14" COLOR DISPLAY UNIT CDU1460MS/HY02
(DSM 50-144)

This display unit is manufactured by **HYUNDAI** and is identified as **DSM 50-144** on the front and rear of its case, and in the Progetto di Gestione. This unit is also identified as **CDU 1460MS/HY02** on the homologation plate, also on the rear of its case.

CHARACTERISTICS

VGA-compatible analog multiscan monitor with power management and DCC-1/2B features.

- Diagonal screen size: 14"
  Horizontal size: 250 ± 4 mm
  Vertical size: 187.5 ± 4 mm

- Input voltage: 90-132 V/180-264 V (universal power supply)
  Line frequency: 50-60 Hz $\pm$ 3 Hz
  Degaussing: At power on
  Power dissipation: ≤ 80 W
  Current: < 2 A

- Video input signals: Separate Red, Green, Blue, H.s. and V.s.
  Video input: 75 Ω to ground
  Level: 0-700 mV
  Polarity: Positive
  Sync H/V TTL input: 1000 Ω to ground
  Polarity: Positive or negative

- External adjustments: Contrast
  Brightness
  Horizontal size
  Vertical size
  Horizontal shift
  Vertical shift
  Pincushio distortion

- Input Timing Limits

Parameter	Horizontal	Vertical
Frequency	30 - 60 KHz	50 - 95 Hz
Blanking	≥ 3.5 µs	≥ 0.5 ms
Back Porch	≥ 0.5 µs	≥ 0.4 ms
Front Porch	$\leq$ Back Porch	$\leq$ Back Porch
Sync Pulse	≥ 1 µs	≥ 0.03 ms

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- Preset Timings

VIDEO MODE	VGA			ERGO VGA		SVGA			VGA PLUS			
HORIZONTAL RESOLUTION (DOTS)	640			640		800			1024			
FREQUENCY (KHz)	31.469			37.86	37.5	37.88	48.07	46.87	35.52	56.47	58.14	60.02
VERTICAL RESOLUTION (LINES)	350	400	480	480		600			768			
FREQUENCY (Hz)	70.08	70.08	59.95	72.8	75	60.31	72.19	75	87	70.07	72.13	75.03
INTERLACED	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
V/H POLARITY	-/+	+/-	-/-	-/-	-/-	+/+	+/+	+/+	+/+	-/-	+/+	+/+
PIXEL RATE (MHz)	25.17	25.17	25.17	31.5	31.5	40	50	49.5	44.9	75	80	78.75

- Power Management

VIDEO MODE	HORIZ. SYNC.	VERT. SYNC.	VIDEO	CONSUM.	RECOVERY TIME	LED COLOR
ON	PULSE	PULSE	ACTIVE	≤ 80 W	NONE	GREEN
STAND-BY	NO PULSE	PULSE	BLANKED	≤ 64 W	< 1 s	ORANGE (FLASH 1 s)
SUSPEND	PULSE	NO PULSE	BLANKED	< 8 W	< 15 s	ORANGE (FLASH 0.5 s)
OFF	NO PULSE	NO PULSE	BLANKED	< 5 W	< 15 s	ORANGE

- VGA Connector for the DDC-1/2B Feature

1   Red video input
2   Green video input
3   Blue video input
4   Identify output (connected to pin 10)
5   Not connected
6   Red video ground
7   Green video ground
8   Blue video ground
9   Not connected
10   Logic ground
11   Identify output (connected to pin 10)
12   SDA (Serial Data)
13   Horizontal sync
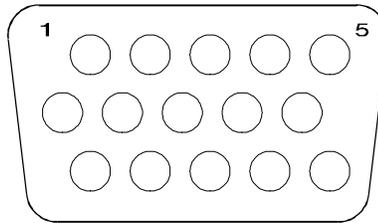14   Vertical sync
15   SCL (Serial clock)

Fig. 41-1   DDC-1/2B Feature VGA Connector

REMOVING THE CASE

1. Disconnect power supply cable (A) and signals cable (S) from their respective connectors on the rear of the display unit.
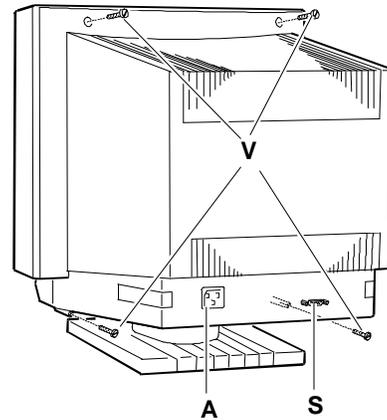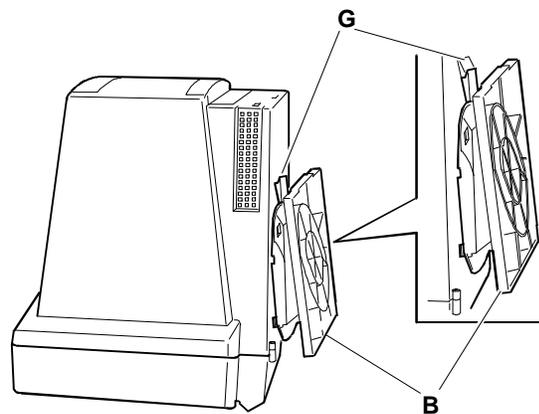

Fig. 41-2   Removing the Case

2. Rest the monitor with its screen against a flat and protected working surface. Lift hook (G) and slide the base out of the securing slots.

3. Using a Philips screwdriver, remove the four screws indicated in figure 41-2 and then remove the case.

Fig. 41-3   Removing the Base

DISCHARGING THE ANODE

1. After having removed the case and before performing any other operation with the boards and cables of the display unit, discharge the high voltage (24.5 KV anode voltage). Use a screwdriver connected to the display frame ground by means of a cable to discharge the CRT anode.
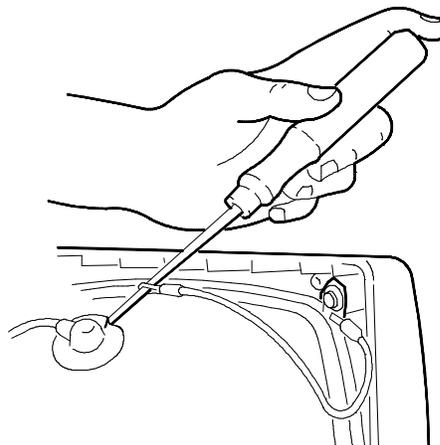

Fig. 41-4   Discharging the CRT Anode

REMOVING THE VIDEO AMPLIFIER BOARD

1. Free the metal cover of the video amplifier board (A) from all connections.

2. Remove the layer of adhesive silicone from the connection netween the CRT connector and the video amplifer board connector (A). This layer is used to protect the display during transport. Turn over the video amplifier board.
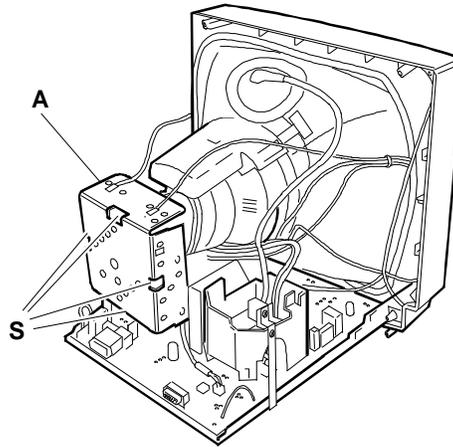
Fig. 41-5 Removing the Video Amplifier Board

3. Free the board by disconnecting the cables from the following connectors: G1, G2, W402, W405 and W499.

4. To separate the board from the metal cover, unsolder the 4 solder points (S) shown in figure 41-5.
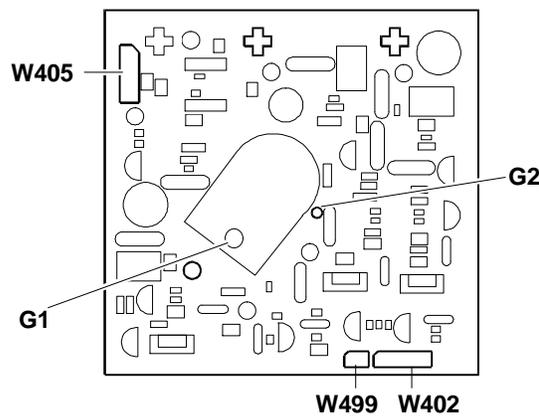
Fig. 41-6 Locating the Connectors on the Video Amplifier Board

REMOVING THE MAIN BOARD

1. Be sure to discharge the EHT high voltage before removing the anode.

2. Remove the anode by lifting the rubber cap, squeezing the two metal contacts with a pair of pliers and removing the contacts through the hole in the CRT.

3. Remove the main board by removing the two screws (V) and sliding the metal support (S) from the main board.
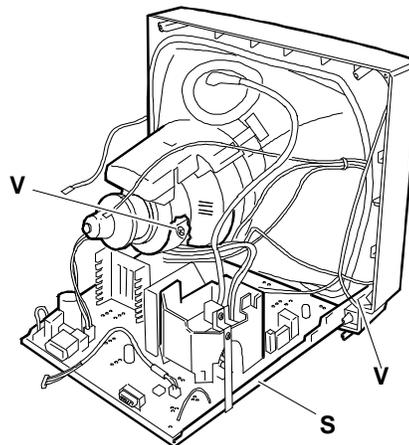
Fig. 41-7 Removing the Main Board

4. To completely remove this support, disconnect the cables from the following connectors on the main board: P101, W401, CN301, W101, W498 and GND1.
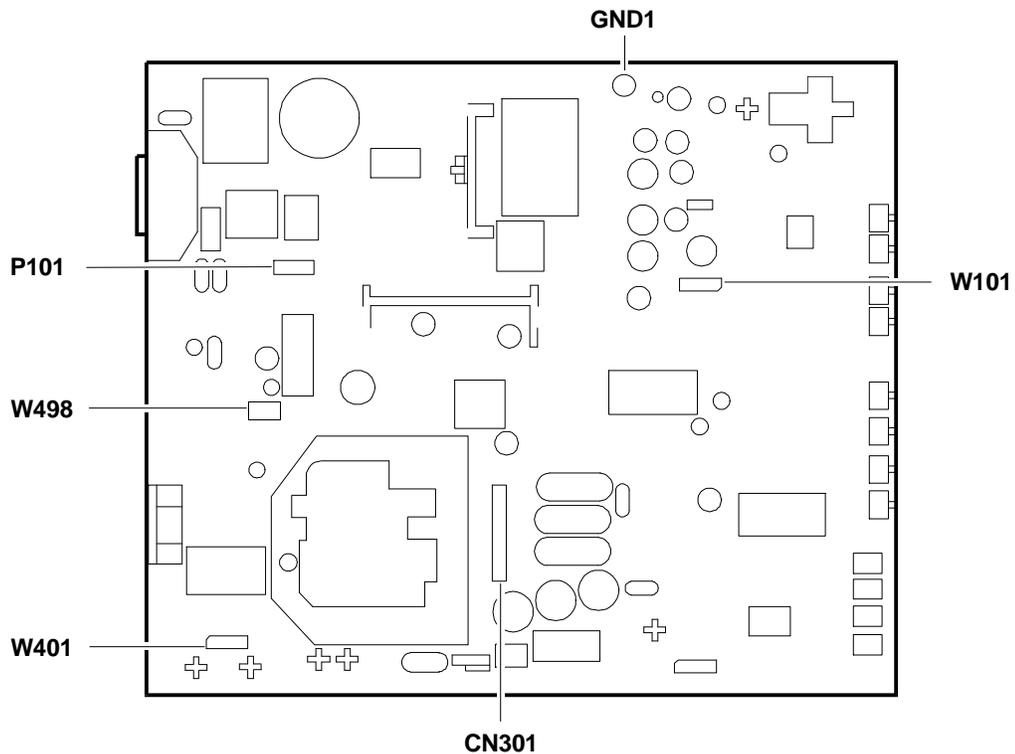

Fig. 41-8   Locating the Connectors on the Main Board

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5. Remove the main board (B) from its metal support (S) by extracting the two pins (P), loosening ground screw (M), loosening screw (V) from the transformer support bracket and disconnecting ground cable GND6. Lift the main board off its support.
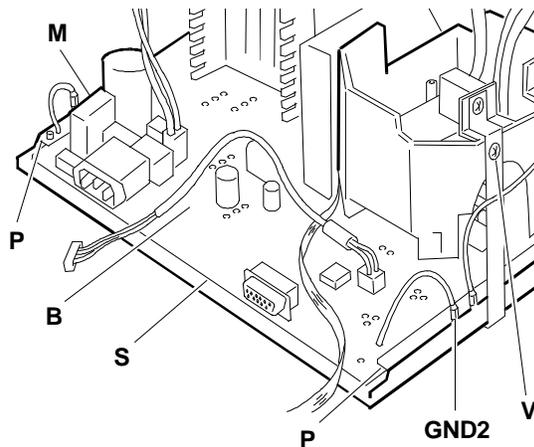

Fig. 41-9   Detaching the Main Board from its Support

REMOVING THE DDC-1/2B BOARD

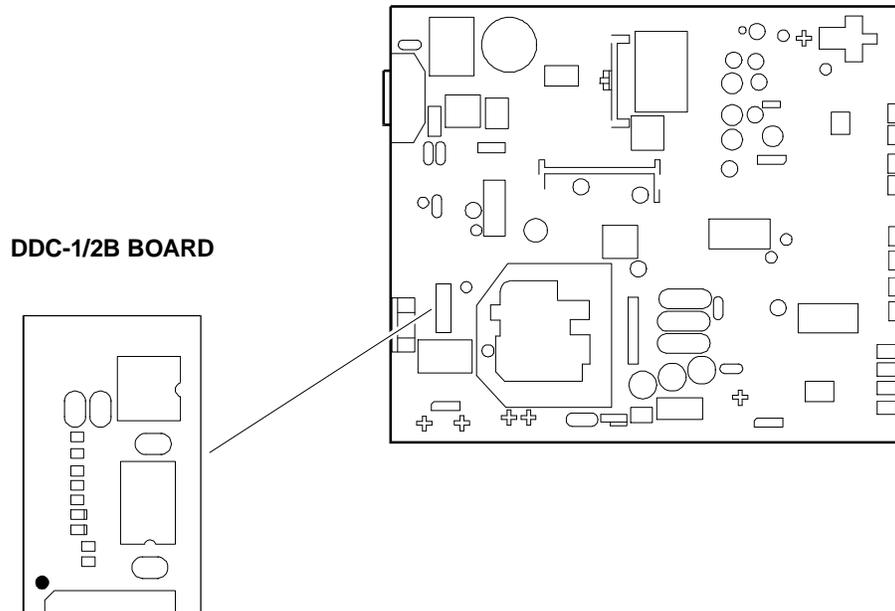1. To remove the DDC-1/2B board its slot on the main board, remove the silicon layer and unsolder the connector pins.

DDC-1/2B BOARD

Fig. 41-10 Removing the DDC-1/2B Board

REMOVING THE CRT

NOTE: The CRT and yoke form a single assembly on which the deflection windings and convergence magnets are fitted. The magnets are set by the manufacturer and must not be moved so as to avoid convergence errors that are difficult to correct. A spare tube comes with the yoke already fitted.

2. Remove the four screws (V) that secure the CRT to the front cover of the display unit.

3. Remove ground winding (M) by removing the spring that holds this winding and the degauss winding (D) in place. Both coils must be fitted back onto the new CRT.

REASSEMBLY PROCEDURES

4. To reassemble the display unit follow its disassembly procedures in reverse order.
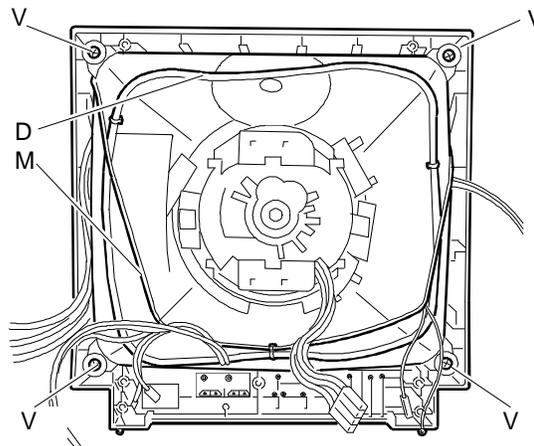

Fig. 41-11 Removing the CRT

DISPLAY ADJUSTMENTS

Two kinds of display adjustments are available for this display unit:

- External controls and adjustments that can be carried out by the user.

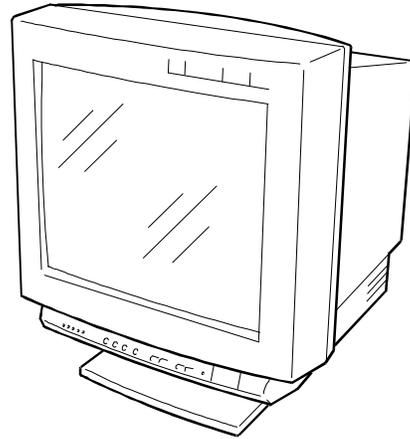- Internal adjustments to be carried out by the field engineering service.

Fig. 41-12 Display Unit

EXTERNAL CONTROLS AND ADJUSTMENTS

In order to perform the external controls and adjustments the user has to use the buttons on the display unit's external control panel and shown in the figure on the side.
External controls can be used by the user or service engineer to adjust:

- Contrast

- Brightness

- Horizontal size

- Vertical size

- Horizontal shift

- Vertical shift

- Pincushion
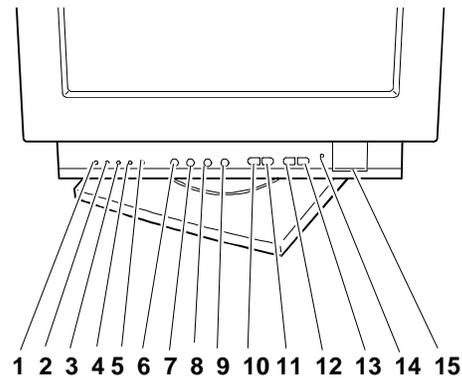
Fig. 41-13 External Adjustments and Controls

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| EXTERNAL CONTROLS			
1	HORIZONTAL SIZE LED	9	RECALL
2	HORIZONTAL SHIFT LED	10	- BRIGHTNESS
3	VERTICAL SIZE LED	11	+ BRIGHTNESS
4	VERTICAL SHIFT LED	12	- CONTRAST
5	PINCUSHION LED	13	+ CONTRAST
6	SELECT	14	POWER LED
7	- ADJUSTMENT	15	POWER SWITCH
8	+ ADJUSTMENT		

The following is a list of the adjustments which can be made by the users on the following image characteristics:

Horizontal size: 250 ± 4 mm
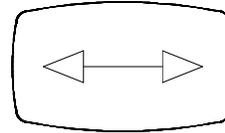
Vertical size: 187.5 ± 4 mm
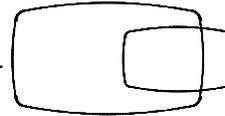
$|a - b| \leq 4$ mm

$|c - d| \leq 4$ mm
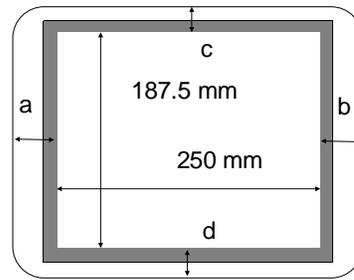
HORIZONTAL SIZE

- Press the SELECT button (6) to select the HORIZONTAL SIZE LED (1).
- Press the + ADJUSTMENT button (8) to increase the horizontal size of the picture.
- Press the - ADJUSTMENT button (7) to reduce the horizontal size of the picture.
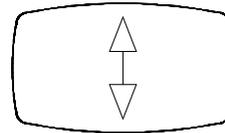
HORIZONTAL SHIFT

- Press the SELECT button (6) to select the HORIZONTAL SHIFT LED (2)
- Press the + ADJUSTMENT button (8) to move the picture to the right.
- Press the - ADJUSTMENT button (7) to mve the picture to the left.

VERTICAL SIZE

- Press the SELECT button (6) to select the VERTICAL SIZE LED (3).
- Press the + ADJUSTMENT button (8) to increase the vertical size of the picture
- Press the - ADJUSTMENT button (7) to reduce the vertical size of the picture.

VERTICAL SHIFT

- Press the SELECT button (6) to select the VERTICAL SHIFT LED (4)
- Press the + ADJUSTMENT button (8) to move the picture upwards
- Press the - ADJUSTMENT button (7) to move the picture downwards.

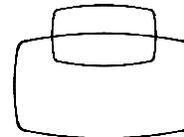**PINCUSHION**

- Press the SELECT button (6) to select the PINCUSHION LED (5)
- Press the + ADJUSTMENT button (8) to correct pincushion distortion outwards
- Press the - ADJUSTMENT button (7) to correct pincushion distortion inwards.

RECALL

- Press the RECALL button (9) to restore factory set adjustments.

BRIGHTNESS

- These buttons are used to adjust the brightness of the picture in relation to the brightness of the work environment

- Press the + BRIGHTNESS button (11) to increase the brightness of the picture

- Press the - BRIGHTNESS button (10) to reduce the brightness of the picture.

CONTRAST

- These buttons adjust the contrast of the picture displayed on the screen.

- Press the + CONTRAST button (13) to increase the contrast of the picture

- Press the - CONTRAST button (12) to reduce the contrast of the picture.

POWER LED

- When green the power LED indicates that the display unit is working normally.

- When orange the power LED indicates that the display unit is in the Power Management mode.

POWER SWITCH

- The power switch (15) is used to power the display unit on and off. When the display unit is powered on the power LED is green.

LED FUNCTIONS

Non-standard resolution mode - All the function LEDs will come on when a new resolution is detected. Pressing any key on the display unit control panel will store this new reolution, afterwhich the LEDs will all turn off.

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Minimum or maximum indication - During any adjustment procedure, the LED will begin to flash when the minimum or maximum value for that particular adjustment is reached.

Autosave - The display unit will automatically store the new adjustment after an inactivity timeout of one second. The corresponding LED will briefly flash during the save operation.

Normal operation - The power LED is green.

Power management mode - The power LED is orange.

Out of range - This condition is detected in the event a resolution exceeds the maximum operating limit allowed for the display unit. In this case all the function LEDs will begin to flash and the user will have to check the system of setup the display unit over again.

INTERNAL ADJUSTMENTS

Internal adjustments are carried out by the field engineer. Follow these procedures step-by-step since some adjustments affect those that follow.

MAIN BOARD ADJUSTMENT TRIMMER

VR101	Voltage adjustment
VR301	High voltage adjustment
VR304	Sub-brightness adjustment
VR403	Sub-contrast adjustment
VR401	Blue cut-off adjustment
VR461	Red cut-off adjustment
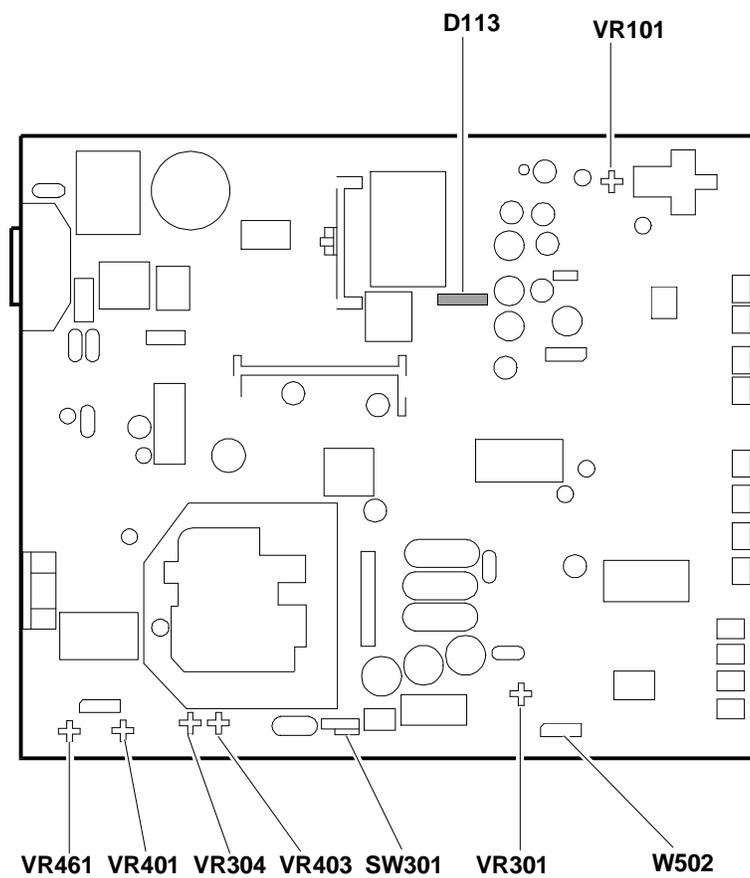
Fig. 41-14 Main Board Adjustments

14" COLOR DISPLAY UNIT CDU1460MS/HY02 (DSM 50-144)

VIDEO AMPLIFIER BOARD ADJUSTMENT TRIMMER

VR402   Blue cut-off
VR432   Green cut-off
VR462   Red cut-off

VR402   **VR462**   **VR432**
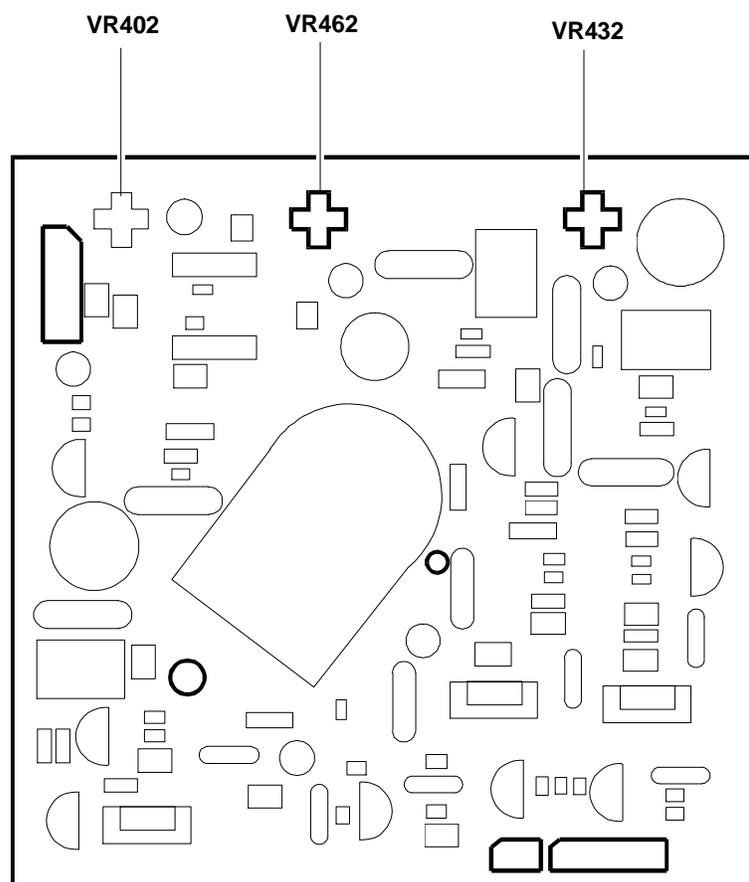
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Fig. 41-15 Video Amplifier Board Adjustments

NOTE: EHT high voltage is present in the area around the FBT (T302) transformer. Do not touch component Q101 nor its heatsink if high voltage is still present in this area.

EQUIPMENT

- Digital voltmeter
- 40 Hz to 100 KHz frequency counter
- Color coordinate analizer
- Video signal generator or a System Test diskette for Olivetti Personal Computers
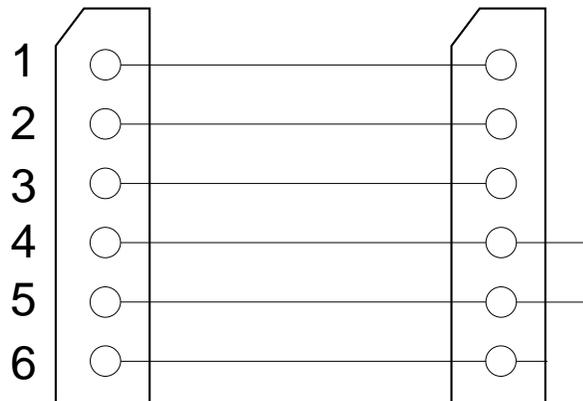- High voltage meter (above 30 KV)
- JIG connector

Fig. 41-16 JIG Adjustment Connector

PRELIMINARIES

Make sure that the voltage level of the video input signals (Red, Green, Blue) is 0.7 Vpp with a 75 Ω termination resistance, and that the video timings are the same as the standard timings given in the specifications. Power on the display unit and wait at least 15 minutes before making any adjustments to allow the unit to stabilize itself thermally.

NOTE: To display video signals, use a video signal generator or the System Test diskette for Olivetti Personal Computers.

VOLTAGE SETTING

- Display a cross-hatch pattern in the 640x480 VGA mode.

- Attach the digital voltmeter to the heatsink of diode D113 on the main board (see figure 41-14).

- Set the voltage to 50 ± 0.5 V by using trimmer VR101 on the main board.

HIGH VOLTAGE SETTING

- Display a black pattern in the 31 KHz 640x480 VGA video mode.

- Set the brightness control to its cut-off position.

- Attach a high voltage voltmeter to the anode.

- Set the high voltage to 24.5 KV $\pm$ 0.1 KV, with $Ib = 0$ μA, by using trimmer VR301 on the main board.

SCREEN VOLTAGE SETTING

- Display a black pattern in the 640x480 VGA video mode.

- Attach a high voltage voltmeter to grid G2 of the video amplifier board (see figure 41-6).

- Set the screen voltage to 560 V $\pm$ 10 V using the SCREEN potentiometer on the FBT transformer of the main board.

GEOMETRY SETTING

Proceed as follows before adjusting the geometry of the picture:

- Insert the JIG adjustment connector into connector W502 on the main board.

- Adjust the geometry of the picture by using the + ADJUSTMENT (8) and - ADJUSTMENT (7) buttons.

Horizontal Raster Setting

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- Display a cross-hatch pattern in the 56 KHz 1024x768 VGA video mode.

- Adjust the raster by using the SW301 switch on the main board.

Vertical Linearity Setting

- Display a cross-hatch pattern in the 31 KHz 640x480 VGA video mode.

- Using the SELECT button (6) on the external control panel, select the HORIZONTAL SHIFT (2) and VERTICAL SIZE (3) LEDs. Set A=B using the + ADJUSTMENT (8) and - ADJUSTMENT buttons (7).
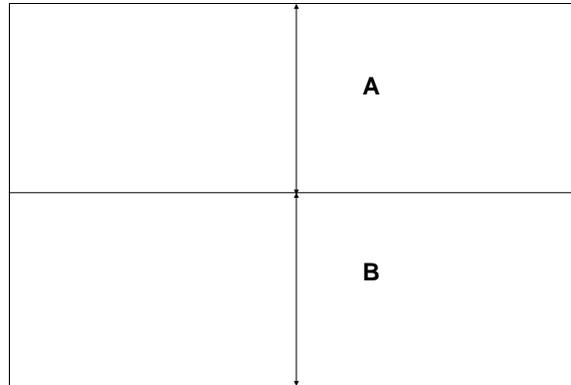
- Using the SELECT button (6) on the external control panel, select the VERTICAL SIZE (3) and VERTICAL SHIFT (4) LEDs. Set C=D=E using the + ADJUSTMENT (8) and - ADJUSTMENT (7) buttons.
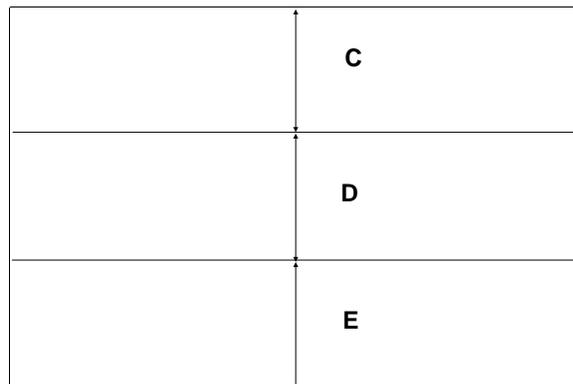
Key-Stone Setting

- Display a cross-hatch pattern in the 31 KHz 640x480 VGA video mode.

- Using the SELECT button (6) on the external control panel, select the HORIZONTAL SIZE LED (1) and HORIZONTAL SHIFT LED (2).

- Adjust the trapezoid distortion using the + ADJUSTMENT button (8) and
  - ADJUSTMENT button (7).

Vertical Shift Setting

- Display a cross-hatch pattern in the 31 KHz to 60 KHz VGA video modes.

- Using the SELECT button (6) on the external control panel, select the VERTICAL SHIFT LED (4) and center the raster vertically by using the + ADJUSTMENT (8) and - ADJUSTMENT (7) buttons.

Vertical Size Setting

- Display a cross-hatch pattern in the 31 KHz to 60 KHz VGA video modes.

- Using the SELECT button (6) on the external control panel, select the VERTICAL SIZE LED (3) and adjust the vertical size by using the + ADJUSTMENT (8) and - ADJUSTMENT (7) buttons.

Horizontal Shift Setting

- Display a cross-hatch pattern in the 31 KHz to 60 KHz VGA video modes.

- Using the SELECT button (6) on the external control panel, select the HORIZONTAL SHIFT LED (2) and adjust the horizontal shift by using the + ADJUSTMENT (8) and - ADJUSTMENT (7) buttons.

Horizontal Size Setting

- Display a cross-hatch pattern in the 31 KHz to 60 KHz VGA video modes.

- Using the SELECT button (6) on the external control panel, select the HORIZONTAL SIZE LED (1) and adjust the horizontal size by using the + ADJUSTMENT (8) and - ADJUSTMENT (7) buttons.

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Pincushion Setting

- Display a cross-hatch pattern in the 31 KHz to 60 KHz VGA video modes.

- Using the SELECT button (6) on the external control panel, select the PINCHSHION LED (5) and adjust pincushion distortion by using the + ADJUSTMENT (8) and - ADJUSTMENT (7) buttons.

NOTE: Remove the JIG connector at the end of the geometry adjustment procedure.

WHITE BALANCE SETTING

Before proceeding with the white balance adjustment, stick the sensor of the color coordinate analizer at the center of the CRT.

Cut-off Adjustment

- Display a black pattern in the 56 KHz 1024x768 VGA Plus video mode.

- Using the external controls, adjust the brightness to its maximum setting and then adjust it to 1 FL using the subbrightness control trimmer VR304 on the main board.

- Adjust the white balance by using the green cut-off (VR432), blue cut-off (VR402) and red cut-off (VR462) controls on the video amplifier board until obtaining the chromaticity coordinates $X = 0.290 \pm 0.02$ and $Y = 0.280 \pm 0.02$.

Drive Setting

- Display a white pattern in the 56 KHz 1024x768 VGA Plus video mode.

- Set the contrast to its maximum setting.

- Set the external brightness control to its minimum setting and then measure a luminance of 7 FL using the sub-contrast adjustment trimmer VR403 on the main board.

- Adjust the white balance using the drive controls for red and blue, in other words using trimmers VR461 (red cut-off) and VR401 (blue cut-off) on the main board, to obtain the chromaticity coordinates $X = 0.290 \pm 0.02$ and $Y = 0.280 \pm 0.02$.

Raster Setting

- Display a black pattern in the 56 KHz 1024x768 VGA Plus video mode.

- Using the sub-brightness control trimmer VR304, adjust the visual limits to -1 FL.

Maximum Brightness Setting

- Display a white pattern in the 56 KHz 1024x768 VGA Plus video mode.

- Set the external brightness and contrast controls to their maximum setting and measure a luminance of 22.5 - 25.5 FL using the sub-contrast adjustment trimmer VR403.

- Using the contrast buttons adjust the brightness limits to 22.5 FL $\pm$ 1 FL.

FOCUS SETTING

- In the 56 KHz 1024x768 VGA Plus video mode, display a screen with a white box in the middle (CENTRAL BOX 20%).

- Using the contrast buttons set the brightness to 20 FL.

- Change the video signal in a page of H characters.

- Adjust the FOCUS potentiometer of the FBT transformer to improve picture focus.
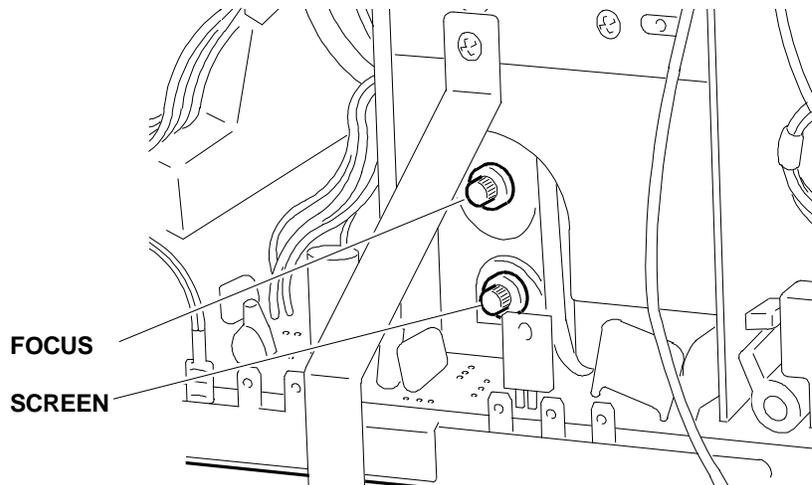

Fig. 41-17 Focus and Screen Potentiometers

X-RAY PROTECTION TEST

- With an input signal, short circuit both terminations of the R362 resistor on the main board by using the JIG connector.
- Check when the raster disappears.
- Remove the JIG connector.
- Turn the power switch off and then on again and ensure correct operation.

BURN-IN TEST

- Power on the display unit with the signals cable detached.
- Under burn-in conditions the free frequency must be of 29 KHz.
- Run the burn-in test after correctly adjusting the brightness.

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