TABLE OF CONTENTS

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.**

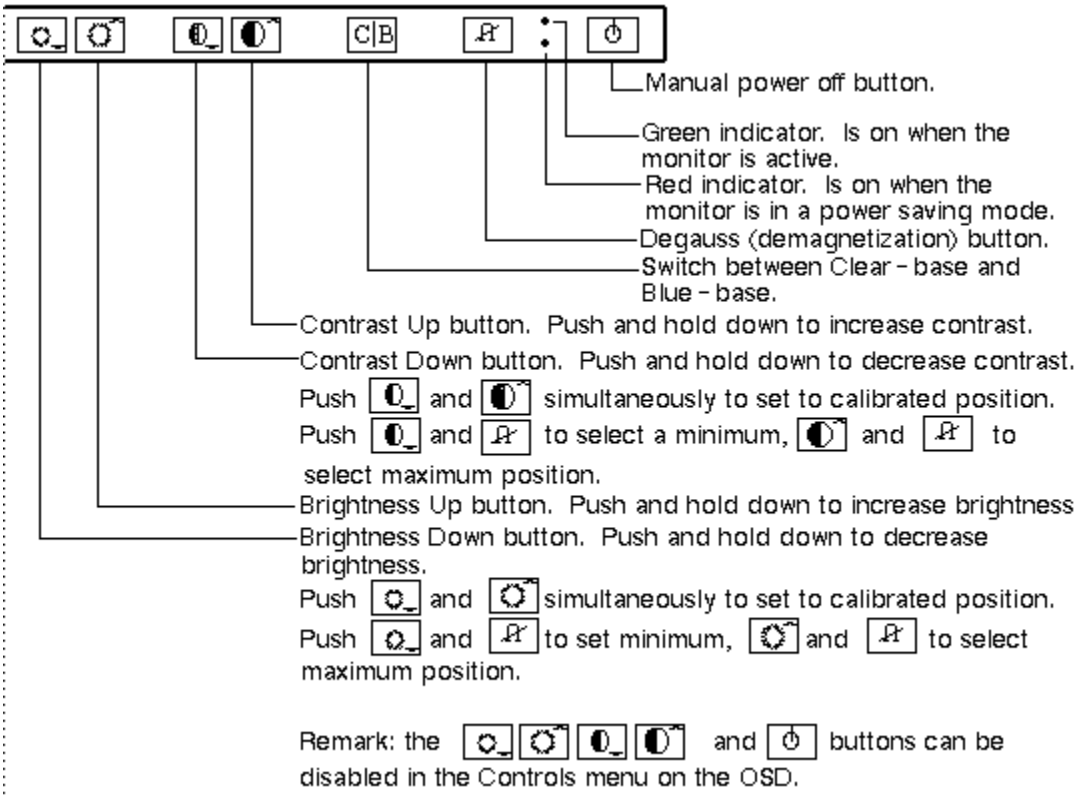
2- MONITOR CALIBRATION CONTROLS

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

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.

Note:

At time of System Installation:

- As of July 28, 2003 all NEW LCD monitors will have a Gamma Software CDROM disk INCLUDED in the box, (GE Part # 2376768) which should be used for software versions based on 9.0 and below. Use this CDROM disk and the instructions it contains to setup gamma for those software versions.

Upon replacement of a failed monitor:
Make sure you also order:
GE Part # 2376768. This CDROM disk is labeled "MR Signa® Host Monitor Gamma Correction Software" contains the most up-to date gamma files needed to setup gamma. The software on the CDROM is required to install a replacement monitor. Follow the installation instructions included with the CDROM disk.

WARNING!

MR SIGNA® HOST MONITOR GAMMA CORRECTION SOFTWARE (GE PART # 2376768) SUPERCEDES ALL OTHER GAMMA FILES THAT MAY BE ON VERSION 14 AND 15 LX/8X SERVICE METHODS CDROM.

5-1 Gamma Configuration for all SGI Computers

Select the section to use based on your Computer type and Software version, using the table at the top of the next page:

GAMMA PROCEDURES BY SECTION

TABLE 5-1

Computer Type:	Software Version:	Gamma Setting:
Octane 1 and Octane 2 (Not valid for Indigo systems)	ALL Software versions 9.0 and below. Setting Gamma with the CDROM disk that came with the monitor.	**See Section 5-1-1**
Octane 1 and Octane 2 (Not valid for Indigo systems)	9.1, HFO2, HF03 Setting Gamma on monitors without a CDROM Disk	**See Section 5-1-2**
All Indigo Computers	ALL Software versions on Indigo systems. Setting Gamma with the CDROM disk that came with the monitor.	**See Section 5-1-1**

5-1-1 Setting Gamma with the Patch CDROM – All Software versions 9.0 and below

- Though Indigo computers cannot run 9.0 software, this section does apply to all Indigo computers with 8.3 and below.
- If you are replacing a failed CRT Monitor, then a CDROM labeled: MR Signa® Host Monitor Gamma Correction Software, (GE Part # 2376768) should have been ordered along with the replacement CRT monitor. The installation instructions are included with the CDROM disk and should be followed to load the gamma software on the system.
- This CDROM disk should be retained and re-used any time a reload of software occurs on the system.
- If you do not know the software version, type “getver” in a c-shell.

This option is used to configure a CRT to set gamma:

- **If you are replacing the same model and make of CRT and have not reloaded software:** No gamma changes are necessary. Proceed to Subsection 6 -Setting Default Contrast and Brightness for the LCD Monitor.

- **If you are replacing the same model and make of CRT and have reloaded software:** Proceed to STEP 1 below:

1. Insert the “MR Signa® Host Monitor Gamma Correction” CDROM into the Host CDROM/DVDROM drive.

2. Follow the instructions included with the CDROM to set the gamma for your CRT monitor type.

3. Proceed to section 6.

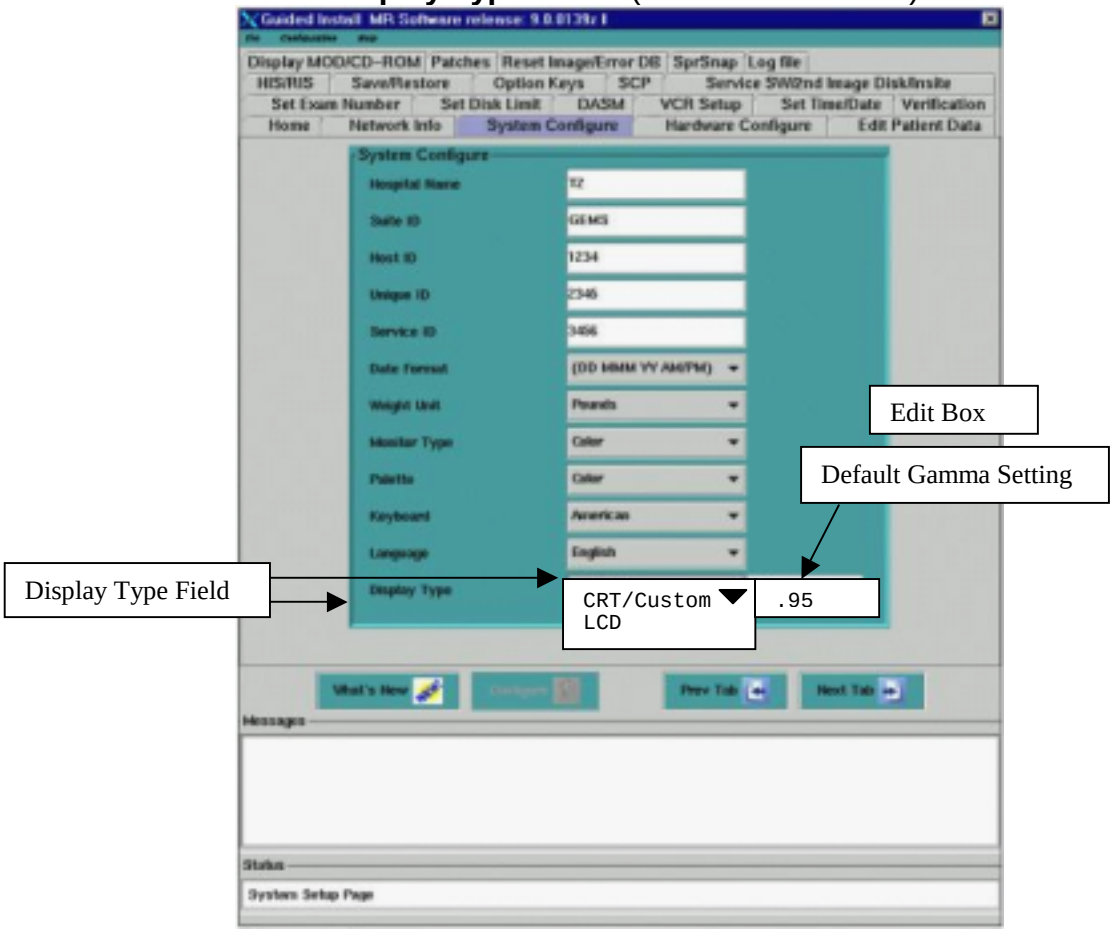
5-1-2 Setting Gamma - 9.1, HF02 and HFO3. (This Section not valid for Indigo systems)

This option is used to configure a CRT to set gamma:

- **If you are replacing the same model and make of CRT and have not reloaded software:** No gamma changes are necessary. Proceed to Subsection 6 -Setting Default Contrast and Brightness for the LCD Monitor.

- **If you are replacing the same model and make of CRT and have reloaded software:** Proceed to STEP 1 below:

1. Open Guided Install and select **System Configure** tab. Refer to illustration 5-1.
2. Look for the "**Display Type**" field. (See Illustration 5-1)



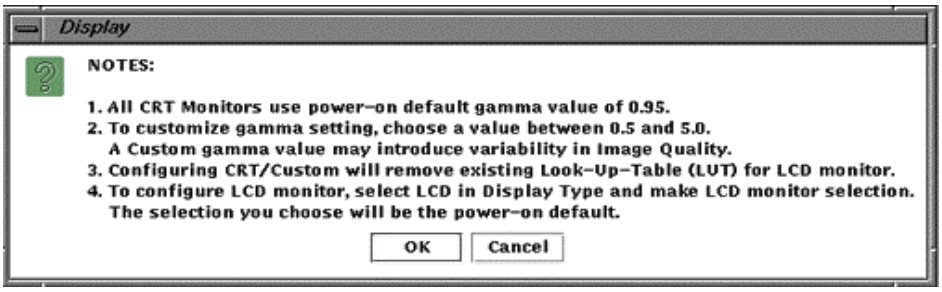
GUIDED INSTALL GUI "SYSTEM CONFIGURE" TAB- DISPLAY TYPE FIELD
ILLUSTRATION 5-1

Note:

It may be necessary to "Toggle" between the "**LCD**" and "**CRT/Custom**" options in the Display Type Field to select "**CRT/Custom**".

1a. If "**LCD"** is displayed in the Field:
   a. Click on the "Display Type Field: ▼
   b. Select **CRT/Custom**.
   c. A Popup Display message will appear, Select [**OK**] (See illustration 5-2)

d. The Field should change to [CRT/Custom] and the cursor should be in the “Edit box”. (See Illustration 5-2)



MESSAGE BOX
ILLUSTRATION 5-2

e. Start with the default value as indicated in Table 5-2. **If the customer does not like this value, enter the desired alternate gamma value** in the “Edit box” To the right, and <**Enter**>.

TABLE 5-2
NOMINAL VALUES

CRT Monitor	Nominal Gamma value
MDW321	0.95
MDW321+	1.1
All Other B/W	0.95
All Other Color	1.1

Note:

A Higher number will increase Brightness & Contrast; A lower number will decrease Brightness & Contrast. The Gamma Value of any LCD is highly dependent on the LCD and Display hardware as well as the Customers’ eye. This can vary a great deal from site to site.

f. Click on the [**Configure**] Button on the Install GUI to save the changes. If you changed the gamma value you will see a slight change in the screen intensity when “Configure” is complete.
g. A Popup message box will appear, Select **OK.**
h. Select **File** and **Exit** and **OK** from the Install/Reconfigure GUI Window.
i. **Reboot the System**. A reboot is required to activate the changes.
j. Proceed to Section 6.

1b. If “**CRT/Custom”** is displayed in the Field:

a. Start with the default value as indicated in Table 5-2. **If the customer does not like this value, enter the desired alternate gamma value** in the “Edit box” To the right and [**Enter**].
b. A Popup Display message will appear, Select [**OK**] (See illustration 5-2)
c. Click on the [Configure] Button on the Install GUI to save the changes. If you changed the gamma value you will see a slight change in the screen intensity when “Configure” is complete.
d. A Popup message box will appear, Select **OK.**

e. Select **File** and **Exit** and **OK** from the Install/Reconfigure GUI Window.
f. **Reboot the System**. A reboot is required to activate the changes. This completes the Gamma Calibration process. Proceed to Section 6- Setting Default Contrast and Brightness for the LCD Monitor.

6- CHECKING MONITOR FREQUENCY RATE AND RESOLUTION

The system software defaults to the proper monitor resolution and scan rate. The Barco Monitors are Fixed Rate monitors. The will only operate at 1280X1024 _72Hz settings. The default frequency is 72Hz.

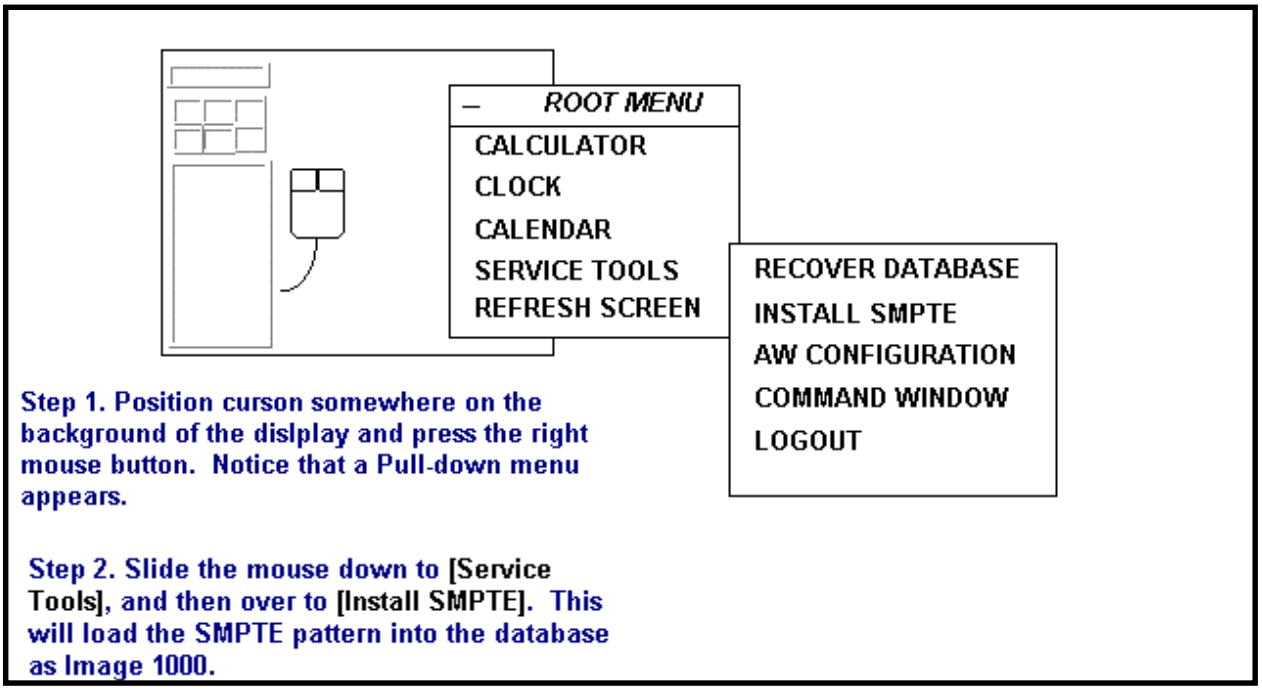
1. If it becomes necessary to check the Frequency Rate and Resolution refer to appendix A of this document. If the monitor is synced and properly displaying data this entire section can be skipped. Proceed to Section 7.

7- SETTING CONTRAST AND BRIGHTNESS

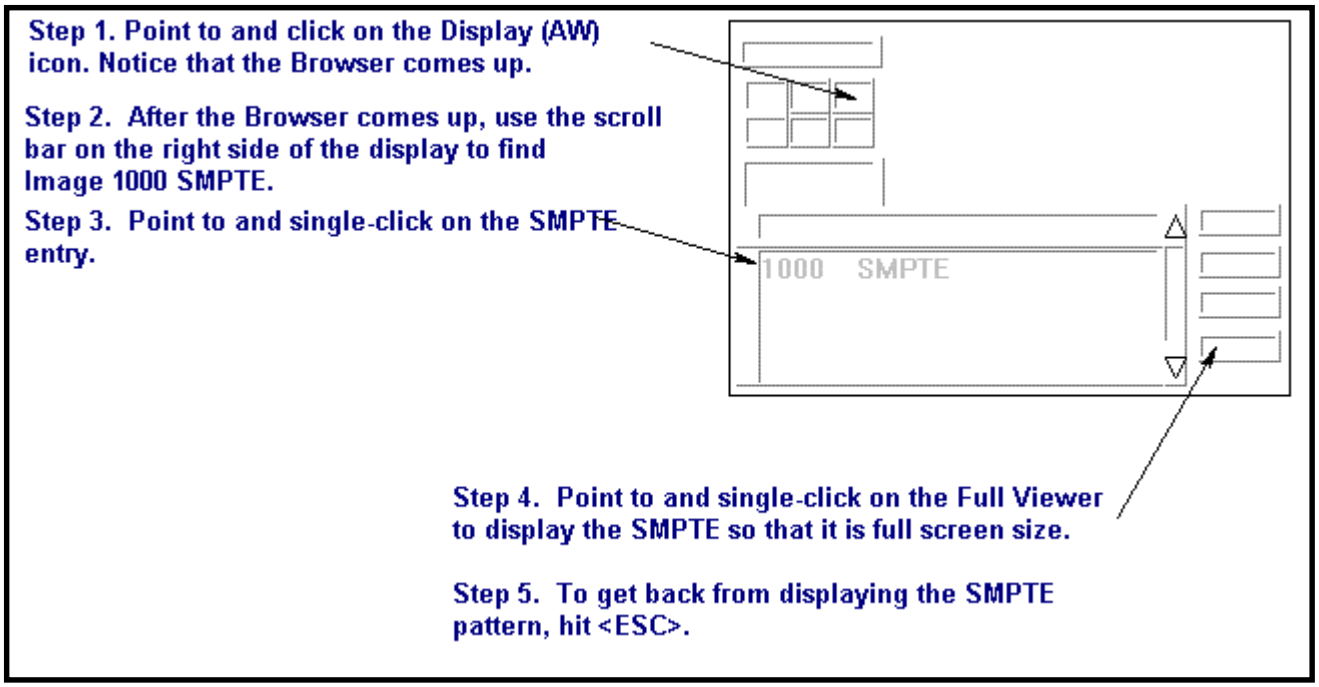
7-1 Displaying the SMPTE Pattern

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.

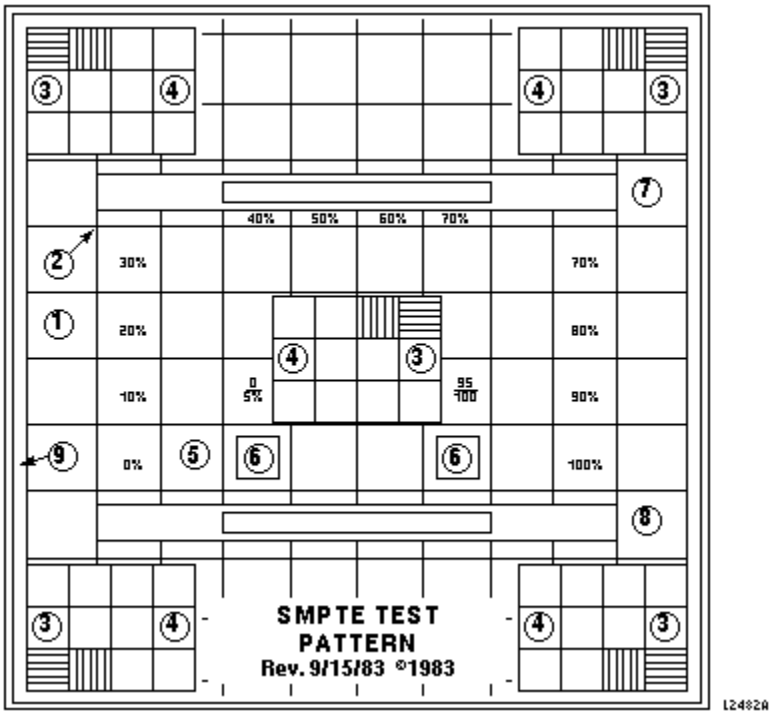
1. Install and display the SMPTE pattern. See Illustration 7-1 for installing and Illustration 7-2 for displaying the SMPTE pattern. See Illustration 7-3 for sample test pattern.



INSTALLING THE SMPTE PATTERN
ILLUSTRATION 7-1



DISPLAYING THE SMPTE PATTERN
ILLUSTRATION 7-2



SAMPLE SMPTE TEST PATTERN
ILLUSTRATION 7-3

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 "**wl 1024**" to set window level to 1024.
4. With the SMPTE Pattern Displayed, adjust the brightness control of the display monitor to the extreme minimum brightness
5. Next, adjust the contrast to the maximum setting that does not cause visible tearing or smearing of the pattern or alpha-numeric characters.

6. 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.(See item 6 in Illustration 7-3). 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).

8- 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.

8-1 DASM interpolaton method

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

8-2 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.

8-3 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.

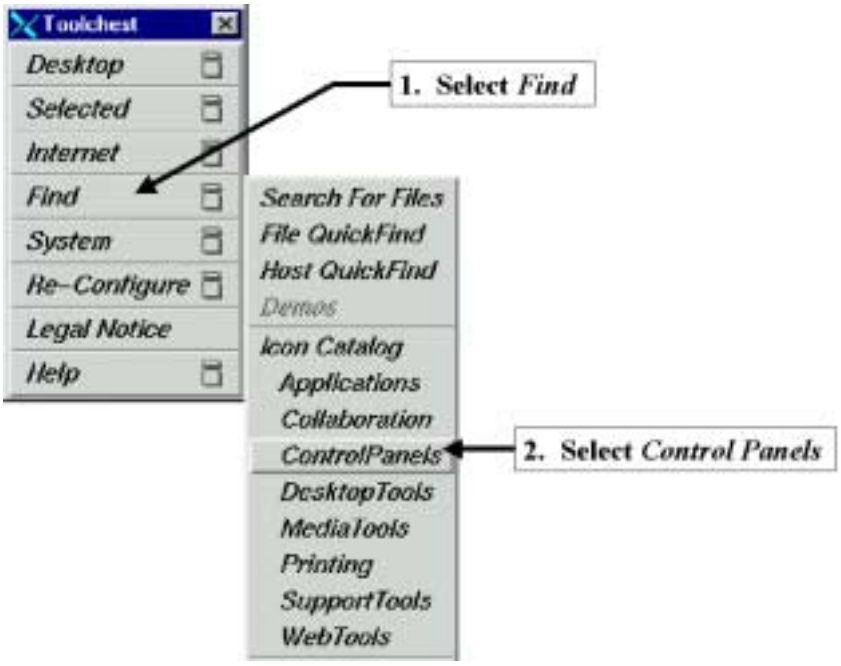
9- ANATOMICAL FILMING

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.

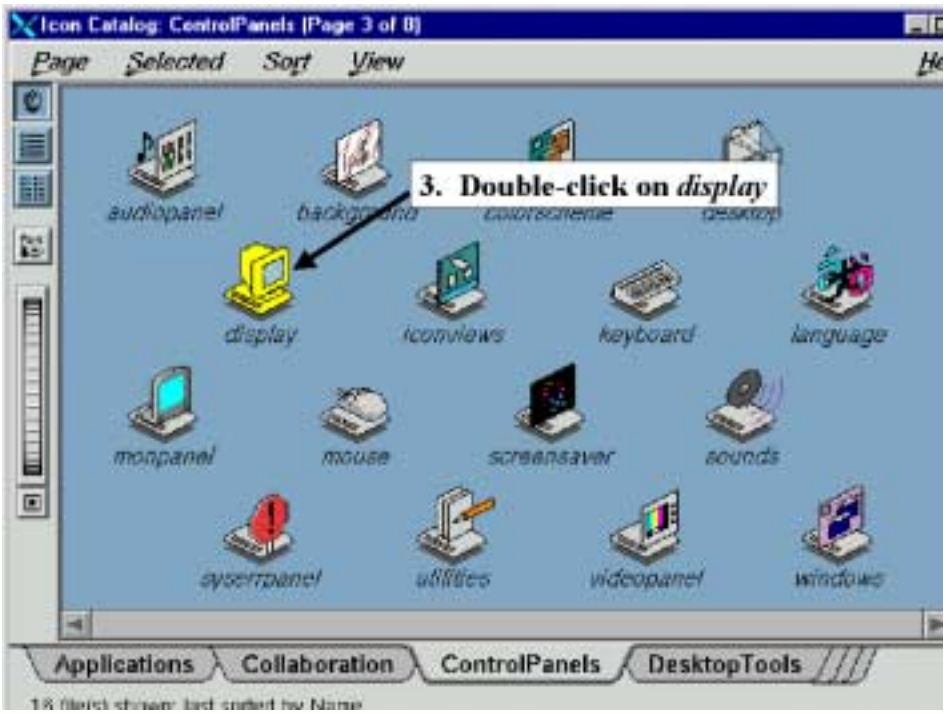
A- APPENDIX A

A-1 Checking the Swap and Frame Rate using the System Tools

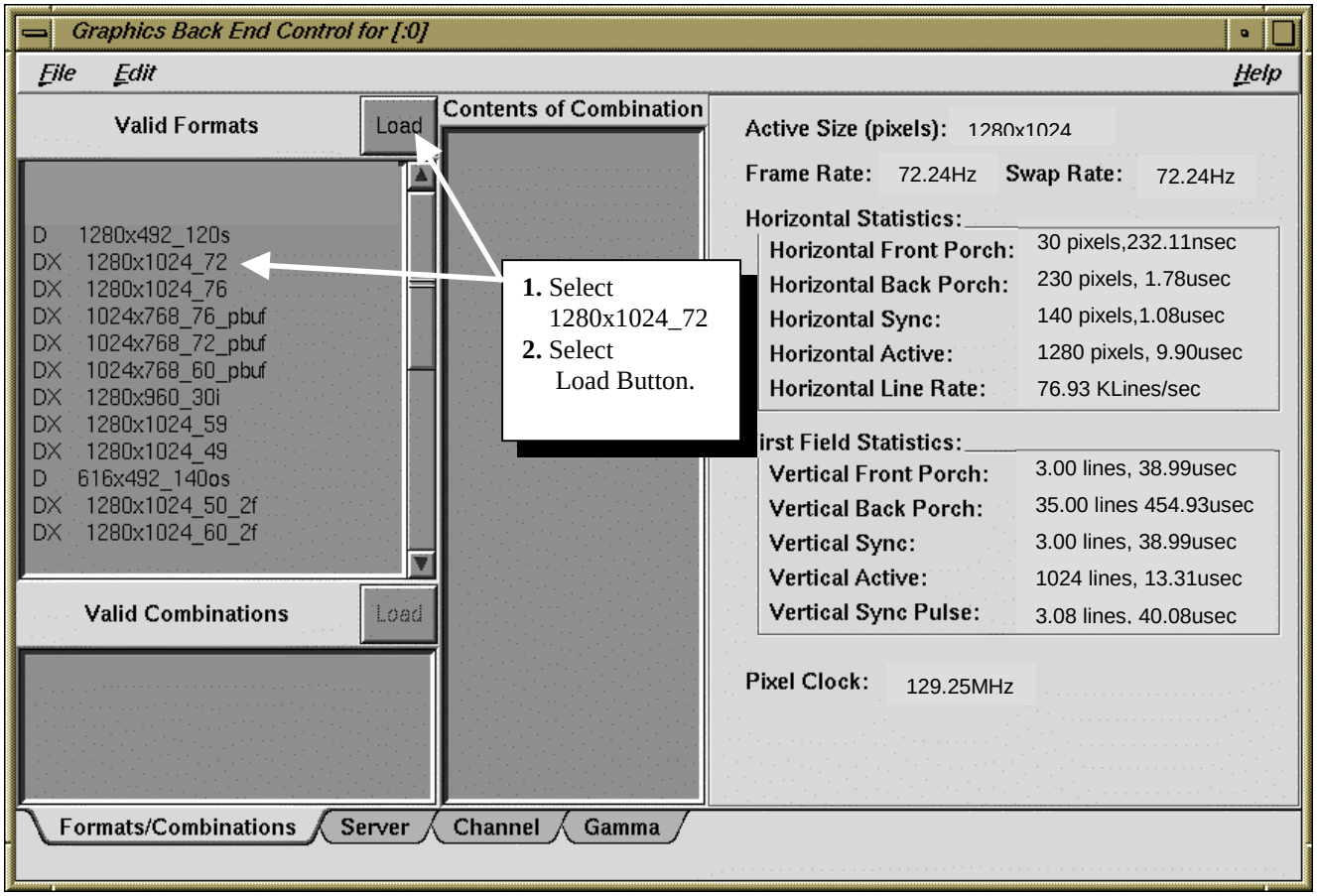
2. From the Service Desktop click on the **C-shell** soft key at the bottom of the window.
3. In the Winterm window login by typing **su <Enter>** and then typing in the password **operator <Enter>**.
4. In the Winterm window prompt type **toolchest&**. A GUI menu like that shown in Illustration A-1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



TOOLCHEST MENUS
ILLUSTRATION A-1



DISPLAY SETTING THROUGH CONTROL PANELS
ILLUSTRATION A-2



LINE RATE WINDOW
ILLUSTRATION A-3

5. Verify that **1280 X 1024_72** is highlighted.

WARNING!

DO NOT SET THE CRT TO ANY OTHER SETTING! DOING SO, WILL RESULT IN AN UNRECOVERABLE "OUT OF SYNC" CONDITION AT THE NEXT REBOOT. THE ONLY WAY TO RECOVER FROM THAT CONDITION IS TO RELOAD SOFTWARE.

6. From the upper left corner of the Graphics Back End Control window select **File → Exit**.

7. From the upper left corner of the Control Panels window select **Page → Exit**.

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.

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.
9	Feb 26, 2003	D. Hofstetter	Added instructions for software versions 9.1 and HFO2
10	Mar, 5, 2003	D. Hofstetter	Added table 5-2 of nominal values
11	July 25, 2003	D. Hofstetter	Removed old gamma update processes and added the new one. Added an appendix for checking the Swap and Frame Rates.