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## 1- INTRODUCTION

The operator workspace monitor must be properly adjusted for the filmed image to accurately represent the console monitor displayed image. This procedure will describe how to adjust the monitor to match the camera. **Once the monitor is re-calibrated, it is essential to re-calibrate the camera before the system is used for filming.**

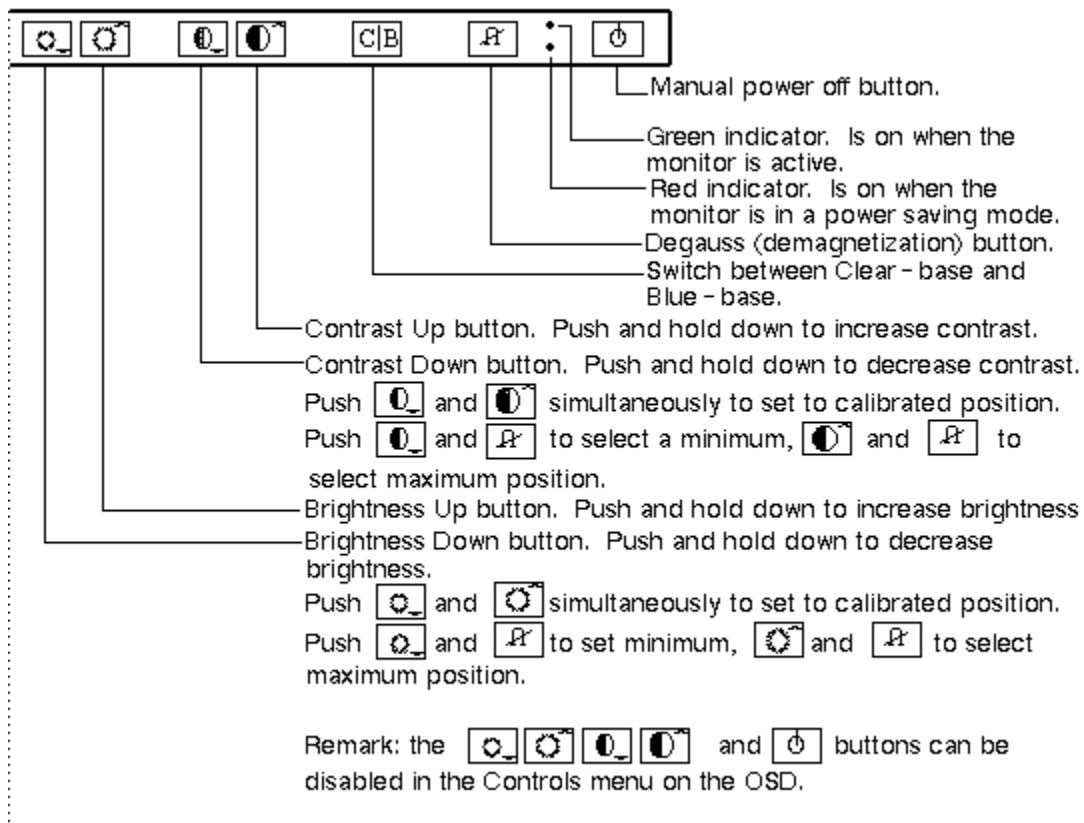
## 2- MONITOR CALIBRATION CONTROLS

### 2-1 Model MDW 321 Controls (including MDW321 Plus)

The controls for the Model MDW 321 are shown in Illustration L1.

#### Notes

For the Model MDW 321, the user controls are disabled. For this model, if power is cycled the contrast and brightness changes will be permanently saved and will not revert back to the factory default values. These controls will need to be enabled for this procedure and then disabled. For the MDW 321, follow the procedure for enabling and disabling the user controls.



MDW 321 COLOR MONITOR CALIBRATION CONTROLS  
ILLUSTRATION L1

## 2-2 Enabling/Disabling User Controls for the MDW 321

1. Bring up the OSD (On Screen Display) by selecting the up contrast and down brightness buttons simultaneously.
2. Use the up contrast or down contrast to scroll through the menu to select the entry for Controls.
3. Push the down brightness button to enter the Controls submenu.
4. Upon entering the controls submenu, the User Controls entry should be highlighted, (if not use the up/down contrast button to select User Controls).
5. To toggle the User Controls to on/off, select the C/B button.
6. Once User control is set, you may back out of the OSD menus by repeatedly selecting the up brightness control. Alternately, after 30 seconds with no activity, the menu will disappear.

## 3- ADJUSTING FOR MAGNETIC FIELD - MODEL MWD 321

Strong magnetic fields cause the image on a picture tube to have distorted colors and geometry. The monitor has 4 tools to eliminate the influence of magnetic fields:

- the Mumetal *tubus*
- Axial uniformity adjustment
- Vertical uniformity adjustment
- MRI connection

Additionally, there is the Rotation adjustment to compensate for the rotation of the image caused by the magnetic adjustments.

### 3-1 Eliminating the Magnetic Field influence

To eliminate the magnetic field influence:

1. Adjust Rotation (Geometry menu) until the image is approximately horizontal. You might have to fine-tune the rotation after the other adjustments
2. Adjust MRI Correction (Uniformity Menu) up or down in steps of 10 units. Observe if the image is becoming better or worse.

#### Note

After every change, the monitor will degauss automatically. The complete effect of the change is only visible in the image after the degauss. There must be a delay of 10 seconds at least between 2 successive changes. This is the time it takes between 2 degauss actions.

3. If the image is becoming better, continue in the same sense (up or down) until the image is getting worse again. That means the adjustment has reached its optimum and will only get worse if you continue in the same sense.
4. If after optimizing the MRI correction, the picture still has distorted colors, you will have to adjust the tubus. See section 3-2.

### 3-2 Adjusting the tubus

1. The Mumetal tubus is covered with a plastic tubus cover. Remove the tubus cover by carefully pulling it to the front (this may be a tight fit). See Illustration 3-1.



**REMOVING PLASTIC TUBUS COVER**  
ILLUSTRATION 3-1

2. The tubus is fixed by 8 screws: 2 on top, 2 underneath, and 2 at both sides. The screws don't have to be removed. Loosen them until you can move the tubus. See Illustration 3-2



**LOOSENING SCREWS EXAMPLE**  
ILLUSTRATION 3-2

3. Extract the tubus for about 4 cm and repeat the MRI correction described in Section 3-1. See Illustration 3-3.



**EXTRACTING TUBUS**  
ILLUSTRATION 3-3

If the image is still not good after extracting the tubus completely:

1. Adjust **Axial** (Ax WH Uniformity) uniformity. If necessary, also adjust **Rotation** to obtain a horizontal image.
2. If the adjustments are insufficient, try to place the monitor further away from the source of the magnetic field.
4. In case the image is still not good enough, proceed by extracting the tubus and adjusting the MRI correction until the image is free from color distortions.
5. If necessary, adjust **Rotation** (Geometry menu) to obtain a horizontal image.
6. Tighten the 8 screws of the tubus and slide the plastic tubus cover back over the tubus.

#### **4-VERIFY AMBIENT LIGHTING CONDITIONS**

In the review area and operator workspace area, verify that the ambient lighting conditions are adjusted to a minimum level. In the operator workspace area, there should be only sufficient light for safely operating the system.

In the review area and operator workspace area, verify that light-boxes are not emitting light, or are properly masked, when not displaying film. This will be a source of excessive glare. In both the review area and the operator workspace area, verify that there is no source of glare for reviewing films or setting up the images for film. For example, windows should not allow direct light (blinds should be closed).

Note that both the operator workspace area and the review area artificial lighting type should be equivalent.

## 5 MONITOR CALIBRATION

### 5-1 Verify and set the color temperature

A large variation in color temperature between the monitor and the review station light-box/film can cause the operator to read the film differently. Set the color temperature to 9300K.

### 5-2 Modifying Gamma

The GAMMA value is modified to optimize the contrast level of the image mid-tones to more closely represent the same contrast that is filmed.

#### GAMMA SETTINGS

TABLE 5-1

Monitor Type	Models	Gamma Setting
CRT	MDW321(B/W)	0.9
CRT	MDW321(Color)	1.1

### 5-3 Checking Gamma Level

1. From the Tools Menu on the Host SGI Computer, Open **C-Shell**.
2. Type **gamma** <enter> The system should respond with the current setting. (Refer to Table 5-1, for the correct gamma setting for your monitor configuration).
  - a. If the gamma value is correct, the gamma level is set. Proceed to Section 5-6, Contrast and Brightness.
  - b. If the value is NOT, correct continue with Sub-section 5-4, Setting Correct Gamma Level

### 5-4 Setting Correct Gamma Level

This section requires the up loading of files to the SGI computer. These files are found on the GEMS Service Documentation CD ROM 2160623 Rev 14. Or Service CD 2250758 Rev 2. You must have these versions of Service CD's to proceed with this section.

### 5-5 Mounting the Service CDROM

1. Insert GEMS Service Documentation CD ROM 2160623 Rev 14. Or Service CD 2250758 Rev 2 into the Signa host CDROM drive. The service class of the service CDROM does not matter.
2. On the Host SGI Computer, Open **C-Shell**.
3. Type: **su root** <enter> At password, type: **operator** <enter>
4. Type: **mediad** <Enter> (Mount CDROM Drive to File System, takes 20-30 seconds)

**Note**

If a message appears stating "another mediad is already running", ignore it.

5. Type: **/CDROM/gamma/setfiles** <enter>

**Note**

Message appears stating this action was performed.

6. Eject the CDROM with the button. Type:

a. B/W Monitors: **setgamma .9** <enter> (The screen should change gamma level instantly)

b. Color Monitors: **setgamma 1.1** <enter> (The screen should change gamma level instantly)

Typical Response:

-----  
<gamma> value was 1.000000 (Original gamma value)  
<gamma> value is now 0.90000 (New gamma value)  
-----

**Note**

If the response was:<gamma> value is now 2.0, then complete step 8, **reboot the system** and repeat this section.

7. Type: **exit** <enter> (Changes user privileges. "root level" access to "sdc level" access).

8. Type: **exit** <enter> Close the C-Shell.

9. Remove the CDROM from the CDROM Reader.

**Note**

If you push the button on the front of the CDROM Reader and it does not open, it is because you did not properly unmount the CDROM from the File System.

1. Re-open a C-shell
2. login as root, Password: operator
3. Type: **umount /CDROM**.
4. Exit the C-Shell.
5. Eject the CDROM with the button.

**5-6 Setting or Checking the Video System Frequency Rate**

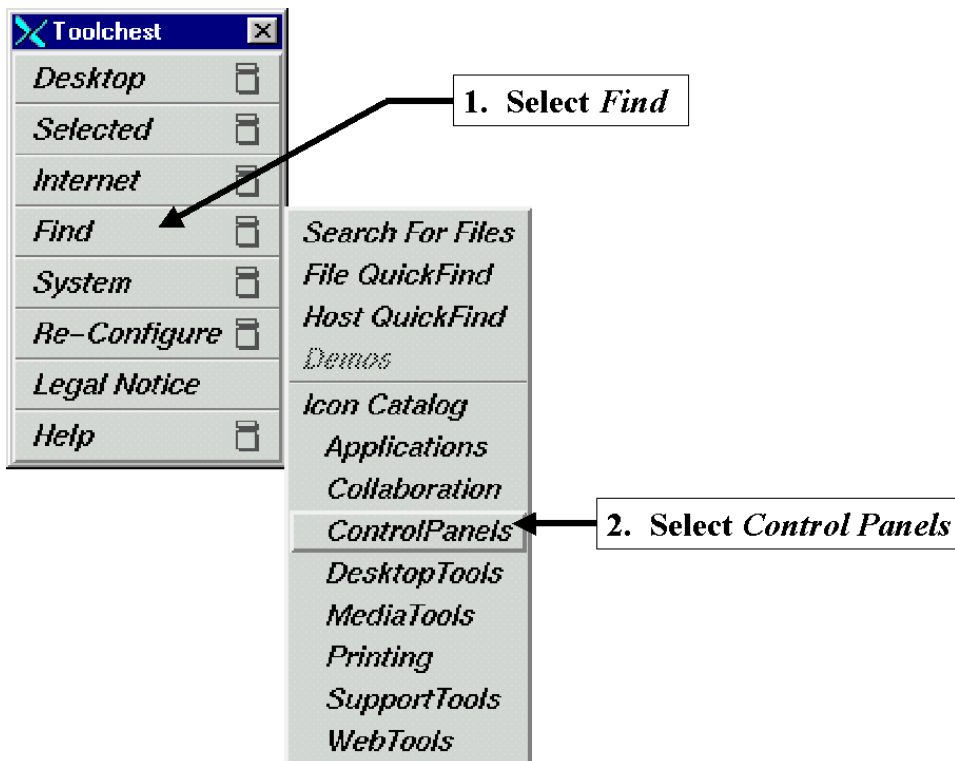
The system software must be configured for the proper monitor resolution and scan rate. The Barco Monitors are Fixed Rate monitors. The will only operate at 72Hz settings.

**Note**

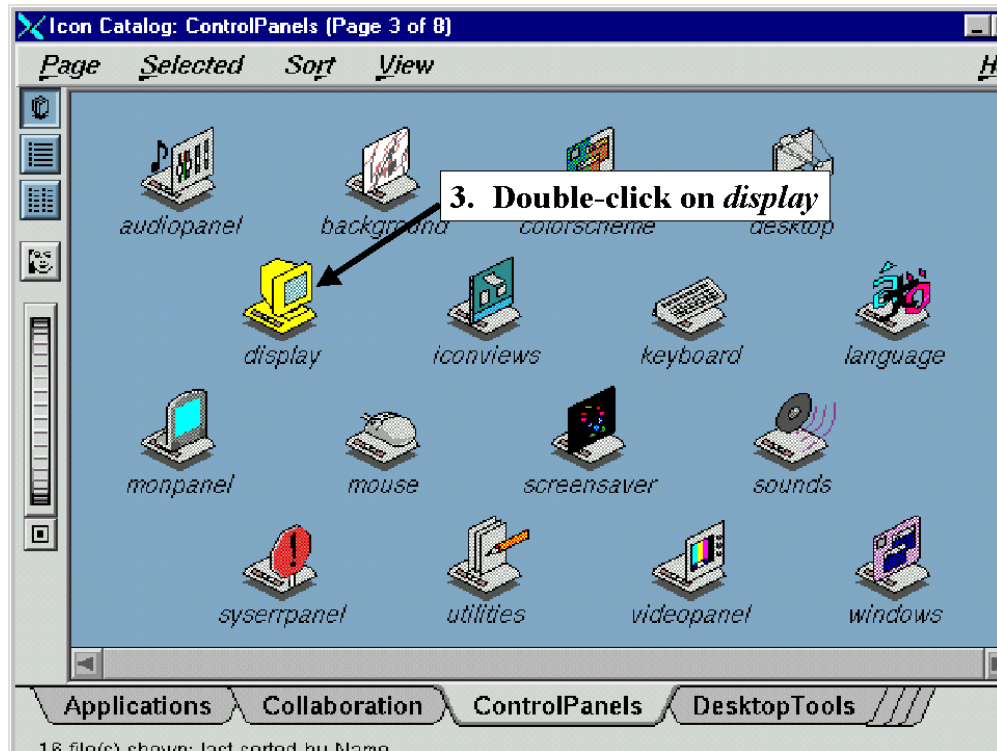
Setting the video system Frequency Rate at a value that the Fixed Rate Barco monitors cannot handle could result in damage to the monitor and a situation where you could NOT recover the correct line rate. You must set the video system to the recommended setting.

**5-6-1 Configuring the System**

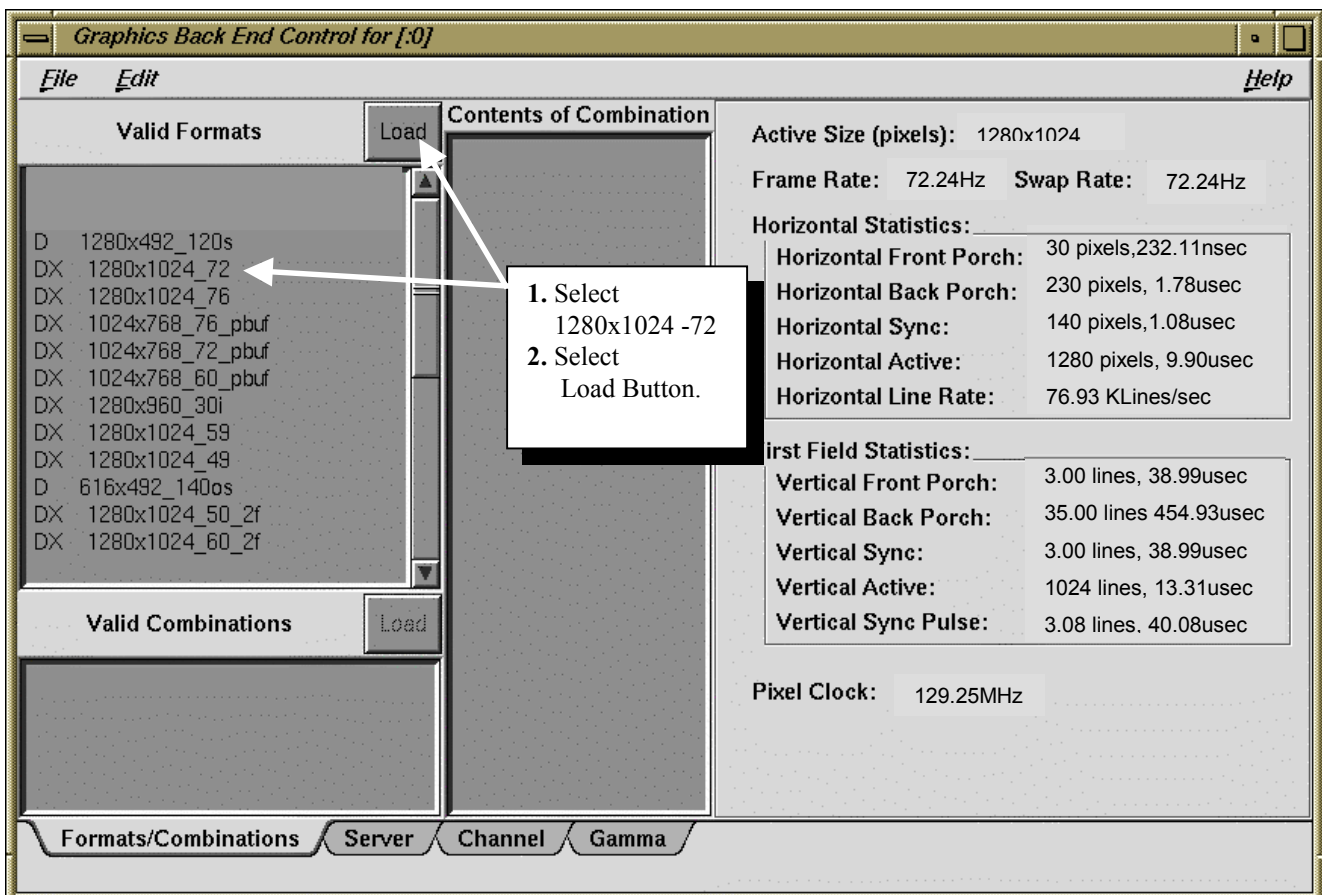
1. From the Service Desktop click on the **C-shell** soft key at the bottom of the window.
2. In the Winterm window login by typing **su <Enter>** and then typing in the password **operator <Enter>**.
3. In the Winterm window prompt type **toolchest&**. A GUI menu like that shown in Illustration 5-1 should, within 20 seconds, display on the screen. Make the selections as shown in Illustrations 5-1 and 5-2.



**TOOLCHEST MENUS**  
ILLUSTRATION 5-1



**DISPLAY SETTING THROUGH CONTROL PANELS**  
ILLUSTRATION 5-2



**LINE RATE WINDOW**  
ILLUSTRATION 5-3

4. From the Display screen select **1280 X 1024 – 72**.
5. Verify that **1280 X 1024 – 72** is highlighted. At the top left of the selection window select **Load**.
6. Answer **Yes** to the two questions about loading the new setting and making it the boot default.
7. The screen will immediately change to the new setting.
8. From the upper left corner of the Graphics Back End Control window select **File → Exit**.
9. From the upper left corner of the Control Panels window select **Page → Exit**.
10. Position the cursor over the **Toolchest** label bar at the top of the Toolchest menu, single-click with the left mouse button and then select Exit from the list of selections to close the Toolchest menu.

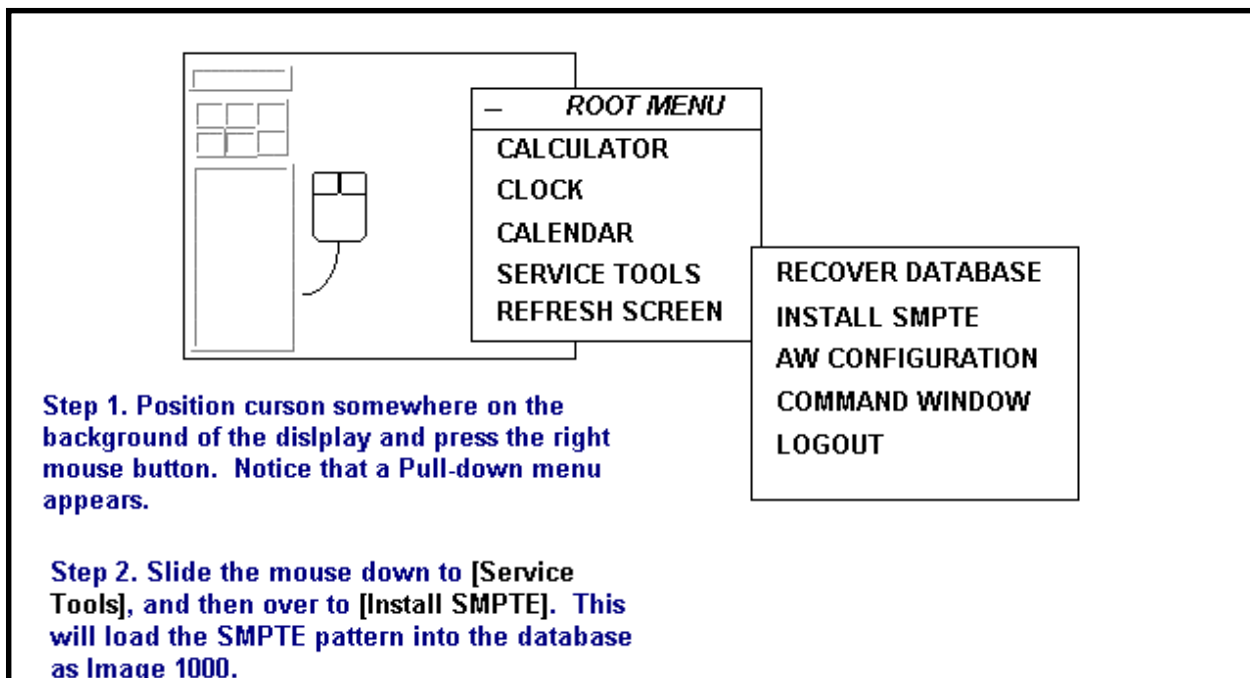
## 5-7 Contrast and Brightness

### 5-7-1 Displaying the SMPTE Pattern

The SMPTE (Society of Motion Picture and Television Engineers) test pattern is used to provide a standard image for calibrating the display.

This test pattern is available on the Operator Workstation Host Computer after has fully booted.

1. Install and display the SMPTE pattern. See Illustration 5-4 for installing and Illustration 5-5 for displaying the SMPTE pattern. See Illustration 5-6 for sample test pattern.



INSTALLING THE SMPTE PATTERN  
ILLUSTRATION 5-4

**Step 1.** Point to and click on the Display (AW) icon. Notice that the Browser comes up.

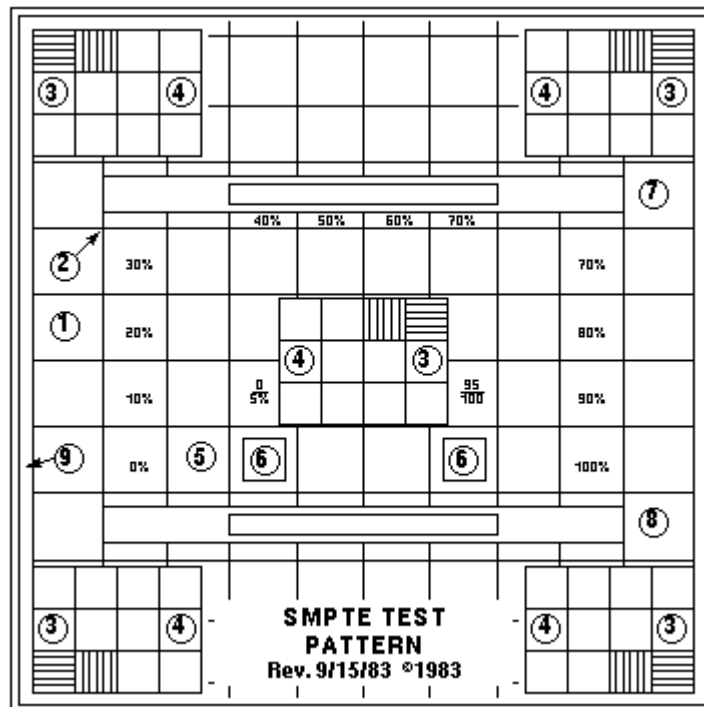
**Step 2.** After the Browser comes up, use the scroll bar on the right side of the display to find Image 1000 SMPTE.

**Step 3.** Point to and single-click on the SMPTE entry.

**Step 4.** Point to and single-click on the Full Viewer to display the SMPTE so that it is full screen size.

**Step 5.** To get back from displaying the SMPTE pattern, hit <ESC>.

**DISPLAYING THE SMPTE PATTERN**  
ILLUSTRATION 5-5



L2462A

**SAMPLE SMPTE TEST PATTERN**  
ILLUSTRATION 5-6

2. With the cursor inside the displayed image, type **"ww 100"** to set window width to 100.
3. With the cursor inside the displayed image, type **"w1 1024"** to set window level to 1024.

## 6- CONTRAST AND BRIGHTNESS ADJUSTMENT

1. With the SMPTE Pattern Displayed, adjust the brightness control of the display monitor to the extreme minimum brightness, see Illustration 5-6.
2. Next, adjust the contrast to the maximum setting that does not cause visible tearing or smearing of the pattern or alpha-numeric characters.
3. Next, adjust the brightness control of the display monitor until the scanning raster for the 0% is barely visible and that the 5% and 95% patches are visible.(item 6). Note that you may need to re-adjust the contrast if tearing or smearing of the pattern or alpha-numeric characters occurred (items 1, 2, 5, 6, 7,& 8).

## 7- CAMERA CALIBRATION

This procedure describes the steps necessary to verify and set the Camera parameters. **Once the display is re-calibrated, it is essential to re-calibrate the camera before the system is used for filming.** Although the steps outlined below are possible for a qualified GE Service Engineer, it is recommended that the following procedure be performed with the Camera Vendor field engineer.

### 7-1 DASM interpolaton method

From the service desktop, select the install icon to modify the DASM. Set the DASM interpolation method to linear.

### 7-2 Optical Density Matching

Note that for optimal reviewing, the light-box luminance of the diagnostic region of the film should be in the range of 50 to 500 nits, as viewed through the light-box.

To calibrate the light-box and film to meet this value, the camera setting for maximum optical density should be varied. A good starting position is a maximum density of 2.8. This is a good starting target for camera calibration. However, the final OD (Operator Display) settings may be refined by the radiologists performing the image review.

### 7-3 Contrast Optimization

1. With the maximum/minimum optical densities set for the review area's light-box, select a look-up table for your camera that will produce a perceivably linear gray scale for the associated light-box and ambient light conditions. Note that the DICOM 3.14 Standard specifies the Barten's curve for linear perception. It is recommended that the manufacturer base perceptual linearity on this curve.
2. Film the SMPTE pattern on a 1-on-15 format display. Verify that the 5% and the 95% levels are visually equivalent. If not, perform a Contrast test with the SMPTE pattern. Select the new contrast setting from the contrast image set. A good value for the Imation Dryview is 3. Use the Camera's calibration procedure to set the contrast setting. Ensure that the camera maintains a perceivably linear gray scale.

#### Note

Filming the SMPTE pattern for contrast calibration may be optional for the camera manufacturer.

3. Ask the technologist to display a clinical image and set window and level controls for desired appearance. A sagittal or axial head image is a good image to start out with.
4. Capture the image on the keypad or host control interface.

5. Print a Contrast Test film. Ask the technologist to select the image that most closely represents the displayed image on the monitor.
6. Observe the image number below the selected image and set the Contrast control to this value.

### **8- ANATOMICAL FILMING**

This portion of the procedure requires the technologist to verify the camera settings with true anatomical images.

Film representative anatomical images to confirm the settings. The image set should include T1 and T2 head images, joint images and c-spines. Observe the accuracy of the low-tones, mid-tones and high-tones. If a filmed image is found not to be not equivalent, re-calibrate the camera based on the customer's evaluation.

## REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
A	10/28/97	K. L-P	This is the first release of this procedure in Toolbook. There are no notes.
2			Added the note regarding ambient lighting and camera calibration.
3			Added note about cycling power to monitor.
4	10/29/97	K. L-P	Added degaussing procedure from Barco manual
5	11/3/97	K. L-P	Added new model procedure/ put document in Word
6	07/19/99	R. Hawthorne	Updated Monitor calibrations to refelect the procedure in FMI 60512 Signa Monitor Calibration/Gamma Adjustment.
7	Oct 19, 2001	D. Hofstetter	Removed all LCD setup procedures and placed them in their own procedures. OW2SCA6.DOC( NEC2000,NEC2010 and NEC2010X) OW2SCA6D.DOC (Eizo L660) and OW2SCA6E.DOC (NEC1850X). Also Modified gamma setup to accommodate all software releases.
8	Nov 8, 2001	D. Hofstetter	corrected several problems with the gamma setting procedure. Added Line Rate Check or adjustment procedure.