SPECIFICATIONS

Monitor Specifications	MultiSync N9702 Monitor	Notes
Picture Tube Diagonal: Viewable: Image Size: Radius:	17 inch 16 inch 1210 mm	90° deflection, 0.26 mm dot pitch CRT, medium –short persistence phosphor, multi-layered anti static screen coating, semi-tint screen, Invar Shadow Mask and Opticlear screen surface.
Input Signal Video: Sync:	ANALOG 0.7Vp-p/75 Ohms Separate sync. Positive/Negative	
Display Color Analog input:	 Unlimited number of Colors	 Depends on display card used.
Synchronization Horizontal: Range Vertical:	31 kHz to 86 kHz 55 Hz to 160 Hz	Automatically Automatically
Resolutions Supported Resolution based on horizontal and vertical frequencies only	640 × 480 @ 60 to 160 Hz 800 × 600 @ 55 to 137 Hz 832 × 624 @ 55 to 128 Hz 1024 × 768 @ 55 to 105 Hz 1152 × 870 @ 55 to 95 Hz 1280 × 1024 @ 55 to 80 Hz ..... 1600 × 1280 @ 55 to 68 Hz	Some systems may not support all modes listed. NEC cites recommended resolution at 85 Hz for optimal display performance.
Active Display Area (Factory Setting) Horizontal: Vertical:	 310 mm 232 mm	 Dependent upon signal timing used, And does not include border area.
Active Display Area (Full Scan)	325 mm 244 mm	Dependent upon signal timing used, And does not include border area.
Power Supply	AC 100 - 240V, 50/60Hz	
Current Rating	2.2A @ 100 - 240V	
Dimensions	403 mm (W) × 420 mm (H) × 418 mm (D)	
Weight	16.0 kg	
Environmental Considerations Operating Temperature: Humidity: Feet: Storage Temperature: Humidity: Feet:	 0° C to + 35° C 30% to 80% 0 to 10,000 Feet -20° C to + 60° C 10% to 90% 0 to 45,000 Feet	

NOTE: Technical specifications are subject to change without notice.

CONTROLS

On-screen display cont  on as follows:

SELECT Enters and exits the OSM menu and decides the icon.

CONTROL - / + Selects one of the controls and increases or decreases the adjustment.

RESET Resets the highlighted control to the factory Setting.

Adjusts the overall image and background screen brightness.

Adjusts the image brightness in relation to the background.

Red Color Control: Adjust the red contrast of the display.

Green Color Control: Adjust the green contrast of the display.

Blue Color Control: Adjust the blue contrast of the display.

Moves the image horizontally (left or right).

Moves the image vertically (up or down).

Increases or decreases the horizontal size of the image.

Increases or decreases the vertical size of the image.

Increases or decreases the curvature of the sides either inward or outward.

Increases or decreases the top of the screen to be the same as the bottom.

Increases or decreases the tilt of the sides either to the left or right.

Increases or decreases the curvature of the sides either to the left or right.

Rotates the entire display clockwise or counterclockwise.

Degauss Control: Eliminates the buildup of stray magnetic fields that alter the correct scan of the electron beams and affect the purity of the screen colors, focus and convergence. When activated, your screen image will jump and waver a bit as the screen is

demagnetized.

Caution: Please allows a minimum of 20 minutes to elapse between uses of the Degauss Control.

9300K This color setting is adjusted at the factory to the stated Kelvin

Moves the OSM menu vertically (up or down).

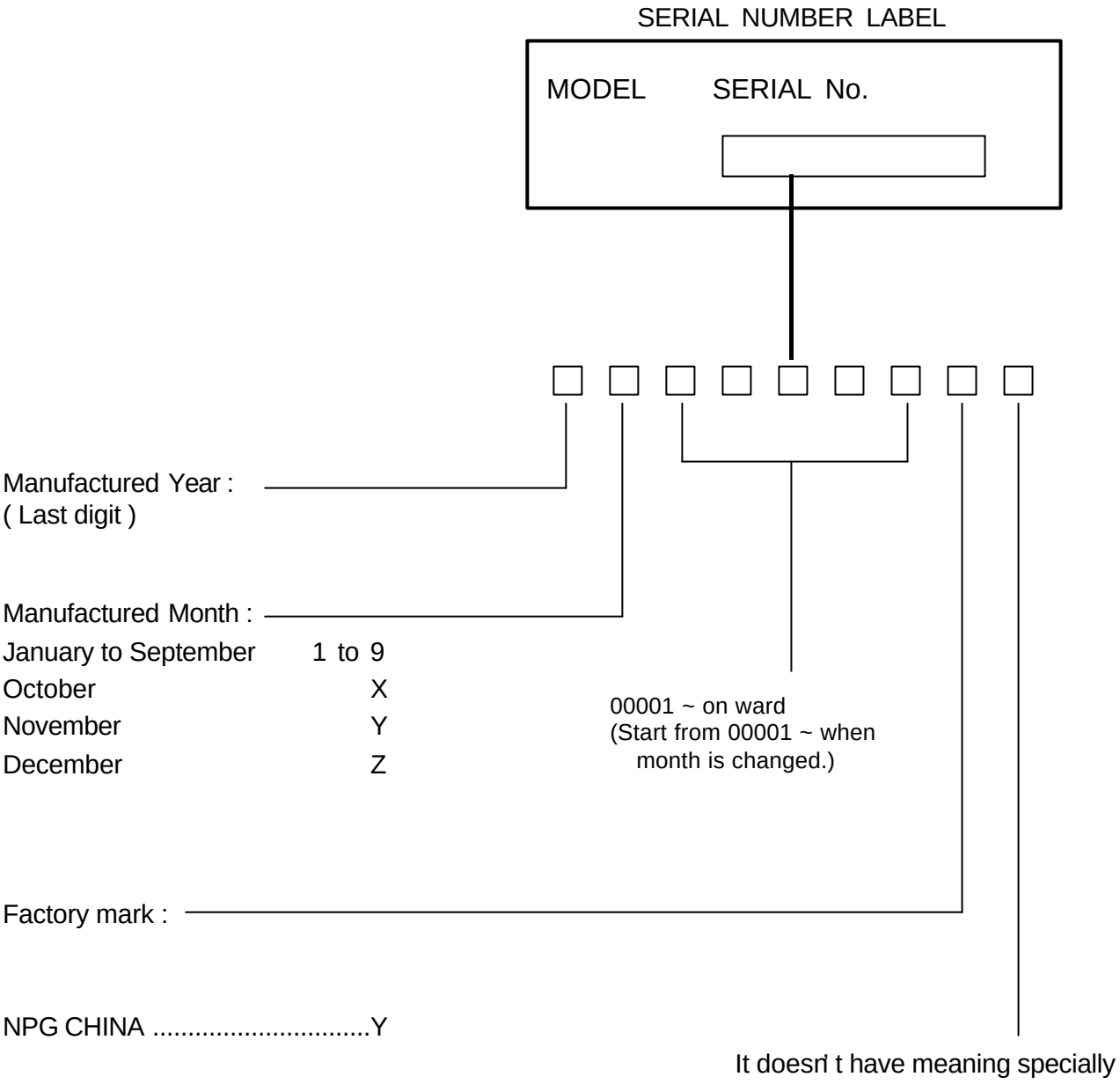
Moves the OSM menu horizontally (left or right).

EXIT: To exit the OSM window. Select EXIT in "Icon select window", then push SELECT button to exit OSM window.

Note: If no buttons are pushed after 10 seconds while in OSM, the window will automactically disappear.

SERIAL NUMBER INFORMATION

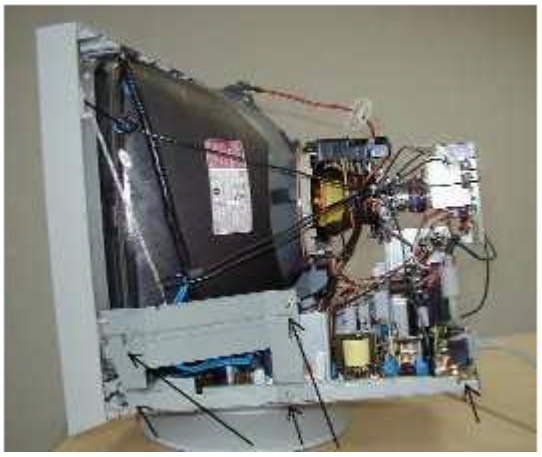
Refer to the serial number information shown below.

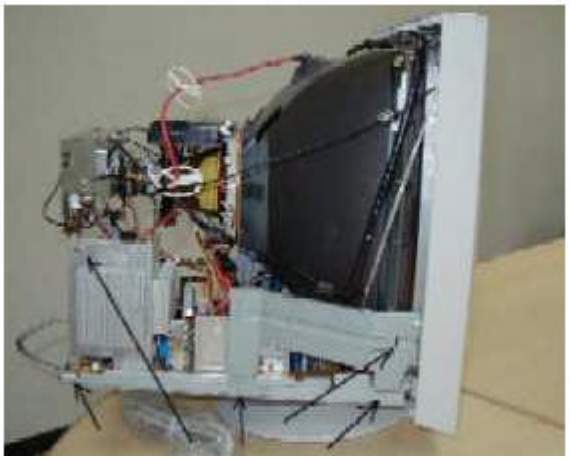


DISASSEMBLY

- Before you disassemble the set, turn off power and pull out the power plug.
- Use a proper screwdriver. If you user screwdriver that does not fit, you may damage the screws.
- Disassembly is the opposite process of assembly.
- Carefully discharge the CRT anode potential by grounding to CRT dag ground harness before removing Anode Cap.

MAIN BOARD and CRT BOARD





EXPLANATION

1. Disassemble a screw like a picture.
2. Unsolder the GND wire (CRT coating earth wire) from MAIN BOARD ASSY and CRT BOARD ASSY. This model has two kinds of CRT. Depend on CRT, the GND wire assembly is some different. Be careful.
3. Disconnect the connector "S201", "S202", "S203", Coating earth connector, and screen lead from the CRT BOARD ASSY.
4. Disconnect the CRT BOARD ASSY from the CRT.
5. Disconnect the connector "S301", "S601", "S703", "S701", "S104" and "P102" from the MAIN BOARD ASSY.
6. Remove the Anode Cap from the CRT.
   NOTE: Carefully discharge the CRT anode by shorting it to ground before removing Anode Cap.

ADJUSTMENT SPECIFICATIONS

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N9702 Adjustment Specifications

Ver. 1.0
2000,1,06

(1) Adjustment tools:

(A) Color Analyzer
(B) CHAROMA 2135 or Function Generator
(C) Multi meter
(D) Hi-Pot Probe
(E) Convergence Meter
(F) Degauss Probe
(G) Power Meter
(H) Automatic Alignment System
(I) DDC test fixture

(2) TIMING TABLE(FACTORY MODE –16 MODES)

MODE	RESOLUTION	H-SYNC EREQ.	V-SYNC FREQ	H . POLARITY	V . POLARITY
1	VGA400	31.4kHz	70Hz	-	+
2	VGA640*480	31.4kHz	60Hz	-	-
3	640*480(75)	37.5kHz	75Hz	-	-
4	640*480(85)	43.2kHz	85Hz	-	-
5	800*600(75)	46.8kHz	75Hz	+	+
6	MACII 50K	49.7kHz	75Hz	-	-
7	800*600(85)	53.6kHz	85Hz	+	+
8	1024*768(75)	60.0kHz	75Hz	+	+
9	1280*1024(60)	64.0kHz	60Hz	+	+
10	1024*768(85)	68.6kHz	85Hz	+	+
11	1280*1024(75)	79.9kHz	75Hz	+	+
12	Free run Adj.	30.0kHz	69Hz	-	+
13	H.CENTERING,EHT	85.938kHz	85Hz	-	+

(3) Definition for Normal Condition:

(A) INPUT AC VOLTAGE 110V/50HZ.
(B) WARM UP TIME 30 MINUTES.
(C) CROSSHATCH PATTERN.
(D) ALL VR ADJ CENTER.
(E) CRT FACE TO EAST DIRECTION
(F) COLOR TEMP 9300K

(4) B+ Adjustment:

(A) MODE: 69kHz 1024*768(85)
(B) PATTERN: CROSSHATCH
(C) Adjustment: Adjust VR102 to make the cathode of D112 has 14.8V±0.1V on cathode.
(D) CHECK: CHECK OTHER POWER SOURCE should be 82±2V,7.0±0.3V,
46V±2V,-12.1V±0.5V.

(5) H.V. Adjustment:

(A) MODE: 86kHz 85Hz
(B) PATTERN: ALL BLACK(Brightness cut off)
(C) Adjustment: Adjust VR302 to make the high voltage has 25.5±0.2KV

(6) H-Free run Adjustment:

(A) MODE: 30kHz
(B) PATTERN: ALL WHITE
(C) Adjustment: a. Tp6 connect 1uF/50V E-Cap to Ground.
b. Adjust VR306 to take H o/p Frequency is 30kHz or the screen stand up.
c. Take away E-Cap.

(7) X-RAY test:

(A) MODE: 86kHz 85Hz
(B) PATTERN: CROSSHATCH(Brightness just cut off)
(C) Test: a. Make TP1 and TP2 to be short circuit confirm the X-ray reactive.
b. Reset the power.

(8) H-CENTER adjustment

(A) MODE: 86kHz 85Hz
(B) PATTERN: CROSSHATCH
(C) Adjustment: Adjust VR301 to make raster is centrally on CRT

(9) H-size adjustment:

(A) MODE: 37.5kHz 640*480(75)
(B) PATTERN: CROSSHATCH
(C) Adjust H-SIZE, OSD set to Max, then adjust VR305 to make the full scan.

(10) MODE 11 Pre-Adjustment:

(A) MODE: 79.9kHz 1280*1024(75)
(B) PATTERN: CROSSHATCH
(C) Adjust V-CENTER, H-SIZE, V-SIZE, PINCUSHION, TRAPEZOID, H-PHASE to make Picture Position Center and Picture Size 310*232mm.

(11) WHITE BALANCE adjustment

(A) MODE: 69kHz 1024*768(85)
(B) PATTERN: ALL BLACK
(C) Adjustment: a. WARM UP 30 min.
b. Make External Degauss.
c. Factory mode R-BIAS/G-BIAS/B-BIAS set to 20% data.
d. Adjust SCREEN VR (FBT) to 500±10V
e. CUT OFF Adjustment: Video signal off (0Vp-p), bright set to MAX, adjust VR304 VR (G1), at the brightness 1~1.5FL.(4.2±0.8 cd/m²)
f. Adjust R-BIAS, G-BIAS, B-BIAS to make x=283±5, y=297±5, with readjusting G2 to keep the brightness between 1~1.5FL(4.2±0.8 cd/m²).

(12) FOCUS adjust:

(A) MODE: 86k 1280*960(85) ALL WHITE
(B) Adjust H.parabola Vp-p by OSM H-Focus control to keep P303 pin1 300Vp-p
(C) MODE: 46.875kHz 800*600(75) ALL WHITE
(D) Adjust H.parabola Vp-p same (B)
(E) MODE: 69kHz 1024*768(85)
(F) PATTERN: CROSSHATCH
(G) Adjust Focus VR(S), horizontal line must be clearly.
Adjust Focus VR(D), vertical line must be clearly.

(13) Convergence adjust:

(A) MODE: 69kHz 1024*768(85)
(B) PATTERN: CROSSHATCH.
(C) Adjustment: Use the convergence meter to check the spec. if can not follow the spec, adjust Yoke coil to make be follow the spec.

(14) Automatically adjust:

Adjust H-SIZE, V-SIZE, H-PHASE, V-PHASE, PINCUSHION, TRAPEZOID R.G.B. GAIN by factory product line automatic adjustment system—systemER9300 ,ER2300)(Adjust NO.1~11MODE).
H.SIZE : 310±3mm
V.SIZE : 232±2mm
H.POSI : ±2mm
V.POSI : ±2mm

(15) White balance check and ABL adjust:

(A) MODE: 69kHz 1024*768(85)
(B) PATTERN: CENTER BLOCK(WINDOW)
(C) Contrast control set to Max and brightness control set to the Max, adjust R.G.B. GAIN standard as below

9300K	x=0.283±0.010 y=0.297±0.010 Y=206±10 cd/m²	7500K	x=0.300+0.010 y=0.315-0.010 Y=206+10 cd/m
6500K	x=0.315±0.010 y=0.325±0.010 Y=206±10 cd/m²		

(D) PATTERN: FULL WHITE 9300K.
(E) If they are out of spec, adjust to following:
BRIGHTNESS: Back raster is 0.2 cd/m² position
CONTRAST MAX: (MAX-5 digit)~(MAX)
Adjust R/G/B gain to be 9300K color due to about spec.
(F) When adjust 7500/6500K color，keep brightness and contrast max position to (E) condition.
Adjust R/G/B/ GAIN to be 7500/6500K color due to about spec..
(G) Adjustment: Brightness control and contrast control set to Max, adjust VR303 to Y=29~31FT-L(103±3cd/m²)

(16) POWER SAVING Test:

(A) MODE: 60kHz 1024*768(75)
(B) PATTERN: ANY PATTERN.
(C) Adjustment:
a. It should be into suspend mode when signal quit after 5 sec.2nd the power output must be ≦15W. Check the LED color :Orange.
b. It should be into power off mode when into suspend mode after 3sec.and the power output must be≦8W. Check the LED color :Orange
c. Transfer the signal and check the screen is normal. Check the LED color :Green

(17) DDC 1/2B Test:

(A) MODE: Any MODE.
(B) PATTERN: Any PATTERN.
(C) Scan bar code label and apply serial NO. to EDID Data.

(18) TIMING TABLE

Preset Mode No.	1	2	3	4	5	6
	VGA	VGA	VESA	VESA	VESA	(MAC)
Signal Name	640*400	640*480	640*480 (75)	640*480 (85)	800*600 (75)	832*624 (75)
Resolution	640*400	640*480	640*480	640*480	800*600	832*624
Dot Clock (MH	25.175	25.175	31.500	36.000	49.500	57.283
fh (kHz	31.47	31.469	37.50	43.269	46.875	49.725
fv (Hz)	70.09	59.940	75.00	85.008	75.00	74.550
Total (dot)	800	800	840	832	1056	1152
(uS)	31.78	31.778	26.667	23.111	21.333	20.111
Disp (dot)	640	640	640	640	800	832
(uS)	25.42	25.422	20.317	17.778	16.162	14.523
Front (dot)	16	16	16	56	16	32
(uS)	0.64	0.636	0.508	1.556	0.323	0.559
Sync Pulse (dot)	96	96	64	56	80	64
(uS)	3.18	3.813	2.032	1.556	1.616	1.117
Back (dot)	48	48	120	80	160	224
(uS)	1.91	1.907	3.810	2.222	3.232	3.910
Total (H)	449	525	500	509	625	667
(mS)	14.268	16.683	13.333	11.764	13.333	13.414
Disp (H)	400	480	480	480	600	624
(mS)	12.711	15.253	12.800	11.093	12.800	12.549
Front (H)	12	10	1	1	1	1
(mS)	0.381	0.318	0.027	0.023	0.021	0.020
Sync Pulse (H)	2	2	3	3	3	3
(mS)	0.064	0.064	0.080	0.069	0.064	0.060
Back (H)	35	33	16	25	21	39
(mS)	1.112	1.049	0.427	0.578	0.448	0.784
Interlace	NON	NON	NON	NON	NON	NON
Polarity (H/V	NEG/POS	NEG/NEG	NEG/NEG	NEG/NEG	POS/POS	NEG/NEG
Composite Sync						
Composite Video						
Character Font	7*9	7*9	7*9	7*9	7*9	7*9
Serration	OFF	OFF	OFF	OFF	OFF	OFF
EQP	OFF	OFF	OFF	OFF	OFF	OFF

Preset Mode No.	7	8	9	10	11	
	VESA	VESA	VESA	VESA	VESA	
Signal Name	800*600 (85)	1024*768 (75)	1280*1024 (60)	1024*768 (85)	1280*1024 (75)	
Resolution	800*600	1024*768	1280*1024	1024*768	1280*1024	
Dot Clock (MHz)	56.250	78.750	108.000	94.5	135.0	
fh (kHz)	53.674	60.023	63.981	68.677	79.976	
fv (Hz)	85.061	75.029	60.020	85	75.025	
Total (dot)	1048	1312	1688	1376	1688	
(uS)	18.631	16.660	15.630	14.561	12.504	
Disp (dot)	800	1024	1280	1024	1280	
(uS)	14.222	13.003	11.852	10.836	9.481	
Front (dot)	32	16	48	48	16	
(uS)	0.569	0.203	0.444	0.508	0.119	
Sync (dot)	64	96	112	96	144	
(uS)	1.138	1.219	1.037	1.016	1.067	
Back (dot)	152	176	248	208	248	
(uS)	2.702	2.235	2.296	2.201	1.873	
Total (H)	631	800	1066	808	1066	
(mS)	11.756	13.328	16.661	11.765	13.329	
Disp (H)	600	768	1024	768	1024	
(mS)	11.179	12.795	16.005	11.183	12.804	
Front (H)	1	1	1	1	1	
(mS)	0.019	0.017	0.016	0.015	0.013	
Sync (H)	3	3	3	3	3	
(mS)	0.056	0.050	0.047	0.044	0.038	
Back (H)	27	28	38	36	38	
(mS)	0.503	0.466	0.594	0.524	0.475	
Interlace	NON	NON	NON	NON	NON	
Polarity (H/V)	POS/POS	POS/POS	POS/POS	POS/POS	POS/POS	
Composite Sync						
Composite Video						
Character Font	7*9	7*9	7*9	7*9	7*9	
Serration	OFF	OFF	OFF	OFF	OFF	
EQP	OFF	OFF	OFF	OFF	OFF	

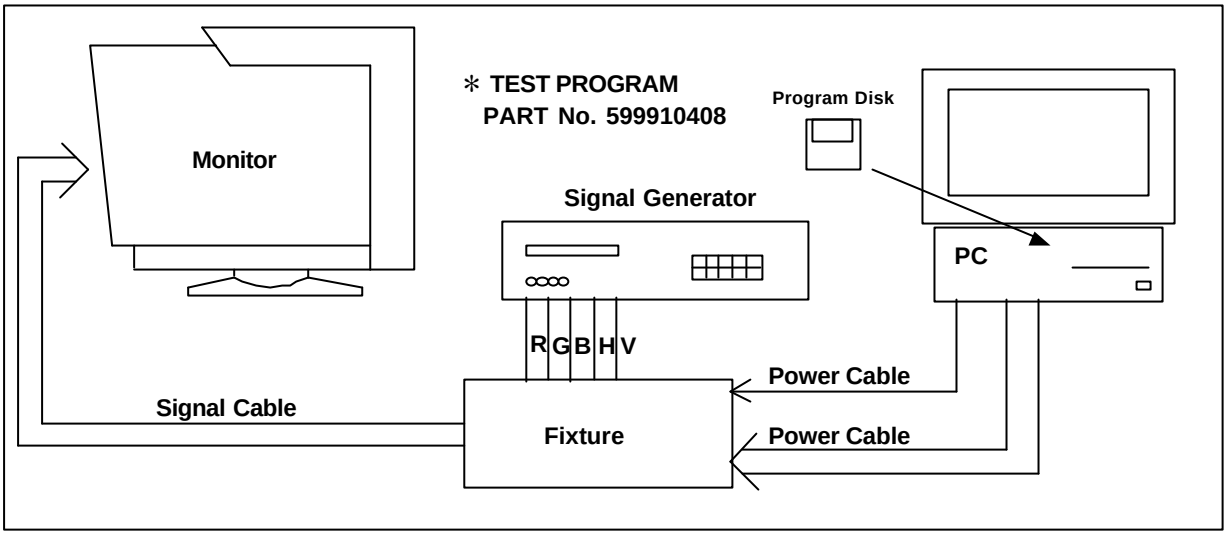
Preset Mode No.			15	16		
Signal Name			FREE	H.CENT		
Resolution			640*400	1024*768		
Dot Clock (MHz)			25.24	125.4		
fh (kHz)			30.05	85.938		
fv (Hz)			69.56	85.002		
Total (dot)			840	1728		
(uS)			33.278	11.636		
Disp (dot)			640	1280		
(uS)			25.357	8.62		
Front (dot)			16	64		
(uS)			0.631	0.431		
Sync (dot)			64	160		
(uS)			2.536	1.077		
Back (dot)			120	224		
(uS)			4.754	1.508		
Total (H)			432	1011		
(mS)			14.376	11.764		
Disp (H)			400	960		
(mS)			13.311	11.171		
Front (H)			1	1		
(mS)			0.033	0.012		
Sync (H)			2	3		
(mS)			0.067	0.035		
Back (H)			29	47		
(mS)			0.956	0.547		
Interlace			NON	NON		
Polarity (H/V)			NEG/POS	POS/POS		
Composite Sync						
Composite Video						
Character Font			7*9	7*9		
Serration			OFF	OFF		
EQP			OFF	OFF		

INSPECTION

1. Inspection of PLUG & PLAY communication

1-1. A construction of System

This system should be connected as shown below.



1-2. Starting method

1) Input Signal

Input signal must be separate sync. Timing is the signal whose vertical synchronization frequency is between 55Hz and 25kHz.
Horizontal synchronization frequency should be set to 31.5kHz.

2) Power ON procedure

- First, put the floppy disk for PnP Inspection into PC and turn on PC.
- Turn on Fixture.
- Make sure that fixture' s LED turns on and off.
- Turn on signal generator and monitor.

3) Starting PC Software

- Inspection of PnP communication
  To check the PnP communication, for N9702, EDID file name is N9702.
  Type " P N9702" on DOS command line and press return key.
- Writing EDID to EEPROM and inspection of PnP communication
  To write EDID to EEPROM and check the PnP communication of N9702, type "WP N9702" on DOS prompt line and press return key.

1-3. Operation

- The operation should be performed according to the screen message.
- The message of "Normally Complete" means that writing of EDID data or PnP inspection completed normally.
  The message of "Error" means that writing of EDID data or PnP inspection finished incorrectly.
- When the PnP inspection is completed, read EDID data would be displayed. And if the read EDID data differed from the original EDID data, the different bytes would be displayed in red.
- For the details of error, see the messages displayed at the bottom right of the screen.
  The meaning of the messages is shown on section 4.
- After writing of EDID data or inspection of DDC2B, monitor can not be communicated by DDC1.
  In that case, turn off and on the monitor again, which will make the DDC1 communication test possible.
- Make sure that fixture's LED flashes on and off before writing EDID data, inspecting DDC1 and DDC2B. If the fixture's LED does not flash on and off, turn off and turn on the monitor and the fixture.

1-4. Error Messages

- Start Bit Error
  This message is displayed when the start bit is not "H" while sending data from PC to MPU on the fixture. This error will be caused by noise etc. on the line.
- Command Error
  This message is displayed when the different command is sent from PC to MPU on the fixture.
- Hardware Error
  This message means that the PC does not recognize ACK command sent from the MPU on the fixture.
- File Open Error
  This message means that the input EDID file name was wrong.
- Command line Switch Error
  This message means that the input communication command is incorrect.
- Parity Error
  This message is displayed when the MPU on the fixture recognized the parity bit is incorrect.
  This error can be caused by noise etc. on the line.
- EDID Data Error
  This message is displayed when the null bit is not detected in EDID data read by DDC1 communication.
- EDID Data Sort Error
  This message is displayed when the header code is not detected in EDID data read by DDC1 communication.
- Time Out Error
  This message is displayed when the PC does not recognize ACK commands sent from MPU within 10 msec after the PC had sent communication command or EDID data.
  If this error occurs, check the connection on PC, fixture and monitor.

1-5. EDID data file

The EDID data file text is shown below. When you write or inspect EDID for this monitor, the following table can be used.

File name: N9702

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00	00	FF	FF	FF	FF	FF	FF	00	38	A3	F0	AB	01	01	01	01
10	*1)	*2)	01	02	08	25	1B	78	EA	22	28	A1	54	48	99	26
20	11	48	4C	FF	FF	80	31	59	45	59	61	59	71	4F	81	59
30	81	99	A9	4F	D1	40	86	3D	00	C0	51	00	30	40	40	A0
40	13	00	64	0B	11	00	00	1E	00	00	00	FD	00	37	A0	1F
50	60	18	00	0A	20	20	20	20	20	20	00	00	00	FC	00	4D
60	75	6C	74	69	53	79	6E	63	20	39	30	0A	00	00	00	FF
70	00	*3)	*3)	*3)	*3)	*3)	*3)	*3)	*3)	*3)	*3)	*3)	*3)	*3)	00	*4)

Table 1-1. Data list (Management number)

※1 : address 10h — Month of Manufacture × 4

※2 : address 11h — Year of Manufacture – 1990

※3 : address 71h ~7Dh — Serial Number String (ASCII code) If less than 13 bytes then terminate with ASCII code 0Ah and pad field with ASCII code 20h.

※4 : address 7h — This Address should be programmed such that a one-byte checksum of the entire 128 byte EDID equals 00h.

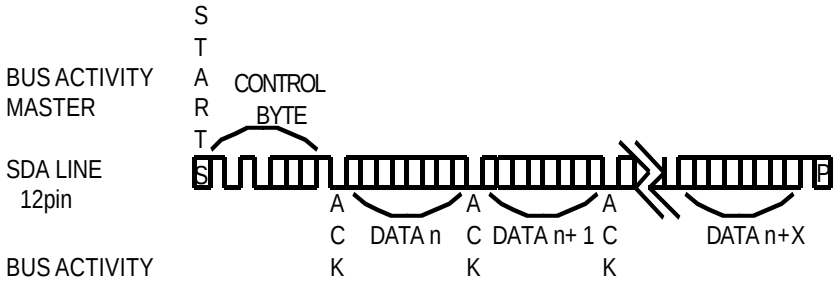


Diagram 1-1 Timing chart of DDC2B

Screen and faceplate blemishes

1. Test procedure

   Set up the tube and adjust the light output on a blanked raster at the center of the screen for approximately 54 lm/m² (5 F/L) and 9300 ° K + 27 M.P.C.D. (OR 6550 ° K + 7 M.P.C.D.) color temperature.
   The screen should be viewed at a minimum distance of 60cm (2 feet).
   Ambient light level at the tube face should be approximately 1.0 lux.
   In the non-operating condition the screen may be viewed under highlevel, single source incandescent light of 700 to 1,000 lux measured at the faceplate surface. The size of a round blemish is equal to its diameter. The size of an irregularly shaped blemish is equal to its equivalent diameter, defined as the average of the major and minor axes.

2. Classification of screen and faceplate blemished

   Blemishes are divided into phosphor screen blemishes and glass bulb blemishes.
   (1) Phosphor screen blemishes
   Blemishes are classified depending upon the next table and judged with the standard specified in clause 4.

Degree of contrast	Contents of blemish	Valuation of blemish
High-contrast	– Black spot – More than 50% of missing phosphor dot	The number of blemished and quality area
Medium-contrast	– 25 to 49% of missing phosphor dot	Ditto
Low-contrast	– Non-uniformity lighted part – Smudge and so on	

   (2) Faceplate blemishes
   Blemishes are classified as scratches and bulb defects and judged with the standard specified in clause 5.

3. Quality area

Tube size	Zone	
	Zone A	Zone B
	Rectangle area concentric with the center of screen	Remaining useful screen area
19”	315 × 236mm	Ditto

4. Limits of phosphor screen blemishes

(1) High-contrast blemishes

The following criteria is applied to high-contrast blemishes.

Blemish			Allowable No. of blemishes			Allowable Minimum Separation(mm)		
			Zone A	Zone B	Total (Zone A & B)	Zone A	Zone B	A + B
A	1 trio		1	1	2	-----	—	20
B	(1)		0	0	0	—	—	—
C	(2)		1	2	2	—	20	20
	(3)		1	2	2	----	20	20
D	1 dot	Green	3	4	10	50	20	20
		Red	5	6				
		Blue	5	6				
E	In case of A+C		—	—	—	50	20	20
F	In case of A+C+D		—	—	—	50	20	20

(1) 3 or more consecutive same color phosphor dots
(2) 2 consecutive same color phosphor dots
(3) 2 consecutive different color phosphor dots

(2) Medium-contrast blemishes

The following criteria is applied to medium-contrast blemishes.

Blemish	Allowable maximum number		Allowable minimum separation(mm)	
	Zone A	Zone B	Zone A	Zone A+B
3 consecutive dot	2	4	30	30
2 consecutive dot	3	7	20	20
1 dot	ignore	ignore	—	—

Note) Minimum separation is 20 mm among any high and medium contrast blemishes (excluding 1 dot medium contrast blemishes).

(3) Low-contrast blemishes

The following criteria is applied to low-contrast blemishes.

Blemishes In zone A	Equivalent diameter of the total area of low-contrast blemishes should be less than 13mm.
Extended blemishes In both zones A and B	Equivalent diameter of the total area of low-contrast blemishes should be less than 50mm.

5. Limits of faceplate blemishes

(1) Scratches

The following criteria is applied to scratches on the faceplate of color display tubes.
Maximum size of scratches allowable

Width (mm)	Length of single scratch(mm)	Allowable number
0.05 or less	Ignore	—
0.06 ~ 0.12	50 or less	1
0.13 ~ 0.20	10 or less	1
Over 0.20	—	0

(2) Limits of faceplate defects

The following criteria is applied to defects of useful screen on panel face.

Zone			Zone A	Zone B
Major defects	Blister (mm)		0.41 ~ 0.60	0.41 ~ 0.60
	Opaque spot & open blister (mm)		0.31 ~ 0.50	0.31 ~ 0.50
	Allowable number of defects	Single zone	1	2
		Total	3	
	Allowable minimum separation(mm)		50	
Gathering defects within *j* 50mm	Blister (mm)		0.25 ~ 0.60	
	Opaque spot & open blister (mm)		0.20 ~ 0.60	
	Allowable number of defects		4	
	Allowable minimum separation		12.7	
Elongated	Width (mm)		0.10 ~ 0.20	0.10 ~ 0.30
	Maximum length (mm)		4.0	6.0
	Allowable number of defects	Single	2	
		Total	2	
	Allowable minimum separation		76	

Limits of Screen and Faceplate Blemish

1. Test Procedure

   Set up the tube and adjust the light output on a blank raster at the center of the screen for approximately 15 FL and C.I.E x = 0.281, y = 0.311 (or x = 0.313, y = 0.329) color coordinate.

   The screen should be viewed at the minimum distance of 60 cm (2 feet).
   Ambient light level at the tube face should be approximately 5.0 Lux.

   In the non-operating condition the screen may be viewed under high level, single-source incandescent light of 700 to 1,000 lux measured at the faceplate surface.

   The size of a round blemish is equal to its diameter. The size of an irregularly shaped blemish is equal to its equivalent diameter, defined as the average of the major and minor axis.

2. Quality area

Tube size	Zone	
	Zone A	Zone B
	Rectangle area concentric with the center of screen	Remained useful screen area
41 cm	300mm x 225mm	Remained area

3. Phosphor screen blemishes

   3.1 The criteria of blemish classification

Category	Contents of blemish
Entire defects	Blank Spot 50% or more of complete dot is missing
Partial defects	25 to 49% of complete dot is missing
Other defects	Non-uniformity lighted part

3.2 High contrast blemishes

Blemish			Allowable number of blemishes			Min. separation [mm]	
			Zone A	Zone B	Total (zone A & B)	Zone A	Zone B
A	1 trio		1	1	1	—	—
B	* (1)		0	0	0	—	—
C	* (2)		1	2	2	50	50
	* (3)		1	2	2	50	20
D	1 dot	green	3	2	10	50	20
		blue	5	4			
		red	5	4			
E	Incase of C+D		—	—	—	50	20

*Note: (1) 3 or more consecutive same color phosphor dots
(2) 2 consecutive same color phosphor dots
(3) 2 consecutive different color phosphor dots

3.3 Medium contrast blemishes

Blemish	Allowable max. number		Allowable min. separation [mm]	
	Zone A	Zone B	Zone A	Zone B
3 consecutive dots	1	2	-	30
2 consecutive dots	3	6	30	20
1 dot	ignore	Ignore	—	—

3.4 Low contrast blemishes

Blemishes in zone A	Equivalent diameter of the total area of low-contrast blemishes should be less than 13mm.
Extended blemishes in both zone A and B	Equivalent diameter of the total area of low-contrast blemishes should be less than 50mm.

3.5 Other defects

Equivalent diameter of the total area should be less than 13mm.

4. Faceplate blemishes

The following criteria of the scratches and the limits of faceplate defects are applied to the useful screen of the panel face.

4.1 Scratches

Width (mm)	Length of single scratch (mm)	Allowable number
0.05 or less	Ignore	—
0.06 ~ 0.12	50 or less	1
0.13 ~ 0.20	6 or less	1
Over 0.21	—	0

4.2 Limits of faceplate defects

Defects			**Zone A**	**Zone B**
Major defects	Blister		0.41 – 0.60	0.41 – 0.60
	Opaque spot & open blister(mm)		0.41 – 0.60	0.41 – 0.60
	Allowable number of defects	Single zone	1	2
		Total	2	
	Allowable minimum separation(mm)		57	
Gathering defects within ϕ 50 mm	Blister		0.25 – 0.40	
	Opaque spot & open blister(mm)		0.20 – 0.40	
	Allowable number of defects		2	
	Allowable minimum separation(mm)		12.7	
Elongated	Width (mm)		0.10 – 0.20	0.10 – 0.30
	Maximum length (mm)		4.0	6.0
	Allowable number of defects	Total	2	

4.3 Definition of coating defects

Ring of defects	Contents of defects	Valuation of defect
High-contrast	• Reflective spots and coating voids • Clearly visible by reflection	The number of defects and quality area
Low-contrast	• Cloudy visible by reflection	Ditto
Elongated	• Same reflection as low contrast • Not include high contrast reflectance	Ditto

4.4 Criteria of coating defects

The following criteria is applied to defects of useful screen area.

Kinds of defect \ Zone		Zone A				Zone B			
High - contrast	Size of defects(mm)	less than 0.5	0.5-1.0	1.1-1.5	over 1.6	less than 0.5	0.5-1.0	1.1-1.5	over 1.6
	Allowable number of defects	ignore	5	3	0	ignore	5	3	0
	Allowable min. separa-tion(mm)	—	30			—	30		
Low - contrast	Size of defects(mm)	less than 1.5	1.5-3.0	over 3.1		less than 1.5	1.5-3.0	over 3.1	
	Allowable number of defects	ignore	3	0		ignore	3	0	
	Allowable min. separa-tion(mm)	—	20			—	20		
Elong-ated	Width(mm)	3.0 or less				ignore			
	Maximum length(mm)	less than 10	10 or over						
	Allowable number of defect	3	0						

TROUBLE SHOOTING

Refer to User' s Manual trouble shooting section before using this chart.

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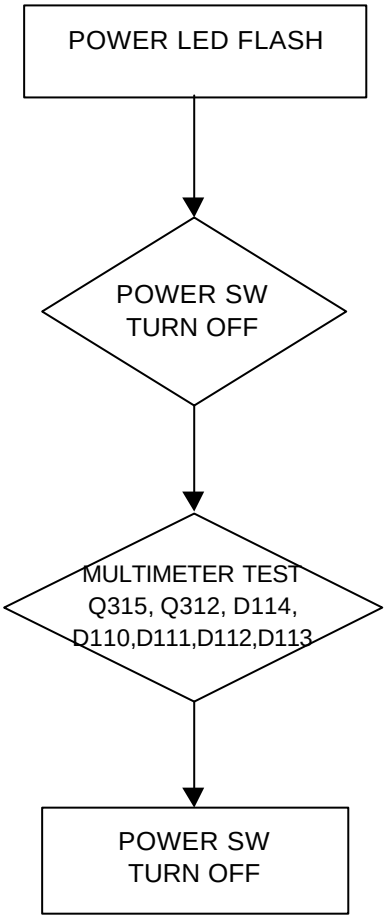
5. NO RASTER 29

6. TROUBLE IN H.V SYNC 30

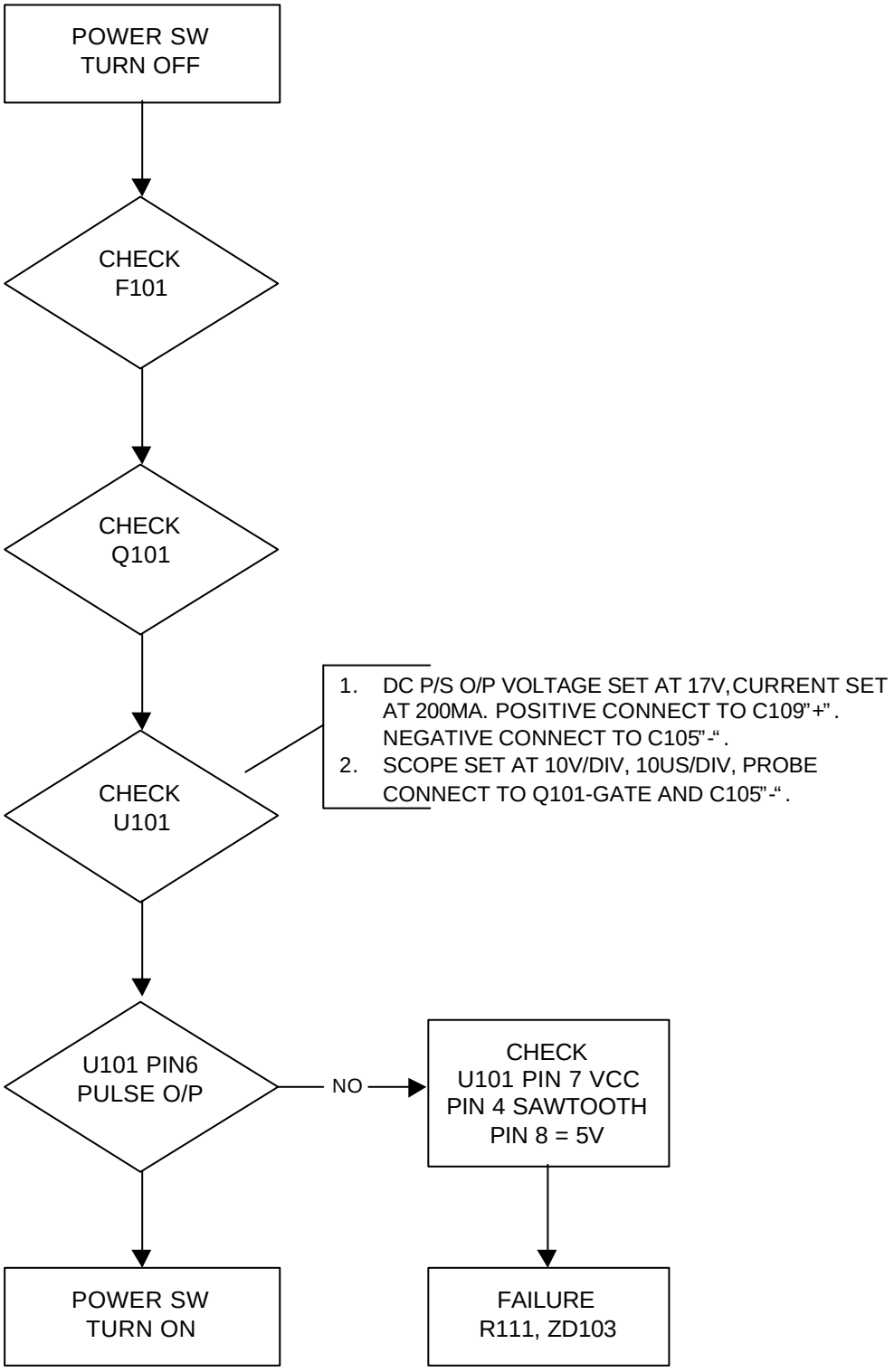
7. PINCUSHION POOR 31

8. FOCUS POOR 32

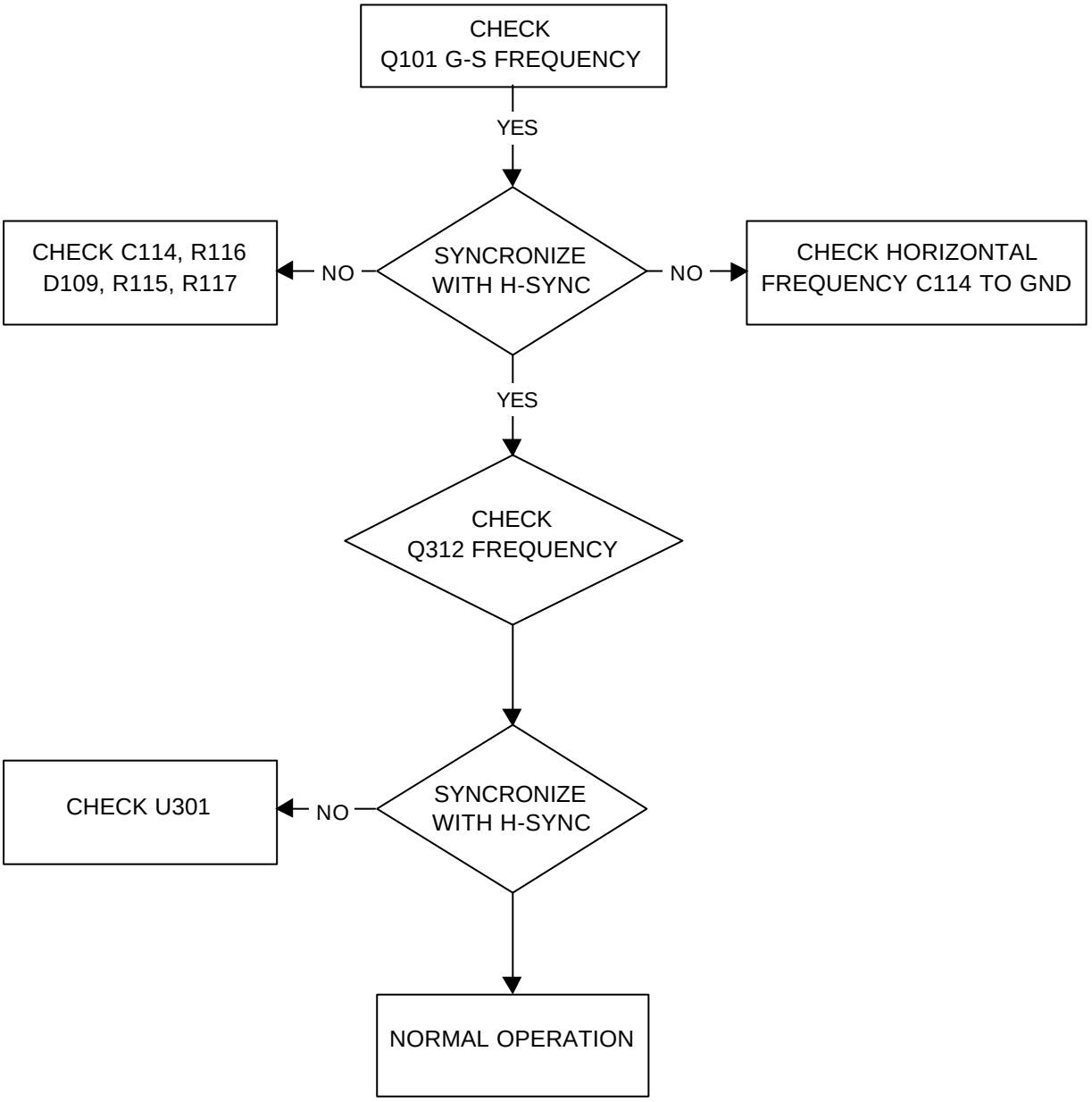
1. NO OPERATION, POWER LED FLASH



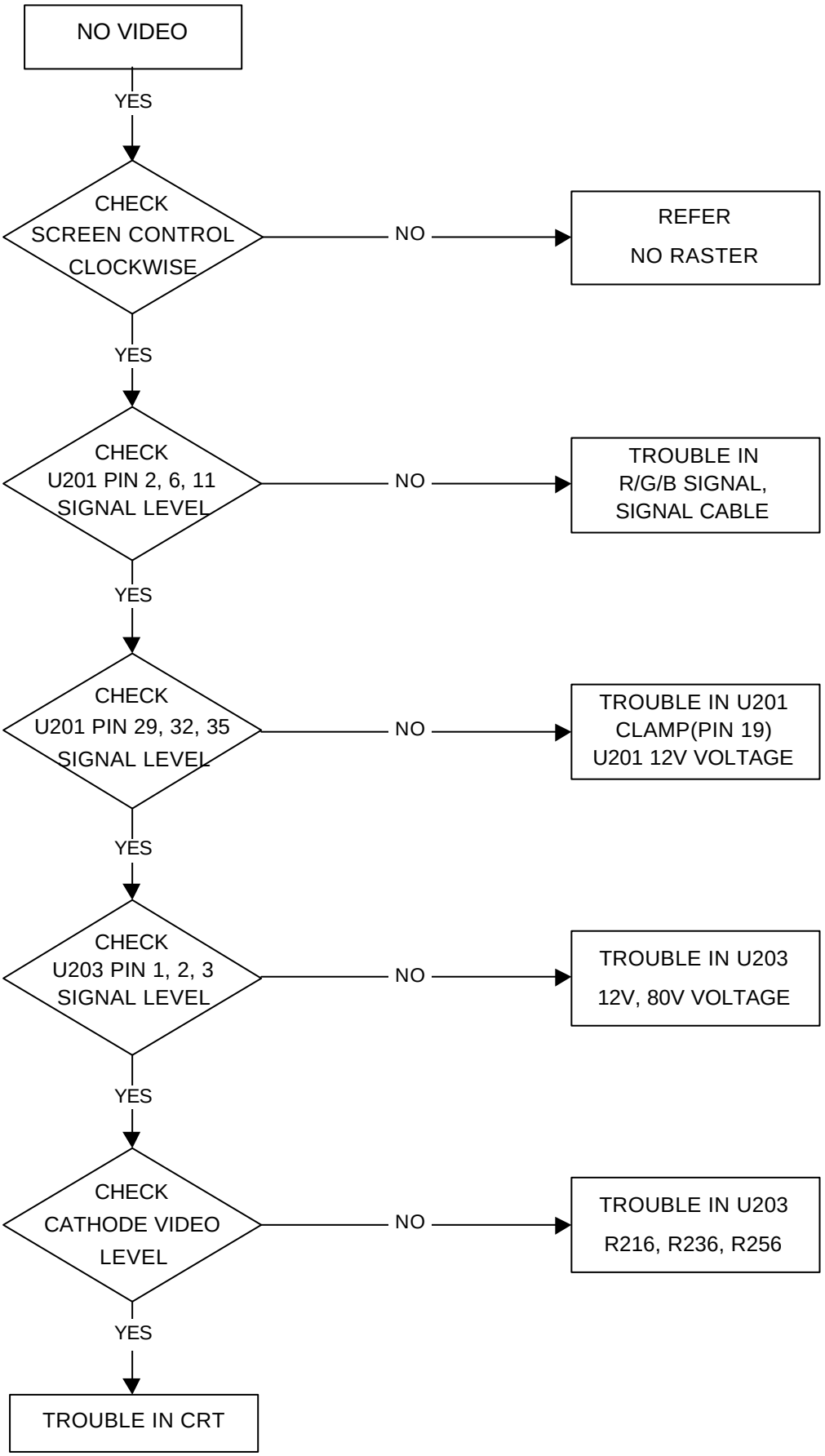
2. NO OPERATION, POWER LED OFF



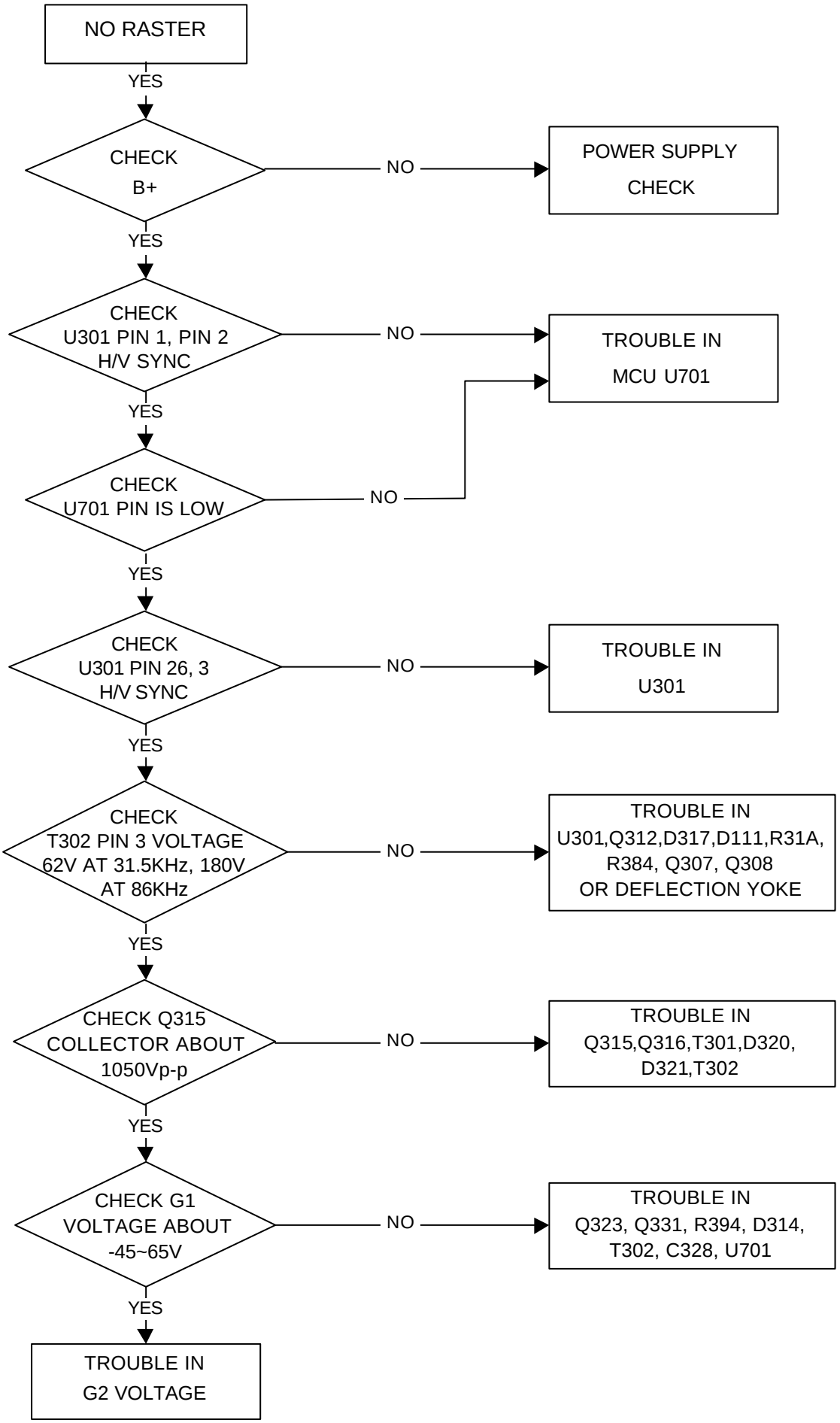
3. VIDEO NOISE, UNSYNCHRONOUS



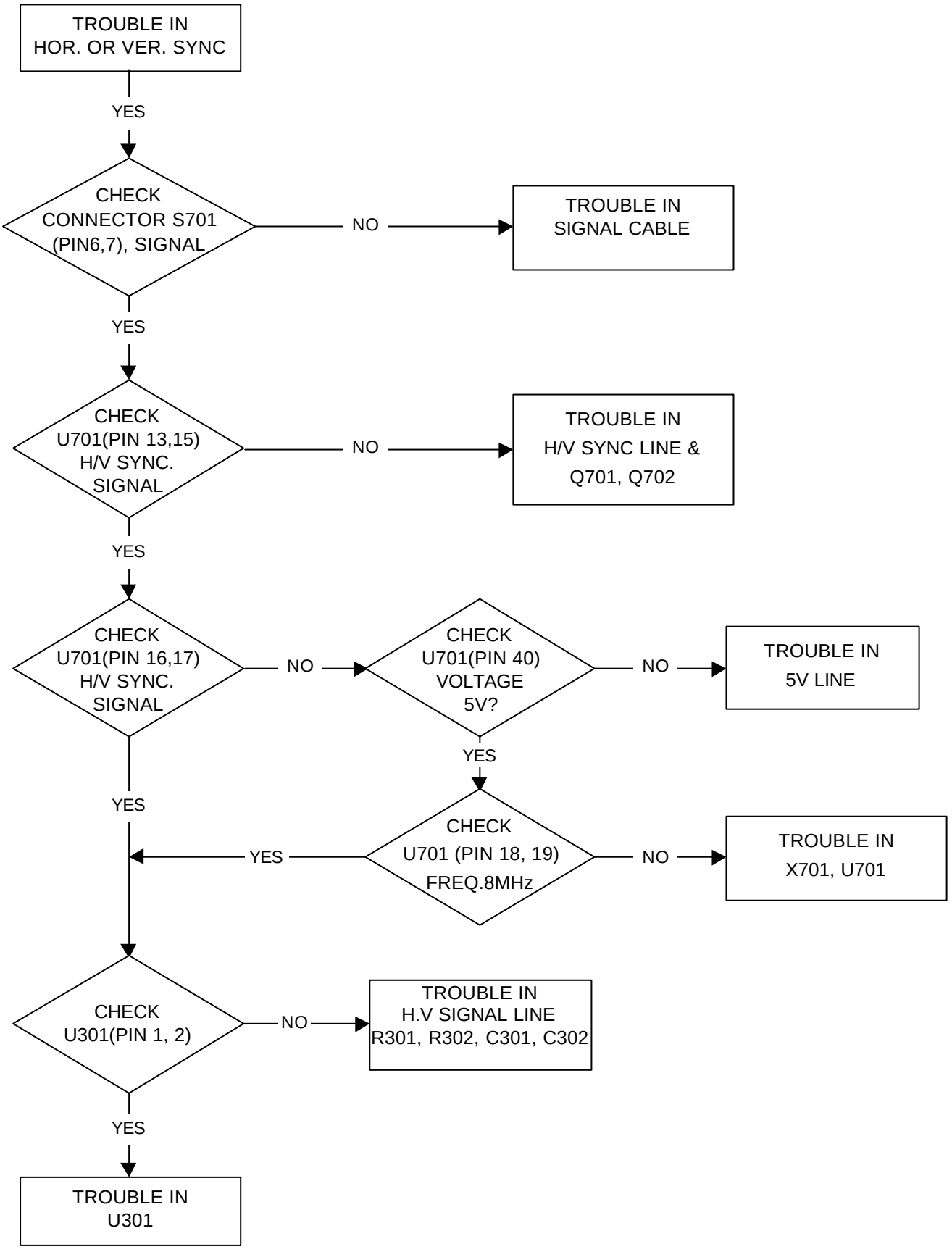
4. NO VIDEO


NO VIDEO
YES
CHECK
SCREEN CONTROL
CLOCKWISE
NO
REFER
NO RASTER
YES
CHECK
U201 PIN 2, 6, 11
SIGNAL LEVEL
NO
TROUBLE IN
R/G/B SIGNAL,
SIGNAL CABLE
YES
CHECK
U201 PIN 29, 32, 35
SIGNAL LEVEL
NO
TROUBLE IN U201
CLAMP(PIN 19)
U201 12V VOLTAGE
YES
CHECK
U203 PIN 1, 2, 3
SIGNAL LEVEL
NO
TROUBLE IN U203
12V, 80V VOLTAGE
YES
CHECK
CATHODE VIDEO
LEVEL
NO
TROUBLE IN U203
R216, R236, R256
YES
TROUBLE IN CRT

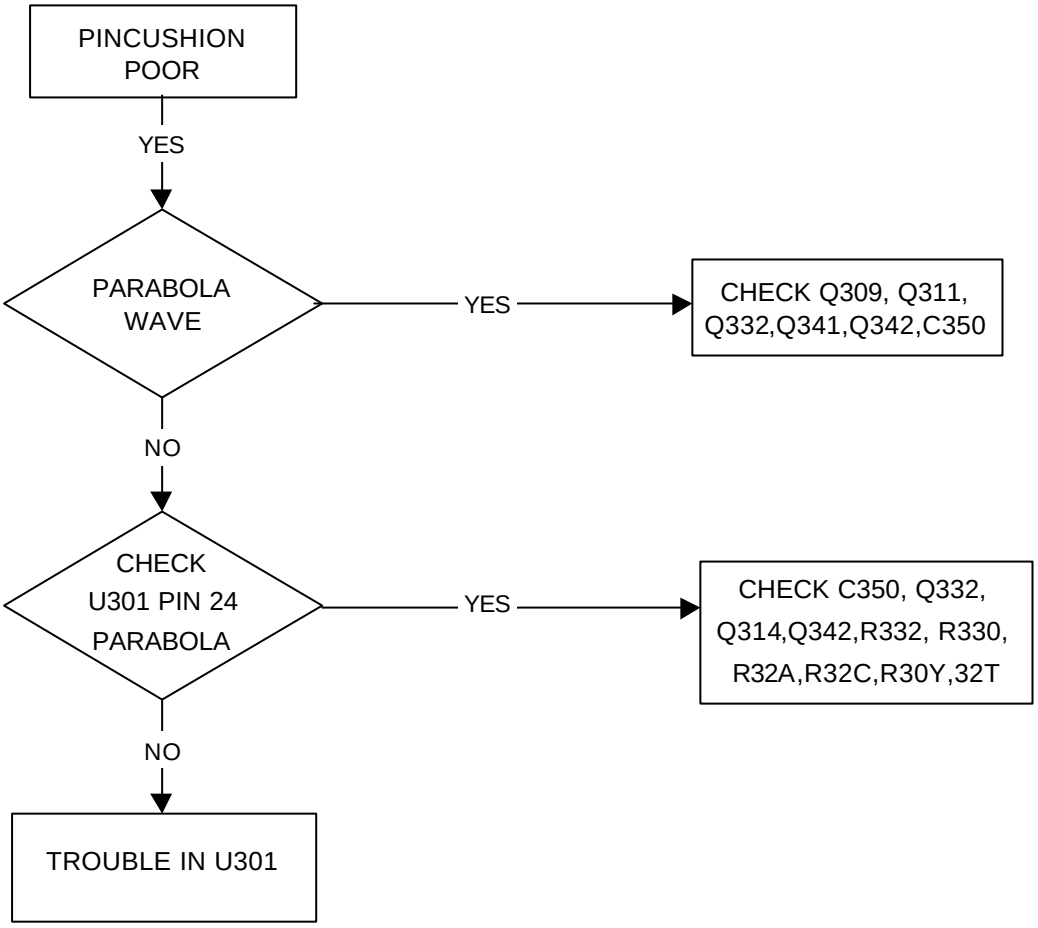
5. NO RASTER


NO RASTER
YES
CHECK
B+
NO
POWER SUPPLY
CHECK
YES
CHECK
U301 PIN 1, PIN 2
H/V SYNC
NO
TROUBLE IN
MCU U701
YES
CHECK
U701 PIN IS LOW
NO
YES
CHECK
U301 PIN 26, 3
H/V SYNC
NO
TROUBLE IN
U301
YES
CHECK
T302 PIN 3 VOLTAGE
62V AT 31.5KHz, 180V
AT 86KHz
NO
TROUBLE IN
U301,Q312,D317,D111,R31A,
R384, Q307, Q308
OR DEFLECTION YOKE
YES
CHECK Q315
COLLECTOR ABOUT
1050Vp-p
NO
TROUBLE IN
Q315,Q316,T301,D320,
D321,T302
YES
CHECK G1
VOLTAGE ABOUT
-45~65V
NO
TROUBLE IN
Q323, Q331, R394, D314,
T302, C328, U701
YES
TROUBLE IN
G2 VOLTAGE

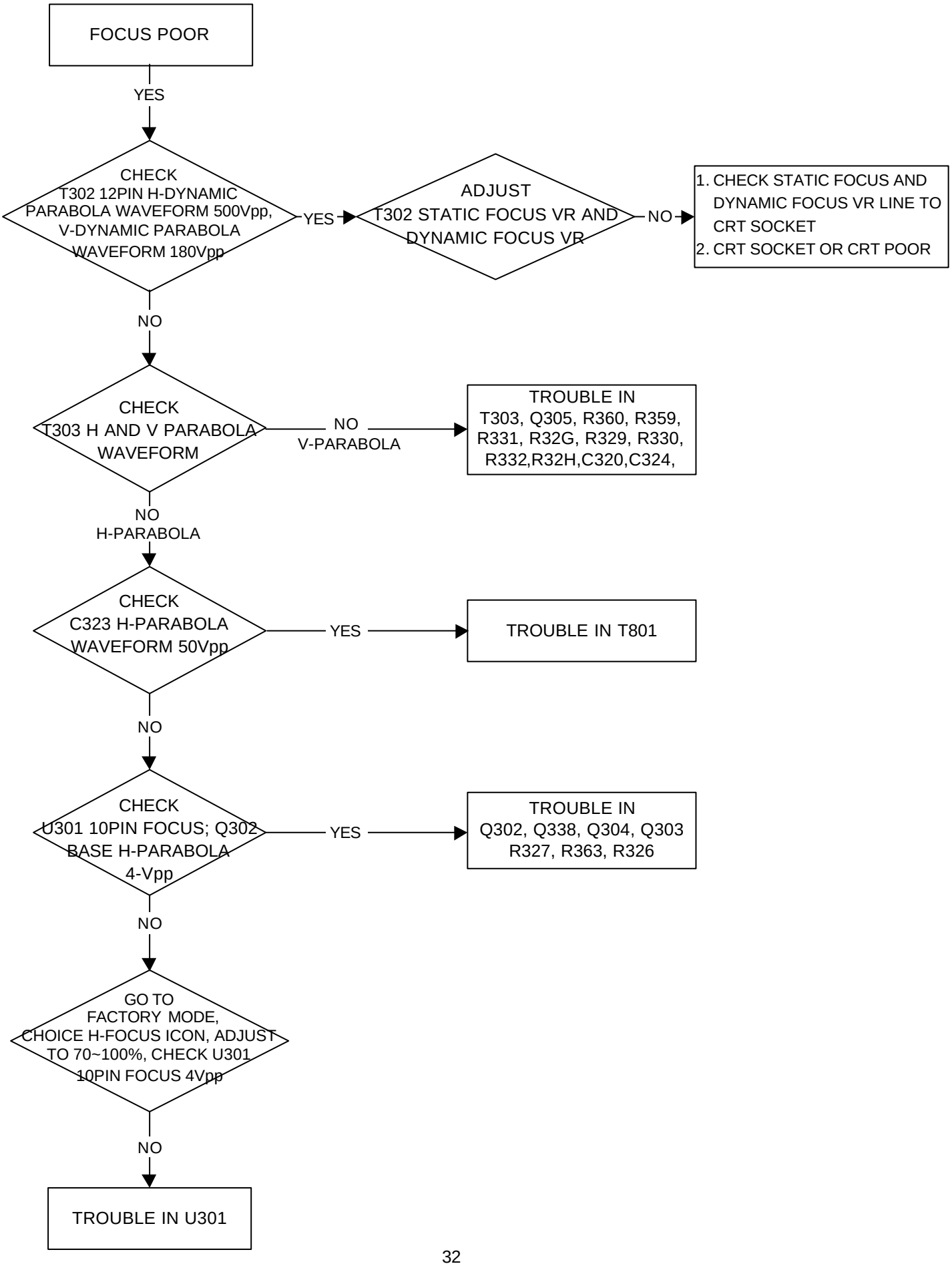
6. TROUBLE IN H. V SYNC



7. PINCUSHION POOR



8. FOCUS POOR


FOCUS POOR
YES
CHECK
T302 12PIN H-DYNAMIC PARABOLA WAVEFORM 500Vpp, V-DYNAMIC PARABOLA WAVEFORM 180Vpp
YES
ADJUST
T302 STATIC FOCUS VR AND DYNAMIC FOCUS VR
NO
1. CHECK STATIC FOCUS AND DYNAMIC FOCUS VR LINE TO CRT SOCKET
2. CRT SOCKET OR CRT POOR
NO
CHECK
T303 H AND V PARABOLA WAVEFORM
NO
V-PARABOLA
TROUBLE IN
T303, Q305, R360, R359, R331, R32G, R329, R330, R332,R32H,C320,C324,
NO
H-PARABOLA
CHECK
C323 H-PARABOLA WAVEFORM 50Vpp
YES
TROUBLE IN T801
NO
CHECK
U301 10PIN FOCUS; Q302 BASE H-PARABOLA 4-Vpp
YES
TROUBLE IN
Q302, Q338, Q304, Q303 R327, R363, R326
NO
GO TO
FACTORY MODE, CHOICE H-FOCUS ICON, ADJUST TO 70~100%, CHECK U301 10PIN FOCUS 4Vpp
NO
TROUBLE IN U301

N9702 Theory of circuit operation

This monitor contains the following blocks

Page

1. Power Supply 34
2. Video Circuit & OSD 34
3. Micro Controller System 34
4. Vertical Deflection 35
5. Horizontal Deflection 35
6. FBT Secondary & Dynamic Focus 36

1. Power Supply

(a) The filter network consists of L104, C101, C107, L101, L102, C103 and C104. The main function of this filter circuit is to eliminate the noise that is produced from monitor itself.

(b) T101 is an energy converter which transfers the energy from primary winding to secondary load. R104, C112 and D105 are the snubber circuit and they function to absorb the spike to protect Q101.

(c) U101 is a pulse width modulation IC which supplies the drive pulse to Q101. The sync pulse is got from FBT secondary to ensure the power supply and horizontal deflection are synchronized.

(d) D110, D111, D112, D113, D114 are output rectifier diodes which are filtered by C119, C120, C121, C122 and C143. The output voltage will supply and control all the deflection circuit.

(e) DC to DC step-up PWM is output from U301 pin28. This waveform through Q307 and Q308 to drive the Q312. This pulse width is varied with horizontal frequency, and then the DC voltage is difference of FBT pin3.

2. Video Circuit & OSD

The video amplifier system is consist of the Pre-Amplifier, the Video-Power-Amplifier, and the cutoff-Voltage-Adjusting circuit.

(a) The U201 (M52743BSP) is a three channel video pre-amplifier IC, that controlled by MCU IIC bus for the features of contrast, output DC level, 3 SUB gain controls (R-Gain, G-Gain, B-Gain)and 3 D/A output pin .

(b) U201 PIN 19 need a positive pulse for clamping and PIN 27 also need a positive pulse for blanking.

(c) The OSD mixer processes are on pin 4, 9, 13, and the OSD Blk input on pin 1.

(d) The Video-Power-Amplifier U203 (LM2435) is a three channel hybrid IC which functions as a cascade type transistor amplifier to reach the high bandwidth performance.

(e) The Cutoff- Adjusting circuit is consist of Q211, Q212, Q231, Q232, Q251 and Q252 to provide the function of background white-balance.

(f) The U202 (MTV021-38) is a OSD generator outputs the R. G. B. and FBLK signals that MCU shows the monitor' s status and the user adjusting indications. This IC is synchronized by horizontal and vertical sync input on pin 5 and pin 10.

3. Micro Controller System

(a) The MCU U701 (MTV112) provides the following functions:

(1) Output 10 PWM to adjust the voltage controlled functions such as H-SIZE, BRIGHTNESS, ROTATION.

(2) When MCU detected the power saving signal, two outputs pin 26 and pin27 will change the Hi/Lo state to control the power saving circuit.

(3) There has 3 outputs (SW1~SW3) to control the H-SIZE, when MCU detected the different sync, the SW1~SW3 will change its Hi/Lo state.

(4) There still has 4 CS outputs and HF/S used to control the S-correction capacitor for horizontal deflection stage.

(5) Pin 16 and pin 17 provides the always positive polarity H-SYNC and V-SYNC.

	SW1	SW2	SW3
fH<40.0k	L	L	L
40.0k<=fH<53.0k	L	H	L
53.0k<=fH<63.0k	H	H	L
63.0k<=fH<70.0k	L	H	L
70.0k<=fH<86.5k	H	H	L
86.5k>=fH	L	L	L

Mode	State	Input		Output									
		Sync		Sync		Mute	PS		CS				
		H	V	H	V		1	2	1	2	3	4	
User	ON	Pulses	Pulses	Pulse	Pulse	L	H	H	Depend on fH				
	Stand By	No pulses	Pulses	L	L	H	L	H	L	L	L	L	
	Suspend	Pulses	No pulses	L	L	H	L	H	L	L	L	L	
	PMS_OFF	No pulses	No pulses	L	L	H	L	L	L	L	L	L	
Factory	ON	Pulses	Pulses	Pulses	Pulses	L	H	H	Depend on fH				
	Stand By	No pulses	Pulses	L	L	L	H	H	L	L	L	L	
	Suspend	Pulses	No pulses	L	L	L	H	H	L	L	L	L	
	PMS_OFF	No pulses	No pulses	L	L	L	H	H	L	L	L	L	

Mode	State	Input		Output					
		Sync		Sync		Rotation	SW		
		H	V	H	V	DAC	1	2	3
User	ON	Pulses	Pulses	Pulse	Pulse	Adj. data	Depend on fH		
	Stand By	No pulses	Pulses	L	L	107/255	H	H	H
	Suspend	Pulses	No pulses	L	L	107/255	H	H	H
	PMS_OFF	No pulses	No pulses	L	L	0/255	H	H	H
Factory	ON	Pulses	Pulses	Pulses	Pulses	Adj. data	Depend on fH		
	Stand By	No pulses	Pulses	L	L	Adj. data	H	H	H
	Suspend	Pulses	No pulses	L	L	Adj. data	H	H	H
	PMS_OFF	No pulses	No pulses	L	L	Adj. data	H	H	H

(b) The U702 is an EEPROM IC which stores the parameters of each mode and the user adjusting result and also DDC data. It is controlled by IIC bus from MCU.

4. Vertical Deflection

(a) Vertical deflection Saw-tooth waveform is provided by U301, pin 23, and amplified by U401 TDA8172.
(b) A voltage multiplier connected to pin 3 and pin 6, consists of D402, C409 to avoid flyback scanning line appeared during the vertical flyback period.
(c) U301 (TDA9111) pin 21 provides a DC level as a V-Position control voltage.
(d) U401 pin 5 is output to drive vertical yoke.

5. Horizontal Deflection

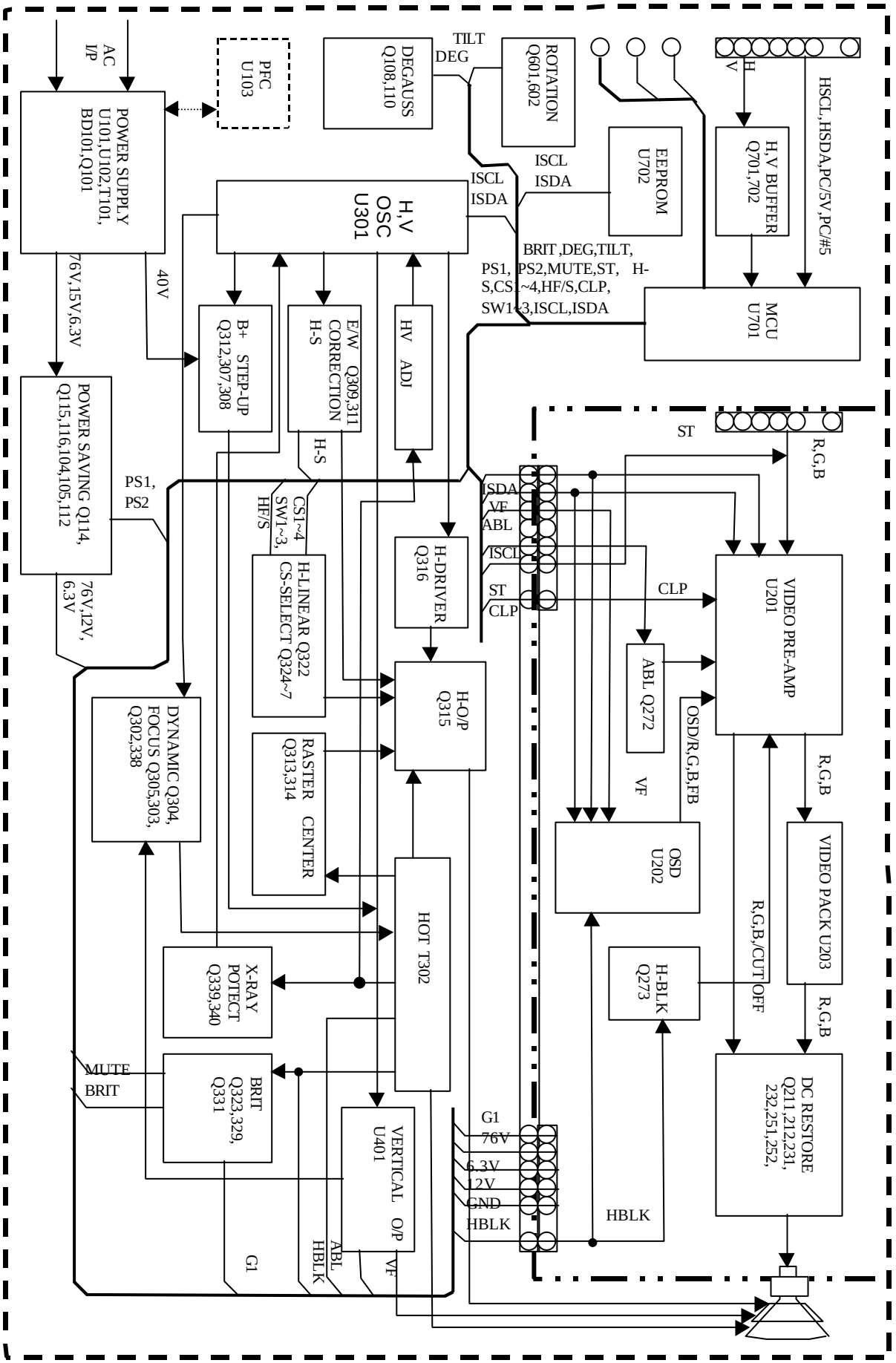
(a) U301 is a horizontal signal processing IC. Horizontal Driver signal is output from pin 26 of U301 TDA9111 and through Q333, Q334 to drive Q316 and T301.
(b) T301 is an on/off type driver transformer. It functions to convert primary energy to secondary, and drive the horizontal output transistor Q315, R369 and C363 are the snubber.
(c) Horizontal linearity and Cs circuit:
(1) Horizontal linearity and Cs is changed by RL301,RL301 can change Horizontal Tr(C337),Linear(L302) and Cs(C336).It control by HF/S from U701 pin 30

(2) C344 is the Cs capacitor, and Q324 controls C345, Q326 controls C347, Q325 controls C346, Q327 controls C348. The U701 pin 1, 2, 3, 4 controls the Q324, Q326, Q325 and Q327 respectively. So different frequency has different combination to meet the requirement.

Cs Table By Frequency				
	CS1	CS2	CS3	CS4
fH < 30K	0	0	0	0
30K ≤ fH < 34K	0	0	0	0
34K ≤ fH < 37K	0	0	1	0
37K ≤ fH < 46K	0	1	1	0
46K ≤ fH < 53K	1	0	0	1
53K ≤ fH < 63K	1	1	0	1
63K ≤ fH < 68K	0	0	1	1
68K ≤ fH < 75K	1	0	1	1
75K ≤ fH < 85K	0	1	1	1
85K ≤ fH ≤ 86.5K	1	1	1	1
86.5K < fH	0	0	0	0

6. FBT Secondary & Dynamic Focus

(a) Focus and screen voltage are come from FBT bleeder.
(b) G1 bias is controlled through R399, R30F, VR304, R30B and Q323.
(c) Q309 is controlled by MCU pin 31 Mute2, and it will blank the picture during mode change.
(d) Q401 is the blanking buffer to G1 to blank the retrace line of picture.
(e) Q339, Q340, D302,ZD301,D326,R322 and R318 are the x-ray protection circuit. Once the HV rises abnormally, U301 win shut down itself, all the horizontal deflection is stopped by then.
(f) Dynamic Focus:
(1) H-Focus: U301 pin 10 outputs a parabolic waveform and through Q302 into Q338 to get a reverse amplified waveform. This waveform is through the SEPP Q303 and Q304, as a current gain then input into T303.
(2) V-Focus: U401 pin 5 output waveform through R329, C322, R32G and C324 to get a parabolic waveform. This waveform is amplified by Q305 and input into T303.
(3) H-Focus and V-Focus are into T303 to get a combined waveform that will input to FBT.


AC I/P
POWER SUPPLY U101,U102,T101, BD101,Q101
PFC U103
DEGAUSS Q108,110
TILT DEG
ROTATION Q601,602
EEPROM U702
H,V BUFFER Q701,702
H
V
HSCL,HSDA,PC/5V,PC/#5
ISCL
ISDA
H,V OSC U301
BRIT ,DEG,TILT, PS1, PS2,MUTE,ST, H-S,CS1~4,HF/S,CLP, SW1~3,ISCL,ISDA
MCU U701
76V,15V,6.3V
40V
B+ STEP-UP Q312,307,308
E/W Q309,311 CORRECTION H-S
HV ADJ
ST
R,G,B
ISDA
VF
ABL
ISCL
ST
CLP
PS1, PS2
CS1~4 SW1~3, HF/S
H-LINEAR Q322 CS-SELECT Q324~7
H-DRIVER Q316
CLP
VIDEO PRE-AMP U201
POWER SAVING Q114, Q115,116,104,105,112
76V,12V, 6.3V
ABL Q272
OSD/R,G,B,FB
VF
R,G,B
DYNAMIC Q304, FOCUS Q305,303, Q302,338
RASTER CENTER Q313,314
H-O/P Q315
OSD U202
VIDEO PACK U203
R,G,B,/CUT OFF
R,G,B
X-RAY POTECT Q339,340
HOT T302
H-BLK Q273
MUTE
BRIT
BRIT Q323,329, Q331
VERTICAL O/P U401
G1
76V
6.3V
12V
GND
HBLK
HBLK
DC RESTORE Q211,212,231, 232,251,252,
G1
ABL
HBLK
VF