
4 Alignment and Adjustments

This section of the service manual explains how to make permanent adjustments to the monitor. Directions are given for adjustments using the monitor Interface Board Ver. 2.0 and software (Softjig).

4-1 Adjustment Conditions

Caution: Changes made without the Softjig are saved only to the user mode settings. As such, the settings are not permanently stored and may be inadvertently deleted by the user.

4-1-1 Before Making Adjustments

4-1-1 (a) ORIENTATION

When servicing, always face the monitor to the east.

4-1-1 (b) WARM-UP TIME

The monitor must be on for 30 minutes before starting alignment. Warm-up time is especially critical in color temperature and white balance adjustments.

4-1-1 (c) SIGNAL

Analog, 0.7 Vp-p positive at 75 ohm, internal termination

Sync: Separate

(TTL level negative/positive)

4-1-1 (d) SCANNING FREQUENCY

Horizontal : 30 kHz to 54 kHz (15" Automatic)

Horizontal : 30 kHz to 70 kHz (17" 70kHz Automatic)

Horizontal : 30 kHz to 85 kHz (17" 85kHz Automatic)

Vertical : 50 Hz to 120 Hz (15" Automatic)

Vertical : 50 Hz to 160 Hz (17" Automatic)

Unless otherwise specified, adjust at the
800 x 600 mode (15" 54 kHz/85 Hz),
1024 x 768 mode (17" 68 kHz/85 Hz),
Refer to Table 2-1 on page 2-3.

4-1-2 Required Equipment

The following equipment may be necessary for adjustment procedures:

4-1-2 (a) DISPLAY CONTROL ADJUSTMENT

1. Non-metallic (–) screwdriver:
1.5, 2.5, 3 mm
2. Non-metallic (+) screwdriver:
1.5, 2.5, 3 mm
3. Digital Multimeter (DMM), or
Digital Voltmeter
4. Signal generator, or
DM200 software
5. Personal computer

4-1-2 (b) COLOR ADJUSTMENTS

1. All equipment listed in 4-1-2 (a), above
2. Color analyzer, or any luminance
measurement equipment.

4-1-3 After Making Adjustments

After finishing all adjustments, test the monitor in all directions. If, for example, the monitor does not meet adjustment specifications when facing north, reposition the monitor to face east and readjust. This time, try for an adjustment closer to the ideal setting within the tolerance range. Test the unit again in all directions. If the monitor again fails to meet specifications in every direction, contact your Regional After Service Center for possible CRT replacement.

4-2 Display Control Adjustments

4-2-1 HIGH VOLTAGE

Signal: 800 x 600 (15" 54 kHz/85 Hz)
 1024 x 768 (17" 68 kHz/85 Hz)
 Display image: Don't care
 Contrast: Minimum
 Brightness: Minimum
 Limit: 25.0 kV \pm 0.3 kV (15")
 26.0 kV \pm 0.3 kV (17")

Measure the high voltage level at the anode cap.
 High voltage should be within the limit as above.

4-2-2 CENTER RASTER (17" 85kHz only)

Adjust SW401 so that the back raster comes to the center when you apply basic mode for 17".

4-2-3 Centering

Centering means to position the center point of the display in the middle of the display area.
 Horizontal size and position and vertical size and position control the centering of the display.

Adjust the horizontal size and vertical size to their optimal settings: 267 mm (H) x 200 mm (V) : (15")
 312 mm (H) x 234 mm (V) : (17").

Adjust the horizontal position and vertical position to ≤ 5.0 mm of the center point of the screen.

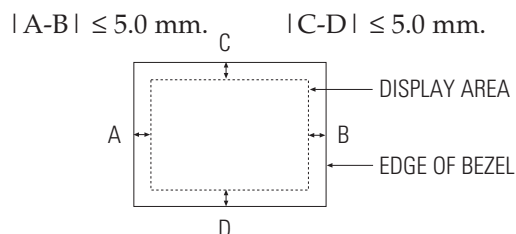


Figure 4-1. Centering

* In Softjig window, "Geometry" has to be selected for GD adjustment.

4-2-3 (a) HORIZONTAL SIZE ADJUSTMENT

CONDITIONS

Scanning frequency: 54 kHz/85 Hz (15")
 68 kHz/85 Hz (17")
 Display image: Crosshatch pattern
 Brightness: Maximum
 Contrast: Maximum

Click Standard Dump on the right Menu in the general field.

Use control bar after selecting size B+ in the left Menu to adjust the horizontal size of the display, Pattern to 267mm(Tolerance : ± 4 mm.)(15")
 Pattern to 312mm(Tolerance : ± 4 mm.)(17")

Run the All Mode save in the Right Menu.

Caution : Do not Run the All mode Save at the other scannig times except for 800 x 600 (54 kHz/85 Hz) -> 15" 1024x768 (68kHz/85Hz) -> 17".

4-2-3 (b) VERTICAL SIZE ADJUSTMENT

CONDITIONS

Scanning frequency: 54 kHz/85 Hz
 68 kHz/85 Hz
 Display image: Crosshatch pattern
 Brightness: Maximum
 Contrast: Maximum

Use control bar after selecting "V-SIZE" in left menu to adjust the vertical size of the display pattern to 200 mm.(Tolerance: ± 4 mm.) : 15",
 234 mm.(Tolerance: ± 4 mm.) : 17"

4-2-3 (c) HORIZONTAL POSITION ADJUSTMENT

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"
 68 kHz/85 Hz : 17"
 Display image: Crosshatch pattern

Use control bar after selecting "H-POSITION" in left menu to center the horizontal image on the raster.

4-2-3 (d) VERTICAL POSITION ADJUSTMENT

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"
 68 kHz/85 Hz : 17"
 Display image: Crosshatch pattern

Use control bar after selecting "V-POSITION" in left menu to center the vertical image on the raster.

4-2-4 Linearity

Linearity affects the symmetry of images as they appear on the screen. Unless each row or column of blocks in a crosshatch pattern is of equal size, or within the tolerances shown in Tables 4-2 and 4-3, an image appears distorted, elongated or squashed.

Table 4-1. Standard Modes Linearity:
800 x 600 / 85Hz (15")

	Adjacent Linearity	Entire Linearity
Preset mode	≤ 4%	≤ 8%
Pre-load mode (48kHz~)	≤ 5%	≤ 14%

* Preset Mode : 54KHz / 85Hz

Pre-load Mode : Refer to Timing Chart

Table 4-2. Standard Modes Linearity:
1024 x 768 / 85Hz (17")

	Standard Modes Linearity	
	Each block (10 %)	Difference between adjacent blocks (4 %)
4 : 3	Horizontal: 20.9~23.1 Vertical : 20.9~23.1	Horizontal: Less than 0.88 mm Vertical : Less than 0.88 mm

Table 4-3. Other Modes Linearity:
above 40 KHz(Hf) : 17"

	Supported Timing Mode	
	Each block (14 %)	Difference between adjacent blocks (5 %)
4 : 3	Horizontal: 20.5~23.5 Vertical : 20.5~23.5	Horizontal: Less than 1.10 mm Vertical : Less than 1.10 mm

Off Spec : Under 40 KHz (Hf)

4-2-4 (a) VERTICAL LINEARITY ADJUSTMENT

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"
68 kHz/85 Hz : 17"

Display image: Crosshatch pattern
Brightness: Maximum
Contrast: Maximum

To adjust the Vertical Linearity, refer to Tables 4-2 and 4-3 for the tolerance range.

Use control bar after selecting "**V-LINEARITY BAL**" in left menu to optimize the image.

4-2-5 Trapezoid Adjustment

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"

68 kHz/85 Hz : 17"

Display image: Crosshatch pattern
Brightness: Maximum
Contrast: Maximum

Use control bar after selecting "**TRAPEZOID**" in left menu to make the image area rectangular.

$$|A - B| < 4 \text{ mm}$$

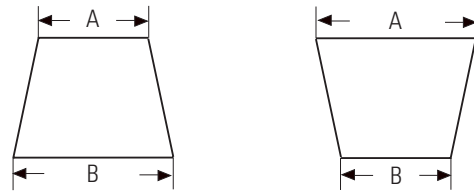


Figure 4-2. Trapezoid

4-2-6 Pinbalance Adjustment

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"
68 kHz/85 Hz : 17"

Display image: Crosshatch pattern
Brightness: Maximum
Contrast: Maximum

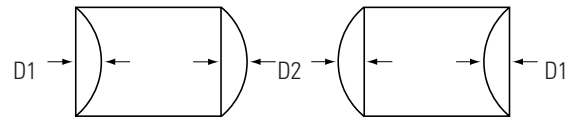


Figure 4-3. Pinbalance

Use control bar after selecting "**PINBALANCE**" in left menu to optimize the image.

4-2-7 Parallelogram Adjustment

CONDITIONS

Scanning Frequency: 54 kHz/85 Hz : 15"
68 kHz/85 Hz : 17"

Display image: Crosshatch pattern
Brightness: Maximum
Contrast: Maximum

Use control bar after selecting "**PARALLEL**" in left menu to make the image area rectangular.

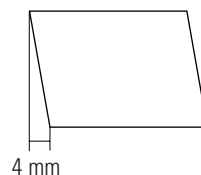


Figure 4-4. Parallelogram

4-2-8 Side Pincushion Adjustment

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"
68 kHz/85 Hz : 17"
Display image: Crosshatch pattern

Use control bar after selecting "**PINCUSHION**" in left menu to straighten the sides of the image area.

$|C1|, |C2| \leq 2.0 \text{ mm}, |D1|, |D2| \leq 2.0 \text{ mm}.$

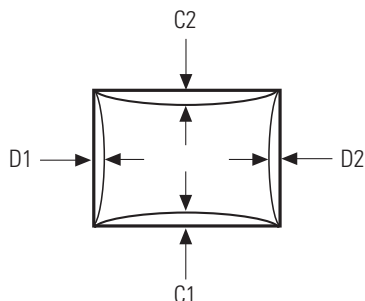


Figure 4-5. Pincushion

4-2-9 Degauss

No adjustments are available for the degaussing circuit. The degaussing circuit can effectively function only once every 30 minutes.

4-2-10 To Delete the User Mode Data

To delete the adjustment data from the user modes, click "**@4: USER DELETE**" in right menu.

4-2-11 Save the Data

To save the adjustment data for a mode, press "**@3: ALL MODE SAVE**" in right menu.

4-3 Color Adjustments

CAUTION: Check below condition before color adjustment
Video signal : Analog 0.7 Vp-p (at 75 Ω)
Sync : TTL level (H, V separate signal)

* Select "Color" in Softjig menu for color adjustment.

4-3-1 Color Coordinates (Temperature)

Color temperature is a measurement of the radiant energy transmitted by a color. For computer monitors, the color temperature refers to the radiant energy transmitted by white. Color coordinates are the X and Y coordinates on the chromaticity diagram of wavelengths for the visible spectrum.

CONDITIONS

Measurement instrument: Color analyzer
Scanning frequency: 54 kHz/85 Hz : 15"
68 kHz/85 Hz : 17"
Display image: White flat field at center of display area
Luminance: Maximum

PROCEDURE

Use the directions in sections 4-3-2 through 4-3-3 to adjust the color coordinates for:

9300K to $x = 0.283 \pm 0.02$, $y = 0.298 \pm 0.02$
6500K to $x = 0.313 \pm 0.02$, $y = 0.329 \pm 0.02$

4-3-2 Color Adjustments for 9300K

4-3-2 (a) BACK RASTER COLOR ADJUSTMENT

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"
68 kHz/85 Hz : 17"
Display image: Back raster pattern
Brightness: Maximum
Contrast: Maximum

1. Select "**@1: CHANNEL 1**" in right menu to control the color for 9300K.
2. Adjust the luminance of the back raster to between 0.5 to 0.7 ft-L using control bar after selecting "**GREEN CUTOFF**" in the menu.
3. Use control bar after selecting "**BLUE CUTOFF**" in left menu to set the "y" coordinate to 0.298 ± 0.02 .
4. Use control bar after selecting "**RED CUTOFF**" in left menu to 0.283 ± 0.02 .

* If color values can not be matched to desirable values, repeat sequences 3 and 4 after readjusting "GREEN CUTOFF" control.

4-3-2 (b) WHITE BALANCE ADJUSTMENT

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"
68 kHz/85 Hz : 17"

Display image: White box pattern

Brightness: 0.06ft-L at Back Raster
Pattern Display

Contrast: Maximum

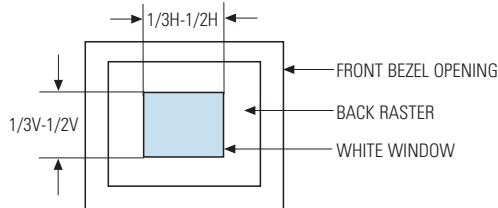


Figure 4-6. White Box Pattern

1. Use control bar after selecting "RED GAIN", "GREEN GAIN" and "BLUE GAIN" to adjust the luminance 47 ± 1 ft-L(15"), 42 ± 1 ft-L(17") with the color coordinates ranged for 9300K to $x = 0.283 \pm 0.02$, $y = 0.298 \pm 0.02$.

4-3-2 (c) ABL ADJUSTMENT

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"
68 kHz/85 Hz : 17"

Display image: Full white pattern

Brightness: Maximum

Contrast: Maximum

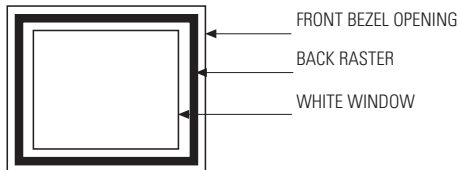


Figure 4-7. Full White Pattern

1. Check the ABL. If it is not within specifications, use the ABL controls to adjust. 31 ± 1 ft-L
2. Select "@4: COLOR SAVE" to save the data.
3. Select "@6: ALL COLOR SAVE" to save CH2.

4-3-2 (d) WHITE BALANCE ADJUSTMENT VERIFICATION

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"
68 kHz/85 Hz : 17"

Display image: Back raster pattern
Full White Pattern

X-Y Coordinates: $x = 0.283 \pm 0.02$,
 $y = 0.298 \pm 0.02$

ABL Luminance Refer to 4-3-2(c)

Brightness: Maximum

Contrast: 5 ft-L, 24 ft-L

1. Check whether the color coordinates of the back raster satisfy the above spec.
If they do not, return to 4-3-2 (a) and readjust all settings.
2. Display a full white pattern.
3. Select "Geometry" in softjig menu.
4. Select "@7: 5-ft " in right menu.
5. Check whether the white coordinates of the video meet the above coordinates spec.
6. Select "@8: 24-ft " in right menu.
7. Check whether the white coordinates of the video satisfies the above spec.

If they do not, return to 4-3-2 (a) and readjust all settings.

Select "Color" and click "@2: CHANNEL 2" for color adjustment for 6500K

Repeat the sequence for 9300K adjustment. luminance values are the same as 9300K, but the color coordinates of back raster and white box are : $x = 0.313 \pm 0.02$ $y = 0.329 \pm 0.02$

4-3-3 MAGIC BRIGHT ADJUSTMENT (MB MODEL ONLY)

CONDITIONS

Scanning frequency: 68 kHz/85 Hz : 17"

Display image: White box pattern

Brightness: 0.06ft-L at Back Raster
Pattern Display

Contrast: Maximum

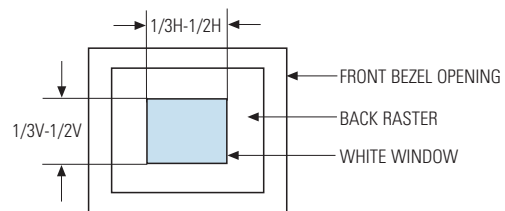


Figure 4-8. White Box Pattern

1. Use control bar after selecting "RED GAIN", "GREEN GAIN" and "BLUE GAIN" to adjust the luminance 115 ± 1 ft-L (17") with the color coordinates ranged for 9300K to $x = 0.283 \pm 0.02$, $y = 0.298 \pm 0.02$.

4-3-4 Color Adjustments for sRGB

4-3-4 (a) BACK RASTER COLOR ADJUSTMENT

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"
68 kHz/85 Hz : 17"
Screen: Back raster pattern
Bright: MAX
Contraster: MAX

1. Select **COLOR CHANNEL 4** to control the color for sRGB.
2. Adjust the luminance of the back raster to between 0.5 to 0.7 ft-L using the **G_CUT** controls.
3. Click on the << or >> boxes next to **R_CUT** and **B_CUT** to adjust the R-Bias to $x = 0.312 \pm 0.02$ and the B-Bias to $y = 0.329 \pm 0.02$.

4-3-4 (b) GAIN (WITHOUT ABL) ADJUSTMENT

1. Bright should be cut off.
2. Save after adjusting : (Color coordinates $x=0.312 \pm 0.015$, $y=0.329 \pm 0.015$
Brightness : 28 ± 1 F/L) with R, G, B gain key.

Notice : The condition for adjusting is the same as 9300K.
Don't adjust ABL to SRGB Mode
Modify with ABL.
Delete all contents and add the contents below.

4-3-4 (c) WHITE BALANCE ADJUSTMENT

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"
68 kHz/85 Hz : 17"
Display image: Full white pattern
Brightness: Cut-off
Contrast: Maximum

1. Click on the << or >> boxes next to **R_GAIN** and **B_GAIN** to make the video white.
(For sRGB color adjustment:
 $x = 0.312 \pm 0.02$, $y = 0.329 \pm 0.02$.)
2. Select **COLOR FACTORY SAVE** to save the data.

Luminance Table 4-4.

Without ABL	28 ft-L
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4-3-5 Luminance Uniformity Check

Luminance is considered uniform only if the ratio of lowest to highest brightness areas on the screen is not less than 7.5:10.

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"
68 kHz/85 Hz : 17"
Display image: White flat field
Brightness: Cut off point at 24 ft-L
Contrast: Maximum

PROCEDURE

Measure luminance at nine points on the display screen (see figure below).

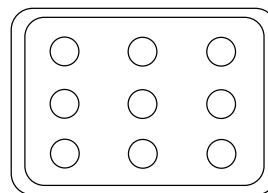


Figure 4-9. Luminance Uniformity Check Locations

4-3-6 Focus Adjustment

CONDITIONS

Scanning frequency: 54 kHz/85 Hz : 15"
68 kHz/85 Hz : 17"
Display image: "H" character pattern
Brightness: Cut off point
Contrast: Maximum

1. Adjust the Focus VR on the FBT to display the sharpest image possible. (17" only)
2. Use Locktite to seal the Focus VR in position. (17" only)

4-3-7 Color Purity Adjustment

Color purity is the absence of undesired color. Conspicuous mislanding (unexpected color in a uniform field) within the display area shall not be visible at a distance of 50 cm from the CRT surface.

CONDITIONS

Orientation: Monitor facing east
 Scanning frequency: 54 kHz/85 Hz : 15"
 68 kHz/85 Hz : 17"
 Display image: White flat field
 Luminance: Cut off point at the center
 of the display area

Note: Color purity adjustments should only be attempted by qualified personnel.

PROCEDURE

Use the following procedure to correct minor color purity problems : 15"

1. Make sure the display is not affected by external magnetic fields.
2. Make sure the spacing between the PCM assembly and the CRT stem is 29 mm \pm 1 mm.
3. Display a green pattern over the entire display area.
4. Adjust the purity magnet rings on the PCM assembly to display a pure green pattern.
 (Optimum setting: $x = 0.295 \pm 0.015$, $y = 0.594 \pm 0.015$)

Table 4-5. Color Purity Tolerances

Red:	$x = 0.640 \pm 0.015$	$y = 0.323 \pm 0.015$
Green:	$x = 0.295 \pm 0.015$	$y = 0.594 \pm 0.015$
Blue:	$x = 0.142 \pm 0.015$	$y = 0.066 \pm 0.015$

(For 9300K color adjustment: $x = 0.283 \pm 0.015$, $y = 0.298 \pm 0.015$)

5. When you have the PCMs properly adjusted, carefully glue them together to prevent their movement during shipping.

Use the following procedure to correct minor color purity problems : 17"

1. Make sure the display is not affected by external magnetic fields.
2. Make sure the spacing between the PCM assembly and the CRT stem is 29 mm \pm 1 mm.
3. Display a green pattern over the entire display area.
4. Adjust the purity magnet rings on the PCM assembly to display a pure green pattern.
 Optimum setting: $x = 0.285 \pm 0.015$,
 $y = 0.600 \pm 0.015$
5. Repeat steps 4 and 5 using a red pattern and then again, using a blue pattern.

Table 4-6. Color Purity Tolerances

Red:	$x = 0.645 \pm 0.015$	$y = 0.321 \pm 0.015$
Green:	$x = 0.285 \pm 0.015$	$y = 0.600 \pm 0.015$
Blue:	$x = 0.142 \pm 0.015$	$y = 0.057 \pm 0.015$

(LE17KS/KT Model)

(For 9300K color adjustment: $x = 0.283 \pm 0.02$, $y = 0.298 \pm 0.02$)

Table 4-7. Color Purity Tolerances

Red:	$x = 0.645 \pm 0.015$	$y = 0.318 \pm 0.015$
Green:	$x = 0.276 \pm 0.015$	$y = 0.596 \pm 0.015$
Blue:	$x = 0.145 \pm 0.015$	$y = 0.060 \pm 0.015$

(LE17LS/LT Model)

(For 9300K color adjustment: $x = 0.283 \pm 0.02$, $y = 0.298 \pm 0.02$)

6. When you have the PCMs properly adjusted, carefully glue them together to prevent movement during shipping.

Memo