

Service Manual

Super VGA Monochrome Monitor

MM14SAE / MM14SAR

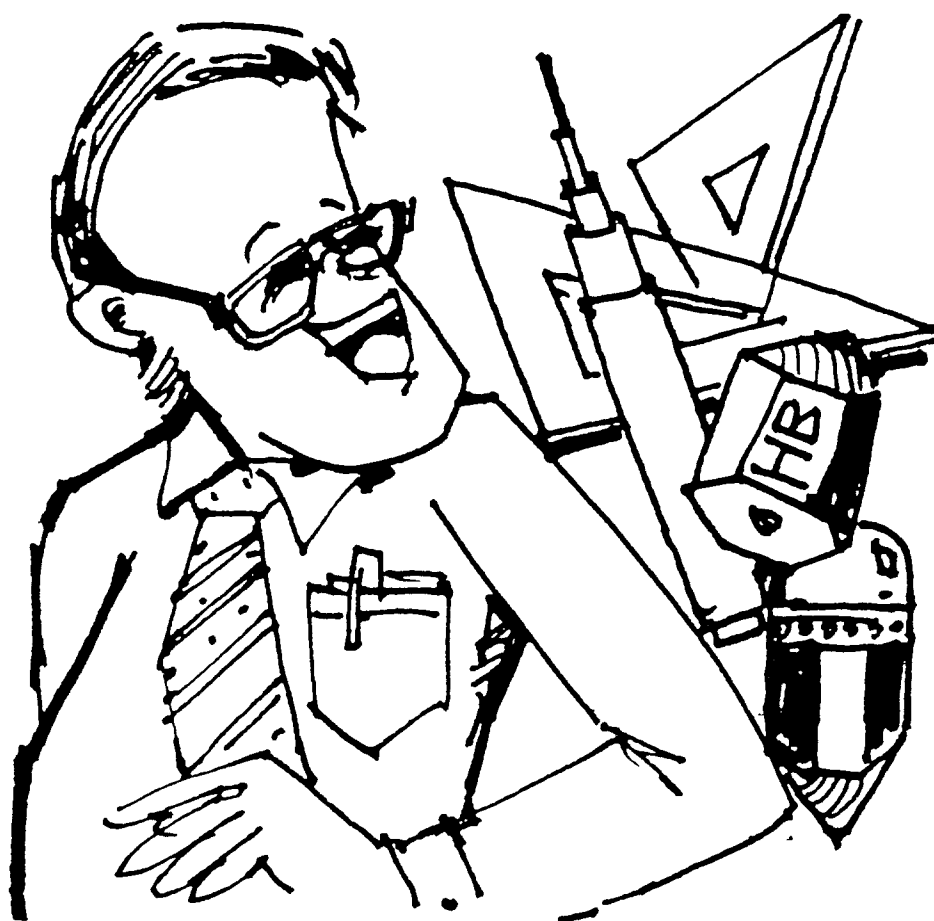


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1. SPECIFICATIONS

APPLICATION	Typical data display device for personal computer applications.					
POWER INPUT	30 Watts (nominal), AC 100~240V 50/60 Hz. A 1 meter 3-wire grounded line cord is furnished.					
VIDEO SIGNALS	Red, Green, Blue: All are positive analogue. Input levels: 0~0.7 Vp-p.					
SYNC. SIGNALS		Hor. Frequency	Vert. Frequency	Vert. SYNC.	Hor. SYNC.	Resolution
	Mode 1	31.5 KHz	70 Hz	—	+	640 x 350
	Mode 2	31.5 KHz	70 Hz	+	—	720 x 400
	Mode 3	31.5 KHz	60 Hz	—	—	640 x 480
	Mode 4	35.2 KHz	56 Hz	+ / —	+ / —	800 x 600
	Mode 5	35.5 KHz	87 Hz	+	+	1024 x 768
SIGNAL CONNECTOR	15-pin D-shell connector.					
DISPLAY TUBE	14", 90°, 1524R, 20 mm neck. MM14SAE: MM14SAR: Anti-static CRT					
DISPLAY AREA	Width: 232 ± 5 mm Height: 170 ± 5 mm					
DISPLAY TIME	Horizontal:	Mode 1: 26.058μs	Mode 2: 26.058μs	Mode 3: 26.058μs		
		Mode 4: 24.1μs	Mode 5: 22.22μs			
	Vertical:	Mode 1: 11.504ms	Mode 2: 13.156ms	Mode 3: 15.762ms		
		Mode 4: 11.2ms	Mode 5: 17.07ms			
RETRACE TIME	Horizontal:	4.0 μs Vertical: 0.5 ms				
RESOLUTION	Horizontal:	1024 dots				
	Vertical:	Mode 1: 350 scan lines (non-interlaced)				
		Mode 2: 400 scan lines (non-interlaced)				
		Mode 3: 480 scan lines (non-interlaced)				
		Mode 4: 600 scan lines (non-interlaced)				
		Mode 5: 768 scan lines (interlaced)				
USER CONTROLS	Power-off, Brightness, Contrast, V-Size, H-Phase					
SERVICE CONTROLS	H-Hold, H-Width, V-Lin, V-Hold, Focus, Sub-Brightness, B+ 12V Adj.					
ENVIRONMENTAL	Operation:	5°C to 35°C ambient.				
	Storage:	-40°C to 65°C.				
	Humidity:	50% to 80% (non-condensing)				
	Altitude:	to 7000 feet above sea level.				
DIMENSIONS	325 (H) x 287 (W) x 320 (D) mm					
WEIGHT	6 Kg (Net)					
MODEL NAME	MM14SAE-U01	MM14SAE-E01				
	MM14SAR-U01	MM14SAR-E01				
LOW RADIATION	MPRII Compliance					
SAFETY AND EMC	U01 Model:	UL/CSA/FCC Class B Approved				
	E01 Model:	TUV/TUV'S GS MARK/FTZ Class B Approved				

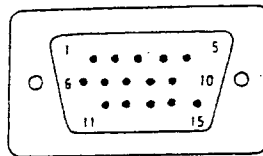
2. OPERATING INSTRUCTIONS

Procedure for installing and using the Model MM14SAE/MM14SAR Monochrome Display:

1. Position the display on the desired operating location and connect the three wire grounded recessed blade plug with boot to AC 100~240V power source in personal computer.
2. Three-wire power cord is provided as a safety precaution as it connects the chassis and cabinet to the electrical conduct ground.

CAUTION: The power cord is intended to serve as the main disconnect device. Install the socket-outlet near the equipment and in an easily accessible place.

3. Connect the 15-pin monochrome display shielded signal cable with core to the video adapter output on your computer and lock both screws on the connector to ensure firm grounding. The connector appears as follows:



15-Pin Monochrome Display
Signal Cable

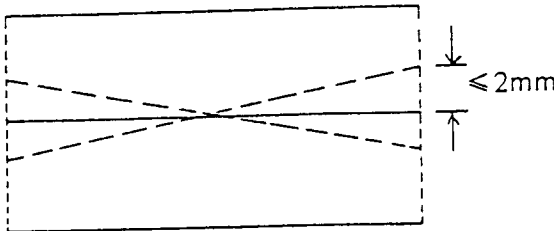
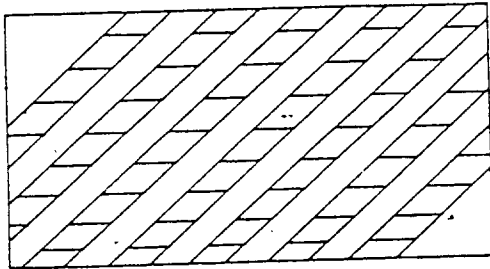
Pin No.	Description	Pin No.	Description
1	Red Signal	9	No Pin
2	Green Signal	10	Digital Ground
3	Blue Signal	11	Jumper to Pin 10
4	Jumper to Pin 10	12	No Pin
5	Jumper to Pin 10	13	Horizontal Sync.
6	Red Return	14	Vertical Sync.
7	Green Return	15	No Pin
8	Blue Return		

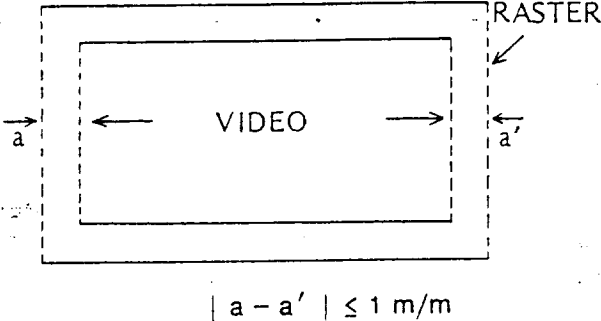
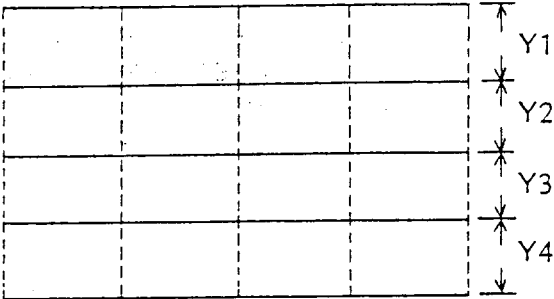
4. Turn on the computer power switch.
5. Apply power to the display by push the monochrome display power switch to the "ON" position and allow about thirty seconds for display tube warmup. The Normal indicator lights when the display is on. After a few seconds, data should appear on the screen. Adjust the brightness and contrast for the best readability.

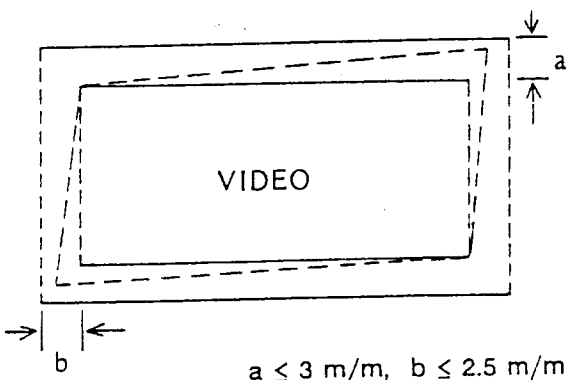
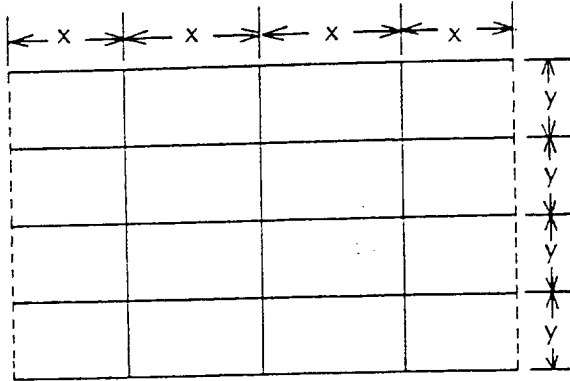
If your MM14SAE/MM14SAR Monochrome Display requires service, refer to the controls and adjustment information of this publication and verify that all controls and adjustments on the display are properly set. If your display does require service, it must be returned with the power cord.

3. ALIGNMENT PROCEDURE

1. AC INPUT VOLTAGE: 100 – 240 VAC
50/60 HZ
2. INPUT SIGNALS: PC + SVGA CARD (VIDEO O/P, 0.7Vp-p)
TEST SOFTWARE (TATUNG 13)
3. NOTE: (1) TEST UNIT SHALL BURNING FOR AT LEAST 15 MINUTES.
(2) CRT FACEPLATE SHALL FACE TO EAST BEFORE ADJUSTMENTS.
(3) ANY INSTRUMENT FOR ADJUSTMENT SHALL HAVE CHECKING OR CORRECTION (IF NEED) EVERYDAY BEFORE MANUFACTURING.

NO.	ITEM	ADJUSTMENT PROCESS AND METHOD	TEST PATTERN AND CONDITIONS
1.	B ⁺ ADJUST	ADJUST RV811 TO HAVE DC O/P = $12 \pm 0.2V$ AT TP803 TEST POINT	F3 RASTER CUT-OFF BRIGHT VR → MAX. CONT. VR → MAX.
2.	DEFLECTION YOKE ADJUST (TILT)	<p>(1) MOUNTING AND ROTATING D. Y. PROPERLY TO HAVE DISPLAY CENTER HORIZ. LINE PARALLEL WITH BEZEL EDGE. THE TOLERANCE IS ± 2 mm</p>  <p>(2) SCREW, DY PROPERLY.</p>	F3 → AF1
3.	HORIZONTAL HOLD ADJUSTMENT	<p>(1) ADJUST RV409 (H-PHASE) TO SHIFT PICTURE TO THE EXTREME LEFT.</p> <p>(2) ADJUST RV406 H-HOLD UNTIL THE PICTURE SHOWN AS FIGURE 45° TO 90° DIAGONAL</p> 	<p>F3</p> <p>F3 → CTRL F3</p>

4.	HORIZONTAL CENTER ADJUSTMENT	<p>ADJUST RV409 (H-PHASE) TO HAVE VIDEO DISPLAY AT CENTER OF RASTER.</p>  <p style="text-align: center;">$a - a' \leq 1 \text{ m/m}$</p>	<p>F3 → AF1 BRIGHT → MAX. CONT. → MAX.</p>
5.	VERTICAL HOLD ADJUSTMENT	<p>(1) ADJUST RV304 (V-HOLD) FIRST AT MODE 5 TO GET GOOD INTERLACE, THEN CHECK THE OTHER MODES.</p>	<p>F3 → CTRL F2 MODE 1 → MODE 5</p>
6.	VERTICAL LINEARITY ADJUSTMENT	<p>ADJUST RV309 TO HAVE DIFFERENCE BETWEEN BLOCK HEIGHT LESS THAN 2 mm.</p> 	<p>F3 → AF1 RASTER CUT-OFF BRIGHT VR → MAX. CONT. VR → 25 F/L</p>
7.	BRIGHTNESS ADJUSTMENT	<p>(1) SET BRIGHT VR TO MAX, SET CONT. VR TO MAX, ADJUST RV425, SUB-BRIGHT TO SET 0.2 ~ 0.8 F/L</p> <p>(2) SET BRIGHT VR TO RASTER CUTOFF SET CONT. VR TO MAX. MEASURING AT CENTER OF CRT, WITH FULL WHITE PATTERN, READING ≥ 30 F/L</p>	<p>F3 → F10</p> <p>F3 (BY J16 PHOTO METER)</p>
8.	HORIZONTAL WIDTH ADJUSTMENT	<p>SET BRIGHT VR TO MAX, SET CONT. VR TO 25 F/L, ADJUST L401 TO SET WIDTH 232 +5/-3 mm.</p>	<p>F3 → AF1</p>
9.	VERTICAL HEIGHT ADJUSTMENT	<p>(1) SET BRIGHT VR TO MAX, SET CONT. VR TO 25 F/L, ADJUST RV1130 TO SET HEIGHT AT 170 ± 3 mm.</p> <p>(2) CHECK MODE 2, MODE 1 PICTURE HEIGHT TO BE AT 170 ± 5 mm.</p>	<p>F3 → AF1</p> <p>F2 → AF1 F1 → AF1</p>

10.	GEOMETRIC DISTORTION ADJUSTMENT	<p>(1) ADJUST THE CENTERING MAGNETS TO HAVE DISPLAY, AT CENTER OF BEZEL.</p> <p>(2) ADJUST THE MAGNETS ON THE 8 POLES AROUND D. Y, TO HAVE PICTURE LIE WITHIN THE WINDOW SHOWN BELOW.</p>  <p style="text-align: center;">$a \leq 3 \text{ m/m}, b \leq 2.5 \text{ m/m}$</p>	F3 → AF1
11.	FOCUS ADJUSTMENT	SET BRIGHT VR TO RASTER CUTOFF, SET CONT. VR TO 25 F/L ADJUST RV422 UNTIL THE WHOLE PICTURE SHOWN BEST FOCUS.	SF7 → SF8
12.	MODE 4 MODE 5 CHECKING	<p>CONFIRM THE AUXILIARY MODES:</p> <p>MODE 4: 800 × 600</p> <p>MODE 5: 1024 × 768</p> <p>THE DISPLAY WIDTH SHALL BE: $232 \pm 5 \text{ mm}$</p> <p>HEIGHT SHALL BE: $170 \pm 5 \text{ mm}$</p> <p>CHARACTERS SHALL BE READABLE.</p>	<p>MODE 4</p> <p>MODE 5</p>
13.	LINEARITY CHECKING	<p>SET BRIGHT VR TO RASTER CUTOFF.</p> <p>SET CONT. VR TO 25 F/L.</p>  <p>VER. LINEARITY:</p> $\frac{ \bar{y} - y \text{ max.} }{\bar{y}} \times 100 \leq 7\%$ $\frac{ \bar{y} - y \text{ min.} }{\bar{y}} \times 100 \leq 7\%$ <p>HOR. LINEARITY:</p> $\frac{ \bar{x} - x \text{ max.} }{\bar{x}} \times 100\% \leq 7\%$ $\frac{ \bar{x} - x \text{ min.} }{\bar{x}} \times 100\% \leq 7\%$	<p>F3 → AF1</p> $\bar{x} = \frac{\text{HORIZONTAL WIDTH}}{4}$ $\bar{y} = \frac{\text{VETICAL HEIGHT}}{4}$

4. CIRCUIT DESCRIPTION

A. Power Supply

Circuit configuration:

The power supply in MM14SA series is a full range switch type. C801, T801, C802, C803 and C804 are used for EMI. R800 is a surge resistor. C806, R805, D802 and C824, R823, D811 are two groups of snubber circuit. Those are used to protect Q801 by reducing the spike and noise. R803 and R804 supply the current at start of power supply.

Control circuit:

The power supply of MM14SA is a current mode control circuit.

It uses a PWM control IC — UC3842.

PIN 1, 2: These are feedback control inputs of I801, RV811 for 12 VDC adjust. The duty ratio is controlled here.

PIN 3: Current sense input. R818 is current limit resistor. When the voltage drop across R818 is over 1V, protection starts to work. R816 and C814 limit the spike on R818.

PIN 4: Free run frequency is controlled by R807, C811 and R808. The power supply sync. signal is provided from T403. This signal is buffered by Q804 and C810 to control the working frequency.

PIN 5: Ground.

PIN 6: Output of I801.

PIN 7: B+ of I801. When power on, 16V is provided via R803, R804 and C807 to start up I801. After initial start, this voltage is supplied by the auxiliary coil of T802.

PIN 8: Provide 5 VDC reference voltage.

Secondary voltages:

This power supply provides three outputs for display to work. These are: 12 VDC, 30 VDC, 33 VDC. 30 VDC or 33 VDC supply to horiz. output circuit. The Q802 switch determines whether 30 VDC or 33 VDC will drive the circuit. 30 VDC for 31.5 kHz scan and 33 VDC for 35.2/35.5 kHz scan.

RV811 is 12 VDC adjust. the overvoltage protection is built up by D807, Q803, R820.

When 12 VDC is too high, D807 will conduct and turn on Q803, 30 VDC or 33 VDC will be shorted, PIN 7 of UC3842 voltage will drop below 10 VDC and shut down power supply.

B. Video Amplifier Circuit

R, G, B analog input signals are mixed by R200R, R200G, R200B, R201R, R201G, R201B. RV202 provides external CONTRAST control. Signal is coupled via C201 and amplified by a feedback amplifier built by Q201 and Q202. D201 provides a DC clamp. Q203 provides horiz. blanking. Q204 provides vert. blanking. Q901 and Q909 are connected as a cascode amplifier for video output stage. C902 provides high frequency peaking.

C. Mode Control Circuit

I101 process the sync. signals to give a positive polarity sync. for vert. circuit, and negative polarity for horiz. circuit. I102 is a frequency decider. The logic to determine whether it is 800x600 or 1024x768 mode is by vert. frequency. R111, C104 determine the output duty. This output is filtered by C105 to control Q101. The logic to determine whether it is 31.5 kHz or 35.2/35.5 kHz is by horiz. frequency. R107, R107A, C103 determine the output duty. This output is filtered by C106 to control Q102, and Q103, 104, 401.

I103 provide vertical size control for all modes. These are:

Mode 1:	D131, R131.	640 x 350 mode
Mode 2:	D132, R132.	720 x 400 mode
Mode 3:	D133, R133.	640 x 480 mode
Mode 4:	D135, R135. or D138, R138	800 x 600 mode
Mode 5:	D139, R139.	1024 x 768 mode

D. Vertical Circuit

Vertical sync. comes from PIN 11 of I101, coupled by C301 to Pin 8 and coupled by C302 to PIN 9. The vert. frequency depend on RV304, R305 and C305.. RV304 provide V. HOLD. control. PIN 7 provide V. SIZE control for each mode.

The output of the buffer stage (PIN 1) feedback via R307, RV309, R306, C306, C307 provide a ramp curve to give a very high degree of linearity. R312 provide current feedback which is compared at PIN 10 with the voltage at PIN 1 by means of R308 and R313. D302 and C304 provide a very short flyback time. The output is at PIN 4 to drive vert. coils of deflect yoke. The vert. blanking provided by PIN 3.

E. Horizontal Circuit

Horiz. sync. comes from PIN 3 of I101 via C401 and R408 to Pin 3 of I401. R405, RV406, C404 determine the horiz. frequency. The collector pulse of horiz. output Q403 is integrated by R417, R410, C309 to give sawtooth feedback at PIN 4. RV 409 provide H. PHASE control. It compares with sync. input at Pin 3 to give phase detect output at PIN 5. It is connected via C403, R404 low pass filter to PIN 7. Thus control oscillator.

The output of I401 is PIN 1 of which duty cycle is controled by R411 and R412 at PIN 8. The output at PIN 1 is then amplified by Q402 and coupled by T401 to horiz. output Q403. R416, C412 provide damping. T401 provide low drive impedance for Q403. The Q403 is simply a switch that is turned on and off at horiz. scan rate. L402 is linearity coil. L401 is width coil for width control. R418, C416 are used for damping. C421 provide dynamic focus wave. It is stepped up by T402 and mixed with DC focus to control PIN 7 of CRT.

The function of T403 secondary are:

PIN 10: Provide B⁺ supply voltage to video output stage.

PIN 1: Gives negative voltage supply for (CRT GRID 1) bias.

RV426 provide external BRIGHTNESS control.

RV425 provide internal SUB-BRIGHTNESS control.

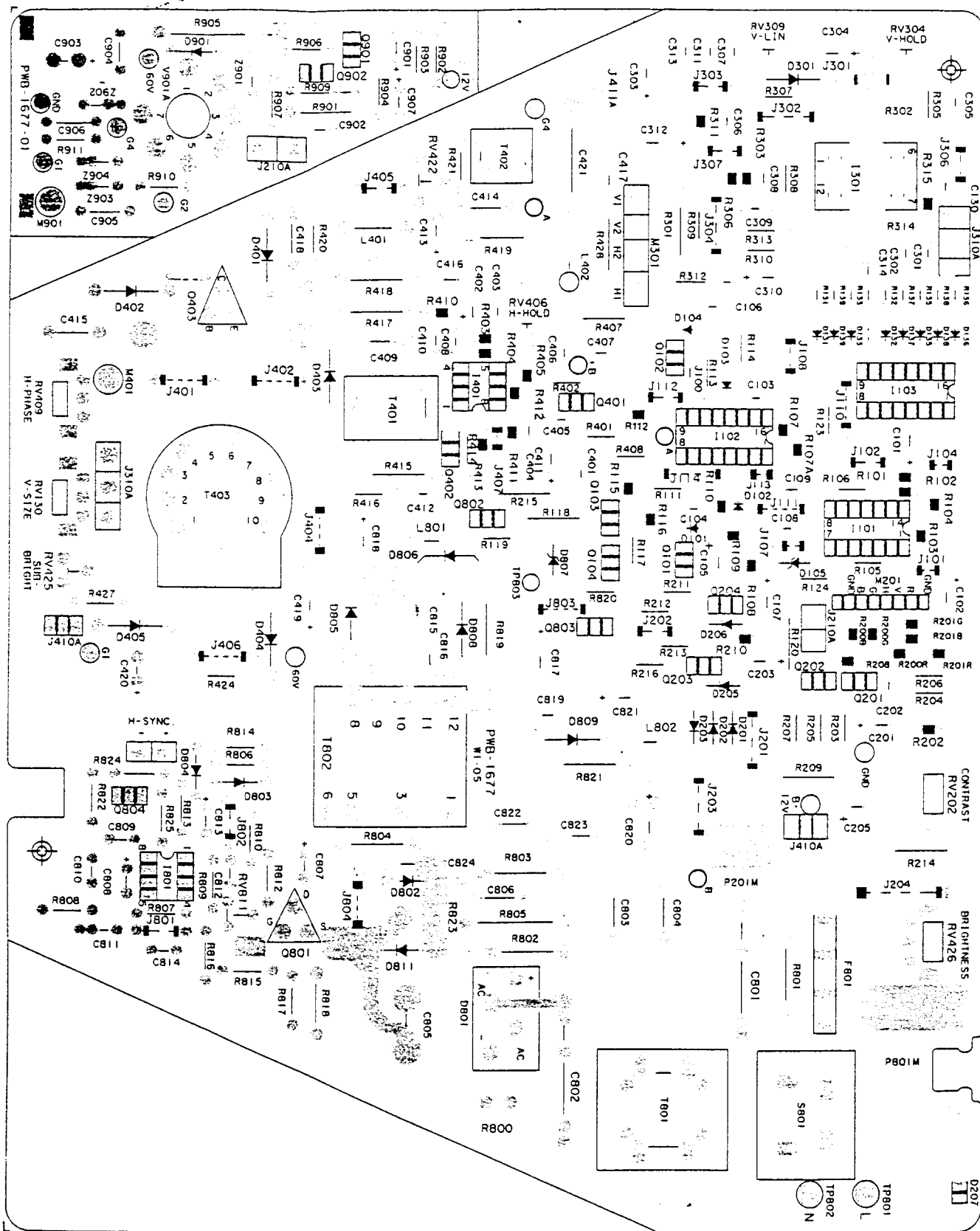
PIN 6: Provide bias for (CRT GRID 2) and DC focus for (CRT GRID 4).

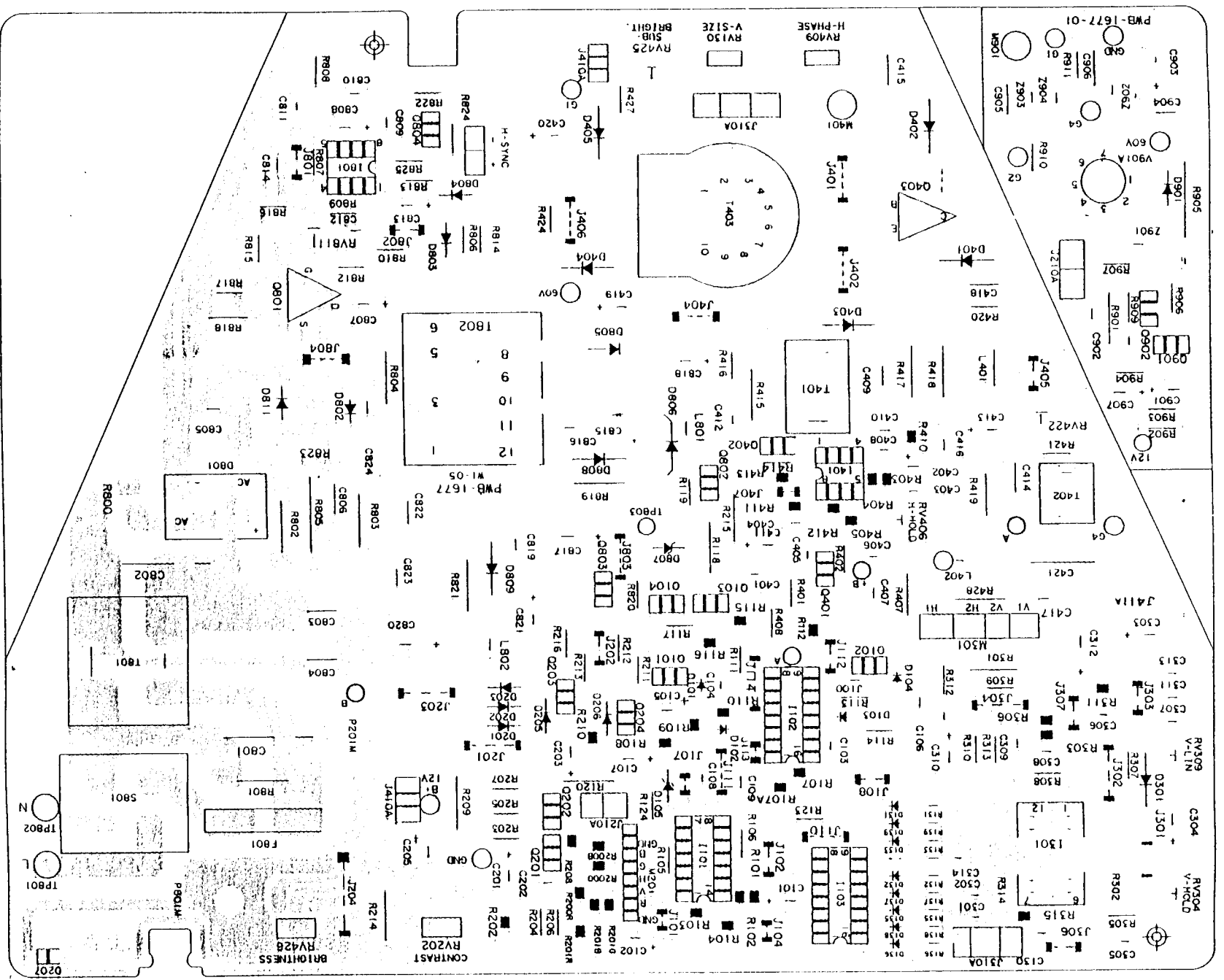
HIGH voltage is supplied via anode cap.

5. CIRCUIT DIAGRAM

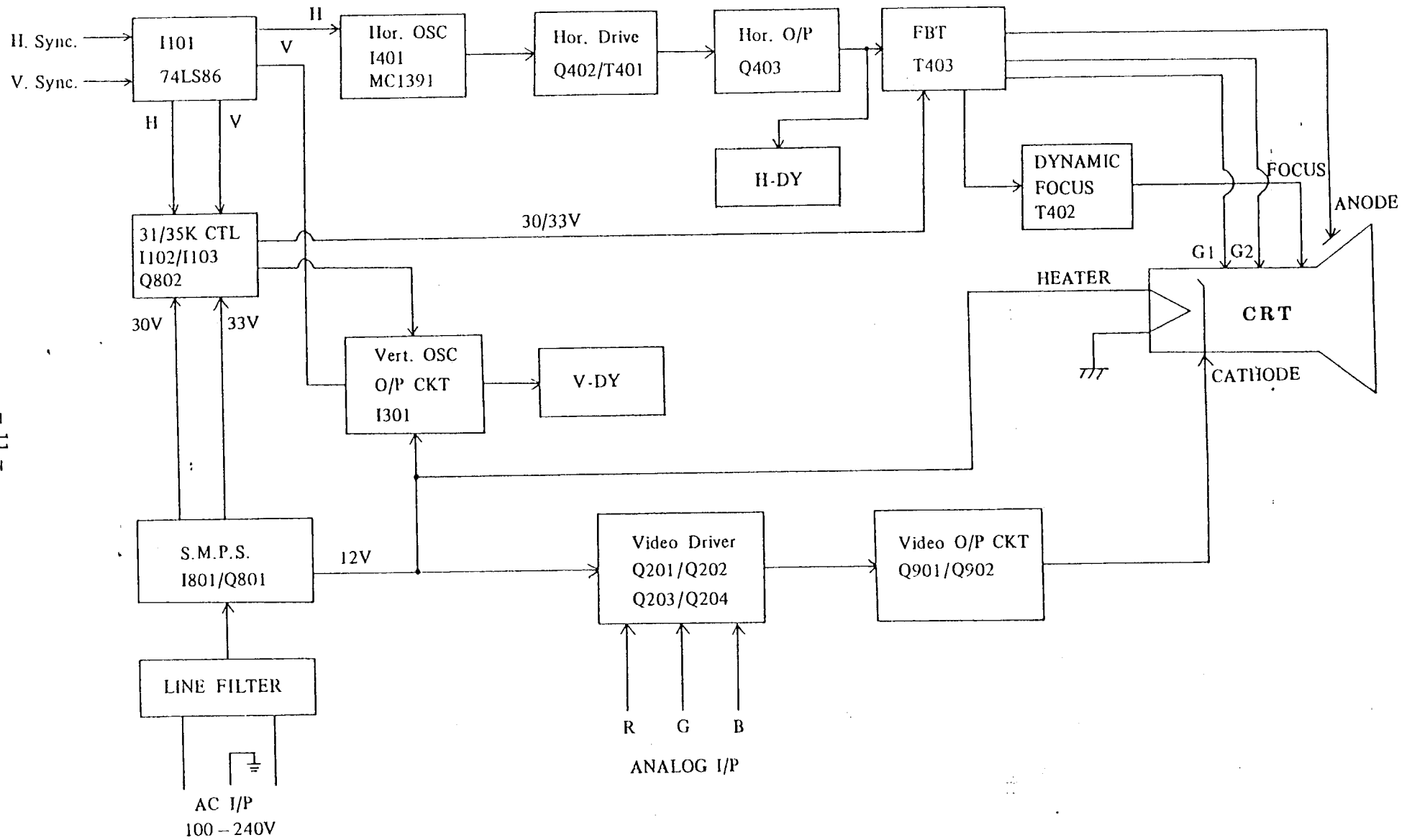
TITLE .		MODEL NO .		DATE	
MONOCHROME MONITOR		MM14SA(E/R)		11	1991 10 22
PWB NO.		DESIGN .	DESIGNER .	CHECKED .	APPROVED .
PWB-1677	H.C. CHANG	H.C. CHANG	Y.W. CHEN		

6. P.C.B. LAYOUT

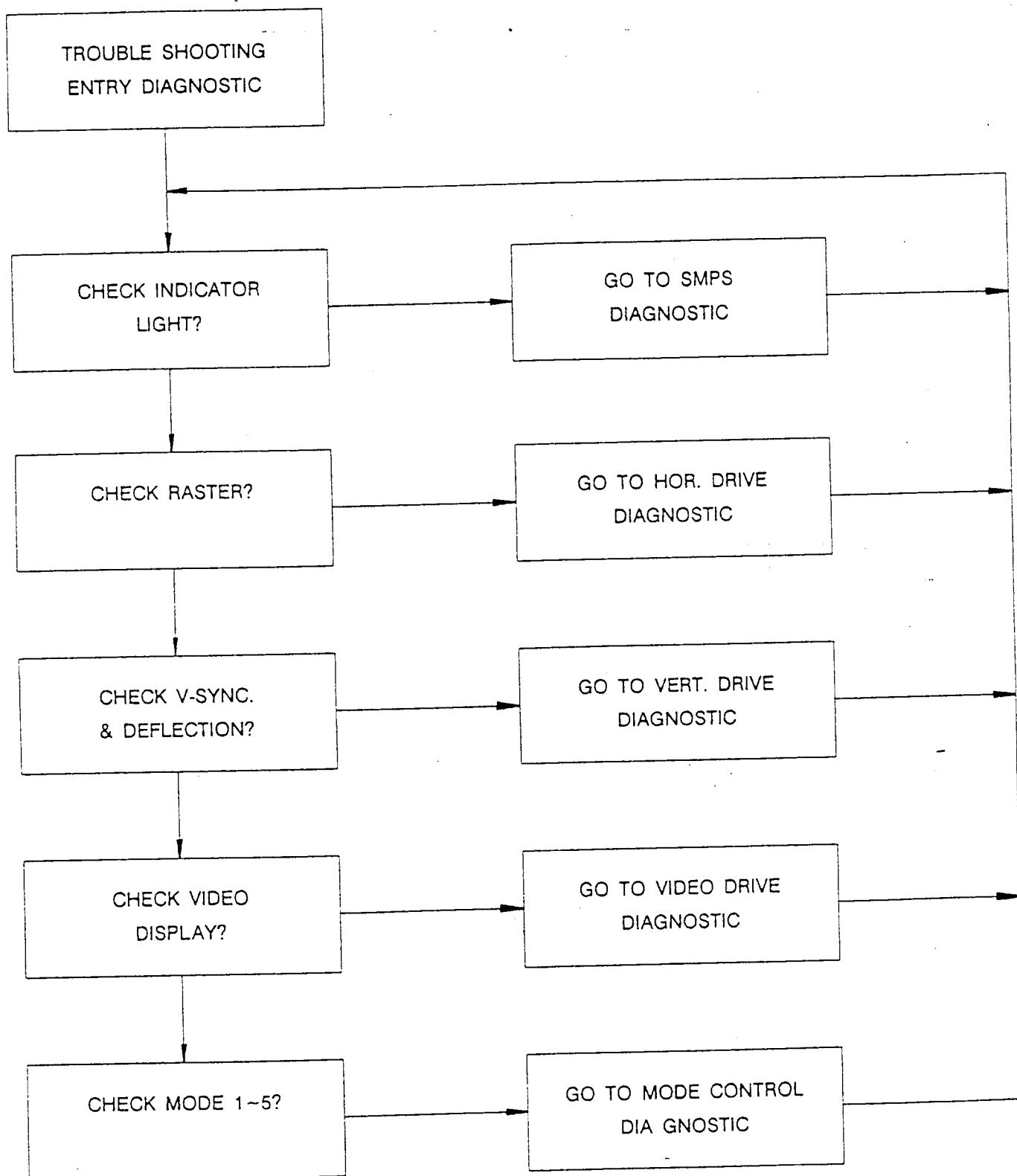




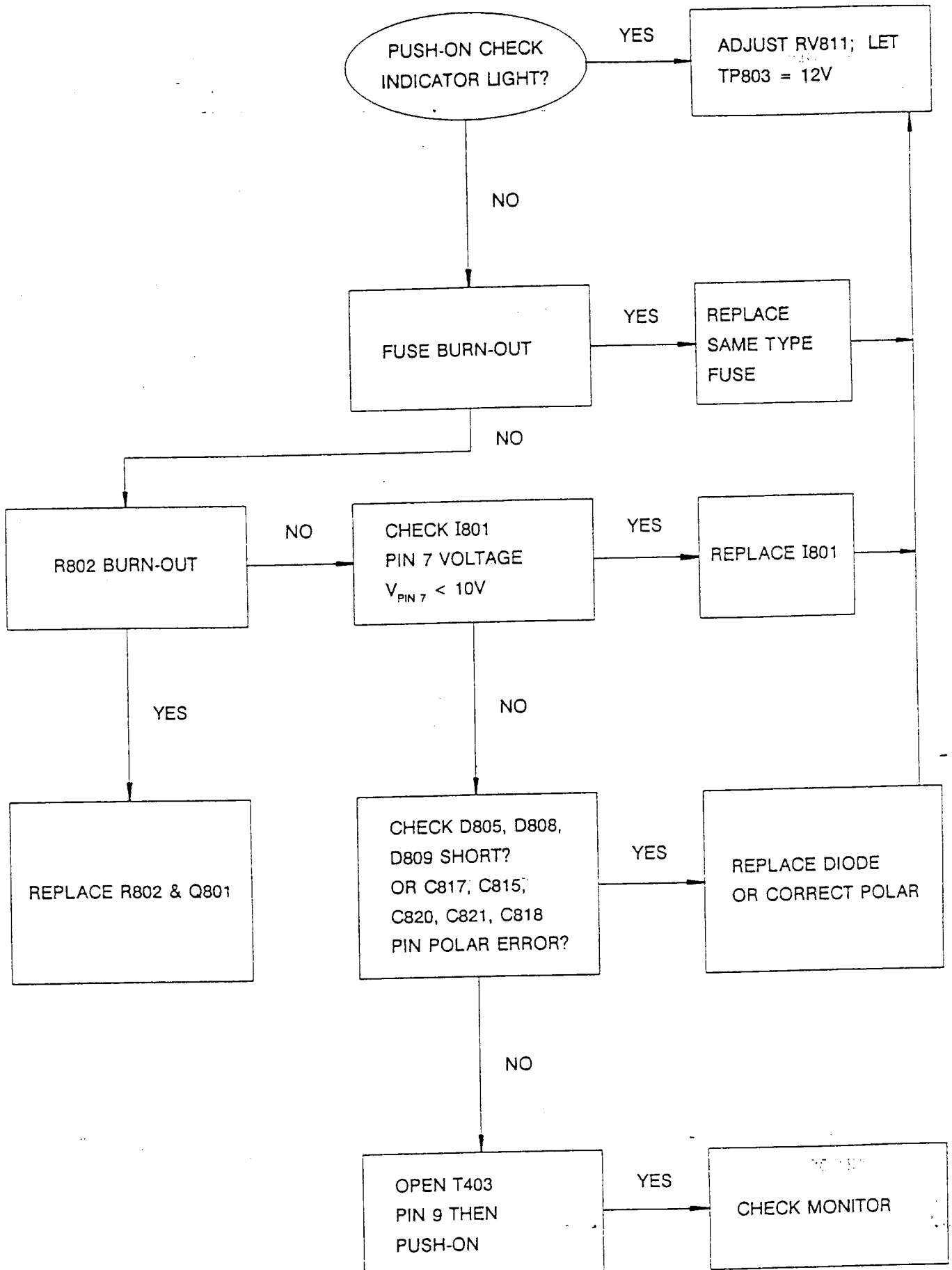
7. BLOCK DIAGRAM



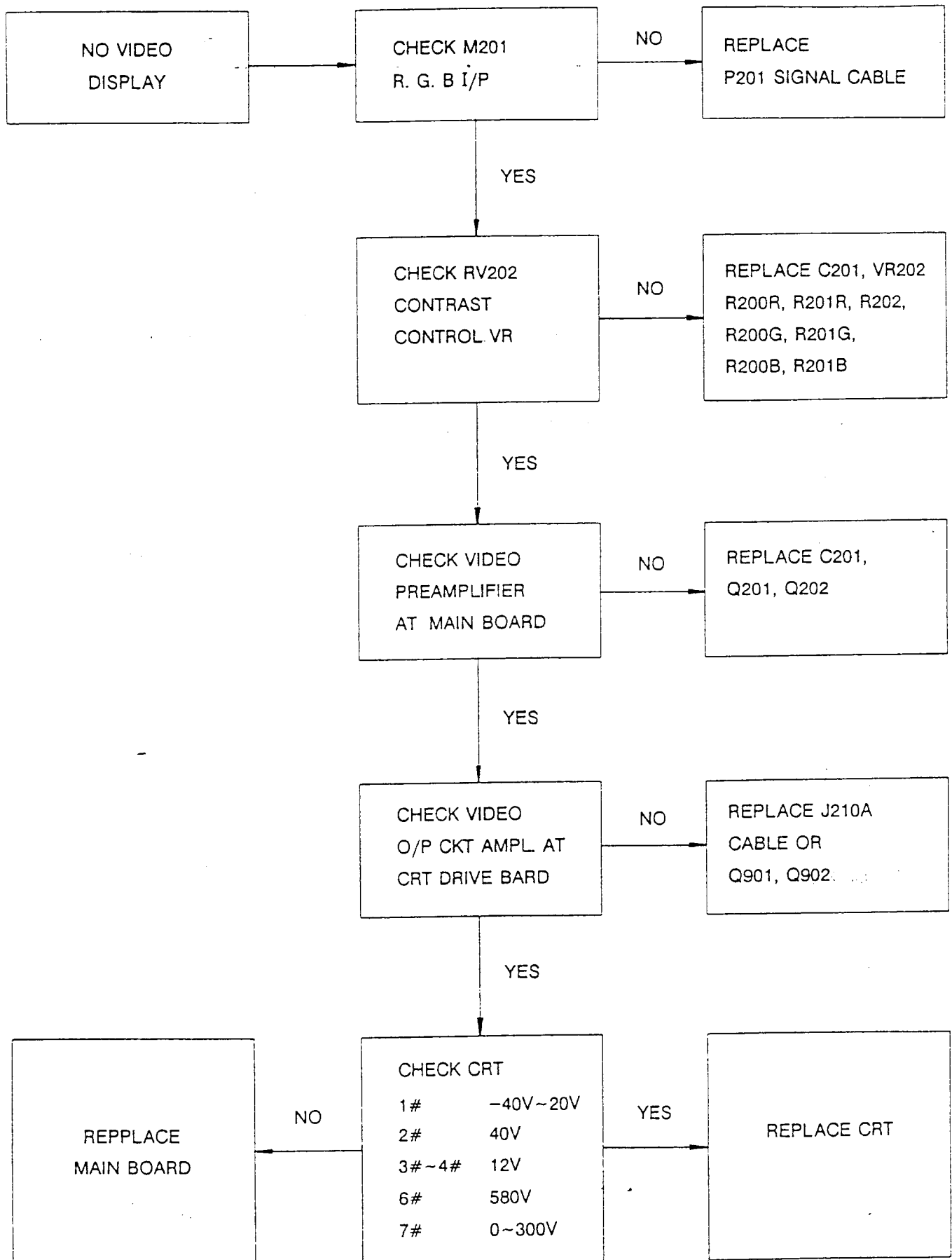
8. TROUBLE SHOOTING



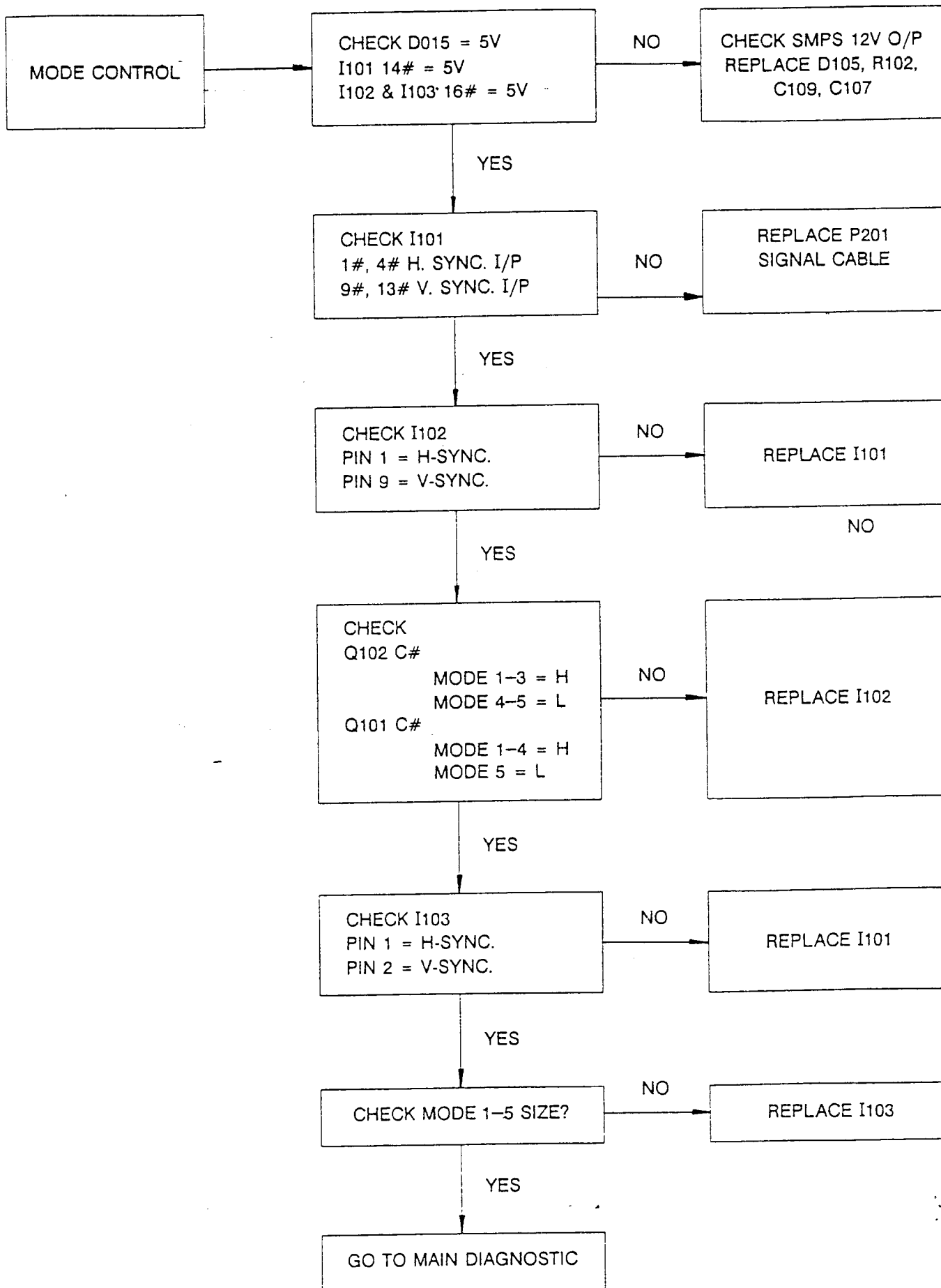
SMPS



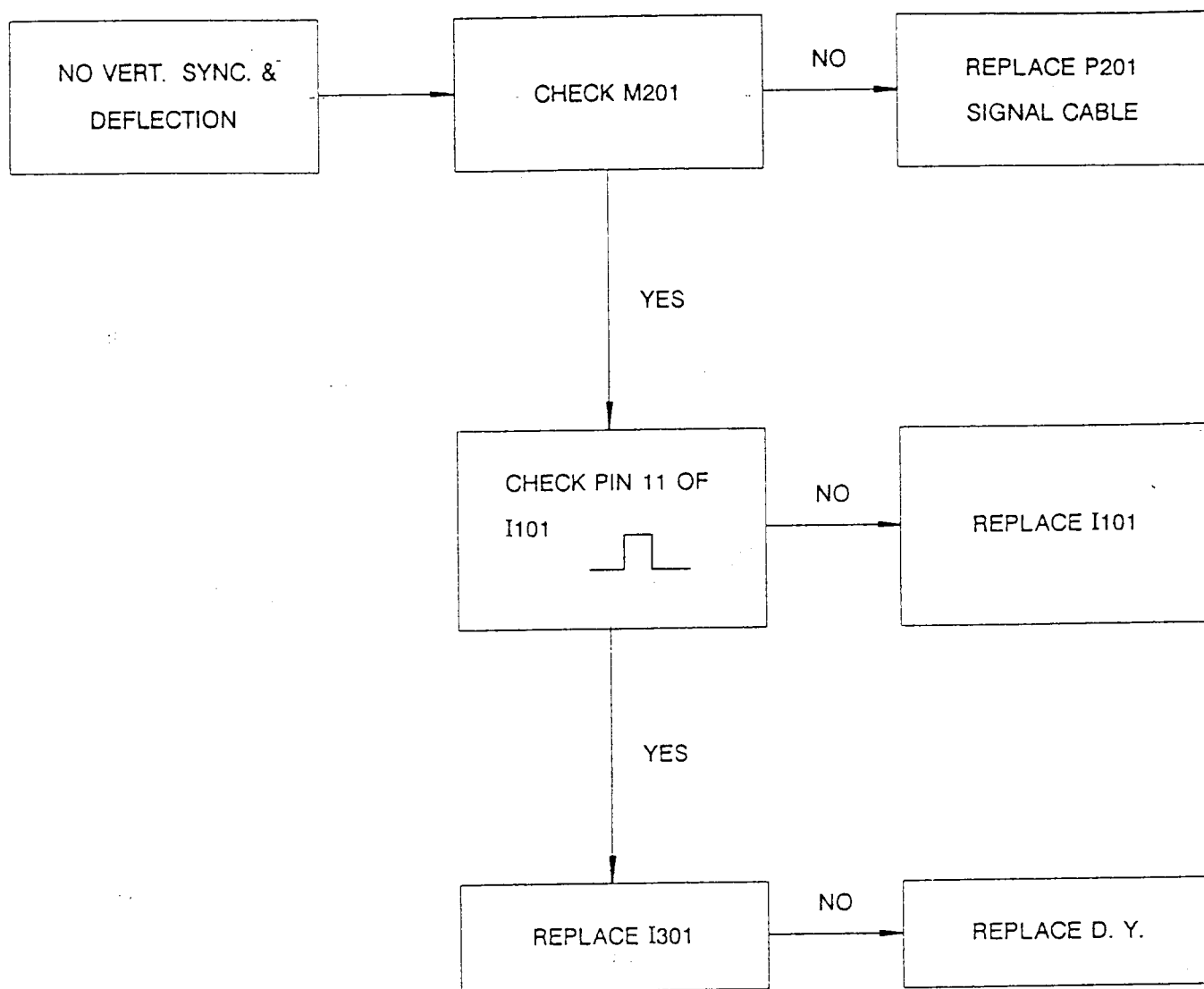
VIDEO DRIVE



MODE CONTROL



VERT. DRIVE



HOR. DRIVE

