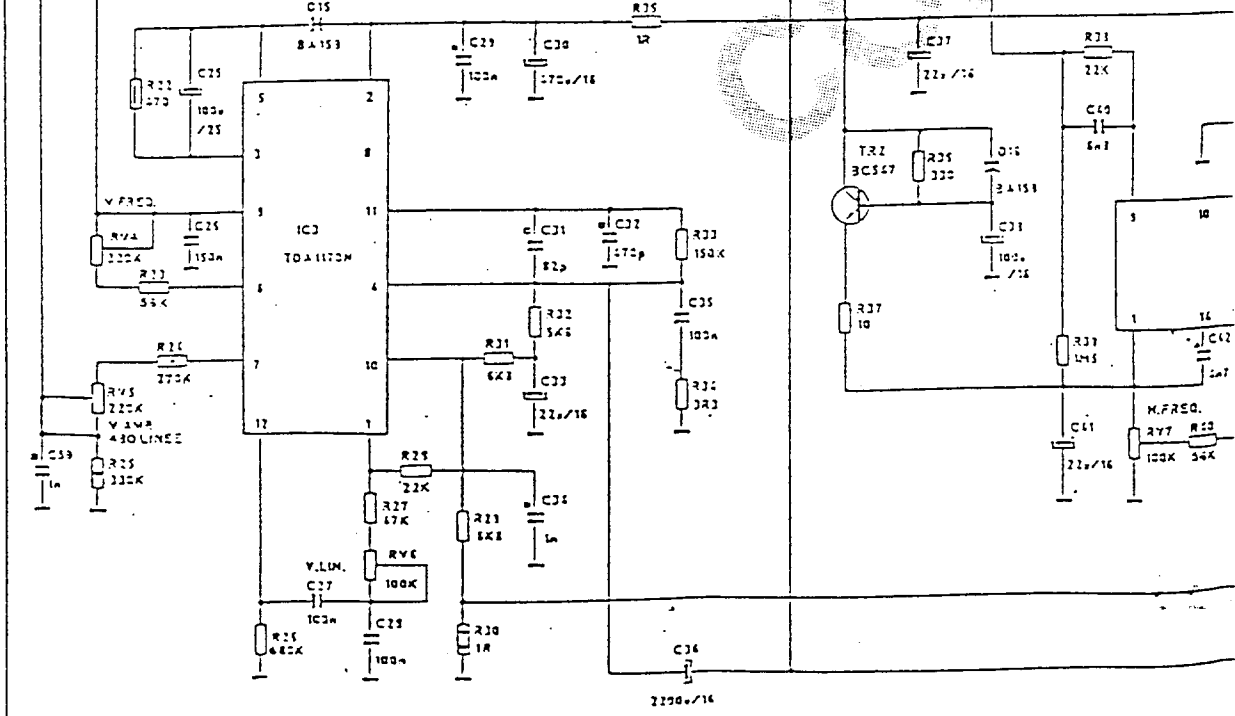
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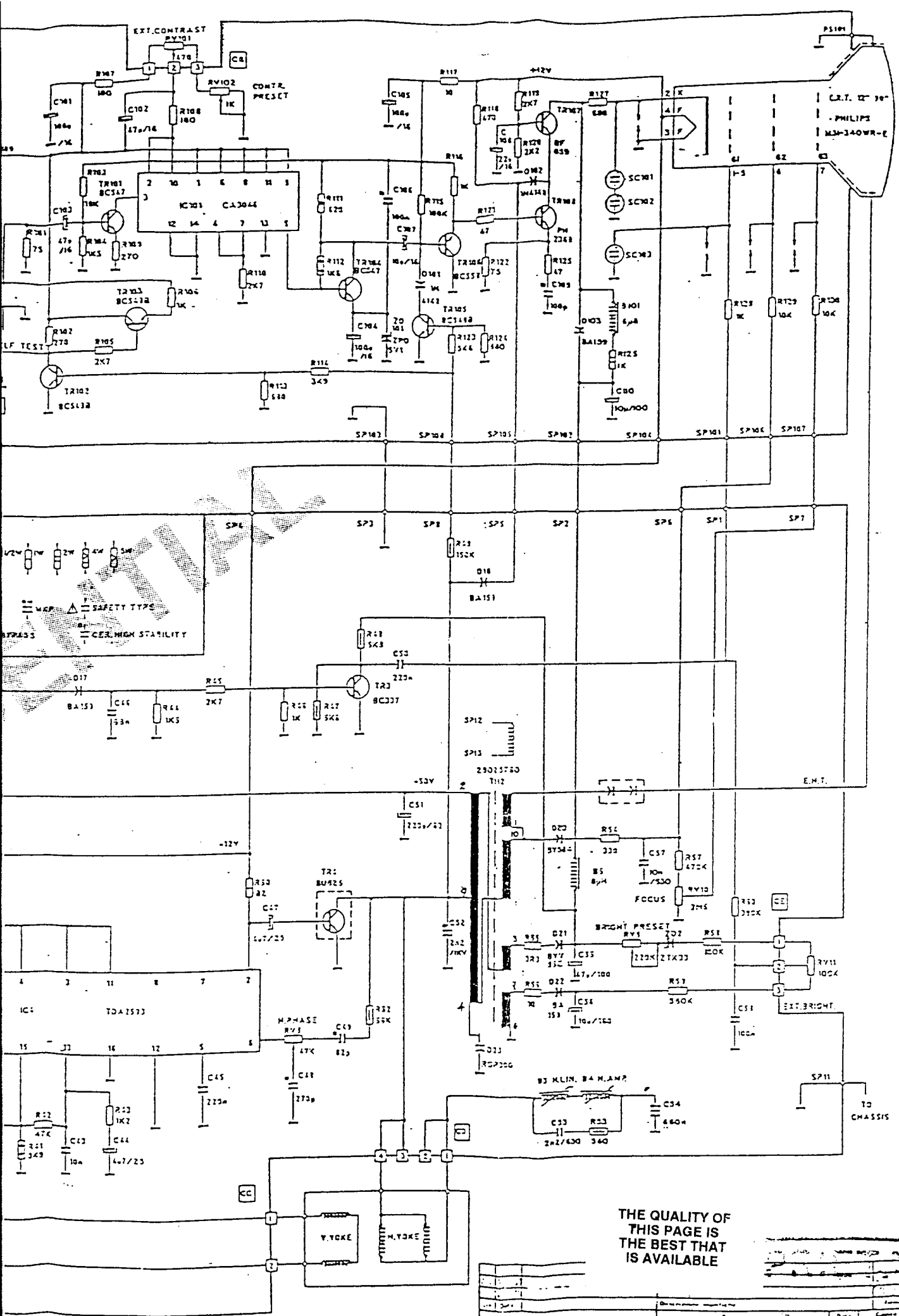


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2	PIN 30F
3	
4	
5	PIN 50F
6	
7	PIN 10F
8	
9	
10	PIN 3-4C3
11	
12	PIN 3-4C3
13	PIN 2C5
14	PIN 5C3
15	





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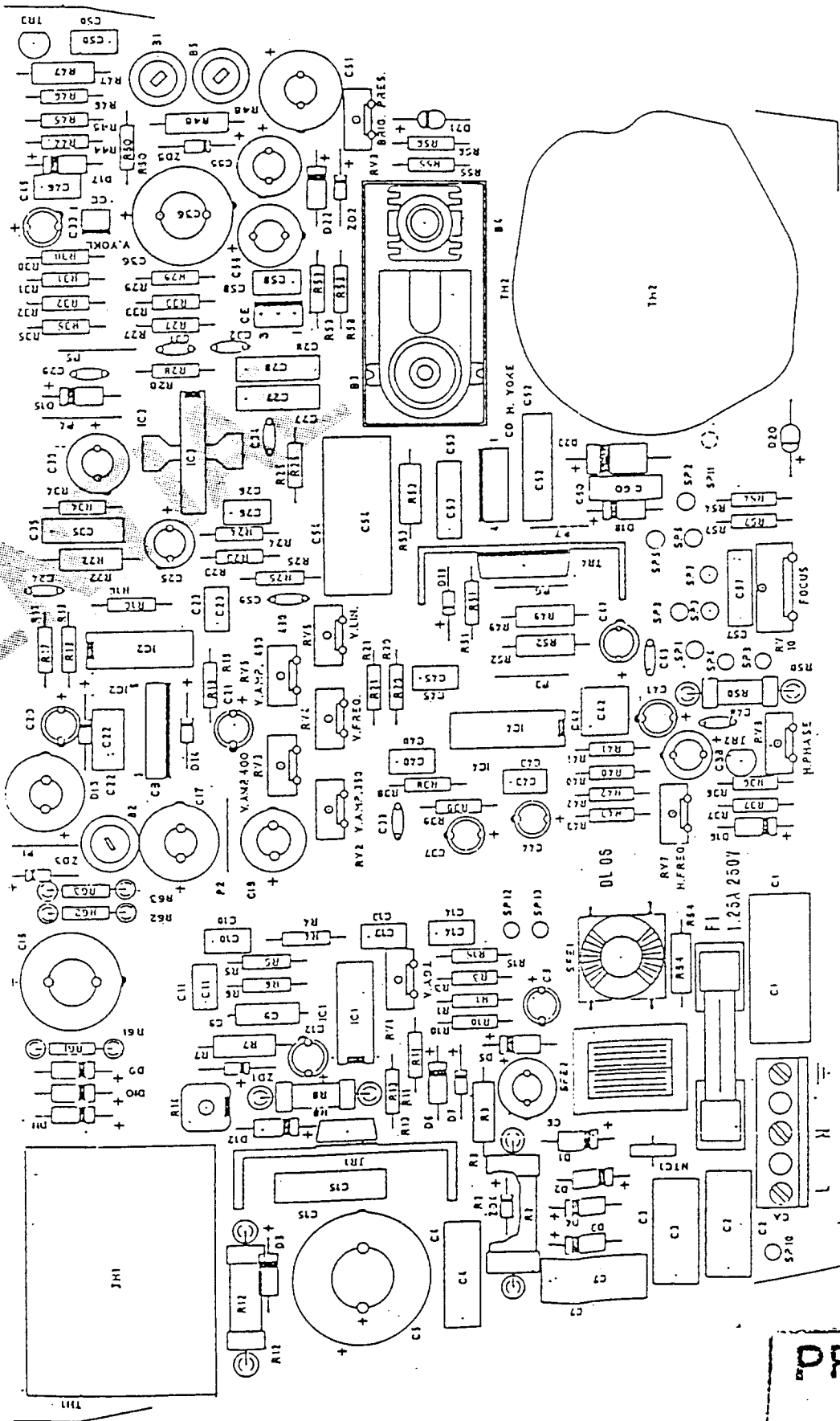


Fig. 3.3 Circuito stampato monitor montaggio componenti

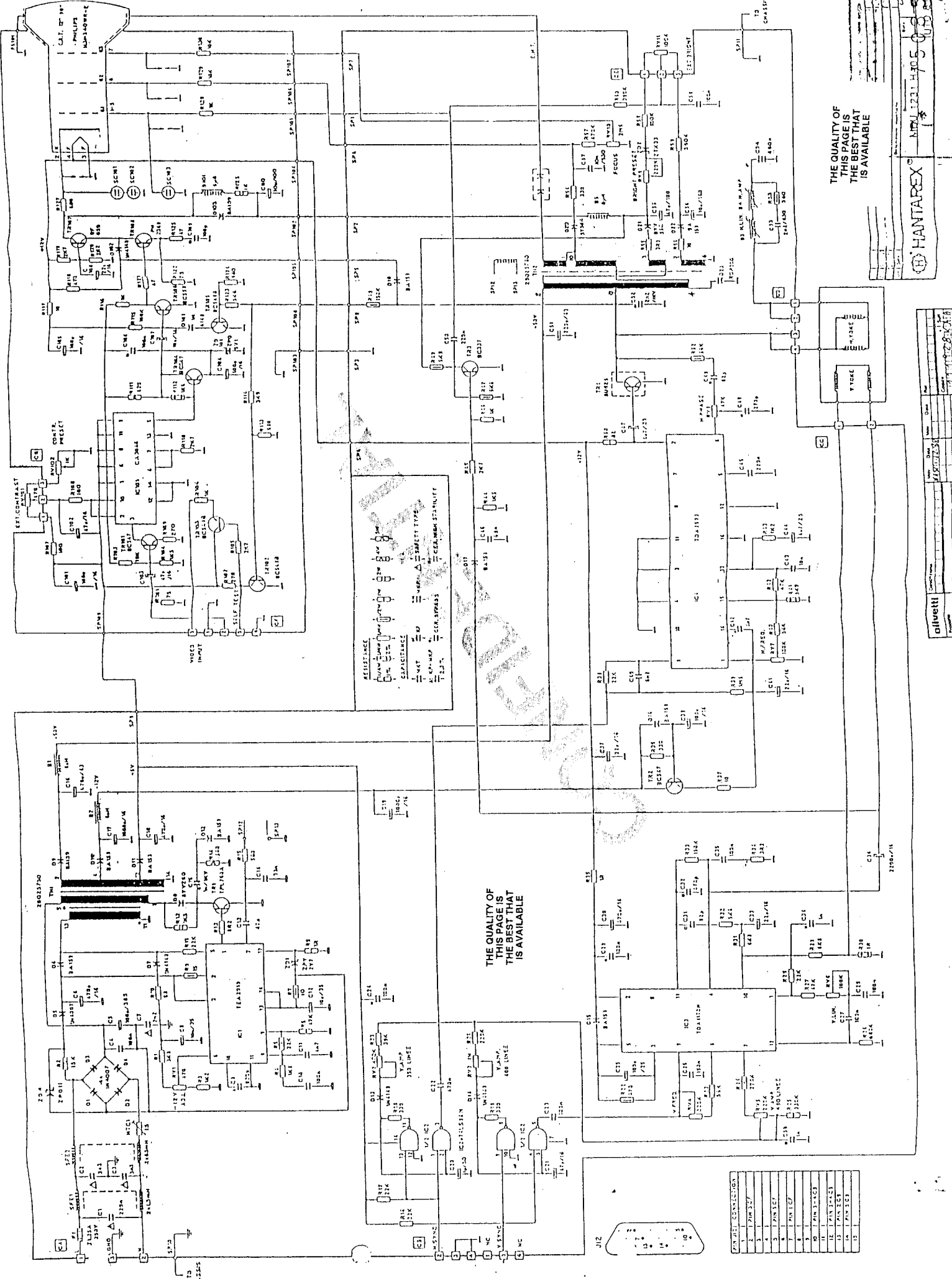
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RESISTANCE
 100K
 100V
 100W
 100A
 100B
 100C
 100D
 100E
 100F
 100G
 100H
 100I
 100J
 100K
 100L
 100M
 100N
 100O
 100P
 100Q
 100R
 100S
 100T
 100U
 100V
 100W
 100X
 100Y
 100Z

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PIN OUT CONNECTION	
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2	100W
3	100X
4	100Y
5	100Z
6	100A
7	100B
8	100C
9	100D
10	100E
11	100F
12	100G
13	100H
14	100I
15	100J
16	100K
17	100L
18	100M
19	100N
20	100O

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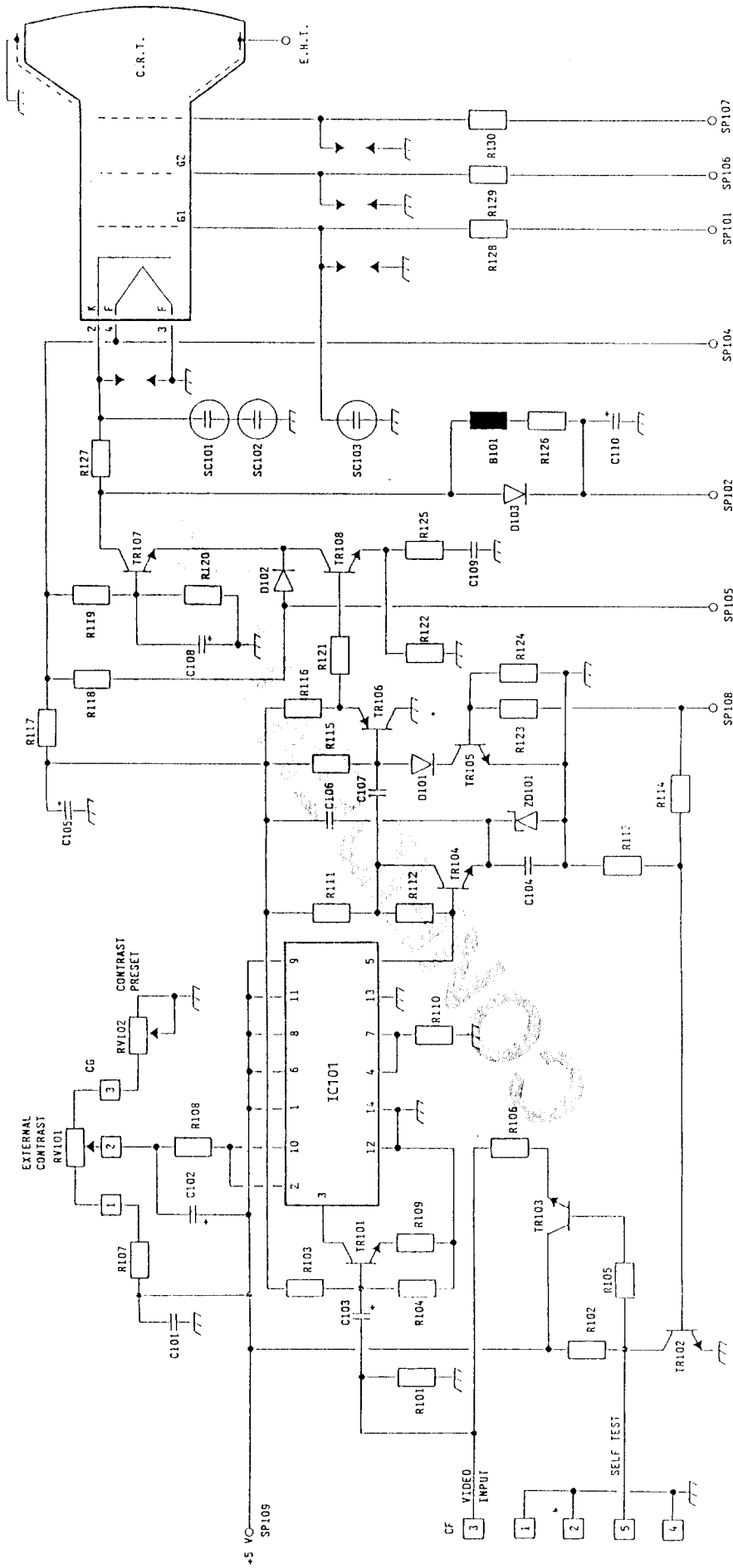
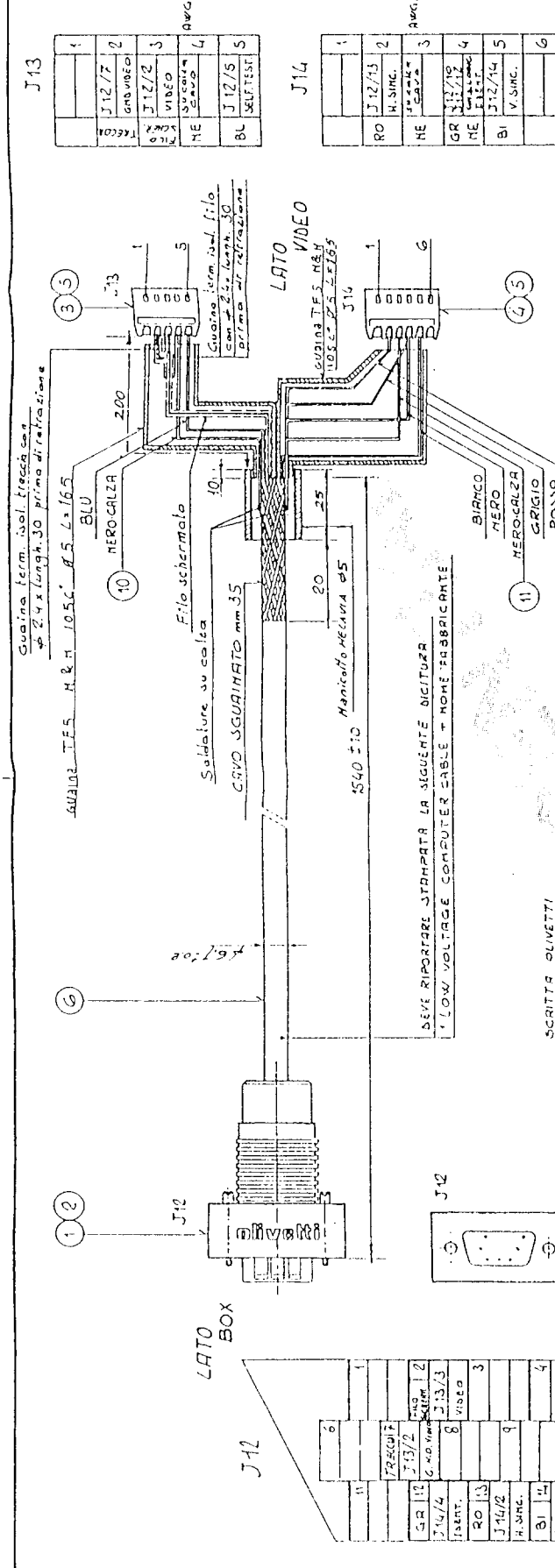


Fig. 1-25 Video Final Amplifier Circuit



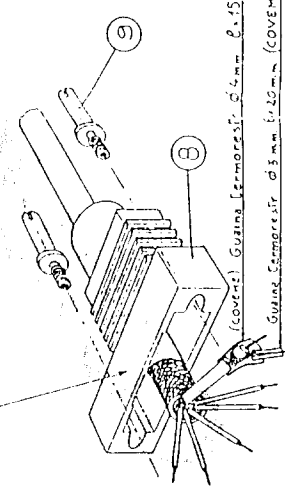
J13

1	
2	J12/7 GR. VIDEO
3	J12/2 VIDEO
4	NE CALZA
5	J12/5 SELF TEST

J14

1	
2	RO J12/13 H. SINC.
3	NE CALZA
4	GR J12/19 H. SINC.
5	BI J12/14 V. SINC.
6	

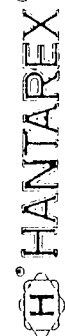
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1	Connettore a serino tipo 1, IS Roman, MOP-22	AMP	740354/1
2	Contatto	AMP	740351/2
3	Connettore a S.Vic	PRESARCO	112/6235
4	Connettore a G.Vic	PRESARCO	112/6236
5	Contatto	PRESARCO	11/6222
6	11No. Cavo Preformato		ICAROFIO
7	1 Schermo per connettore	OLIVETTI	491910
8	1 Caricatore		
9	2 Viti fissaggio		
10	1 Cavoletto mm 22 AWS 22 STYLE 1007		
11	1		
12	1		
13			



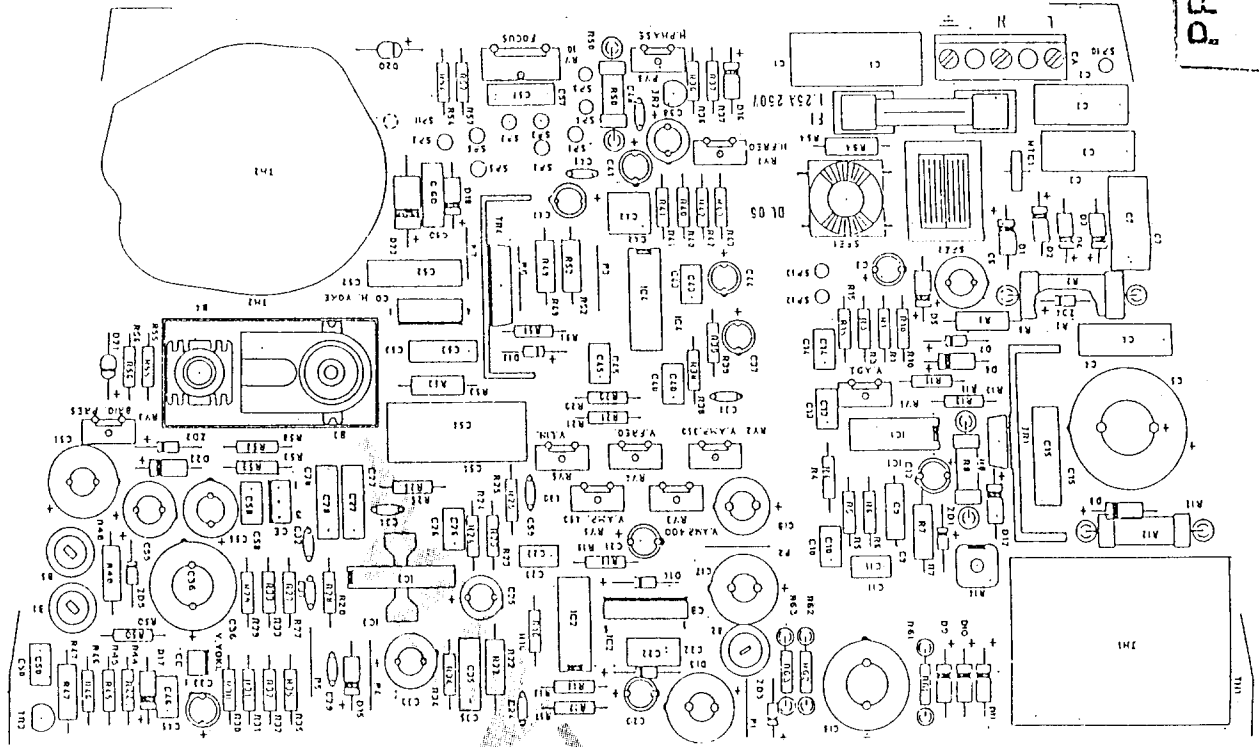
02	27/11/73	Isolamento della apparecchiatura di serie con filo TEMPAFUSIBILE 9951/F	Prodotto
03	14/1/80	Aggiunta nota sulla serie "OLIVETTI"	OLIVETTI MDU 1231
02	19/05/84	Aggiunta due pagine per protezione fili: N.84 T.F.S. 1055-225-2-2285	Codec 621006050
01	4-1-88	Ultimata modifica al lib. con AWS 22 style 1007	N° Dis U.T.C. 627
N	Data	Descrizione modifiche	Firma
Materiale		Descrizione	Data
Trattamen.		CRVO INGRESSO SEGNALE	11.11.87
		Firma	Lozz.
		App	
		Toll. gen.	
		Prodotto	
		OLIVETTI MDU 1231	
		Codec	
		N° Dis	
		U.T.C.	627

NB: LA SCRITTA "OLIVETTI" CHE SI TROVA SUL
 CARICATORE DEVE CORRISPONDERE
 ALLA PARTE PIU' STRETTA DEL CONNETTORE
 A VASCETTA.

Una volta gruppato i cavi sui connettori
 può essere ammessa l'applicazione di una
 coda del tipo TEMPAFUSIBILE 9951/F cod MANT 81001640



15 AUG 85

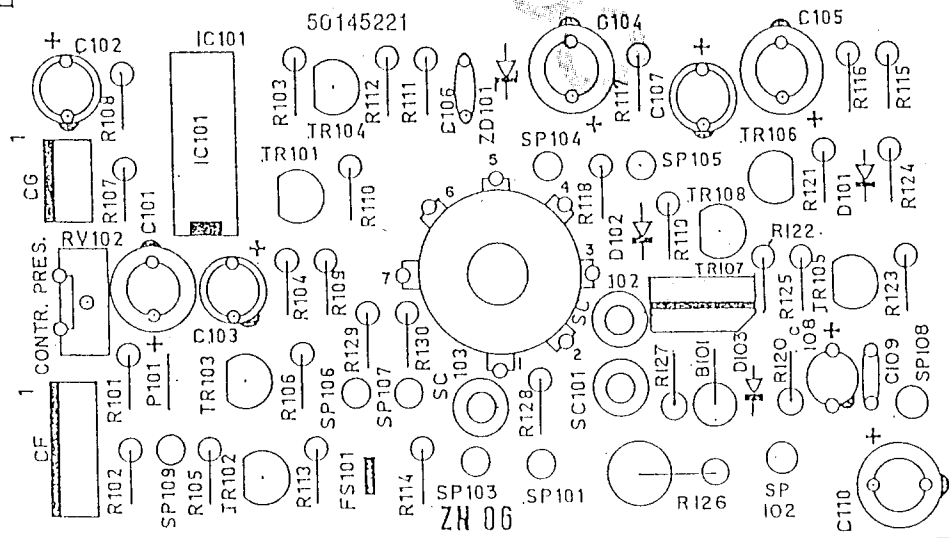


Rev.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Date																					
Code																					

PROPRIETARY

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Fig. 3.3 Circuito stampato monitor montaggio componenti



Rev.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Date																					
Code																					

Fig. 3.4 c.s. amplificatore video montaggio componenti

