Discovery CT590 RT
Optima CT580
Discovery RT

Installation Manual
Book 2 of 2: Electrical Calibration, Integration & Testing

OPERATING DOCUMENTATION

5366637-1EN
Rev 23

Book 2 of 2: Electrical Calibration, Integration & Testing

Pages 231 - 380

Effectivity

The information in this manual applies to the following CT Scanner:

- Discovery CT590 RT
- Optima CT580
- Discovery RT

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Chapter 4
Electrical Introduction

NOTICE **Potential for Data Loss and/or Equipment Damage.**

To prevent potential data loss and equipment damage, please do the following:

- **Record data collected from the procedures in this chapter into Form e4879 when directed.**
- **Only use the Installation manual that existed in SIMS content viewer. Any other revisions of this manual may not exactly match your system.**

Section 1.0
Introduction

Use the continuity and ground checks to verify the system power connections have not shorted to ground and that the ground and neutral connections are intact.

Section 2.0
Review Mechanical Hand Off Material

Complete the Mechanical Hand Off checklist:

- ❒ All options were installed. If not, contact your install specialist.
- ❒ Check for short ships.
- ❒ Review cable connections with mechanical team.
- ❒ Complete mechanical vendor evaluation.

Section 3.0
Training

This product requires a trained FE to proceed with the calibrations in this section.

Section 4.0
Required FE Common Tools and Supplies

4.1 FE Calibration and Service Tool List

Note: Items with a “check” (√) are included in the Install Support Kit.

Special CT Tools used for mechanical alignments:

- √ 5mm hex bit for 3/8” drive 6" long (Snap-On FAML5E or equivalent)
- √ 10mm hex bit for ratchet wrench (ball end) (Snap-On FABM10E or equivalent)
- √ 2.5mm Allen hex bit for ¼"
- • Standard FE Tool Kit
- • Torque Wrench Kit
- √ 10mm open-end thin wrench (Snap-On SRSM10 or equivalent)
- √ 21mm open-end thin wrench (Snap-On LTAM2124 or equivalent)
- √ 14mm ball hex socket bit for 3/8” drive
- √ 14 mm hex socket bit for ½" drive

4.2 Electrical Tools

These tools must be calibrated yearly.

- Fluke 87 DVM or equivalent
- Clamp on amp meter

4.3 Image Quality Calibration Tools

- GE Performance Phantom
- QA Phantom (2206352)
  - 24cm (2144721)
  - 48cm (2144721-2)
  - Phantom Holder

4.4 Detector Service Tools

A DAS/Detector Service Kit (PN 2344539) is included in the Install Support Kit.

- Aero Duster
- AMAX Contact Cleaner

4.5 Optional Tools

Needed for warranty recalibration:

- GE HV Bleeder
- Scope with 10X probes
- Beckman CT231 clamp-on Amp probe: 46-194427P228 (Fits up to #2 size wire)
- Beckman CT232 clamp-on Amp probe: 46-194427P270 (Fits #1 size wire and larger)
- Scope Probe-to-bleeder Cable 46-219921G1 (Belden #8422 cable, 30 ft)
- Polaroid type 52 film and developer
- Radial dial indicator (mm or inches) and mounting bracket
- Caliper Dial indicators (mm or inches)
- Ground Rod Tester Clamp on Amp Probe

4.6 Safety Materials

Note: Items with “checks” (√) are included in the Install Support Kit

√ Lockout/Tagout kit, or equivalent

√ Nitrile Rubber Gloves

- Safety Glasses

4.7 Cleanliness

Any dirt on the surface increases leakage current on the filter or converter cards and causes the DAS to fail the drift spec. Wear Nitrile gloves (part number 2207303-6 [large] and 2207303-7 [extra large]) when you handle the DAS, because fingerprints on the board can cause problems during humid conditions. Use only clean, new Nitrile gloves. Do not use hospital grade gloves.

NOTICE **NEVER USE AN ERASER TO CLEAN ANY PART OF THE DAS.**

DUST COVERS REQUIRED for installations on construction sites.

Section 5.0 Requirements/Assumptions

- This procedure will be performed by an appropriately trained engineer.
- All stations in a suite must have the same SUITE ID.
- You need the name of all hosts in the suite and their corresponding Internet/Ethernet numbers.
- You need the Internet (IP) addresses the first time you execute a reconfig on the system.
  - When you connect the system to a network, contact the system administrator to obtain the IP addresses for all the computers in the suite.
  - You also need an IP address for each gateway (second) ethernet board in any OC or IC.
  - You can use the default internet number on stand-alone systems (stand-alone = not connected to any network).
- For more detailed information and instructions regarding Network Integration, see Chapter 7 on page 335.

Section 6.0 FE Workflow

1.) Review mechanical hand-off material.
2.) Obtain required FE common tools and supplies.
3.) Perform electrical power-on and ground checks.
4.) Gather all customer information needed for reconfiguration.
5.) Perform computer integration.
6.) Complete Table/Gantry integration.
7.) Complete the calibration process.
8.) Perform tube warm-up and fast calibration.
9.) Complete tomographic plane indication.
10.) Run image series tests.
11.) Run system functional test.
12.) Create system state DVD / USB.
13.) Perform PatientTouch Leakage test.
14.) Perform the CT System Chassis Leakage test, as required by local code.
15.) Complete installation and verification of any customer options.
16.) Complete and return GE Form e-4879 Installation Data Verification for all installations.

Section 7.0
Checklists for Completed Installation

Complete the installation tasks listed below and check the appropriate boxes here and on the GE e-4879 form to verify the completion of these tasks. Section 8.1 contains an explanation of the GE e-4879 form, which the FE must complete and submit for ALL installations.

7.1 System-Level

7.1.1 General

- ❒ HVAC system is operational and environmental data reported on the GE e-4879 form.
- ❒ System realignments completed, if required.
- ❒ Broadband installed and operational.
- ❒ Power and ground audit completed.

7.1.2 Optional and Regional

- ❒ Seismic mounting kit installed, if required in your area.
- ❒ Generator recalibration completed, if necessary.
- ❒ Collimator recalibration completed, if necessary.

7.2 Site Clean Up

- ❒ All DVDs / USBs for customer options placed in the GE service cabinet.
- ❒ All system software and service tools placed in the GE service cabinet.
- ❒ System cleaned and nicks touched-up with paint.
- ❒ Installation site cleaned and all trash properly disposed.

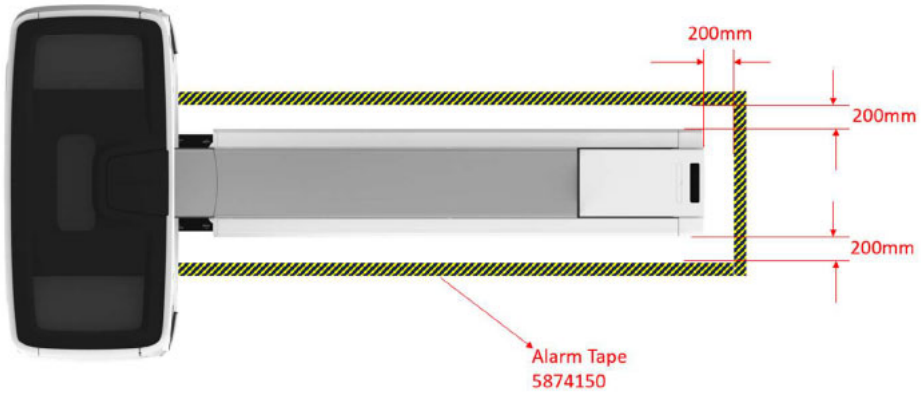
7.3 Alarm Tape Attaching (only for GT Table)

The alarm tape (5874150, shipped with table ship collector) is use to mitigate some damage risk of GT table covers. FE should communicate with customer and attach it to scan room floor.

Figure 4-1 Alarm Tape

1.) Clean the scan room floor with proper method depend on customer floor material, wait for the floor fully dry.
2.) Move table to the lowest position.
3.) Attached the Alarm Tape(5874150) firmly on the floor, position refer below illustration.

Figure 4-2 Alarm Tape Attaching Position



4.) Leave the rest of Alarm Tape to customer for further refresh when the tape rubbed.

7.4 Dolly Return

❒ Return of dollies arranged and dolly pick-up confirmed.

7.5 Options

Check the appropriate boxes here and on the GE e-4879 form to verify the installation and proper functionality of all customer-ordered options.

❒ Injector installed and operational.
❒ Advantage Windows Workstation installed and functional tests completed.
❒ Advantage 4D installed and functional tests completed.
❒ Prospective Respiratory Gating Option.
❒ Filming/Camera/DASM installed and operational.
❒ Modem installed and functional tests completed.
❒ UPS installed and functional tests completed.
❒ Network items installed and functional tests completed.
❒ Customer software options installed and operational.
❒ Teleradiology connections completed.
❒ Remote monitor installed and operational.
❒ Bar code reader installed and operational.
❒ Cardiac monitor and stand installed and operational.

7.6 Paperwork (Final Activities)

- ❒ GE e-4879 form completed; see Section 8.1. (Required for installations in ALL countries.)
- ❒ FDA 2579 form completed; see Section 8.2. (Required ONLY for U.S. installations.)
- ❒ Any Complaints that you encountered have been reported.
- ❒ All FMIs for system completed, if necessary.
- ❒ All dispatching activities (03-04-10 codes) completed.
- ❒ Customer acceptance checks completed.
- ❒ System transfer completed and appropriate GE personnel notified.
- ❒ All outstanding customer installation issues have been addressed.

Section 8.0
GE and Regulatory Forms

Field Engineers must complete and submit the documents listed in Section 8.1 for ALL installations, regardless of the country. In addition, for installations performed within the United States, Field Engineers must ALSO complete and submit the documents listed in Section 8.2.

8.1 All Countries

8.1.1 GE e-4879 Form

The Field Engineer should:

1.) Locate the GE e-4879 form on the SIMS Contents Viewer
2.) Complete the form.
3.) E-mail the completed form to the HHS Administrator

8.1.2 Product Locator Cards

The Field Engineer should:

1.) Enter the Product Locator Card information on the Product Locator Web site. Go to the following address to access the site: http://gib.gehealthcare.com/gib/gib_entry.jsp
2.) Leave ONE (1) Product Locator Card (or a copy) at the customer site for EACH piece of equipment installed there.

Note: CT Manufacturing completes GE HHS Data Sheets and provides them to the HHS Administrator.

8.2 U.S. Installations Only

8.2.1 FDA 2579 Form

The Field Engineer should:

1.) Download the FDA 2579 form from the HHS Support Central Web site: http://supportcentral.ge.com/products/sup_products.asp?prod_id=16442
2.) Complete the form.
3.) E-mail the completed form to the HHS Administrator.

Note: Do NOT print this form after completion. The HHS Administrator will e-mail a printable version to the FE for customer site records.

NOTICE **Some states require a State Registration Number to complete this form. For any questions concerning your state, contact the HHS Administrator or check the HHS Support Central Web site.**

Some states may also require additional information and test information. For instructions, contact the Project Manager of Installation.

8.2.2 System Chassis Ground Leakage Test Form

The Field Engineer should:

1.) Locate the System Chassis Ground Leakage Test form on the Service Methods.
2.) Complete the form, if required in your area.
3.) Forward the results as instructed on the form.

Chapter 5
Electrical Integration and Safety Verifications

NOTICE **Potential for Data Loss and/or Equipment Damage.**

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- **Record data collected from the procedures in this chapter into Form e4879 when directed.**
- **Only use the Installation manual that existed in SIMS content viewer. Any other revisions of this manual may not exactly match your system.**

Section 1.0
Electrical Power ON & Ground Checks

WARNING **THIS PROCEDURE MEASURES POTENTIALLY HAZARDOUS VOLTAGES. USE AND FOLLOW LOCKOUT/TAGOUT PROCEDURES.**

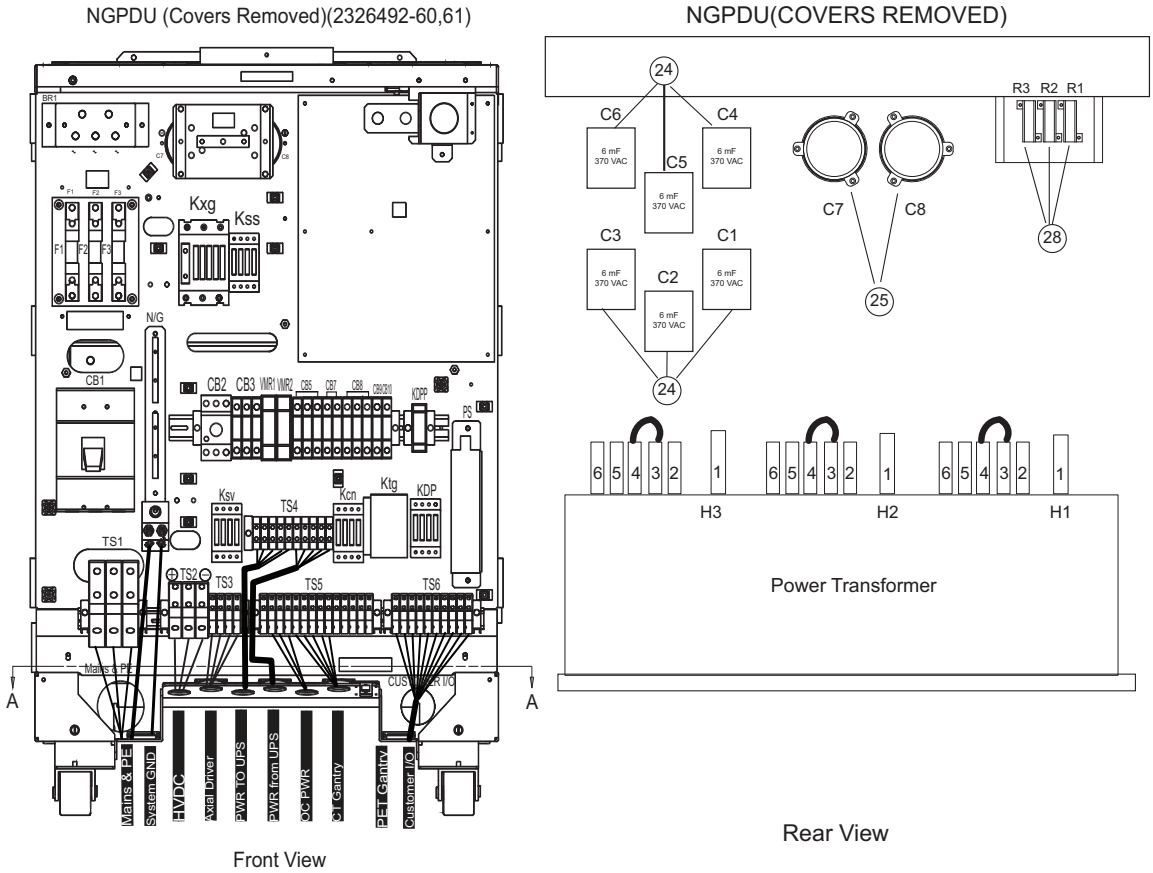


Figure 5-1 NGPDU-60

1.1 Required Tools

- Multimeter with a rating of at least 1000 volts
- Multimeter leads with a rating of at least 1000 volts

1.2 Initial PDU Configuration

WARNING **THIS PROCEDURE MEASURES POTENTIALLY HAZARDOUS VOLTAGES. USE AND FOLLOW LOCKOUT/TAGOUT PROCEDURES.**

1.2.1 Circuit Breakers

Set all circuit breakers to OFF

1.2.2 Relay Board

1.) Set SW to the normal position.

2.) When system is already, three lamps are both lighting (refer to Figure 5-2).

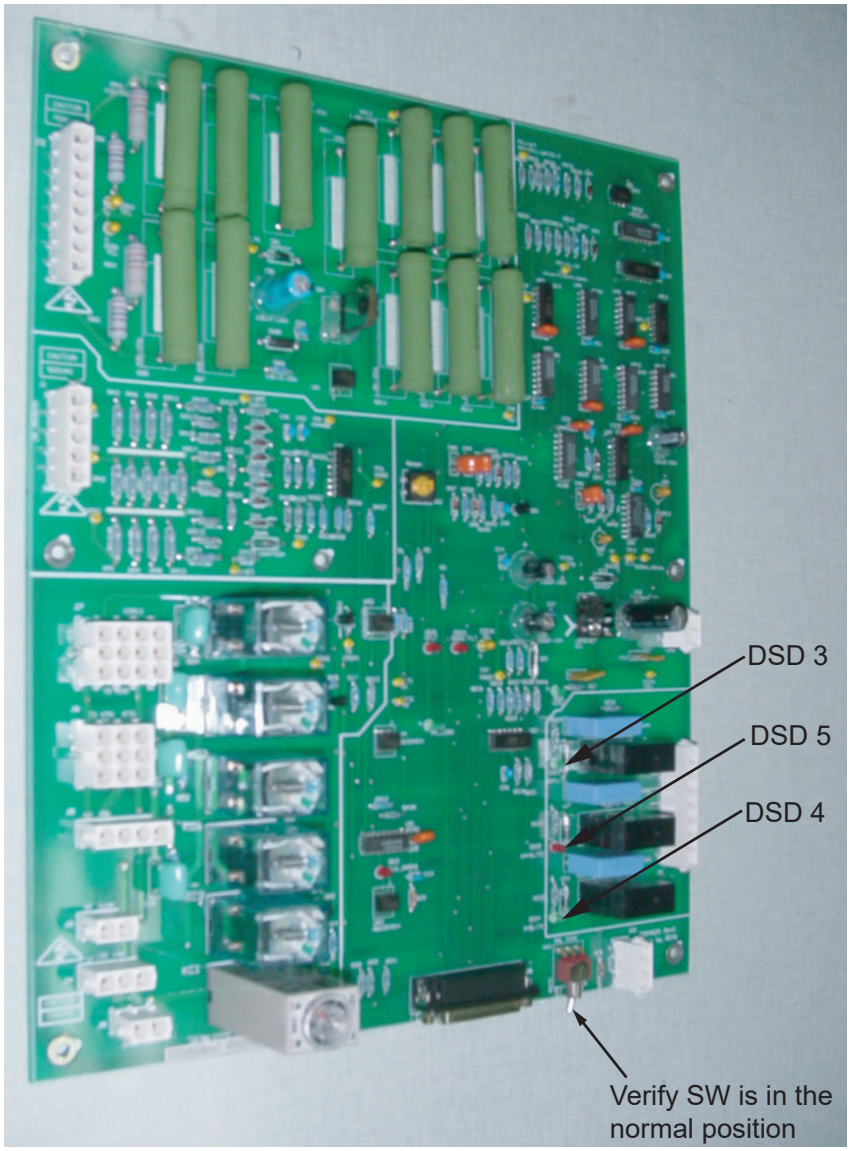


Figure 5-2 NGPDU Control Board

1.2.3 Power Switches

Turn OFF all power switches on all subsystems

- Gantry
- DAS
- Table
- Console

1.2.4 Hardware and Connection Check

Use this step to check mechanical connections and tighten anything that may have shaken loose during shipment. Verify **all** hardware and connections in the PDU are securely fastened.

- PDU
- Gantry
- Table
- Console

1.2.5 Covers

Install, or verify the presence of, all the lexan safety covers for the PDU.

1.3 Suite Emergency Off Checks SEO

WARNING **VERIFY ALL PERSONNEL HAVE CLEARED THE SYSTEM BEFORE YOU TURN ON WALL POWER.**

1.) Turn wall power ON to the PDU.

2.) Press the suite emergency off button and verify it turns off wall power to the PDU.

[Typically, this red palm button is located on the wall close to the console, within the scan suite.]

3.) Verify that all “Emergency Off” button are working properly.

4.) Leave power “OFF”

1.4 Line Transformer Settings

WARNING **MAINS VOLTAGE MAY VARIABLE FOR DIFFERENT COUNTRY (REGION). MAKE SURE TO SET THE APPROPRIATE PDU TAPS CONNECTIONS.**

1.4.1 Requirements

1.) The PDU is shipped configured for 480VAC.

2.) Complete only if your site uses a voltage other than 480VAC.

3.) If PDU is configured for 480VAC, go to 1.5. Otherwise, proceed to Section 1.4.2.

WARNING **MAKE SURE YOU TURNED OFF, TAGGED AND LOCKED THE MAIN WALL POWER BEFORE YOU CHANGE TAPS. FAILURE TO DISCONNECT POWER AT MAIN INPUT MAY RESULT IN ELECTROCUTION. TURN OFF WALL POWER TO CONNECT OR MOVE METER LEADS, OR TO REMOVE OR INSTALL COVERS.**

NOTICE **TAPS SHOULD BE SHIPPED AS SHOWN FOR 480VAC ONLY. FOR ALL OTHERS, YOU MUST MOVE THE TAPS. THE TAP CHECK SHOULD BE COMPLETED BY THE MECHANICAL INSTALLER.**

1.4.2 Line Input Conditions

1.) Monitor the No Load Line to Line Voltage at L1, L2, L3, during the workday. Do not record this data during “brown out” conditions.

2.) After you determine the nearest nominal line, verify the tap connections match (refer to Table 5-1 and Figure 5-3 for tap locations).

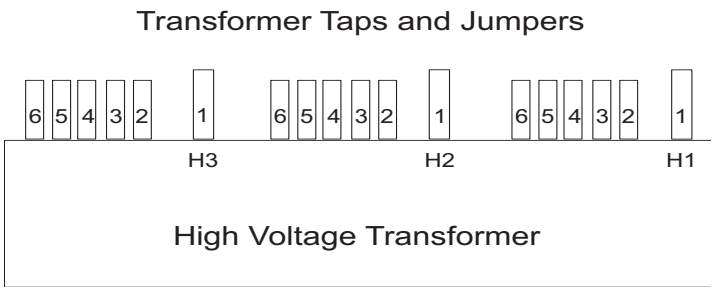


Figure 5-3 PDU Tap Positions (Rear)

3.) Verify that the No Load Line to Line Voltage never falls outside the corresponding minimum and maximum values listed in Table 5-1.

4.) Use a 0-750 AC voltmeter of 3/4% accuracy to measure the line-to-line voltages at L1, L2, and L3.

- Verify the highest line-to-line voltage does not exceed 1.02 times the lowest voltage.
- **Example:** If the lowest voltage equals 474, the highest voltage should not exceed 474 x 1.02 = 483.5 volts.

WARNING **THIS PROCEDURE MEASURES POTENTIALLY HAZARDOUS VOLTAGES. USE AND FOLLOW LOCKOUT/TAGOUT PROCEDURES.**

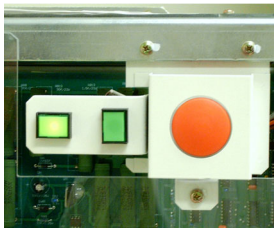
NO LOAD **Line to Line Voltages**		**TAP CONNECTIONS** **(All 3 phases must have same the configuration)**		
Nominal	Maximum Range (10%)	Phase A Connection	Phase B Connection	Phase C Connection
480V*	432 to 528*	3-4*	3-4*	3-4*
460V	414 to 506	3-5	3-5	3-5
440V	396 to 484	3-6	3-6	3-6
420V	378 to 462	2-4	2-4	2-4
400V	360 to 440	2-5	2-5	2-5
380V	342 to 418	2-6	2-6	2-6
240V	216 to 264	1-4	1-4	1-4
220V	198 to 242	1-5	1-5	1-5
200V	180 to 220	1-6	1-6	1-6
* Factory Default				

Table 5-1 PDU Line Tap Connections

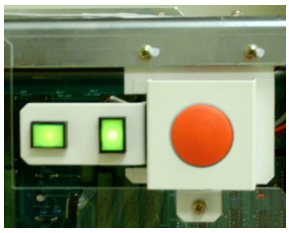
1.5 System Power Up

CAUTION **Verify all personnel have cleared the system before you turn on wall power.**

1.) Turn ON A1 breaker panel.
2.) Turn ON all system power switches and breakers (table, gantry, PDU, console).
   - ALL PDU breakers
   - Make sure that the on/off button (on the front PDU panel) is ON for console power.



PDU Power Switch Off



PDU Power Switch On

   - Gantry power pan breaker
   - Gantry slip ring ground fault breaker on stationary base right side & all service switches
   - Table base power
   - Console power (Check internal breaker.)

SUB-SYSTEM POWER-UP

1.) Turn ON switch S3 in the table (120vac 24hr power).
2.) Turn ON the Gantry **120VAC**. (Light should turn on.)
3.) Turn **AXIAL DRIVE ENABLE** ON. (Light should turn on.)
4.) Turn **HV DC ENABLE** ON. (Light should turn on.)
5.) Push the Service Switch Panel reset button (see Figure 5-4).

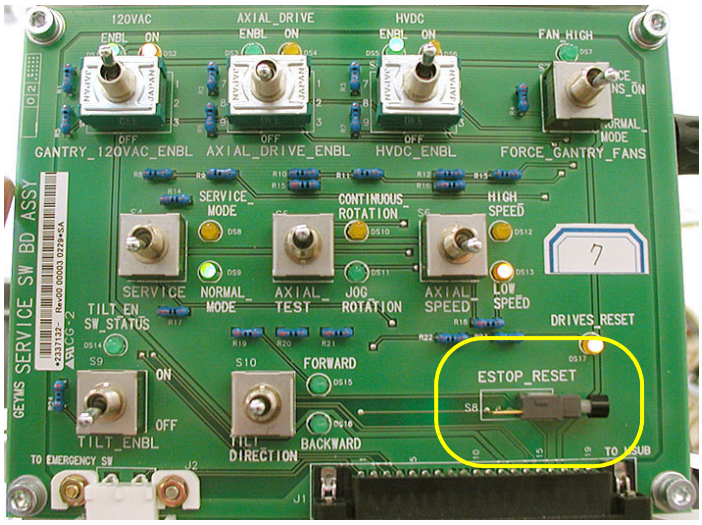


Figure 5-4 Service Switch Panel

AXIAL ENABLE SWITCH TEST

1.) Turn OFF axial drive enable switch **AXIAL_DRIVE** on the Service Switch Panel.

Note: For the initial condition, do not leave the tube at the 2:30 position.

2.) Clear the gantry area for rotation.

3.) Press the alignment light push button.

4.) Verify that the gantry did not rotate.

5.) Turn ON axial drive enable switch **AXIAL_DRIVE** on the Service Switch Panel.

ROTATION SAFETY CHECKLIST

1.) Turn OFF axial drive enable switch **AXIAL_DRIVE**.

2.) Turn OFF **HVDC** enable switch.

3.) Press red **E-STOP** button.

4.) Manually rotate the gantry 360 degrees. (Keep one finger on the Gantry button.)

- Listen for any interference between the rotating and stationary parts. (Correct any interference problems.)
- Listen for any loose parts. (Tighten parts as needed.)

5.) Turn ON axial drive enable switch **AXIAL_DRIVE**.

WARNING **MAKE SURE THERE ARE NO OBSTRUCTIONS AROUND THE GANTRY. PRESSING THE ALIGNMENT LIGHT PUSHBUTTON WILL CAUSE THE GANTRY TO ROTATE.**

6.) Press the alignment light push button.

7.) Verify that the gantry rotates.

8.) Perform a 4 second X-ray OFF scan.

NOTICE **During the scan, it may be necessary to enter the scan room, to obtain a better listening position. If so, keep a finger on one of the four E-STOP buttons (on the gantry), to quickly stop the gantry, if necessary.**

a.) From the console, click on the SERVICE DESKTOP icon. 

b.) Select DIAGNOSTICS.

c.) Select DIAGNOSTIC DATA COLLECTION

d.) Set the scan time to 4.00 seconds

e.) Leave the door open. (This makes it easier to hear any loose or interfering parts.)

* Listen for any interference between the rotating and stationary parts. (Correct any interference problems.)
* Listen for any loose parts. (Tighten parts as needed.)

9.) After completing the 4 second scan, repeat steps 9a through 9e, with the following scan times:

- 2.0 second scans
- 1.0 second scans
- 0.7 second scans
- 0.5 second scans

1.6 Emergency Stop Check

1.) Use the gantry push-buttons to advance the cradle about 0.5m (2ft) from the home position.
2.) Press one of the E-STOP buttons on the gantry.
3.) Make sure the TABLE POWER shuts off, and the green LED flashes.
4.) Depress one of the table elevation buttons, to verify the emergency stop disabled table elevation.
5.) Depress one of the cradle drive buttons, to verify the emergency stop disabled the cradle drive.
6.) Press one of the **RESET** buttons to turn on X-RAY DRIVES POWER. (120 VAC LED stops flashing.)
7.) Press the other E-STOP button on the gantry.
    a.) Make sure the Table Power shuts off.
    b.) Manually move the cradle to the home position to make sure the cradle clutch released.
    c.) Make sure the cradle latches securely in the home position.
8.) Press one of the **RESET** buttons to turn on X-RAY DRIVES POWER.
9.) Press one of the four table tape switches to make sure the table down motion stops. Repeat with the three remaining table tape switches.
10.) Press the console emergency stop switch; make sure the Table Power shuts off.
11.) Press one of the **RESET** buttons to turn on X-RAY DRIVES POWER. (See Figure 5-4).

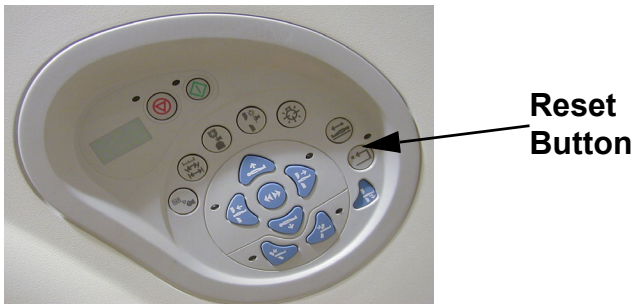


Figure 5-5 Reset buttons on Gantry and Service Switch bank.

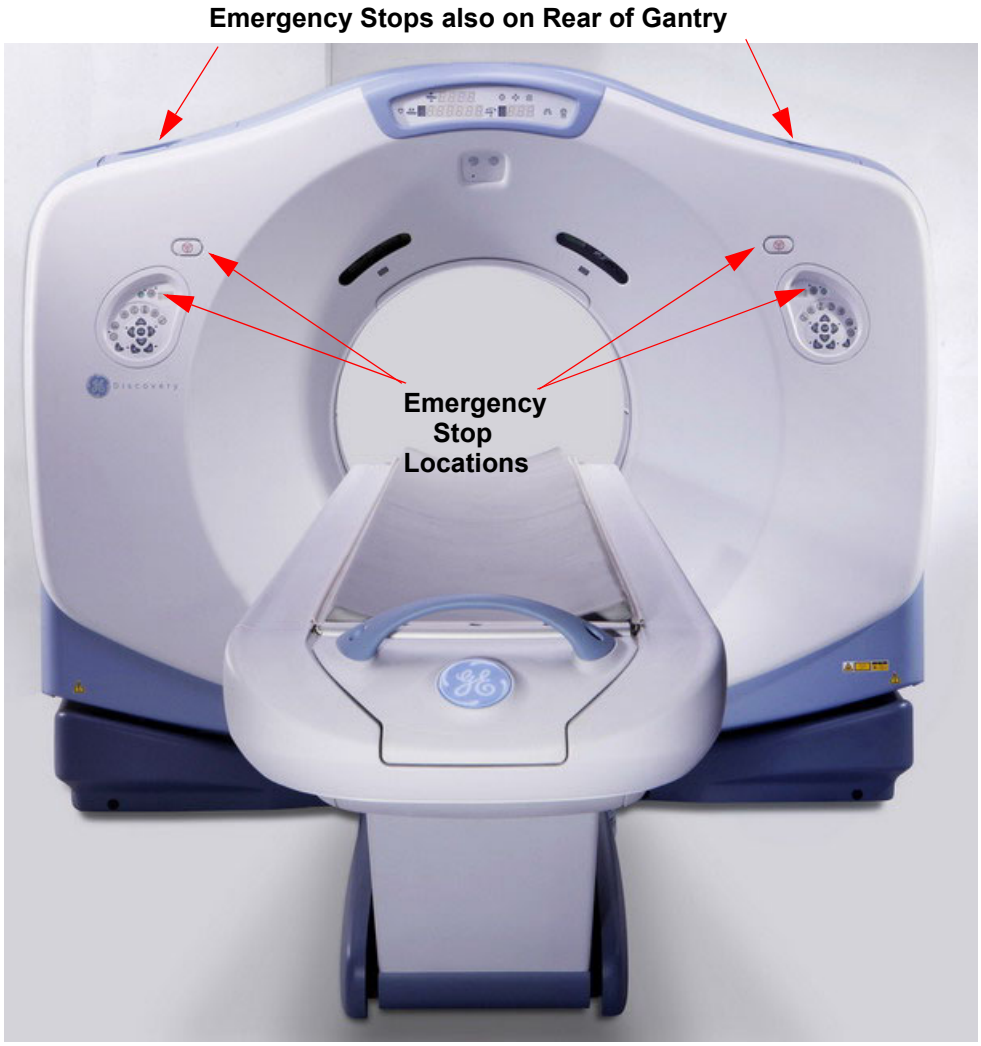


Figure 5-6 Gantry Emergency Stop Button Positions

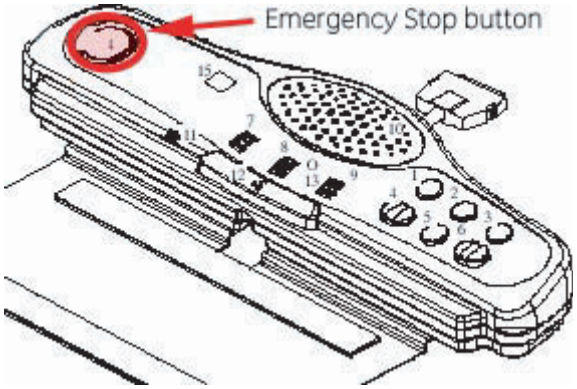


Figure 5-7 SCIM Emergency Stop Button on True-In-One Console

Figure 5-8 GSCB Emergency Stop Button on NIO16/OpenOC Console

Note: Emergency Stop buttons are located on the front and rear of the gantry (8 in all), as noted in Figure 5-6. They are also located on both sides of the table base (4 in all). Additionally, an emergency stop button is provided on the Operator Console SCIM/GSCB (see Figure 5-7 and Figure 5-8).

Section 2.0
Computer Integration

2.1 Introduction

This Section describes the reconfiguration, system state restore, options, and monitor adjustment procedures.

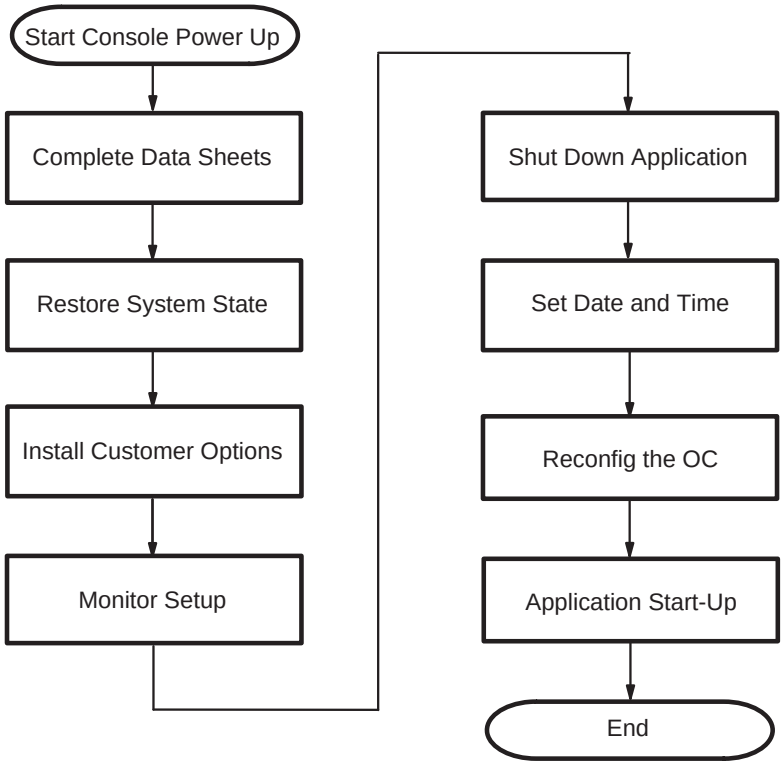


Figure 5-9 Computer Integration Process Overview

2.2 System Configuration Data Sheets

For convenient removal and use during installation, System Configuration Data Sheets appear in Appendix E. Please locate and complete to them at this point during installation.

2.3 Restore System State

Tools Required: None

Your system should have a system state DVD / USB, located in the software collector box.
The system state DVD / USB contains:

- Collimator Characterization
- Phantom Calibrations
- Gen Cal
- Other Data

The installation process uses all the system state files. At this time, use the system state DVD / USB to restore all files.

If you cannot locate an existing system state DVD / USB, you must recalibrrate your system.

1.) If you are not on the Service Desktop, click on the SERVICE DESKTOP icon. 

2.) Click on the UTILITIES icon. 

3.) Select SYSTEM STATE. or SYSTEM STATE - USB.

4.) Insert the DVD into the DVD drive or the USB into USB port.

5.) Select CHARACTERIZATION.

6.) Select CALS.

7.) Select RESTORE to restore the system characterization and phantom calibration files to the system.

Note: Restore State can take as long as ten minutes, although typical times average about three minutes. When Restore State completes, dismiss the tool, and proceed to the next section.

If any error should occur during the restore process, see the Software Load Procedure manual (Load From Cold) for information regarding possible error messages and their recovery.

8.) Click NO for `Reset Scan Hardware` popup message.

9.) Select DISMISS.

2.4 Install Customer Options

2.4.1 Software

Note: Your system has one or more DVDs that contain customer-purchased options. Standard options (one or two DVDs) are required for system operation. Install the Options DVDs at this time, following the instructions in this section.
If your system has not an options DVD, need to install options by eLicense, please follow Service Methods -> Software -> Install Software Options by eLicense.

Ensure that the options DVD is NOT write protected at this time. The initial install requires that the DVD be write enabled; subsequent installs can be done with the DVD write protected.

1.) If you are not on the Service Desktop, click on the SERVICE DESKTOP icon. 

2.) Click on the CONFIGURATION icon.

3.) Select INSTALL.

4.) Select INSTALL OPTIONS.

An Options Window appears (Figure 5-10):

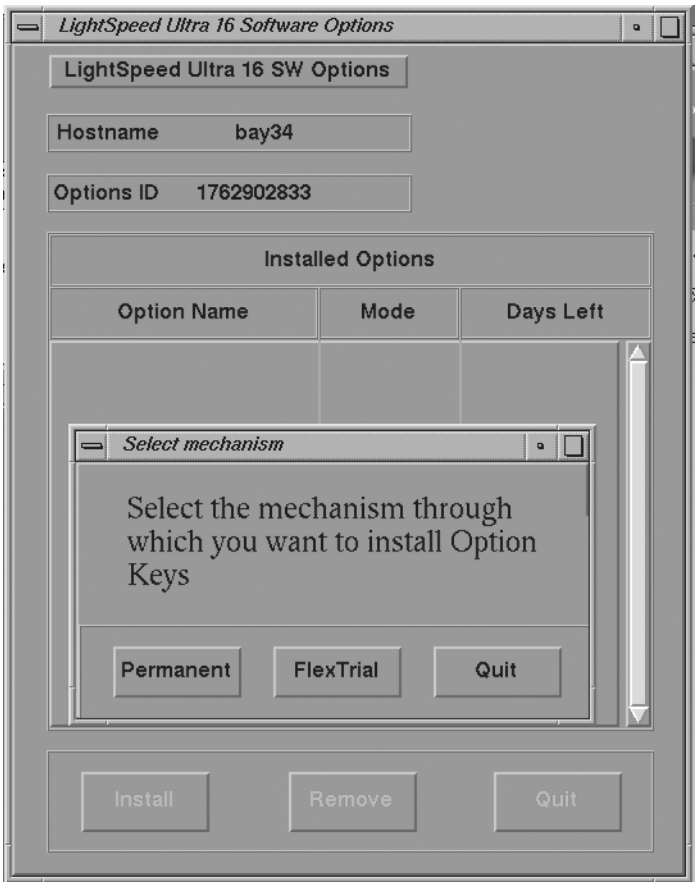


Figure 5-10 Options Window when First Selected

- Check the FDO to see what options were ordered.
- Compare FDO options to those on the Option DVD.
- If different contact your local sales representative.

5.) Insert the options DVD into the DVD drive and click on OK. (If you do not have an options DVD, click on OK anyway, wait for the abort pop up, then abort the process.)

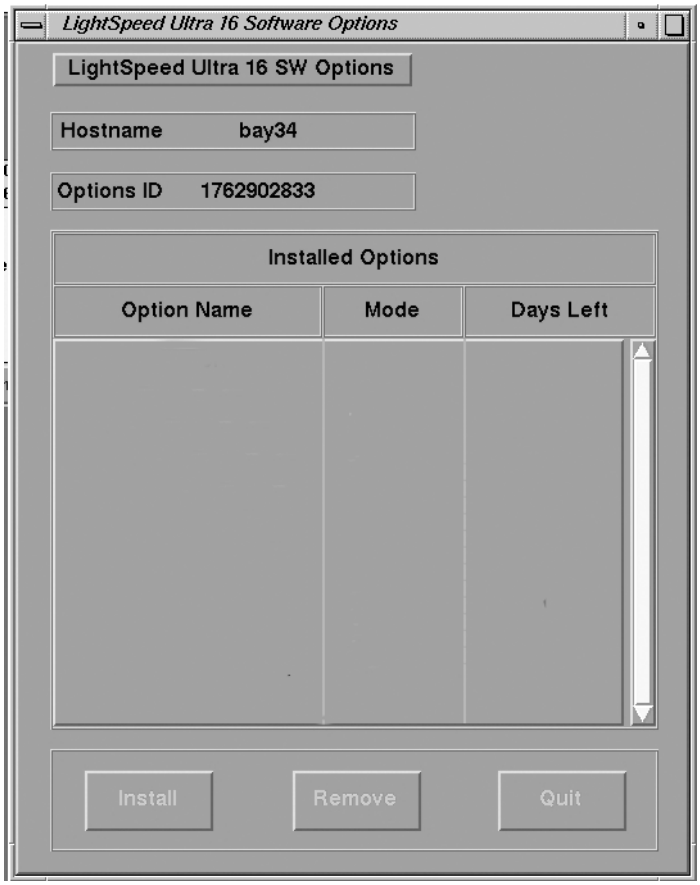


Figure 5-11 Example: Options Window

6.) Select all of the options in the left-hand column to install the corresponding software.

7.) Select INSTALL. A box may appear while the options are loading. When an option is displayed in the `Installed Options` list, then installation of that option is complete. Note that some options take a fraction of a second to install, while options like 3D may take a half minute (due to the fact that they are installing software).

8.) After the options are installed, select QUIT.

9.) Select OK.

10.) Remove the DVD and write protect the side with options.

11.) When the system prompts to Reboot, click YES, and reboot the system to complete the installation.

2.4.2 Camera

2.4.2.1 Time & Personnel

Required Persons	Preliminary	Procedure	Finalization
1 (Field Engineer)			

Table 5-2

2.4.2.2 Tools and Test Equipment:

- Data collected from data sheets (See Camera Application Configuration on page 374.)
- Software Load Procedures manual
- System Service manual.

2.4.2.3 Preparation

If a DASM is required, notify the PMU that the DASM is not supported on systems with TIO Console.

For details on camera configuration, refer to the Software Load Procedures manual.

For details on troubleshooting the camera, refer to the System Service manual.

2.4.2.4 Procedures

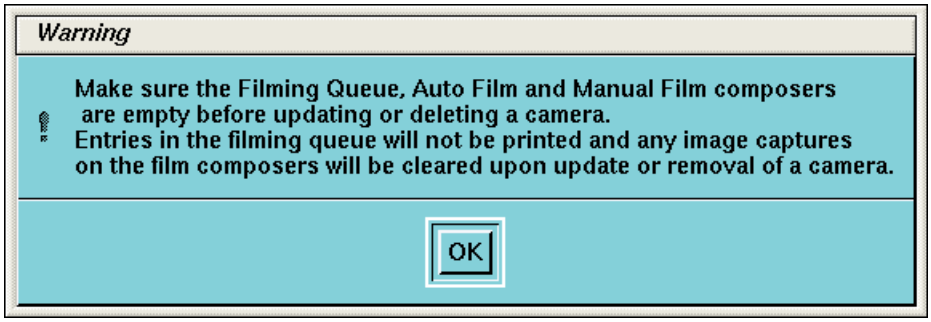
1.) Click on the SERVICE DESKTOP icon 

.

2.) Select CONFIGURATION icon.

3.) Select INSTALL CAMERA.

4.) Read WARNING message, and click OK.



5.) From the remote printer list select a camera, and select ADD for new install.

a.) ADD

b.) UPDATE

c.) DELETE

6.) Select DICOM or POSTSCRIPT.

* Follow the manufacturers suggested setup instructions.

7.) Follow procedures on the screen.

Note: Camera and film information is required. Review this information with the customer. Data sheets are available in Service Methods under Alignment, Setup and Calibrations.

8.) Return to Home Page

9.) Click the SERVICE DESKTOP icon

10.) Click SHUTDOWN

2.5 Shut Down Application

Tools Required: None

Standard Level

If Applications is currently running, you must shutdown system applications.

1.) Click on the SERVICE DESKTOP icon. 

.

2.) On the desktop toolbar select UTILITIES icon.  .

3.) Select APPLICATIONS SHUTDOWN (to bring down applications only).

Super User Level

1.) Open a UNIX Shell window.

2.) Type: **`su -`** **ENTER** at the prompt.

3.) Type the root (super user) password: **`#bigguy`**

2.6 Reconfig the OC

Tools Required: None

Note: The document collector box that arrived with your system contains the *Software Installation Procedures* manual, which documents the reconfiguration procedure in more detail.

2.6.1 Overview

On the following screens, you should make the changes necessary, pressing the corresponding button at the top of the screen to move from screen to screen. When you are done, you can either press the ACCEPT button to start the reconfiguration process, or press the QUIT button to exit without changing the system configuration.

While the reconfiguration is going on, messages are displayed in a shell window that closes when reconfiguration is complete. Should you later want to review the reconfiguration output, it is logged to the following file:

`/var/adm/install.log.`*`YYYYMMDDWWWHHMMSS`*

Where

`YYYYMMDDWWWHHMMSS` is the Date/Time that the reconfiguration was started.

To view the file, type: **`more /var/adm/install.log.`*`YYYYMMDDWWWHHMMSS`***

It is possible to abort the reconfiguration while entering information on the reconfiguration screens. Simply press the QUIT button at the top of the screen. There is NO safe way to abort the reconfiguration after pressing the ACCEPT button. If the entries made in the screens were incorrect, DO NOT try to stop the reconfiguration, instead wait for it to complete, and rerun reconfig, entering the correct parameters.

2.6.2 Procedure

1.) Shut down application from the Service Desktop.

2.) In an xterm window, log in as root:
Type: `su -` **ENTER**
Type the root password: `#bigguy` **ENTER**

3.) Launch the Install utility:
Type: `reconfig` **ENTER** at the prompt.
The OC displays the Install Utility Window as shown in Figure 5-12.

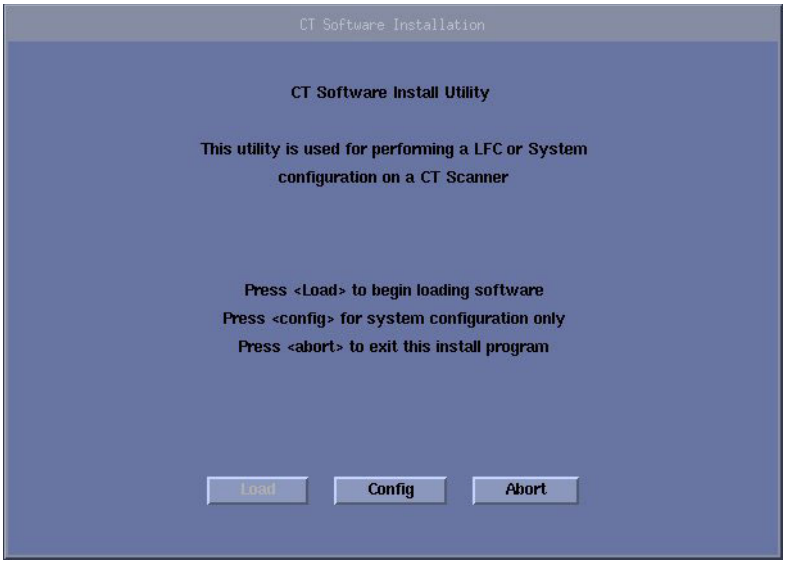


Figure 5-12 Install Utility Window

4.) Click on the CONFIG button.

The OC displays the System Configuration - System Settings Screen as shown in Figure 5-13.

Comment: The following pages show the screens that are used to change the configuration of the system. These screens are the same as those used for the Software Configuration during Load From Cold. The actual screens will vary depending on the current configuration of your system.

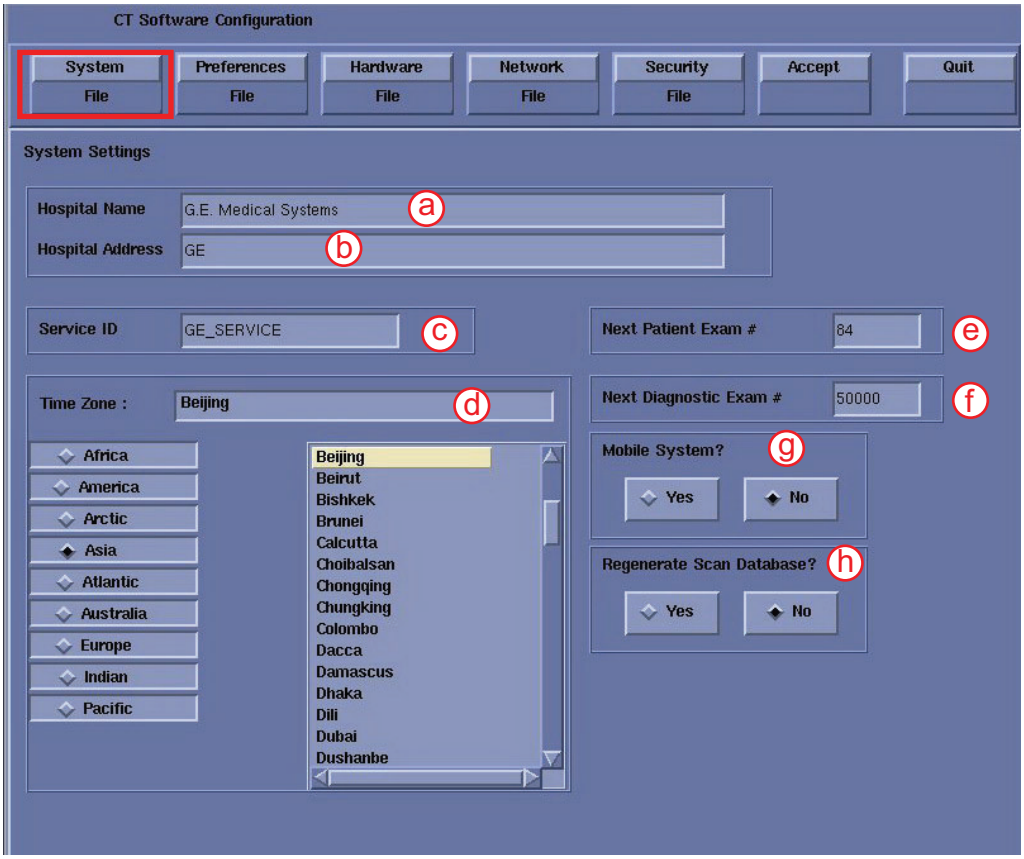


Figure 5-13 System Settings Screen

5.) Configure System Settings

a.) `Hospital Name` configures the name that will show up on images produced by this scanner.
Example: ST MARYS HOSPITAL

b.) `Hospital Address` configures the hospital address.

c.) `Service ID` is issued by the Service organization.
Example: 262785CT2 (no spaces)

d.) Select the `Time Zone` for the site.

Note: Use the scrollbar at the bottom of the time-zone selection list to view the entire description of the time-zone you are about to select, to ensure that you are selecting the correct time-zone for your location.

If the time-zone of your location is not in the list above, select one of the universal times in the selection menu. In this case, automatic changes for daylight savings time will not take effect. See Load from Cold manual, if you require more information regarding time-zone setting & selection.

e.) `Next Patient Exam #` configures the next Exam number the scan user interface will use. At initial system installation, type: **1**

f.) `Next Diagnostic Exam #` *Customer Selected.*

g.) `Mobile System` Select to tell the software if this CT is in a mobile environment or not.

h.) `Regenerate Scan Database` *Selected.*

6.) Select the PREFERENCES button to display the Preference Settings Screen as shown in Figure 5-14.

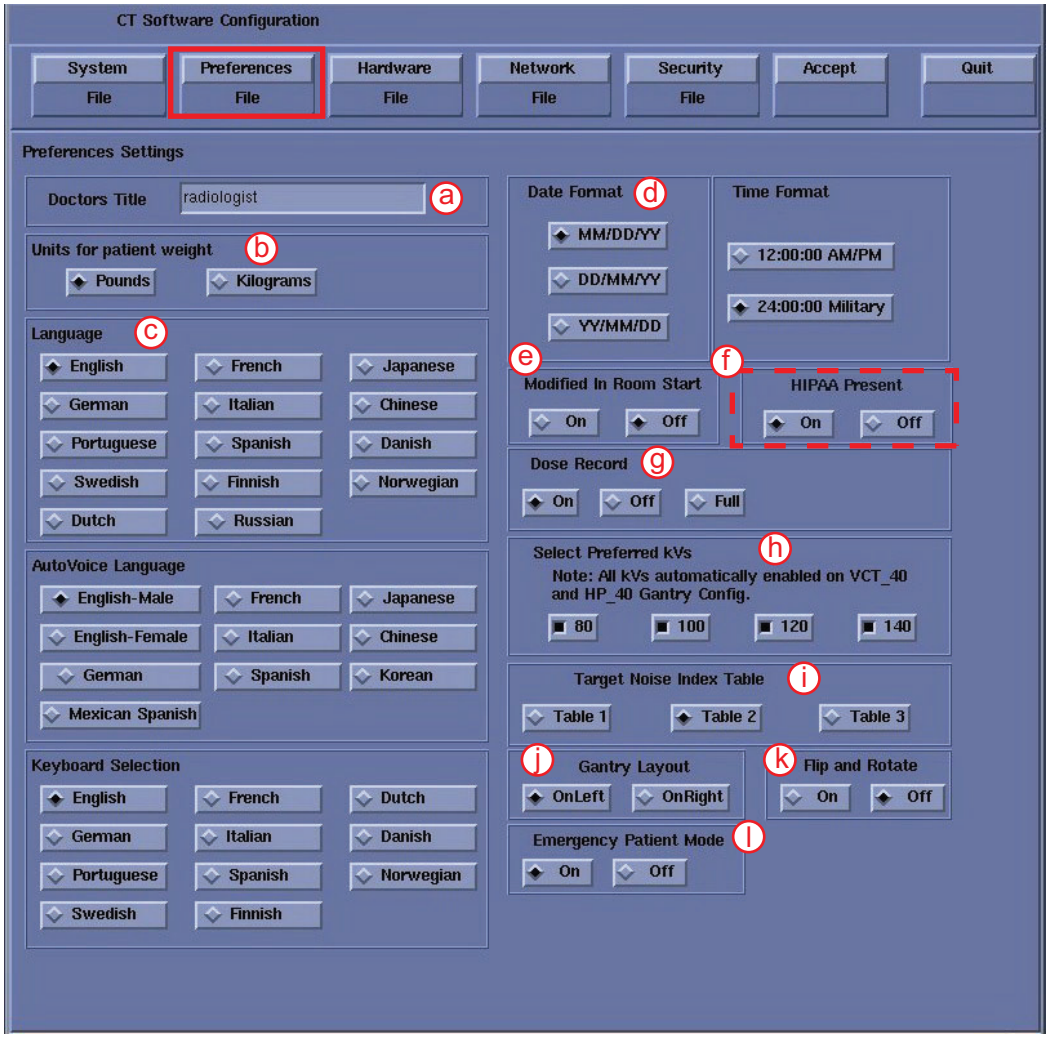


Figure 5-14 Preferences Setup Screen

7.) Configure Preferences Settings

a.) `Doctors Title` Enter the title for the Doctor. (eg. radiologist)

b.) `Units for Patient Weight` Tells the software whether pounds or kilograms are being used.

Note: Use Direction 5221102-1EN (found in the keyboard collector kit shipped with the system) to complete the language selection.

c.) `Language` configures the language to be displayed on the Application screens.

1.) Review the language matrix (in direction 5221102-1EN) and identify the appropriate language for your country.

2.) Ask the radiology manager, or equivalent, to agree to the user interface (UI) language and keyboard requirements listed for that country (per 5221102-1EN), OR choose another language for the UI and keyboard.

3.) Record the information on GE form e4879.

d.) `Date Format` configure the format in which the date will be displayed on the images.
`Time Format` configure the format in which the time will be displayed on the images

e.) `Modified In Room Start:` **Select ON for Japan sites**, OFF for other sites.

f.) `HIPAA Present:` Configures the preference for Data Privacy (User Authorization) feature on the system.
Select ON if customer requests Data Privacy (User Authorization) feature enabled on the CT system.

Note: HIPAA Present is enabled as default and the selection button is not displayed on Discover RT 16BW32.x or later software version. HIPAA ON/OFF can be selected at Configure HIPAA in Common Service Desktop.

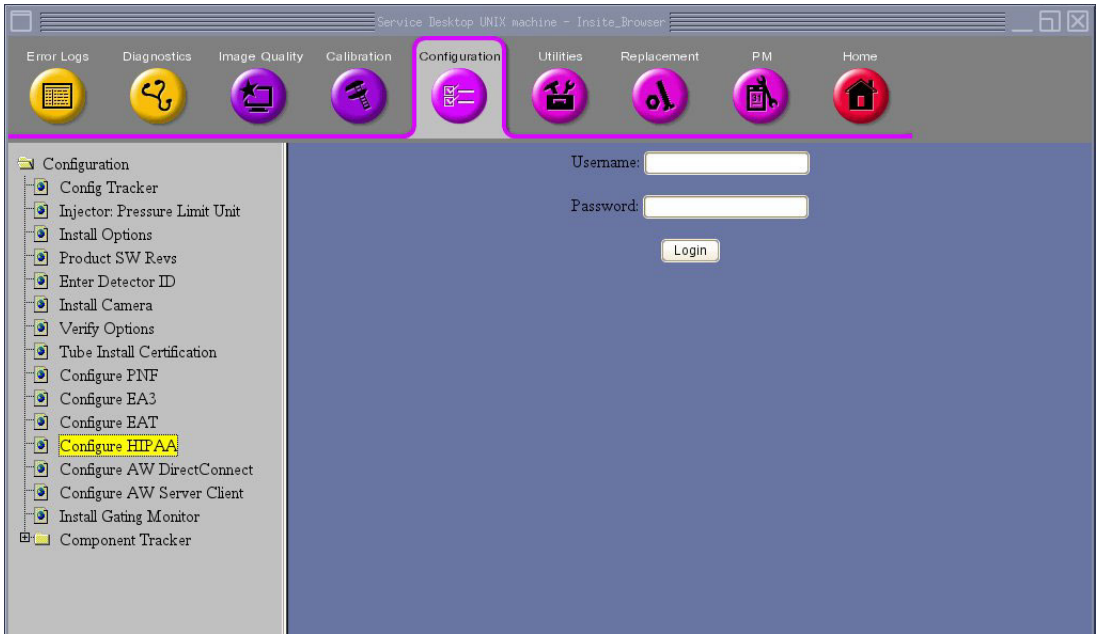


Figure 5-15 HIPAA Configuration

g.) Select the site-preferred `Dose Record` to `On` as default. Configures support for DICOM Dose SR Record option for saving dose information with study. The dose information is saved in a DICOM structured report. The DICOM standard defines a new DICOM X-RAY Radiation SR SOP class, which the other systems must support. The Dose SR feature saves an exam's dose information in this format.

* ON = Saves the dose information in a DICOM Enhanced SR SOP Class
* OFF = Turns off the option
* FULL = Saves the dose information in a DICOM X-Ray Radiation Dose SR SOP Class

h.) `Preferred Fast Cal KV` configures the preferred kV that the Fast Cal Routine will calibrate (80, 100, 120, 140 in the `Selected Preferred Fast Cal KV` field). The default selections are 120 and 140.

Comment: These kVs should include all kVs that the site uses for patient scanning. Deselecting All Preferred FastCal KVs is the same as selecting ALL the Preferred FastCal KVs

i.) Select Target Noise Index Table: default is [TABLE 2].

j.) Select `Gantry Layout` according to gantry/table layout in the hospital.

Note: Select ONLEFT if gantry is laid to the left of table (viewed from the control room), otherwise, select ONRIGH.

k.) `Flip and Rotate`: Configures the preference for allowing the `Flip and Rotate` feature to be turned on in the User interface on the (Left) SCAN Monitor. Default is `OFF`. This preference allows the Customer to apply custom orientation changes based on Exam Type and reconstructions methods on the DICOM images that will be transferred to PACS and related systems.

Note: This preference shall not be enabled unless specifically requested by the Customer and `Evaluation of Image Flip and Rotate Compatibility` functional check procedure has been executed and all DICOM test images pass orientation check.

l.) `Emergency Patient`: Configures the preference for allowing the Emergency Patient to be turned on in the user interface.

8.) Select the HARDWARE button to display the Hardware Settings Screen (Figure 5-16).

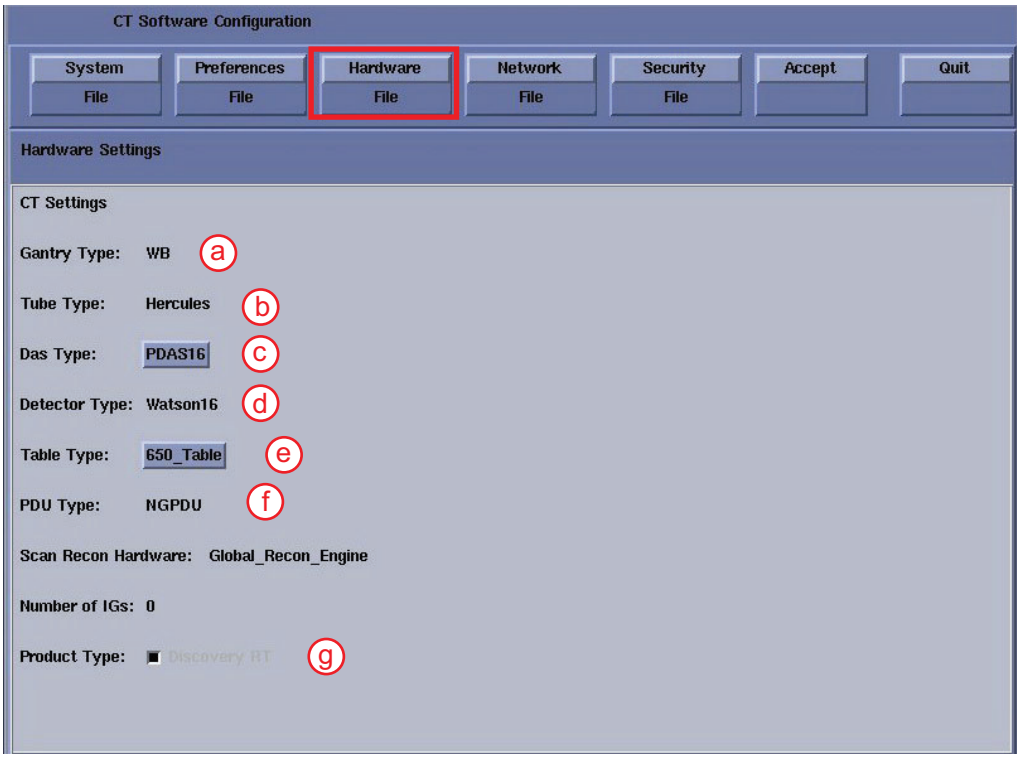


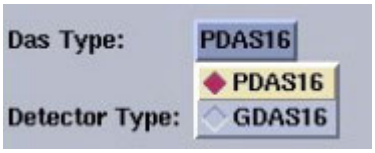
Figure 5-16 Hardware Settings Screen (example only - actual screen may vary)

9.) Configure Hardware Settings

a.) `Gantry Type` Indicates the type of Gantry that is installed.

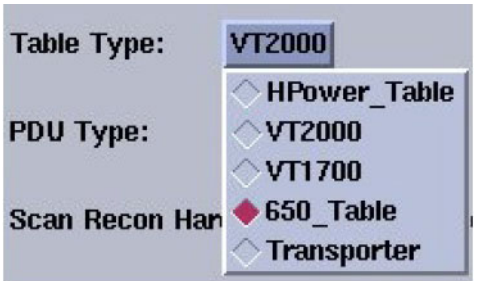
b.) `Tube Type` Indicates the type of X-Ray Tube that is installed.

c.) `DAS Type` Select the DAS type, the type of DAS shipped can be determined by reviewing the order information.



d.) `Detector Type` Indicates the type of Detector that is installed.

e.) `Table Type` Select the Table type, the type of table shipped can be determined by reviewing the order information.



f.) `PDU Type` Indicates the type of PDU that is installed.

g.) `Product Type` Indicates the type of product that is installed.

10.) Select the NETWORK button to display the Network Settings Screen as shown in Figure 5-17.

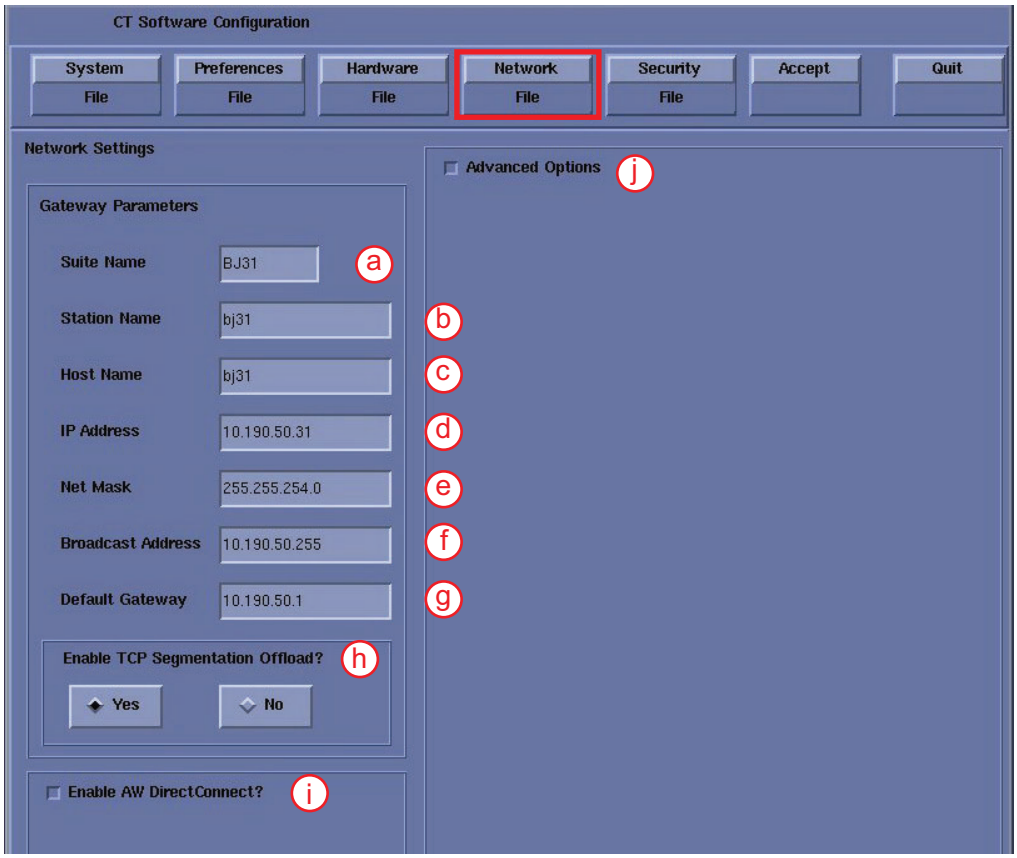


Figure 5-17 Network Settings Screen

11.) Configure Network Settings

Comment: *This screen provides the ability to declare the CT system on a hospital network. Key information such as Host Name, IP Address, Net Mask (for CT systems on a subnet) must be obtained from the hospital network administrator.*

See Chapter 7 for more information and complete details of setting the Hospital/System Network Configuration.

a.) Enter the `Suite Name`.

The Suite Name must start with a letter, followed by three alphanumeric characters. Total must be four characters long. The name of the OC interface will be `<Suite Name>`, within the scanner's subnet.

Typically, you should use `su01 or ct01` ("su" and "`ct`" must be lowercase), unless the customer prefers a different suite name.

b.) Enter the `Station Name`.

* It cannot exceed 16 characters
* It can only contain **a** though **z**, and **0** through **9**.

`Example: stmary or ct01`

c.) Enter the hospital provided `Host Name`.

The Host Name identifies the network hostname and AE Title of the CT system to the hospital's network. The Host Name**:**

* **MUST NOT** exceed 16 Characters.
* **MUST** only contain the following characters: `A` through `Z`, `a` through `z`, `0` through `9`, `-` and `_`.

Comment: *The Host Name is typically* `stmary or ct01`.

d.) Enter the hospital provided `IP Address` for the system.

e.) Enter the hospital provided `Net Mask` (if the CT system is on a subnet).

f.) Enter the `Broadcast Address`.

Comment: *The Broadcast Address should be the same as the IP Address except for the bits of the host id portion (last digit group) set to 1's or 0's depending on the configuration of the network. The standard default is 1's, but older Sun OS machines used 0's.*

For example:

If the IP Address is 192.100.9.17, the Broadcast Address should be 192.100.9.255 if the network is configured to use 1's to specify the Broadcast Address.

If the network contains genesis based scanners or other Sun OS 3.5 or 4.1 computers, the Broadcast Address should be 192.100.9.0.

g.) Enter the hospital provided Default Gateway IP Address in the `Default Gateway` field (if applicable). If the site network does not use a default gateway, leave the field blank.

h.) "`Enable TCP Segmentation Offload?`" The default selection is `Yes`. In some situation, TCP Segmentation Offload can't work normally, please select `No` at this time.

i.) `Enable AW DirectConnect`, if this option is provided with this system.

j.) `Advanced Option:`

- Use NIS
  * NIS Domain Name: Customer-provided site domain name.
  * IP Address: The IP Address for the NIS Server, if used, hospital provided.
- Enable Network Time Protected: Hospital decision.
- Change DARC Subnet: Hospital decision.

12.) Select ACCEPT on the System Configuration Screen.

Comment: *The system loads the CT Application Software, OS patches, kernel changes and configures the system on the OC.*

*The loading process takes approximately 15 minutes. While the load is going on, the results are displayed in a shell window that closes when the loading process is complete. All the window output is logged to a file named:*_____

13.) When the loading process and configuration changes are complete, the system displays a prompt to reboot. Click on YES. (See Figure 5-18.)

Figure 5-18 Reboot Screen

14.) The system will automatically login as `ctuser` after the reboot. Select OK on the Autostart Disabled popup message.

2.7 Check/Set Date and Time

Tools Required: None

If date and time need to be corrected:

1.) Open a Unix Shell window to check the current date.
Type {`ctuser@hostname`} **`date`** **ENTER** at the prompt.

2.) If the date is correct, proceed to the next section; if it is incorrect, continue this procedure.

Note: You must set the date and time on the Host computer with the Application software down.

3.) Open a Unix Shell window and login as root:
   a.) Type {`ctuser@hostname`} **`su -`** **ENTER** at the prompt.
   b.) Type the password: **`#bigguy`**

4.) Set the date and time.
   a.) Type {`root@hostname`}**`# setdate`** **ENTER**
   b.) Follow the instructions of the individual time-entry prompts, which will appear in the following sequence:

```
* Note: Type "q" at any time to quit. Press ENTER to continue.
* Note: TO BE ACCURATE, this tool will prompt you the enter the
  "Second." Watch your clock or PC carefully to enter the proper
  value, and hit [ENTER] at the right second to set the accurate
  time. Enter to proceed. Press ENTER to continue
* Enter the current Year (1980 - 2030) [2010]:
* Enter the current Month (1-12) [04]:
* Enter the current Day (1-30) [14]:
* Enter the current Hour (Military Time) (0-23) [18]: 15
* Enter the current Minute (0-59)  [13]: 18
* Enter the current Second (0-59)  [00]: 10
* Updating the time on the OC, Please Wait...
```

2.8 Data Privacy Configuration

If "HIPAA Present" was enabled in reconfig, apply the following procedure to fully configure the Data Privacy (EA3 User Authorization) feature. Refer to *Data Privacy (EA3 User Authorization) Configuration* procedure in the Service Methods 5366638-8EN.

2.9 Initial Setup of EA3 Administrator Account

Service assistance is required for initial setup of User Accounts using EA3 Admin Browser. Complete the Section 4 of the *Dose Check Management and EA3 Configuration* procedure in the Service Methods 5366638-8EN.

2.10 Save System State

Note: When performing Save/Restore System State, check to ensure there is no two or more USB storage devices (SSA Key or other mobile storage) plugged in Console/Tower at the same time which may result in incorrect data storage.

1.) Insert the DVD into the Peripheral Tower DVD drive or USB in any of the console's USB ports.
2.) Select: SERVICE DESKTOP.
3.) Select: UTILITIES.
4.) Select: SYSTEM STATE for DVD Media or SYSTEM STATE-USB for USB Media.

Note: System State Save may be under Utilities or PM.

5.) Select ALL to save all data.
6.) Click SAVE, the System State Media Ready pop-up window appears.
7.) Select YES.
8.) When completed, select CANCEL, then select DISMISS.
9.) Remove the DVD or USB from the drive, then label and date the disk including the suite name.
10.) Close the Service Desktop window at the upper left corner of the screen.

2.11 Applications Start-Up

Open the Console shell window, and type: **`st`** **ENTER**.
The applications desktop appears on the monitor.

2.12 Operator Console Boot-up Flow Chart

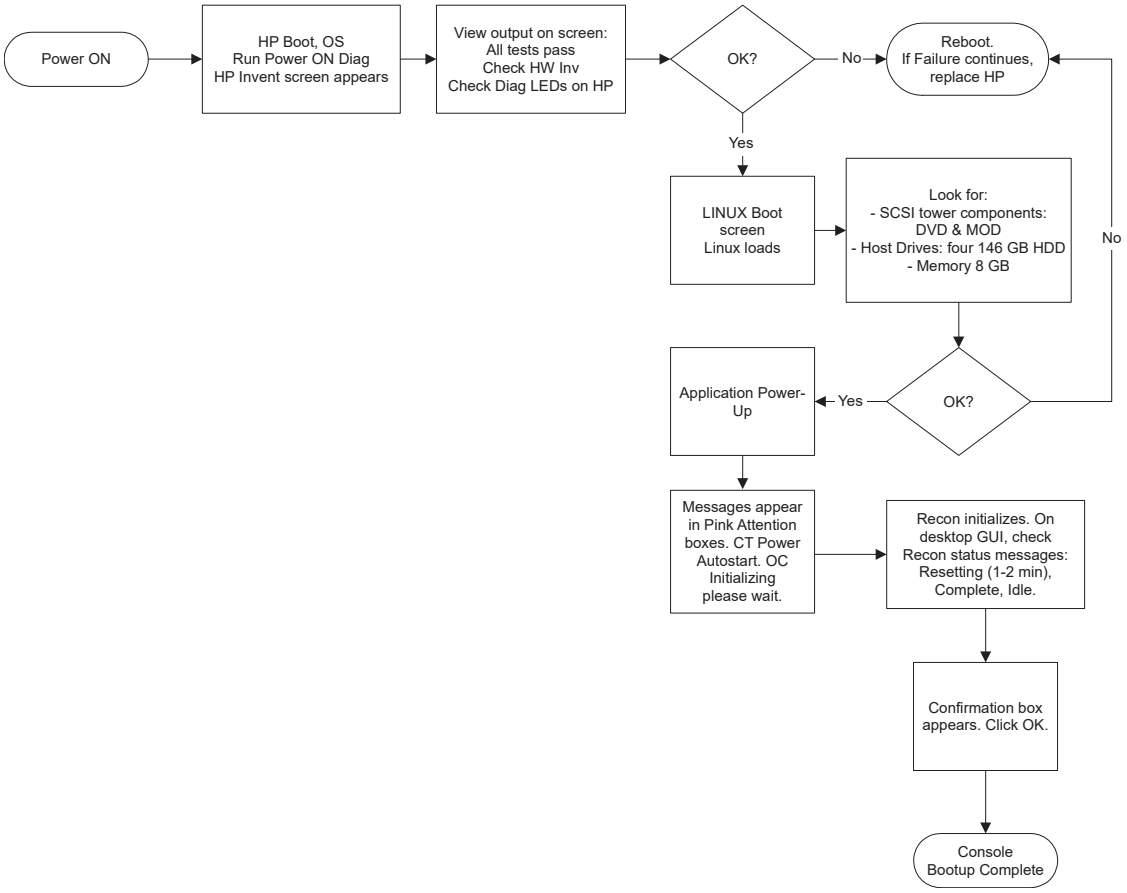


Figure 5-19 True-In-One Console Boot-up Flow Chart

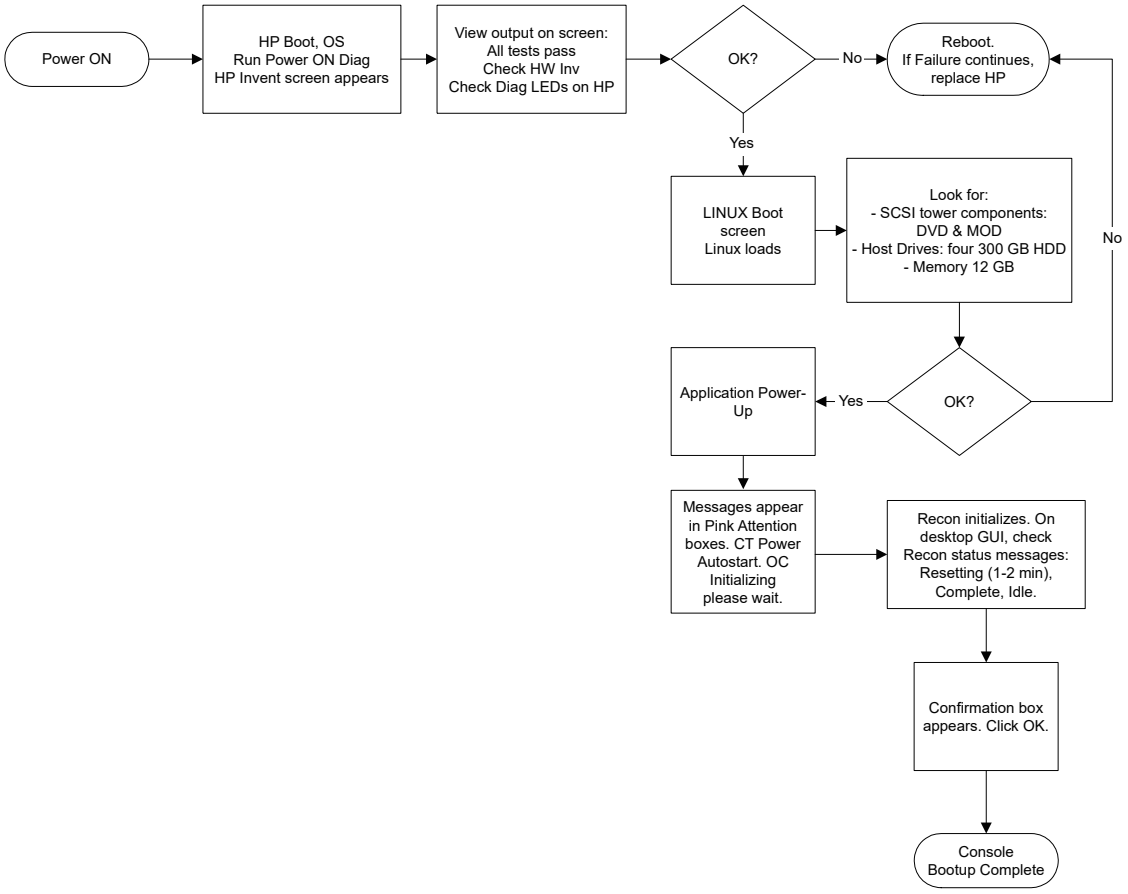


Figure 5-20 NIO16 Console with Z800 Boot-up Flow Chart

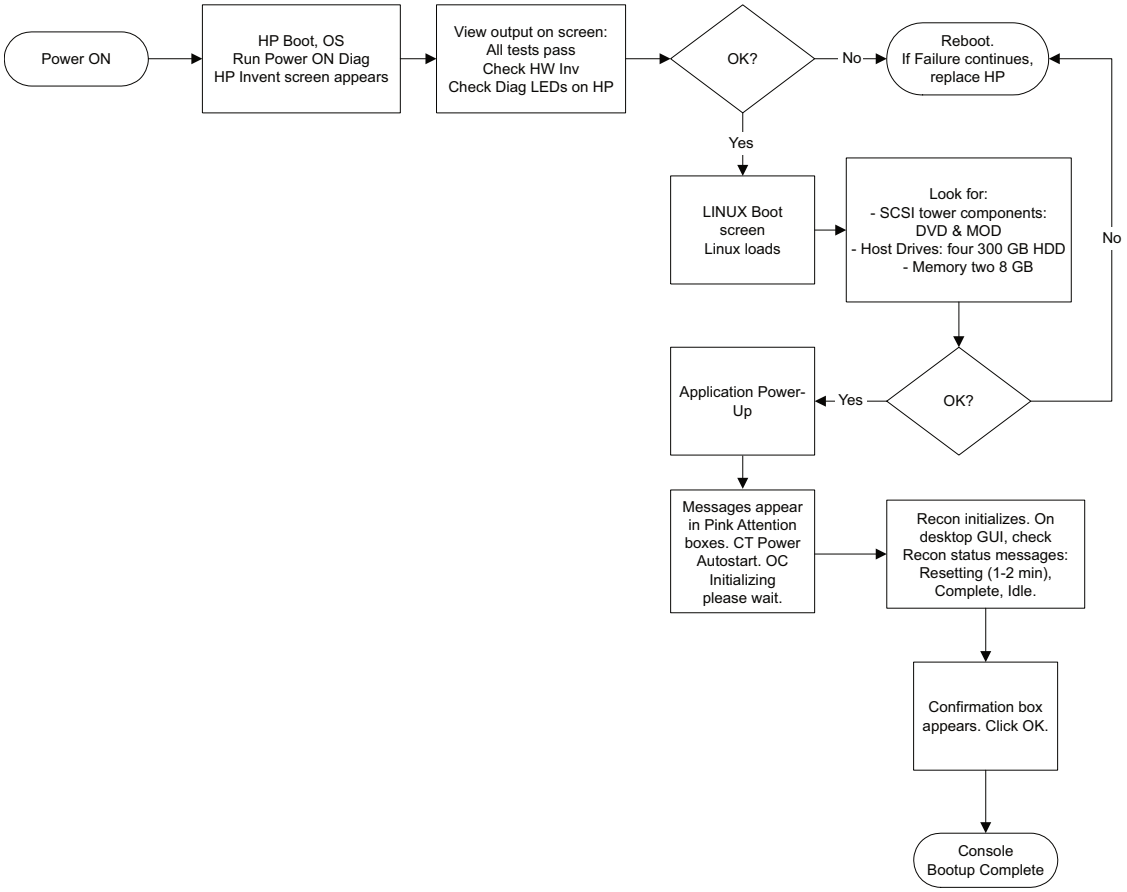


Figure 5-21 NIO16 Console with Z840 Boot-up Flow Chart

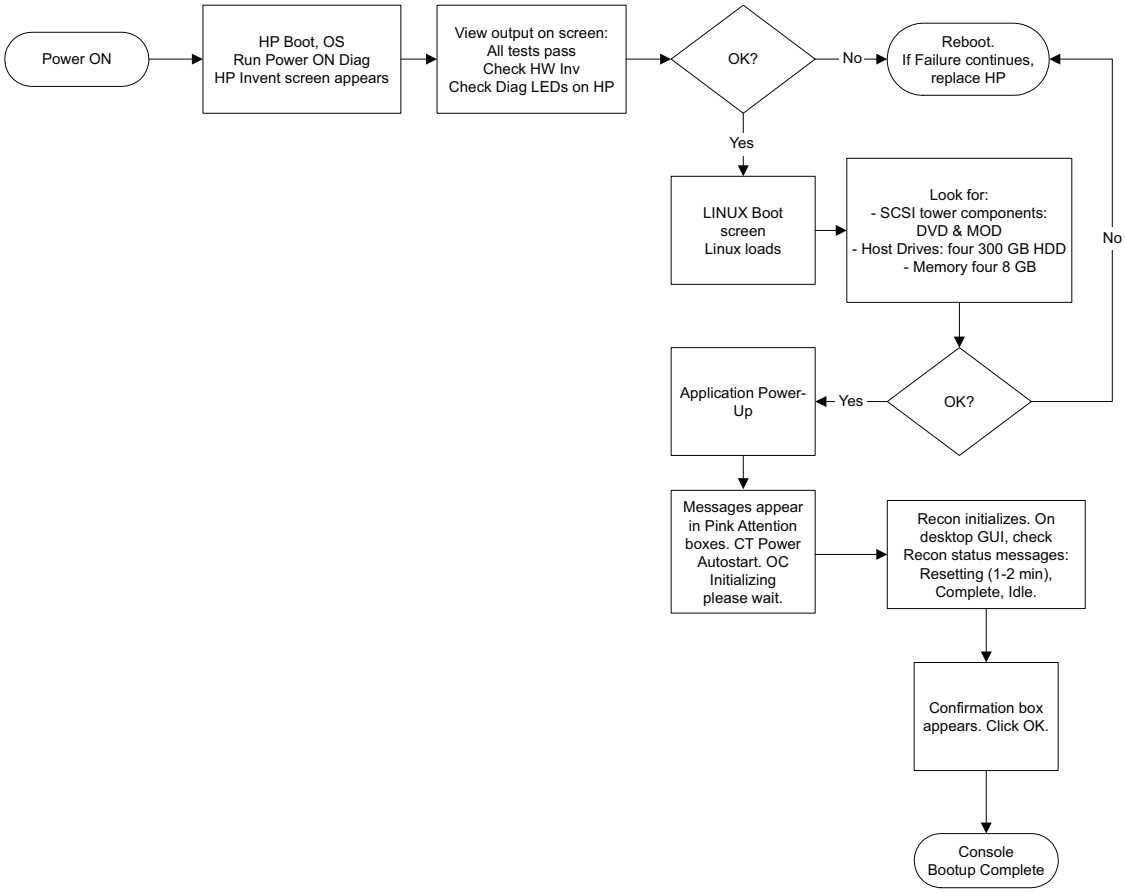


Figure 5-22 OpenOC16 Console Boot-up Flow Chart

2.13 Monitor Setup

The systems are shipped with LCD monitors. For information on LCD monitor color setup, please refer to the documentation shipped with the monitor.

2.14 Contrast/Brightness Black & White Adjustment Procedure

1.) If you are not on the Service Desktop, click on the SERVICE DESKTOP icon. 

2.) Click on the IMAGE QUALITY icon. 

3.) Select INSTALL SMPTE IMAGE and wait approximately 3-4 minutes for SMPTE image to install. (When complete the following message will display: `SMPTE and QA images have been successfully copied`)

4.) Press **ENTER** to exit the Service Desktop.

5.) Click the IMAGEWORKS icon 

.

6.) Display the SMPTE pattern. Use the browser to select Exam 1000, which contains the SMPTE pattern, and enlarge the image to full screen display.

7.) Select Viewer.

8.) Select 1:1 format.

9.) Increase the monitor's contrast to maximum.

Note: Adjust monitor contrast until the operator sees the anatomical structure (window raster)

10.) Increase the Brightness to maximum.

11.) Decrease the Brightness, until the raster just fades into, and matches, the monitor screen background. At this point, the 5% and 95% patches should be just visible.

- If additional tweaking is required to attempt to match the monitor image to the filmed image, use only the brightness control.
- If the CRT image exhibits any tearing or smearing of the alphanumeric characters, then reduce the contrast setting slightly until the tearing/smearing is just eliminated. The optimum setting for contrast is the highest setting that does not cause tearing/smearing of the alphanumeric characters.
- You should always finish up by displaying and filming images of anatomy (typical heads and bodies), and asking the technologist to compare the CRT image to the film image.

2.15 Screen Saver Setup Utility

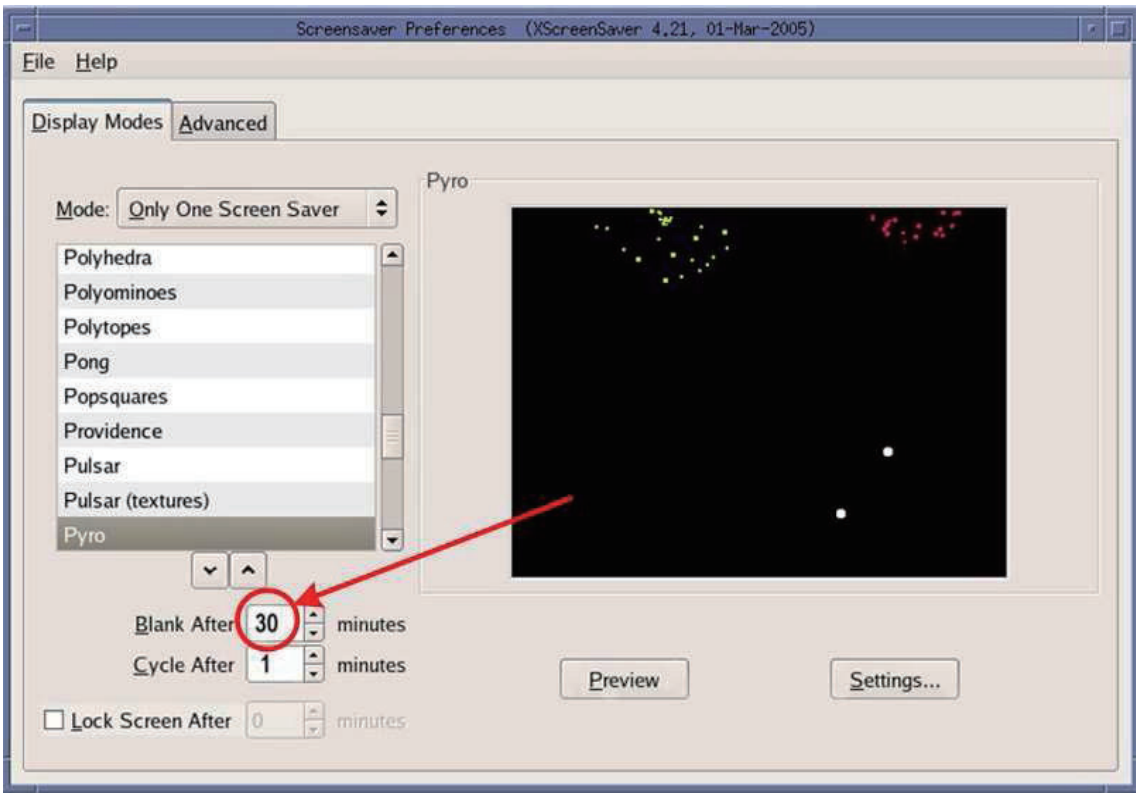
1.) Open a Terminal Window

Type: ***{ctuser@hostname} xscreensaver-demo*** **ENTER**

2.) The Screensaver Preferences UI will appear.

3.) Change the default ***"Blank After"*** time from 57 to 30 minutes on the ***"Display Modes"*** tab of the Screensaver Preferences.

Note: No other changes are recommended.



4.) Then click FILE on the menu bar and select RESTART DAEMON.

5.) Click FILE again on the menu bar and select QUIT.

Section 3.0
Enable CT Number Range

Expanded CT Number Range may be configured using the selection on the Tool Bar on the Image Works Desktop. Enable extended CT number for Discovery RT, Discovery CT590 RT and Optima CT580 RT and disable extended CT number for Optima CT580W.

1.) Click on the TURN ON EXTEND HU button. See Figure 5-23

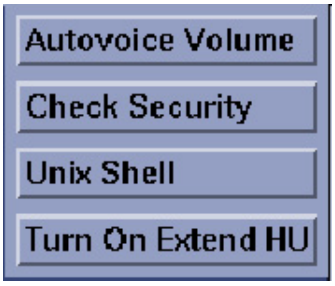


Figure 5-23 Turn On Extend HU

Note: If Extend HU is already turned-on, the Tool bar will display TURN OFF EXTEND HU, as shown in Figure 5-24.

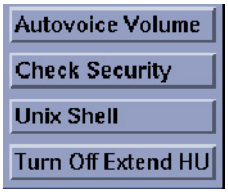


Figure 5-24 Turn OFF Extend HU

2.) A notice will appear, indicating that a system reboot is required to enable the change of modes from the current to mode selected in the Tool Bar. See Figure 5-25.

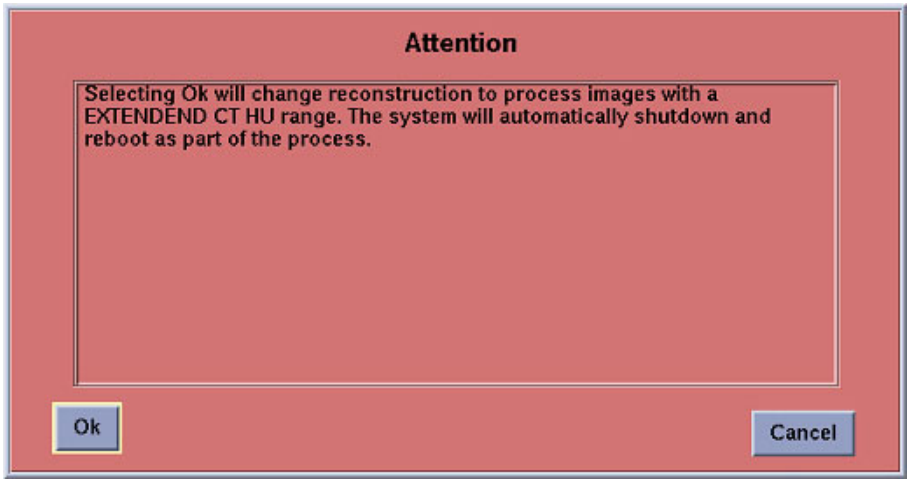


Figure 5-25 System Reboot Notice Screen

3.) Click OK to reboot. (See Figure 5-25.)

Section 4.0
Table Gantry Integration

4.1 Introduction

Use these procedures to functionally check every part of the table/gantry subsystem.

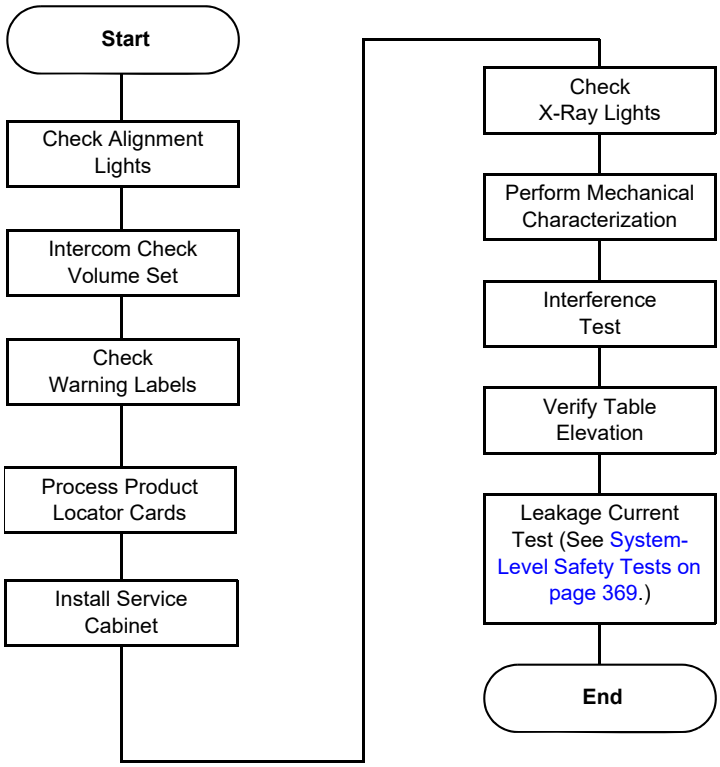


Figure 5-26 Table Gantry Integration Process Overview

Required Tool

- Multimeter

4.2 Check Alignment Lights

4.2.1 Room Light Adjustment

Adjust the scan room lights to normal customer operating levels.

4.2.2 Turning the Alignment Lights ON

CAUTION **Verify all personnel have cleared the system. The Gantry rotates during this check.**

1.) Turn ON the **AXIAL DRIVE ENABLE** and **HVDC ENABLE** switches (located on the service switch panel.

2.) Turn on the alignment light switch on the gantry service panel. The gantry will rotate and the alignment lights will turn ON.

CAUTION **LASER EYE INJURY!**

NEVER STARE DIRECTLY INTO THE LASER BEAMS WHEN YOU OPERATE THE ALIGNMENT LIGHTS. STARING INTO THE BEAMS CAN CAUSE PERMANENT EYE DAMAGE.

4.2.3 Internal Axial Lights

1.) Place a sheet of plain white paper over the output port of each light.

2.) Verify that the two laser lines coincide and appear as a single line.

Note: GE designed the internal axial lasers on the current CT system to shine *down* on the collimator. Do NOT adjust the internal alignment lights at this time. The tomographic plane tests use the QA phantom to check the internal axial lasers alignment to the collimator.

4.2.4 External Axial to Internal Axial Distance

Note: Ensure that cradle is level.

1.) Raise the table to its highest elevation.

2.) Extend the cradle until you see both the internal and external laser lights shining on the cradle.

3.) Place a metric rule on the right edge of the cradle, and measure the distance from the internal axial laser line to the external axial line. Verify this distance equals 240.0 mm ± 1.0 mm.

4.) Place the rule on the left edge of the cradle, and measure again.

5.) Leave the cradle in its current position, and lower the table to the minimum elevation.

6.) Measure the distance between the internal and external lights on both edges of the cradle, as above. Verify the distance remains equal to 240.0 mm ± 1.0 mm.

4.2.5 Coronal Lights

1.) Place a sheet of plain white paper at the left side of the patient opening, in front of the coronal laser light. Verify the two coronal lines coincide.

2.) Move the paper to the right side of the patient opening. Verify the two coronal lines coincide.

3.) Place the paper in the center of the gantry opening. Use a level to verify that the coronal lines are horizontal.

4.2.6 Turn Lights OFF

Press the alignment light button on the gantry control panel, again, to turn the lights OFF.

4.3 Autovoice/Intercom Check

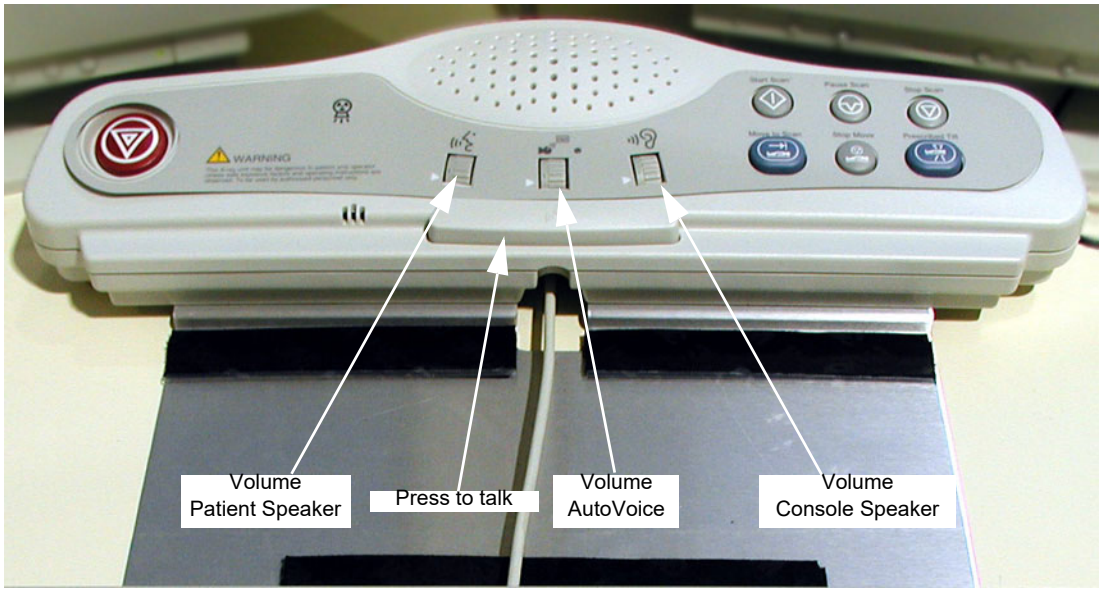


Figure 5-27 SCIM Volume Controls on True-In-One Console

Figure 5-28 GSCB Volume Controls on NIO16 / OpenOC16 Console

4.3.1 Requirements

Two people are required to complete this procedure.

4.3.2 Patient Speaker

1.) To adjust the volume of the patient speaker in the table, adjust the left-most volume thumb wheel on the SCIM/GSCB while speaking into the console microphone. (Press the bar on the SCIM/GSCB to talk; release the bar to listen.)

2.) The patient should be able to clearly hear the operator.

4.3.3 Operator Console Speaker

To adjust the console speaker volume:

1.) Have an assistant speak into the gantry microphone.
2.) Adjust the SCIM/GSCB console volume knob until you can clearly hear the patient.

4.3.4 Autovoice Volume

1.) On the Scan Desktop, select PROTOCOL MANAGEMENT.
2.) Select AUTO VOICE RECORD.
3.) Click the 3.4 button, to the right of “FF2. Inspiration”.
4.) Click the PLAY button, to play the Inspiration AutoVoice message.
5.) Adjust the center volume thumb wheel while Autovoice is playing, to set the volume for the gantry speaker.
6.) Repeat steps 4 and 5 as necessary to achieve satisfactory volume.
7.) Select DONE, then select QUIT.

Note: If a satisfactory volume can not be achieved, refer to the system service manual and review the intercom module setup procedure.

4.4 CT System X-Ray ON Indicators, Cautions & Warning Labels

4.4.1 Check And Install System Warning Labels

4.4.1.1 System have warning labels as following:

All labels are installed in English and present on PDU, Console, Table, Gantry and Accessories. Add the labels listed below (Table 5-3 and Section 4.5) for the appropriate language for the country in which this system is installed. Additionally, apply any other warning labels if present, on equipment where appropriate.

For system complies with IEC 60601-1-2: 2004 (gantry model number of 2374681-8, 2374681-9, 2374681-10 and 2374681-11) have below labels.

NOTICE **Do not cover English labels already on the system.**

Subsystem	Component	Label(s)
Console	SCIM/GSCB	SCIM/GSCB overlay warning label
	Keyboard	Function key overlay label
Gantry	Scan Window	Laser warning label
	Laser Window	Laser warning label
	Front Cover	Laser warning label Information labels
	System GIB	System Global Installation Base (rating) label
High capacity table	Front Side Cover	Pinch Hazard warning label - each side of cover
	Back Cradle Pan	Pinch Hazard warning label - each side of cover
Table 1700mm	Front Side Cover	Pinch Hazard warning label - each side of cover
	Rear Side Cover	Pinch Hazard warning label - each side of cover
	Back Cradle Pan	Pinch Hazard warning label - each side of cover
NGPDU	Front Cover	Emergency OFF label Gantry Enable label Power ON label
Accessories	Table Foot Extender	Warning label
	Coronal Head Holder	Warning label
	Sagittal Head Holder	Warning label
	Accessory Tray	Warning label
	IV Pole	Caution label

Table 5-3 System Warning Labels

4.4.1.2 System have below IEC rev3 unique labels as followings:

All labels are installed in English and present on PDU, Console, Table, Gantry and Accessories. Add the labels listed below (Table 5-5 and Section 4.5) for the appropriate language for the country in which this system is installed. Additionally, apply any other warning labels if present, on equipment where appropriate.

For system complies with IEC 60601-1-2: 2007 (for the scanner with the gantry model number of 2374681-12, 2374681- 13, 2374681-14 and 2374681-15) have below labels.

Caution Label Classification

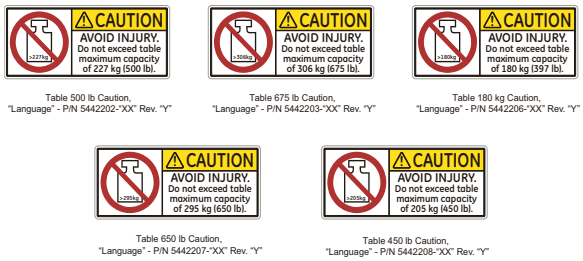
	Read Docs Caution
	Pinch Point Caution
	PDU Movement Caution
	Load Limit Caution Label (Only use a label that exactly matches the Table Load Limit Value)

Table 5-4 Caution label Classification

NOTICE **Do not cover English labels already on the system.**

Subsystem	Component	Label(s)
Console	SCIM/GSCB	SCIM/GSCB overlay warning label
	Keyboard	Function key overlay label
	Rear Panel	Read Documentation Caution Label
Gantry	Scan Window	Laser warning label
	Laser Window	Laser warning label
	Front Cover	Laser warning label Information labels
	Front Cover, Right Side	Read Documentation Caution Label Pinch Point Caution Label
	Front Cover, Left Side	Pinch Point Caution Label
	Rear Cover, Right Side	Pinch Point Caution Label
	Rear Cover,Left Side	Pinch Point Caution Label
	System GIB	System Global Installation Base (rating) label
High capacity table	Front Side Cover	Pinch Hazard warning label - each side of cover
	Back Cradle Pan	Pinch Hazard warning label - each side of cover
Table 1700mm	Front Side Cover	Pinch Hazard warning label - each side of cover
	Rear Side Cover	Pinch Hazard warning label - each side of cover
	Back Cradle Pan	Pinch Hazard warning label - each side of cover
	Front Leg	Read Documentation Caution Label
	Cradle Handle	Load Limit Caution Label
NGPDU	Front Cover	Emergency OFF label Gantry Enable label Power ON label
	Rear Panel	Read Documentation Caution Label
	Cabinet Side	PDU Movement Caution Label
Accessories	Table Foot Extender	Warning label
	Coronal Head Holder	Warning label
	Sagittal Head Holder	Warning label
	Accessory Tray	Warning label
	IV Pole	Caution label

Table 5-5 System Warning Labels

4.4.2 Documentation - Verification

When finished update GE4879 (US Only) and the mechanical installation completion form that all appropriate language labels were installed and present.

4.5 Check Warning Labels

Note: The labels on the system and the system manuals must comply with the country law, as listed in Direction 5221102-1EN (found in the keyboard collector kit shipped with the system) regardless of the user interface (UI) language that is chosen. Compliance to the law must be completed prior to releasing the system to the customer.

Note: Do not cover English labels already on the system.

4.5.1 On SCIM/GSCB

1.) Make sure the SCIM/GSCB overlay warning label appears in the correct location on the SCIM/GSCB.

2.) Record this information on Form 4879. For more information about this form, see Section 8.0 of Chapter 4.

4.5.2 On Gantry

1.) Check that all laser warning labels are present on the gantry near the laser opening.

2.) There should also be warning labels on the lower right side of the gantry front cover.

3.) Record this information on Form 4879. For more information about this form, see Section 8.0 of Chapter 4.

4.5.3 On Laser

1.) Make sure all laser warning labels appear in the correct location on the outside of the gantry.

2.) Obtain and install replacements for any missing labels.

Figure 5-29 Laser Warnings and Precautions

4.6 Process Product Locator Cards

1.) Collect the product locator cards shipped with the system. There should be approximately 28 product locator cards with the average system.

2.) Update the online product locator web site with the required hospital information.

3.) Confirm that the serial numbers on the cards shipped with the system match those found on the web site for that GON number.

4.) Update as required. Place the cards in a plastic bag, then place them in the service cabinet.

4.7 Verify Service Cabinet Installation

Verify that the service cabinet is installed and that the shipped service materials are in the cabinet. If the cabinet was not installed, install it at this time by following the Service Cabinet Installation procedure in Section 7.7 of Chapter 2.

4.8 Check X-Ray Lights

Perform several scans following the steps below. Verify that the X-ray ON lights are ON during the scans. When done, check the boxes in Table 5-6.

1.) Make sure the axial drive enable and HVDC enable switches are ON.
2.) If you are not on the Service Desktop, click on the Service Desktop icon.
3.) Select DIAGNOSTICS.
4.) Select DIAGNOSTIC DATA COLLECTION.
5.) Set the scan time to 2.00.
6.) Set the kV to 80.
7.) Set the mA to 40.
8.) Press **ACCEPT RX**.
9.) Press **START SCAN** button when flashing.
10.) Record this information on Form 4879. For more information about this form, see Section 8.0 of Chapter4.

Light On	Warning Light Locations
☐	SCIM/GSCB
☐	Gantry Front
☐	Gantry Back (Use a mirror to view)
☐	Room Light (outside of the room)

Table 5-6 X-ray Light Chart

4.9 Mechanical Characterization

The relationship of table height to ISO center and internal-to-external landmarks must be characterized for proper interference matrix functionality.

Note: Do NOT perform tilt characterization.

4.9.1 Alignment Light Characterization

1.) Start the Mechanical Characterization tool from the *Calibration* tab on the Common Service Desktop.
2.) Select the CHARACTERIZE ALIGNMENT LIGHTS button from the interface.
3.) Follow the on-screen instructions.

4.9.2 Table Height Characterization

1.) Select the CHARACTERIZE TABLE HEIGHT FROM ISO button from the interface.
2.) Follow the on-screen instructions.
3.) Record the distance from ISO.

Note: If the distance is less than 21mm or greater than 25mm, relative to ISO, you must adjust the table height using the table leveling pad and adjusters. Raise or lower all four adjusters equally to achieve desired results. Note down the value of distance "V" which will be used in Section 4.0.

4.10 Interference Test

PREREQUISITES

- Be sure that the System State was restored from **DVD** per Section 2.0.
- Reset the hardware to download the new characterization values before performing the table/ gantry interference tests in this section.

CONFIGURATION

1.) Table flashed with latest SW
2.) Table must have elevation and cradle characterized
3.) Table must be mechanically aligned to gantry
4.) Table must have had the table-gantry characterization completed
5.) Verify the Table extender is installed.

TEST OUTLINE

The following tests verify the proper tilt and table interference matrix on the RT gantry.

- Verify Table Elevation – Section 4.10.1
- Position Tilt, Move Table to Interference Limit – Section 4.10.2
- Position Table, Move Tilt to Interference Limit – Section 4.10.3
- Tilt Limits When Table Below Scan Plane Lower Limit – Section 4.10.4

REQUIREMENTS

The following requirements are tested in this series of tests.

1.) No motion shall cause the table to hit the gantry (or gantry to hit the table)
2.) Requirement #1 shall include the use of the table extender.
3.) No tilt motion shall cause the gantry tilting frame to touch the stationary base covers for any tilt angle.

LIMITATIONS

These requirements will only be met when the table is NOT in service mode.

INTERPRETING TEST RESULTS

If test results indicate that elevation and/or tilt display readings fail to meet specifications, DO NOT adjust the limit switches. Instead, re-characterize and/or adjust tilt speed. Refer to *Service Methods (5366638-8EN)*. Perform elevation and cradle characterization first, then repeat the test. If it still fails, perform tilt.

4.10.1 Verify Table Elevation

Note: "V" means distance from table Maximum Height to ISO.

#	TEST	EXPECTED RESULTS
4.10.1-1	Move the cradle (and IMS) to home position. Push the table down gantry push-button to lower the table to the minimum height.	Elevation Display should read (561.0+ V) ± 3 mm; (466.0+ V) ± 3 mm for High capacity table
4.10.1-2	Raise the table to the maximum height using the gantry controls. If the mechanical alignment of the table/gantry is not correct, as is often the case during manufacturing staging, this value may be out of range. Most of the following tests will still be valid: Those that might have some variation are indicated in **bold type**.	Elevation Display should read V ± 3 mm. **If mechanical alignment of the table/gantry is not correct, this value can be as low as 0 mm and as high as 40 mm**.

Table 5-7 Table Elevation Tests

4.10.2 Position Tilt, Move Table to Interference Limit

The following tests verify the table interference limits at different tilt locations.

Note:
- “I” means top of gantry tilts toward the table base
- “S” means top of gantry tilts away from the table base.
- "V" means distance from table height to ISO.

Important: **For all tests, make sure there is 2.5 cm of clearance between the gantry and table. Also, for all tilt angles used in this test, make sure that the Gantry Tilting frame covers do not touch the stationary base covers.**

#	TEST	EXPECTED RESULTS
4.10.2-1	Move cradle (and IMS) to home position and set internal landmark.	Cradle position on display should read 0.0
4.10.2-2	Raise table height to maximum height, set the internal landmark, move cradle into gantry 1200mm.	Table elevation on display should read V ± 3mm. **(This value will be the same as in 4.10.1-2 above.)** Cradle position on display should read 1200.0 mm.
4.10.2-3	Tilt the gantry to I30.0, then lower table until motion stops.	Table elevation on display should read 80.0 ± 3mm. Tilt display should read I30.
4.10.2-4	Tilt the gantry to I23.0, then lower table until motion stops.	Table elevation on display should read 146.0 ± 3mm. Tilt display should read I23.
4.10.2-5	Tilt the gantry to I20.0, then lower table until motion stops.	Table elevation on display should read 173.0 ± 3mm. Tilt display should read I20.
4.10.2-6	Raise the table elevation to maximum height.	Table elevation on display should read V ± 3mm. **(This value will be the same as in 4.10.1-2 above.)**
4.10.2-7	Tilt the gantry to S30.0, then lower table until motion stops.	Table elevation on display should read 180.5 ± 3mm. Tilt display should read S30.
4.10.2-8	Tilt the gantry to S23.0, then lower table until motion stops.	Table elevation on display should read 213.0 ± 3mm. Tilt display should read S23.

Table 5-8 Position Tilt, Move Table to Interference Limit Tests

#	TEST	EXPECTED RESULTS
4.10.2-9	Tilt the gantry to S20.0, then lower table until motion stops.	Table elevation on display should read 225.5 ± 3mm. Tilt display should read S20.
4.10.2-10	Raise the table to 178 mm.	Table elevation on display should read 178mm.
4.10.2-11	Tilt gantry to S30 and verify the table height can be adjusted from 180 to 25 mm. **(This value will be the same as in 4.10.1-2 above.)**	Tilt display should read S30. Table lower limit should be 180 ± 3mm. Upper table limit should be 25 ± 3 mm. **(This value will be the same as in 4.10.1-2 above.)**
4.10.2-12	Set the table height to 78 mm.	Table elevation on display should read 78.0mm.
4.10.2-13	Tilt gantry to I30 and verify the table height can be adjusted from 80 to 25 mm. **(This value will be the same as in 4.10.1-2 above.)**	Tilt display should read I30. Table lower limit should be 80 ± 3mm. Upper table limit should be V ± 3 mm. **(This value will be the same as in 4.10.1-2 above)**

Table 5-8 Position Tilt, Move Table to Interference Limit Tests(Continued)

4.10.3 Position Table, Move Tilt to Interference Limit

The following tests verify the tilt interference limits at different table heights.

Note:
- "I" means top of gantry tilts toward the table base
- "S" means top of gantry tilts away from the table base.
- "V" means distance from table height to ISO.

Important: **For all tests, make sure there is 2.5 cm of clearance between the gantry and table.**

#	TEST	EXPECTED RESULTS
4.10.3-1	Move cradle (and IMS) to home position and set internal landmark. Set gantry tilt to zero.	Cradle position on display should read 0.0. Gantry tilt on display should read 0.0.
4.10.3-2	Raise table height to maximum height, set the internal landmark, move cradle into gantry 1200mm.	Table elevation on display should read V ± 3mm. **(This value will be the same as in 4.10.1-2 above.)** Cradle position on display should read 1200.0 mm.
4.10.3-3	Lower table until height is 115mm. Tilt the gantry top away from the table ("S") until it stops.	Table elevation on display should read 115 mm. Tilt display should read S30 ±0.5º.
4.10.3-4	Tilt the gantry top toward the table ("I") until it stops.	Table elevation on display should read 115 mm. Tilt display should read I26.0 ±0.5º.
4.10.3-5	Tilt the gantry to 0. Lower table until height is 200mm. Tilt the gantry top away from the table ("S") until it stops.	Table elevation on display should read 200 mm. Tilt display should read S25.5 ±0.5º.
4.10.3-6	Tilt the gantry top toward the table ("I") until it stops.	Table elevation on display should read 200 mm. Tilt display should read I16.5 ±0.5º.
4.10.3-7	Tilt the gantry to 0. Lower table until height is 280 mm. Tilt the gantry top away from the table ("S") until it stops.	Table elevation on display should read 280 mm. Tilt display should read S2.0 ±0.5º.
4.10.3-8	Tilt the gantry top toward the table ("I") until it stops.	Table elevation on display should read 280 mm. Tilt display should read I1.5 ±0.5º.

Table 5-9 Position Table, Move Tilt to Interference Limit Tests

4.10.4 Tilt Limits When Table Below Scan Plane Lower Limit

The following tests verify the table and tilt interference limits when the table height is below the scan plane.

Note:
- "I" means top of gantry tilts toward the table base
- "S" means top of gantry tilts away from the table base.
- "V" means distance from table height to ISO.

Important: **For all tests, make sure there is 2.5 cm of clearance between the gantry and table.**

#	TEST	EXPECTED RESULTS
4.10.4-1	Set gantry tilt to zero. Move cradle (and IMS) to home position, lower the table all the way, and set the internal landmark.	Cradle position on display should read 0.0 Gantry tilt on display should read 0.0. Table height should read (561.0+V) ± 3 mm. For High capacity table should read (466.0+ V) ± 3 mm **(This value will be the offset from 561 mm or 466 mm by the same amount as the upper table limit varies from 25 mm in 4.10.1-2 above.)**
4.10.4-2	Tilt the gantry forward and backwards and verify the following tilt limits: S1.5 and I30 for GT1700; S6.5 and I30 for High capacity table	Gantry tilt on display should read S1.5 ± 0.5º for GT1700 S6.5 ± 0.5º for High capacity table Gantry tilt on display should read I30.0 ± 0.5º.
4.10.4-3	Set Gantry tilt to 0. Then, using the gantry push-buttons, move the cradle in towards the gantry until it is stopped.	Gantry tilt on display should read 0.0. Cradle should stop at 29.0 mm ± 6 mm from the home position. **(This value will not be valid if the table/gantry mechanical characterization is not correct as described in 4.10.1-2 above. Insure that the front of the table is at least 25 mm from the gantry.)**
4.10.4-4	Set gantry tilt to zero. Move cradle to home position.	Cradle position on display should read 0.0 Gantry tilt on display should read 0.0.
4.10.4-5	Raise the table to a height of 386 mm and verify the following tilt limits: S13.5 and I30.0.	Table height should read 386 mm. Gantry tilt on display should read S13.5 ± 0.5º. Gantry tilt on display should read I30.0 ± 0.5º.
4.10.4-6	Set Gantry tilt to 0. Set the internal landmark. Then, using the gantry push-buttons, move the cradle (and IMS) in towards the gantry until it is stopped.	Gantry tilt on display should read 0.0. Cradle should stop at 171 mm ± 6 mm from the home position.
4.10.4-7	Set gantry tilt to zero. Move cradle to home position.	Cradle position on display should read 0.0. Gantry tilt on display should read 0.0.
4.10.4-8	Raise the table to a height of 292 mm and verify the following tilt limits: S21.5 and I30.0.	Table height should read 292.0 mm. Gantry tilt on display should read S21.5 ± 0.5º. Gantry tilt on display should read I30.0 ± 0.5º.
4.10.4-9	Set Gantry tilt to 0. Raise the table to 280 mm. Then, using the gantry push-buttons, move the cradle in towards the gantry until it is stopped.	Gantry tilt on display should read 0.0. Cradle should go all the way through the gantry bore to the full-extended position, approximately 2045 mm for High capacity table, 2115mm for GT1700.

Table 5-10 Tilt Limits When Table Below Scan Plane Lower Limit Tests

#	TEST	EXPECTED RESULTS
4.10.4-10	Set gantry tilt to zero. Move cradle (and IMS) to home position, lower the table all the way and set the internal landmark.	Cradle position on display should read 0.0 Gantry tilt on display should read 0.0. Table height should read (561+V) ± 3 mm. For High capacity table should read (466.0+ V) ± 3 mm **(This value will be the offset from 561 mm or 466 mm by the same amount as the upper table limit varies from 25 mm in 4.10.1-2 above.)**
4.10.4-11	Tilt the gantry top toward the table to a tilt of 30 degrees	Display should read I30.
4.10.4-12	With the table down all the way, move the cradle in until it stops.	Cradle position should be 404.5 ±3 mm for GT1700 411.0 ±3 mm for High capacity table
4.10.4-13	Move the table to the home position, raise the table to a height of 386 mm, set the internal landmark, and then move the cradle in until it stops.	Cradle position should be 421 ±5 mm.
4.10.4-14	Raise the table to a height of 79 mm, then move the cradle in.	Cradle should go all the way through the gantry bore to the full-extended position, approximately 2045±50 mm for High capacity table, 2115±50 mm for GT1700.

Table 5-10 Tilt Limits When Table Below Scan Plane Lower Limit Tests

4.10.5 Gantry Rotational Characterization

For RT systems, this characterization is required on installation and when any axial drive components are changed.

Refer to the *Gantry Rotational Characterization* calibration procedure on the Service Methods for the instructions.

4.10.6 Alignment Light Characterization

For RT systems, this characterization is only needed if the customer has supplied their own external gantry laser alignment lights. In this instance the gantry external lasers are disabled and the distance from the customer external lasers to the gantry internal lasers must be characterized.

Tools/Supplies Needed

- Cable Ties
- Part 5111615: “Laser not used” labels for laser assemblies (2 per system required)
- Part 5111733: “Laser not used” labels for above the external laser windows on front cover (2 per system required)

Note: Both labels can be found in the installation support kit.

Procedure

1.) Remove right side gantry cover.

DANGER **CRUSH HAZARD.**

UNEXPECTED GANTRY ROTATION CAN CAUSE SERIOUS INJURY. NEVER SERVICE THE GANTRY WITH THE AXIAL DRIVE ENABLED.

2.) Turn OFF the Axial Drive on the service switch panel.

3.) For external laser light near the 107 degree weight stack:

a.) Rotate gantry by hand until the laser bracket nearest the 107deg weight stack is accessible. Figure 5-30 below shows the two external laser light brackets with the front cover off for reference.

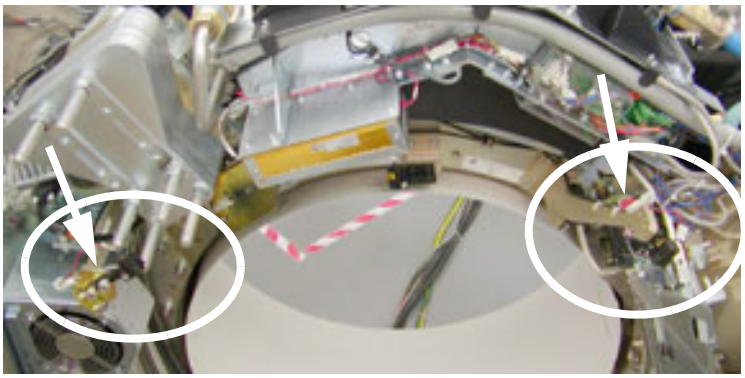


Figure 5-30 Two External Lasers

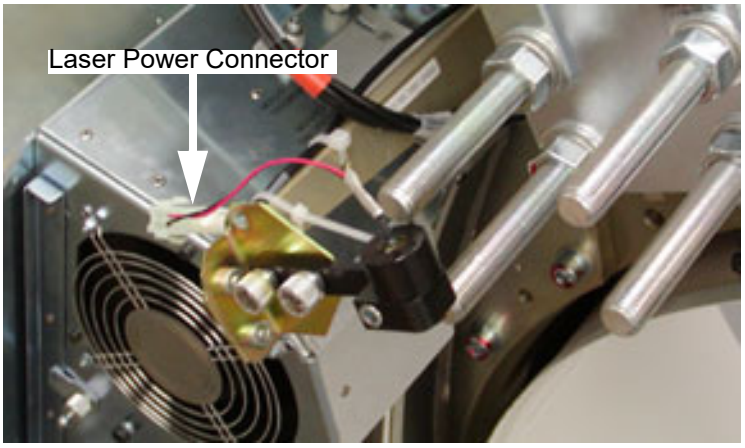


Figure 5-31 Laser bracket near 107 degree weight stack

WARNING **POTENTIAL FOR SHOCK**

VOLTAGE MAY BE PRESENT.

ENSURE LASERS ARE TURNED OFF, PRIOR TO DISCONNECTING THEM.

b.) Turn OFF the 120VAC enable switch on the service switch panel.

c.) Disconnect laser power plug. Cut the cable ties that hold the cable and plug in place if needed for better access.

d.) Wrap additional cable on the laser diode side around the laser holder and secure the female plug with cable tie(s).

e.) Secure the male end of the plug to the external laser bracket with cable ties as required.

Note: Be sure to secure the plugs adequately to prevent movement during gantry rotation.

f.) Be sure to re-secure any loose cable where cable ties may have been removed for better access.

g.) Place label Part #5111615 on the cable to the laser diode.

h.) Rotate gantry (if needed for access) towards the external laser located near the heat exchanger and repeat Step b through Step f. Turn ON the 120VAC to rotate the gantry easier and then turn it back OFF prior to continuing.

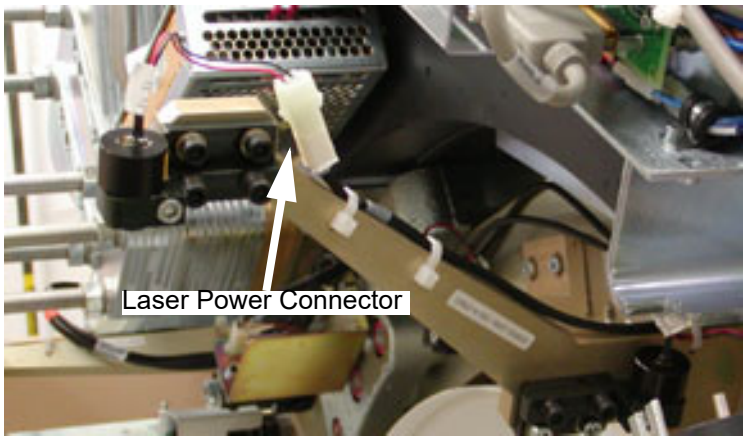


Figure 5-32 Laser bracket near Heat Exchanger

4.) Enable 120AC and Axial Drive.

5.) Replace right side gantry cover and secure.

6.) Place labels 5111733 on the front gantry cover near the gantry external laser ports. See Figure 5-33, below.

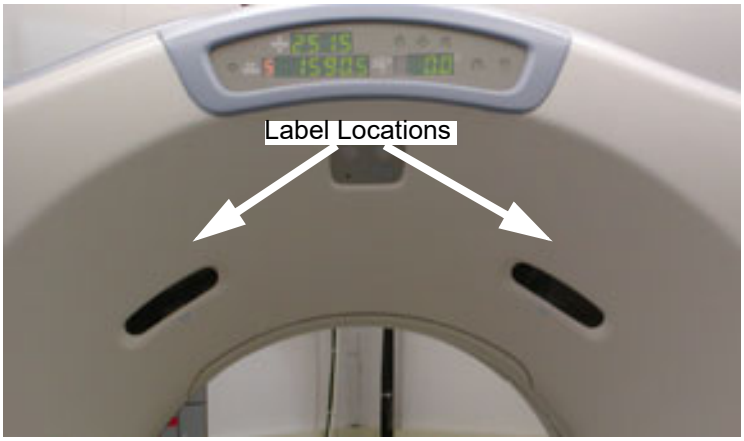
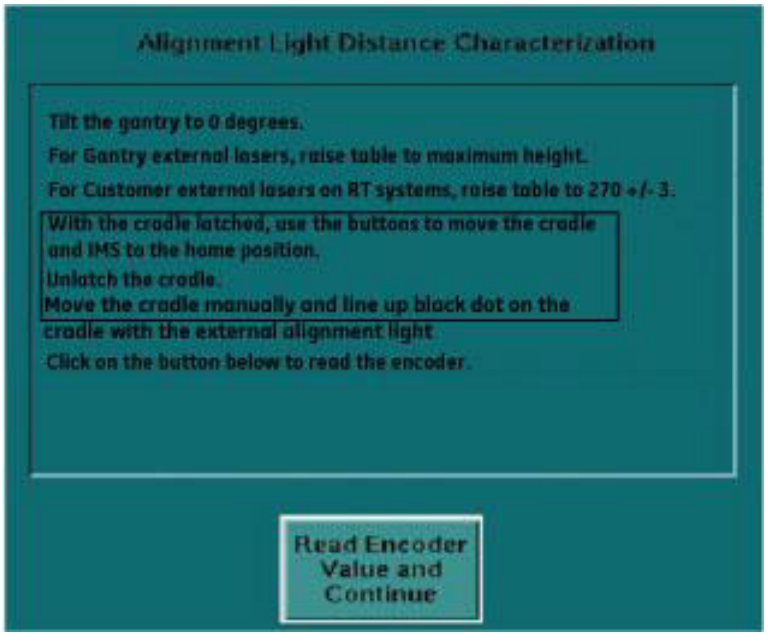


Figure 5-33 External Laser Ports - Label Locations

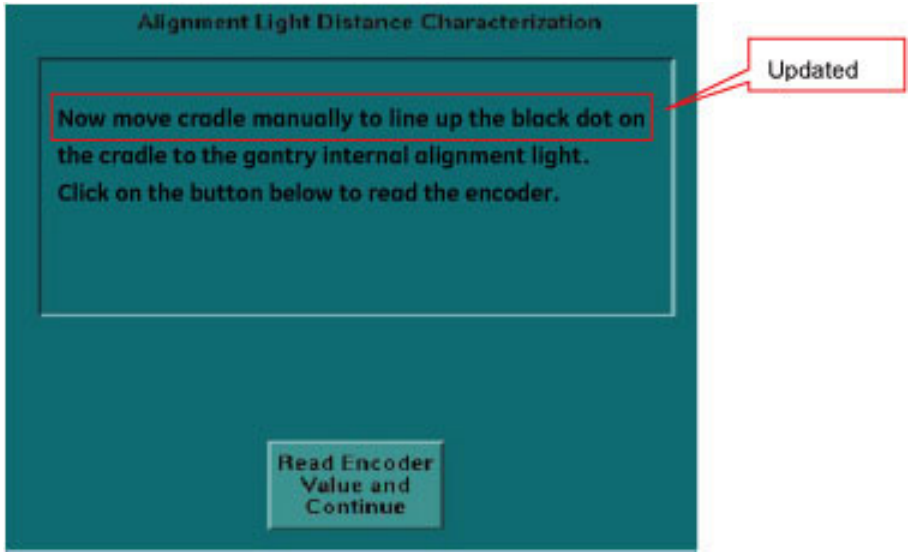
7.) Perform the Gantry Alignment light characterization procedure to characterize the distance from the customer external lasers to the gantry internal lasers.

- Open the CSD, go to *Calibration* tab, click *Mechanical Characterization*, and select *Characterize Alignment Light*.
- Move table to home position by gantry panel "OUT" button. (This is to ensure to support the max distance of external laser about 820mm).

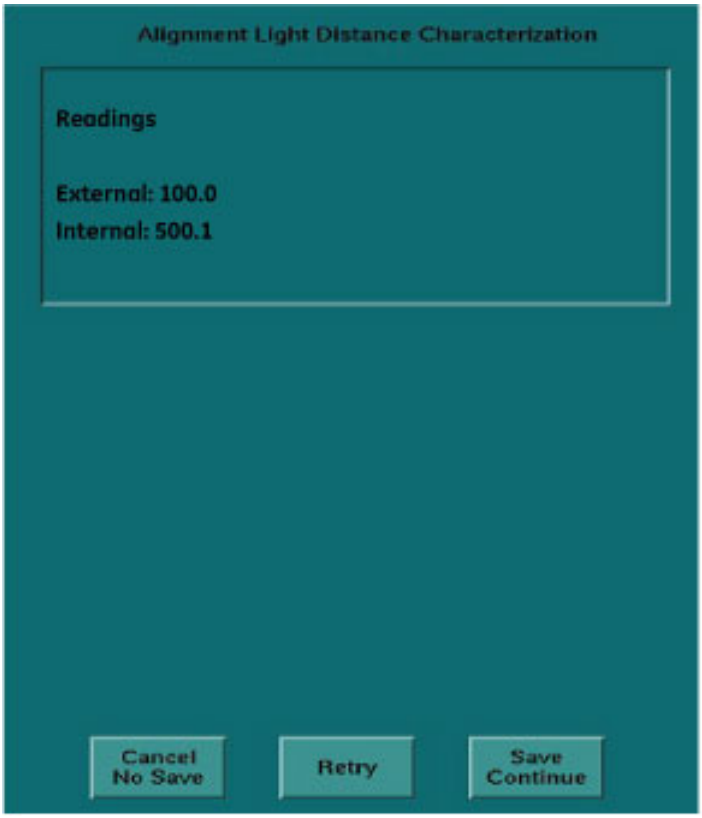
- Unlatch cradle.
- Perform the procedure as written in the screen-capture:



- Move cradle manually to line up the black dot with internal laser and perform again the procedure as written in the screen-capture from the next version of software:



- Following steps are same as before from software screen:



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Chapter 6
Image Quality

NOTICE **Potential for Data Loss and/or Equipment Damage.**

To prevent potential data loss and equipment damage, please do the following:

- **Record data collected from the procedures in this chapter into Form e4879 when directed.**
- **Only use the Installation manual that existed in SIMS content viewer. Any other revisions of this manual may not exactly match your system.**

Section 1.0 Introduction

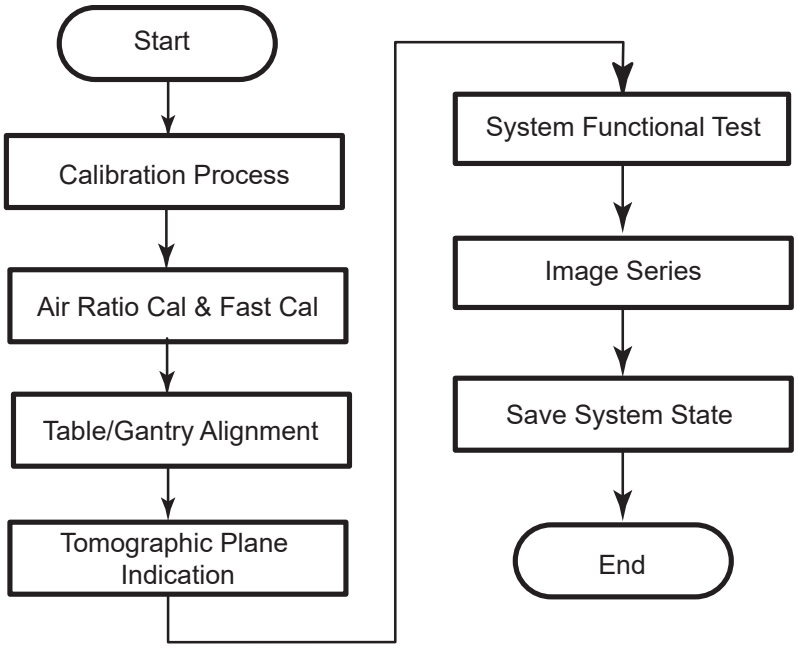


Figure 6-1 System Test Overview

Section 2.0
Calibration Process

2.1 Reference Procedures

Do not perform these procedures (Scanning with Service Protocols or Center Phantom) until instructed to do so in other sections of this chapter.

2.1.1 Scanning with Service Protocols

Locate the Manufacturing and Installation protocols under Infant area 20.

Note: **Manufacturing and Service share this Protocol list. Different product option offerings also use this list. Carefully follow the scan section instructions, and verify you acquired the images with the correct technique before filling out the data sheet. Otherwise you may troubleshoot an image problem that only exists because you used the wrong technique.**

1.) Select the NEW PATIENT icon on the left monitor
2.) Enter a Patient ID (e.g., **`getest`**).
3.) Click on the box labeled PEDIATRIC.
4.) Select a service protocol from the list, to display the corresponding view edit screen.
Optional Method: Enter the protocol number into the `Protocol Number Field` on the Exam Rx Screen.

2.1.2 Center Phantom

1.) Select SCANNER UTILITIES icon on the left monitor
2.) Select CENTER PHANTOM.
3.) Follow the on-screen procedures.
4.) The phantom center spec is ±.5mm.
5.) Select QUIT, when the phantom is within specification.
6.) Level the phantom both front to back and side to side. (use a 6" level)

2.2 Prepare the QA Phantom

1.) Locate the multi-language sticker packet in the QA phantom shipping box.
2.) Attach the sticker with the customer's language to the face of the phantom hanger bracket.

2.3 Calibration Process Introduction

If your system has a factory supplied state DVD, you used it to load the system calibration files during the Restore System State (2.3 on page 257 of this manual).

Section 3.0
Air Ratio Cal and Fast Cal

1.) Select SCANNER UTLITIES, perform Air Ratio Cal.

2.) Select FAST CALIBRATION from the Daily Prep menu.

Note: **Use the default Fast Cal selections determined by the system configuration. (The system defaults to all four kV stations, but you can choose kV stations to calibrate during reconfig.)**

3.) Run the selected air calibrations.

4.) When the calibration process completes, click on QUIT.

Section 4.0
Table/Gantry Alignment Procedure (For RT purpose)

4.1 Conditions

This procedure applies to the system with Flat Table Top (FTT) option. If the site has not FTT option, please skip this section.

This procedure contains three tests to make sure Table/Gantry is correctly aligned by the evidence of image that:

1.) Cradle movement is perpendicular to the scan plane.
2.) Cradle movement is linear.
3.) Table vertical movement does not cause In-Out movement.

This procedure may require the removal of the table bottom, side and rail covers.

This procedure requires that mechanical final alignment was completed and passed.

4.2 Procedure

Tool Required: 0.5 mm diameter metal wire (5113046)

Test 1:

1.) Assemble the FTT on the Table Cradle.
2.) Assure the FTT level in latitudinal/ longitudinal orientation using the bubble level.
3.) Drive the table to the ISO elevation.
4.) Put the FTT Lock Bar on the first lock station of (H4) FTT. (Reference to Gantry).
5.) (For High Capacity Table only): Attach two perpendicular metal wires on the lock bar. One is to the center of lock bar, aligned with sagittal laser. The other is aligned with internal axial laser. Set internal landmark.

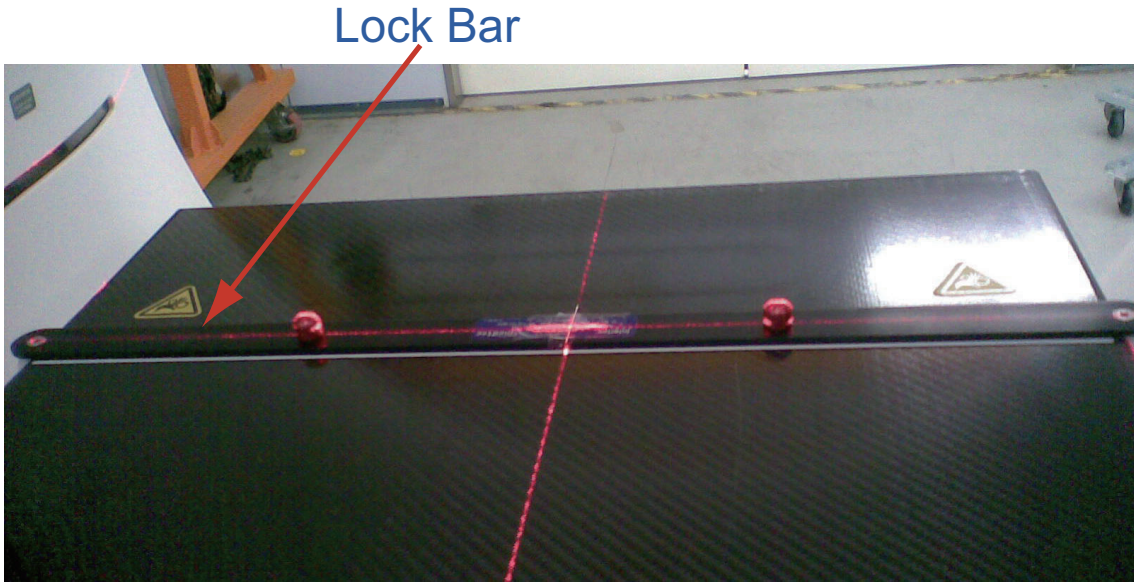


Figure 6-2 Attach metal wires on lock bar

6.) Select the NEW PATIENT, set protocol as shown in Table 6-1

Scan Type	Start Loc.	End Loc.	KV	mA	Scan Plane
Scout	S30	I30	120	20	0

Table 6-1 Scan Parameter

7.) Click on CONFIRM, then press the START SCAN button when lighted, to perform the scan.

8.) On the Image Works desktop, in the Browser, select and display the image which is just generated, see Figure 6-3

Figure 6-3 Image at H4

9.) Draw a horizontal line (# 1) on the above image, the line length equal to width of FTT

10.) Zoom the image to 5 times to view image, see Figure 6-4

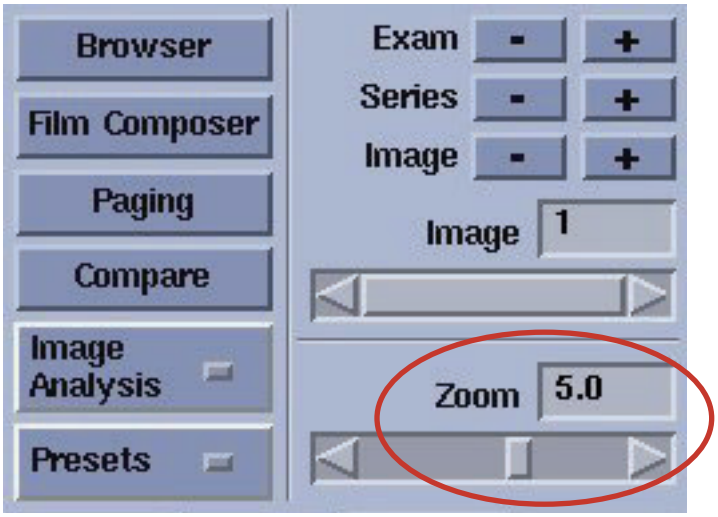


Figure 6-4 Zooming function

11.) Move the horizontal line to the edge of lock bar, whatever above or below both OK, see Figure 6-5 and Figure 6-6

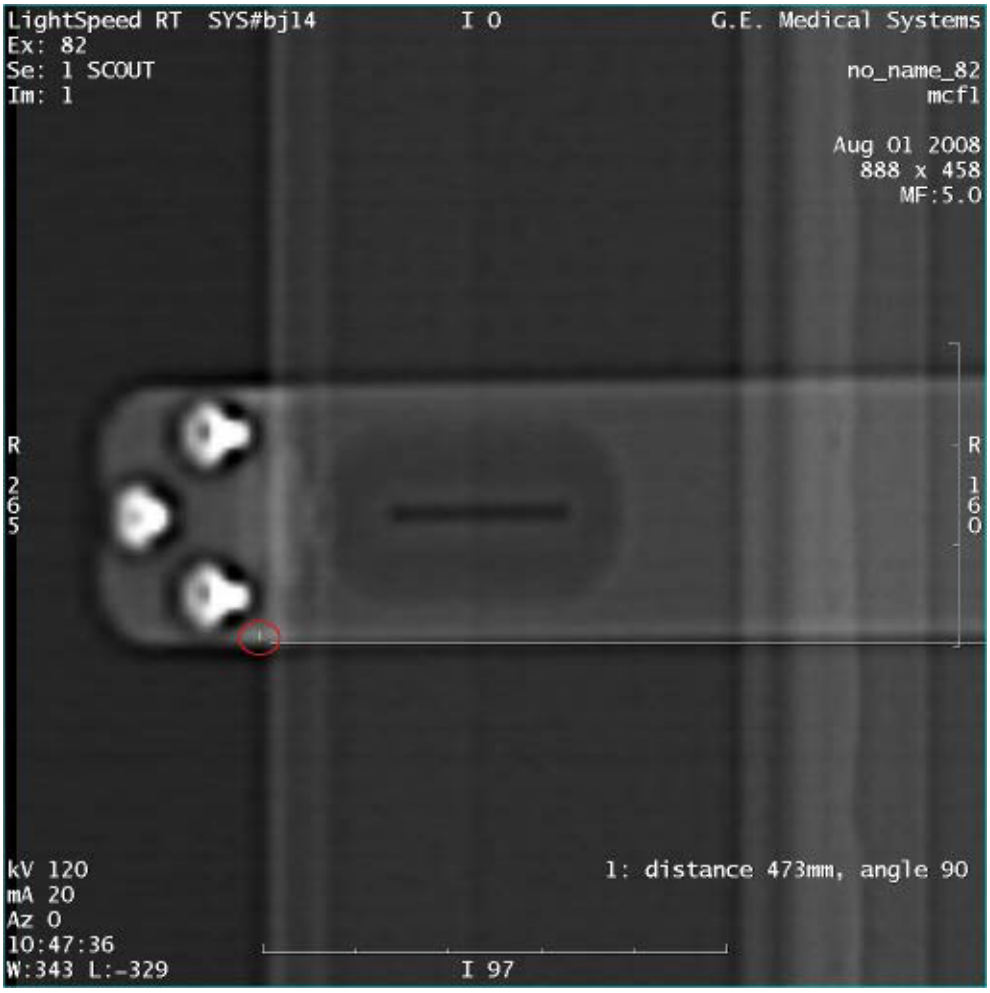


Figure 6-5 Zooming image (left side)

Figure 6-6 Zooming image (right side)

12.) Make vertical line (# 2) from right point of line # 1 to the edge of the lock bar, the length of line # 2 will display on the right corner. the value should be within ± 2mm.

13.) If the result is out of specification, adjust the Table according to the test result.

14.) Repeat the steps 5-12 to assure the value within ± 2mm.

15.) Move the lock bar to another bar lock station about 800mm away from the first one, and make the same test as steps 5-12, make sure the line # 2 within ± 2mm.

Test 2: (For High Capacity Table Only)

1.) In ImageWorks, open the image at H4 got in test 1 above. Click on COMPARE, and open image at F4

2.) Zoom the images to 3 times to view. Measure the location of the wire cross point on images at H4 and F4. The difference of the two locations should be within 2 mm.

3.) If the result is out of specification, adjust the Table according to the test result.

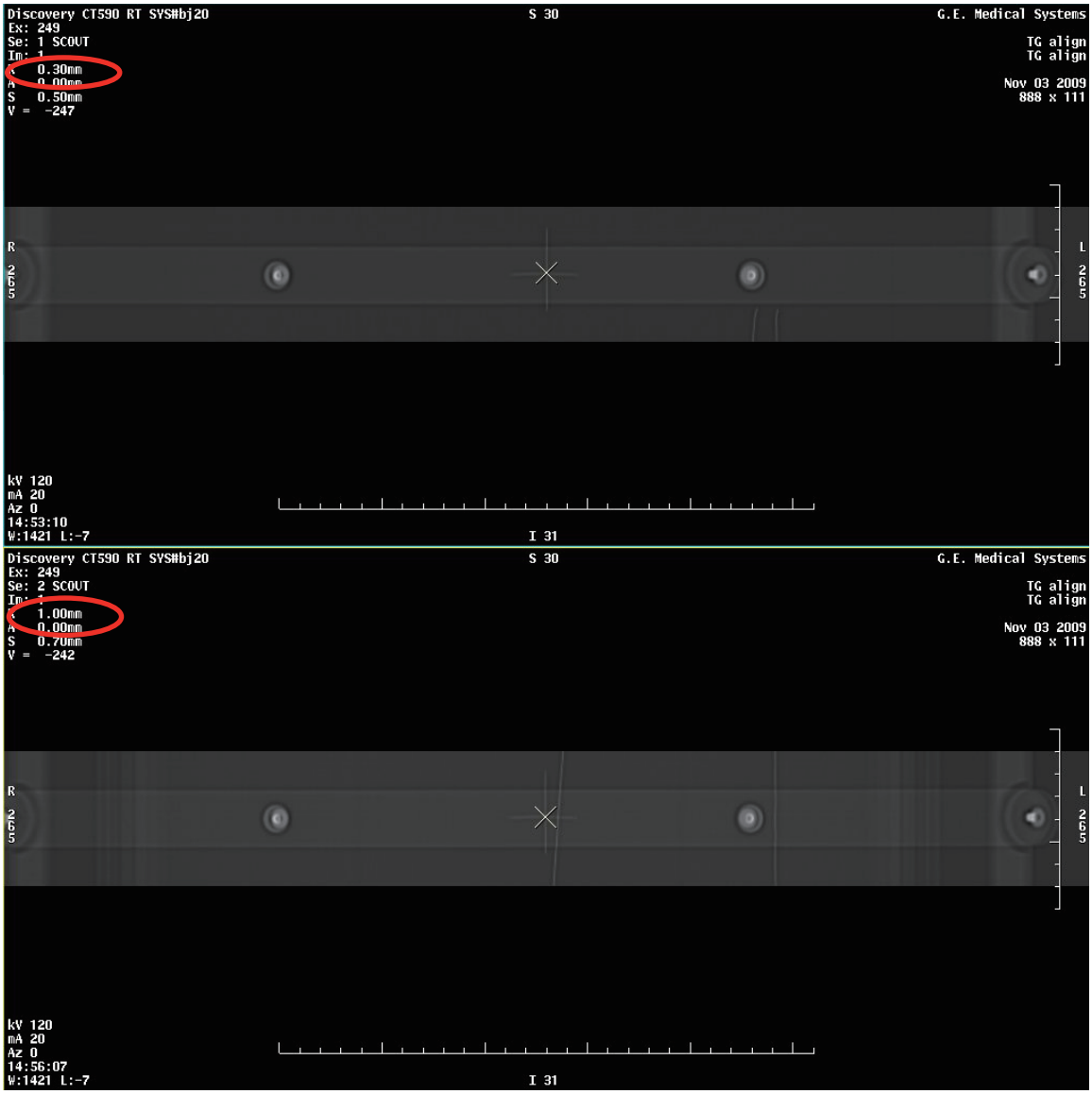


Figure 6-7 Compare right/left difference

Test 3: (For High Capacity Table Only)

1.) Move to lock bar to the H4 location.

2.) Elevate the Table to Up limit.

3.) Select the NEW PATIENT, set protocol as shown in Table 6-1.

4.) Click on CONFIRM, then press the START SCAN button when lighted, to perform the scan and get Image 1.

5.) Move Table to Down limit.

6.) Repeat scan series to get scout scan Image 2.

7.) Compare Image 1 and Image 2, zoom the images to 3 times to view. Measure the two locations of the wire cross point. The different of the two locations (I/S direction) should be within 2 mm.

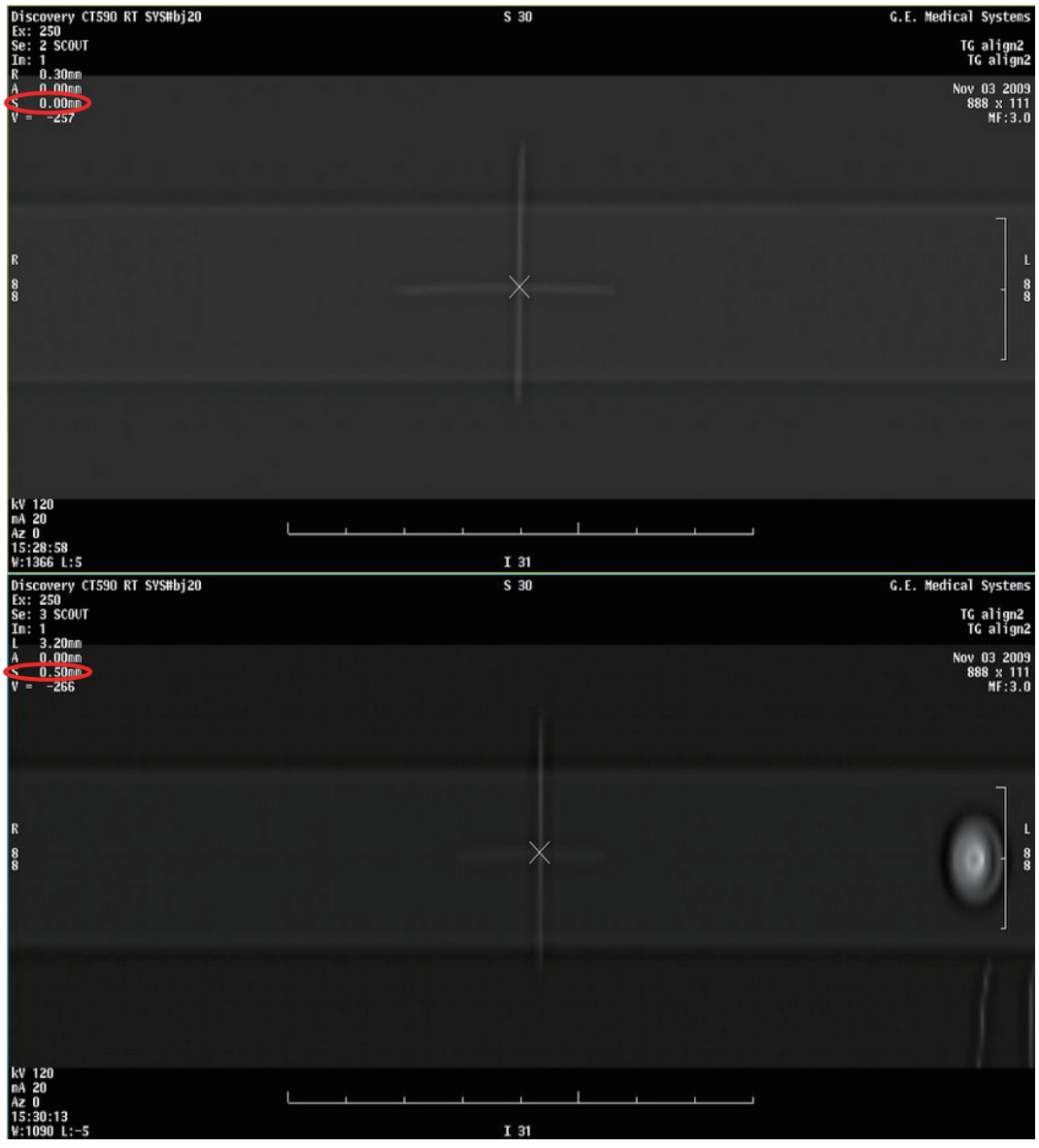


Figure 6-8 Compare S/I location different

8.) If the different is out of spec, recheck Gantry tilt characterization refer to Service Methods, Gantry Tilt Pot Adjustment, recheck and adjust Gantry level as necessary.

Section 5.0
RTP (Radiotherapy Treatment Planning) Alignment Test Procedure

The detailed procedure please refer to Service Methods -> Align, Setup, Calibration -> System.

Section 6.0
Tomographic Plane Indication

1.) Place the QA phantom on the phantom holder.
2.) Center the Phantom (refer to procedure 2.1.2 on page 300)
3.) Turn ON the internal alignment lights, and drive the phantom into the gantry opening, until the line on the phantom lines up with the internal laser lights.
4.) Verify that BOTH internal axial lasers line up along the line on the QA phantom. If not, check table/gantry, cradle, and/or laser alignment.
5.) Center the phantom in the scan plane with the calibration program. (See 2.1.2 on page 300 for details on the phantom centering procedure.)
6.) On the Service Protocol Selection window, click on MANUFACTURING.
7.) Select the service protocol TOMO PLANE INDICATION. (See 2.1.1 on page 300 for details on scanning with service protocols.)

or

Manually select the scan parameters in Table 6-2.

Scan Type	kV	mA	SFOV	Thickness	Scan Time	Start Loc.	End Loc.	Algorithm	Interval
Helical	120	130	Small	1.25HQ	1.0sec	I3.0	S3.0	Bone	0.2

Table 6-2 Tomographic Plane Indication Scan Parameters

8.) Display the image series, and locate the scan plane indicator, the longest bar in the bar pattern on the right side of the phantom. The right side of the phantom corresponds to the side of the image labeled **L** on the display screen.
9.) On the HHS Data Sheet, record the scan location (shown on the image annotation) of the image with the darkest scan plane indicator (darkest long bar).
10.) If your system meets all the installation and alignment specifications, the image at scan location zero (S0.0) should contain the scan plane indicator. If scan location S1.0 or scan location I1.0 has the darkest bar, the system still meets the specification. The scan plane deviation should equal S0.0 ±1.0mm. If necessary, adjust the internal alignment light position to meet the S0.0 ±1.0mm requirement.
11.) Repeat the Tomographic Plane Indication test with the external alignment lights.
    a.) Use the external alignment light, and press the external landmark.
    b.) Verify the external light lines up along the black line on BOTH the left and right sides of the QA phantom.
    c.) The scan plane indication must fall within the S0.0 ±1.0mm specification.
12.) Initial below.

Section 7.0
Image Series

NOTICE **Run ALL Image Series Tests in Auto Mode. Manual procedures are provided in this section as REFERENCE ONLY.**

7.1 Scan Protocol

The person who acquires the image series has the responsibility to review the images and verify they meet the specifications listed on data sheets. Responsibilities also include means and standard deviation measurements and keeping a record of failures that occur during the image series.

Unless otherwise stated, use the following scan parameters during the image series acquisition:

- Scan FOV equal to display FOV (Field of View)
- 512x512 matrix size

Note: **Consider *any* image series scan that does not meet specifications as failing.**

For means and standard deviations, 90% of the slices must pass. Any failure on a particular technique requires at least ten additional slices to evaluate effectively.

Systems with metal-free cradles have a phantom holder with a perpendicular adjustment (Z-axis) knob on it. **Each time you change phantoms,** make sure you use a bubble level, and the Z-axis knob on the phantom holder, to level the phantom.

7.2 Data Recording: Means and Standard Deviation

Any failure on a particular technique requires at least a ten additional slices to evaluate effectively. For means and standard deviations, 90% of the slices must pass.

- Record means to two decimal places, and round to the nearest one-tenth, (one decimal place) when you compare the resulting values to the spec.
- Record standard deviations to two decimal places, then round off to one decimal place, to compare it to the spec.
- Average standard deviations: Use two decimal places to average the values, then round off to one place.

Before you record the means and standard deviations, check the image data sheets to determine whether to average the means and standard deviations, or record them slice by slice. Make sure you record all the required image data on the HHS data sheets.

7.3 Term Definitions and Screens

Xc - Mean CT number for the specified center coordinates of the phantom image.

AvXc - Average Mean CT number for the center of the phantom image: Average the mean CT value for all specified center coordinates of all slices in an exam.

Xo - Mean CT number for the outside of the phantom image: Average the mean CT value for all specified outside coordinates of one slice.

AvXo - Average outside mean CT number for the number of slices in an exam.

AvSDc - Average image noise about the center image coordinate (measured as the standard deviation) of all slices in an exam.

AvSDo - Average image noise (standard deviation) for the outside of a phantom: Average of all outside coordinates of all the slices in an exam.

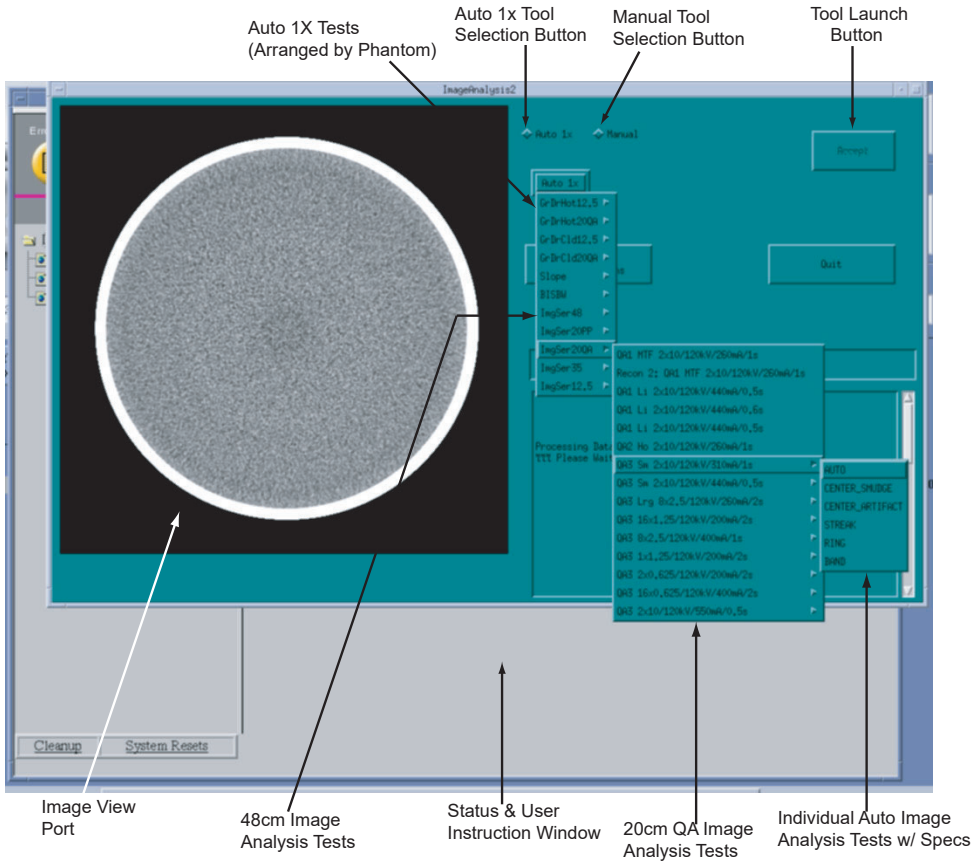


Figure 6-9 Image Analysis Tool User Interface - Auto 1x Test Pull Down Menu

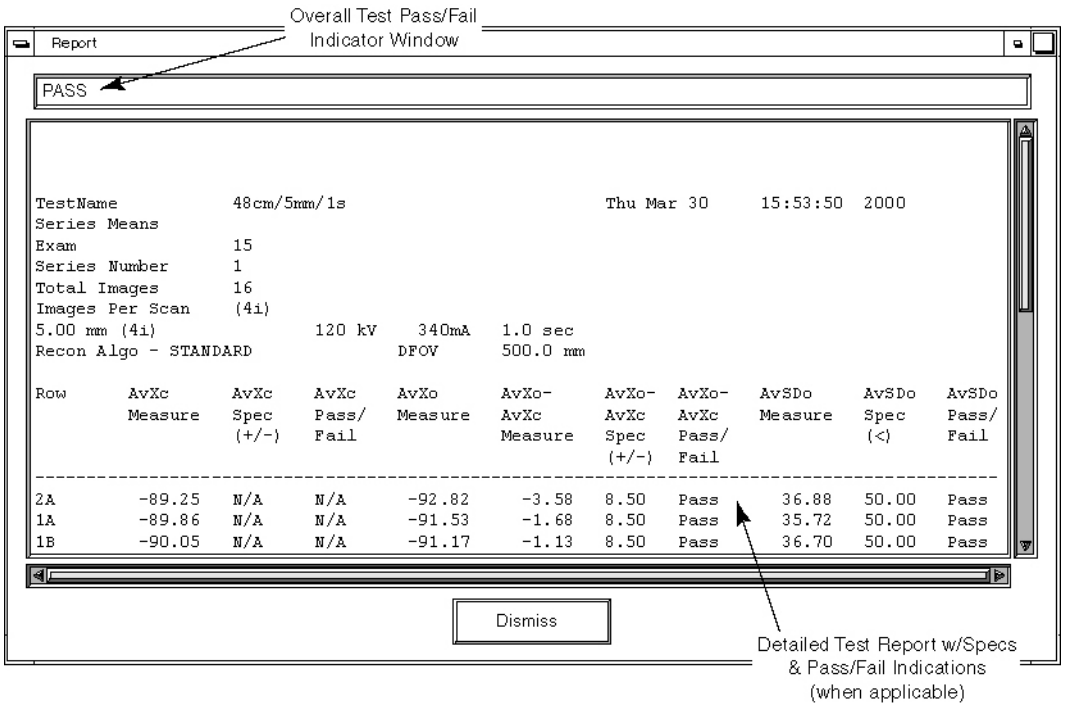


Figure 6-10 Image Analysis Tool User Interface - Test Results Report Window

7.4 48cm Phantom Image Series Image Performance Verification

7.4.1 Acquiring the 48cm Phantom Image Series

1.) Mount the Phantom Holder on the head-end of the table.
2.) Mount the 48cm Phantom on the Phantom Holder.
3.) Align, level, & center the 48cm Phantom.
- Align phantom using the internal laser lights.
- Level phantom using bubble level and the Z Axis knob on the Phantom Holder.
- Center phantom using the CENTER PHANTOM procedure in the left head SCANNER UTILITIES selection and the X and Y Axis knobs on the Phantom Holder.

4.) Set up the system to scan a single, 64 image, 48cm Phantom series.

MANUAL SCAN PROTOCOL SETUP

Refer to Table 6-3 to manually set-up an Axial scan with the parameters shown.

Note: These parameters may differ from those found using the Auto Scan Protocol Setup below.

System	Series Description	Scan Type	Start Loc.	End Loc.	Total # of Images	Thick Speed	Interval (mm)	Gantry Tilt	SFOV	kV	mA	Total Exposure Time	DFOV (cm)	Recon Type
16 Slice	48 16x1.25/120kV /400mA/2s	Axial Full 2.0 sec	I9.375	S9.375	64	1.2516i	0.00	S0.0	Large	120	400	8.0 sec.	50.0	Std
8 slice	48 8x2.5/120kV /340mA/1s	Axial Full 1.0 sec	I8.750	S8.750	32	2.5 8i	0.00	S0.0	Large	120	340	4.0 sec	50.0	Std

Table 6-3 48cm Phantom Image Series Scan Parameters

AUTO SCAN PROTOCOL SETUP

a.) On the Exam Rx desktop, select NEW PATIENT.
b.) Type the following entries in the two listed `Patient Information` fields:
* `Patient ID:` **`Service`**
* `Name:` **`48cm Phantom Image Series`**

c.) From the Protocol Selection display, click on the Service Tab under Anatomical Selector.
d.) On the Service Protocol Selection window, click on MANUFACTURING.
e.) On the Service Category Protocol List, click on 45.7 IMGSER 48CM.
f.) On the ExamRx protocol parameter display, select the 1st Series for 8 slice system (`Series Description: 48 8x2.5/120kV/340mA/1s`); select the 3rd Series for 16 slice system (`Series Description: 48 16x1.25/120kV/400mA/2s`).
g.) Set internal Landmark.

5.) Acquire a single image series of the 48 cm Phantom.

7.4.2 Image Performance Verification

7.4.2.1 Series Means (AvXo-AvXc and AvSDo) & Center Smudge

1.) Launch the Image Analysis Tool.
a.) From the Global Control Palette, click on the Service Desktop.
b.) From the Service Desktop upper navigational bar, click on the IMAGE QUALITY icon.

c.) In the left navigational area directory, click on IMAGE ANALYSIS.

Note: During the Image Analysis process, you will need to switch between the Service Browser screen (to select the image series to analyze) and the Image Analysis screen (to run a particular Auto 1x analysis test). Use **ALT/F1** to bring a window to the front. Use **ALT/F3** to send a window to the back.

2.) Using the AUTO 1X Tool on the Image Analysis screen, generate a Series Means and Center Smudge report for the 1st series of the 48cm Phantom acquisition.

a.) From the Service Browser window, select the 48cm Phantom series acquired in Section 7.4.1.

b.) On the Image Analysis Tool window, click on the AUTO 1X diamond shaped button. (See Figure 6-9, on page 310.)

c.) Click on the AUTO 1X rectangular button, select the IMGSER 48CM test from the pull-down menu, slide cursor to the right and select 8X2.5/120KV/340MA/1S for 8 slice system; select 16X1.25/120KV/400MA/2S for 16 slice system from the test pull-down menu, and continue to slide cursor to the right to select AUTO.

d.) Click on the ACCEPT button.

a.) Review the Image Analysis Report data and record the Series Means (AvXo-AvXc, and AvSDc) data and the Center Smudge data for each row in Table 6-4.

a.) Verify the Overall Test Pass/Fail Indicator Window of the Report display indicates PASS. (See Table 6-3)

b.) Verify the scan parameter values displayed in the report match those in Table 6-3.

a.) Record the Series Means (AvXo-AvXc, and AvSDo) data and the Center Smudge data for each row in Table 6-4.

7.4.2.2 Band and Streak Artifact

1.) Review the 48cm Phantom images acquired in Section 7.4.1 for Bands and Streaks using the Image Works Desktop.

a.) From the Global Control Palette, click on the IMAGE WORKS Desktop.

b.) From the Image Works Browser window, select the 48cm Phantom series acquired in Section 7.4.1.

c.) From the Image Works Browser window, click on the VIEWER button.

d.) While paging through the 64 images in the series, analyze images for any Band or Streak artifacts. Adjust Window/Level using the center mouse button, as required.

e.) Note any image that appears to have a Band or Streak artifact.

2.) Verify any images noted above (step 1e) meet 48cm Phantom Band or Streak Image Performance requirements.

a.) From the Global Control Palette, click on the Service Desktop.

b.) From the Service Browser window, select an image of the 48cm Phantom series acquired in Section 7.4.1 that appeared to have a Band or Streak while reviewing the series in Image Works.

c.) On the Image Analysis Tool window, click on the AUTO 1X rectangular button, select the IMGSER 48CM test from the pull-down menu, slide cursor to the right and select 8X2.5/120KV/340MA/1S for 8 slice system; select 16X1.25/120KV/400MA/2S for 16 slice system from the test pull-down menu, and continue to slide cursor to the right to select BAND or STREAK.

d.) Click on the ACCEPT button.

Note: If required, adjust Window/Level using the center mouse button.

e.) Position and size the Band or Streak ROI using the left cursor button.

Note: To ensure specifications are properly applied, do not adjust the Reference ROI's for the Band and Streak artifact tests. The Reference ROI's are adjustable after the 1st Accept Modification click.

f.) Click on ACCEPT MODIFICATION twice, to generate a report.

g.) Verify the Overall Test Pass/Fail Indicator Window of the Report display indicates PASS.

h.) Repeat steps b through g, for each image noted in Step 1e.

Box Size = 1600 mm2 to 2500 mm2
45 mm (+/- 5 mm) x 45 mm (+/- 5 mm)
45 (+/- 4 pixels) x 45 (+/- 4 pixels)

Box Positions: Box 1 = 0 mm x 0 mm
Box 2 = 0 mm x -190 mm
Box 3 = 190 mm x 0 mm
Box 4 = 0 mm x 190 mm
Box 5 = -190 mm x 0 mm

Row	Images	Brightness Uniformity (AvXo - AvXc)	Noise (AvSDo)	Center Smudge Row Values	Comments
8A	1, 17, 33, 49				
7A	2, 18, 34, 50				
6A	3, 19, 35, 51				
5A	4, 20, 36, 52				
4A	5, 21, 37, 53				
3A	6, 22, 38, 54				
2A	7, 23, 39, 55				
1A	8, 24, 40, 56				
1B	9, 25, 41, 57				
2B	10, 26, 42, 58				
3B	11, 27, 43, 59				
4B	12, 28, 44, 60				
5B	13, 29, 45, 61				
6B	14, 30, 46, 62				
7B	15, 31, 47, 63				
8B	16, 32, 48, 64				
Specifications		< +/- 17	< 50	< +/- 14	

Table 6-4 48cm Phantom CT# Brightness Uniformity, Noise & Center Smudge Row Performance Data Sheet (16 slice system)

Row	Images	Brightness Uniformity (AvXo - AvXc)	Noise (AvSDo)	Center Smudge Row Values	Comments
4A	5, 21, 37, 53				
3A	6, 22, 38, 54				
2A	7, 23, 39, 55				
1A	8, 24, 40, 56				
1B	9, 25, 41, 57				
Specifications		< +/- 17	< 50	< +/- 14	

Table 6-5 48cm Phantom CT# Brightness Uniformity, Noise & Center Smudge Row Performance Data Sheet (8 slice system)

Row	Images	Brightness Uniformity (AvXo - AvXc)	Noise (AvSDo)	Center Smudge Row Values	Comments
2B	10, 26, 42, 58				
3B	11, 27, 43, 59				
4B	12, 28, 44, 60				
Specifications		< +/- 17	< 50	< +/- 14	

Table 6-5 48cm Phantom CT# Brightness Uniformity, Noise & Center Smudge Row Performance Data Sheet (8 slice system)

7.4.3 Failure Recommended Actions

7.4.3.1 Series Means (AvXo-AvXc or AvSDo) Failure Recovery

Specifications

Each Row of the series must pass 48cm Series Means (for the first series scan parameters) specifications:

- AvXo - AvXc: < +/- 17
- AvSDo: < 50.0

Recommended Recovery

1.) Repeat Detailed Cal for the 48cm Phantom.

2.) Repeat Sections 7.4.1 & 7.4.2, to verify Image Performance.

7.4.3.2 Center Smudge Failure Recovery

Specifications

80% the Rows must pass Center Smudge specifications when re-scanning:

Center Smudge: Smudge Factor < +/- 14.0

Recommended Recovery

1.) If one image of one Row fails (Row fails once):

- Re-scan the 48cm Phantom acquiring two series of 64 images using the same protocol settings as listed in .
- Analyze the two 64 re-scanned image series using the Image Analysis IMGSER 48CM -> 8X2.5/120KV/340MA for 8 slice system; 16X1.25/120KV/400MA for 16 slice system-> AUTO tool.
- Verify that all the 128 re-scanned images do not fail Series Means (AvXo - AvXc and AvSDo) or Center Smudge.

2.) If more than one image of one Row fails (Row fails more than once) or multiple rows are failing:

- Repeat Detailed Cal for the 48cm Phantom.
- Re-scan the 48cm Phantom acquiring three series of 64 images using the same protocol settings as listed in Table 6-3 (on page 311).
- Analyze the three re-scanned image series using the Image Analysis IMGSER 48CM ->

8X2.5/120KV/340MA for 8 slice system; 16X1.25/120KV/400MA for 16 slice system -> AUTO tool.

- Verify that all the 192 re-scanned images do not fail Series Means (AvXo – AvXc and AvSDo) or Center Smudge.

7.4.3.3 Band or Streak Artifact Failure Recovery

Specifications

- Band Artifact: Band Factor< +/- 8.0
- Streak Artifact: Streak Factor< +/- 4.0

Recommended Recovery

1.) Troubleshoot Band or Streak artifact failures, as described in the *System Service Manual*.
2.) Repeat Detailed Cal for the 48cm Phantom.
3.) Repeat Sections 7.4.1 & 7.4.2, to verify Image Performance.

7.5 20cm QA Phantom Image Series Image Performance Verification

7.5.1 Image Performance Verification Methods Selection

1.) From the **Service** Desktop, select IMAGE QUALITY -> IMAGE ANALYSIS .

2.) Click the Auto 1x tool on the Image Analysis screen, and select **ImgSer20QA**.
- If Scan Protocol shown as Figure 6-11, please go to Section 7.5.2

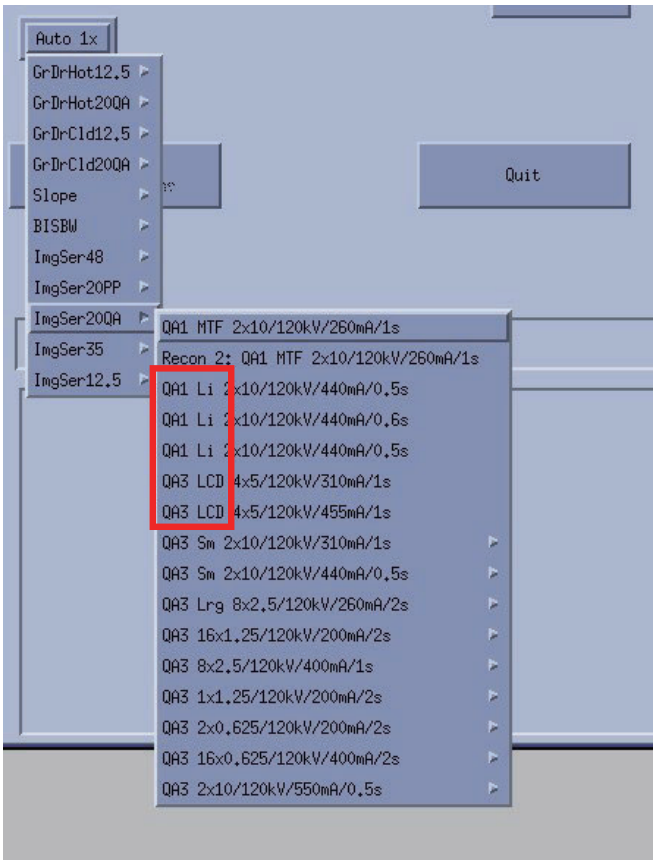


Figure 6-11 Auto 1x without QA2 Protocol

- If Scan Protocol shown as Figure 6-12, please go to Section 7.5.3

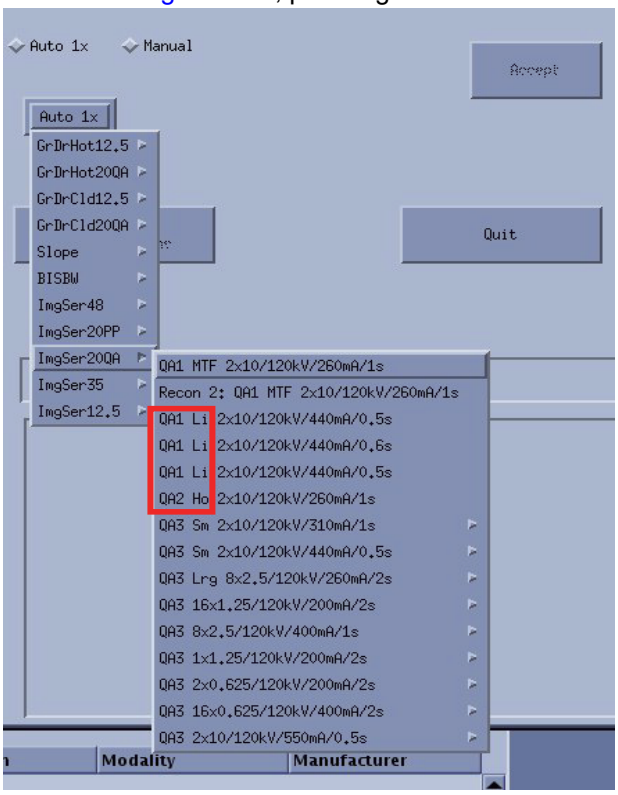


Figure 6-12 Auto 1x with QA2 Protocol

7.5.2 Image Performance Verification (without QA2 Protocol)

7.5.2.1 Acquiring the 20cm QA Phantom Image Series

1.) Mount the Phantom Holder on the head-end of the table.
2.) Mount the 20cm QA Phantom on the Phantom Holder.
3.) Align, level, & center the 20cm QA Phantom.
   - Align black line on phantom using the internal laser lights.
   - Level phantom using bubble level and the Z Axis knob on the Phantom Holder.
   - Center phantom using the CENTER PHANTOM procedure in the left head SCANNER UTILITIES selection and the X and Y Axis knobs on the Phantom Holder.
4.) Set up the system to scan three 20cm QA Phantom image series with a Recon of the 1st series.
   a.) On the Exam Rx desktop, select NEW PATIENT.
   b.) Type the following entries in the listed `Patient Information` following fields:
      * `Patient ID:` **`Service`**
      * `Name:` **`20cm QA Phantom Image Series`**
   c.) From the Protocol Selection display, click on the Service Tab under Anatomical Selector.
   d.) On the Service Protocol Selection window, click on MANUFACTURING.
   e.) On the Service Category Protocol List, click on the 45.9 IMGSER 20CMQA selection.
   f.) On the ExamRx protocol parameter display, select the 1st Series (`Series Description: QA1 MTF 2x10/120kV/260mA/1s`).
   g.) Set internal Landmark.

5.) Acquire the 1st 20cm QA Phantom image series and ***2nd Recon series*** (MTF and Contrast, Visible Lines) by performing the 1st series protocol scan, the series name as "QA1 MTF 2x10/ 120kV/260mA/1s". The ***2nd Recon series*** is generated from QA1 MTF 2x10/120kV/260mA/ 1s automatically.

6.) Acquire the 3rd 20cm QA Phantom image series by performing the 5th series protocol scan, the series name as "QA3 LCD 4x5/120kV/310mA/1s".

Acquire the 4th 20cm QA Phantom image series by performing the 6th series protocol scan, the series name as"QA3 LCD 4x5/120kV/455mA/1s"

7.) Acquire the 5th 20cm QA Phantom image series by performing the 7th series protocol scan, the series name as "QA3 Sm 2x10/120kV/310mA/1s".

20cm QA Phantom image series acquired are as following:

Acquired 20cm QA Phantom Image Series	1st 20cm QA Phantom image series	***2nd Recon series****	3rd 20cm QA Phantom image series	4th 20cm QA Phantom image series	5th 20cm QA Phantom image series
Series Name	QA1 MTF 2x10/ 120kV/260mA/1s (1st series protocol scan)		QA3 LCD 4x5/ 120kV/310mA/1s (5th series protocol scan)	QA3 LCD 4x5/ 120kV/455mA/1s (6th series protocol scan)	QA3 Sm 2x10/ 120kV/310mA/1s (7th series protocol scan)
* Note: ***2nd Recon series*** is generated from QA1 MTF 2x10/120kV/260mA/1s automatically					

7.5.2.2 20cm QA Phantom Image Series Image Performance Verification

1st QA Phantom Image Series (4 Image MTF Average and Contrast Scale) Image Performance Verification

1.) Launch the Image Analysis Tool.

a.) From the Global Control Palette, click on the Service Desktop.

b.) From the Service Desktop upper navigational bar, click on IMAGE QUALITY TESTS.

c.) In the left navigational area directory, click on IMAGE ANALYSIS.

Note: During the Image Analysis process, you will need to switch between the Service Browser screen (to select the image series to analyze) and the Image Analysis screen (to run a particular Auto 1x analysis test). Use **ALT/F1** to bring a window to the front. Use **ALT/F3** to send a window to the back.

2.) Using the Auto 1x Tool on the Image Analysis screen, generate a QA#1 MTF and QA#1 Contrast Scale report for the 1st series of the 20cm QA Phantom acquisition.

a.) From the Service Browser window, select the 1st series of the 20cm QA Phantom series acquired in section 7.5.3.1.

b.) On the Image Analysis Tool window, click on the AUTO 1X diamond shaped button. (See Figure 6-9, on page 310.)

c.) Click on the AUTO 1X rectangular button, select the IMGSER 20CMQA test from the pull-down menu, slide cursor to the right to select QA1 MTF 2X10/120KV/260MA/1S from the test pull-down menu.

d.) Click on the ACCEPT button.

3.) Review the Image Analysis Report data and record the Per Image MTF, 4 Image MTF Average, and Per Image Contrast Scale data for each row in Table 6-6.

a.) Verify the Overall Test Pass/Fail Indicator Window of the Report display indicates PASS. (See Figure 6-10, on page 310.)

b.) Record Per Image MTF and Per Image Contrast Scale data for each image in Table 6-6.

c.) Record the 4 Image MTF Average in Table 6-6.

Image	MTF	MTF 4-slice average	Contrast Scale	Comments
1		N.A.		
2		N.A.		
3		N.A.		
4		N.A.		
Specifications	N.A.	0.65 to 1.0	110.0 to 130.0	N.A.

Table 6-6 20cm QA#1 Phantom High Contrast Spatial Resolution Image Performance (MTF and Contrast Scale)

***2nd Recon series* (4 Bone Retro Image Visible Lines) Image Perf. Verification**

1.) Using the Auto 1x Tool on the Image Analysis screen, generate a Per Image QA#1 Lines report for ***2nd Recon series*** acquisition.

a.) From the Service Browser window, select the 1st image of ***2nd Recon series*** acquired in section 7.5.2.1 (on page 317).

b.) Click on the AUTO 1X rectangular button, select the IMGSER 20CMQA test from the pull-down menu, and slide cursor to the right to select RECON 2: QA1 MTF 2X10/120KV/260MA/1S.

c.) Click on the ACCEPT button. The tool displays a Visible Lines pop-up window.

d.) On the Visible Lines pop-up window, click on the VISIBLE LINE button.

Note: The Image Analysis Tool automatically sets the Window/Level for optimal viewing. If required, adjust Window/Level using the center mouse button.

e.) From the Visible Line pull-down menu, select the letter (A through F) that matches the smallest line pair pattern that you can discern in the Image View Port.

f.) On the Visible Lines pop-up window, click on the OK button.

2.) Review the Image Analysis Report data and record the Per Image QA#1 Visible Lines data for the 1st image in Table 6-7.

a.) Verify the Overall Test Pass/Fail Indicator Window of the Report display indicates PASS. (Refer to Figure 6-10, on page 310.)

b.) Record the Per Image QA#1 Visible Lines data for the 1st image in Table 6-7.

3.) Repeat Steps 1 and 2, for each of the remaining three images in ***2nd Recon series***.

Image	Line Patterns Visible	Comments
1		
2		
3		
4		
Specifications	B, C, D, E, F	N.A.

Table 6-7 20cm QA#1 Phantom High Contrast Spatial Resolution Image Performance (Visible Lines)

3rd and 4th QA Phantom Image Series Image Performance Verification

1.) Using the Auto 1x Tool on the Image Analysis screen, generate a Per Image QA#3 LCD report for the 3rd series of the 20cm QA Phantom acquisition.

a.) From the Service Browser window, select the 1st image of the 3rd series of the 20cm QA Phantom series acquired in Section 7.5.2.1.

b.) Click on the AUTO 1X rectangular button, select IMGSER 20CMQA from the pull-down menu, and slide cursor to the right to select QA3 LCD 4X5/120KV/310MA/1S.

c.) Click on the ACCEPT button. The report pops up window.

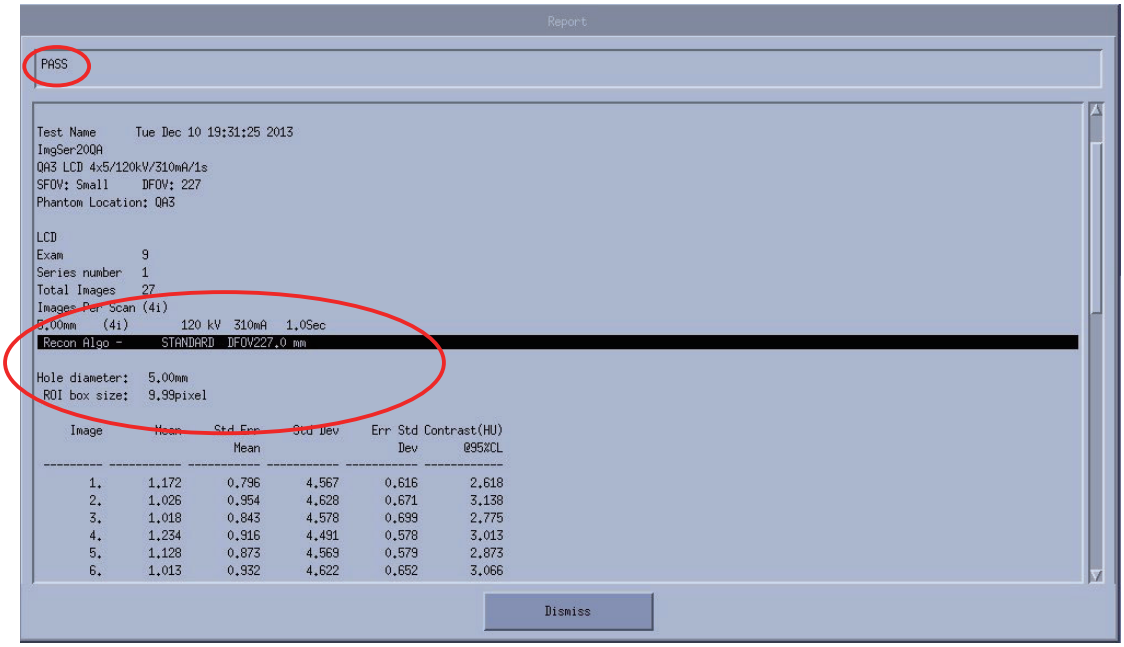


Figure 6-13 QA3 LCD_310mA_1s

2.) Using the Auto 1x Tool on the Image Analysis screen, generate a Per Image QA#3 LCD report for the 4th series of the 20cm QA Phantom acquisition.

a.) From the Service Browser window, select the 1st image of the 4th series of the 20cm QA Phantom series acquired in Section 7.5.2.1.

b.) Click on the AUTO 1X rectangular button, select IMGSER 20CMQA from the pull-down menu, and slide cursor to the right to select QA3 LCD 4X5/120KV/455MA/1S.

c.) Click on the ACCEPT button. The report pops up window.

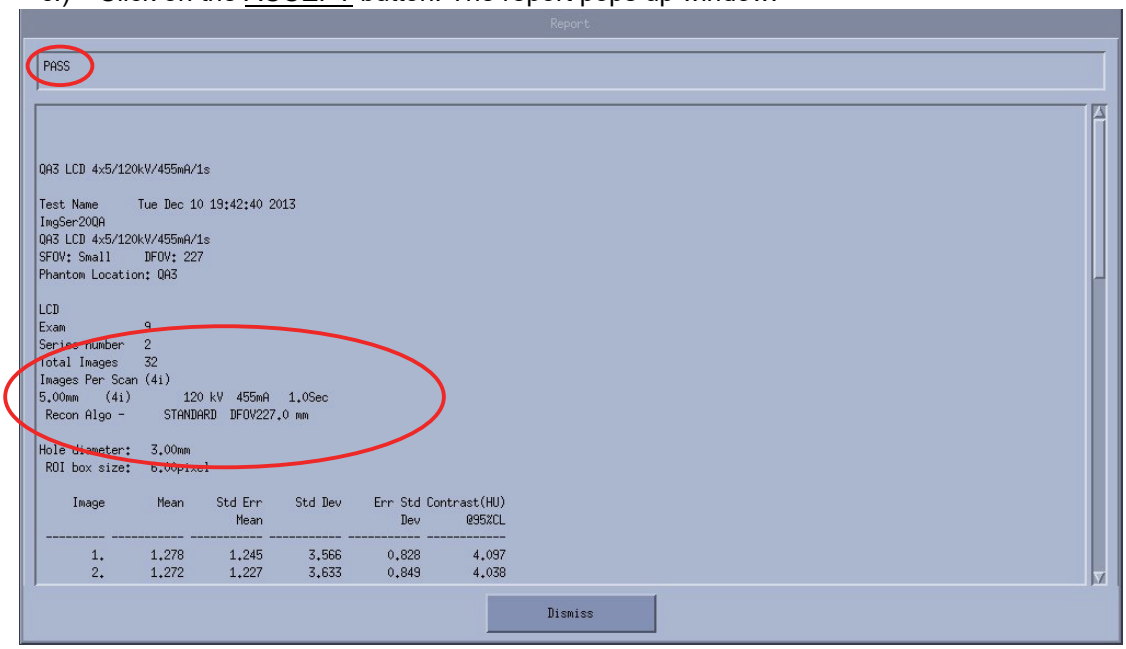


Figure 6-14 QA3 LCD_455mA_1s

5th QA Phantom Image Series (QA#3 Small) Image Performance Verification

1.) Using the Auto 1x Tool on the Image Analysis screen, generate a QA#3 Small report for the 5th series of the 20cm QA Phantom acquisition.

a.) From the Service Browser window, select the 5th series of the 20cm QA Phantom series acquired in section 7.5.2.1 (on page 325).

- Click on the AUTO 1X rectangular button, select IMGSER 20CMQA from the pull-down menu, slide cursor to the right to select QA3 SM 2X10/120KV/310MA/1S from the test pull-down menu, and continue to slide cursor to the right to select AUTO. (Refer to Figure 6-10, on page 310.)

b.) Click on the ACCEPT button.

2.) Review the Image Analysis Report data and record the QA3 Small data for the 5th 20cm QA Image Series in Table 6-8.

a.) Verify the Overall Test Pass/Fail Indicator Window of the Report display indicates PASS. (Refer to Figure 6-10, on page 310.)

b.) Record the QA3 Small data (Row 2A1A and Row 2B1B Series Means AvXc and AvXo – AvXc), QA3 (AvSDc), and the Center Smudge Row data in Table 6-8.

Box Size = 196 mm2 to 256 mm2
15 mm (+/- 1 mm) x 15 mm (+/- 1 mm)
31 (+/- 2 pixels) x 31 (+/- 2 pixels)

Box Positions: Box 1 = 0 mm x 0 mm
Box 2 = 0 mm x -80 mm
Box 3 = 80 mm x 0 mm
Box 4 = 0 mm x 80 mm
Box 5 = -80 mm x 0 mm

Row	Images	AvXc	AvXo	AvXo - AvXc	AvSDo	AvSDc	Avg Spec Center Smudge Factor	Comments
2A1A	1, 3, 5, 7				N.A.			
1B2B	2, 4, 6, 8				N.A.			
Specifications		+3.0 to -3.0	N.A.	+3.0 to -3.0	N.A.	+ 2.9 to +3.5	+2.2 to -2.2	

Table 6-8 20cm QA#3 Phantom CT#, Brightness Uniformity, Center Noise & Center Smudge Row Performance Data Sheet

3.) Review the 5th 20cm QA Phantom images acquired in Section 7.5.3.1 for Rings, Bands, and Streaks using the Image Works Desktop.

a.) From the Global Control Palette, click on the IMAGE WORKS DESKTOP.

b.) From the Image Works Browser window, select the 5th 20cm QA Phantom series acquired in section 7.5.2.1.

c.) From the Image Works Browser window, click on the VIEWER button.

d.) While paging through the eight images in the series, analyze images for any Ring, Band, or Streak artifacts. Adjust Window/Level using the center mouse button, as required.

e.) Note any image that appears to have a Ring, Band, or Streak artifact.

4.) Verify any images noted above (step 3e) meet 20cm QA Phantom Ring, Band, or Streak Image Performance requirements.

a.) From the Global Control Palette, click on the Service Desktop.

b.) From the Service Browser window, select an image of the 5th 20cm QA Phantom series acquired in section 7.5.2.1 that appeared to have a Ring, Band, or Streak while reviewing the series in Image Works.

c.) On the Image Analysis Tool window, click on the AUTO 1X rectangular button, select the IMGSER 20CMQA test from the pull-down menu, slide cursor to the right to select QA3 SM 2X10/120KV/310MA/1S from the test pull-down menu, and continue to slide cursor to the right to select RING, BAND, or STREAK.

d.) Click on the ACCEPT button.

Note: If required, adjust Window/Level using the center mouse button.

e.) Position and size the Ring, Band, or Streak ROI, using the left cursor button.

Note: To ensure specifications are properly applied, do not adjust the Reference ROIs for the Ring, Band, and Streak artifact tests. The Reference ROIs are adjustable after the 1st Accept Modification click.

f.) Click on ACCEPT MODIFICATION twice to generate a report.

g.) Verify the Overall Test Pass/Fail Indicator Window of the Report display indicates PASS.

h.) Repeat steps b through g for each image noted in Step 3e.

7.5.2.3 Failure Recommended Actions

1st Image Series (4 Image MTF Average) Failure Recovery

Specifications

The 4 Image MTF Average must pass specifications:

`4 Image MTF Average:` 0.65 to 1.00

Recommended Recovery

1.) Repeat Detailed Cal for the 20cm QA Phantom.
2.) Repeat Auto CT# Adjust for the 20cm QA Phantom.
3.) Repeat Sections 7.5.2.1 & 7.5.2.2, to verify Image Performance.

2nd Recon series (Visible Lines) Failure Recovery

Specifications

The Largest 5 line pair patterns (coded F, E, D, C, and B) must be visible for each of the four images in this series.

Recommended Recovery

Note: The most common failure for this test is that the phantom has air bubbles that are obscuring the line pair patterns.

1.) Carefully inspect the 20cm QA Phantom for air bubbles. If required, refill the phantom with water, to eliminate all air bubbles.
2.) Repeat Sections 7.5.2.1 & 7.5.2.2, to verify Image Performance.

3rd and 4th Image Series Failure Recovery

Specifications

Protocol Name	Hole Diameter	Specification
QA3 LCD 4x5/120kV/310mA/1s	5mm	3
QA3 LCD 4x5/120kV/455mA/1s	3mm	4.5

Recommended Recovery

1.) Repeat Detailed Cal for the 20cm QA Phantom.

2.) Repeat Auto CT# Adjust for the 20cm QA Phantom.
3.) Repeat Sections 7.5.2.1 & 7.5.2.2, to verify Image Performance.

5th Image Series Failure Recovery

Series Means

SPECIFICATIONS

Both Rows (2A1A, 1B2B) of the series must pass QA#3 Series Means specifications:

- `AvXc`: < +/- 3.0
- `AvXo - AvXc`: < +/- 3.0

RECOMMENDED RECOVERY

1.) Repeat Detailed Cal for the 20cm QA Phantom.
2.) Repeat Auto CT# Adjust for the 20cm QA Phantom.
3.) Repeat Sections 7.5.2.1 & 7.5.2.2, to verify Image Performance.

QA#3 (AvSDc)

SPECIFICATIONS

Both Rows (2A1A, 1B2B) of the series must pass QA#3 `AvSDc` specifications:

- `AvSDc` (< 5K Scans): 2.90 to 3.50
- `AvSDc` (> 5K Scans): 2.80 to 3.60

RECOMMENDED RECOVERY

1.) Repeat Detailed Cal for the 20cm QA Phantom.
2.) Repeat Auto CT# Adjust for the 20cm QA Phantom.
3.) Repeat Sections 7.5.2.1 & 7.5.2.2, to verify Image Performance.

Center Artifact or Center Smudge

SPECIFICATIONS

All eight images of the series must pass 20cm QA#3 Center Artifact and Center Smudge specifications:

- Center Artifact Factor: +/- 3.5
- Center Smudge Factor: +/- 2.2

RECOMMENDED RECOVERY

1.) Repeat Detailed Cal for the 20cm QA Phantom.
2.) Repeat Auto CT# Adjust for the 20cm QA Phantom.
3.) Repeat Sections 7.5.2.1 & 7.5.2.2, to verify Image Performance.

Ring, Band, or Streak Artifact Failure Recovery

SPECIFICATIONS

- Ring Artifact: Ring Factor < +/- 4.8
- Band Artifact: Band Factor +/- 2.8 from 0cm to 8.5cm
  < +/- 2.8 > 8.5cm
- Streak Artifact: Streak Factor < +/- 4.0

RECOMMENDED RECOVERY

1.) Troubleshoot Ring, Band or Streak artifact failures as described in the Service Manual.
2.) Repeat Detailed Cal for the 20cm QA Phantom.
3.) Repeat Sections 7.5.2.1 & 7.5.2.2, to verify Image Performance.

7.5.3 Image Performance Verification (with QA2 Protocol)

7.5.3.1 Acquiring the 20cm QA Phantom Image Series

1.) Mount the Phantom Holder on the head-end of the table.
2.) Mount the 20cm QA Phantom on the Phantom Holder.
3.) Align, level, & center the 20cm QA Phantom.
   - Align black line on phantom using the internal laser lights.
   - Level phantom using bubble level and the Z Axis knob on the Phantom Holder.
   - Center phantom using the CENTER PHANTOM procedure in the left head SCANNER UTILITIES selection and the X and Y Axis knobs on the Phantom Holder.
4.) Set up the system to scan three 20cm QA Phantom image series with a Recon of the 1st series.
   a.) On the Exam Rx desktop, select NEW PATIENT.
   b.) Type the following entries in the listed `Patient Information` following fields:
      * `Patient ID:` **`Service`**
      * `Name:` **`20cm QA Phantom Image Series`**
   c.) From the Protocol Selection display, click on the Service Tab under Anatomical Selector.
   d.) On the Service Protocol Selection window, click on MANUFACTURING.
   e.) On the Service Category Protocol List, click on the 45.9 IMGSER 20CMQA selection.
   f.) On the ExamRx protocol parameter display, select the 1st Series (`Series Description: QA1 MTF 2x10/120kV/260mA/1s`).
   g.) Set internal Landmark.
5.) Acquire the 1st 20cm QA Phantom image series and ***2nd Recon series*** (MTF and Contrast, Visible Lines) by performing the 1st series protocol scan, the series name as "QA1 MTF 2x10/120kV/260mA/1s". The ***2nd Recon series*** is generated from QA1 MTF 2x10/120kV/260mA/1s automatically.
6.) Acquire the 3rd 20cm QA Phantom image series by performing the 5th series protocol scan, the series name as "QA2 Ho 2x10/120kV/260mA/1s".
7.) Acquire the 4th 20cm QA Phantom image series by performing the 6th series protocol scan, the series name as "QA3 Sm 2x10/120kV/310mA/1s".

20cm QA Phantom image series acquired are as following:

Acquired 20cm QA Phantom Image Series	1st 20cm QA Phantom image series	***2nd Recon series****	3rd 20cm QA Phantom image series	4th 20cm QA Phantom image series
Series Name	QA1 MTF 2x10/ 120kV/260mA/1s (1st series protocol scan)		QA2 Ho 2x10/120kV/ 260mA/1s (5th series protocol scan)	QA3 Sm 2x10/120kV/ 310mA/1s (6th series protocol scan)
* Note: ***2nd Recon series*** is generated from QA1 MTF 2x10/120kV/260mA/1s automatically				

7.5.3.2 20cm QA Phantom Image Series Image Performance Verification

1st QA Phantom Image Series (4 Image MTF Average and Contrast Scale) Image Performance Verification

1.) Launch the Image Analysis Tool.

a.) From the Global Control Palette, click on the Service Desktop.

b.) From the Service Desktop upper navigational bar, click on IMAGE QUALITY TESTS.

c.) In the left navigational area directory, click on IMAGE ANALYSIS.

Note: During the Image Analysis process, you will need to switch between the Service Browser screen (to select the image series to analyze) and the Image Analysis screen (to run a particular Auto 1x analysis test). Use **ALT/F1** to bring a window to the front. Use **ALT/F3** to send a window to the back.

2.) Using the Auto 1x Tool on the Image Analysis screen, generate a QA#1 MTF and QA#1 Contrast Scale report for the 1st series of the 20cm QA Phantom acquisition.

a.) From the Service Browser window, select the 1st series of the 20cm QA Phantom series acquired in section 7.5.3.1.

b.) On the Image Analysis Tool window, click on the AUTO 1X diamond shaped button. (See Figure 6-9, on page 310.)

c.) Click on the AUTO 1X rectangular button, select the IMGSER 20CMQA test from the pull-down menu, slide cursor to the right to select QA1 MTF 2X10/120KV/260MA/1S from the test pull-down menu.

d.) Click on the ACCEPT button.

3.) Review the Image Analysis Report data and record the Per Image MTF, 4 Image MTF Average, and Per Image Contrast Scale data for each row in Table 6-9.

a.) Verify the Overall Test Pass/Fail Indicator Window of the Report display indicates PASS. (See Figure 6-10, on page 310.)

b.) Record Per Image MTF and Per Image Contrast Scale data for each image in Table 6-9.

c.) Record the 4 Image MTF Average in Table 6-9.

Image	MTF	MTF 4-slice average	Contrast Scale	Comments
1		N.A.		
2		N.A.		
3		N.A.		
4		N.A.		
Specifications	N.A.	0.65 to 1.0	110.0 to 130.0	N.A.

Table 6-9 20cm QA#1 Phantom High Contrast Spatial Resolution Image Performance (MTF and Contrast Scale)

2nd Recon series (4 Bone Retro Image Visible Lines) Image Perf. Verification

1.) Using the Auto 1x Tool on the Image Analysis screen, generate a Per Image QA#1 Lines report for ***2nd Recon series*** acquisition.

a.) From the Service Browser window, select the 1st image of ***2nd Recon series*** acquired in section 7.5.3.1 (on page 325).

b.) Click on the AUTO 1X rectangular button, select the IMGSER 20CMQA test from the pull-down menu, and slide cursor to the right to select RECON 2: QA1 MTF 2X10/120KV/260MA/1S.

c.) Click on the ACCEPT button. The tool displays a Visible Lines pop-up window.

d.) On the Visible Lines pop-up window, click on the VISIBLE LINE button.

Note: The Image Analysis Tool automatically sets the Window/Level for optimal viewing. If required, adjust Window/Level using the center mouse button.

e.) From the Visible Line pull-down menu, select the letter (A through F) that matches the smallest line pair pattern that you can discern in the Image View Port.

f.) On the Visible Lines pop-up window, click on the OK button.

2.) Review the Image Analysis Report data and record the Per Image QA#1 Visible Lines data for the 1st image in Table 6-10.

a.) Verify the Overall Test Pass/Fail Indicator Window of the Report display indicates PASS. (Refer to Figure 6-10, on page 310.)

b.) Record the Per Image QA#1 Visible Lines data for the 1st image in Table 6-10.

3.) Repeat Steps 1 and 2, for each of the remaining three images in ***2nd Recon series***.

Image	Line Patterns Visible	Comments
1		
2		
3		
4		
Specifications	B, C, D, E, F	N.A.

Table 6-10 20cm QA#1 Phantom High Contrast Spatial Resolution Image Performance (Visible Lines)

3rd QA Phantom Image Series (4 Image Visible Holes) Image Performance Verification

1.) Using the Auto 1x Tool on the Image Analysis screen, generate a Per Image QA#2 Holes report for the 3rd series of the 20cm QA Phantom acquisition.

a.) From the Service Browser window, select the 1st image of the 3rd series of the 20cm QA Phantom series acquired in section 7.5.3.1.

b.) Click on the AUTO 1X rectangular button, select IMGSER 20CMQA from the pull-down menu, and slide cursor to the right to select QA2 HO 2X10/120KV/260MA/1S.

c.) Click on the ACCEPT button. The tool displays a Visible Hole pop-up window.

d.) On the Visible Hole pop-up window, click on the VISIBLE HOLE button.

Note: The Image Analysis Tool automatically sets the Window/Level for optimal viewing. If required, adjust Window/Level using the center mouse button.

e.) From the Visible Hole pull-down menu, select the number (1 through 5) that matches the smallest hole that you can discern in the pattern centered in the image displayed in the Image View Port.

f.) On the Visible Hole pop-up window, click on the OK button.

2.) Review the Image Analysis Report data and record the Per Image QA#2 Visible Holes data for the 1st image in Table 6-11.

a.) Verify the Overall Test Pass/Fail Indicator Window of the Report display indicates PASS. (Refer to Figure 6-10, on page 310.)

b.) Record the Per Image QA#2 Visible Holes data for the 1st image in Table 6-11.

3.) Repeat Steps 1 and 2 for the 3rd, 5th, and 7th images in the 3rd 20cm QA Image Series.

Image	Visible Holes Viewable at Window 20	Contrast Factor	Comments
1			
3			
5			
7			
Specifications	See Table 6-12	2.0 to 12.0	N.A.

Table 6-11 20cm QA#2 Phantom Low Contrast Detectability Image Performance (Visible Holes)

Contrast Factor Range (Box 1 Means - Box 2 Means)	Visible Number of Holes		Smallest Visible Hole Size
	Lower Limit *	Upper Limit *	
2.00 to 3.99	2	5	7.5 mm
4.00 to 7.99	3	5	5.0 mm
8.00 to 12.00	4	5	3.0 mm
* Required Number of Visible Holes depends on the Contrast Factor			

Table 6-12 20cm QA#2 Phantom Visible Hole Specifications

4th QA Phantom Image Series (QA#3 Small) Image Performance Verification

1.) Using the Auto 1x Tool on the Image Analysis screen, generate a QA#3 Small report for the 4th series of the 20cm QA Phantom acquisition.

a.) From the Service Browser window, select the 4th series of the 20cm QA Phantom series acquired in section 7.5.3.1 (on page 325).

b.) Click on the AUTO 1X rectangular button, select IMGSER 20CMQA from the pull-down menu, slide cursor to the right to select QA3 SM 2X10/120KV/310MA/1S from the test pull-down menu, and continue to slide cursor to the right to select AUTO. (Refer to Figure 6-10, on page 310.)

c.) Click on the ACCEPT button.

2.) Review the Image Analysis Report data and record the QA3 Small data for the 4th 20cm QA Image Series in Table 6-13.

a.) Verify the Overall Test Pass/Fail Indicator Window of the Report display indicates PASS. (Refer to Figure 6-10, on page 310.)

b.) Record the QA3 Small data (Row 2A1A and Row 2B1B Series Means AvXc and AvXo – AvXc), QA3 (AvSDc), and the Center Smudge Row data in Table 6-13.

Box Size = 196 mm2 to 256 mm2
15 mm (+/- 1 mm) x 15 mm (+/- 1 mm)
31 (+/- 2 pixels) x 31 (+/- 2 pixels)

Box Positions: Box 1 = 0 mm x 0 mm
Box 2 = 0 mm x -80 mm
Box 3 = 80 mm x 0 mm
Box 4 = 0 mm x 80 mm
Box 5 = -80 mm x 0 mm

Row	Images	AvXc	AvXo	AvXo - AvXc	AvSDo	AvSDc	Avg Spec Center Smudge Factor	Comments
2A1A	1, 3, 5, 7				N.A.			
1B2B	2, 4, 6, 8				N.A.			
Specifications		+3.0 to -3.0	N.A.	+3.0 to -3.0	N.A.	+ 2.9 to +3.5	+2.2 to -2.2	

Table 6-13 20cm QA#3 Phantom CT#, Brightness Uniformity, Center Noise & Center Smudge Row Performance Data Sheet

3.) Review the 4th 20cm QA Phantom images acquired in Section 7.5.3.1 for Rings, Bands, and Streaks using the Image Works Desktop.

a.) From the Global Control Palette, click on the IMAGE WORKS DESKTOP.

b.) From the Image Works Browser window, select the 4th 20cm QA Phantom series acquired in section 7.5.3.1.

c.) From the Image Works Browser window, click on the VIEWER button.

d.) While paging through the eight images in the series, analyze images for any Ring, Band, or Streak artifacts. Adjust Window/Level using the center mouse button, as required.

e.) Note any image that appears to have a Ring, Band, or Streak artifact.

4.) Verify any images noted above (step 3e) meet 20cm QA Phantom Ring, Band, or Streak Image Performance requirements.

a.) From the Global Control Palette, click on the Service Desktop.

b.) From the Service Browser window, select an image of the 4th 20cm QA Phantom series acquired in section 7.5.3.1 that appeared to have a Ring, Band, or Streak while reviewing the series in Image Works.

c.) On the Image Analysis Tool window, click on the AUTO 1X rectangular button, select the IMGSER 20CMQA test from the pull-down menu, slide cursor to the right to select QA3 SM 2X10/120KV/310MA/1S from the test pull-down menu, and continue to slide cursor to the right to select RING, BAND, or STREAK.

d.) Click on the ACCEPT button.

Note: If required, adjust Window/Level using the center mouse button.

e.) Position and size the Ring, Band, or Streak ROI, using the left cursor button.

Note: To ensure specifications are properly applied, do not adjust the Reference ROIs for the Ring, Band, and Streak artifact tests. The Reference ROIs are adjustable after the 1st Accept Modification click.

f.) Click on ACCEPT MODIFICATION twice to generate a report.

g.) Verify the Overall Test Pass/Fail Indicator Window of the Report display indicates PASS.

h.) Repeat steps b through g for each image noted in Step 3e.

7.5.3.3 Failure Recommended Actions

1st Image Series (4 Image MTF Average) Failure Recovery

Specifications

The 4 Image MTF Average must pass specifications:

`4 Image MTF Average:` 0.65 to 1.00

Recommended Recovery

1.) Repeat Detailed Cal for the 20cm QA Phantom.
2.) Repeat Auto CT# Adjust for the 20cm QA Phantom.
3.) Repeat Sections 7.5.3.1 & 7.5.3.2, to verify Image Performance.

2nd Recon series (Visible Lines) Failure Recovery

Specifications

The Largest 5 line pair patterns (coded F, E, D, C, and B) must be visible for each of the four images in this series.

Recommended Recovery

Note: The most common failure for this test is that the phantom has air bubbles that are obscuring the line pair patterns.

1.) Carefully inspect the 20cm QA Phantom for air bubbles. If required, refill the phantom with water, to eliminate all air bubbles.
2.) Repeat Sections 7.5.3.1 & 7.5.3.2, to verify Image Performance.

3rd Image Series (Visible Holes) Failure Recovery

Specifications

The number of visible holes in this image series must pass specifications as follows:

- Contrast Factor = 2.0 to 3.99:
  Minimum of 2 holes must be visible (10mm & 7.5mm)
- Contrast Factor = 4.0 to 7.99:
  Minimum of 3 holes must be visible (10mm, 7.5mm & 5mm)
- Contrast Factor = 8.0 to 12.0:
  Minimum of 4 holes must be visible (10mm, 7.5mm, 5mm, & 3mm)

Recommended Recovery

1.) Repeat Detailed Cal for the 20cm QA Phantom.
2.) Repeat Auto CT# Adjust for the 20cm QA Phantom.
3.) Repeat Sections 7.5.3.1 & 7.5.3.2, to verify Image Performance.

4th Image Series Failure Recovery

Series Means

SPECIFICATIONS

Both Rows (2A1A, 1B2B) of the series must pass QA#3 Series Means specifications:

- `AvXc`: < +/- 3.0
- `AvXo - AvXc`: < +/- 3.0

RECOMMENDED RECOVERY

1.) Repeat Detailed Cal for the 20cm QA Phantom.
2.) Repeat Auto CT# Adjust for the 20cm QA Phantom.
3.) Repeat Sections 7.5.3.1 & 7.5.3.2, to verify Image Performance.

QA#3 (AvSDc)

SPECIFICATIONS

Both Rows (2A1A, 1B2B) of the series must pass QA#3 `AvSDc` specifications:

- `AvSDc` (< 5K Scans): 2.90 to 3.50
- `AvSDc` (> 5K Scans): 2.80 to 3.60

RECOMMENDED RECOVERY

1.) Repeat Detailed Cal for the 20cm QA Phantom.
2.) Repeat Auto CT# Adjust for the 20cm QA Phantom.
3.) Repeat Sections 7.5.3.1 & 7.5.3.2, to verify Image Performance.

Center Artifact or Center Smudge

SPECIFICATIONS

All eight images of the series must pass 20cm QA#3 Center Artifact and Center Smudge specifications:

- Center Artifact Factor: +/- 3.5
- Center Smudge Factor: +/- 2.2

RECOMMENDED RECOVERY

1.) Repeat Detailed Cal for the 20cm QA Phantom.
2.) Repeat Auto CT# Adjust for the 20cm QA Phantom.
3.) Repeat Sections 7.5.3.1 & 7.5.3.2, to verify Image Performance.

Ring, Band, or Streak Artifact Failure Recovery

SPECIFICATIONS

•	Ring Artifact:	Ring Factor	< +/- 4.8
•	Band Artifact:	Band Factor	+/- 2.8 from 0cm to 8.5cm < +/- 2.8 > 8.5cm
•	Streak Artifact:	Streak Factor	< +/- 4.0

RECOMMENDED RECOVERY

1.) Troubleshoot Ring, Band or Streak artifact failures as described in the Service Manual.
2.) Repeat Detailed Cal for the 20cm QA Phantom.
3.) Repeat Sections 7.5.3.1 & 7.5.3.2, to verify Image Performance.

Section 8.0
System Functional Test

Use the system tests in the following sections to exercise all aspects of the system and to ensure system integrity before releasing to the customer. Although the means, standard deviation, and resolution specifications do not apply during system functional tests, treat any artifact or image anomaly as a failure.

If you encounter a failure during the system tests:

- Record any evidence of artifacts, such as rings, streaks, shading, cupping, noise, or center artifacts.
- Correct artifacts, system test, or image series failures when they occur. Any delay in repairs could increase the number of retests.

1.) Place the QA phantom on the cradle.

- Drive the table to an elevation of 100.
- Align the line on the phantom with the internal laser lights.

Never scan above 50mA without first placing a phantom in the field of view. Levels in excess of 50mA can cause temporary radiation damage to the detector that lasts several hours. If you acquire image series cals with a radiation damaged detector, the cals may cause artifacts in subsequent image series scans.

2.) Select the service protocol, SYSTEM SCAN/CUST QUAL RELI.

3.) Run each series.

Note: Stop the service protocol after the second helical series. It is not necessary to proceed past that point in the protocol.

4.) Complete all scans.

5.) Review the message log for unacceptable errors and review the images for artifacts.

Section 9.0
Save System State

Use the following commands to create the System State DVD.

1.) Load a DVD into the mod drive on the front of the console.

2.) If you are not on the Service Desktop, click on the SERVICE DESKTOP icon, 

.

3.) Click on the PM icon. 

4.) Select SYSTEM STATE to open the System State Save/Restore menu.

5.) Select ALL

6.) Select SAVE

7.) When the save operation completes, select FILE and QUIT from the pull down menu.

8.) Remove the DVD from the drive

Chapter 7
Customer Options Installation & Verification

Note: **Only use the Installation manual that arrives with your system for installation. Any other revisions of this manual may not exactly match your system.**

Section 1.0
CT Options

NOTICE

The following list should be used as a guide for *completion of actions* only. The electronic form contains additional fields. It MUST be completed in its entirety and returned to GE.

- ❒ Injector functional tests completed.
- ❒ AWW functional tests completed.
- ❒ Filming/Camera/DASM functional tests completed.
- ❒ UPS functional tests completed.
- ❒ Network items installed and functional tests completed.
- ❒ Verify that all customer software options are installed and functional.
  - * Direct 3D
  - * SmartScore Pro
  - * CT Perfusion
- ❒ Teleradiology Connections (Refer to Section 10.0 on page 354)
- ❒ Auxiliary Monitor

Section 2.0
DICOM Network Introduction

LightSpeed systems support two basic Networking Protocols:

- Advantage NET (IC, Signa 4.X, CT-HLA, CT/I …)
- DICOM (CT/I, CT Synergy, Advantage Workstations, …)

DICOM NETWORK INTRODUCTION

DICOM networks basically operate on the **tasks** or services that various devices on the network use or provide. These services are labeled as Application Entity Titles (AE Titles). The CT scanner system is a **user** of six DICOM Network Services and is a **provider** of two DICOM Services:

AS A DICOM SERVICE USER:

- Send or **Push** images to another network device.
- Send or **Push** images to a DICOM Printer.
- Review image database on another device and retrieve or **Pull** selected images from that device (Query/Retrieve User).
- Send or **Push** images to a an image storage device and obtain confirmation that the images have been archived (Storage Commitment).
- Obtain Patient Worklist Information from the Hospital HIS/RIS System.
- Store images on MOD media.

AS A DICOM SERVICE PROVIDER:

- Receive **Pushed** images from another network device
- Allow another network device to review the image database and to retrieve or **Pull** selected images (Query/Retrieve Provider)

For each DICOM Service that the CT system will be a **User** (except for storing images on MOD media), you must **declare** this device on the CT system using three menu selections. For some devices, you must declare not only the device, but each service (AE Title) that the device provides. For example, you may be required to declare a PACS System twice on the CT system: once as a destination to **push** images and, second, as destination that provides storage commitment capability after images have been **pushed**.

For each DICOM Service that the CT system will be a **Provider**, you must **declare** the CT system on the network device that will be using these services.

Information required to complete configuring a hospital DICOM network is provided by the hospital network administrator (hostnames, IP Addresses) and the DICOM Conformance Statement document (AE Titles, Port Numbers) provided with each DICOM compatible network device on the network.

Section 3.0
Before You Start

3.1 Network Physical Requirements

Before setting up the CT scanner system on the hospital network, verify the following physical items are complete:

- Scanner console, monitor, keyboard, and mouse are installed and connected.
- CT system power is ON
- Hospital Ethernet network RJ45 Class IV twisted pair cable is connected to the scanner console network receptacle.
- Hospital network connection is operational and is running 10baseT or 100baseT.

3.2 Network Identity Information

To declare the CT system on the network, ensure the following network identity information is available from the Hospital Network Administrator:

- Hostname (No more than 16 Characters)
- Internet Protocol (IP) Address
- Subnet Net Mask IP Address (if applicable)
- Broadcast Address (if applicable)

3.3 Scanner to DICOM Remote Hosts Network Information

To declare DICOM remote hosts (PACS systems, archival devices, review workstations) on the CT system, ensure the following information is available for each remote host:

From the Hospital Network Administrator:

- Hostname
- Internet Protocol (IP) Address
- Network Protocol (DICOM for CT Systems)

From the Remote Host Device DICOM Conformance Statement Document:

- DICOM Application Entity Title or AE Title (DICOM service that remote host provides or uses)
- DICOM Listening Port Number

3.4 Scanner to DICOM HIS/RIS Interface Network Information

To declare DICOM Hospital HIS/RIS Interface devices (Mitra and others) on the CT System, ensure the following information is available:

From the Hospital Network Administrator: *Internet Protocol (IP) Address*

From the HIS/RIS Interface Device DICOM Conformance Statement Document:

- DICOM Application Entity Title or AE Title (DICOM Service that the HIS/RIS interface provides)
- DICOM Listening Port Number

3.5 Scanner to DICOM Printers Network Information

To declare DICOM on the CT System, ensure the following information is available for each printer:

From the Hospital Network Administrator:

- Hostname
- Internet Protocol (IP) Address

From the Printer DICOM Conformance Statement Document:

- DICOM Application Entity Title or AE Title (DICOM service that remote host provides or uses)
- DICOM Listening Port Number

Section 4.0
Declaring the System on the Hospital Network

4.1 Enter Configuration Routine

1.) On the OC, open a Unix shell window.

2.) Enter root as a superuser:
Type: **su -** **ENTER** at the prompt.
Type: **#bigguy** **ENTER** at the password prompt.

3.) Change directory to scripts:
Type: **cd /user/g/scripts** **ENTER** at the root prompt.

4.) Launch the Install Utility:
Type: **reconfig** **ENTER** at the prompt.
The OC displays the Install Utility Window as shown in Figure 7-1.

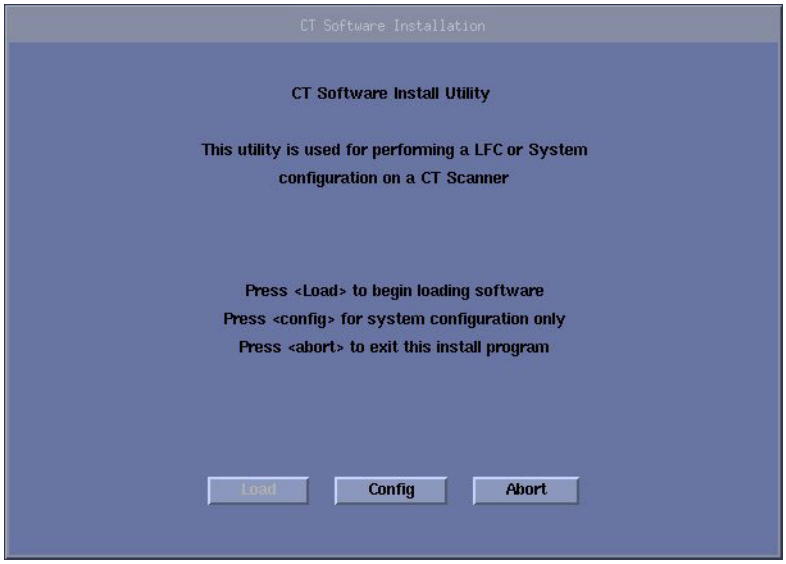


Figure 7-1 Install Utility Window

5.) Enter the Configuration Routine:

Using the mouse, click on the CONFIG button.

The OC displays the System Configuration - System Settings screen, as shown in Figure 7-2.

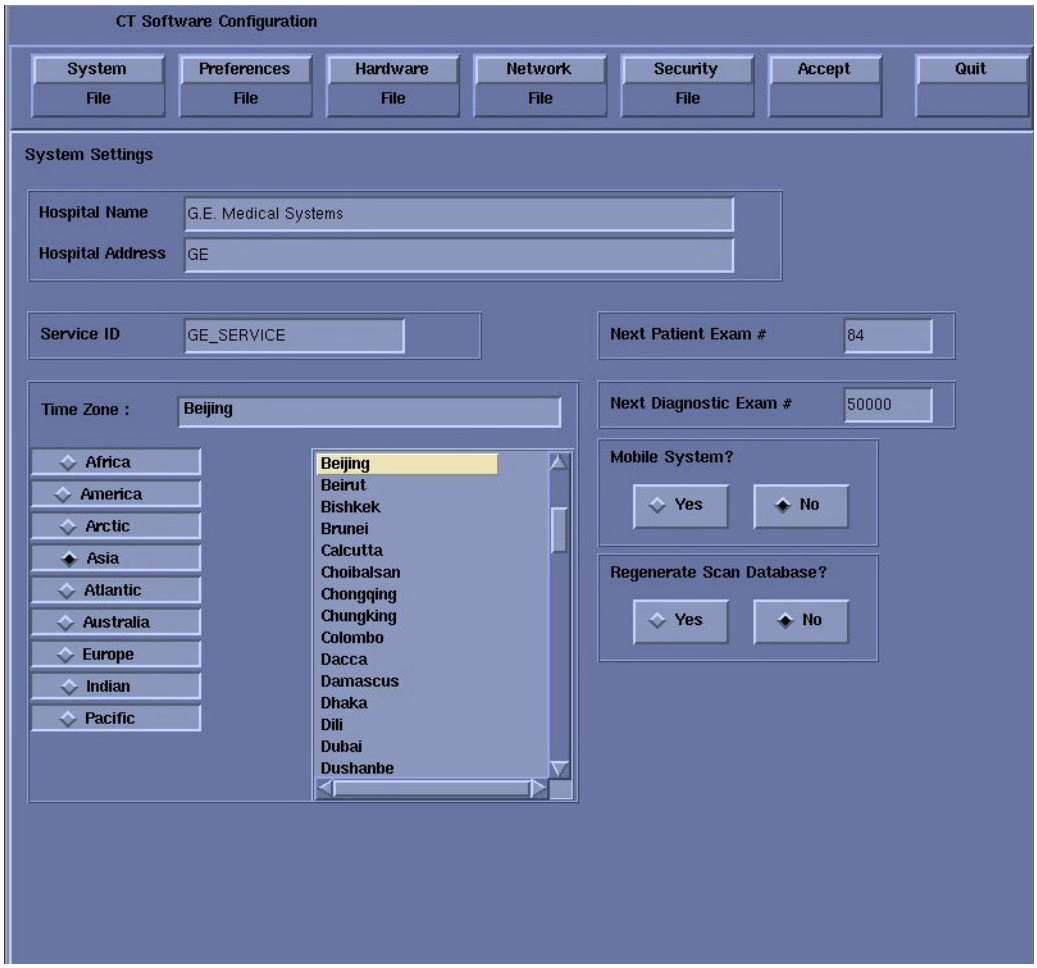


Figure 7-2 System Settings Screen

4.2 Configure Network Settings

This screen provides the ability to declare the CT system on a hospital network. Key information such as Host Name, IP Address, Net Mask (for CT systems on a subnet) must be obtained from the hospital network administrator.

1.) Select the NETWORK button to display the Network Settings screen as shown in Figure 7-3.

2.) Enter the `Suite Name`.

The Suite Name is a means of identifying this particular CT system as a part of a group of CT Systems in a suite configuration. This Suite Name will appear on all image headers.

The Suite Name must start with a letter, followed by three alphanumeric characters (total MUST be four characters long). The name of the OC interface will be *<Suite Name>*`_oc` and the SBC interface will be *<Suite Name>*`_sbc`.

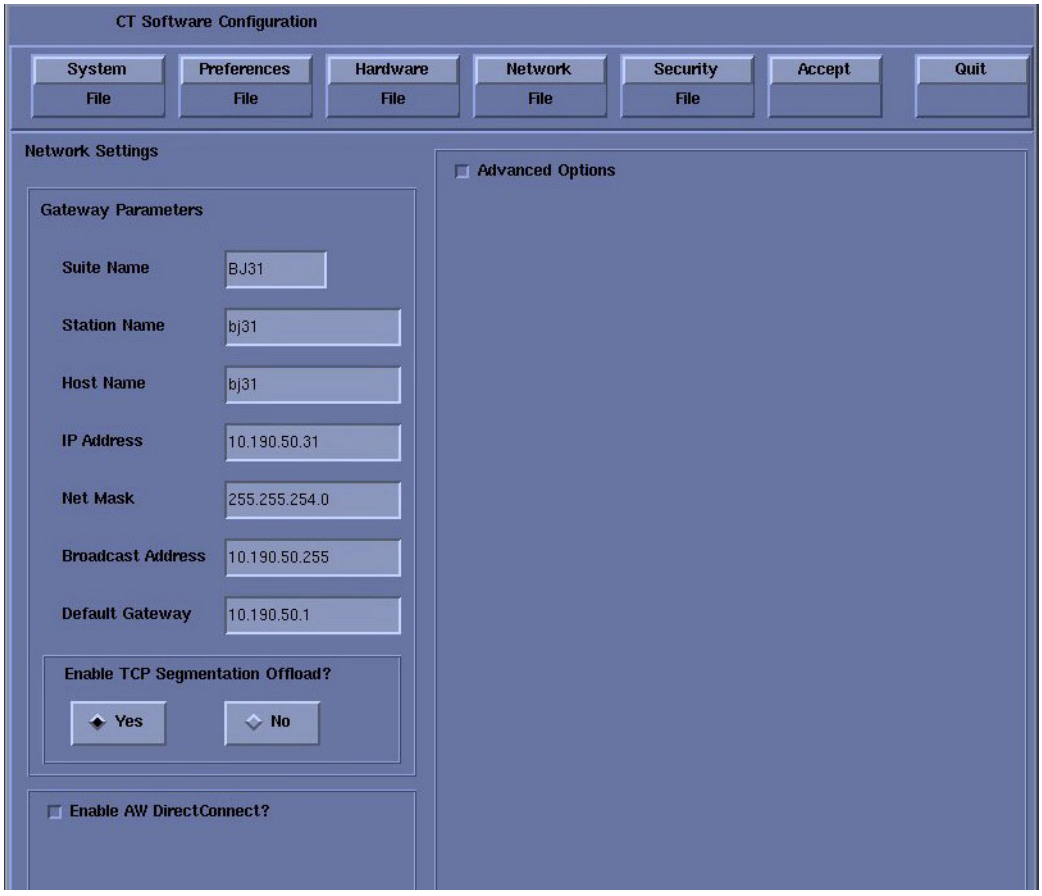


Figure 7-3 Networks Settings Screen

3.) Enter the hospital provided `Host Name`.

The Host Name identifies the network hostname and AE Title of the CT system.

The Host Name:

- **MUST NOT** be <*Suite Name*>`_oc` or <*SUITE NAME*>`_OC`.
- **MUST NOT** exceed 16 Characters.
- **MUST** only contain the following characters: **A** through **Z**, **a** through **z**, **0** through **9**, - and _

4.) Enter the hospital provided `IP Address`.

5.) Enter the hospital provided `Net Mask` (if the CT system is on a subnet).

6.) Enter the `Broadcast Address`:

The Broadcast Address should be the same as the IP Address except for the bits of the host id portion (last digit group) set to 1s or 0s depending on the configuration of the network. The standard default is 1s but older SunOS machines used 0s.

Example: If the IP Address is 192.100.9.17, the Broadcast Address should be 192.100.9.255 if the network is configured to use 1's to specify the broadcast address.

If the network contains genesis based scanners or other SunOS 3.5 or 4.1 computers, the Broadcast Address should be 192.100.9.0.

7.) Enter the hospital provided `Default Gateway` IP Address in the `Default Gateway` field (if applicable). If the site network does not use a default gateway, leave the field blank.

8.) Select NIS (Yellow Pages database) `Advanced Option` only if requested by the hospital network administrator as follows:

a.) Select ADVANCED OPTIONS button on the Network Settings screen.

b.) Select Use NIS? button.

c.) Enter the hospital provided Domain Name.

9.) Record all the Network parameters in the *Software Installation Procedures* Document, or on the worksheet in 2.2 on page 257.

4.3 Initiate System Reconfiguration

1.) Select ACCEPT on the System Configuration Screen.

The system loads the application software, OS patches, and kernal changes, and configures the system on both the OC and the SBC.

This loading process takes approximately 15 minutes. While the load is going on, the results are displayed in a shell window, which closes when the loading process is complete. All the window output is logged to a file named:

`/var/adm/install.log.YYYYMMDDWWWHHMMSS.`

(Where *YYYYMMDDWWWHHMMSS* is the Date/Time that the loading process was started.)

2.) When the loading process and configuration changes are complete, the system displays a prompt to reboot. Click on YES.

3.) The system will automatically login as ctuser after the reboot. Select OK on the Autostart Disabled popup message.

4.) To startup Applications, in the console shell window, type **startup ENTER**.

Section 5.0
Declaring Remote Hosts on the CT System (CTT OS System)

5.1 Enter Remote Host Configuration Screen

1.) On the OC, select the IMAGE WORKS icon. 

2.) Select NETWORK.

5.2 Declaring Advantage NET Remote Hosts on the Scanner

Use Advantage NET Protocol networks to communicate with older CT or MR Systems (MR Signa 4.x, CT-HLA, CT/I Systems, and Workstations that support the Advantage NET protocol). Advantage NET Protocol does not offer full compatibility with LightSpeed DICOM formats.

Repeat the following procedure for each Advantage NET Remote Host device that the customer expects to have this CT system communicating with.

1.) Select REMOTE HOSTS from the pull down menu. The system displays the Remote Host Parameter Screen as shown in Figure 7-4.

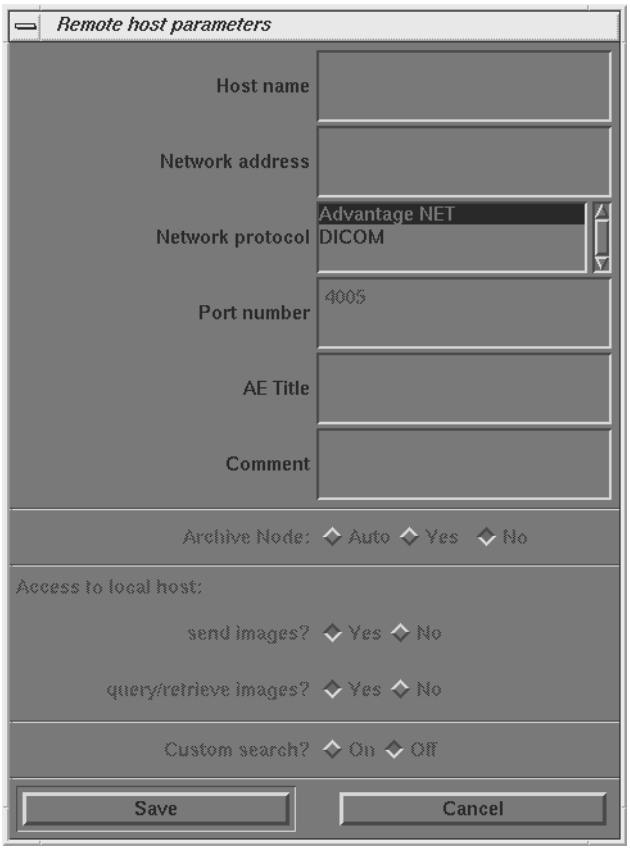


Figure 7-4 Advantage Net Network Protocol Parameter Settings

2.) Enter the hospital provided `Host name`.

3.) Enter the hospital provided `Network Address` (IP Address).

4.) Select ADVANTAGE NET as the `Network Protocol`.

The systems automatically de-highlights the remaining parameter fields on the Remote Host parameter selection screen. These are dedicated DICOM protocol parameters and do not apply to Advantage NET type devices.

5.) Select SAVE to store the parameter settings of the remote host.

5.3 Declaring DICOM Remote Hosts on the CT Scanner

Use DICOM protocol networks to communicate to DICOM devices such as CT/i, CT Synergy, DLX, MR Lx, and third party hosts.

Repeat the following procedure for each DICOM remote host device that the customer expects to have this CT system communicating with.

1.) Select REMOTE HOSTS from the pull down menu. The system displays the Remote Host Parameter screen as shown in Figure 7-5.

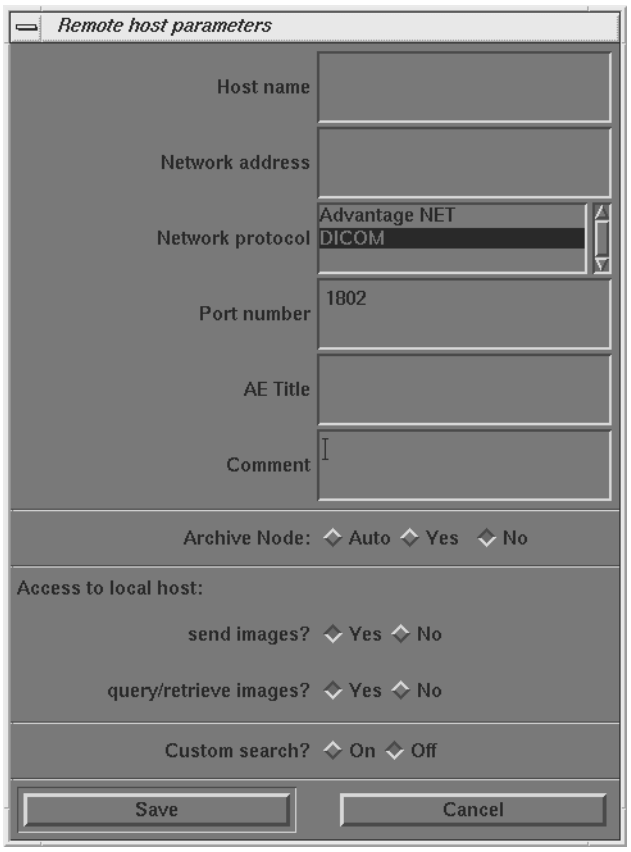


Figure 7-5 DICOM Network Setting Protocol Parameter Settings

2.) Enter the hospital provided `Host name`.

3.) Enter the hospital provided `Network Address` (IP Address).

4.) Select DICOM as the `Network Protocol`.

The system automatically highlights the remaining parameter fields on the Remote Host parameter selection screen. These are dedicated DICOM Protocol parameters.

5.) Enter the TCP/IP Listening `Port Number` from the DICOM Conformance Statement provided with the device.

6.) Enter the `AE Title` from the DICOM Conformance Statement provided with the device.

Application Entity Titles (also known as ACR-Nema or Dicom Name) refer to the DICOM Network Services that a device provides to the CT System. For most devices, the AE Title is the same as the hostname (CT systems are equipped with this feature).

However, some devices such as PACS systems may have separate AE Titles and port numbers for each of the services that the PACS system provides. In these cases, you must enter a separate remote host (same hostname and IP Address) for each of the independent AE Title Services that the host provides (one host as an image **push-to** destination, another host as a **query/retrieve** provider, and another host as a **storage/commitment** provider).

Be sure to review the DICOM Conformance Statement for each device that will provide a remote host network service for the CT system (image **push-to** or store destination, Query/ Retrieve, and Storage Commitment) to ensure that each service is correctly configured.

7.) Select the correct `Archive Node` choice for the device. The Archive Node selection field defines the ability of the remote host to act as a DICOM Storage/Commitment provider and indicate to the operator that a study/series/image was archived. Select:

- AUTO to have the CT system automatically check to see if the designated remote host is a DICOM Storage/Commitment Provider.
- YES if the device is the hospital designated DICOM Storage/Commitment Provider. During an Application Study Archive process, the local browser screen will indicate `Archive Status = Y` to the operator.
- NO if the device is not a DICOM Storage/Commitment Provider.

8.) Select the correct `Access to local host`: settings. These two selections allow you to selectively block the remote host from using the LightSpeed DICOM services as a provider (image **push-to** destination, and a **Query/Retrieve** provider).

- `Send Images?` Set to YES if the customer wants the CT system to be able to have images **pushed** to the system from the applicable remote host. Set to NO if the customer wants to block an image **push** from the applicable remote host.
- `Query/retrieve images?` Set to YES if the customer wants the remote host to be able to review the image database (query) and **pull** selected images from the database. Set to NO if the customer does not want the remote host to have this ability.

9.) Select the correct `Custom search?` setting. This selection allows the CT scanner to selectively search through the remote host's image database when the operator is using remote browser screen to **query** the remote host. The search parameters that the CT system allows the customer to use are: last name contains, patient ID, exam number, accession number, and exam date.

- Select ON if the device supports custom searches as part of the devices **Query/Retrieve** DICOM Provider service.
- Select OFF if the device does not support custom searches.

10.) Record all the remote host network parameters for each remote host in the *Software Installation Procedures* Document.

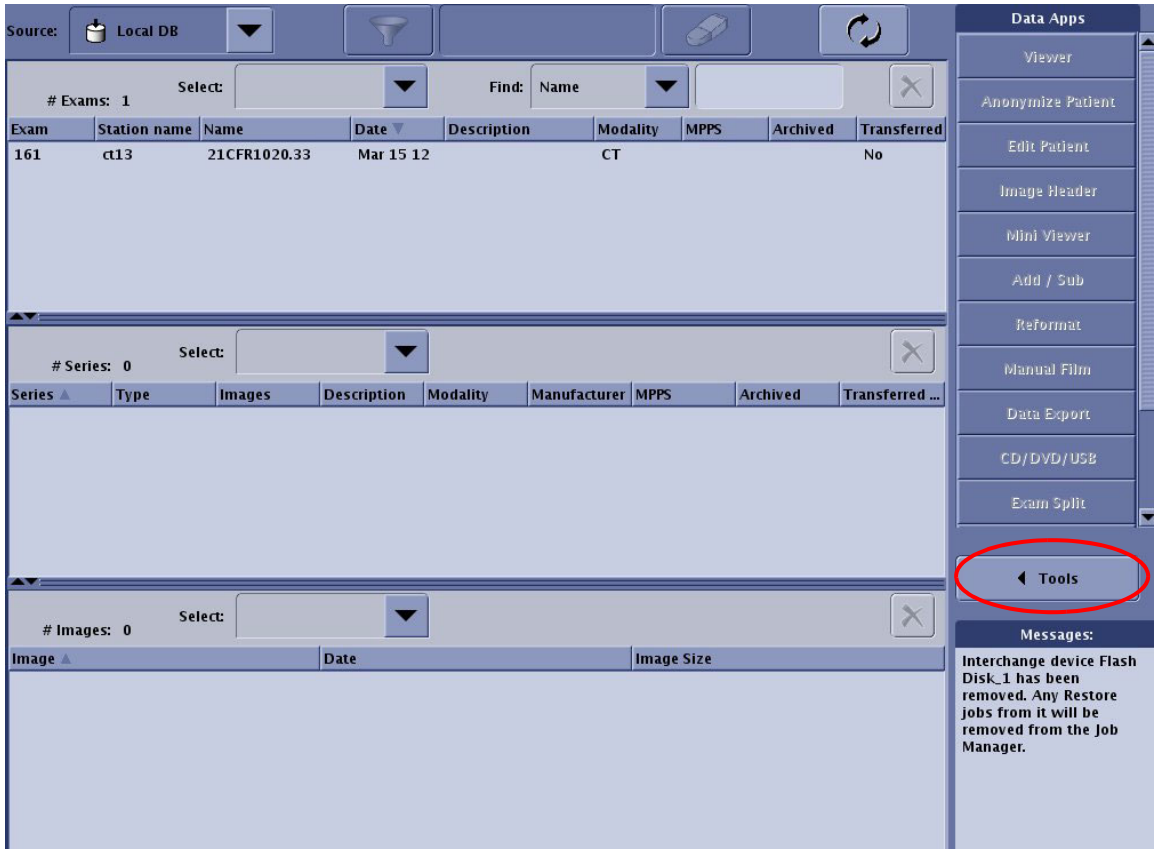
11.) Select SAVE to store the parameter settings of the remote host.

Section 6.0
Declaring Remote Hosts on the CT System (SUSE OS System)

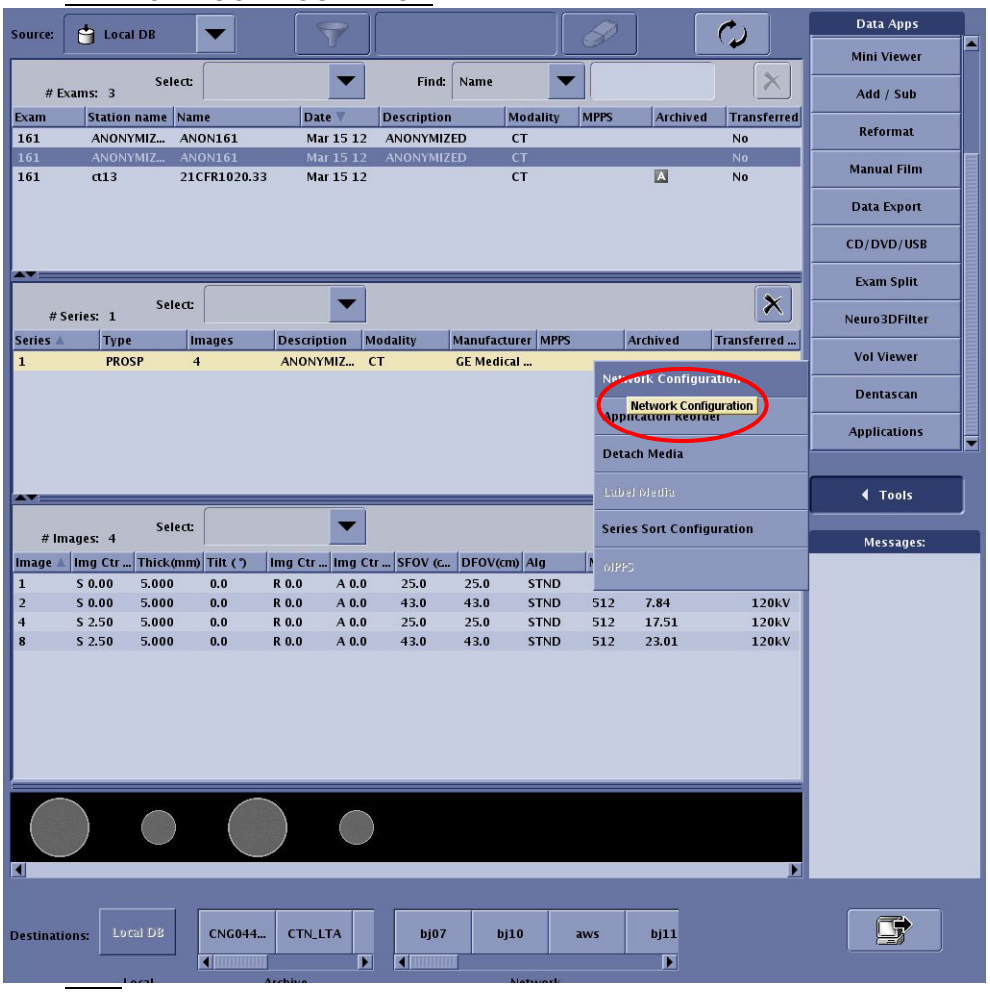
6.1 Enter Remote Host Configuration Screen

1.) On the OC, select the IMAGE WORKS icon. 

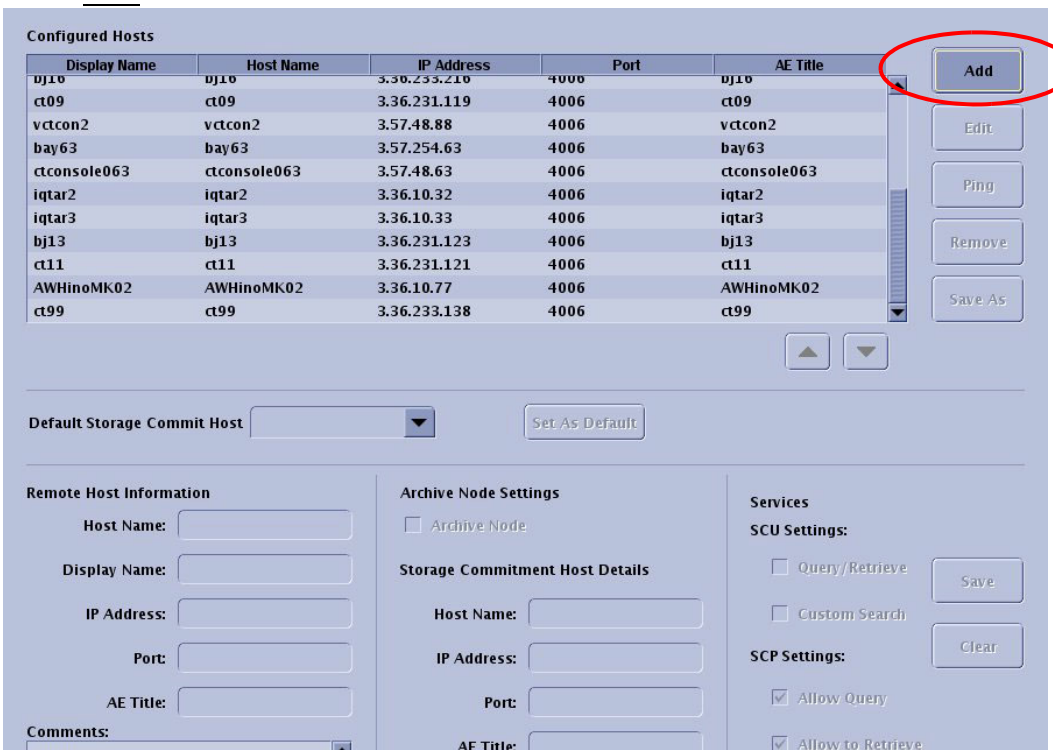
2.) Select TOOL.



3.) Select NETWORK CONFIGURATION.



4.) Select ADD.



6.2 Declaring DICOM Remote Hosts on the CT Scanner

Use DICOM protocol networks to communicate to DICOM devices such as CT/i, CT Synergy, DLX, MR Lx, and third party hosts.

Repeat the following procedure for each DICOM remote host device that the customer expects to have this CT system communicating with.

1.) Enter the hospital provided `Host name`.

2.) Enter the hospital provided `IP Address`.

3.) Enter the TCP/IP Listening `Port` from the DICOM Conformance Statement provided with the device.

4.) Enter the `AE Title` from the DICOM Conformance Statement provided with the device.

Application Entity Titles (also known as ACR-Nema or Dicom Name) refer to the DICOM Network Services that a device provides to the CT System. For most devices, the AE Title is the same as the hostname (CT systems are equipped with this feature).

However, some devices such as PACS systems may have separate AE Titles and port numbers for each of the services that the PACS system provides. In these cases, you must enter a separate remote host (same hostname and IP Address) for each of the independent AE Title Services that the host provides (one host as an image **push-to** destination, another host as a **query/retrieve** provider, and another host as a **storage/commitment** provider).

Be sure to review the DICOM Conformance Statement for each device that will provide a remote host network service for the CT system (image **push-to** or store destination, Query/ Retrieve, and Storage Commitment) to ensure that each service is correctly configured.

5.) Select the correct `Archive Node` choice for the device. The Archive Node selection defines the ability of the remote host to act as a DICOM Storage/Commitment provider and indicate to the operator that a study/series/image was archived.

- Select `Archive Node` if the device is the hospital designated DICOM Storage/ Commitment Provider. During an Application Study Archive process, the local browser screen will indicate `Archive Status = Y` to the operator.
- Don't select `Archive Node` if the device is not a DICOM Storage/Commitment Provider.

6.) `SCU Settings`: The following two selections allow you to selectively block the remote host from using the Brivo CT385 Series DICOM services as a provider (image **push-to** destination, and a **Query/Retrieve** provider).

- `Query/Retrieve:` select if the customer wants the remote host to be able to review the image database (query) and **pull** selected images from the database. Don't select if the customer does not want the remote host to have this ability.
- `Custom Search:` This selection allows the CT scanner to selectively search through the remote host's image database when the operator is using remote browser screen to **query** the remote host. The search parameters that the CT system allows the customer to use are: last name contains, patient ID, exam number, accession number, and exam date.
  * Select if the device supports custom searches as part of the devices **Query/Retrieve** DICOM Provider service.
  * Don't select if the device does not support custom searches.

7.) Select the correct `SCP Settings:` setting.

8.) Record all the remote host network parameters for each remote host in the *Software Installation Procedures* Document.

9.) Select SAVE to store the parameter settings of the remote host.

Section 7.0
Declaring the CT System on Remote Hosts

7.1 Declaring the Scanner on Advantage NET Protocol Devices/Systems

Refer to the appropriate service manual provided with the Advantage NET Protocol device or system to find instructions how to declare the CT System as an Advantage NET remote host.

7.2 Declaring the Scanner on DICOM Protocol Devices/Systems

Refer to the appropriate Service Manual provided with the DICOM protocol device or system to find instructions how to declare the CT System as a DICOM remote host.

The CT System provides two DICOM Services as a provider to remote hosts:

- A remote host can **push** images to the CT image database.
- A remote host can review the CT image database (query) and **pull** selected images (retrieve).

Use the following parameter information to configure the DICOM device/system to either **push** images to the CT scanner and/or perform a **Query/Retrieve** operation:

- `Hostname:` Provided by the Hospital Network Administrator. Exactly the same scanner assigned hostname entered in Network Configuration Screen.
- `Application Entity Title:` Exactly the same entry as the Hostname.
- `Network Address:` Provided by the Hospital Network Administrator. Exactly the same scanner assigned IP Address entered in Network Configuration Screen.
- `Network Protocol:` DICOM 3.0.
- `Port Number:` For all DICOM service that the CT System provides, use 4006.
- `Provider Type:` This field concerns the LightSpeed DICOM **Query/Retrieve** provider capability. All CT systems are wtudy root systems, which allow queries at the exam, series, and image level.
- `Support Worklist:` This field concerns whether a DICOM **Query/Retrieve** provider capable device or system supports a filter search of the image database. All CT systems support a filtered search of the image database as part of the LightSpeed DICOM **Query/Retrieve** provider capability.

Section 8.0
DICOM HIS/RIS Setup

8.1 Prerequisites

Most hospital HIS/RIS systems are not DICOM compatible and require a DICOM HIS/RIS Worklist Interface to provide patient scheduling information to the CT system. Contact your local HNS support engineer to determine exactly what DICOM HIS/RIS Interface is appropriate for the customer.

In addition, the CT system must have the ConnectPRO software option installed to utilize the DICOM Protocol Worklist capability.

8.2 Loading ConnectPRO Software Option on the CT System

1.) If you are not on the Service Desktop, click on the SERVICE DESKTOP icon. 

2.) Click on the UTILITIES icon. 

3.) Click on INSTALL.

4.) Select INSTALL OPTIONS and click START. The console displays the Software Options window as shown in Figure 7-6.

Figure 7-6 Options Window when First Selected

5.) Insert the ConnectPRO Options MOD into the MOD drive.

6.) Click on OK to continue.

7.) On the Software Option window, select the CONNECTPRO option in the Available Options window.

8.) Click on the INSTALL button.

The console may display a message box during the software loading operation. When the system has completed loading the software:

- the Installed Options window displays the ConnectPRO option, and
- the console displays the ConnectPro Setup window as shown in Figure 7-7.

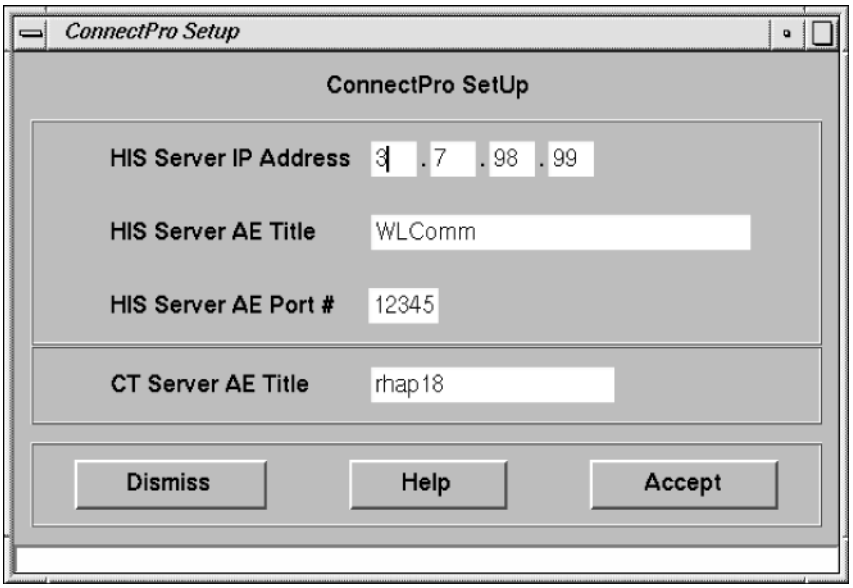


Figure 7-7 ConnectPro Setup Screen

9.) Enter the hospital provided `HIS Server IP Address`.

10.) Enter the `HIS Server AE Title` from the DICOM HIS/RIS Interface device DICOM Conformance Statement document.

11.) Enter the `HIS Server AE Port #` from the DICOM HIS/RIS Interface device DICOM Conformance Statement document.

12.) Record all the ConnectPRO HIS/RIS Network parameters in the *Software Installation Procedures* document.

The system will automatically load the LightSpeed `CT Server AE Title` (Hostname of the system).

13.) Click on the ACCEPT button. The system will check valid setup entries, execute a perl script that makes changes to the configuration files for HIS/RIS, and return to the Software Option window shown in Figure 7-6.

14.) Click on the QUIT button and the subsequent OK button in the message window.

15.) Remove the MOD from the MOD drive, and write protect the side containing the ConnectPRO option.

Section 9.0
Troubleshooting Tips

The following is a summary of troubleshooting information for DICOM print that was gathered during software testing and validation of the DICOM print feature.

There is also a significant amount of additional troubleshooting procedures, and the theory of the DICOM print feature in the System Service Manual. Should you have problems installing a DICOM print camera, first read the information in System Service Manual.

ERROR BRINGING UP THE CAMERA INSTALLATION/FILMING APPLICATION

- **Symptom**: After creating/modifying the DICOM print camera the install camera interface does not come up and the filming application indicates it cannot bring up the film composer.

  Cause: The configuration field contains invalid information such as a backslash (\) as the final character in the field or brackets ({}).
- **Solution**: The camera.dev file in `~ctuser/app-defaults/devices` must be manually edited to remove the offending characters in the set configuration line. Invalid characters include `\{}`

CONFIGURATION INFORMATION FIELD

- **Symptom**: Cannot view the entire configuration field (> 25 characters)
- **Solution**: Hold down the middle mouse button and move the field contents

NEED TO SET DICOM PRINT ATTRIBUTES NOT SUPPORTED BY SOFTWARE

- **Symptom**: User wants the white border around each image box ON/OFF permanently for this system and it cannot be set as the default for the camera.
- **Solution**: Using your favorite editor, add the following line to the camera.dev file located in `~ctuser/app-defaults/devices` after the DICOM print device has been otherwise configured.

  For Trim Off - set `TRIM NO`

  For Trim On - set `TRIM YES`
- **Symptom**: DICOM print camera supports multiple film sizes and the user only wants to print if the film size is correct for Discovery and Optima RT (14x17). [Otherwise the camera will queue the films or return an error causing the queue to pause (based upon the DICOM print camera specifications).]
- **Solution**: Using your favorite editor, add the following line to the camera.dev file located in `~ctuser/app-defaults/devices` after the DICOM print device has been otherwise configured.

  To force a 14x17 film size - set `filmSize 14INX17IN`

NEED TO PREVENT DICOM PRINT ATTRIBUTES FROM BEING SENT TO DICOM PRINT CAMERA

- **Symptom**: Some DICOM print attributes are optional, and may result in fatal errors. For example, the Fuji camera does not support the Empty Image Density parameter for the film box.
- **Solution**: Using your favorite editor, add the following line(s) to the camera.dev file located in `~ctuser/app-defaults/devices` after the DICOM print device has been otherwise

configured.

- To prevent sending the Smoothing Parameter set `FB_Smooth FALSE`
- To prevent sending the Border Density set `FB_Border FALSE`
- To prevent sending the Empty Image Density set `FB_EID FALSE`
- To prevent sending the Minimum Density set `FB_MinD FALSE`
- To prevent sending the Trim Parameter set `FB_Trim FALSE`

ERROR TRYING TO CONNECT TO THE DICOM PRINT CAMERA

- **Symptom**: DICOM print server can be reached (ping), but Application error indicates `"Unable to start filming interface"` and the help message talks about running the install.dasm (Association Error)
- **Solution**: The system is unable to complete the association. Check the `AE Title` and the `Port number` of the DICOM print server and correct them through the Install Camera procedure.

FILM COMPOSER ERROR NOT USABLE

- **Symptom**: Film composer error says "`unrecognized status - code 0`"
- **Solution**: Review the log file, the attention and status windows. These areas have the correct filming status (for example, **film jam** and **supply empty**).

DEBUGGING CONNECTION ISSUES DIFFICULT

- **Symptom**: The timeouts for the DICOM print are very long, which means one needs to wait a long time before you know the application is not working.
- **Solution**: The timeouts for the DICOM print were setup to ensure that the system would work regardless of whether the DICOM print camera was on a LAN or a WAN halfway around the world. The DICOM print timeouts for the association and DIMSE classes (for example, **N-GET**, **N-DELETE**) can be modified within the DICOM print camera installation. They can be reduced down to 90 seconds.

DICOM PRINT ERROR ON N-GET TIMEOUT CONFUSING

- **Symptom**: When the N-GET timeout goes off, the error message in the prslog file will be "`Could not get printer status, invalid command sequence for N-GET`".
- **Solution**: When the user sees the above error they may want to consider that the issue may be an inactivity timer on the N-GET DIMSE service.

DICOM PRINT CAMERA SLIDE SUPPORT

- **Symptom**: Current implementation of DICOM print does not allow selection of slide format.
- **Solution**: Feature not currently supported. Possibly in future releases.

CONFUSION ON FILM FORMAT NOTATION

- **Symptom**: GEMS Laser Camera and DICOM Print film format notations are opposite.
- **Solution**:
  - GEMS Laser Camera film format notation has always been row x col (for example, 12 on 1 = 4x3)
  - DICOM Print Standard film format notation is col x row (for example, 12 on 1 = 3x4)

Section 10.0
Teleradiology (Framegrabber Type) Systems & Aux. Monitors

10.1 Introduction

Some systems may have teleradiology (TR) systems that framegrab the video. Discovery and Optima RT DOES NOT directly support this type of TR. The CT scanner's RGB color display video is a much larger format at a much higher pixel frequency. GE does not promise any direct compatibility with framegrabbing TR systems (DICOM 3.0 TR systems may work depending on the DICOM implementation but GE does not and cannot validate all the various TRs.)

In the framegrabber case, a high quality (300Mhz bandwidth) video splitter/amplifier (as listed above) is needed to intercept and re-drive the display CRT RGB video. Composite grey-scale would then be available on Green #2 (1280x1024 pixels at 72Hz). Any framegrabber hardware attempting to capture this signal must be capable of a 140Mhz pixel rate. This also involves TR system configuration parameters. The TR capture software may also need upgrading to deal with 1280x1024 and/or **crop** the signal. The TR remote display software may need upgrading to view the larger format. The image transmission times to the remote TR may be up to 4 times as long. GE will supply all technical information necessary to assist TR suppliers in making their systems work with Discovery and Optima RT, but GE cannot be responsible for this third party TR equipment, software, or compatibility with Discovery and Optima RT.

The following common parts are available from CT Systems:

PART NUMBER	DESCRIPTION
2237018-2	Four-way Video Splitter (BNC Converter)
2154425	BNC to BNC 7' Splitter Cable
2142221	BNC to Host Computer 7' video Cable
2256482	DB15 to Host Computer 7' Video Cable
2256485	DB15 to BNC 7' Adapter Cable

Table 7-1 Common Parts Available From GE

10.2 Auxiliary Monitors Setup

Figure 7-8 illustrates the **only approved GE CT configuration** for remote monitors, including the part numbers for the only approved components. The use of other configurations and/or components should be strictly avoided.

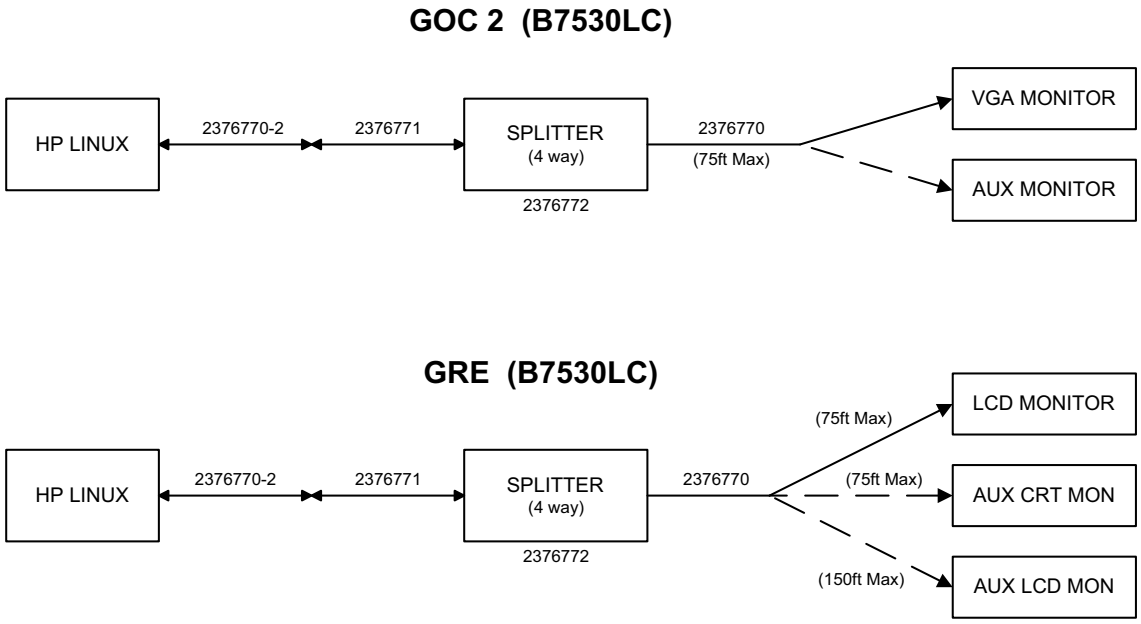


Figure 7-8 Video Splitter / Monitor Cabling

10.3 CT Analog Filming Interface Specs (Video & Serial)

Note: **The analog (VDB) video output specs and serial interface were specified from, and are the same as, the Genesis interface output specs. This does NOT apply to the digital (LCAM) filming interface**.

OUTPUT	VALUE
amplitude	1 volt peak-to-peak
video	0.643V ± 10%
setup	0.071V ±10%
sync	0.286V ± 10%
DAC resolution	8 bits
diff. linearity	±1 LSB max
glitch area	80 picovolt seconds max, for any step size
rise/fall times	> 10 nsec, ± 10-90%
FS settling time	7.5 nsec typical to 1 LSB
transfer function	guaranteed monotonic
noise level	> 5.0 millivolt peak-t~peak, combined sync/async noise
DC offset	±1 VDC referenced to ground

Table 7-2 Video Output (Measured Into 75Q at BNC Output)

OUTPUT	VALUE
logic family	F series TTL
output low level	0.8VDC max
output high level	2.OVDC mm
output period	41.336 nsecs ±10%
transition times	10 nsec max, ± 10-90%

Table 7-3 Pixel Clock Output

VIDEO TIMING CHARACTERISTIC	60HZ	50 HZ
pixel frequency	24.192 Mhz	24.192 Mhz
pixel period	41.336 nsec	41.336 nsec
horizontal line frequency	33.6 Khz	33.6 khz
horizontal line width	720 pixels	720 pixels
horizontal active	544 pixels	544 pixels
horizontal blanking	176 pixels	176 pixels
horizontal front porch	26 pixels	26 pixels
horizontal sync	76 pixels	76 pixels
horizontal back porch	74 pixels	74 pixels

Table 7-4 Video Timing Characteristics

VIDEO TIMING CHARACTERISTIC	60HZ	50 HZ
vertical frame frequency	60Hz	50Hz
vertical frame time	560 lines	672 lines
vertical active	524 lines	524 lines
vertical blanking	36 lines	148 lines
vertical sync	3 lines	3 lines
vertical back porch	30 lines	86 lines
vertical front porch	3 lines	59 lines
scanning format	non-interlaced	non-interlaced

Table 7-4 Video Timing Characteristics (Continued)

FORMAT	VALUE
visible field	544 pixels by 524 lines
image field	512 pixels by 512 lines
greyscale field	32 pixels by 16 level grey bar on left side of image
greyscale	software selectable on/off
greyscale off value	0 (black)
initial greyscale	255 (white) at upper left corner
border field	12 lines at bottom of visible field
border field value	any 8bit value, software programmable

Table 7-5 Video Display Format

ATTRIBUTE	VALUE
interface	R5422
25D conn pinout	pin 8 (RX+), pin 21 (RX-), pin 9 (TX+), pin 22 (TX-), pin 7 (GND)
baud rate	1200 baud
word length	8 bit, 1 start bit, 1 stop bit
parity	even
type	asynchronous

Table 7-6 Host Communications/Control Serial Port (analog interface only)

Note: **The digital DASM/LCAM serial control has standard R5232 on pins 2, 3, & 7.**

Section 11.0
Network Connections

BROAD-BAND

Broad-band is considered the standard network connection for Discovery and Optima RT. (A dial-up modem is optional.) Broad-band connections should use one of the following Category 5 patch cables:

CAT Num	GE Part Num	Length
K9000WB	2215028-10	20 m
K9000KP	2215028-5	10 m
K9000JR	2215028-4	5 m
K9000WA	2215028-9	3 m

The CT system is connected to the network through the Console.

- A ethernet cable (not to exceed 10 feet) should be provided by the customer, and it is used to connect the console to a wall box. (See Notes on Figure 7-9)
- Some customer-site units may require cable duct-work or conduit to route connecting network cables to the workstation, camera and console.
- The run from the hospital switch to the CT wall outlet must not exceed 290 ft. (88m). Bandwidth performance is degraded when the length reaches 300 ft. (91m) or greater.
- For the optional modem: **Two phone lines should be provided by the facility**. One line is for use with a modem and must be an analog line. The second line is a voice only line.

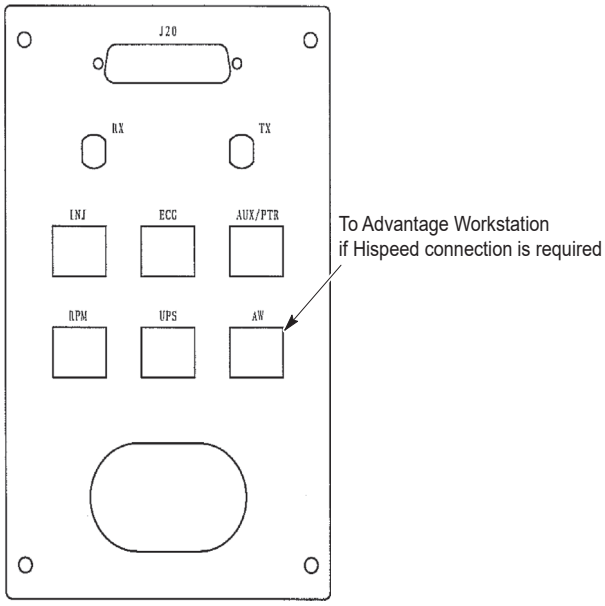
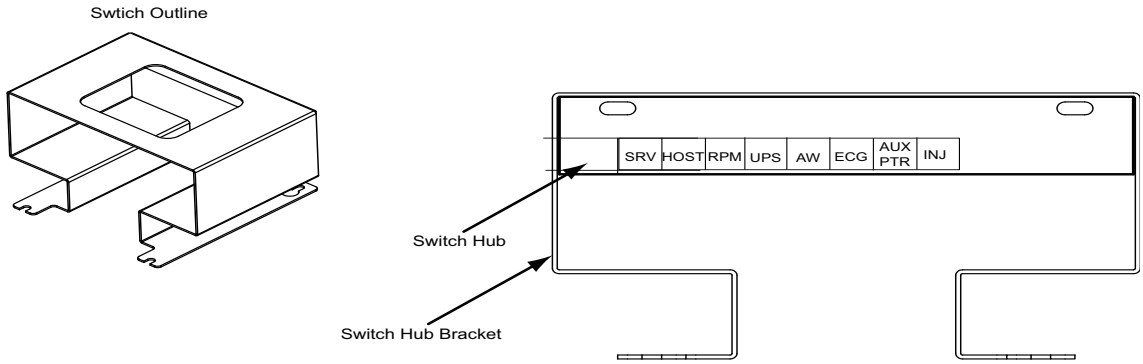
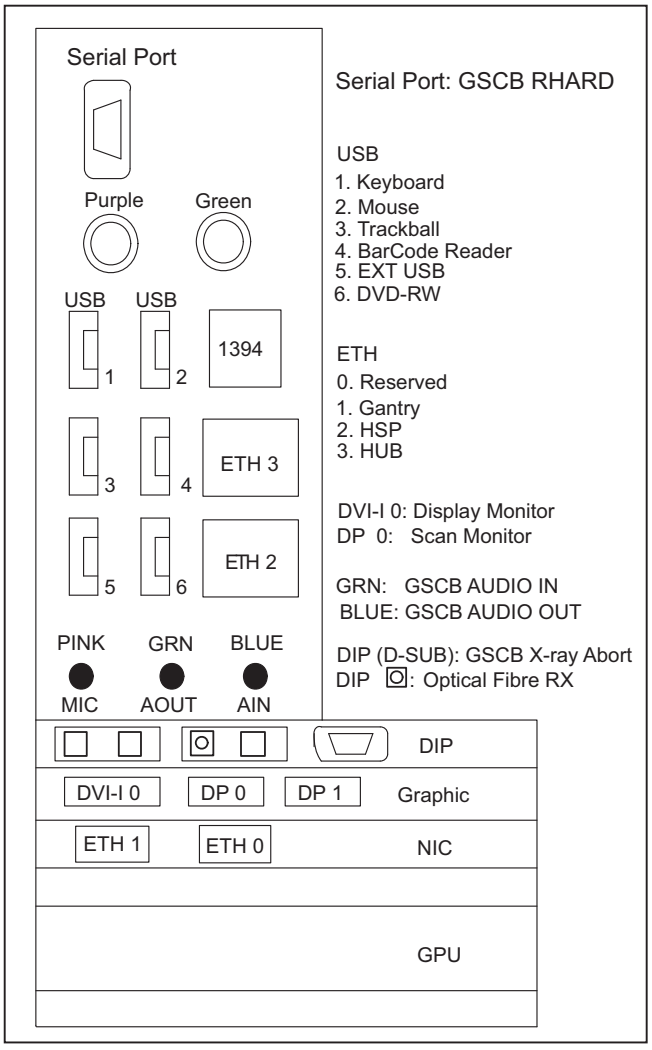


Figure 7-9 True-In-One Console Rear Bulkhead

For NIO16/OpenOC16 Console Network Connection:

- All cables connection via Switch Hub, Switch Hub located on the left bottom of the console, Plug cables into Switch Hub on console.





NOTE: EXT USB is for DVD Tower External HD Drive
DVD-RW is for DVD Tower DVD-R / CD-R Drive

Figure 7-10 NIO16 Console with Z800 Host Computer Rear View

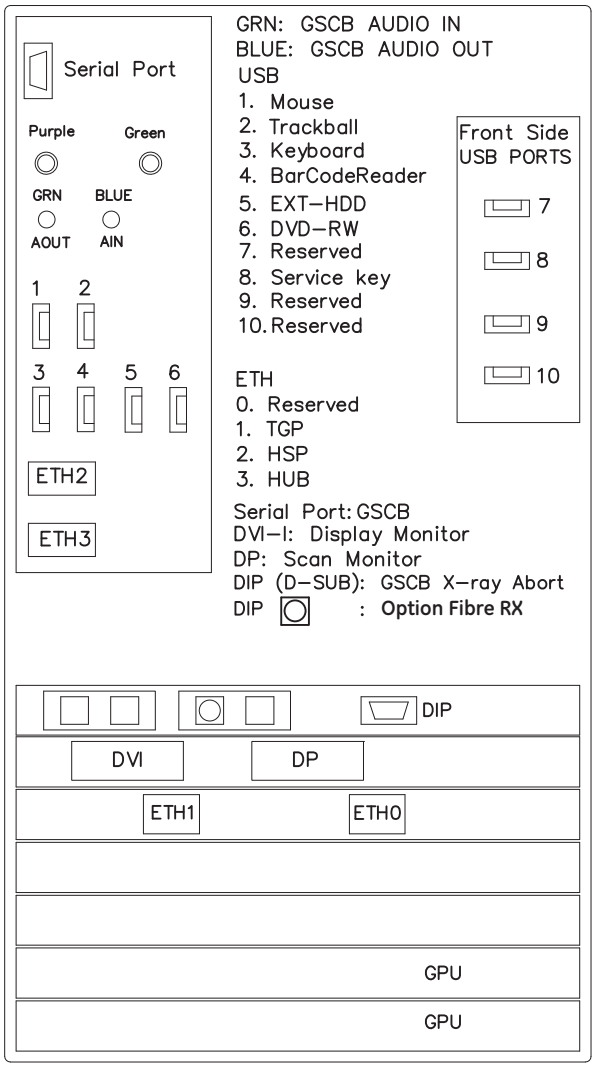


Figure 7-11 NIO16 Console / OpenOC16 Console with Z840 Host Computer Rear View

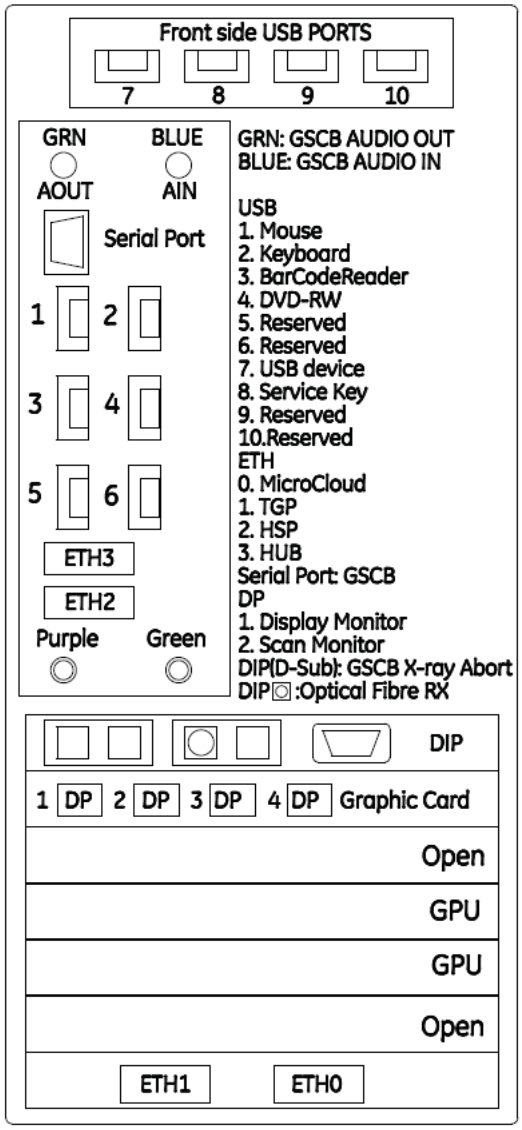


Figure 7-12 OpenOC16 Console with Z8G4 Host Computer Rear View

US Broad Band Process Overview

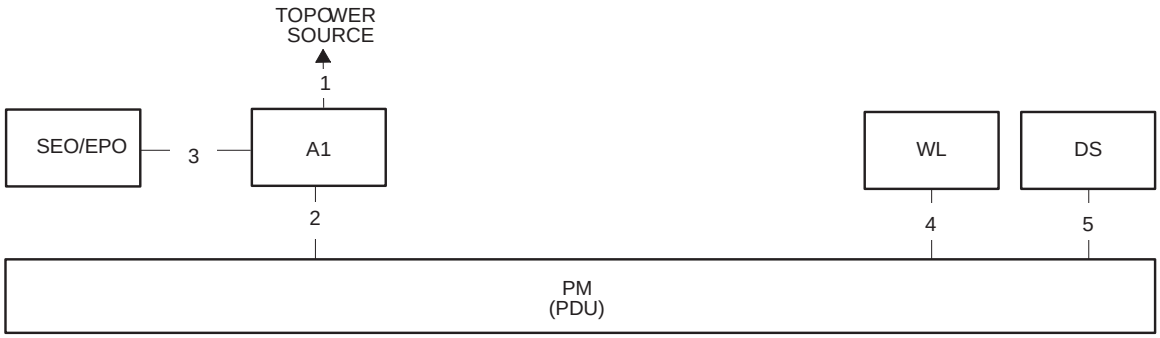
The United States network connectivity requirement for this product is broad-band. The US process relies on the Install Specialist to select a Customer Champion and identify an IT contact for the site. Together, those individuals then complete a site assessment to gauge what tasks are needed to fulfill the connection.

Anyone can contact the GE Connectivity team at 800.321.7937, Option #3, with questions.

Customer Broad-Band Responsibilities

Provide GE Installation Project Manager with an accurate site address, telephone number, contact name, and e-mail address for the:

- Customer Champion
  - Co-ordinate VPN activities between Radiology/Cardiology and the Information Technology (IT) departments
  - Act as a focal point in assuring site broad-band infrastructure meets GE requirements for connection as determined by a mutual assessment with the GE Connectivity team.
- IT Contact
  - Complete an equipment assessment with GE Connectivity team to determine site readiness for broad-band
  - Contact your Installation Project Manager, for the name of the zone Broad-Band Specialist
  - Work with the Customer Champion to complete any identified infrastructure changes
  - Provide IP addresses for new CT equipment
  - Provide a VPN compatible appliance that will support the IPSec tunneling protocol and 3DES data encryption
  - To utilize an Internet Service Provider that supports static routing



Only one phone connection is required for the system.

NOTES:

1) Used for remote diagnostics - Option
2) Refer to the appropriate Pre-installation / Installation documents for the Laser Camera
3) Category 5 cable. Use one of the following patch cords:

CAT Num	GE Part Num	Length
K900WB	2215028-10	20 m
K900KP	2215028-5	10 m
K900JR	2215028-4	5 m
K900WA	2215028-9	3 m

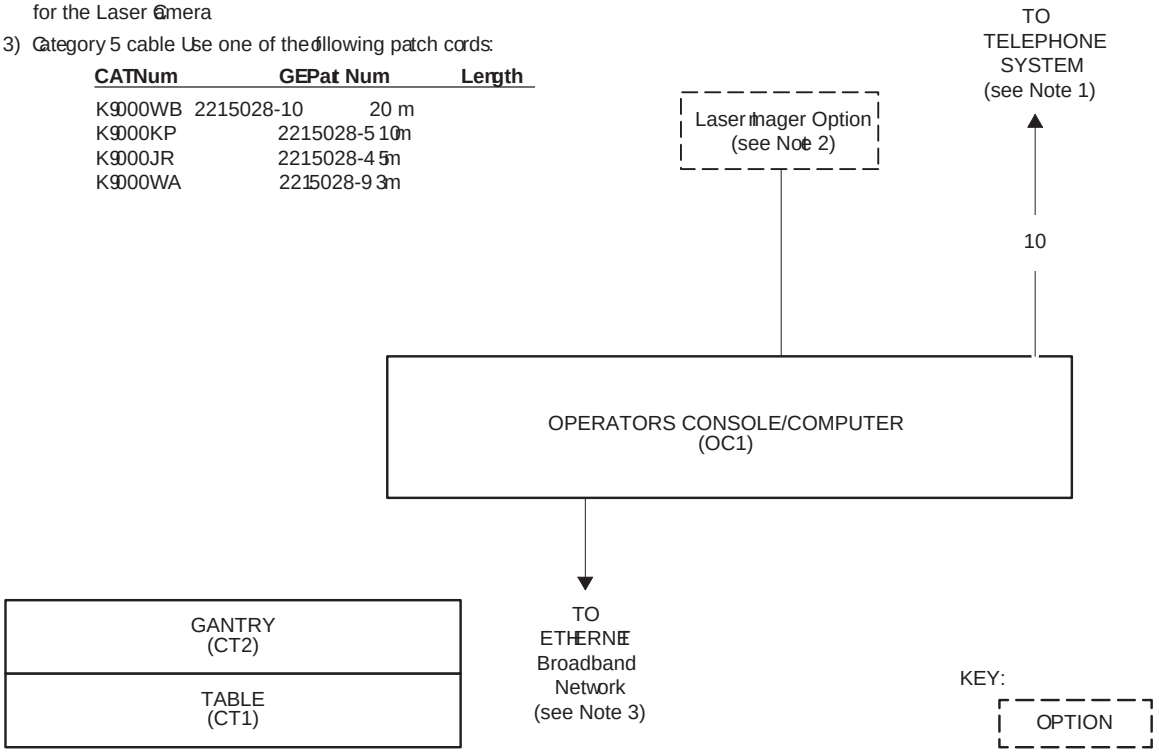


Figure 7-13 System Interconnection Runs

Section 12.0
RSvP Network

12.1 RSvP Check List

NO		VERIFIED
1	The system must be physically connected to the hospital network (the ethernet cable is available for the computer, either directly from the hospital network or from a GEHC supplied router)	☐
2	Network configurations are completed, port 443 has been authorized outbound. For site utilizing DNS, obtain the IP address:_____	☐
3	Reference the list below if the customer requires the URLs accessed via 443: • https://insite.gehealthcare.com:443 • https://as1-insite.gehealthcare.com:443 • https://as2-insite.gehealthcare.com:443	☐
4	If a proxy is required to access the internet at the site then obtain the following information: • Proxy IP:_____ • Proxy Port:_____ • User and Password (if required) to the proxy: - User:_____ - Password:_____	☐
5	Confirm the System ID is setup in CRM by checking for a successful “CRM verified” agent status on the system. FFA would show this as connected.	☐

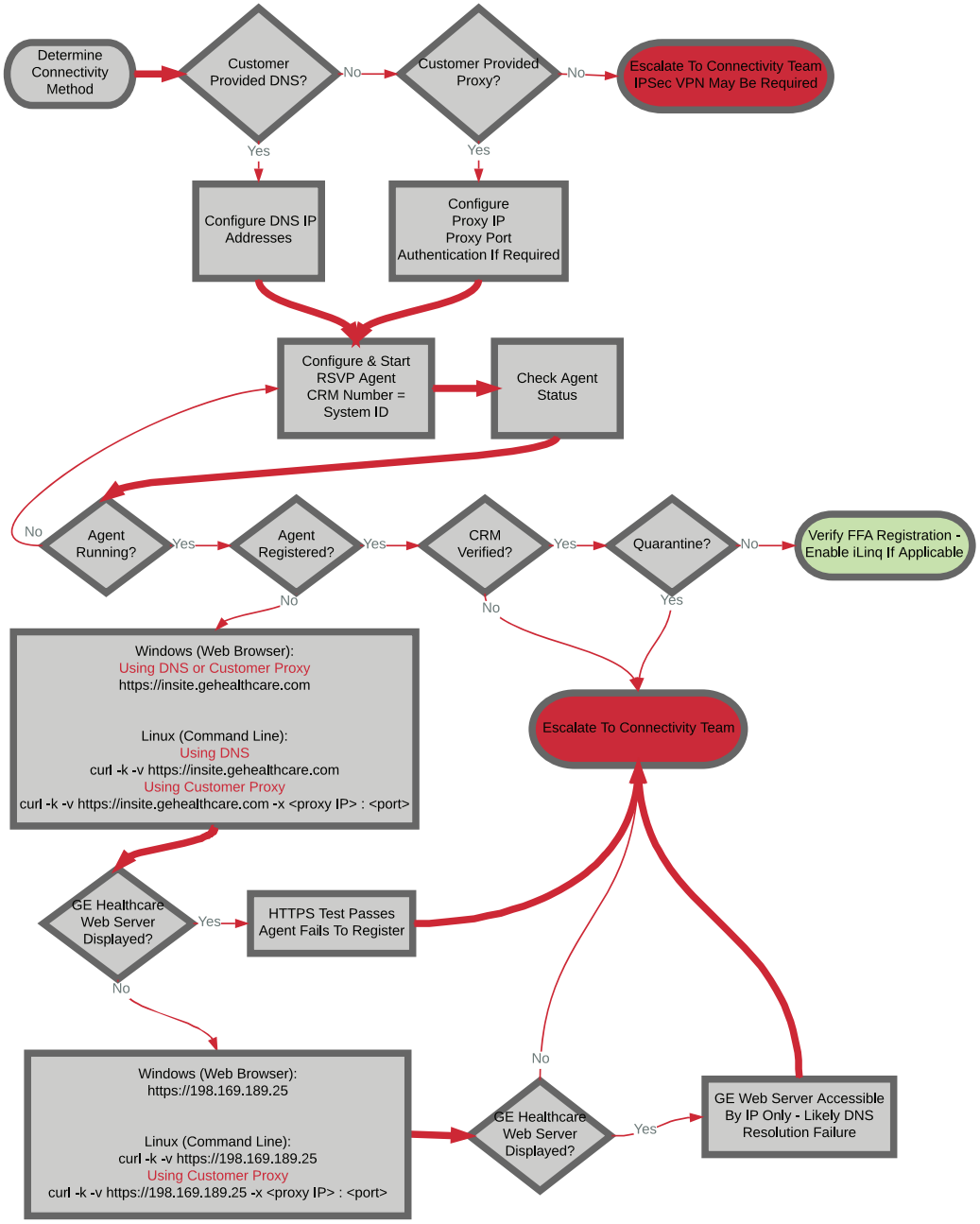
Table 7-7 Check List

Note: 1.) Either DNS or Proxy is required to establish RSvP InSite connectivity.

2.) Refer https://devcloud.swcoe.ge.com/devspace/display/HCKCL/RSvP+Documentation+Team+Information for more RSvP related documentation.

12.2 RSvP Troubleshooting Flow Chart

Figure 7-14 FlowChart



12.3 RSvP Troubleshooting

12.3.1 Determine Connectivity Method

There are 3 main use cases for establishing connectivity from the RSvP agent on the modality to the GE web server.

1.) Customer Provided DNS (domain name server)

The domain name server returns the IP address associated with a provided URL. For the RSvP agent the URL is https://insite.gehealthcare.com and the associated IP address may change in the future. Using DNS allows the modality to stay connected by configuring a single URL that doesn't need to be changed. This is considered typical internet access. DNS server IP addresses are configured on the modality. Failure to configure DNS will result in lack of connectivity.

2.) Customer Provided Proxy Server

Some customers may choose to have the modality configured to send traffic to a proxy server on their network. This server will handle the connection from the modality destined for the GE web server. Instead of standard internet access, the customer provided proxy IP address and port are configured on the modality. Authentication (user name & password) may also be required. This method does not require DNS configuration.

3.) IPSec VPN Typically Associated With InSite 1 Systems

Use of the existing IPSec VPN is discouraged for latency and functionality concerns. Connection speed will be affected. Currently, Flexera software download is not allowed over VPN connections in the GE infrastructure. At some customer sites, VPN may be the only possible method of connectivity, these should be handled on a case by case basis with your GE connectivity support team.

12.3.2 RSvP Agent Status

There are 4 main status indications on the RSvP agent. It is recommended that each modality implement this, however not all products have this feature.

1.) Agent Running

RSvP agent software has been configured and the process is running on the modality. The agent should be attempting to establish a connection with the GE web server.

2.) Agent Registered

The agent has successfully established an HTTPS connection to the GE web server. Associated modality specific information has been communicated to the server.

3.) CRM Verified

The system ID that is configured on the modality has matched successfully with the asset record associated with the CRM platform. The CRM system ID configured on the modality must match exactly.

4.) Quarantine

In the event that two or more systems that are actively establishing HTTPS connections with the GE web server using the same CRM number (system ID), they are placed in quarantine condition. This requires a case to be submitted with the FFA support team to resolve.

12.3.3 Agent Fails To Register

In the event that the modality agent is configured but does not show a registered status, there are 3 main reasons:

1.) The modality simply does not have internet access. There is no path for the modality to reach public internet space. This may be by design as some customer network segments are meant to restrict access to the internet, or there may be a network configuration issue that the customer will need to resolve.

2.) The modality technically has internet access but does not have DNS configured. Since the modality will have a URL configured, DNS server IP addresses need to be configured to resolve the IP address associated with the GE web server URL.

3.) Customer security policy does not allow access until an internal review process has been completed and access is granted. Many customer sites have advanced security layers to deal with internet related traffic on their network. This can include IPS/IDS (intrusion prevention/ detection) sensors that must be explicitly configured to allow RSvP agent traffic to the GE web server.

Note: Your GE connectivity support team can help identify the above cases and work with the customer to resolve.

12.3.4 How To Determine Internet Access & DNS Issues

The associated troubleshooting flowchart has some simple tests to help determine if the agent does not register due to an internet access or DNS issue:

1.) For Windows based systems we can leverage the built-in web browser. If you have a DNS or Customer Proxy connection, simply try the URL (https://insite.gehealthcare.com) and if that fails to load try the IP address (https://198.169.189.25). If the URL fails but IP passes, this is likely a DNS problem. If a customer proxy is being used, we assume the same proxy configured on the RSvP agent is configured on the browser. Issues that appear to be customer proxy related will be more difficult to determine and will need customer assistance.

2.) For Linux based systems we can leverage the built-in command line:

   a.) The modality has DNS configured so we attempt a connection using the curl command to the web server URL (curl -k -v https://insite.gehealthcare.com)

   b.) If the test fails in step (a) we modify the curl command to specify the web server IP, this can help determine the issue is DNS resolution related (curl -k -v https://198.169.189.25)

   c.) If the modality RSvP agent is configured with a customer provided proxy we modify the curl command to specify the proxy IP and port:
   curl -k -v https://insite.gehealthcare.com -x <proxy IP> : <port>
   (Example: curl -k -v https://insite.gehealthcare.com -x 10.150.2.2:800)

   d.) We can also attempt to pass the IP of the GE web server to the customer proxy, the result may be useful in fault isolation:
   curl -k -v https://198.169.189.25 -x <proxy IP> : <port>
   (Example: curl -k -v https://198.169.189.25 -x 10.150.2.2:8002)

In summary, always reference your product specific service manual for configuration and troubleshooting information. Also leverage your connectivity support team to ensure we can establish and maintain this important connectivity for remote support and product analytics.

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Chapter 8
System-Level Safety Tests

You must complete these tests after all options are installed. They cover three safety and leakage current checks:

- Patient Touch Current Test (completed after installation)
- System Ground Resistance Measurement (completed during installation)
- Ground Current Typical (completed after installation - optional)

Refer to the Discovery and Optima RT Service Methods to locate the latest Enclosure Leakage (Patient Touch) and System Chassis Leakage Tests under the **Functional Checks** chapter.

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Appendix D
Additional Characterization Procedures

For information related to alignment, setup, and calibration procedures, please refer to the appropriate the Service Methods publication, Direction 5366638-8EN.

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Appendix E
System Configuration Data Sheets

REQUIREMENT

Record valuable system information in the data sheets that follow. Consult with your customer or network administrator to obtain the information. Understanding how the customer plans to use their CT scanner, and their network and filming expectation reduces the time required to reconfigure the system.

MANUAL FILM COMPOSER OPTIONS

MANUAL FILM COMPOSER OPTIONS	
Slide Format (if available):	
Greyscale:	
Auto Printing:	
Auto Clear Page:	
Icon Labels:	
Expose Order:	
No. of Copies:	

Table E-1 Manual Film Composer Options

SYSTEM NETWORK CONFIGURATION

SYSTEM NETWORK CONFIGURATION			
	FIELD NAME:	**SETENV NAME:**	**FIELD VALUE:**
System Settings:	Service ID	SERVICE_ID	
	Hospital Name	HOSPITAL_NAME	
	Exam Number *	* ask customer or checklog	
	DAS Type	DASTYPE	
	PDU Type	PDUTYPE	
Network Settings:	Gateway Host Name	GATEWAY_HOSTNAME	
	Gateway IP	GATEWAY_IP	
	Gateway Net Mask	GATEWAY_NETMASK	

Table E-2 System Network Configuration

SYSTEM NETWORK CONFIGURATION			
	FIELD NAME:	**SETENV NAME:**	**FIELD VALUE:**
	Gateway Broadcast Mask	GATEWAY_BROADCAST	
	Suite Name	SUITEID	
Option	Network Printer IP Address		
Option	HIS Server IP Address		
Option	HIS Server AE Title		
Option	HIS server AE Port		
Option	CT Server AE Title		
Option	Connect Pro IP Address		

Table E-2 System Network Configuration(Continued)

NETWORK APPLICATION (IMAGE TRANSFER) CONFIGURATION

Record the network application (image transfer) configuration.

NETWORKING APPLICATION (IMAGE TRANSFER) CONFIGURATION				
AE TITLE OR HOST NAME	**NETWORK ADDRESS**	**NETWORK PROTOCOL**	**PORT NUMBER**	**COMMENTS**

Table E-3 Networking Application (Image transfer) Configuration

HOST ETHERNET ADDRESS

_____:_____:_____:_____:_____:_____

Camera Application Configuration

Record the camera application configuration for the DICOM print camera.

DICOM PRINT CAMERA CONFIGURATION	
Camera Type:	
Host Name:	

Table E-4 DICOM Print Camera Configuration

DICOM PRINT CAMERA CONFIGURATION	
IP Address:	
AE Title:	
TCP/IP Listen Port:	
Comments (Optional):	
Valid Film Formats:	
Default Film Formats:	
Destination:	
Orientation:	
Medium Type:	
Magnification Type:	

Table E-4 DICOM Print Camera Configuration (Continued)

DICOM PRINT CAMERA ADVANCE CONFIGURATION	
Smoothing Type:	
Configuration:	
Minimum Density:	
Maximum Density:	
Empty Density:	
Border Density:	
Association Timeout:	
Session Timeout:	
N-Set Timeout:	
N-Action Timeout:	
N-Create Timeout:	
N-Delete Timeout:	
N-Get Timeout:	

Table E-5 DICOM Print Camera Advanced Configuration

CONFIGURATION

Note: Type the text shown in **boldface**, and press the **ENTER** key on the keyboard.

NEXT STEPS

Resume installation following instructions in Chapter 5: Restore System State (Section 2.3).

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Appendix F
Symbols

SYMBOL	PUBLICATION	DESCRIPTION
	417-5032	Alternating Current
	335-1	Three-phase Alternating Current
	335-1	Three-phase Alternating Current with neutral conductor
		Direct Current
	417-5019	Protective Earth (Ground)
	348	Attention, consult ACCOMPANYING DOCUMENTS
	417-5008	OFF (Power: disconnection from the mains)
	417-5007	ON (Power: connection to the mains)
		Warning, HIGH VOLTAGE
		Emergency Stop
		Type B

Table F-1 Symbols

SYMBOL	PUBLICATION	DESCRIPTION
	417-5339	X-ray Source Assembly Emitting
	417-5009	Standby
		Start
		Table Set
		Abort
		Intercom
		(on Operator Console) Power On: light on Standby: light off

Table F-1 Symbols

www.gehealthcare.com