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# **Service Manual**

**17-inch Color Monitor  
HP mx703 / m703**

## Service Manual Versions and Revision

No.	Version	Release Date	Revision
1.	1.0	Aug. 26, 2002	Original release
2.	2.0	DEC. 31, 2002	Original release

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# 1 Precautions

Follow these safety and servicing precautions to prevent damage and to protect against potential hazards such as electrical shock and X-rays.

## 1-1 Safety Precautions

### 1-1-1 Warnings

1. For safety purpose, do not attempt to modify the circuit board, and always disconnect the AC power before performing servicing on the monitor.
2. Operation of the monitor outside its cabinet or with the cover removed involves the risk of shock hazard. Repair work on the monitor should only be attempted by service personnel who are thoroughly familiar with all necessary safety precautions and procedures for working on high voltage equipment.
3. Do not lift the CRT by the neck. After completely discharging the high voltage anode, handle the CRT only when wearing shatterproof goggles. Try to keep the CRT away from the body during handling.
4. High voltage should always be kept at the rated value, no higher. Only when high voltage is excessive are X-rays capable of penetrating the shell of the CRT. Operation at high voltages may also cause failure of the CRT or high voltage circuitry.
5. The CRT is especially constructed to limit X-ray emission to 0.5 mR/HR at 300 microamperes anode current. To ensure continued X-ray protection, replace the CRT with only the same or equivalent type as the original, and adjust the anode's voltage to the designated maximum rating, never to exceed.

### 1-1-2 Safety Checks

Before returning the monitor to the user, perform the following safety checks:

1. Inspect to make certain that each lead dress is not pinched or that hardware is not lodged between the chassis and other metal parts in the monitor.
2. Inspect all protective devices such as

nonmetallic control knobs, insulating materials, cabinet backs, adjustment and compartment covers or shields, isolation resistor-capacitor networks, mechanical insulators, etc.

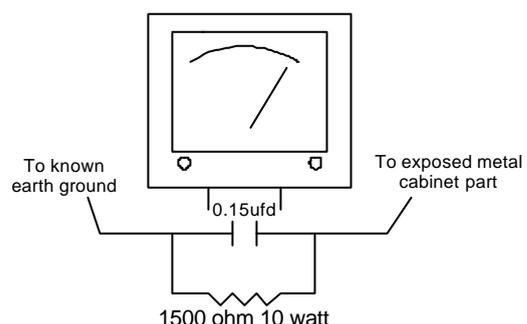
### 3. AC Leakage Current Check

Always perform the AC Leakage Current Check on the exposed metal parts, including metal cabinets, screwheads and control shafts, as follows:

- a) Plug the AC line cord directly into a rated AC outlet. Do not use an isolation transformer during the check.
- b) Use an AC voltmeter with at least 5000 ohms per volt sensitivity as follows:

Connect a 1500 ohms, 10 watt resistor paralleled by a 0.15 uF AC capacitor in series with all exposed metal cabinet parts and a known earth ground, such as electrical conduct or electrical ground connected to earth ground, as shown in the Figure 1-1. Measure the AC voltage across the combination of resistor and capacitor.

Figure 1-1. Set Up For AC Leakage Current Check



- c) Reverse the AC plug at the AC outlet and repeat the steps for AC voltage measurements for each exposed metal part.
- d) Voltage reading must not exceed 0.3 volts RMS, equivalent to 0.2 milliampere AC. Any value exceeding this limit will constitute a potential shock hazard and must be corrected immediately.



### 1-1-3 Product Safety Notices

Many electrical and mechanical parts in this chassis have special safety-related characteristics which are often not evident from visual inspection, the protection afforded by them may not be obtained by replacing them with components rated for higher voltage, wattage, etc. Before replacing any of these components, consult the Recommended Spare Parts List given at the end of this manual. Any of the replacements that do not provide the same safety characteristics may result in shock, fire, X-ray emission or other hazards.

### 1-2 Servicing Precautions

**Warning:** An electrolytic capacitor installed with the wrong polarity might explode.

**Caution:** Before performing servicing covered by this service manual, read and follow the Safety Precautions section of this manual.

**Note:** If unforeseen conflict between the following servicing precautions and any of the safety precautions, always follow the safety precautions

1. Follow closely the servicing precautions printed on the monitor cabinet and chassis.
2. Always unplug the AC power cord from the AC power source before removing or installing any component or assembly, disconnecting PCB plugs or connectors and connecting a test component in parallel with a capacitor.
3. When replacing parts or circuit boards, clamp the lead wires around the component before soldering.
4. When replacing a high wattage resistor (>0.5W metal oxide film resistor) in the circuit board, keep the resistor about 1 cm (1/2 inch) away from the circuit board.
5. Keep wires away from the high voltage or high temperature components.
6. Keep wires in their original positions so as to minimize interference.
7. Always connect a test instrument's ground lead to the instrument chassis ground before connecting the positive lead; always remove the instrument's ground lead last.

After putting the rear cover back and make sure the monitor is working properly, the Hi-Pot & Ground Continuity tests **MUST BE** performed before the monitor is returned to user.

### 1-3 Hi-Pot Test

#### 1. Test Equipment

Puncture test model PM5530 ADT or KIKUSU TOS-8750 voltage tester or equivalent approved equipment.

Note : The test equipment must be calibrated in regular period.

#### 2. Test Setup

- a) Apply voltage : DC 2100 VDC
- b) Test duration : 3 seconds
- c) Cutoff current should be set to 3 mA

#### 3. Test Procedure

- a) Unplug power cord from AC source.
- b) Put the power switch of the monitor in the "ON" position.
- c) Leave signal cable un-connected.



- d) Plug monitor power cord to the Hi Pot tester terminals.
- e) Turn on tester and watch the indicator or beeper.
- f) If the indicator lamp lightens, or beeper beeps, the test fails.

## 1-4 Ground Continuity Test

### 1. Test Equipment

AC low ohm tester TOS-6100 or equivalent approved equipment.

Note : The test equipment must be calibrated in regular period.

### 2. Test Setup

- a) Test duration : 3 seconds
- b) Set current limit at 25 A
- c) The grounding resistance must be less than 0.1 ohm.

### 3. Test Procedure

- a) Plug the monitor power cord to the tester terminals.
- b) Make sure all connections are well-contacted.
- c) Turn on monitor power and tester power.
- d) Press "Test" button.
- e) If green light shows up, means test OK.  
If red light shows up, means test fails.
- f) If the Tester has a digital display, the resistance value must not exceed 0.1 ohm.

Note : Be sure not to touch the metal portion of the signal cable head during testing.



## 2 Product Specifications

### 2-1 Specifications

Picture Tube	17-inch (16-inch Visual image area), slotted mask, 90 degrees deflection, dot type black matrix, medium short persistence phosphor, dark tint, non-glare/ anti-static screen, 0.27 mm dot pitch for m703 and 0.25mm dot pitch for mx703
Scanning Frequency	VGA, Super VGA, 1024x768@60/70/75/85 Hz 1280x1024@60Hz
Maximum Resolution	1280 dots (H) x 1024 lines (V) @60Hz refresh rate
Display Area	312 mm (H) x 234 mm (V) typical
Display Characters	80 char. x 60 rows on a 10 x 10 matrix
Display Colors Analog Input	Unlimited Colors
Synchronizatin Signals	Separate Sync: horizontal/vertical, TTL, positive or negative
Synchronization Frequencies	Horizontal : 30 to 70 kHz Vertical : 50 to 140 Hz
Signal Connectors	15-pin, D-shell connector
Video Signals	Analog : 0.7 Vp-p, RGB positive
Power Input	75 Watts (maximum) AC rated voltage, 100VAC to 240VAC
Misconvergence	Center Area : $\leq 0.3$ mm; Corner Area : $\leq 0.4$ mm
User Controls	Power On/Off, Contrast, Brightness, Horizontal Size, Horizontal Position, Vertical Size, Vertical Position, Pincushion, Trapezoid, Rotation, Color temperature, Language, Display Frequency, Degauss, Recall, H. Moire, V. Moire
Service Controls	PWB-1700 PWB-1697 : power voltage adjust (VR801)
Preset Modes	8 (see Table 2-2. Timing Chart)
Environmental Considerations	Operation temperature : 10°C to 35°C ambient Operation Humidity : 20% to 80% ambient Storage temperature : -40°C to 65°C ambient Storage Humidity : 10% to 90% (non-condensing) Altitude : Non operating 40,000 feet sea level operating 10,000 feet sea level

Note: Above specifications are subject to change without prior notice.



## 2-2 Signal Cable Pin Connections

Table 2-1. Signal Cable Pin Assignment

Pin	Signal	Pin	Signal
1	Red video	9**	+5V
2	Green video	10	Digital Ground
3	Blue video	11	Ground
4	Ground	12	SDA
5*	NC	13	H-Sync
6	Red ground	14	V-Sync/VCL
7	Green ground	15	SCL
8	Blue ground		

**Note \*** This pin is used for selftest detection. Connect this pin to ground at the PC end.

**\*\*** For PC 99: This pin will provide +5V from PC side.



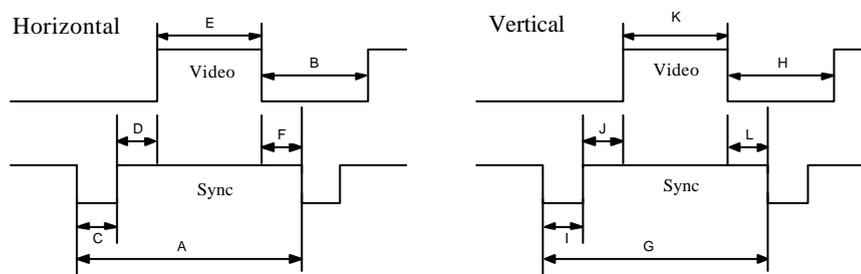
## 2-3 Timing Chart

This section describes the timings that the computer industry recognizes as standard for computer-generated video signals.

Table 2-2. Timing Chart

Mode	1	2	3	4	5	6	7	8	9
H. Dots	640	720	640	640	800	800	1024	1024	1280
V. Dots	480	400	480	480	600	600	768	768	1024
H-freq (kHz)	31.47	31.47	37.5	43.27	46.8	53.67	60.02	68.68	63.98
Sync Polarity	-	-	-	-	+	+	+	+	+
A period us	31.78	31.78	26.666	23.11	21.333	18.63	16.66	14.56	15.63
B Blanking us	6.356	6.356	6.349	5.33	5.172	4.409	3.657	3.725	3.778
C Sync us	3.81	3.81	2.032	1.556	1.616	1.138	1.219	1.016	1.037
D B.P. us	1.907	1.907	3.81	2.22	3.232	2.702	2.235	2.201	2.296
E Active us	25.42	25.42	20.317	17.78	16.162	14.22	13	10.836	11.852
F F.P. us	0.636	0.636	0.508	1.556	0.323	0.569	0.203	0.508	0.444
V-freq (Hz)	59.95	70.08	75	85	75	85	75.03	85	60.02
Sync Polarity	-	+	-	-	+	+	+	+	+
O Period ms	16.68	14.27	13.33	11.76	13.333	11.76	13.33	11.77	16.661
P Blanking ms	1.43	1.557	0.533	0.67	0.533	0.578	0.533	0.582	0.656
Q Sync ms	0.064	0.064	0.08	0.069	0.064	0.056	0.05	0.044	0.047
R B.P. us	1.02	1.08	0.427	0.578	0.448	0.503	0.466	0.524	0.594
S Active us	15.25	12.71	12.8	11.09	12.8	11.18	12.8	11.18	16.005
T F.P. us	0.35	0.413	0.027	0.023	0.021	0.019	0.017	0.015	0.016

### Seperate Sync



#### H.Parameters:

- A: Period
- B: BlankingTime
- C: Sync Width
- D: Back Porch
- E: Active Time
- F: FrontPorch

#### V.Parameters:

- G: Period
- H: BlankingTime
- I: Sync Width
- J: Back Porch
- K: Active Time
- L: FrontPorch



## 2-4 Power Saving Function

**Note:** The monitor will be driven into “Power Saving” mode by the control signal from the display controller, as indicated by the amber-color power LED.

Table 2-3. Power Saving Function

State	Power Consumption	LED Light
ON	Normal*	Blue
Active OFF	<2 watts	Amber

The power saving states will be kept until a control signal has been detected or the keyboard or mouse is activated. The recovery time from Active OFF state back to ON state is around 10 seconds.

\* For power consumption : 75W Max. (@ 230V AC, preset size and maximum light output condition)

## 2-5 TCO Version (Optional)

The monitor meets the TCO 99, NUTEK energy saving, electric and magnetic field requirements. Also it is compliant with TCO 99 labelling scheme.

The emission from magnetic and electric field must comply with the limits specified by the Swedish Board for Measurement and Testing, commonly known as MPR 1990 recommendations. These limits are summarized in the Table 2-4.

Table 2-4. TCO 95 Emission Requirements

	VLF/TCO	ELF/TCO
Magnetic Field	25 nT	200 nT
Electric Field	1 V/m	10 V/m
Frequency Range	2~400 kHz	5~2000 Hz
Value	RMS	RMS
Distance	30 cm	30 cm
Electrostatic Potential	+/- 500 V	+/- 500 V

The monitor is designed with selected CRT and carefully routed wires around CRT, make sure exactly the



same routing scheme is used when doing CRT replacement.

**2-5-1 TCO95 Version (Optional)**

The TCO 95 scheme is for international and environmental labelling of personal computers. The labelling scheme was developed as a joint effort by the TCO (The Swedish Confederation of Professional Employees), Naturskyddsforeningen (The Swedish Society for Nature Conservation) and NUTEK (The National Board for Industry and Technical Development in Sweden).

1) Scope

TCO 95 touches on ergonomic qualities, emissions (electrical and magnetic fields), energy efficiency and ecology (with demands for environmental adaptation for both the product and the production processes at the manufacturing plant).

2) Environmental Requirements

The monitor abides by the environmental demands concerning restrictions on the presence and use of heavy metals, brominated and chlorinated flame retardants, CFCs (freons), and chlorinated solvents, among other things. The monitor is also recyclable.

3) Energy Requirements

The monitor also follows the energy requirements that, after a certain period of inactivity, the monitor shall reduce its power consumption to a lower level in one or more stages.

4) Others

The monitor meets the strict environmental demands for the reduction of electric and magnetic fields, physical and visual ergonomics and good usability.

Table 2-5. TCO95 Visual Ergonomics

Feature	Standard	Description
Linearity	1% or less	Difference in length of columns or rows compared to the corresponding lengths through the center of the monitor.
Display Luminance	100 cd/m2 (at least)	
Luminance Uniformity	1.7:1 or less	The ratio is between the max to min luminance within the whole active area.

**2-5-2 TCO 99 Version (Optional)**

TCO 99 will append the color temperature and energy efficiency specification, also cover the environmental requirement.



### 3 Operation Theory

This is a fully digital controlled multi-sync color monitor that is compliant with DDC1 and 2B Plug and Play VESA standard and offers the following main features.

#### 3-1 Main Features

1. Simplified design with minimum components.
2. The NOVA NT6863 32 processor-- that has I<sup>2</sup>C BUS controlled geometric correction, contrast and brightness-- offers the functions for: (a) Contrast, (b) Brightness, (c) H-size, (d) H-position, (e) V-size, (f) V-position, (g) Pincushion, and (h) Trapezoid.

In addition, it also offers more functions as: (a) Sync. processor, I/P and O/P, (b) Mute, (c) Power saving - Suspend & Stand-By, (d) Power saving override, (e) DDC1/2B, (f) I<sup>2</sup>C Bus for auto-alignment through signal cable (g) CS1/CS2/CS3/CS4 for linearity and size compensation.

3. Stores up to 10 factory preset modes and offers 8 user modes. There are 16 function icons at OSD. They are controlled by   keys on front panel.
4. Powerful PHILIPS TDA4863AJ A5 and TDA4841 present the following useful functions: (a) Pincushion, (b) Trapezoid, (c) V-Position, (d) V-Size, (e) Vertical's "C" and "S" correction -- factory adjust, (f) Pincushion's V. position correction, (g) Corner correction -- factory adjust, (h) Pincushion unbalance correction -- factory adjust, (i) Parallelogram distortion -- factory adjust, (j) Moire cancellation, (k) X-ray protection, and (l) Full horizontal and vertical auto sync capability.
5. Software controlled auto shut off function activated if  $fH \leq 29$  kHz and  $fH \geq 70$  kHz.
6. Full range AC input and simplified line filter design.

#### 3-2 Microcontrol Section

1. This monitor uses NOVA NT6863 CPU. It contains a 8051 8-bit CPU core, 512 bytes of RAM used as working RAM and stack area, 32k bytes of MASK ROM, 10-channel 8 bit PWM D/A converter, 4-channel A/D converters for key detection saving I/O pins, internal H. sync and V. sync signals processor providing mode detection, and an I<sup>2</sup>C bus interface. When H/V sync through D-Sub signal cable enter pin 41 and pin 42, the CPU performs frequency /polarity detection and calculate and send to H/V sync OUT. Then CPU reads the data from I703 and transfer to device 4841 and some DAC in CPU, above operation takes about 500 ms.
2. There allowed 8 factory preset modes and 8 user modes. There are 11 functions, Contrast, Brightness, H. Size, H. Position, V. Size, V. Position, Pincushion, and Trapezoid, Rotation, H. Moire, V Moire, all controlled by OSD icon which can be adjusted by user.
3. The pin 25 and pin 26 are used for ATE function. When CPU receives C6 as slave address, it will operate in ATE mode which is used for auto-alignment. After alignment the data will be stored in I703.
4. The user control parameters are selected by OSD icons, through  &  keys, they are detected by sensing the voltage through R710, R740, R741, R743, R716, R717 to pin 16 and 17 of I701.

#### 3-3 Deflection Section

1. I<sup>2</sup>C -- autosync deflection controller is TDA4841.
2. The TDA4841 is a high performance and efficient solution for autosync monitors. All functions are controllable by I<sup>2</sup>C bus. SDA and SCL signals coming from microprocessor feed to pin 12 and pin 13 to control all functions.



### 3-3-1 Horizontal Section

1. The oscillator is driven by the currents in R419 and R420. The minimum oscillator frequency is determined by R419 and the maximum frequency is determined by R420.
2. Horizontal sync goes into pin 15 through R318. And horizontal flyback pulse goes into pin 1 through R401 from pin 5 of FBT for HFLB loop.
3. Horizontal driver (pin8) O/P to Q401 via C410.

### 3-3-2 Vertical Section

1. Vertical sync goes into pin 14 through R317.
2. The free running frequency is determined by R301 and C301.

### 3-3-3 Vertical O/P section

1. The differential output currents from pin 13 of Vout1 and pin 12 of Vout2 can be directly coupled to the vertical deflection booster pin 1 and pin 2 of TDA4863 AJ.
2. The TDA4863 AJ has two output stages which are current driven in opposite phase and operate in combination with the deflection coil in a full bridge configuration.
3. This IC is powered by two sets of positive voltage and one set of negative voltage. (+12V at pin 1, -12V at pin 4).

### 3-3-4 E-W/Trapezoid and H. Width Controls

1. The horizontal O/P stage uses diode modulator D419, C411, C412, L409 and C418 for East-West (Pincushion) Trapezoid and H. width controls.
2. The scan current is determined by  $B^+ - V_m$  (the voltage of C418) values and the pincushion control is accomplished by OPAMP(KA324) I402 and Q419 by coupling a parabola waveform from pin 11 of TDA4841. The H. width / corner and trapezoid correction are also accomplished by this pin 11. The DC level controls H. size. The AC level is combined with side pin and trapezoid corners functions.

### 3-3-5 X-Ray Protection

1. To avoid X-ray hazard, a DC voltage generated at pin 5 of FBT and rectified by D410, C424 and divided by R404, R406 and R405 come into pin 2 of TDA4841.
2. If this voltage is higher than 6.39 V, then TDA4841 will be activated to float HUNLOCK (pin17), H. DRV (pin 8), B DRV (pin 6), VOUT1 (pin 12), VOUT2 (pin13). After that all deflection circuit stop working.

### 3-3-6 G1, Blanking and Brightness

1. The vertical blanking signal comes from unlock pin 17 of I401. This positive vertical pulses through Q405 amplified and converted into negative pulse and sent to G1 for vertical blanking.
2. In protection mode or an out-of-range situation HUNLOCK will send 5 V pulse to CPU pin 30 of I701, then G1 will go down to -150V. During the mode change, Mute acts as same as HUNLOCK's.

### 3-3-7 Contrast Section

1. Contrast is controlled by I701 through I<sup>2</sup>C bus to I501 (LM1247) directly.
2. Beam current is detected through T402 (FBT) pin 7, C429, R449 and detected voltage feeding into pin 12 of I403 (KA324), R459, R548, C556 to control I501 pin 22 voltage. When I501 pin 22 voltage drops



below 4.0 V, the ABL function will happen.

### 3-3-8 H/V size breathing compensation

1. Beam current is sensed as above section (3-3-7 item 2) and this voltage routes through R451, R468, C470 then through R437 to pin 31 of I401 for H. size compensation.
2. HV voltage is detected through T402(FBT) pin 11. C481, R4F4, R4F8, C430, R411, pin 5, 6, 7 of I403 (KA324) then through R302 to I401 pin 21 for V. size compensation.

### 3-3-9 Dynamic focus circuitry

The dynamic focus is applied to improve the corner focus performance, it includes horizontal and vertical dynamic focus.

1. Horizontal dynamic comes from Idy current through T403, R434, C448, R428 and feed to FBT dynamic focus pin (T401 pin 12).
2. Vertical dynamic comes from pin 32 of I401 through C315, R309, R326, R322, R323, Q301, R324, R325 and feed to FBT dynamic focus pin.

## 3-4 Power Supply Section

### 3-4-1 AC Rectifier

The circuit can accept 90 V to 264 V AC input through D801~D803 bridge diodes and C808 filtering to get DC 126 V~364 V for power conversion in T802.

### 3-4-2 Line Filter

It consists of C803, T801, C804, C805, C806, C819, C807, C817, C862, C863, C864 and meets EMI regulation.

### 3-4-3 Power LED Status

1. The LED has 3 leads with common cathode to emit blue and amber color light for different power saving states. It is controlled by CPU.
2. Normal : blue light  
Amber LED is off because CPU pin 29 is 1.96V and pin 24 is 0.45V, only blue LED is turned on.
3. Off Mode : Amber light  
CPU pin 24 is 1.87V and pin 29 is 0.46V, then blue is off and amber is illuminated.

### 3-4-4 Auto Degaussing

When S705 turns on, pin 32 of I701 will send a signal to Q802 and turns on RL801 for degaussing. After 4 seconds, it will turn off RL801 automatically.

### 3-4-5 PWM Control

1. Start Up

The I801 (6S0765C) gets power from R807, R808, C830 and pin 3 voltage reaches 15 V for starting up. The I801 starts oscillation at 25 kHz, pin 1 output to drive T802. Switching on, R819 set up an 15 V to keep I801 working through D809 auxiliary voltage.

## 2. Regulation

The DC O/P voltage is proportional to the auxiliary voltage, so I801 pin 4 senses the feedback voltage from the divider D806, R809, C810, VR801, Q803, Q801 and C814 to compare with the built-in 1.5 volts reference voltage for error amplifier operation. Finally pin 4 can modulate the different duty cycle by VR801 setting to achieve regulation purpose.

### 3-4-6 Synchronization

#### 1. Normal Mode

The sync pulse from FBT (31 kHz~69 kHz) via R812, R811 and C815 to pin 5 of I801 to keep I801 synchronized with horizontal sync input frequency.

#### 2. Power Saving Modes: Standby/Suspend/OFF

Because there is no pulse from FBT, so the burst mode frequency SMPS works at 50 kHz by I801 itself.

#### 3. Override

The horizontal free run frequency is about 63.2 kHz under override condition, SMPS is synchronized to this frequency.

### 3-4-7 O.V.P.

If the auxiliary voltage is higher than 27 volts makes pin 3 of I801 is limited to have the OVP activated.

### 3-4-8 O.P.P.

The excess current of T802 through I801 pin 1, 2, make  $V_s > 1.1V$  internal of I801, then limit the power.

### 3-4-9 Step Up Power Supply For FBT

1. The B+ of FBT is proportional to horizontal frequency, that is the higher frequency, the higher voltage. The basic voltage is 58 volts from T802 pin 10 via L811, D813, C824 and the gate control of Q451 comes from I401 pin 6 via Q450, Q434, Q435 and R456. The duty cycle is controlled by I701 pin 23 (PWM pin Adj.) via R719, C741, R4F6, R4F5, R4F1.
2. The regulation and boost up (from 68 V to 160 V or more, on demand). The H.V. is set at 25 kV (zero beam) by I701 pin 23 which senses the secondary O/P from FBT. The booster comprises Q451, L410, L411, D450, C425 and T402 to offer the required B+ for different frequency modes.

## 3-5 Video Amplifier Section and OSD (On Screen Display) function

1. RGB signal inputs are terminated by R501, R531 and R561 then pass through the coupling capacitors C503, C533 and C563 to IC501 LM1247 preamplifier.
2. The amplifier RGB signals (0~3 Vpp) are adjusted by I<sup>2</sup>C bus, I501 pin 23 is for clamp pulse which comes from pin 16 of TDA4841 to set up equal clamp level.
3. The pre-amp video stage is amplified by I501 (LM1247), it's including OSD function and control by I701 pin 12, 13 (I<sup>2</sup>C).
4. The video output stage 15 is amplified by I502 (LM2466).
5. The RGB cathodes cut off are adjusted by I503 (LM2480) pin 8, 7, 6, which comes from I501 pin 16, 15, 14 to adjust cut off voltage level by I<sup>2</sup>C bus.
6. Under override condition, "NO SIGNAL" will show up on the screen.



## 4 Alignments and Adjustments

This section of the service manual explains how to make permanent adjustments to the monitor settings.

### 4-1 General Adjustments

#### 4-1-1 Adjustment Conditions

a) Power Supply

Apply AC 115 V or 220 V

b) Warm-up Time

The monitor must be powered on for 15 minutes before starting any alignment, but requires 30 minutes of warm-up time for convergence adjustment.

c) Signal Input

1. Video: RGB Analog, 0.7 Vp-p, positive
2. Synchronization: Horizontal and vertical TTL signal, separate, positive or negative
3. All adjustments should be made using a signal of FH = 68.68 kHz, FV = 85 Hz, unless otherwise defined.

#### 4-1-2 Equipment Required

The following equipments are necessary for adjustment procedures:

1. Volt-ohm-A meter (Sanwa FD-750C or equivalent)
2. 30 kV high voltage probe (HP34111A)
3. Oscilloscope (TEK2235 or equivalent)
4. Minolta Color Analyzer II
5. Signal generator (IBM PC with proper display cards or Chroma 2000)
6. Screwdriver

#### 4-1-3 Switching Power Supply and Regulator Adjustment

- a. The regulated B+ control has been preset in the factory and needs no adjustment. However, if any repair is made on the power supply section, the following readjustment procedures are recommended:
1. Allow the monitor to warm-up for about 15 minutes.
  2. Apply VGA (1024x 768 @ 68.68 kHz/85 Hz) signal to the monitor.
  3. Connect a DC voltage meter to TP001 (on the Main board), and adjust VR801 for  $11.6 \pm 0.1$  Vdc
  4. If a fuse is broken during adjustment, remember to replace it with the exact same type of fuse.
- b. If necessary, follow the following procedures to enter the factory mode.
1. Press both  key and  key simultaneously then power ON.
  2. After turn the power off, this monitor will go back to normal mode.



## 4-2 Alignment Procedures

### 4-2-1 High Voltage Adjustment

#### *CONDITION*

Press  $\square$  and  $\square$  buttons simultaneously when switching the power “On”.

Display image : No video (68.68kHz Mode)

#### *PROCEDURE*

Connect DC meter to TP002 and adjust HV (i)

R802 to obtain a DC voltage of  $-174.5 \pm 0.2$  V DC (Sampo FBT) or  $-172.5 \pm 0.2$  V DC (LCE FBT) for CPT CRT M41AGE93X46 (TCO) or M41AGE83X46 (MPRII).

### 4-2-2 Screen and White Balance Adjustment

#### *CONDITION*

Press  $\square$  and  $\square$  buttons simultaneously when switching the power “On”.

Display image : No video (68.68kHz Mode)

#### *PROCEDURE*

- 1 Raster color setting
  - 1-a. Set Brightness max. to 77, G1 to 60 (OSD cursor) and  $560 \pm 5$  at G2, cursor.
  - 1-b Adjust R and B cutoff to min.
  - 1-c Adjust G cutoff to about 0.4FL
  - 1-d Adjust B cutoff to get  $y=298 \pm 5$ , R cutoff to get  $x=283 \pm 5$  and  $Y=0.6 \pm 0.05$  FL.
  - 1-e Adjust Brightness cutoff to raster 0.01-0.02 FL.

#### *CONDITION*

Display image : 50 mm x 50 mm white block pattern

#### *PROCEDURE*

- 1 5500<sup>0</sup>K color temperature setting
  - 1-a. Set Brightness to cutoff and Contrast to maximum.
  - 1-b Move cursor on OSD to choose color temperature icon.
  - 1-c. With green block pattern, adjust G gain to get Y about 28FL.
  - 1-d Adjust R.B. gain to get  $x=333 \pm 5$ ,  $y=348 \pm 5$ ; and  $Y=40 \pm 0.5$  FL
- 2 6500<sup>0</sup>K color temperature setting
  - 2-a. Set Brightness to cutoff and Contrast to maximum.
  - 2-b Move cursor on OSD to choose color temperature icon.
  - 2-c. With green block pattern, adjust G gain to get Y about 32FL.
  - 2-d Adjust R.B. gain to get  $x=313 \pm 5$ ,  $y=329 \pm 5$ ; and  $Y=43 \pm 0.5$  FL
- 3 9300<sup>0</sup>K color temperature setting
  - 3-a. Set Brightness to cutoff and Contrast to maximum.
  - 3-b Move cursor on OSD to choose color temperature icon.
  - 3-c. With green block pattern, adjust G gain to get Y about 32FL.

- 3-d Adjust R.B. gain to get  $x=283\pm 5$ ,  $y=297\pm 5$ ; and  $Y=43\pm 0.5FL$
- 4 Full white ABL setting

### CONDITION

Display image : full white pattern

- 4-a Set Brightness to cutoff  $Y=0.06FL$  and Contrast to maximum.
- 4-b. Adjust ABL to  $Y=31.9FL \pm 0.5FL$ .
- 4-c. Check the white balance at 5FL and 28FL.
- 4-d. Repeat all the procedures in 4-2-2 section until the best white balance is obtained.

### 4-2-3 Focus Adjustment

#### CONDITION

Display image : "me" character pattern (68.68 kHz Mode)

#### PROCEDURE

1. Set Brightness to cutoff and Contrast to maximum.
2. Adjust focus 1 at T402 (static focus VR) to make vertical line clear.
3. Adjust focus 2 at T402 (static focus VR) to make horizontal line clear.
4. Repeat above procedures to get best focus.

### 4-2-4 Static Convergence Adjustments

Static convergence involves alignment of the red, blue and green lines in the center area of the display.

Note : The monitor requires 30 minutes of warm-up time for convergence adjustment.

#### CONDITION

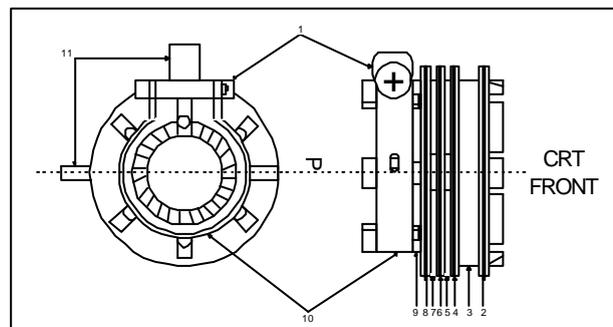
Display image : Crosshatch pattern

Warm-up Time : 30 minutes

#### PROCEDURE

1. Set brightness and contrast to display a well-defined pattern.
2. Ensure the convergence magnet rings are correctly positioned on the CRT.

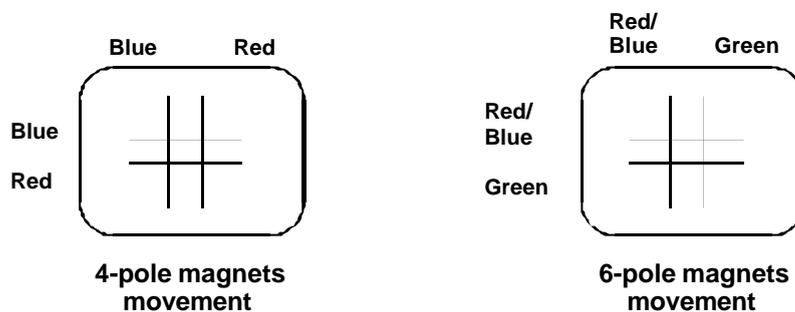
Figure 4-1. Convergence Magnets on the CRT



- |               |                  |           |                  |
|---------------|------------------|-----------|------------------|
| 1) Setup Bolt | 2) Bow Magnet    | 3) Band   | 4) 2-Pole Magnet |
| 5) Spacer     | 6) 4-Pole Magnet | 7) Spacer | 8) 6-Pole Magnet |
| 9) Holder     | 10) Band         | 11) Tabs  |                  |

3. Rotate the individual rings of 4-pole convergence magnets by changing the spacing between the 2 tabs to converge the vertical red and blue lines at the center of the screen.
4. Rotate the pair of rings of 4-pole convergence magnets by maintaining spacing between the 2 tabs to converge the horizontal red and blue lines at the center of the screen.
5. Rotate the individual rings of 6-pole convergence magnets by changing the spacing between the 2 tabs to converge the vertical red, blue and green lines.
6. Rotate the pair of rings of 6-pole convergence magnets by maintaining spacing between the 2 tabs to converge the horizontal red, blue and green lines.
7. Repeat the steps from 3~6 until the best convergence is obtained.

Figure 4-2. 4-pole and 6-pole Magnets Movement



Note : The 4-pole magnets and the 6-pole magnets interact, making dot movement complex.

#### 4-2-5 Degaussing

Degaussing is required when poor color impurity appears on the screen. This monitor uses an automatic degaussing circuit that is activated when the power is on. The automatic degaussing will be fully functional again after the monitor has been in operation for 20 minutes.

The degaussing effect is confined to the picture tube since the coils are mounted at the back of the tube. Should any part of the chassis or cabinet becomes magnetized, it is necessary to degauss the affected area with a manual degaussing coil.

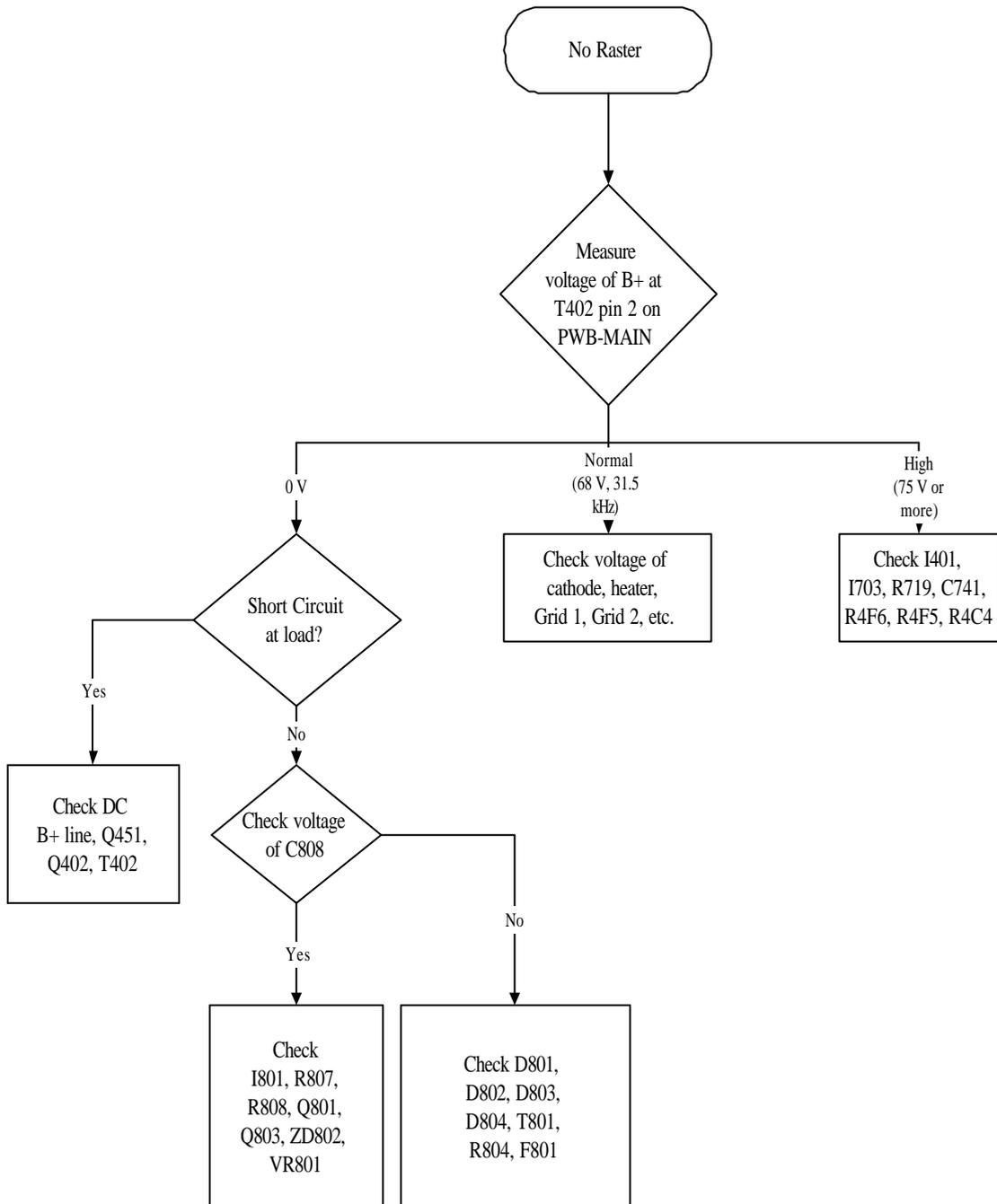
#### 4-2-6 Manual Degaussing

1. Apply line voltage to the degaussing coil and move it in a rotary motion over the front, sides, and top of the monitor. The coil should be kept away from the rear of the monitor to avoid damaging the magnetic neck components.
2. Slowly rotate and move the coil away from the monitor to about 6 feet beyond the point where no effect on the CRT will be noticeable.

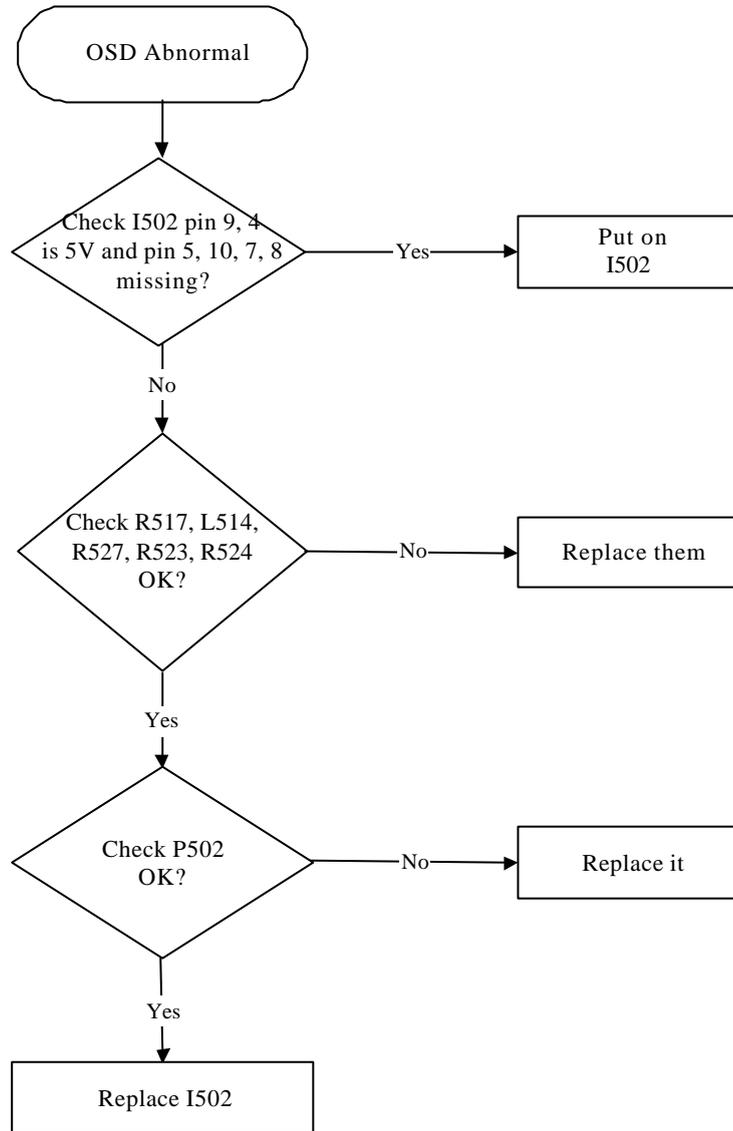
For proper degaussing, it is essential that the field be gradually reduced by moving the coil slowly away from the monitor. The degaussing coil must never be shut off or disconnected while near the monitor, as this would introduce a strong field instead of canceling the effect of the stray fields.

## 5 Troubleshooting

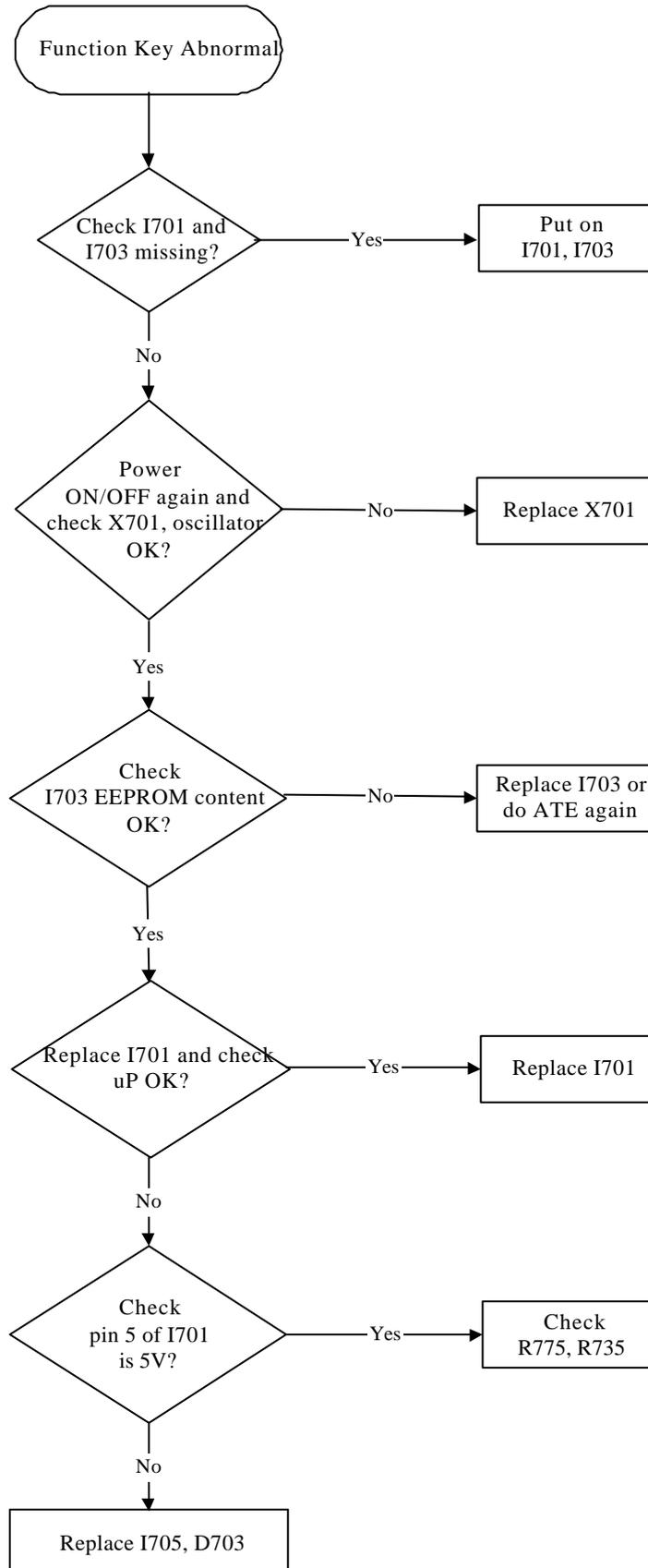
### 5-1 No Raster



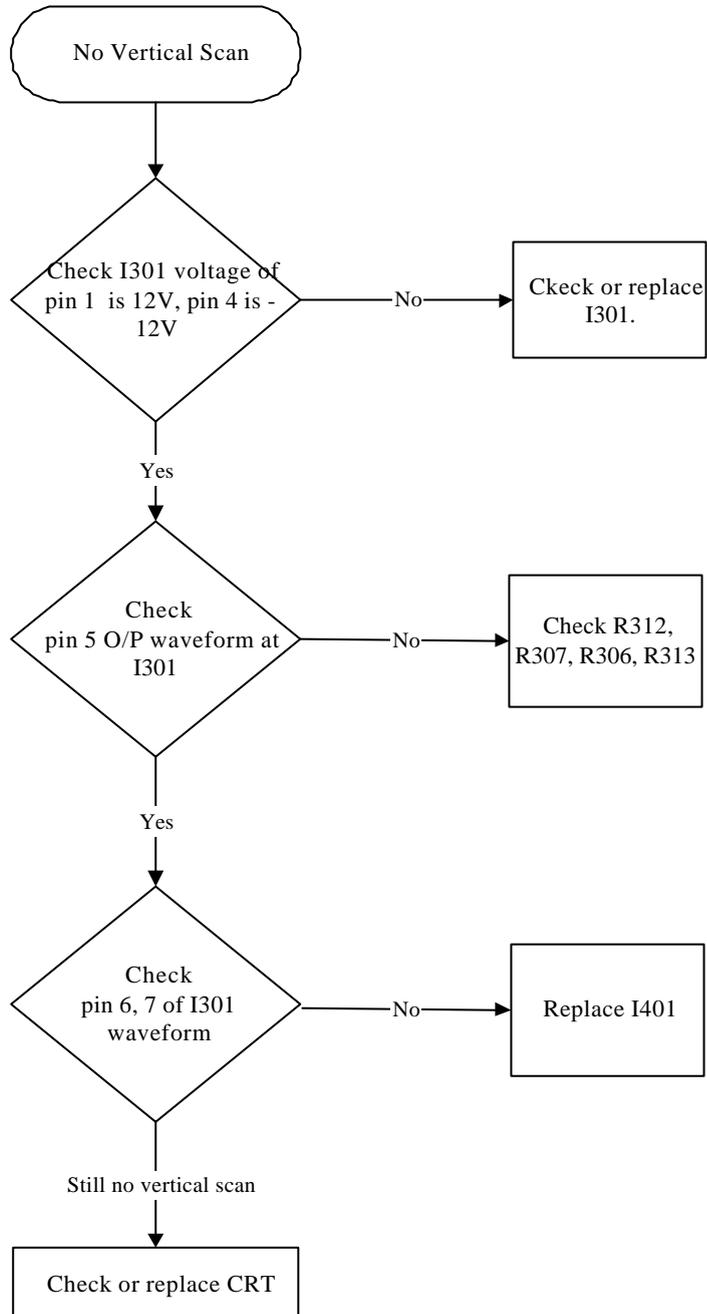
### 5-2 OSD Abnormal



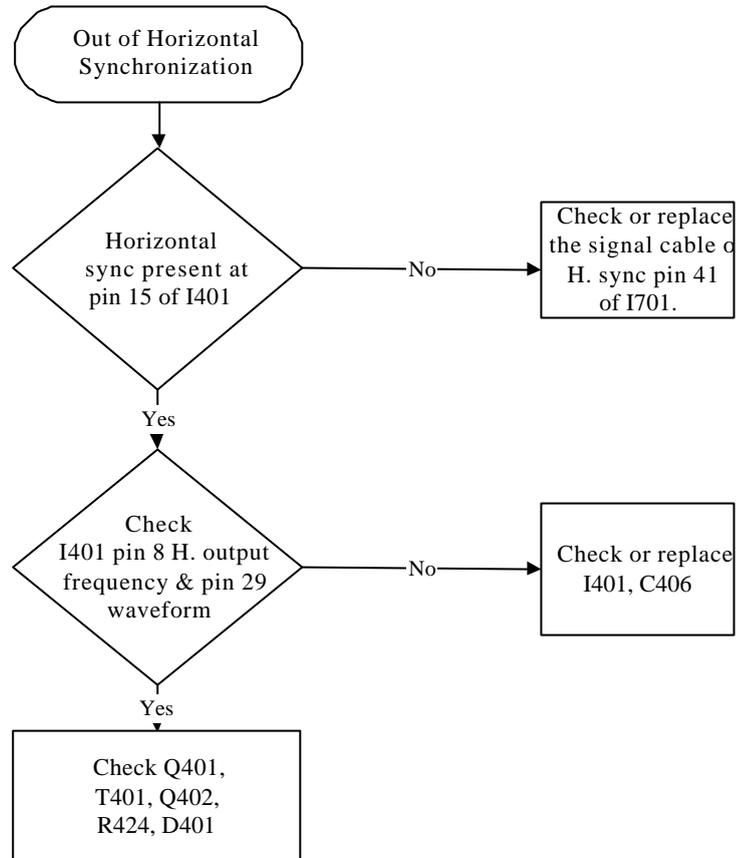
### 5-3 Function Key Abnormal



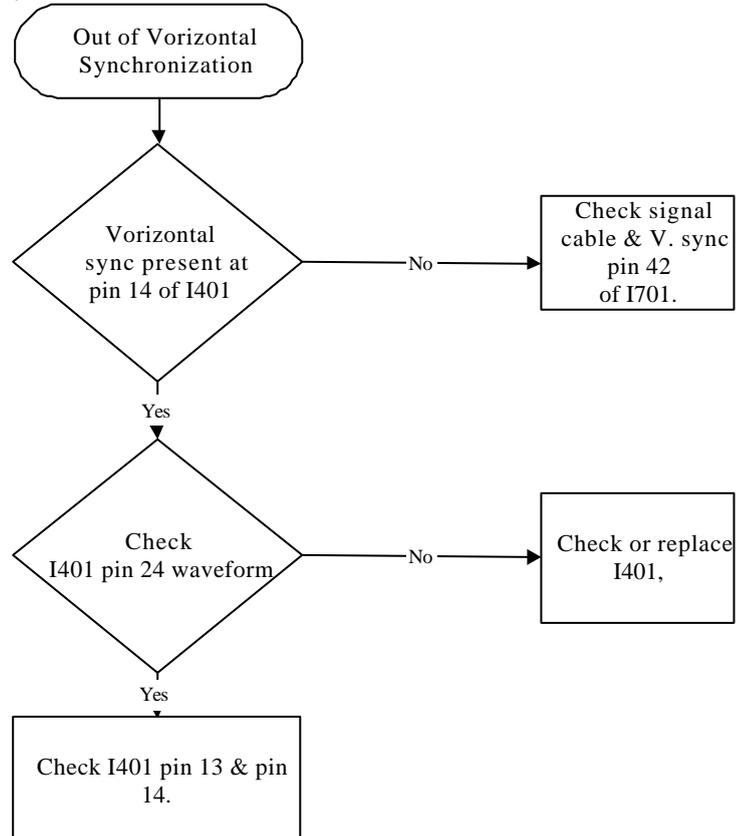
### 5-4 No Vertical Scan (Raster is one horizontal line)



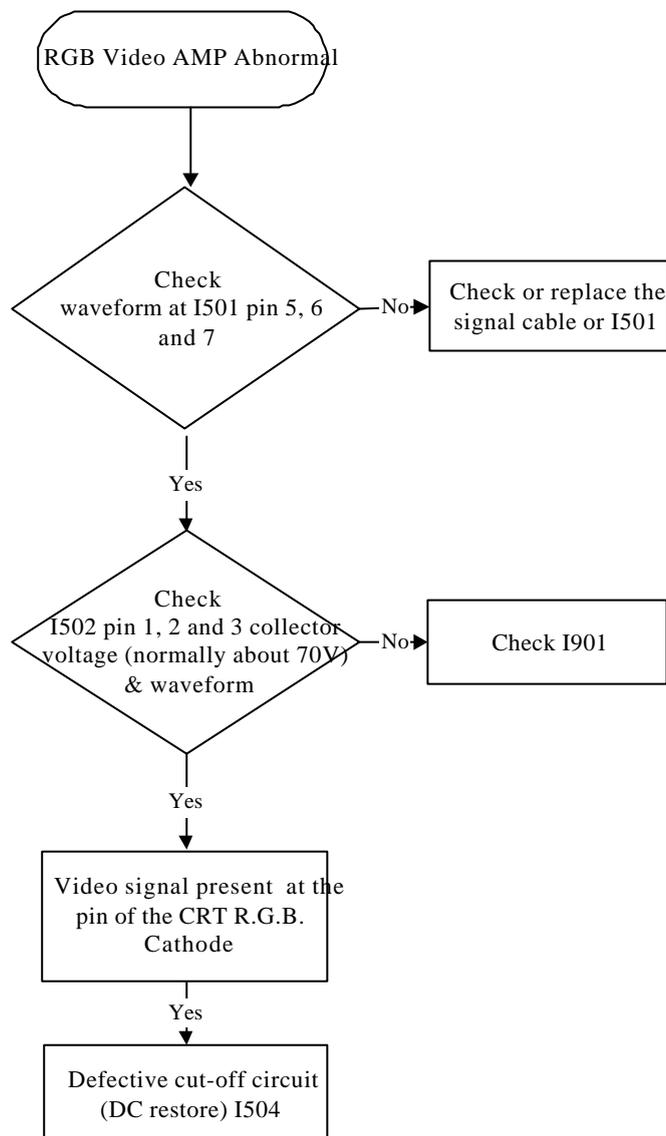
### 5-5 Out of Horizontal Synchronization



### 5-6 Out of Vertical Synchronization



## 5-7 R.G.B. Video Amplifier Abnormal



## 5-8 Blank EEPROM Trouble-shooting:

### Description of functions for models under m703/mx703 series EEPROM DATA AUTO-RELOAD

The function allows plant staff to pre-write and customer service personnel to use blank EEPROM through the pre-write EEPROM function whenever the CPU is implemented. The method of operation is as follows:

First, start after m703/mx703 turns to (<&>) KEY. At this point of time, the CPU is capable of detecting the first 8 DATA of each page that EEPROM contains. When the reading goes to 00H or FFH, the EEPROM PAGE will turn to blank; instead, the pre-set value is being written into the EEPROM through CPU. Otherwise, it shall be deemed an effective value and that the pre-write function shall not be activated.

**Note:** The pre-write operation is only used in the service operation, if the EEPROM becomes faulty, we need to replace it with a new one, but, to enable the adjustment ( geometry, color temperature, .. etc ) we have to put in some " factory preset values " so that we can have a good start point, this is what we call " pre-write " operation.



## 6 Recommended Parts List

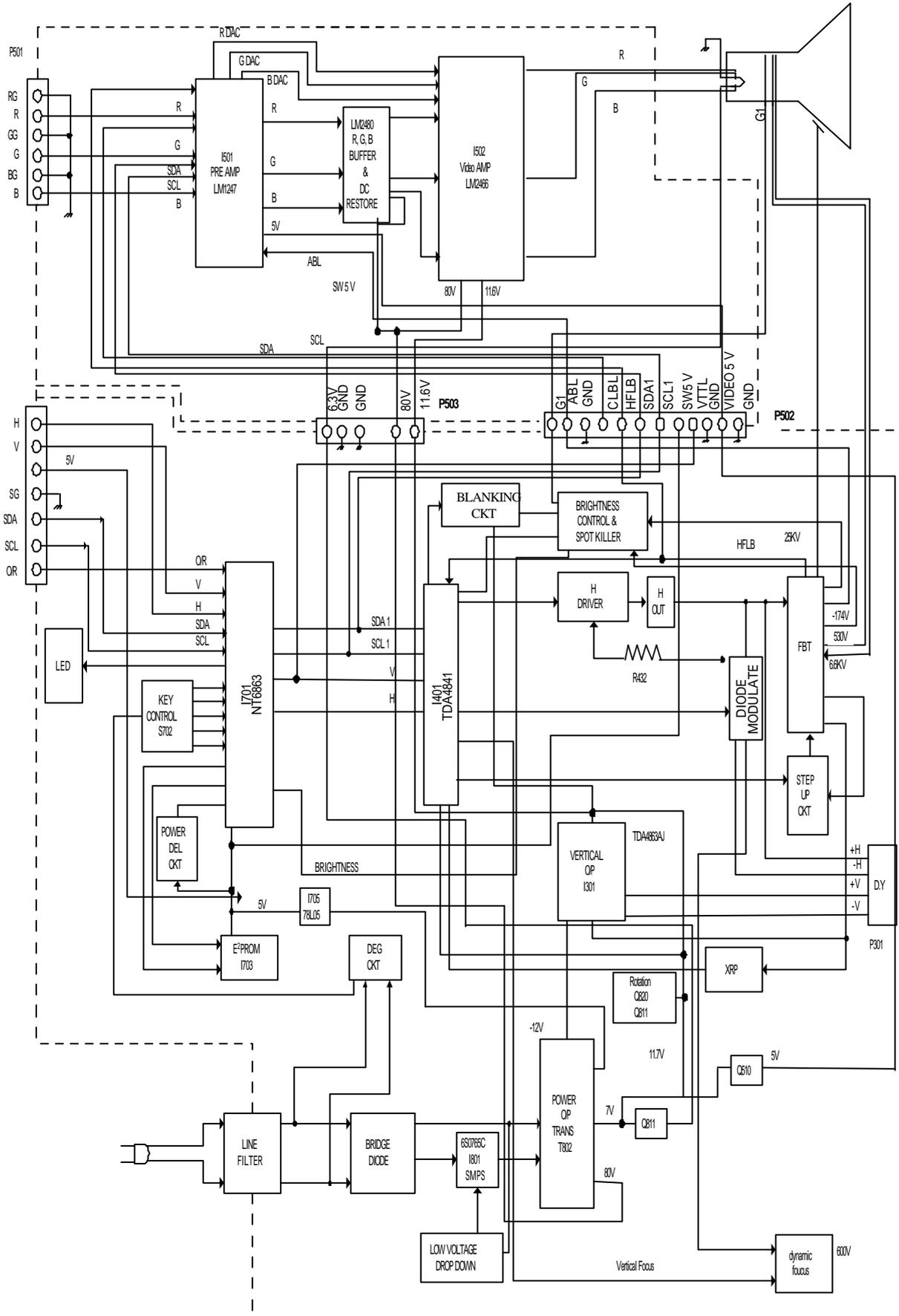
- Note:1. The components identified by “” mark are critical for X-ray safety. Replace these with exactly the same parts specified.
2. There is only OTPIC at the model beginning (FPR stage or before). When it put in mass production and there must be Mask coming out. If you have spart parts need, please use BOM to get the last release part number and related information.

No.	Location	Part Number	Description
1	Q401	6421002705	TR NPN KSD1616A G TA
2	C808	6312615109	ALU uF 150 400V F 85C 25x35
3	D801 D802 D803 D804	6412010917 (S0) 6412010907 (S1)	DIODE LT2A06 T52 2A/800V
4	D814	6412020022 (S0) 6412021702 (S1)	DIODE FE30-02BXF06
5	D810	6412004147	DIODE UF2004M 2A/200V 50 nS
6	D815	6412002627	DIODE ER302 3A/100V 50 nS
7	D817	6412024414	DIODE HER106 1A/600V 50 nS
8	F801	6851504053	FUSE TIME LAG H-BRK 4A/250V
9	I301	6442026401	IC TDA4863AJ 7P (PHILIPS)
10	I401	6442030010	IC TDA4841 32P SDIP (PHILIPS)
11	I501	6442035200	IC LM1247 24P SDIP (NS)
12	I502	6442034900	IC LM2466 9P NS
13	I503	6442029901	IC LM2480 8P NS
14	I701	6448021100(OTP)	IC NT6863 42P PDIP NOVA
15	I703	6448015730	IC MTV24C08 (ATC)
16	I705	6442000875	IC KIA78L05 (SAMSUNG)
17 	I801	6442034500	IC 6S 0765C 5P FAIRCH
18	I802	6442014000	IC LTV817D 4P
19	L404	6111274130	COIL CHOKE 2.7mH K DR8x10
20	L405	6119008400	COIL LINEAR
21	L409	6111155133	COIL CHOKE 150uH DRWW 14x15 LY3B
22	L410	6111155139	COIL CHOKR L=150uH K DRWW 14x15
23	Q402	6421004900	TR NPN 2SC5387
24	Q405	6422002925	TR NPN HBF422T/B TO-92 TAPING



No.	Location	Part Number	Description
24	Q419	6422006000	TR NPN 2SD2012 TO-220(IS)
25	Q420 Q421 Q430	6426006401 (S0) 6426010510 (S1) 6426010500 (S2)	FET N-CHNL IRF630MFP/IRFS630A
26	Q451	6426006301	FET N-CHNL IRFS634A FAIRCH 11d
27	R803	6203080022	POSISTOR & OHM DGC2D8ROM
28	R804	6201100019	THERMISTOR 10 OHM 3A P=5 UEI
29	R802	6221127852	MOF OHM 0.27 1W J HOR
30	T401	6135000801	XFRMER HOR DRIVE THD-1008A EI19
31 	T402	6133070230	FBT TFB-7023 FEA9 SAMPO (S1)
32	T403	6136001700	XFRMER DYNAMIC TDF-1018 EI19LSE
33	T801	6138001603	LINE FILTER TLF-1016C 16mH LSE
34 	T802	6131042900 6131042910	XFRMER PWR TPW-1105A ERL35 LSE (S0) XFRMER PWR TPW-1105A ERL35 HJC (S1)
35	X701	6449006910 (S1) 6449006900 (S0)	CRYSTAL 12.000 MHZ 49U 30PF TOP

# 7 Block Diagram





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