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|---------------------|-----------|---------------------|---------|----------|
| <b><i>TOVIS</i></b> | TOVIS P/N | MTG-1971XT          | DATE    | 03/11/02 |
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**Color Monitor Service Manual**

**MODEL: MTG – 1971XT**



|                     |           |                              |         |            |
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## 1. SAFETY PRECAUTIONS

**WARNING:** Service should not be attempted by anyone unfamiliar with the necessary safety precautions for this unit.

1-1.1. Some parts in this unit, such as the picture tube, have special safety related characteristics for X-RAY RADIATION protection. For continued safety, the parts replacement should be under taken referring to the below article (1-2~1-5).

1-2. Many electrical mechanical parts in this unit have special safety-related characteristics for protection against shock hazard and other potential harms.. These characteristics are often passed unnoticed by a visual inspection and the protection afforded by them cannot necessarily be obtained by using replacement components rated for higher voltage, wattage, etc. Replacement parts, which have these special characteristics, are identified in the manual and supplements by shading on the schematic diagram and the parts list. Before replacing of these components read the parts list in this manual carefully.

1-3. When replacing chassis in the cabinet, always be certain that all the protective devices are installed properly, such as insulating covers, strain relief, etc.

1-4. Before replacing the back cover of the set, thoroughly inspect inside the cabinet to see that no stray parts or tools have been left inside.

1-5 Before returning the set to the customer always perform an ac current leakage check on the exposed metallic parts of the cabinet, such as terminal, screw heads, metal overlays, control shafts, etc. To be sure the set is safe to operate without danger of electrical shock, plug the AC line cord directly into an 115V AC outlet (do not use a line isolation transformer during this check). Use an AC volt- meter having 5000 ohms per volt or more sensitivity in the following manner. Cannot use a 1500 ohm, 10watt resistor, paralleled by a 0.15 (uF) capacitor. Reverse the AC plug the AC outlet and repeat AC voltage measurements for each exposed metallic part. Voltage measured must not exceed 0.3V RMS. This corresponds to 0.2mA AC any value exceeding this limit constitutes a potential shock hazard and must be corrected immediately.

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## 2. SPECIFICATIONS

### 2-1. Picture Tube

- Size : 19"
- Dot Pitch : 0.25mm

### 2-2. Signal Input

- Video Input : Analog, Positive Signal(0.7Vp-p)
- Horizontal Sync : TTL Level, Positive or Negative pulse.
- Scanning : 28Khz ~ 70KHz
- Vertical Input : TTL Level, Positive or Negative pulse.
- Scanning : 40~ 160Hz

### 2-3. Power Supply

- Power Input : AC100~ 240V, 60/50Hz
- Fuse Rating : 250V, 50T 3.15A
- Power Consumption
  - Normal: less than 130W
  - DPMS: less than 20W

### 2-4. External Control:

Refer to page 7.

### 2-5. Operating Temperature: 0°C~ 55°C

### 2-6. Operating Humidity: 10%~ 90%(Non-condensing)

### 2-7. Net weight: 23kg

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### 3. TECHNICAL FEATURES.

#### 3-1. U-com (MCU) control with OSD.

U-com recognizes the computer signal and signal output from control board connected with the wire. So the circuit is simplified.

#### 3-2. Universal AC input voltage.

Power supply operates on AC100~ 240volt 60/50Hz for use all over the world.

#### 3-3. Protection Circuit for over-current.

When over-current occurs in the circuit, the protection circuit operate in order to prevent the components from electrical shock or other risks.

#### 3-4. Override function

It is designed for the normal display when the monitor is powered on without connecting from the source (No signal message).

#### 3-5. Control panel

If you are not satisfied with the factory mode size, position, color settings, use this control panel to program those you prefer in each resolution mode.

Then, these adjusted settings are kept in memory even if you change resolution mode or turn off the monitor.

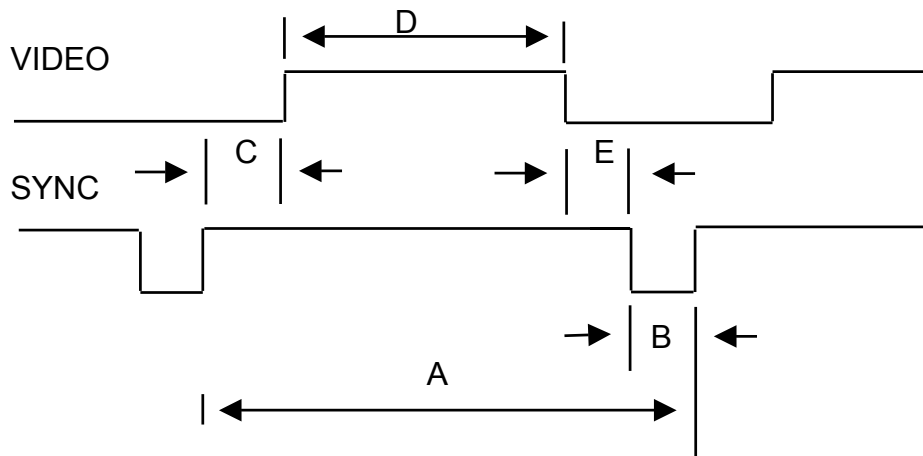
#### 3-6. I<sup>2</sup>C BUS control

It is designed by I<sup>2</sup>C BUS control for simplifying the circuit.

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#### 4. TIMING CHART

Factory Pre-Set Timing Modes.



| DESCRIPTION |        | MODE 1<br>VGA 720*400 | MODE 2<br>VGA 640*480 | MODE 3<br>8514/A 1024*768 | MODE 4<br>S-VGA 680*400 |
|-------------|--------|-----------------------|-----------------------|---------------------------|-------------------------|
| H           | FH     | 31.469KHz             | 31.469KHz             | 35.552KHz                 | 37.500KHz               |
|             | A      | 31.778μs              | 31.778μs              | 28.251μs                  | 26.667μs                |
|             | B      | 3.813μs               | 3.813μs               | 3.920μs                   | 2.032μs                 |
|             | C      | 1.907μs               | 1.589μs               | 1.247μs                   | 3.810μs                 |
|             | D      | 25.422μs              | 25.422μs              | 22.806μs                  | 20.317μs                |
|             | E      | 0.636μs               | 0.318μs               | 0.170μs                   | 0.508μs                 |
|             | POL.   | NEGATIVE              | NEGATIVE              | POSITIVE                  | NEGATIVE                |
| V           | FH     | 70.087Hz              | 59.940Hz              | 86.960KHz                 | 75.000Hz                |
|             | A      | 14.268ms              | 16.683ms              | 11.500ms                  | 13.333ms                |
|             | B      | 0.064ms               | 0.064ms               | 0.113ms                   | 0.080ms                 |
|             | C      | 1.112ms               | 0.794ms               | 0.563ms                   | 0.427ms                 |
|             | D      | 12.711ms              | 15.253ms              | 10.810ms                  | 12.800ms                |
|             | E      | 0.381ms               | 0.064ms               | 0.014ms                   | 0.027ms                 |
|             | POL.   | POSITIVE              | NEGATIVE              | POSITIVE                  | NEGATIVE                |
| VIDEO       | ANALOG | ANALOG                | ANALOG                | ANALOG                    |                         |

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| DESCRIPTION |        | MODE5 S-VGA<br>VESA 800*600 | MODE6<br>VGA 800*600 | MODE 7 VGA<br>VESA 800*600 | MODE 8<br>VESA 1024*768 |
|-------------|--------|-----------------------------|----------------------|----------------------------|-------------------------|
| H           | FH     | 37.879KHz                   | 46.875KHz            | 48.077KHz                  | 48.363KHz               |
|             | A      | 26.400μs                    | 21.333μs             | 20.800μs                   | 20.677μs                |
|             | B      | 3.200μs                     | 1.616μs              | 2.400μs                    | 2.231μs                 |
|             | C      | 2.200μs                     | 3.232μs              | 1.280μs                    | 1.615μs                 |
|             | D      | 20.000μs                    | 16.162μs             | 16.000μs                   | 15.754μs                |
|             | E      | 1.000μs                     | 0.323μs              | 1.119μs                    | 0.998μs                 |
|             | POL.   | POSITIVE                    | POSITIVE             | POSITIVE                   | NEGATIVE                |
| V           | FV     | 60.317Hz                    | 75.000Hz             | 72.188Hz                   | 60.004Hz                |
|             | A      | 16.579ms                    | 13.333ms             | 13.853ms                   | 16.666ms                |
|             | B      | 0.106ms                     | 0.064ms              | 0.125ms                    | 0.124ms                 |
|             | C      | 0.607ms                     | 0.448ms              | 0.478ms                    | 0.600ms                 |
|             | D      | 15.840ms                    | 12.800ms             | 12.480ms                   | 15.880ms                |
|             | E      | 0.026ms                     | 0.021ms              | 0.772ms                    | 0.062ms                 |
|             | POL.   | POSITIVE                    | POSITIVE             | POSITIVE                   | NEGATIVE                |
| VIDEO       | ANALOG | ANALOG                      | ANALOG               | ANALOG                     |                         |

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| DESCRIPTION |        | MODE 9<br>VESA<br>800*600 | MODE 10<br>VESA<br>1024*768 | MODE 11<br>VESA<br>1024*768 | MODE 12<br>VESA<br>1280*1024 | MODE 13<br>VESA<br>1024*768 |
|-------------|--------|---------------------------|-----------------------------|-----------------------------|------------------------------|-----------------------------|
| H           | FH     | 53.674KHz                 | 56.476KHz                   | 60.023KHz                   | 63.981KHz                    | 68.677KHz                   |
|             | A      | 18.631μs                  | 17.707μs                    | 16.660μs                    | 15.698μs                     | 14.561μs                    |
|             | B      | 1.138μs                   | 1.813μs                     | 1.219μs                     | 1.037μs                      | 1.016μs                     |
|             | C      | 2.702μs                   | 1.920μs                     | 2.235μs                     | 2.296μs                      | 2.201μs                     |
|             | D      | 14.222μs                  | 13.653μs                    | 13.003μs                    | 11.852μs                     | 10.836μs                    |
|             | E      | 0.569μs                   | 0.321μs                     | 0.203μs                     | 0.360μs                      | 0.508μs                     |
|             | POL.   | POSITIVE                  | NEGATIVE                    | POSITIVE                    | POSITIVE                     | POSITIVE                    |
| V           | FV     | 85.062Hz                  | 70.069Hz                    | 75.029Hz                    | 60.020Hz                     | 84.997Hz                    |
|             | A      | 11.756ms                  | 14.272ms                    | 13.328ms                    | 16.638ms                     | 11.765ms                    |
|             | B      | 0.056ms                   | 0.106ms                     | 0.050ms                     | 0.047ms                      | 0.044ms                     |
|             | C      | 0.503ms                   | 0.513ms                     | 0.466ms                     | 0.594ms                      | 0.524ms                     |
|             | D      | 11.179ms                  | 13.599ms                    | 12.795ms                    | 16.005ms                     | 11.183ms                    |
|             | E      | 0.019ms                   | 0.054ms                     | 0.017ms                     | 0.016ms                      | 0.015ms                     |
|             | POL.   | POSITIVE                  | NEGATIVE                    | POSITIVE                    | POSITIVE                     | POSITIVE                    |
| VIDEO       | ANALOG | ANALOG                    | ANALOG                      | ANALOG                      | ANALOG                       |                             |

## 5. SET-UP

Setting up your monitor is easy. All you have to do is make a few simple connections and adjustments. The procedure is as follows.

### 5-1. Start Up

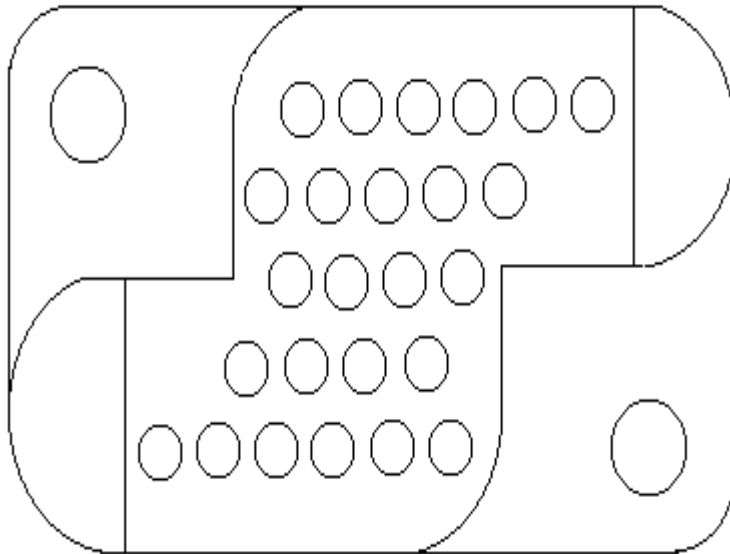
Your monitor starts up automatically when you insert the power plug to the power source.

### 5-2. Signal cable Connection

Connect the 15pin-signal cable to the source and lock both screws to ensure that the monitor is properly grounded.



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AMP 25pin connector

| NO. | DESCRIPTION | NO. | DESCRIPTION |
|-----|-------------|-----|-------------|
| 1   | VIDEO RED   | 14  | MRESET      |
| 2   | RED GND     | 15  | NET GND     |
| 3   | VIDEO GREEN | 16  | USB VCC     |
| 4   | GREEN GND   | 17  | USB D-      |
| 5   | VIDEO BLUE  | 18  | USB D+      |
| 6   | BLUE GND    | 19  | USB GND     |
| 7   | SHIELD GND  | 20  | NET13V      |
| 8   | H-SYNC      | 21  | +13VDC      |
| 9   | V-SYNC      | 22  | A GND       |
| 10  | SCL         | 23  | FRAME GND   |
| 11  | SDA         | 24  | AC LINE     |
| 12  | NET RXD     | 25  | AC NEUTRAL  |
| 13  | NET TXD     |     |             |

## 6. CONTROLS AND ADJUSTMENTS

There are four switches on the control panel.

Adjustable controls allow the best display status for individual preferences.

### 6-1. Key Function

#### ① MODE

MODE - Call the Main-Menu OSD.

#### ② SEL/DEGAUSS

SEL – Select the function (sub-Menu OSD) on the Main- Menu OSD.

DEGAUSS – Do degaussing in the state that the OSD isn't displayed.

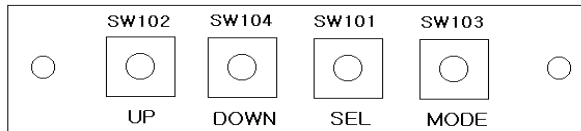
#### ③ DOWN/UP

-When the Main-Menu is displayed, you can search each function using these keys.

-When the Sub-Menu is displayed (after selecting the function), you can change each state of the screen using these keys.

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O.S.D Control Sub-P.C.B



6.2. O.S.D CONTROL METHOD

1) Control items.

| Location | Adjustment Method                 | Function   |
|----------|-----------------------------------|--|
| SUB PCB  | OSD Control                       | Brightness<br>Contrast<br>Horizontal Position<br>Horizontal-Size<br>Vertical Position<br>Vertical-Size<br>Side Pincushion<br>Trapezoid<br>Pin Balance<br>Parallelogram |
| MAIN PCB | VR control, VR501<br>VR301<br>FBT | Sub-Bright<br>H.V Adjustment<br>Focus and Screen   |

6-3. OSD Controls

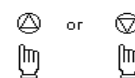
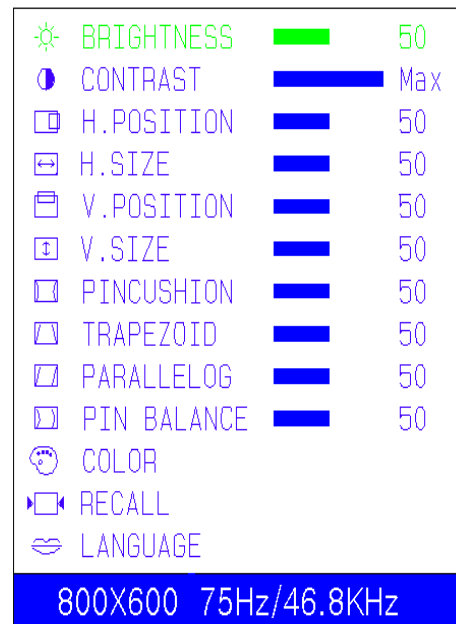
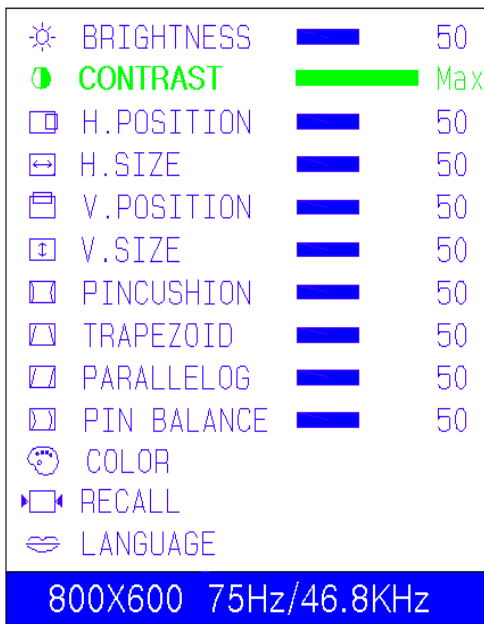
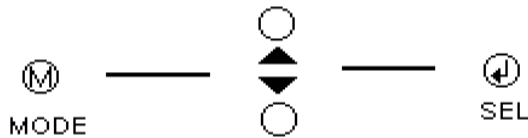
- User's control.

A. BRIGHTNESS ADJUSTMENT.

- 1) Press the "MODE" key then Main-Menu OSD should come out as below figure.
- 2) Search "BRIGHTNESS" sub-menu using the "UP/DOWN" key on the Main-Menu OSD.
- 3) Select the "BRIGHTNESS" by pressing "SEL" key. Then The "BRIGHTNESS" OSD color changes from yellow to red.

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- 4) Adjust the Brightness as much as you want using “UP/DOWN” key.
- 5) After finishing the Brightness adjustment, Press the “MODE” key then the “BRIGHTNESS” OSD color should change from red to yellow and the changed brightness value saved automatically.
- 6) If you want to adjust other functions, search your sub-menu. For example if you want to adjust the “CONTRAST” use the “UP/DOWN” keys and then adjust the same way as item 3), 4) and 5).
- 7) To finish the adjustment press the “MODE” key then the OSD will disappear.

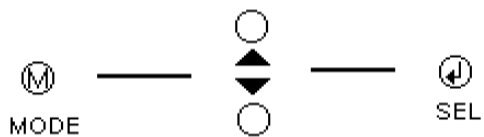


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- |                |                          |
|----------------|--------------------------|
| B. CONTRAST    | ADJUST SAME WAY AS ABOVE |
| C. H. POSITION | ADJUST SAME WAY AS ABOVE |
| D. H. SIZE     | ADJUST SAME WAY AS ABOVE |
| E. V. POSITION | ADJUST SAME WAY AS ABOVE |
| F. V. SIZE     | ADJUST SAME WAY AS ABOVE |
| G. PINCUSHION  | ADJUST SAME WAY AS ABOVE |
| H. TRAPEZOID   | ADJUST SAME WAY AS ABOVE |
| I. PARALLELOG  | ADJUST SAME WAY AS ABOVE |
| J. PIN BALANCE | ADJUST SAME WAY AS ABOVE |

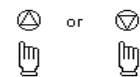
**K. COLOR ADJUSTMENT.**

1) Press the "MODE" key then Main-Menu OSD come out as left below figure.



| COLOR1 | COLOR2 | USER |
|--------|--------|------|
| RED    |        | 50   |
| GRE    |        | 50   |
| BLU    |        | 50   |

|                             |              |  |     |
|-----------------------------|--------------|--|-----|
|                             | BRIGHTNESS   |  | 50  |
|                             | CONTRAST     |  | Max |
|                             | H.POSITION   |  | 50  |
|                             | H.SIZE       |  | 50  |
|                             | V.POSITION   |  | 50  |
|                             | V.SIZE       |  | 50  |
|                             | PINCUSHION   |  | 50  |
|                             | TRAPEZOID    |  | 50  |
|                             | PARALLELOG   |  | 50  |
|                             | PIN BALANCE  |  | 50  |
|                             | <b>COLOR</b> |  |     |
|                             | RECALL       |  |     |
|                             | LANGUAGE     |  |     |
| <b>800X600 75Hz/46.8KHz</b> |              |  |     |



min->1-99->max

|              |           |                              |         |            |
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- 2) Search "COLOR" sub-menu using the "UP/DOWN" key on the Main-Menu OSD.
- 3) Select the "COLOR" by pressing "SEL" key. Then the color Sub-Menu OSD comes out as right below figure.
- 4) Search using the "UP/DOWN" key ("COLOR1" and "COLOR2" are adjusted in the factory by an auto-alignment machine. )
- 5) Press the "SELECT" key to adjust the "RED", "GREEN" and "BLUE"  
"RED", "GREEN" and "BLUE" are selected by pressing the "SELECT" key and the selected item changes to its corresponding color.  
(ex: "RED" goes to red color)
- 6) Adjust "RED", "GREEN" or "BLUE" using "UP/DOWN" key.
- 7) Press "MODE" key to finish the color adjustment then the OSD goes back to Main-Menu.
- 8) Press the "MODE" key again to finish the adjustment then the OSD disappears.

#### L. RECALL.

When the "RECALL" key is pressed, all user's adjustment values are erased and system reverts back to factory set values.

#### M. LANGUAGE.

There are 4 languages provided for the user as below.

(Fixed in English at the factory for reference)

- 1) Press the "MODE" key for the Main-Menu OSD.
- 2) Search "LANGUAGE" sub-menu using "UP/DOWN" key on the Main-Menu OSD.
- 3) Select the "LANGUAGE" by pressing "SEL" key. Then The Language sub-menu comes out as right below figure.

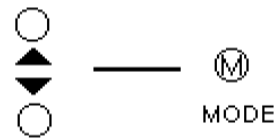
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- 4) Search any language using "UP/DOWN" key.
- 5) Select a language by pressing the "SEL" key.
- 6) Press "MODE" key to finish and save the selected language.  
Then the OSD returns to the Main-Menu in selected language.
- 7) Press the "MODE" key again to finish the adjustment

|           |
|-----------|
| LANGUAGE  |
| ENGLISH   |
| FRANCAIS  |
| ESPANOL   |
| PORTUGUES |

- Factory control.

This monitor has two-adjustment modes. One is for the user's own adjustment and the other is only for factory adjustments.



Factory adjustments may be required during repair. Incorrect factory adjustments may adversely affect the user adjustment mode. Any factory adjustment errors can be recovered using the "RECALL" function (refer to 6-3 M item).

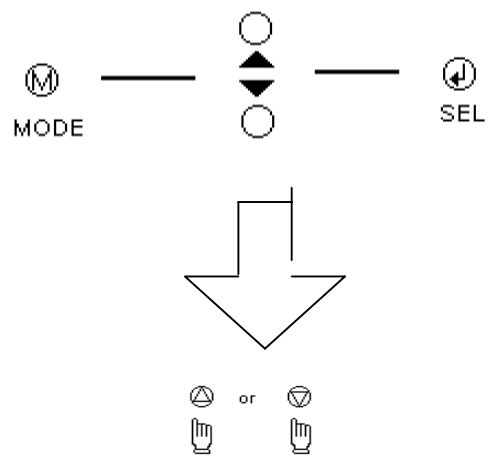
#### A. Entering Factory Mode.

Press the "MODE" and "DOWN" key simultaneously until the OSD comes out as below.

The OSD factory mode is the same format as the user mode except the color of the bottom line. (User mode is blue; factory mode is red as shown below)

|              |           |                              |         |            |
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|                      |             |     |
|----------------------|-------------|-----|
| ☀                    | BRIGHTNESS  | 50  |
| ●                    | CONTRAST    | Max |
| □                    | H.POSITION  | 50  |
| ▭                    | H.SIZE      | 50  |
| ▭                    | V.POSITION  | 50  |
| ▭                    | V.SIZE      | 50  |
| ▭                    | PINCUSHION  | 50  |
| ▭                    | TRAPEZOID   | 50  |
| ▭                    | PARALLELOG  | 50  |
| ▭                    | PIN BALANCE | 50  |
| 🗨                    | COLOR       |     |
| ▶                    | RECALL      |     |
| 🗨                    | LANGUAGE    |     |
| 800X600 75Hz/46.8KHz |             |     |



**B.Exit and save.**

- 1) After finishing the adjustment; search "RECALL" using "UP/DOWN" key.
- 2) Press "SEL" key until OSD disappears then the adjusted value is saved and exits from the factory mode.

**C.Adjustment.**

All adjustment methods are the same as the user's control mode except "COLOR".

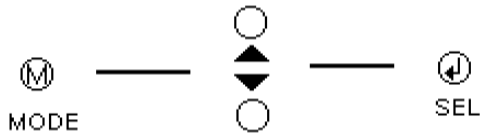
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#### D.COLOR ADJUSTMENT.

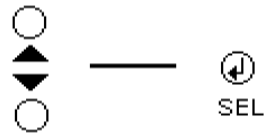
- 1) Before adjusting "COLOR", "CONTRAST" and "BRIGHTNESS" fix levels at maximum. (It's a TOVIS's reference condition.)
- 2) At the factory mode, search "COLOR" using "UP/DOWN" key.
- 3) Select "COLOR" by pressing "SEL" key then color sub-menu comes out as left below figure.
- 4) Search the color temperature which you want to adjust (gain or bias) using "UP/DOWN" key.  
( "GAIN" means high-beam area's adjustment and "BIAS" means low-beam area's adjustment.)
- 5) Select an item by pressing "SEL" key then the OSD changes to under sub-menu as right below figure.
- 6) Adjust color temperature using "UP/DOWN" and "SEL" key.  
( "UP/DOWN" key: moves item position, "SEL" key : changes value.)
- 7) At the "GAIN" mode, "CO" means sub-contrast adjustment.  
Sub-contrast can be adjusted using the "UP/DOWN" key if necessary.  
(To meet the white peak "ft" level.)
- 8) Press the "MODE" key to finish the "GAIN" or "BIAS" adjustment.
- 9) If you want to adjust other "GAIN" or "BIAS",  
Repeat steps from item 4) to 8) once again.
- 10) Press "MODE" key again to finish the "COLOR" adjustment.
- 11) If you want to finish the factory adjustment, Select "RECALL" as in item "B. Exit and save"



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|           |           |
|-----------|-----------|
| 9300 GAIN | 9300 BIAS |
| 6500 GAIN | 6500 BIAS |



At  
GAIN

|    |    |
|----|----|
| RG | GG |
| BG | CO |

OR

At  
BIAS.

|    |    |
|----|----|
| RB | GB |
| BB |    |

|                      |             |  |     |
|----------------------|-------------|--|-----|
|                      | BRIGHTNESS  |  | 50  |
|                      | CONTRAST    |  | Max |
|                      | H.POSITION  |  | 50  |
|                      | H.SIZE      |  | 50  |
|                      | V.POSITION  |  | 50  |
|                      | V.SIZE      |  | 50  |
|                      | PINCUSHION  |  | 50  |
|                      | TRAPEZOID   |  | 50  |
|                      | PARALLELOG  |  | 50  |
|                      | PIN BALANCE |  | 50  |
|                      | COLOR       |  |     |
|                      | RECALL      |  |     |
|                      | LANGUAGE    |  |     |
| 800X600 75Hz/46.8KHz |             |  |     |

“SEL” and “UP/DOWN”

|              |           |                              |         |            |
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## 7. Adjustment Specifications

### 7-1. Adjustment Sequence.

It needs a minimum of 15 minutes of warm up time before adjustment.

### 7-2. Adjustment Sequence.

FBT B+ Voltage → G2 Voltage → Hor. Center → Hor. Size → Hor. Position → Ver. Size → Ver. position → Side-pin → Trapezoid → Focus → White balance → Convergence

### 7-3. Adjustment Procedure.

How to enter the Factory Mode: Press Menu and Down key simultaneously.

#### 7-3.1. FBT B+ voltage adjustment.

- 1) Input the crosshatch pattern with the 48KHz 1024\*768 mode.
- 2) After connecting a digital voltage meter to the each pin of D316, anode and cathode adjust FBT B+ voltage to 114V ± 1.0V using VR301.

#### 7-3.2. G2 Voltage adjustment.

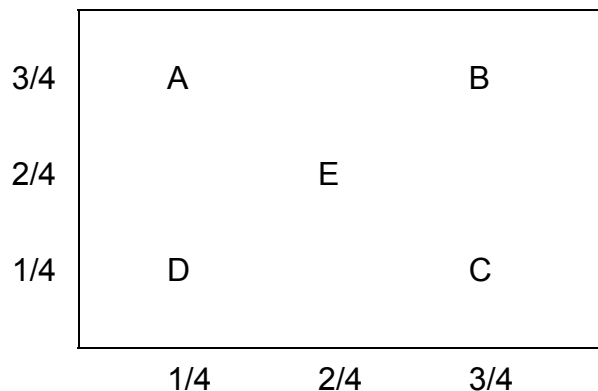
- 1) Input the cross-hatch pattern with 48KHz 1024\*768 mode
- 2) After connecting a DC high voltage meter to the G2 of the CRT socket, adjust G2 voltage to 600V ± 10V by changing SCREEN VR of FBT.

#### 7-3.3 G/D Adjustment.

Refer to controls and adjustment. (Article 6)

#### 7-3.4 Focus adjustment.

- 1) Input the "H" character pattern with 48KHz 1024\*768.
- 2) Adjust the focus for the best balance at each point of A, B, C, D, E as shown below by rotating the focus VR of FBT.



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### 7-3.5. White balance Adjustment. (25% Window Box Pattern)

#### Pre-adjustment

- 1) This should be carried out for at least 15 minutes.
- 2) Input the window pattern with 31KHz 640\*480 mode.
- 3) Degauss the screen with Manual degaussing coil.

#### White Balance adjustment (Back Raster)

- 1) Remove the video signal
- 2) Adjust the sub-brightness of back raster to be **0.13FT**(With/Touch) with SUB BRIGHTNESS volume VR501.
- 3) And, adjust the color temperature to be  $X=0.281 \pm 0.015$  and  $Y=0.311 \pm 0.015$  by R.G.B bias control function on OSD menu.
- 4) Adjust BRIGHTNESS to be **0.13FT**(With/Touch).

#### White Balance adjustment (Video)

- 1) Input the 25% window pattern with 31KHz 640\*480 mode.
- 2) Adjust the color temperature to be  $X=0.281 \pm 0.015$  and  $Y=0.311 \pm 0.015$  by R.G.B gain on OSD menu.
- 3) Adjust CONTRAST to be **40FT**(With/Touch).

### 7-3.6. Purity and Convergence Adjustment.

#### 1) Purity Adjustment.

- ① Demagnetize the picture tube and cabinet using a degaussing coil.
- ② Turn the CONTRAST and BRIGHTNESS controls to maximum.
- ③ Adjust RED and BLUE bias controls to provide only a green raster
- ④ Loosen the clamp screw holding the yoke, and slide the yoke, backward to provide vertical green belt(zone) in the picture screen.
- ⑤ Remove the Rubber wedges.
- ⑥ Rotate and spread the tabs of the purity magnet see figure 1 around the neck of the picture tube until the green belt is in the center of the screen. At the same time, center the raster vertically.
- ⑦ Move the yoke slowly forward until a uniform green screen is obtained. Tighten the clamp screw of the yoke temporarily.
- ⑧ Check the purity of the red and blue raster by adjusting the bias controls.

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⑨ Obtain a white raster, referring to "CRT GRAY SCALE ADJUSTMENT"

⑩ Proceed with convergence adjustment.

## 2) Convergence adjustment.

- ①. Receive crosshatch pattern with a color bar signal generator.
- ②. Adjust the BRIGHTNESS and CONTRAST Controls for well defined pattern.
- ③. Adjust two tabs of the 4-Pole Magnets to change the angle between them (See figure 1) and superimpose red and blue vertical lines in the center area of the picture screen.
- ④. Turn both tabs at the same time keeping their angles constant to superimpose red and blue horizontal lines at the center of the screen. (See figure 2.)
- ⑤. Adjust two tabs of 6-Pole Magnets to superimpose red/blue line with green one. Adjusting the angle affects the vertical lines and rotating both magnets affects the horizontal lines
- ⑥. Repeat adjustment 3,4,5 Keeping in mind red, green and blue movement, because 4-Pole Magnets and 6-Pole Magnets interact and make dot movement complex.

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## 8. DESCRIPTION OF CIRCUIT OPERATION

### 8-1. Mode control

8-1.1. H-Sync is inputted to pin 30 of IC601, V-Sync to pin 29 of IC601 for each mode, and pin 27, 26 of IC601 output always-positive polarity sync.

8-1.2. The outputs from IC601 are as below (See Table 1)

| No. | Frequency |          | Resolution | Range of Frequency |             | OUT PUT (MCU PIN) |           |           |           |
|-----|-----------|----------|------------|--------------------|-------------|-------------------|-----------|-----------|-----------|
|     | Hf<br>KHz | Vf<br>Hz |            | Hf<br>(kHz)        | Vf<br>(Hz)  | CS3<br>38         | CS2<br>39 | CS1<br>40 | SUS-<br>4 |
| 1   | 31        | 70       | 720x400    | 28~ 32.9           | 68~ 72      | L                 | L         | L         | H         |
| 2   | 31        | 60       | 640x480    | "                  | 58~ 62      | L                 | L         | L         | H         |
| 3   | 35        | 86       | 1024x768   | 33~ 35.9           | 84~ 88      | H                 | L         | L         | H         |
| 4   | 38        | 75       | 640x480    | 36~ 40.9           | 73~ 77      | H                 | H         | L         | H         |
| 5   | 38        | 60       | 800x600    | 36~ 40.9           | 58~ 62      | H                 | H         | L         | H         |
| 6   | 47        | 75       | 800x600    | 41~ 51.9           | 73~ 77      | H                 | L         | H         | H         |
| 7   | 48        | 72       | 800x600    | "                  | 70~ 74      | H                 | L         | H         | H         |
| 8   | 48        | 60       | 1024x768   | "                  | 58~ 62      | H                 | L         | H         | H         |
| 9   | 53        | 85       | 800x600    | 52~ 61.9           | 83~ 87      | L                 | H         | H         | H         |
| 10  | 56        | 70       | 1024x768   | "                  | 68~ 72      | L                 | H         | H         | H         |
| 11  | 60        | 75       | 1024x768   | "                  | 73~ 77      | L                 | H         | H         | H         |
| 12  | 64        | 60       | 1280x1024  | 62~ 70             | 58~ 62      | H                 | H         | H         | H         |
| 13  | 69        | 85       | 1024x768   | 62~ 70             | 83~ 87      | H                 | H         | H         | H         |
| 14  | -         | -        | -          | $H \leq 10$        | NORMAL      | X                 | X         | X         | L         |
| 15  | -         | -        | -          | NORMAL             | $V \leq 40$ | X                 | X         | X         | L         |
| 16  | -         | -        | -          | $H \leq 10$        | $V \leq 40$ | X                 | X         | X         | L         |

(Table 1)

|              |           |                              |         |            |
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## 8-2. Deflection Processor (IC301)

### 8-2.1. Horizontal section

#### 1) Horizontal oscillation

R314 and C347 set horizontal free frequency to 48KHz.

Auto-sync processing can be done from 30KHz to 70KHz by means of IC301 without any adjustment.

#### 2) Phase shift

Horizontal phase shift is controlled by IC601 using I<sup>2</sup>C BUS control.

#### 3) Horizontal driver output

The output pulse, which has the duty-cycle of 47%, is available at pin 26 of IC301.

This output is used for horizontal drive circuit.

#### 4) B+ control driver output

The output pulse is available at pin 6 of IC301 and it is used for H-scan voltage control driver.

#### 5) X-ray protection

When the fly-back voltage rises up to an unacceptable level X-ray protection is activated. X-ray input pin 13 of IC601 is above 4V.

This results in the complete line drive stage to stop working.

The reset of this protection is obtained by activating the Main power off.

### 8-2.2. Vertical section

#### 1) Vertical oscillation

The free running frequency of the vertical oscillator is determined by the capacitor C342 at pin VCAP (pin22) of IC301.

#### 2) Vertical amplitude

Vertical amplitude is controlled by IC601 using I<sup>2</sup>C.

#### 3) Vertical position

Vertical position is controlled by IC601 using I<sup>2</sup>C.

#### 4) East-west parabola

A parabola waveform is available on pin 24 of IC301 for driving the pincushion correction stage. Amplitude of parabola waveform is controlled by IC601 using I<sup>2</sup>C.

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### 8-2.3. B+ Regulator

B+ PWM regulator output is available on pin 28 of IC301 for driving the B+ control stage. This PWM output is adjusted through VR301.

### 8-3. Vertical Deflection (IC201)

IC201 (KA2142) is used for direct driving of vertical deflection yoke.

### 8-4. Horizontal scan voltage control stage

The step-up converter is used in this stage.

The output pulse at pin 28 of the IC301 is synchronized on horizontal frequency. And this pulse is operated via buffer stage Q311/Q312.

This output is rectified through D315/L304.

In this way, the supply voltage to the fly-back transformer can be proportional to the horizontal line frequency.

### 8-5. Horizontal deflection output stage

#### 8-5.1. Line driver stage

As a driver device, small MOSFET Q307 (IRF630) is used.

The driver transformer T302 is equipped with a snubber circuit (R327/C309) at the primary side to damp excessive ringing.

#### 8-5.2. Horizontal power output stage

The horizontal power output stage is a conventional one with a diode modulator.

As a deflection transistor, the Q308 (2SC5682) is used.

To compensate the horizontal linearity, T301 is connected in a series with the horizontal DY. It is controlled by DC collector voltage of Q304, which the base voltage of Q304 and is integrated from output at pin 22 of IC601.

#### 8-5.3. S-correction capacitor switches

Q316 is off when horizontal frequency is 35KHz.

Q316,Q317 is off when horizontal frequency is 37KHz.

Q316,Q318 is off when horizontal frequency is 43KHz-52KHz.

Q317,318 is off when horizontal frequency is 53KHz~ 61KHz.

Q316,Q317,Q318 is off when horizontal frequency is 62KHz~ 70KHz.

Q316,Q318 is off when input is override condition.

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#### 8-6. FBT (Fly-back Transformer)

The high voltage for CRT anode focus, G2 voltage for CRT and - 12V for vertical deflection are generated by the FBT.

Also, -130V for G1 voltage, -12V for the vertical supply voltage is extracted from the FBT.

#### 8-7. ABL (Automatic Beam Limiting)

The voltage of the FBT pin10 is affected by the anode current of the FBT.

When the voltage at pin 10 is decreased, the anode current is increased accordingly. When the anode current is increased, contrast is set at the certain limited level (28FL in white pattern) that is set by inner voltage of IC401.

#### 8-8. Video amplification section.

##### 8-8.1. Video pre-amplifier (IC401)

Input video signals are amplified by means of IC401, and the amplified signals drive the video output stage (IC402).

Video gain is adjusted by DC voltage at pin 12 for ABL control.

##### 8-8.2. Video output stage (IC402)

The video output signal from IC401 is amplified again by IC402, and IC402 apply video signal to each cathode of the CRT.

Q405, Q406 and Q407, which is operated by I<sup>2</sup>C BUS control through u-com, adjust cutoff voltages.

##### 8-8.3. OSD (On Screen Display : IC403)

The OSD signal is applied from IC403 to IC402.

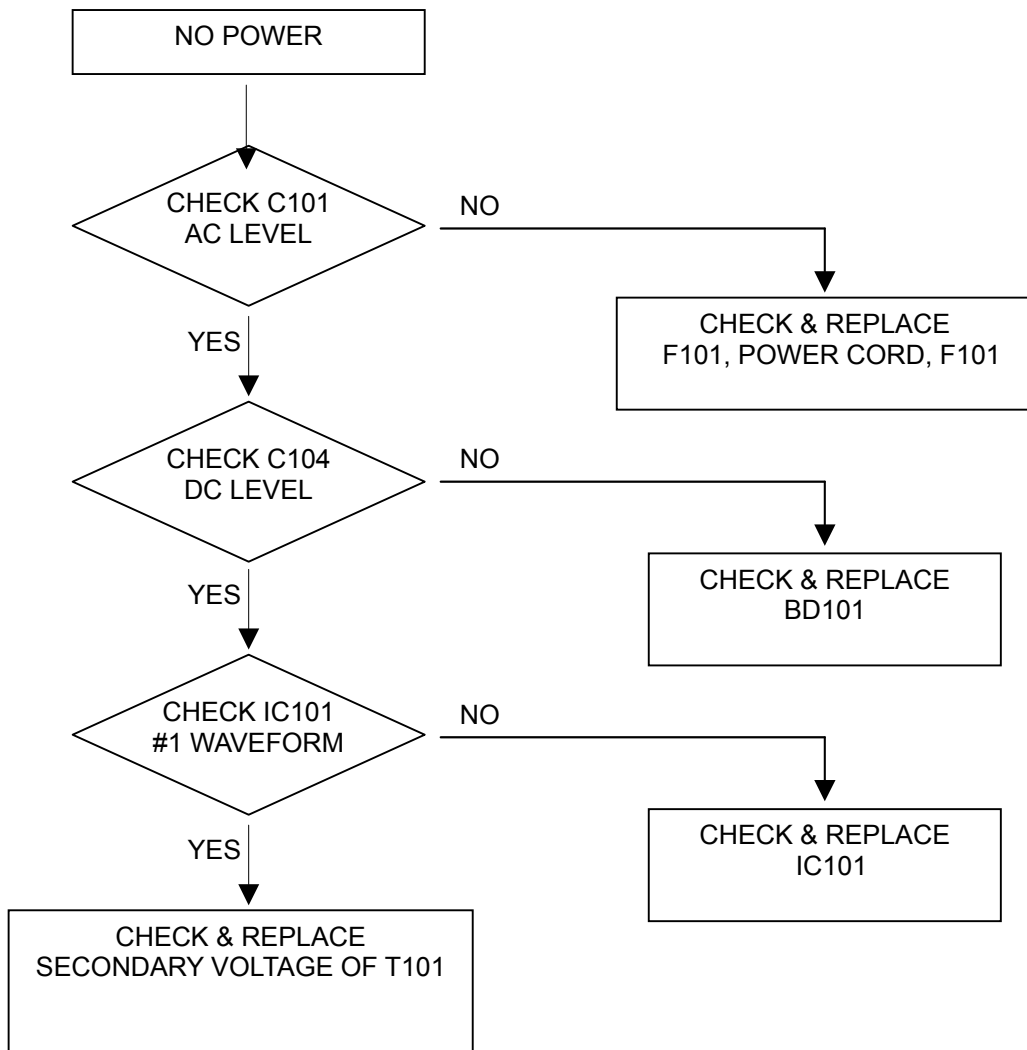
It is controlled by I<sup>2</sup>C BUS control line.



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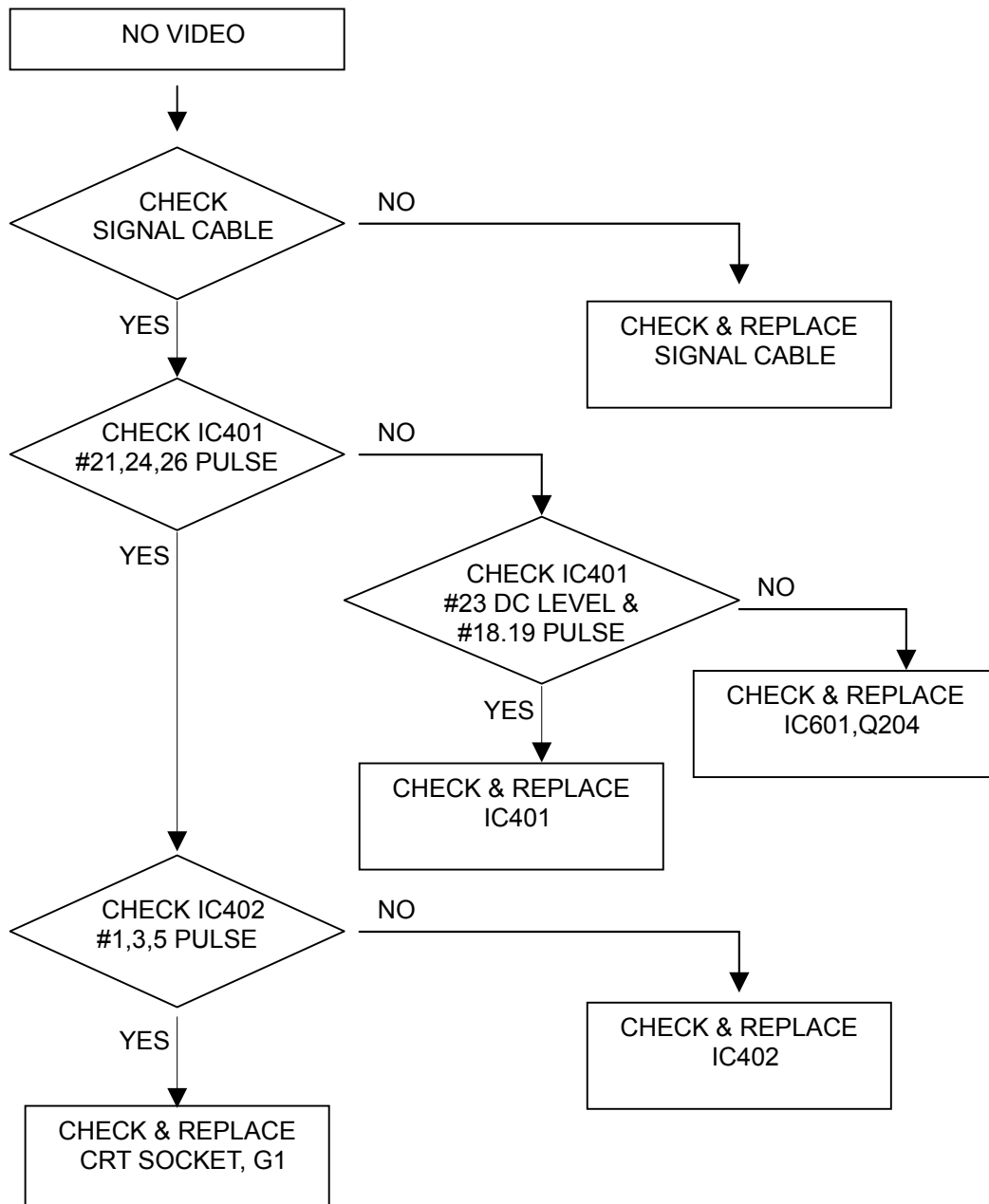
## 9. TROUBLE SHOOTING

### 9-1. NO POWER



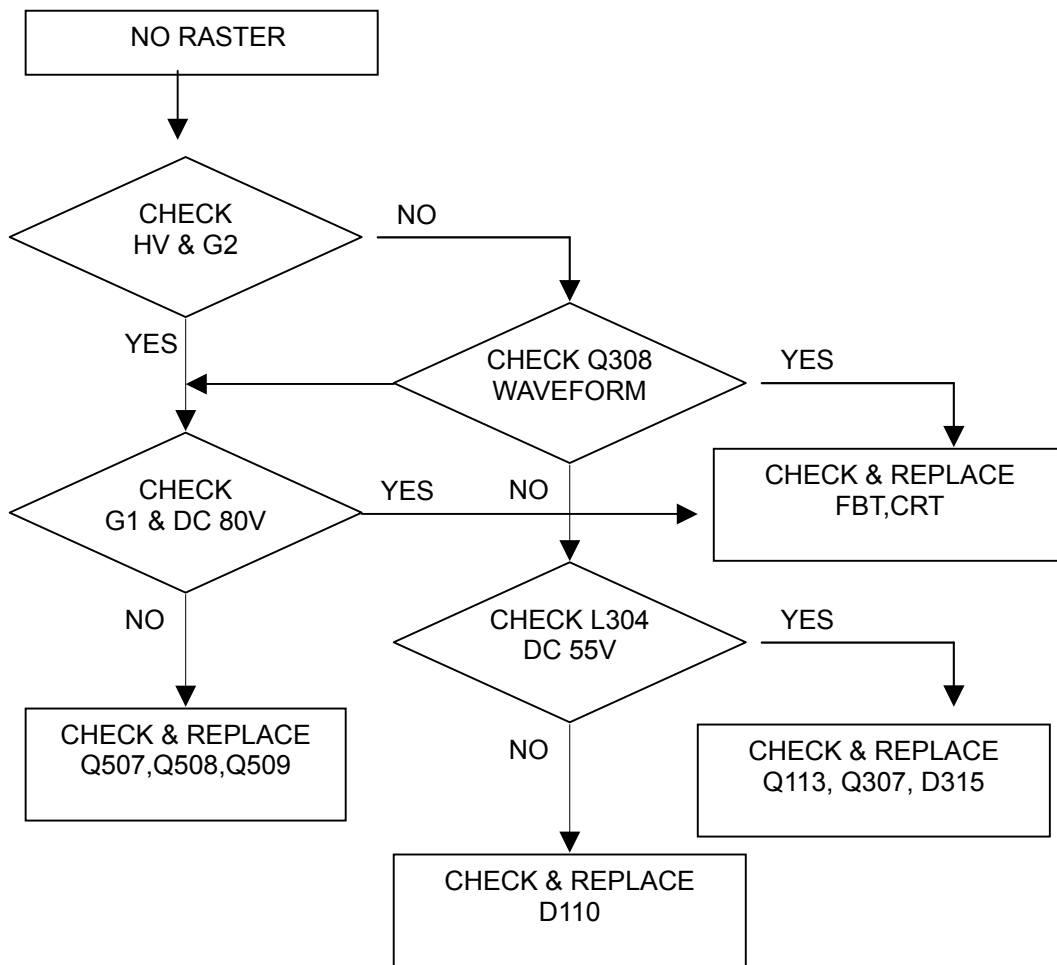
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9-2. NO VIDEO



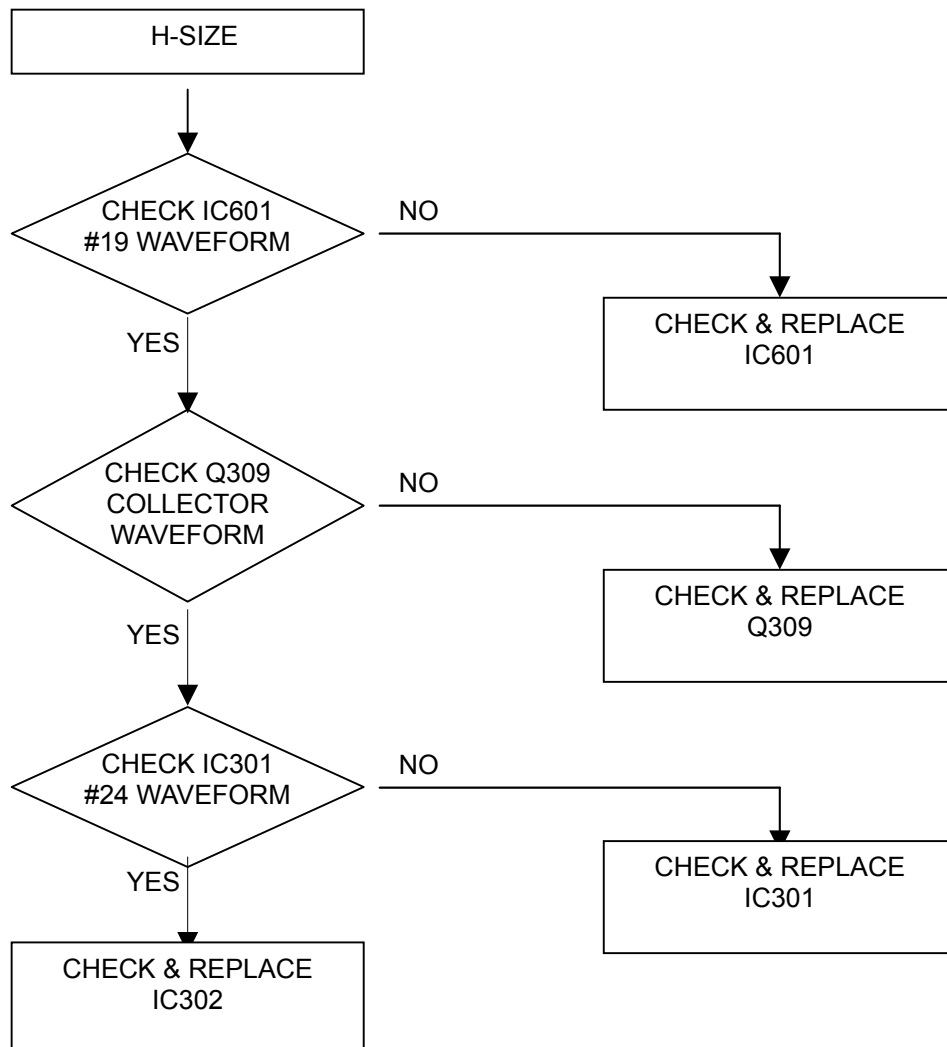
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9-3. NO RASTER



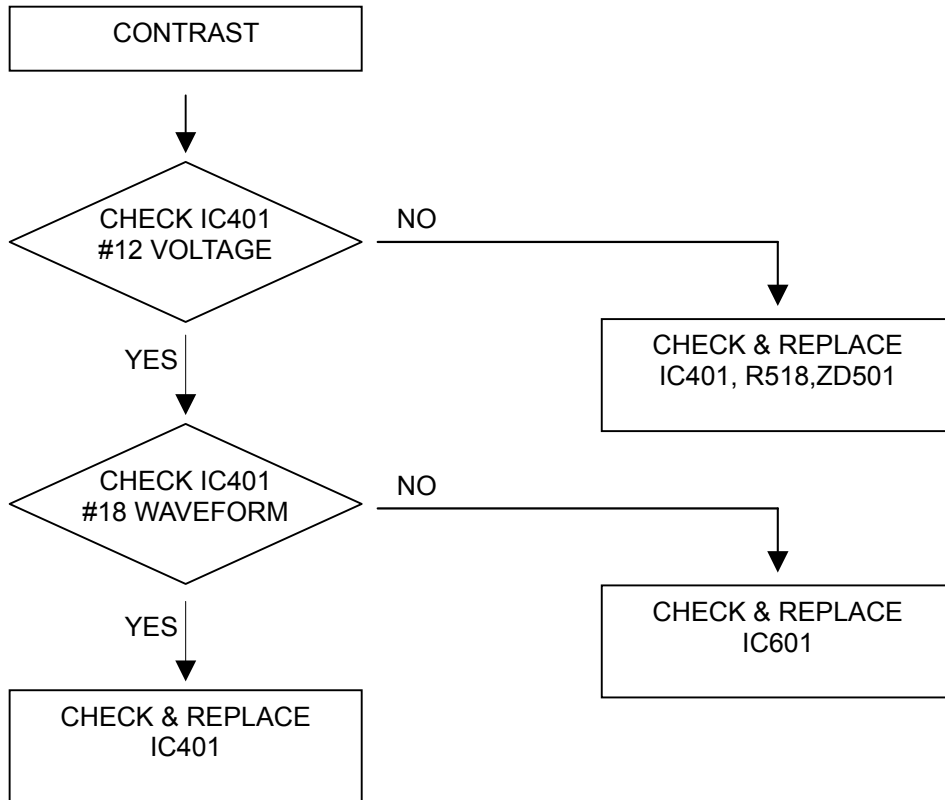
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#### 9-4. TROUBLE IN HORIZONTAL SIZE



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9-5. TROUBLE IN CONTRAST



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9-6. TROUBLE IN BRIGHTNESS

