# InSight
## Mini C-arm Imaging System
## Service Manual

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# Chapter 1
# Introduction

## InSight Major Components

The major components of the Fluoroscan InSight Imaging System are shown below.



**Note:** *Refer to the Addendum for a view of the InSight Imaging system in the 08-series of serial numbers.*

| A | Touch screen monitor | I | Foot switch |
|---|---|---|---|
| B | Keyboard with integrated pointing device | J | Foot switch shelf |
| C | Flex-arm | K | Image printer shelf |
| D | C-arm | L | X-ray ON light |
| E | X-ray source and collimator | M | C-arm retainer strap (located on side of Flex-arm) |
| F | Radiological Imaging Unit | N | Base Cabinet |
| G | Computer On/Standby switch | O | Control Panel |
| H | Floppy disk & DVD RAM recorder | P | USB Port |

# Base Cabinet

The base cabinet is the main structure of the InSight system. The cabinet encloses most of the electrical components and serves as the point of attachment for the C-arm, touch screen monitor, and keyboard. The cabinet is mounted on casters.

# Monitor

The monitor is a grayscale flat panel display with an integrated touch screen function. The monitor displays software screens and live or stored radiological images. The touch screen serves as one method of user interaction with the InSight software for selecting many system functions. An external power supply, located in the base cabinet, provides DC voltage to the monitor.

# Keyboard

The keyboard provides a method of data entry and user interaction with the system software.The keyboard with an integrated pointing device utilizes a PS2 interface to the computer assembly's ATX motherboard.

# Flex Arm

The flex-arm supports the C-arm and is comprised of straight links connected by movable joints that allow the arm to be manually re-positioned as required to facilitate imaging. The arm is neutral balanced and there is a friction lock on the vertical motion that is applied to hold the arm in the desired position.

# C-arm

The C-arm is mounted to the final link in the flex-arm and carries the X-ray Head and the Radiological Imaging Unit (RIU) at opposite ends of the 'C'. The C-arm can be manually rotated about center and the motion is equipped with a friction lock that can be applied to hold the C-arm in the desired position. A strap secures the C-arm to the right side rail when moving the InSight system.

## X-ray Head

The X-ray head is comprised of the control panel, x-ray source, collimator, positional lasers, C-arm I/O board, and the image intensifier's high-voltage power supply.

### Control Panel

The control panel provides buttons to turn the positioning lasers and X-rays on or off. Additional controls allow the user to rotate and print images, toggle noise suppression, and select X-ray power level.

### X-Ray Source

The x-ray source is mounted to one end of the C-arm and is comprised of a high-voltage power supply and an x-ray tube. The high voltage power supply, under the control of the x-ray controller, provides a variable high potential between the anode and cathode of the x-ray tube and variable current to the x-ray tube filament.

### Collimator

The collimator, located at the x-ray source end of the C-arm, defines the size and shape of the x-ray beam The collimator is adjustable to fix the direction of the X-ray cone onto the center of the image intensifier. An attached secondary collimator lets the user select a full (six inch) or reduced (four inch) field of view. The position of the secondary collimator is sensed by two switches.

### Positioning Lasers

The positioning lasers create a cross hair laser that identifies the center of the field of view to the user.

### C-arm I/O board

The C-arm I/O board provides an interface between the X-ray Controller and the control panel, collimator position switches, and positional lasers. It also provides DC voltage to the Radiological Imaging Unit's camera.

### Image Intensifier High-Voltage Power Supply

This power supply provides the high voltages required by the image intensifier.

## Radiological Imaging Unit

The Radiological Imaging Unit (RIU), is mounted to one end of the C-arm and is comprised of an image intensifier, a lens and a video camera. The RIU also includes a high-voltage power supply, located in the X-ray head, that supplies the high voltages required by the image intensifier.

### Image Intensifier

The image intensifier converts x-ray energy into low-level visible light that is focused and amplified to form an image from the x-rays that penetrate the patient and arrive at the image intensifier input. The image intensifier's HVPS is located in the x-ray head.

### Lens

The lens further focuses the image and controls the amount of light entering the camera.

### Video Camera

The video camera mounts to the image intensifier output and records the image produced during fluoroscopy. The image is then transmitted to the host computer where it is formatted for display, processed and optionally stored.

## Footswitch

The footswitch provides controls for X-ray on/off, image save, and image print functions.

# Base Cabinet Components

## Power Distribution Assembly

**Note:** *Refer to the Addendum in this manual for a description of the InSight Imaging system power distribution assembly for 08- series of serial numbers.*

The power distribution assembly is located in the rear bottom of the system cabinet. AC power is provided through an input module, located at the rear of the system cabinet, to the primary of an isolation transformer. Fusing of 10A is provided for nominal input voltage of 100-120 VAC and 6.3A is provided for 220-240 VAC 50/60 Hz.

The secondary of the isolation transformer is hard wired for 120V output. The output is applied through an EFI line filter to an internal outlet strip.

The outlet strip provides AC power to the computer assembly, X-ray controller board, printer outlet, 12VDC monitor power supply, 28VDC X-ray controller power supply, and a AC outlet located on the rear of the system.

# Computer Assembly

The computer assembly is a standard computer box that provides housing for the ATX mainboard, video controller, image processor, audio amplifier, and permanent and removable data storage devices. The CPU chip controls system I/O functions, interfaces with the disk drives, and runs the Windows XP operating system and the InSight application software. The computer assembly has an integrated DC power supply and its own power switch. The power supply is battery backed to allow the system to shut down without loss or corruption of data if the AC line power input is interrupted.

## ATX Mainboard

The ATX mainboard includes the following features: processor, AGP Video Slot, PCI-X Slot, PS/2 port, 2 serial ports, 4 USB ports, 512 MB RAM minimum, onboard serial ATA support, onboard networking, and onboard sound.

## Video Controller Board

The video controller board is the graphics interface between the monitor and the computer. It uses the advanced graphics port (AGP) slot in the computer for fast graphics display.

## Image Processor Board

The image processor board grabs images from the camera at the rate of 30 frames per second. The image processor also performs image processing functions, such as image flip, rotation, edge enhancement, reverse video, dark fluoro, and noise reduction. The board also provides image zoom, area of interest, motion detection, plus brightness and distortion correction.

## Audio Amplifier Board

The audio amplifier board interfaces to a base cabinet speaker.

## Battery Backed Power Supply

The battery backed power supply supplies power to the system in the event of an interruption of AC input power so as to allow the system to shut down without loss of data or corruption of files. The backup supply may also protect against transient high and low line conditions.

## Permanent Data Storage

A permanent data storage device (hard disk drive) allows large amounts of image data to be stored and retained even when power is off.

## Removable Data Storage

Removable data storage devices (floppy disk drive and DVD-RAM drive) allow data to be transferred to removable media so it can be physically transported to another device location. A conveniently located USB port on the front of the system cabinet, provides additional removable data storage for USB compatible storage devices.

# X-ray Controller (XRC)

The X-ray controller board, mounted in the system cabinet, controls X-ray on and off, times X-ray exposure, and generates alarm signals when the X-ray is turned on. The XRC interacts with the InSight application software for automatic dose rate correction, which controls X-ray power levels when in automatic mode. The XRC interacts with the footswitch, control panel, and the battery backed power supply.

# InSight Product Specifications

## X-Ray Specifications

| | |
|---|---|
| Source – Image receptor Distance | 44 cm (17.5") |
| X-ray Source | Grounded anode X-ray tube |
| X-ray tube window | 0.005" (0.127mm) Beryllium |
| Beam Filtration | Stainless Steel with aluminum Equivalence Š2.5mm (0.1") |
| Focal Spot | 0.045 mm (0.0018") |
| Field of View | Operator selectable collimation of 4" or 6" diameter (10.16cm or 15.24 cm) FOV at the plane of the image intensifier |
| Rated peak tube potential | 75 kVp |
| Tube kVp range | 40 to 75 kVp |
| Tube current range | 0.020 to 0.100 mA |

## Weights/Dimensions

**Note:** *Refer to the Addendum in this manual for the InSight Imaging system weight/dimension data for 08- series of serial numbers.*

| | |
|---|---|
| Height | 65 in. (165.1 cm) |
| Width | 35 in. (88.9 cm) |
| Depth | 35in. (88.9 cm) |
| Weight | 500 pounds (227 kg) |

## Space Requirements

**Note:** *Refer to the Addendum in this manual for the InSight Imaging system space requirements data for 08- series of serial numbers.*

| | |
|---|---|
| Required Floor Space: | 5 ft. x 6.6 ft. (1.5 m x 2.0 m) |
| Door Size | 30 in. (88.9 cm) minimum |
| Ground Clearance: | 3.875 in. (9.8 cm) minimum |
| Floor Capacity | 151.1 lb/ft$^2$ (737.2 kg/m$^2$) |

# Temperature/Humidity

| | |
|---|---|
| Storage Temperature Range | -20° to +50° C (-4° to +122° F) |
| Ambient Operating Temperature Range | +15.5° to +32° C (+60° to +90° F) |
| Ambient Pressure Range | 500-1060 hPa (375 – 795 mmHg) |
| Ambient Operating Humidity Range | 20 – 80% non-condensing |
| Ambient Storage and Transportation Humidity Range | 20 – 85% non-condensing |

# Power Requirements

| | |
|---|---|
| Voltage | Nominal 100/120/220/240 volts |
| Wattage | 750 watts |
| Frequency | Nominal 50/60 Hz |

# Equipment Classification

InSight is classified* as follows:

| | |
|---|---|
| Type of protection against electric shock | CLASS 1 |
| Degree of protection against electric shock | TYPE B |
| Laser per IEC-60825-1 | CLASS 1 |
| Degree of protection against harmful ingress of water | IPXO |
| Mode of operation | Continuous Operation |

InSight is also classified* as: Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.

* Medical Electrical Equipment - UL 60601-1

# Periodic Maintenance

Refer to Chapter 5 for periodic maintenance procedures.

## Cleaning

Exterior surfaces of the InSight should be cleaned once a week and anytime after a surface has become soiled. Clean exterior surfaces of the Console, Flex-arm and C-arm with a soft cloth or disposable lint-free tissue moistened with water, isopropanol or methanol. Wipe surfaces, do not scrub.

# Chapter 2
# Functional Description

This chapter provides a functional description of the InSight Imaging System.

An overall InSight System Block Diagram (BD-00015) is provided in Appendix F.

Refer to the InSight Interconnect Diagram (ID-00041) in Appendix F of this manual, for detailed interconnections between system components

# Main Power Distribution

The Main Power Distribution provides the AC voltages required by the InSight system. The distribution consists of a power input module, power distribution chassis, and an internal power strip.

## Power Input Module

The Power Input Module has an input AC power range of 100V, 120V or 220V, 240V 50/60 Hz which is fused for the appropriate voltage/current ratings.Fusing of 10A is provided for nominal input voltage of 100-120 VAC and 6.3A is provided for 220-240 VAC 50/60 Hz. The module is configurable to select the voltage applied to the Power Distribution Chassis. The selectable AC power is applied to an isolation transformer located in the Power Distribution Chassis.

## Power Distribution Chassis

**Note:** *Refer to the Addendum in this manual for a description of the InSight Imaging system power distribution chassis for 08- series of serial numbers.*

The Power Distribution Chassis, located in the bottom rear of the system cabinet, consists of an isolation transformer and line filter.

The output of the Power Input Module is fed to the isolation transformer, which always provides a nominal 120V on its secondary. The secondary output of the transformer is fed through the line filter and applied to the cabinet's internal power strip.
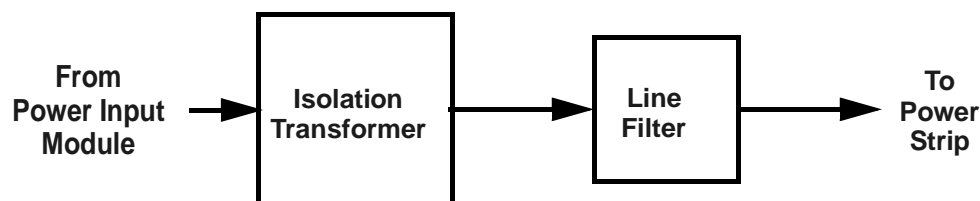
## Power Strip

The power strip applies 120 VAC to the ATX power supply, a 12VDC power supply that provides power to the flat panel display unit, printer power outlet, a 28VDC power supply that provides power to the X-ray controller, and an auxiliary AC outlet on the rear of the base cabinet.

# ATX Power Supply

With the exception of the 28 VDC power supply which supplies DC power to the X-ray Controller board, the ATX power supply, contained in the computer chassis, provides DC operating voltage levels required by the InSight system.

The ATX power supply is battery backed to provide power to the system in the event of an interruption of AC input power so as to allow the system to shut down without loss of data or corruption of files.

The supply receives 120 VAC from the Power Distribution Chassis via the cabinet's internal power strip. It outputs +5VDC, + 12VDC, -12VDC, and +3.3VDC as required to the ATX Main board, hard drive, floppy disk drive, DVD drive, X-ray controller board, and cabinet fan.

The supply receives a power on/off signal from the ATX Main board and a shut down signal from the X-ray Controller board. It also sends a power OK signal to the ATX Main board and an AC power fail and low battery signal to the X-ray Controller board.
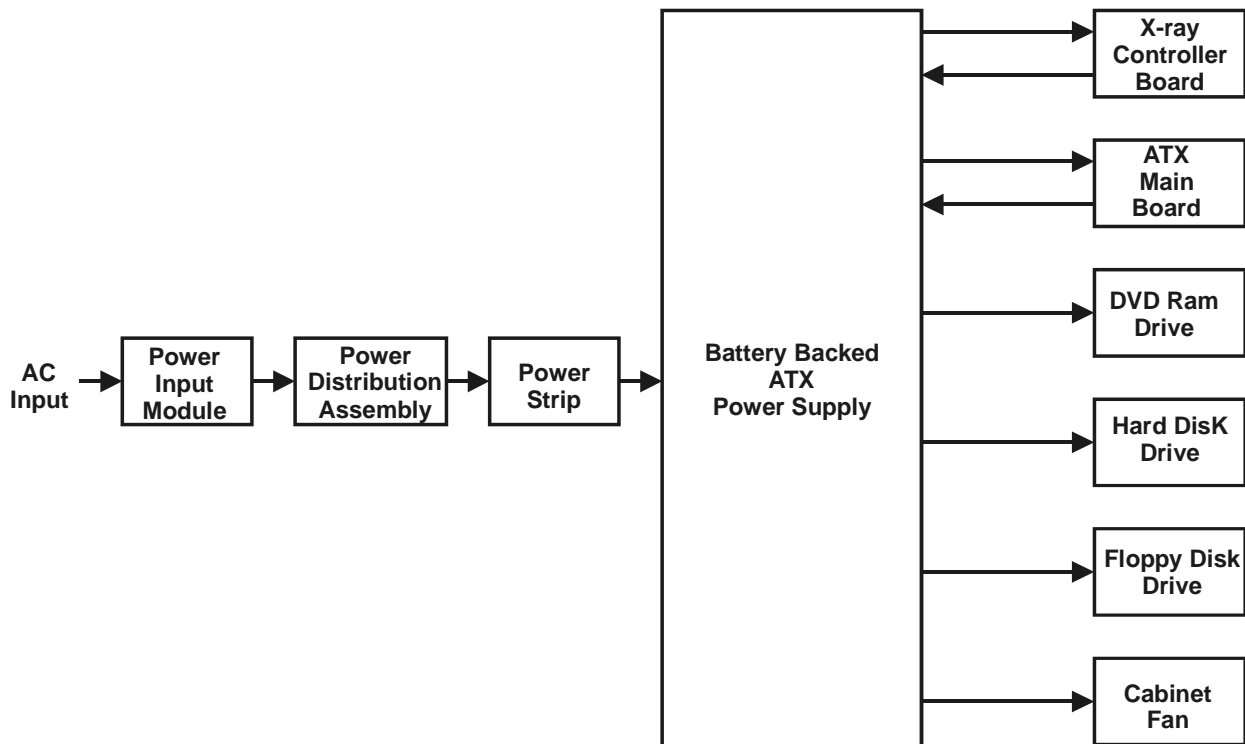
# X-ray Controller (XRC)

The X-ray Controller controls an integrated X-ray source as a component of a mini C-arm diagnostic X-ray system. The board functions under the control of a host computer, communicating with the host over an RS232 serial connection. The X-ray Controller board also provides interfacing to controls and indicators, an X-ray image intensifier, and a battery-backed power supply.

**Figure 2-1** X-ray Controller Board and Associated Components
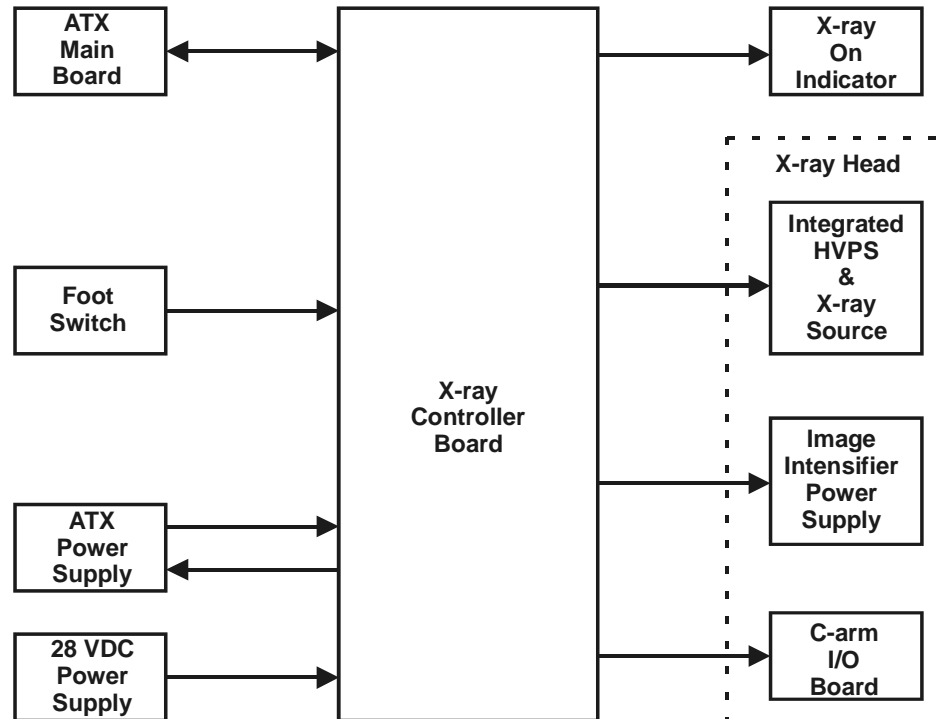


## Source Power

The board receives + 28VDC from the 28V power supply located on the power distribution unit and + 5VDC and +12VDC from the battery-backed ATX power supply located in the computer chassis.

## Footswitch Interface

Input signals to signal the XRC to initiate image acquisition, print image, and save image.

## X-ray On Indicator Interface

Interface to light the X-ray On lamp when x-rays are enabled.

## Integrated X-ray Source Interface

Outputs +28VDC source power, two analog signals to set the desired power level of the X-rays, and two digital to enable or disable X-ray generation.

Inputs two analog input signals to report the actual power level out and three digital signals to report certain detectable internal fault conditions.

## ATX Main Board Interface

An RS232 serial communications link.

## ATX Power Supply Interface

In addition to receiving + 5VDC and +12VDC from the battery-backed ATX power supply this interface receives a power on/off signal from the ATX Main board and sends a power OK signal to the ATX Main board.

## Image Intensifier Power Supply Interface

Outputs +24VDC source power and a digital signal to select the 4 inch or 6 inch image intensifier mode.

## C-arm I/O Board Interface

Outputs +28VDC and +12VDC source power.

A bi-directional serial communications link allows the XRC to read the status of switches on the control panel and the collimator position switches and to set the control panel switches backlighting to On or Off.

Inputs an interrupt signal when any control panel switch except X-ray and Laser is activated and de-activated.

Inputs an X-ray On signal when the X-ray switch is quickly pressed, released, and pressed again and held down.

# Integrated X-ray Source

The integrated x-ray source contains an x-ray tube, high-voltage power supply, filament current controller and electronic control circuitry that enables it to generate x-rays under control of an external system. Varying the level of the high-voltage potential (kV) across the x-ray tube and the tube filament current (mA), controls the energy and the flux density, respectively, of the x-rays produced.   The external system enables or disables x-ray generation and sets the desired kV and mA levels through the source interface connector.

The X-ray Controller signals the X-ray source to set the desired power level of the X-rays and to enable or disable X-ray generation. The X-ray source signals the X-ray Controller to report the actual power level out and certain detectable internal fault conditions.

## Source Power

The integrated X-ray source receives +28VDC from the XRC board.

## XRC Interface

Two analog inputs signal the X-ray source to set the desired power level of the X-rays and two digital signals enable or disable X-ray generation.

Two analog output signals report the actual power level out and three digital signals report certain detectable internal fault conditions.

```
┌──────────────┐      ┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│   X-ray      │◄────►│  Integrated  │─────►│  Collimator  │─────►│    Image     │
│  Controller  │      │    HVPS      │      │              │      │ Intensifier  │
│   Board      │      │     &        │      └──────────────┘      └──────────────┘
│              │      │   X-ray      │
│              │      │   Source     │
└──────────────┘      └──────────────┘
```
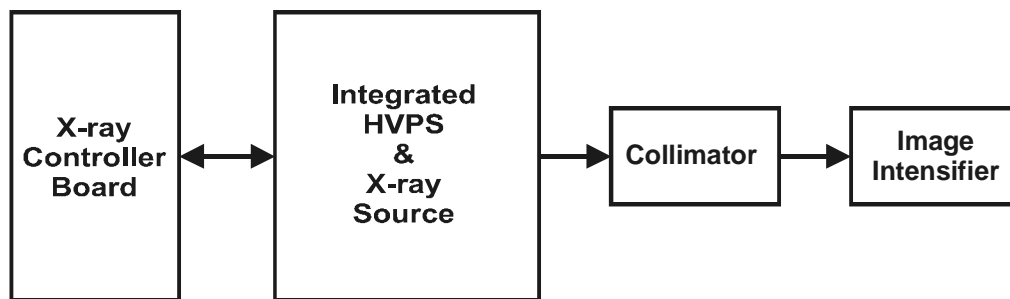
# Radiological Imaging Unit

The radiological imaging unit (RIU) contains the components necessary to convert X-rays into digital images: an image intensifier, a lens, and a CCD camera. The image intensifier converts X-rays not absorbed by the object of interest into low-level visible light that is focused and amplified to form an image. The lens further focuses the image and controls the amount of light entering the camera. The camera converts the amplified light image into a 12 bit digital signal that is applied to the image processor board located on the ATX main board. The RIU includes a high voltage power supply located in the X-ray head that supplies the high voltages required by the image intensifier.

## Radiological Imaging Unit

```
X-ray                    Image
Controller               Intensifier        Image
(XRC)          ───►      High Voltage  ───► Intensifier
Board                    Power Supply

               C-arm                                      ATX Main Board
          ───► I/O    ──────────────────► CCD        ───► Image
               Board                      Camera           Processor
                                                           Board
```
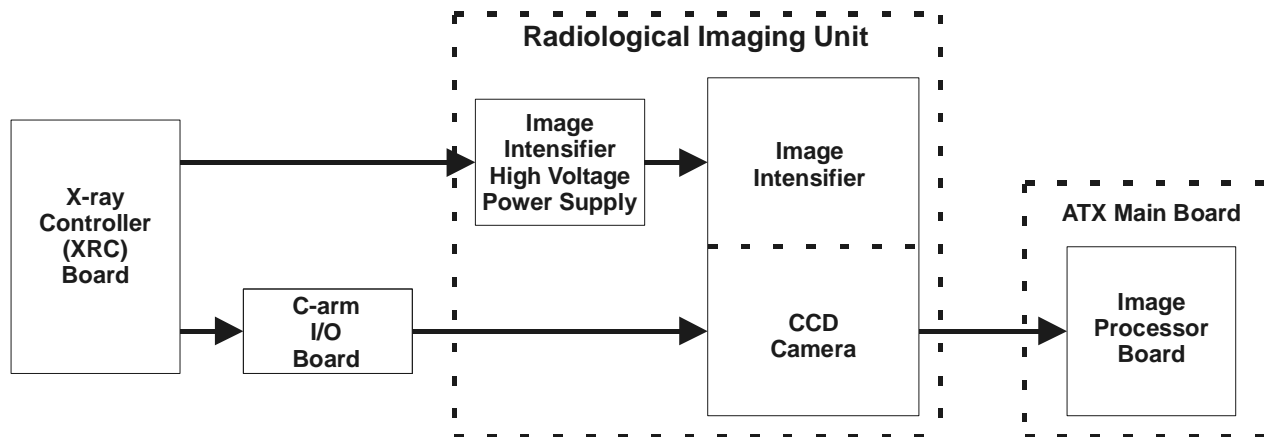
## Source Power

The image intensifier power supply is powered by 24VDC supplied by the XRC. The camera is powered by 24VDC supplied by the C-arm I/O board.

# C-arm Input/Output Board

The C-arm I/O board provides the interface between the x-ray controller (XRC) board and the contr[...] panel and collimator position switches. It also provides control of the positional lasers and regulate[...] DC power for the CCD camera.

The C-arm I/O board communicates with the x-ray controller board through a bi-directional serial communication link and discrete signal lines.

## Source Power

The board receives +12VDC and +28VDC from the XRC board. The 12VDC provides the power f[...] the board logic and I/O functions. The 28VDC is applied to a DC-DC converter which supplies regulated 24VDC to the CCD camera.

## Power Output

The 28VDC input is applied to a DC-DC converter which supplies regulated 24VDC to the CCD camera.
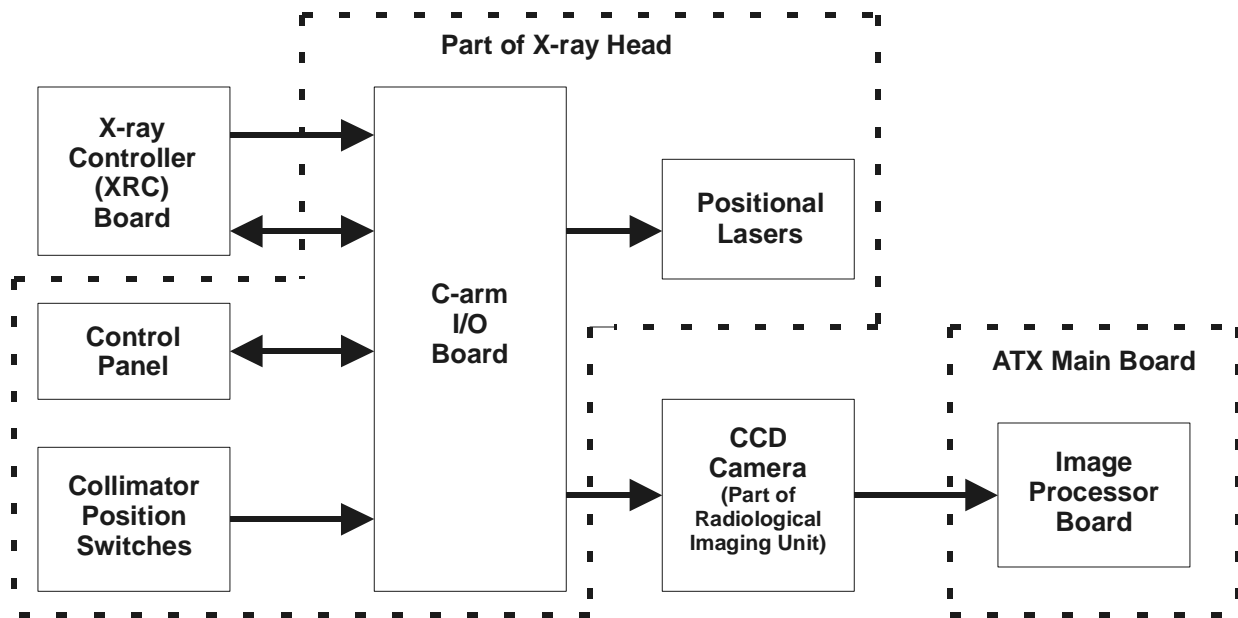


## XRC Interface

A bi-directional serial communications link allows the XRC to read the status of switches on the control panel and the collimator position switches and to set the control panel switches backlightin[...] to On or Off.

An individual interrupt signal is sent to the XRC when any control panel switch except X-ray and Laser is activated and de-activated.

An individual X-ray On signal is applied to the XRC when the X-ray switch is quickly pressed, released and pressed again and held down.

## Control Panel Interface

Provides inputs from each control panel switch and backlighting outputs to the switches.

## Positional Lasers Interface

Provides outputs to turn the lasers on. A timer on the board turns the lasers off after a predetermined time if the lasers are not turned off.

# Monitor

The monitor receives DC power from the monitor power supply located in the bottom of the system cabinet. The monitor receives display data from the video controller board contained in the computer chassis. The touch screen outputs user interaction to a USB port on the computer assembly's ATX motherboard.
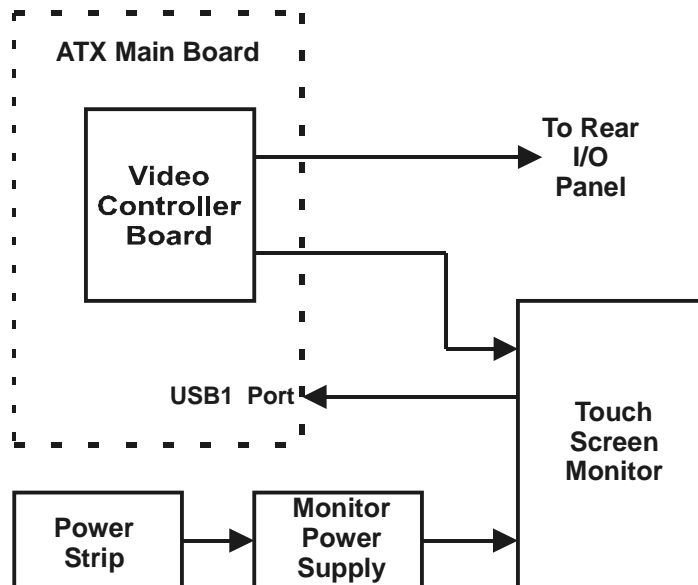


# Keyboard and Pointing Device

The keyboard receives DC power from and outputs user interaction to the PS2 port on the computer chassis ATX mainboard.

# Chapter 3
# Remove and Replace Procedures

This chapter provides a list of InSight Imaging System Field Replaceable Units (FRUs), their locations, and procedures for removing and replacing them on the system.

## Locations of Field Replaceable Units (FRUs)

### System Cabinet

The system cabinet contains the computer chassis, monitor DC power supply, internal power strip, X-ray Controller, 28V power supply, power input module, isolation transformer, line filter, and speaker. The computer chassis contains the system disk drives, computer motherboard, Video Controller board, Image Processor board, and Audio Amplifier board.

**Figure 3-1** System Cabinet, Front View



Speaker

Image Printer

Power Input Module

Hard Disc Drive (Behind chassis panel)

Monitor Power Supply

DVD RAM Drive

Floppy Disc Drive

X-ray Controller and 28V Power Supply

Power Strip

Foot Switch
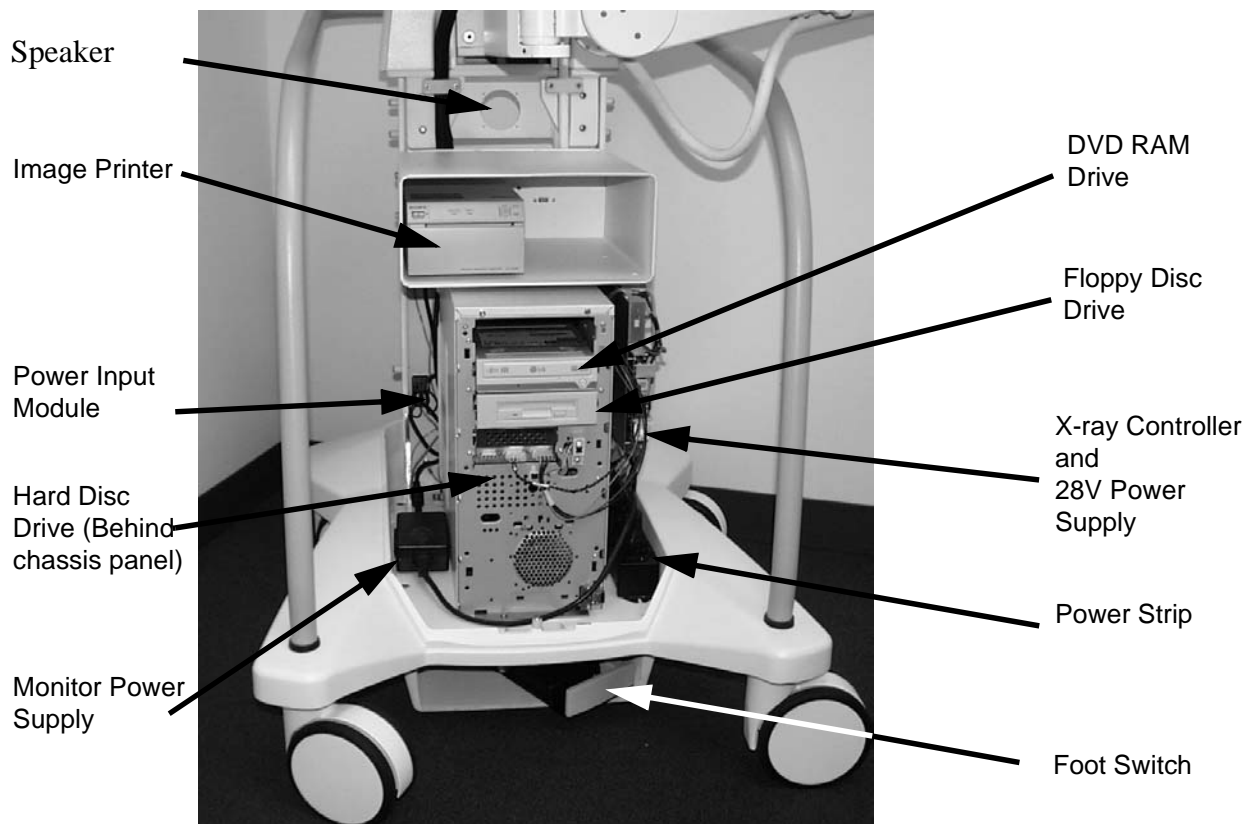
The power input module and isolation transformer and line filter assembly are located on the rear of the unit.

**Figure 3-2** System Cabinet, Rear View



Power Input Module

Isolation Transformer
and Line Filter Assembly
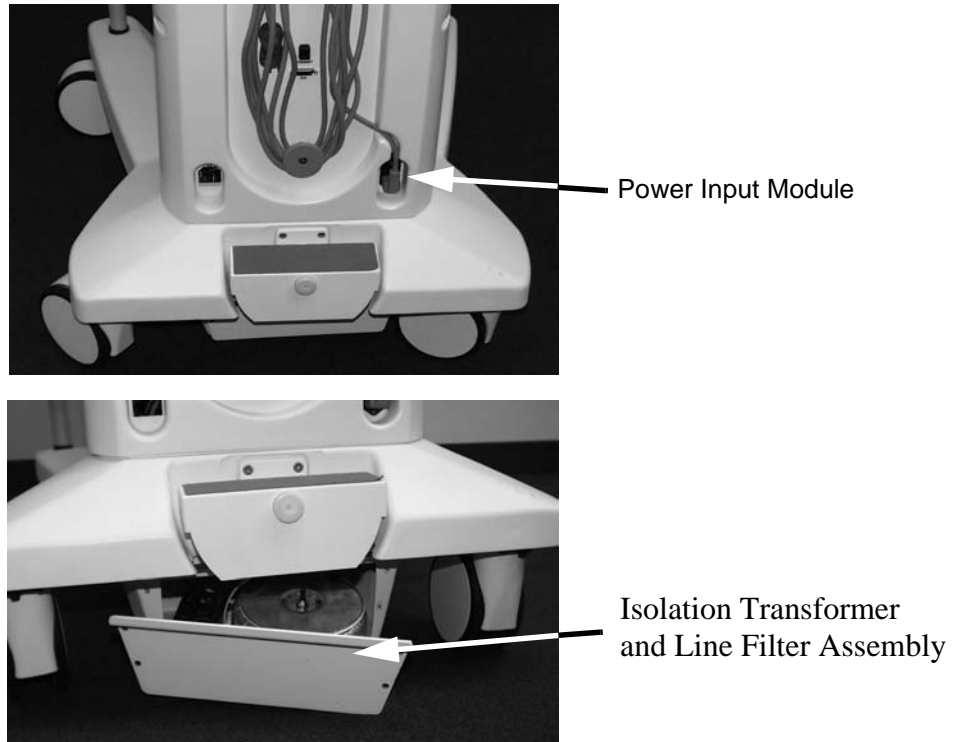
**Figure 3-3** Computer Chassis, PCBs



Computer
Motherboard

Video Display
Board

Audio Amplifier Board

Image Processor
Board
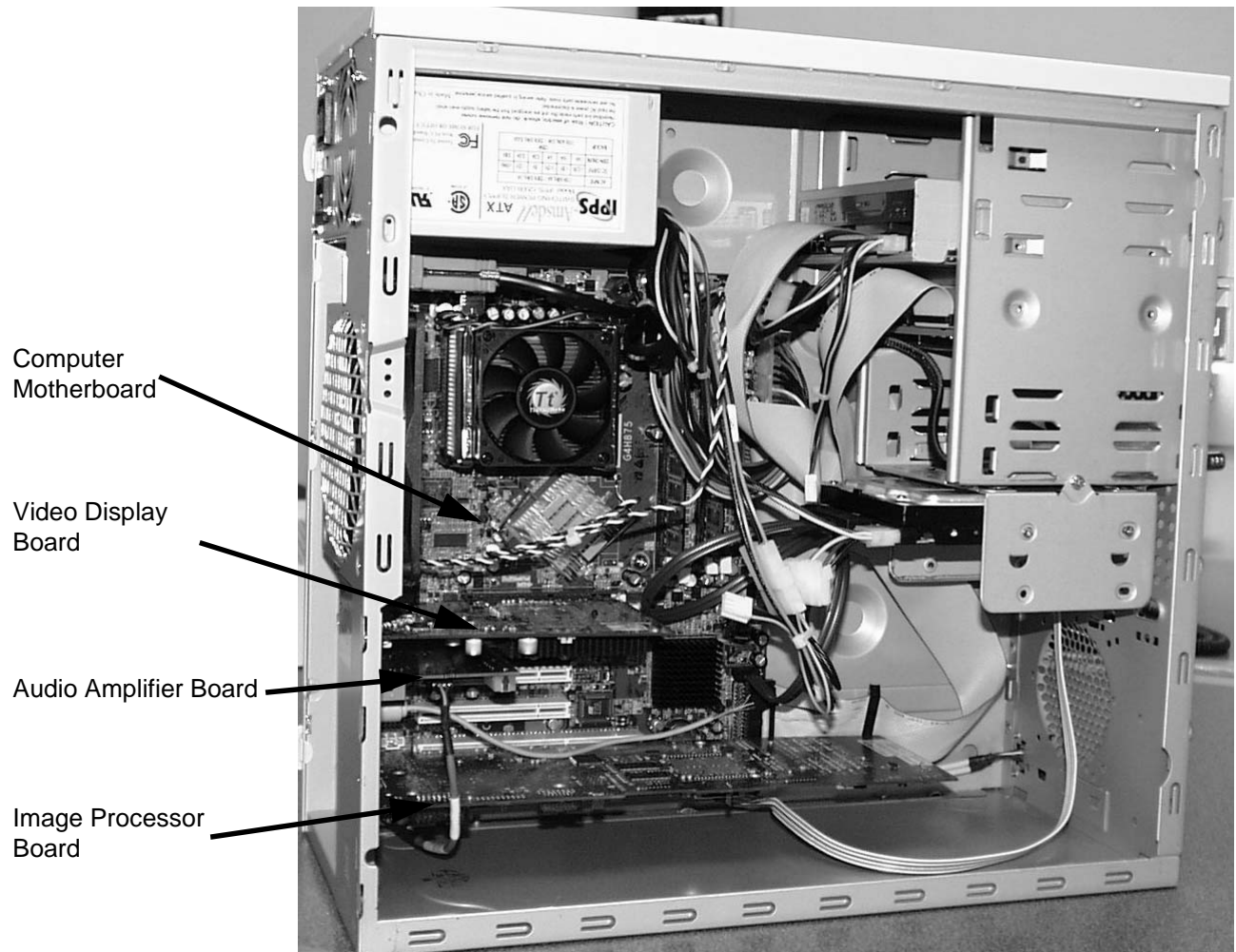
**Figure 3-4** Computer Chassis, System Drives



DVD RAM Drive

Floppy Disk Drive

Hard Disk Drive
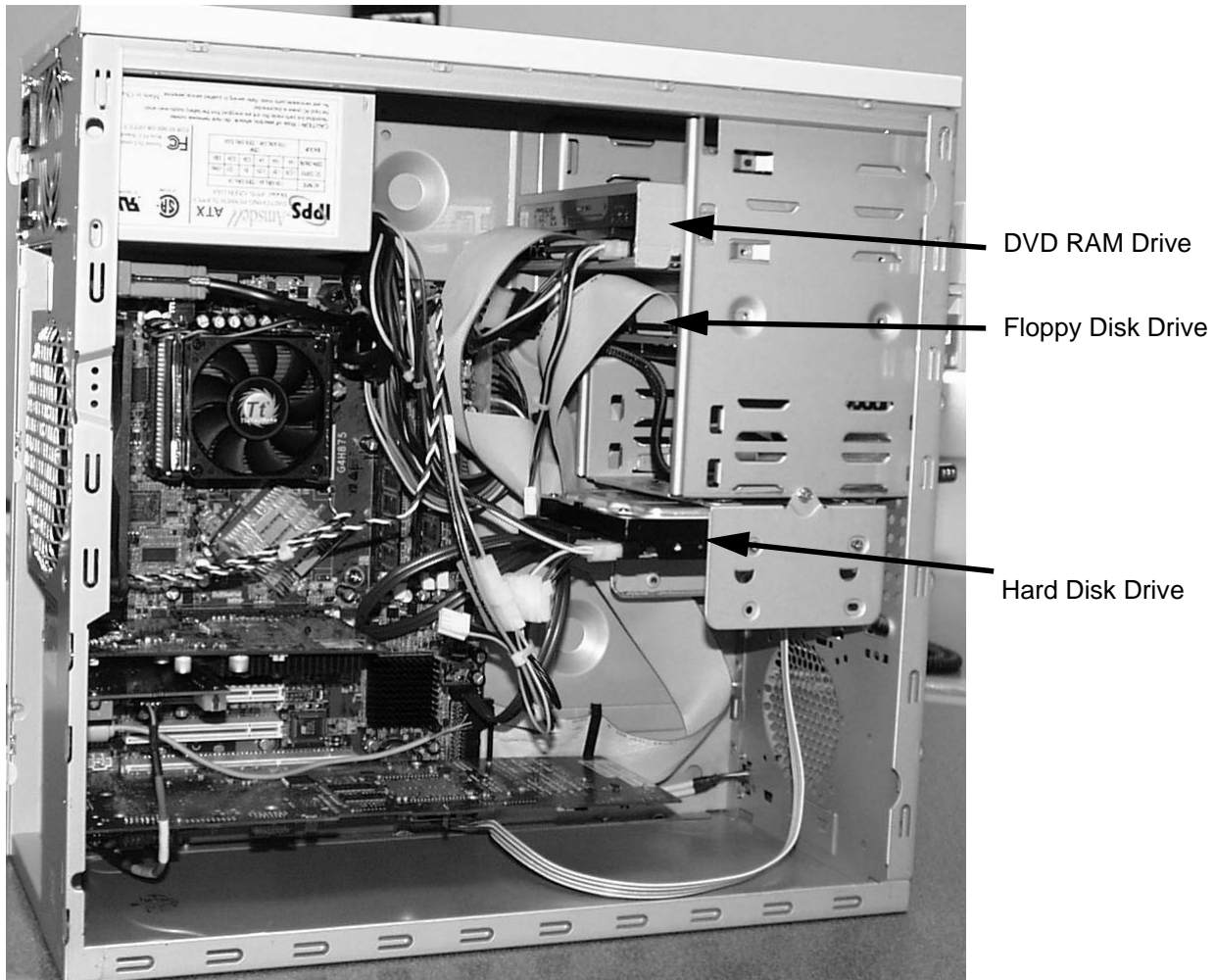
**Figure 3-5** X-ray Controller (XRC) and 28V Power Supply Boards
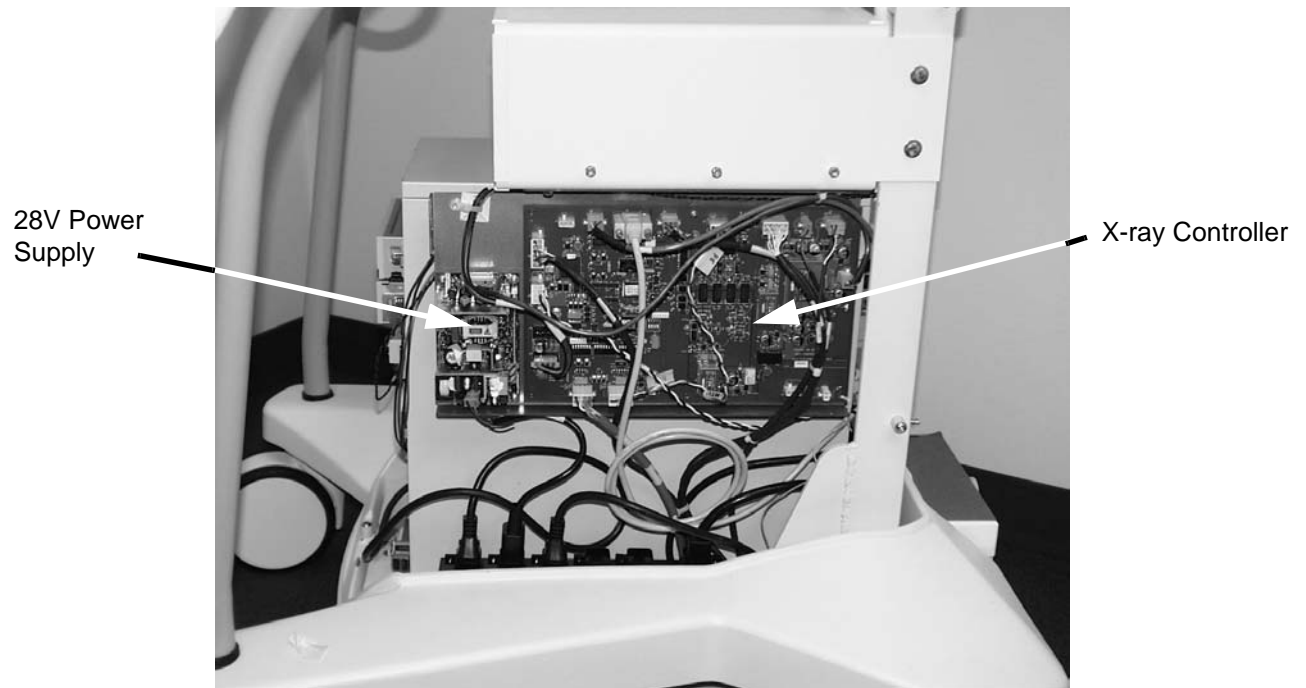
28V Power
Supply

X-ray Controller

# C-arm Assembly

The C-arm assembly contains the Articulation Unit, X-ray Head, and Image Intensifier with CCD camera.



X-ray Head

Articulation Assembly

Radiological Imaging Unit (RIU)

## X-ray Head

The X-ray Head contains the Control Panel, C-arm I/O board, High Voltage Power Supply (HVPS) and X-ray Source assembly, Image Intensifier Power Supply, Collimator, and Positioning Lasers (attached to the Collimator).



C-arm I/O Board

Image Intensifier HVPS

Control Panel

HVPS and X-ray Source

Collimator

## Radiological Imaging Unit (RIU)
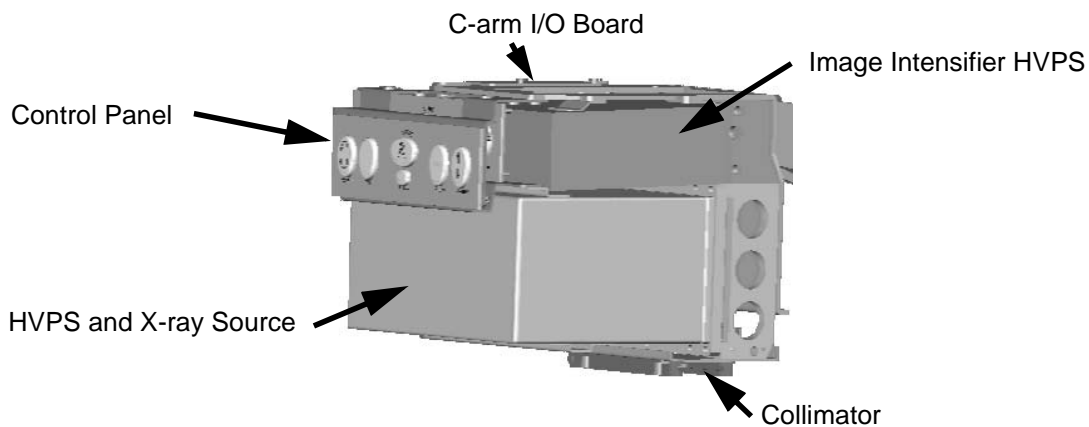
The RIU includes the Image Intensifier, CCD Camera, and the Image Intensifier Power Supply (located in the X-ray Head).



Image Intensifier

CCD Camera
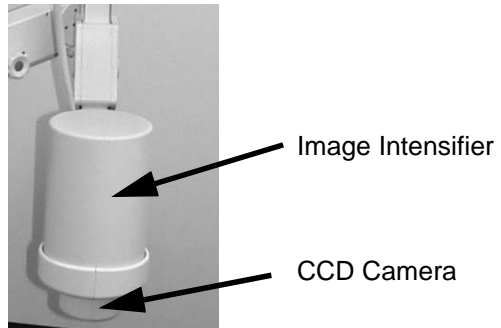
# FRU Procedures

Before removing/replacing FRUs, always shut down system software first, turn power off using the front power switch, and unplug the power cable from the power input module. Just turning off the power switch does not remove all the power to the instrument.

Whenever possible, always orient the C-arm so if you drop a screw, it falls to the floor and not into the HVPS or other component.

When removing a component, always lock the C-arm in place using the joint knob and the C-arm lever lock to prevent sudden movement from an unbalanced C-arm.

Whenever any cover is removed from the instrument, the person performing the FRU removal/replacement procedure must wear a grounding wrist strap.

**ESD Precautions:** To prevent damage due to ESD (Electrostatic Discharge), you must take precautions when handling components. Remove any charges from your body by wearing an approved and properly grounded wrist strap. Keep PCBs and any assemblies containing PCBs in their ESD protective bag until you are ready to install them. Treat defective PCBs as new to prevent any additional damage.

## System Cabinet Covers Removal/Replacement

Covers must be removed in the following order:

1. Rear cover
2. Front cover

## Rear Cover Removal/Replacement

Disconnect main power cable from the Power Input Module.

Remove two screws securing rear cover to front cover.

Pull the cover back, tilt down, and disconnect the internal network and DVI cables from the rear of the computer chassis.
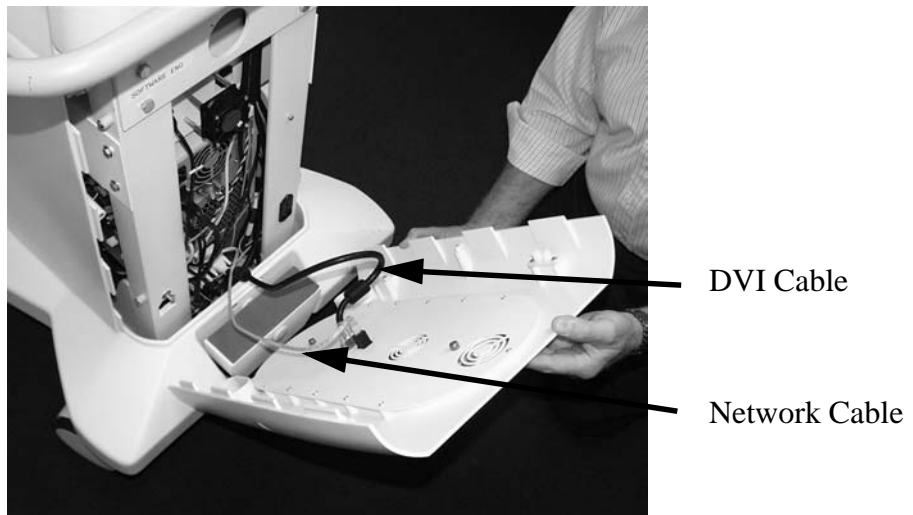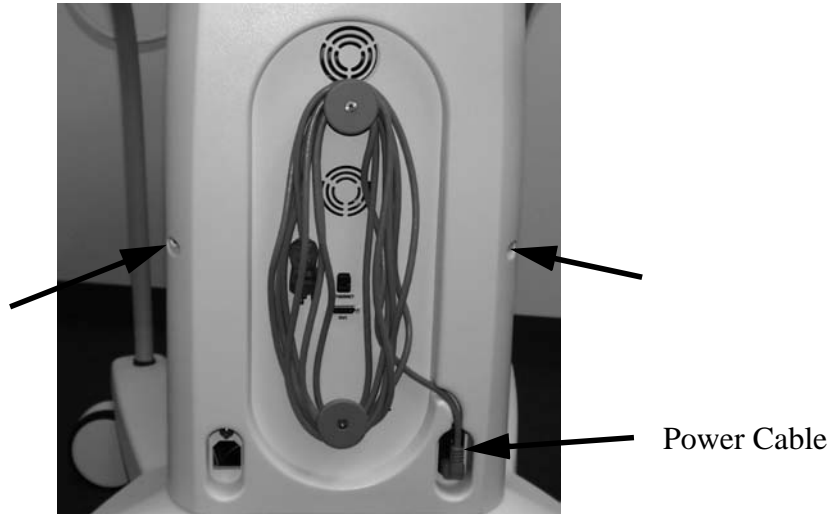
Power Cable

DVI Cable

Network Cable

# Front Cover Removal/Replacement

Remove System Cabinet rear cover (see "Rear Cover Removal/Replacement" on  page 3-9).

Pull the cover back enough to reach in and disconnect the power switch and USB cables.
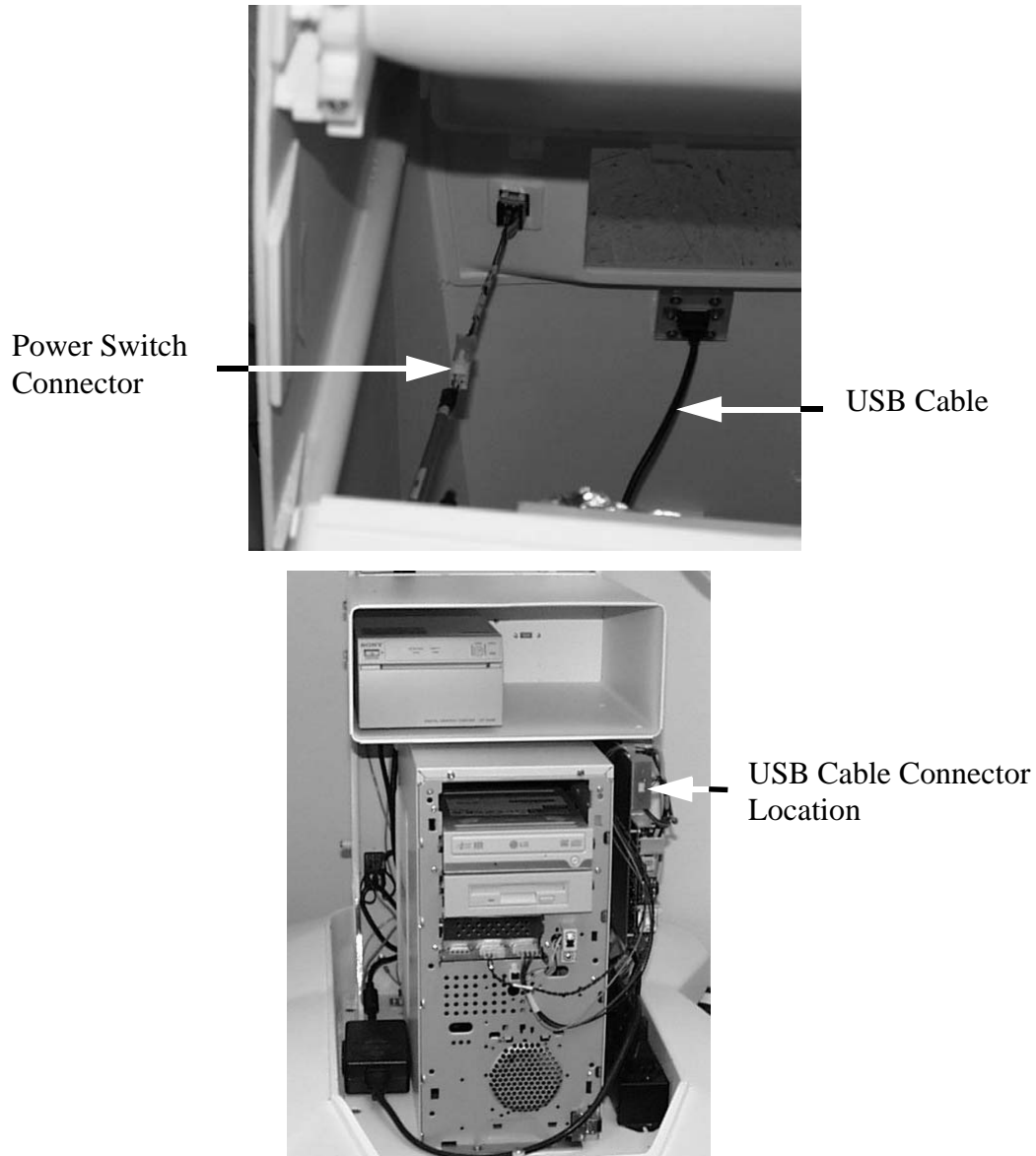


Power Switch
Connector

USB Cable



USB Cable Connector
Location

# Computer Chassis Removal/Replacement

Remove System Cabinet rear and front covers (see "System Cabinet Covers Removal/Replacement" on page 3-8).

Remove computer chassis retaining plate and screws.

Remove System Cabinet front cover guide post.

Disconnect X-ray Controller and cabinet fan power cables.

Lift front of computer chassis slightly and pull the chassis forward enough to access connectors located on the rear of the computer chassis.



X-ray Controller Power Cable

Cabinet Fan Power Cable

Retaining Plate and Screws

Front Cover Guide Post
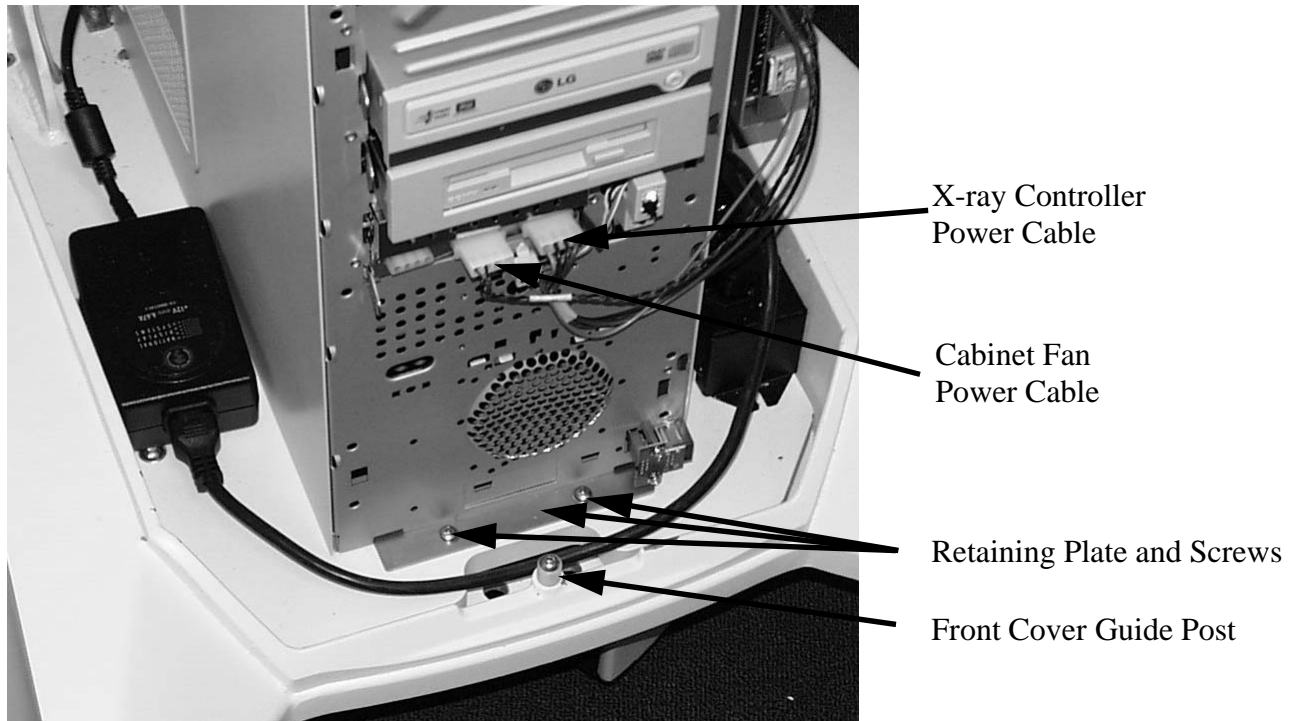
Remove the AC input, pointing device, keyboard, serial, USB (3), XRC Controller, Video Controller, Image Processor, speaker, and computer On/Off switch cable connectors.
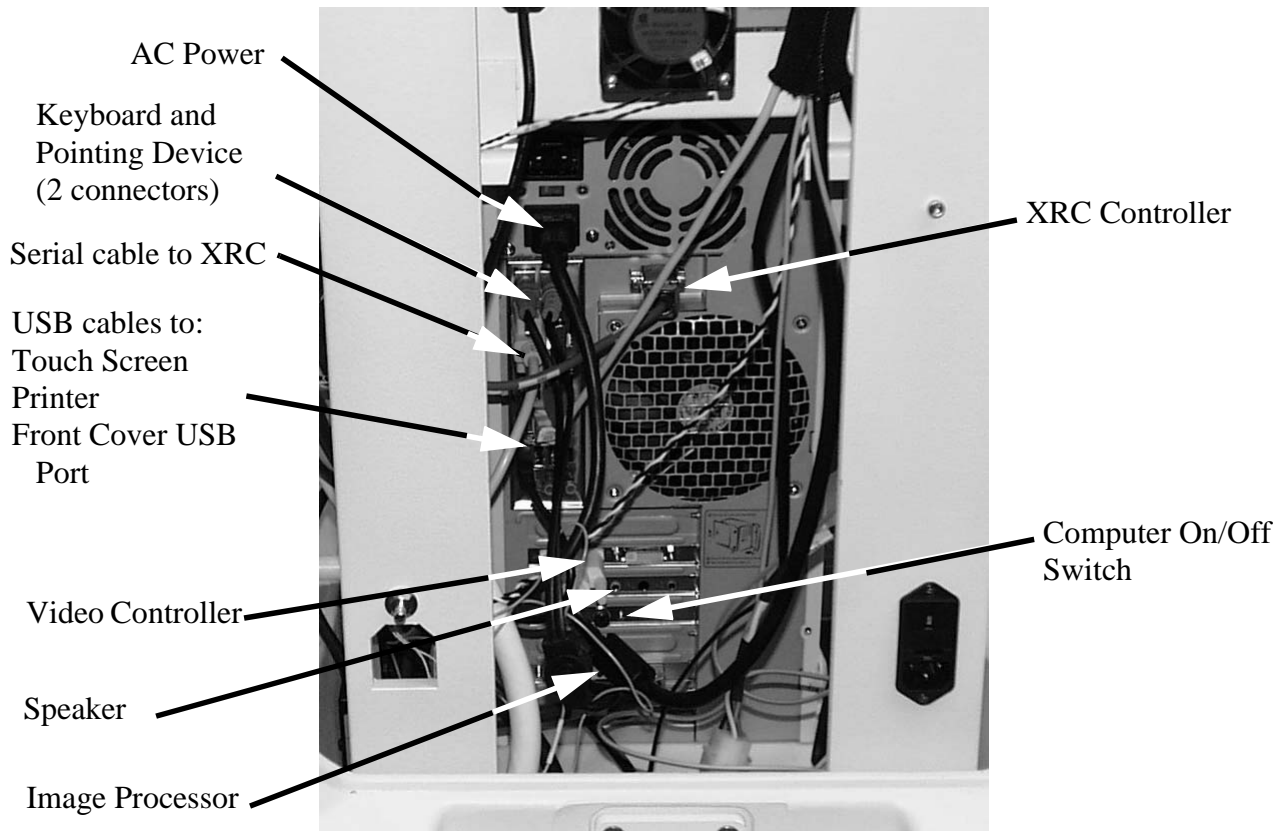


Pull the computer chassis out of the system cabinet.

## Computer Chassis Cover Removal/Replacement

Lift the two cover latches.

Slide the cover slightly toward the back and lift it from the chassis.
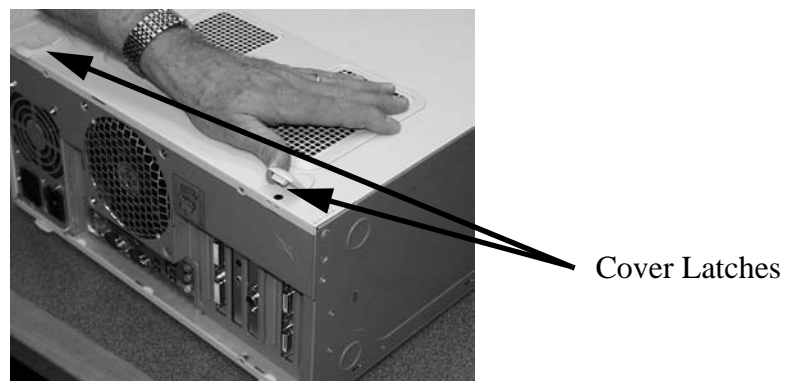
# Video Controller Board Removal/Replacement

Remove system cabinet rear and front covers (see "System Cabinet Covers Removal/Replacement" on page 3-8).

Remove the computer chassis from the cabinet (see "Computer Chassis Removal/Replacement" on page 3-11).

Remove the computer chassis cover (see "Computer Chassis Cover Removal/Replacement" on page 3-12).

Remove the retaining screw securing the controller board to the computer chassis.

Remove the board.

# Image Processor Board Removal/Replacement

Remove system cabinet rear and front covers (see "System Cabinet Covers Removal/Replacement" on page 3-8).

Remove the computer chassis from the cabinet (see "Computer Chassis Removal/Replacement" on page 3-11).

Remove the computer chassis cover (see "Computer Chassis Cover Removal/Replacement" on page 3-12).

Remove the retaining screw securing the controller board to the computer chassis.

Remove the board.

**After replacing the board perform the following:**

"Image Board Calibration (Unwarp/ Flat Field)" on page 4-9.
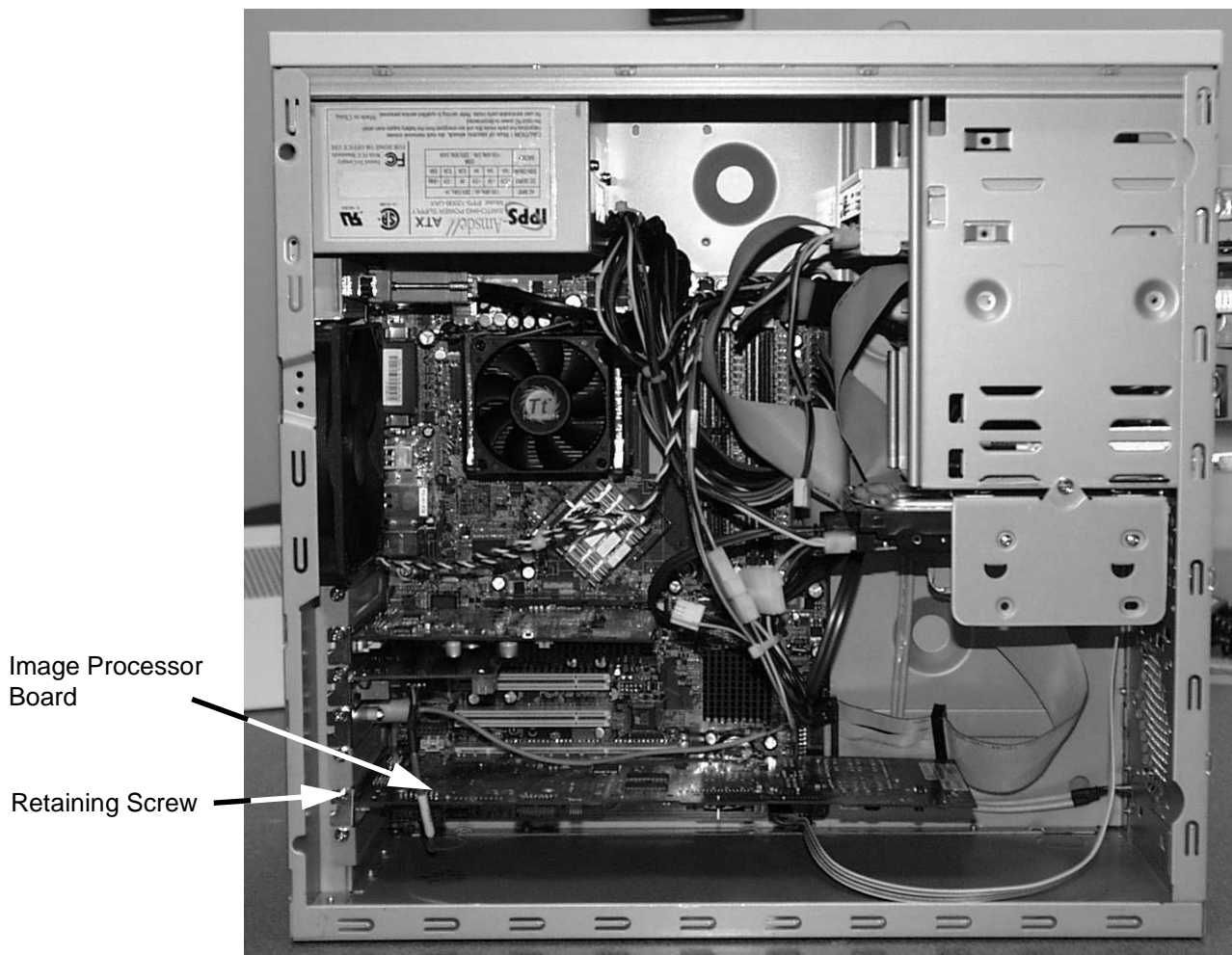
Image Processor Board

Retaining Screw

# Audio Amplifier Board Removal/Replacement

Remove system cabinet rear and front covers (see "System Cabinet Covers Removal/Replacement" on  page 3-8).

Remove the computer chassis from the cabinet (see "Computer Chassis Removal/Replacement" on page 3-11).

Remove the computer chassis cover (see "Computer Chassis Cover Removal/Replacement" on  page 3-12).

Disconnect the internal speaker cable from the Audio Amplifier board.

Remove the retaining screw securing the amplifier board to the computer chassis.
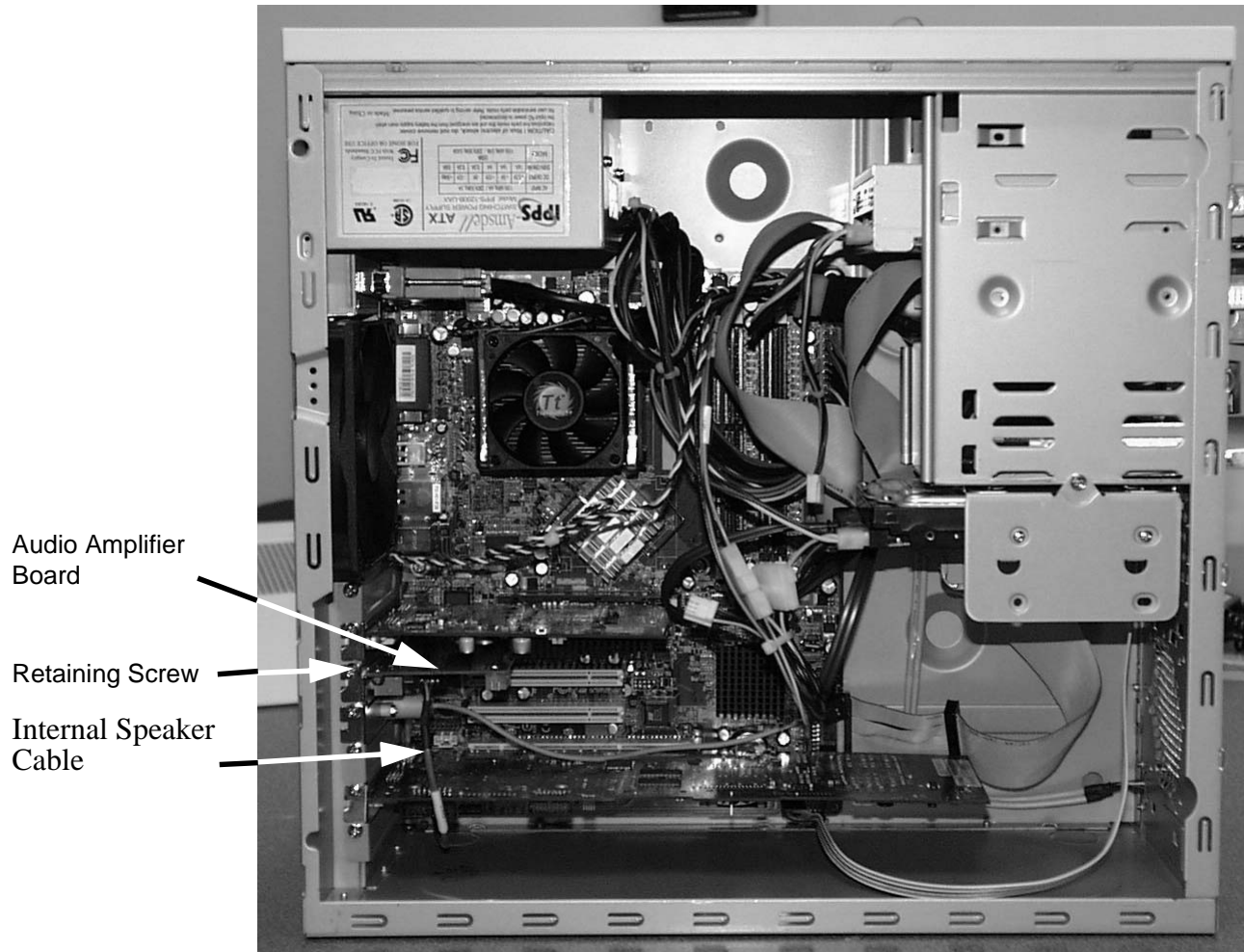
Remove the board.



Audio Amplifier Board

Retaining Screw

Internal Speaker Cable

# System Disk Drives Removal/Replacement

Remove system cabinet rear and front covers (see "System Cabinet Covers Removal/Replacement" on page 3-8).

Remove the computer chassis from the cabinet (see "Computer Chassis Removal/Replacement" on page 3-11).

Remove the computer chassis cover (see "Computer Chassis Cover Removal/Replacement" on page 3-12).

## Hard Disk Drive Removal/Replacement

Disconnect the hard drive power and interface cables.

Remove the Hard Drive Support Assembly retaining screw while holding onto the assembly.

Pull the Hard Drive Support Assembly outwards and slide the entire assembly out.

Remove the four screws securing the hard drive to the Hard Drive Support Assembly.

Remove the drive from the Hard Drive Support Assembly.



Hard Drive Support Assembly Retaining Screw

Hard Drive Retaining Screws (4 - 2 front, 2 back)

Hard Drive Support Assembly

Hard Drive Power Cable

Hard Drive Interface Cable
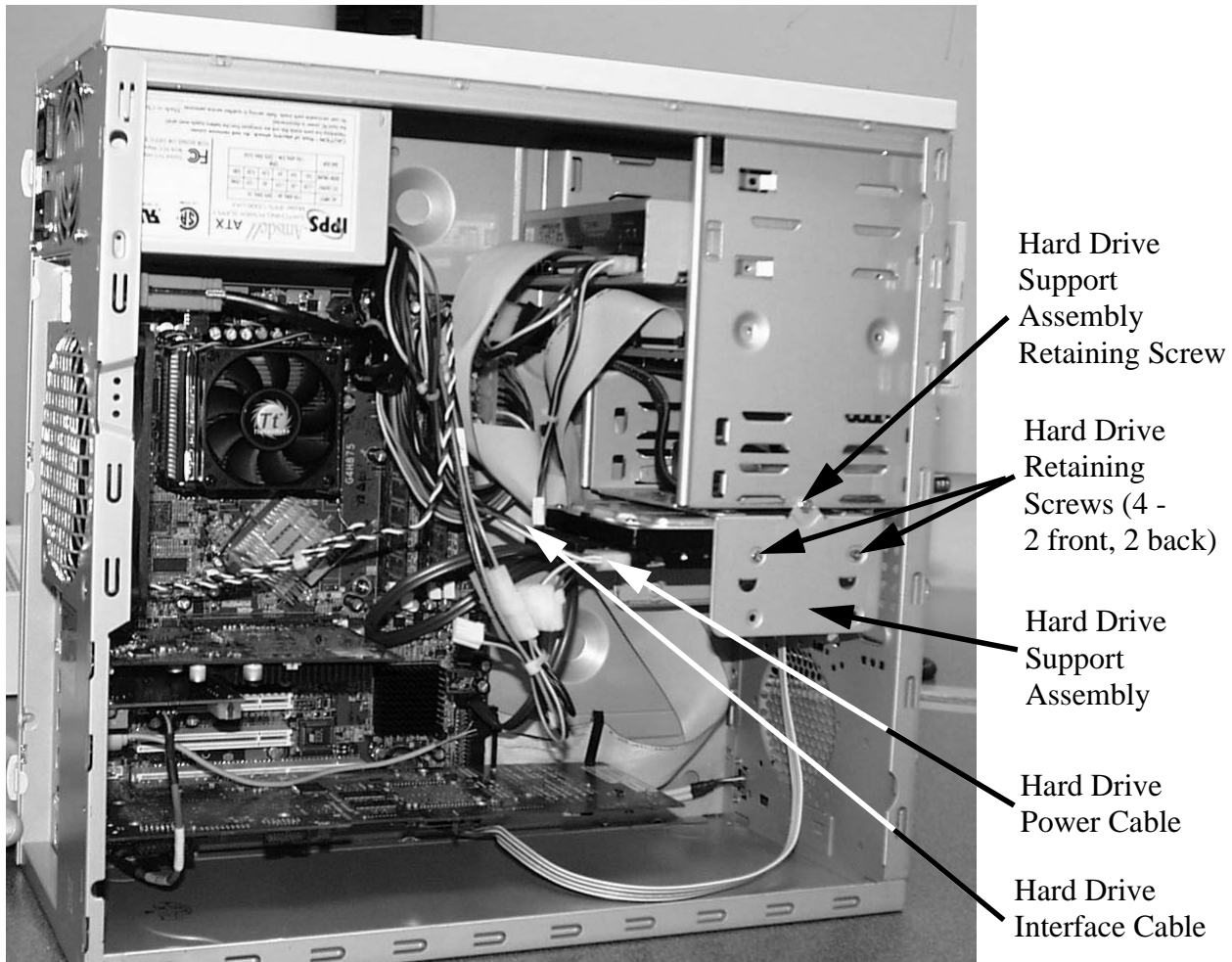
## Floppy Disk and DVD RAM Removal/Replacement

Disconnect the drive's power and interface cables.



DVD RAM
Drive Interface
Cable

DVD RAM
Drive Power
Cable

Floppy Drive
Interface Cable

Floppy Drive
Power Cable
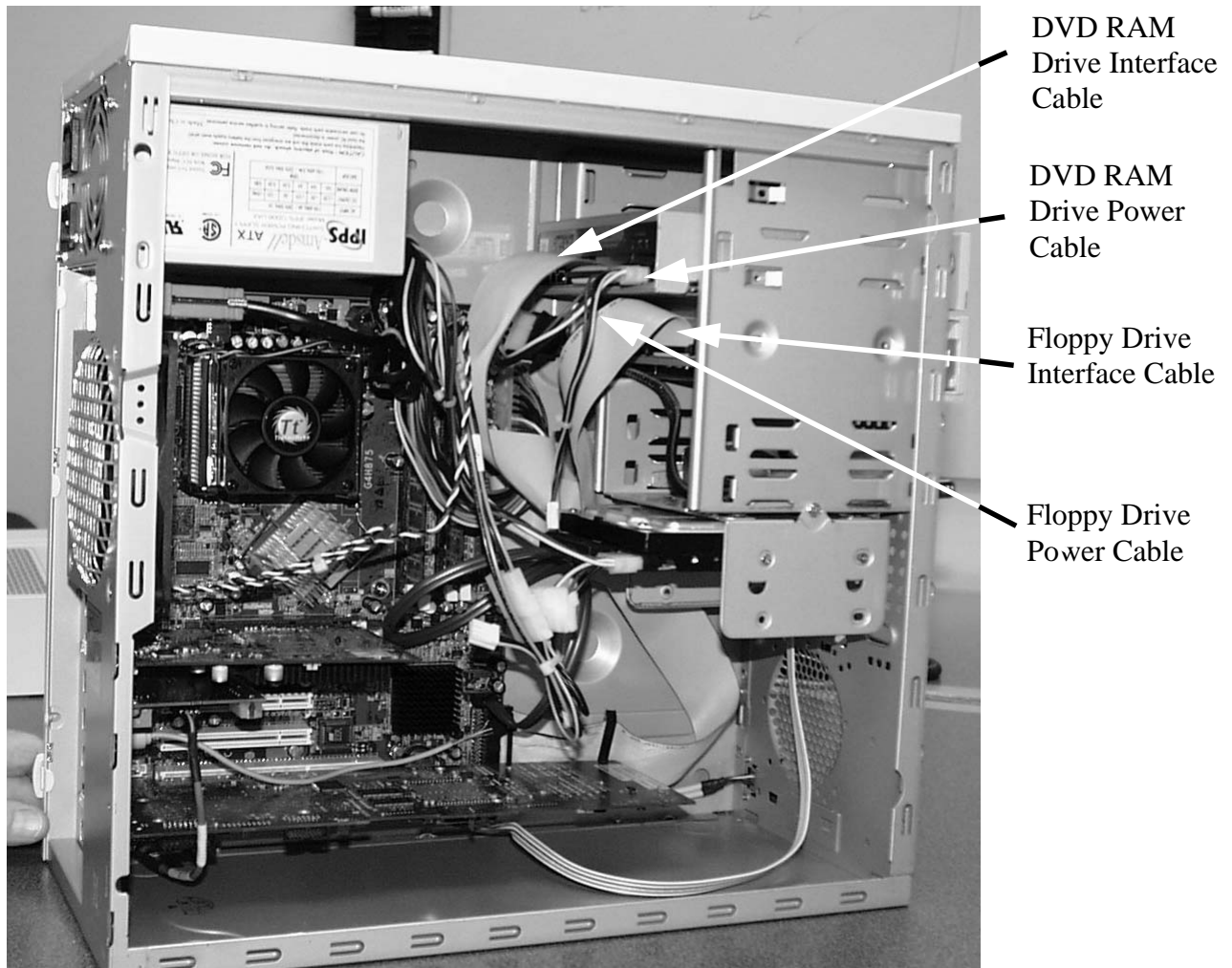
Press in on the drive's retaining clips (one on each side of the drive) and pull the drive out.
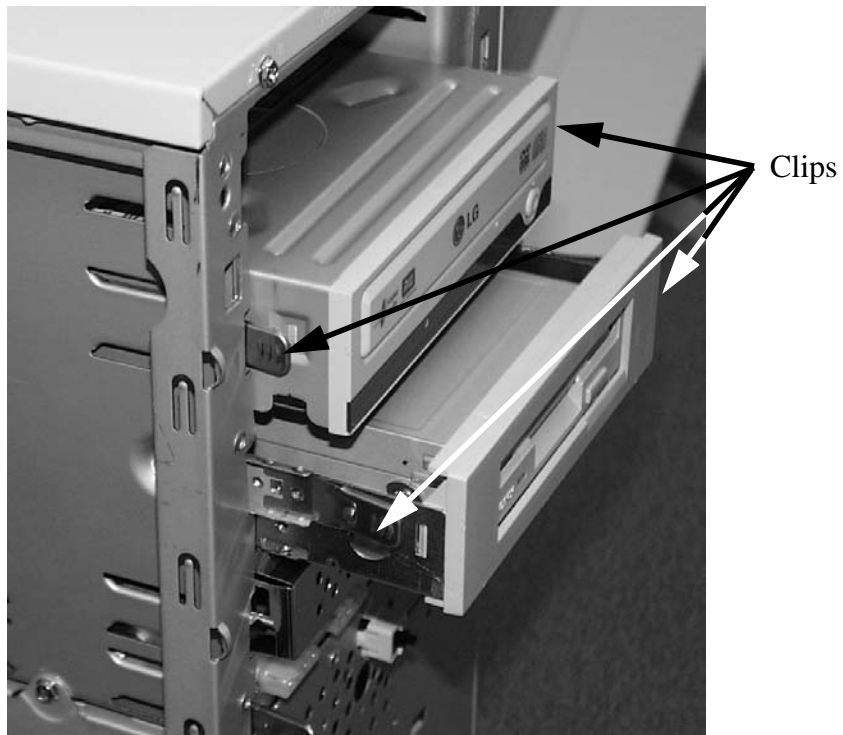


Clips

# 28 V Power Supply Removal/Replacement

Remove system cabinet rear and front covers (see "System Cabinet Covers Removal/Replacement" on  page 3-8).

Remove the AC in and DC out cables.

Remove four nuts on each corner of the board.

DC out

AC in
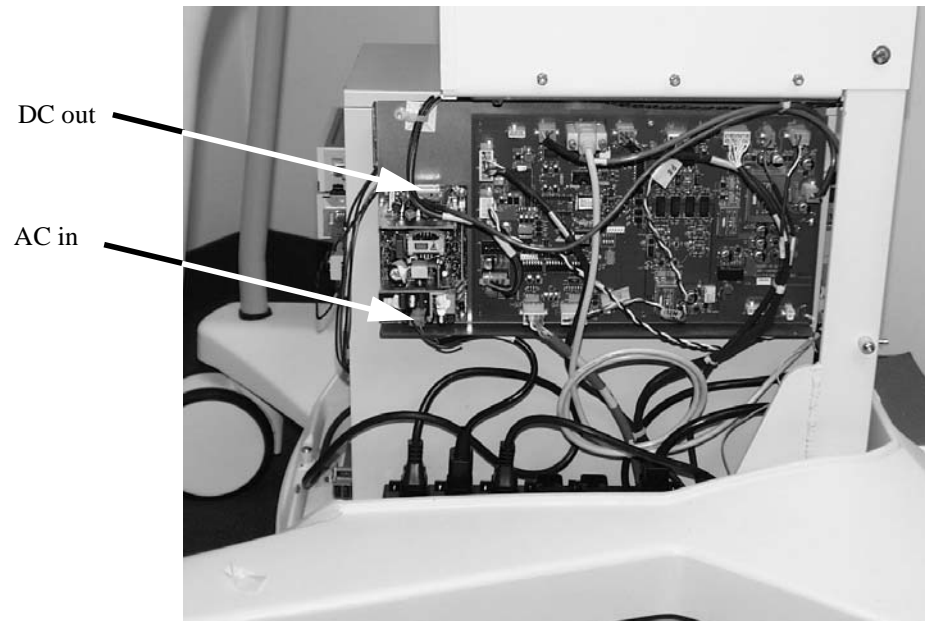
Lift the board off the four studs.

# X-ray Controller Board Removal/Replacement

Remove system cabinet rear and front covers (see "System Cabinet Covers Removal/Replacement" on  page 3-8).

Be sure all cables are labeled. If not, label them before removing.

Disconnect all cables from the board.

Remove six screws securing the board to its mounting panel.

Remove the board.

**After replacing the board perform the following:**

"X-ray Controller Calibration" on page 4-8.

"kV Accuracy Test" on page 4-11.

"mA Accuracy Test" on page 4-12.

"Beam Quality Checks" on page 4-13.

"Image Quality / Resolution Checks" on page 4-13.
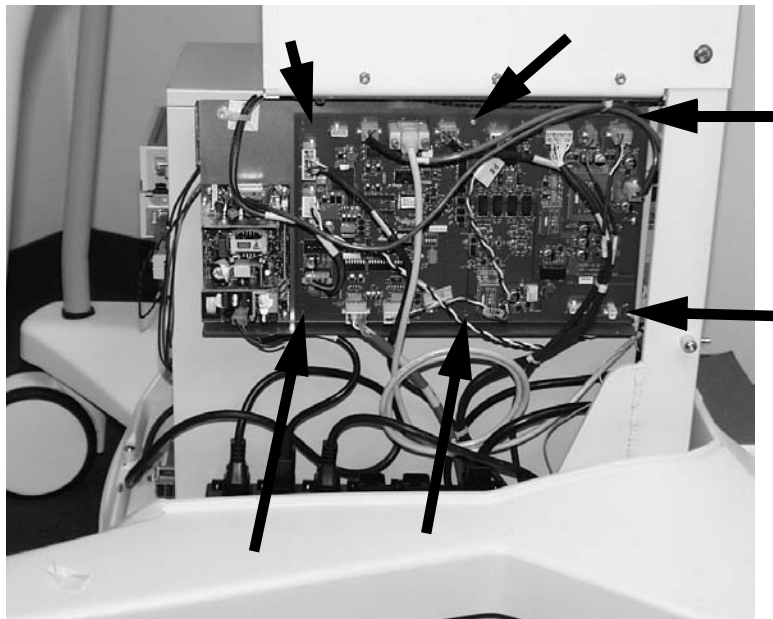
# Isolation Transformer and Line Filter Removal/Replacement

Remove system cabinet rear and front covers (see "System Cabinet Covers Removal/Replacement" on  page 3-8).

Disconnect the AC power input cable (Molex connector) from the inside of the power input module and the AC output cable from the power strip.

Remove four screws securing the assembly to the system cabinet.



Power Strip

Power Input Module

Screws (2) One hidden

Screws (2) One hidden

.

Remove the assembly from the cabinet.



Molex Connector to Power Input Module

AC Power to Power Strip

Isolation Transformer

Line Filter

# Power Input Module Removal/Replacement

Remove the AC cable connector from the module.
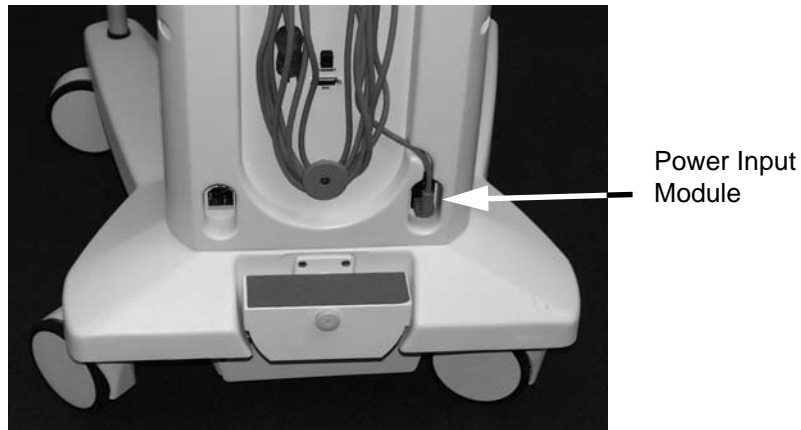


Power Input
Module

Use a small flat blade screwdriver to pry the module out.



The input power fuses are accessible after prying the module out.

# X-ray Head Covers Removal/Replacement

Whenever possible, when removing/replacing C-arm FRUs, always orient the C-arm so if you drop a screw, it falls to the floor and not into the HVPS or other component.

Always lock the C-arm in place using the joint knob and the C-arm lever lock to prevent sudden movement from an unbalanced C-arm.

The X-ray Head has two covers.

## X-ray Head Front Cover Removal/Replacement

Remove two screws on the top of X-ray Head front cover.

Remove two screws on the bottom of X-ray Head front cover.

Pull the front cover off.
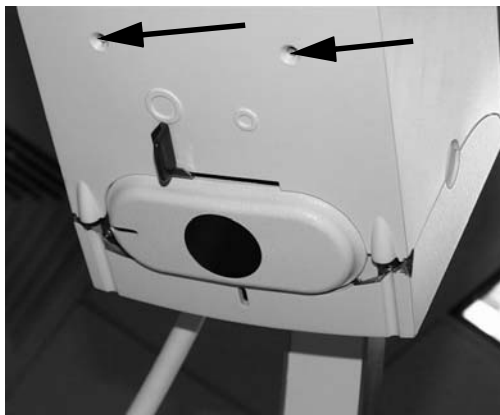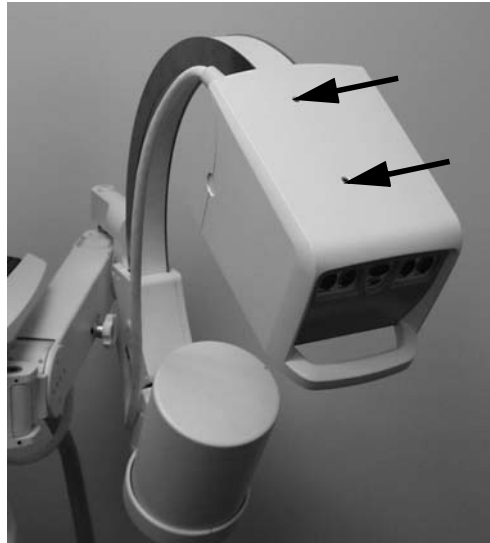
## X-ray Head Rear Cover Removal/Replacement

Remove two screws on the bottom of X-ray Head rear cover.

Pull the rear cover off.
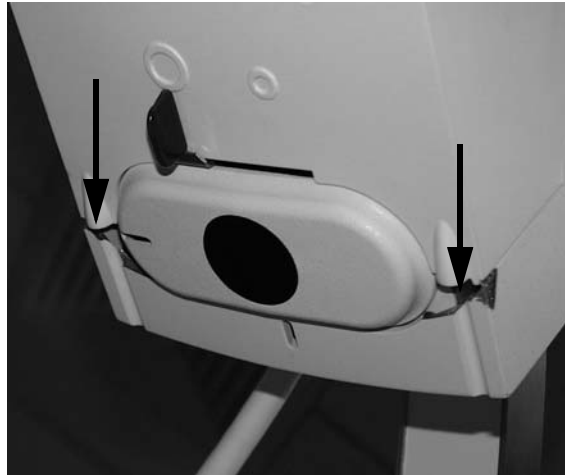


# Control Panel Removal/Replacement

Remove the X-ray Head front cover (see "X-ray Head Front Cover Removal/Replacement" on page 3-23).

Remove the Control Panel bracket by removing four screws.



Remove the interface cable and remove the Control Panel and bracket.

# C-arm I/O Board Removal/Replacement

The C-arm I/O board is removable from the top of the X-ray Head.

Remove the X-ray head covers ("X-ray Head Covers Removal/Replacement" on page 3-23).

Unplug the C-arm I/O cables (7).

Remove two plastic nuts holding the board in place and remove the board.
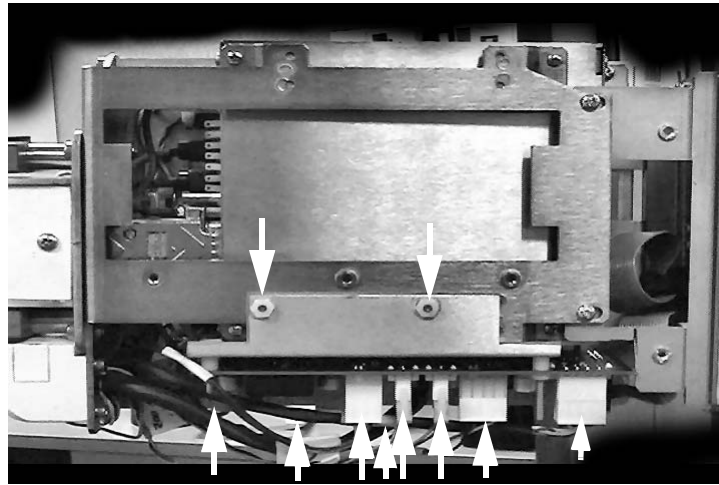


# Collimator Removal/Replacement

The Collimator is located on the underside of the X-ray Head.

Remove the X-ray head cover ("X-ray Head Front Cover Removal/Replacement" on page 3-23).

Remove four screws securing the collimator to the X-ray Head plate.
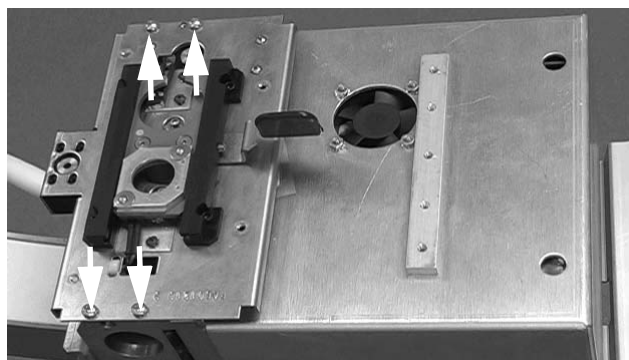
Flip the Collimator over and unplug the positioning laser cables.



Positioning
Laser
Cables



Collimator
Adjusting
Screws
(2)

Collimator
Lock Down
Screws
(2)



Secondary
Collimator
Adjustment
Screws

Positioning
Lasers

# HVPS/X-ray Source Assembly Removal/Replacement

**Warning:** **When removing/replacing the HVPS/X-ray Source assembly, be sure to lock the C-arm in place. If the C-arm is unlocked, removing the HVPS/X-ray Source assembly will cause the C-arm to move suddenly and could cause damage to the unit and injury to you.**



C-arm Lever Lock

Joint Knob

Remove the X-ray Head covers (see "X-ray Head Covers Removal/Replacement" on  page 3-23).

Remove the Collimator (see "Collimator Removal/Replacement" on  page 3-25).

Rotate the C-arm to view the top of the X-ray head.
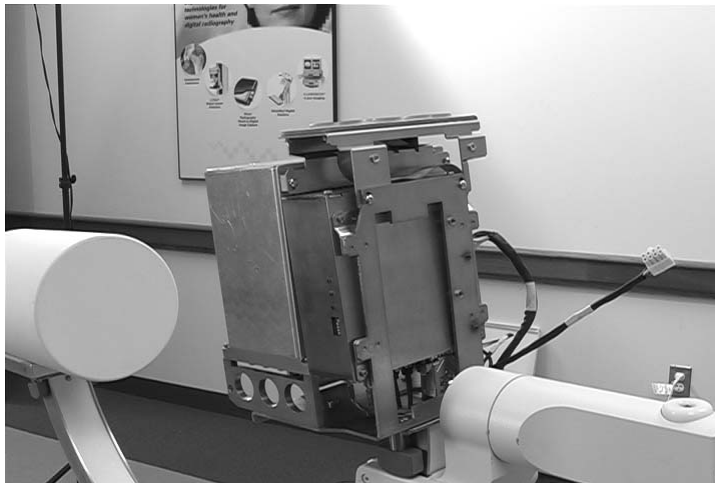


Remove two screws that attach the control panel plate.

Re-orient the C-arm to view the bottom of the X-ray Head.
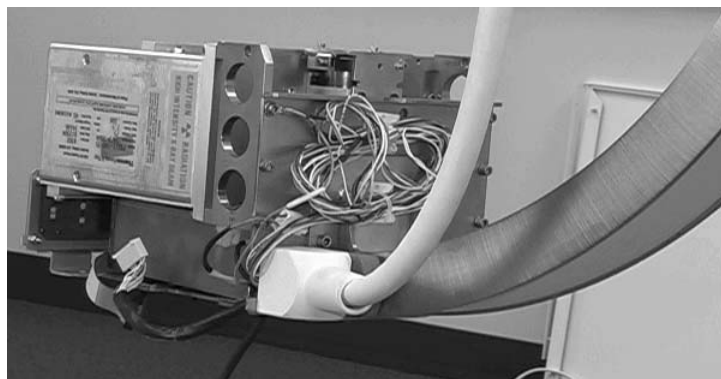


Loosen six bolts located on the bottom of the mounting plate.
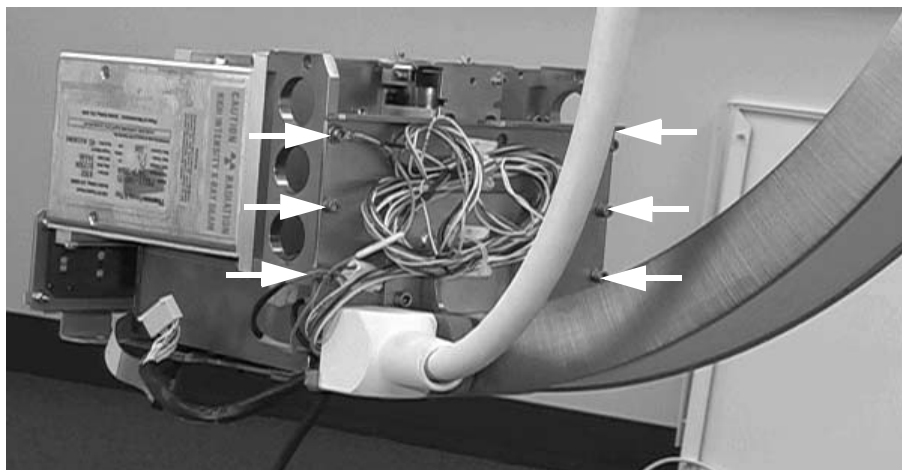
Rotate the C-arm so that the X-ray Head is positioned as shown below.

**Be sure to lock the C-arm in place**.



Finish removing the six mounting bolts located on the bottom of the mounting plate.



Lift the HVPS/X-ray Source assembly, from its mounting plate, unplug the interface cable, and remove the assembly.

**After replacing the board perform the following:**

"X-ray Controller Calibration" on page 4-8.

"Image Board Calibration (Unwarp/ Flat Field)" on page 4-9

"kV Accuracy Test" on page 4-11.

"mA Accuracy Test" on page 4-12.

"Beam Quality Checks" on page 4-13.

"Image Quality / Resolution Checks" on page 4-13.

# Radiological Imaging Unit (RIU) Removal/Replacement

**Notes: The RIU and power supply are a matched set and must be replaced as a pair.**

**Warning: The C-arm must be solidly locked in position prior to the removal of the Image Intensifier. Otherwise when the weight of the Image Intensifier is removed the arm can quickly raise causing serious injury.**



C-arm Lever Lock

Joint Knob

The RIU is located in two places.



Image Intensifier
Power Supply
(located in X-ray Head)
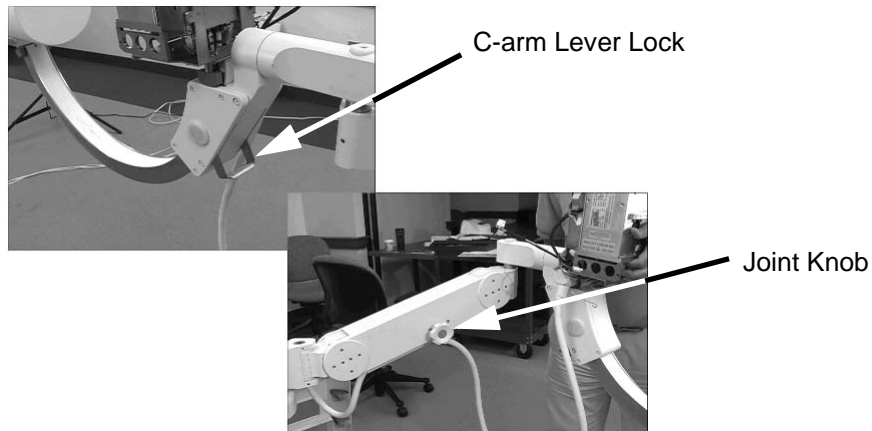
Image Intensifier,
CCD Camera, and Lens
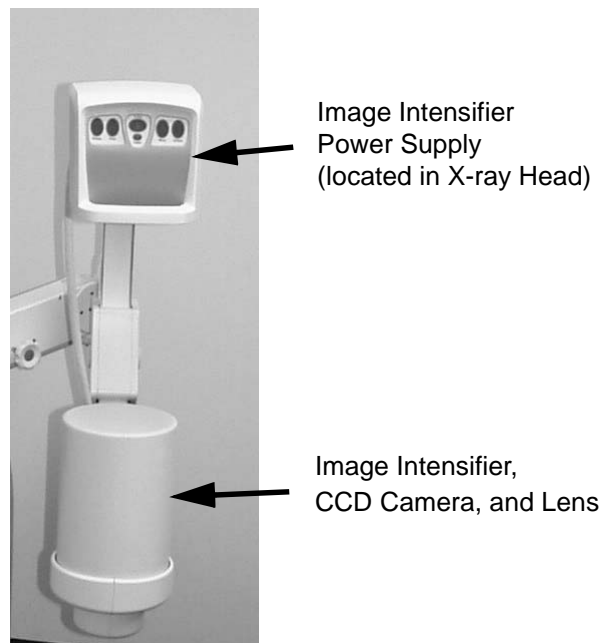
Remove the Image Intensifier covers (two side screws and two bottom screws).



Remove the X-ray Head covers (see "X-ray Head Covers Removal/Replacement" on  page 3-23).

Remove the +28V power connector and signal interface cable from the camera.



Position the C-arm so that the Control Panel is at the top.

Remove the four Phillips head screws mounting the power supply.

Rotate the power supply to gain access to the cables on the back of the power supply. Note the position of the cables and remove them by turning the lock nuts until they are loose and pull the cable out of the receptacle.



Remove the power supply.

Remove the lock nuts and o-rings from the power supply cables noting the position of the o-rings.

Attach a piece of string or wire to the power supply cables to use when routing the cables when installing the new image intensifier. This will be pulled through the C-arm when removing the cables and used to pull the new cables back into the proper position.

Remove the four allen head screws attaching the Image Intensifier to the C-arm.

Slowly lift and rotate the Image Intensifier while pulling the cables out of the C-arm. Remove the string or wire that was attached to the cables previously, leaving it routed through the C-arm, and place the image intensifier on a stable surface.

Position the new image intensifier close to the C-arm and attach the string or wire to the cables of the new Image Intensifier.

While pulling the cables through the C-arm carefully position the Image intensifier and attach it to the C-arm with the four allen head screws removed earlier.

Install the locknuts and o-rings on the power supply cables.

Attach the cables to the new power supply.

Rotate the new power supply into position and secure it with the four Phillips head screws removed earlier.

Insert the power cord and power InSight up.

**After replacing the board perform the following:**

Verify the collimation and adjust if necessary (see "Collimation" on page 4-3).

"X-ray Controller Calibration" on page 4-8.

"Image Board Calibration (Unwarp/ Flat Field)" on page 4-9

"kV Accuracy Test" on page 4-11.

"mA Accuracy Test" on page 4-12.

"Beam Quality Checks" on page 4-13.

"Image Quality / Resolution Checks" on page 4-13.

Backup the system to the DVD RAM.

# Monitor Removal/Replacement

Disconnect all monitor cables.

Remove two screws at the bottom of the monitor bracket. These are special screws. Be careful not to lose them.

Loosen two screws at the top of the monitor bracket. Lift up on the monitor and pull it away from the bracket.

**After replacing the board perform the following:**

"Monitor / Touchscreen Calibration" on page 4-2
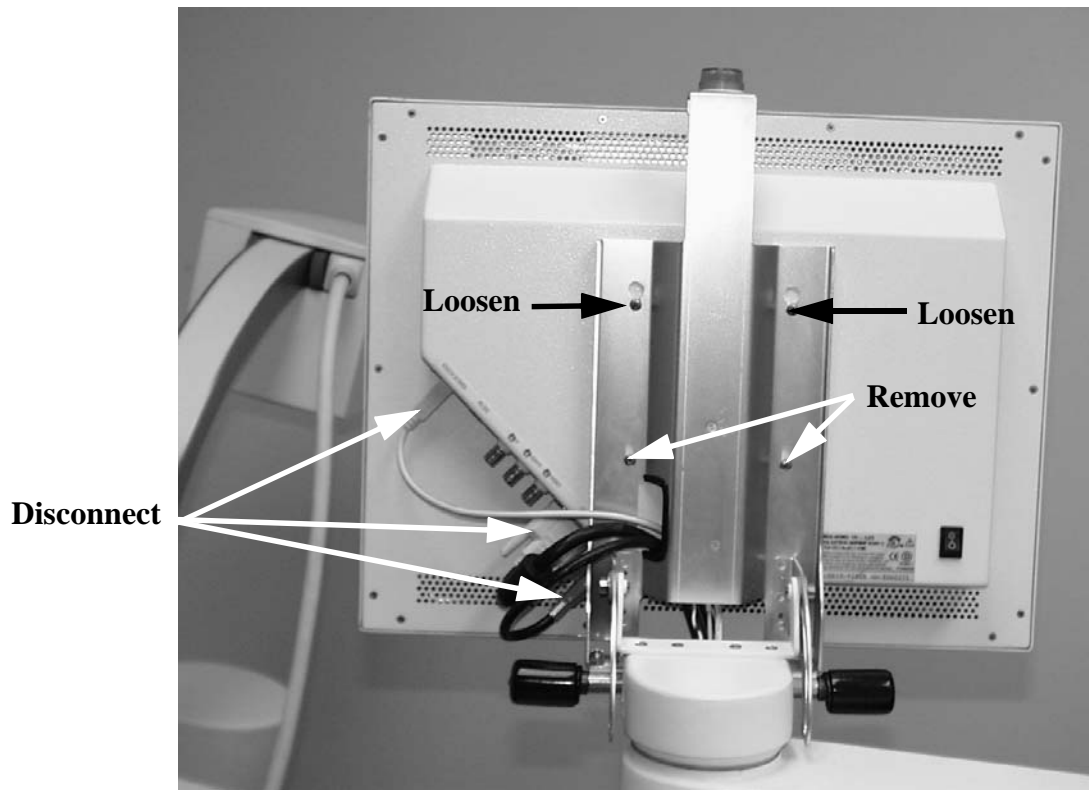
# Monitor Power Supply Removal/Replacement

The monitor power supply is located in the bottom of the system cabinet to the right of the computer chassis.

Remove system cabinet rear and front covers (see "System Cabinet Covers Removal/Replacement" on page 3-8).

Remove the monitor/keyboard cable clamp.

Open the cable cover.
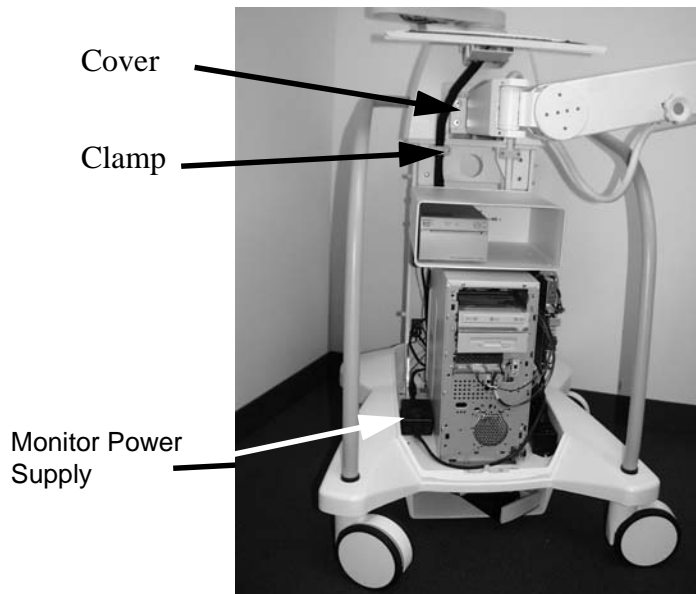


Disconnect the AC input cable from the power supply.

Disconnect the DC output cable from the monitor.
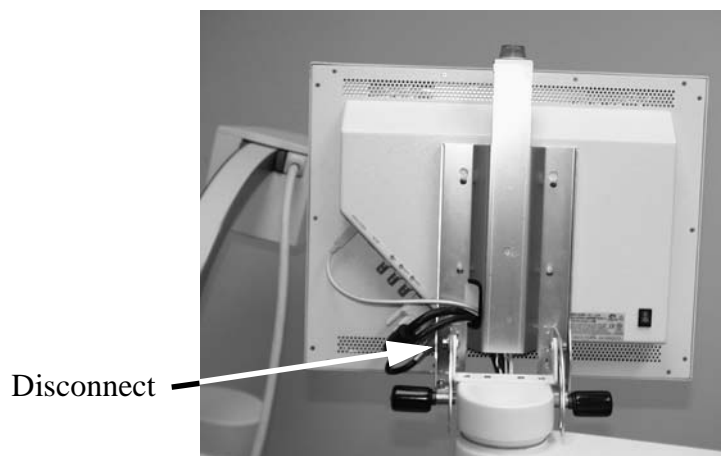


Remove the power supply and DC output cable.

# X-ray ON Lamp Removal/Replacement

The X-ray ON lamp is located on top of a lamp assembly located on the back of the monitor bracket.

Unscrew the lamp's cap from lamp holder.

Twist the lamp to release it from the holder.
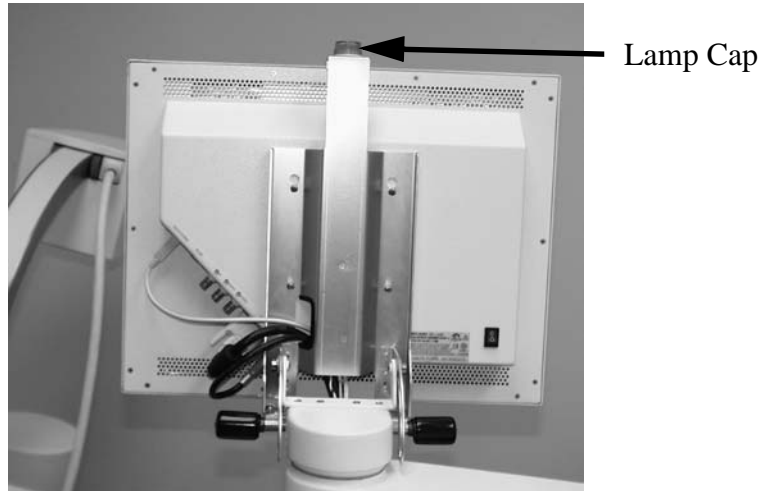


Lamp Cap

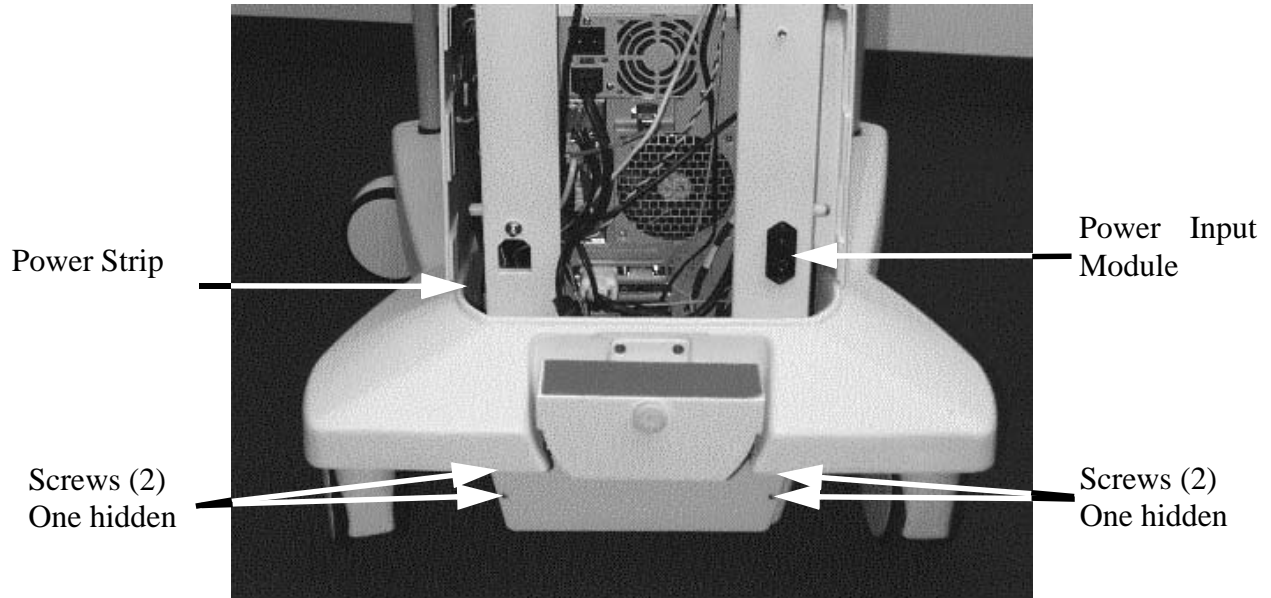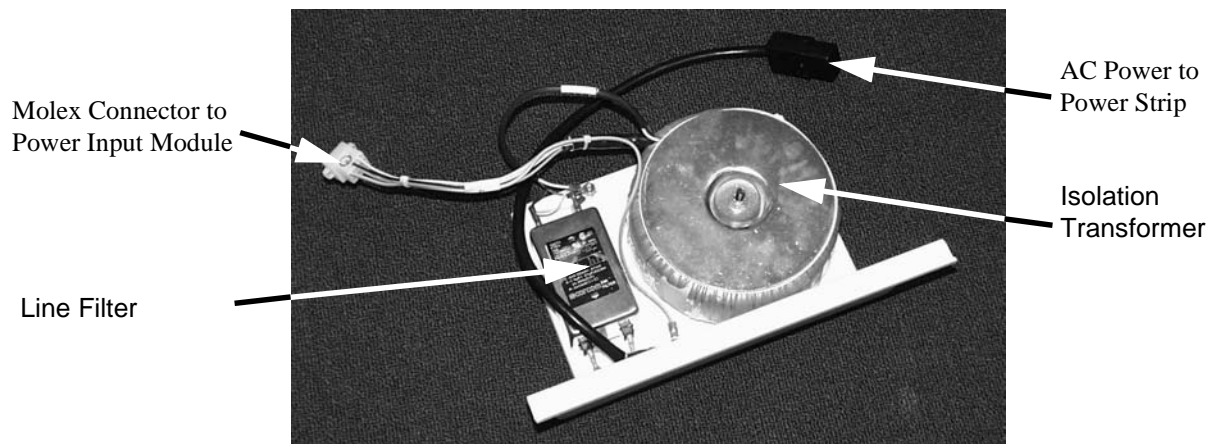# Keyboard Removal/Replacement

Remove system cabinet rear and front covers (see "System Cabinet Covers Removal/Replacement" on page 3-8).

Remove the monitor/keyboard cable clamp.

Open the cable cover.
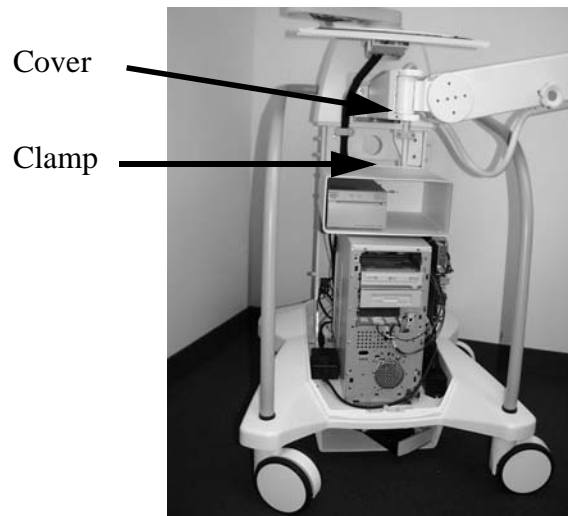


Disconnect the keyboard/pointing device cable from the I/O Ports panel of the computer chassis.
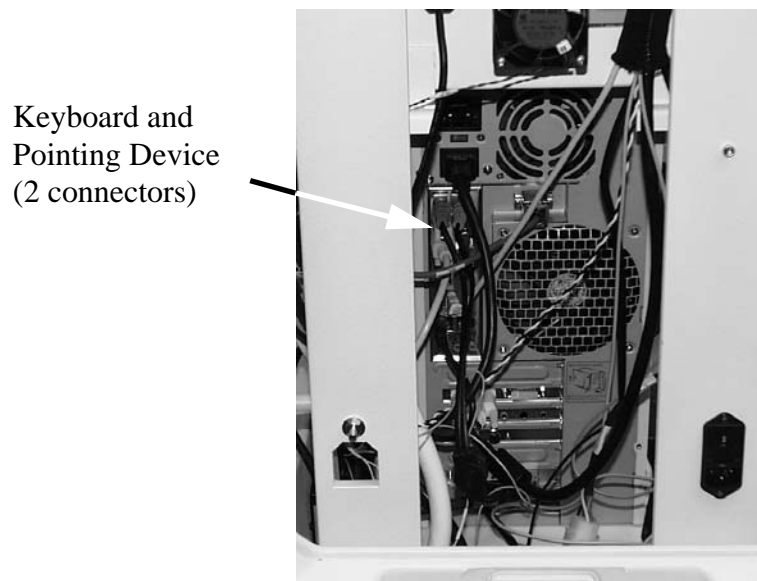


Remove the cable from the back of the system cabinet and the bottom portion of the keyboard tray arm.

Remove the keyboard and cable.

# Speaker Removal/Replacement

Remove system cabinet rear and front covers (see "System Cabinet Covers Removal/Replacement" on  page 3-8).

Unplug the speaker cable from the Audio Amplifier board.
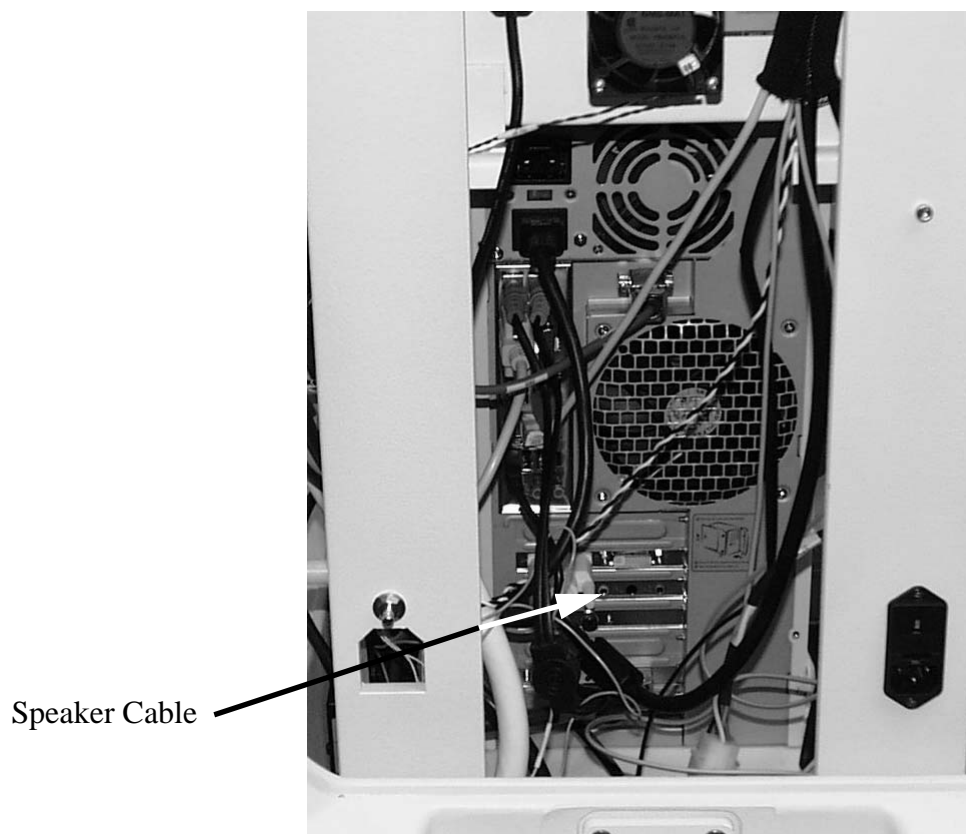
Speaker Cable

Remove four screws and remove speaker.
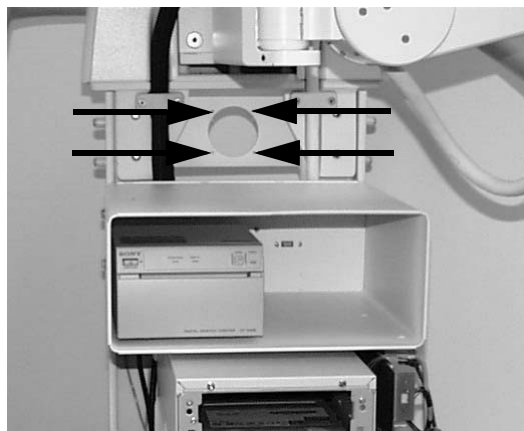
# Cabinet Fan Removal/Replacement

Remove system cabinet rear cover (see "Rear Cover Removal/Replacement" on page 3-9).

Unplug the fan's cable connector.

Remove four screws and remove fan.



Connector
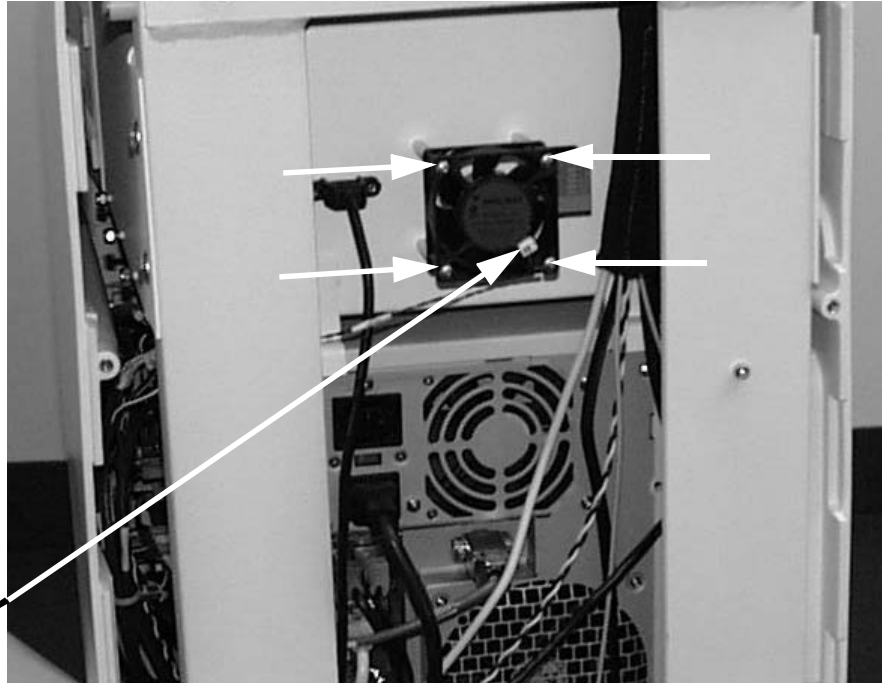
# Caster Removal/Replacement

**Lock the C-arm in place using the C-arm retainer bracket.**

1. When replacing a caster be sure to replace it with the correct caster. The front and rear casters are different.

2. If replacing a rear caster, disconnect the caster brake pedal rod end from the caster locking lever.



Rod end
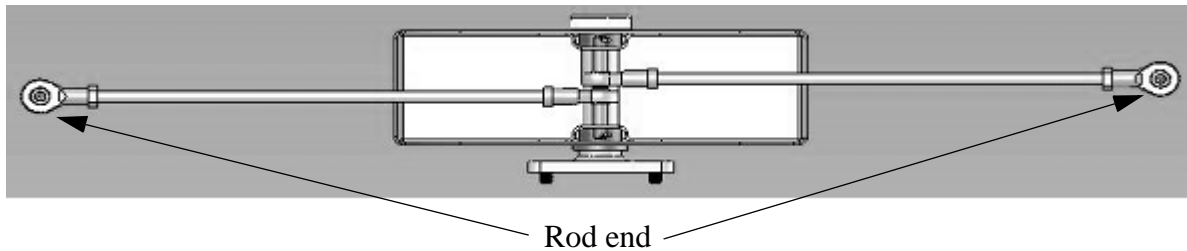
3. Using scissor jacks positioned under the unit near the caster being replaced, raise the unit enough so that the caster just lifts off the floor.

4. Remove four bolts securing the caster to the cabinet frame.

5. Install the replacement caster and four bolts and lower the unit back onto the floor.

6. If replacing a rear caster, reconnect the caster brake pedal rod end to the caster locking lever and ensure that the caster locking lever latches into the locked position when the brake pedal is in the locked position. If adjustment is required, disconnect the caster brake pedal rod end from the caster locking lever, turn the rod end as required, and reconnect it.

# Fuses

There are two fuses located in the Power Input Module.

Remove the Power Input Module (see "Power Input Module Removal/Replacement" on page 3-22).

The fuses are accessible after prying the module out.



Fuse ratings:

100 - 120V input - 10A Time Delay

220 - 240V input - 6.3A Time Delay

# FRU List

| Part Number | Description |
| --- | --- |
| CMP-00132 | Computer, InSight Assembly |
| CMP-00087 | Video Controller Bd, AGP P650 |
| CMP-00109 | Image Processing Bd |
| PWR-00029 | Pwr Sply, 200W ATX w/Battery |
| CMP-00139 | Keyboard w/Pointer, PS2 |
| CMP-00085 | Display,Mono,19.6", w/Touch |
| PWR-00044 | Pwr Sply, Display Monitor |
| CMP-00089 | Hard Disk Drive, 80GB, Serial |
| CMP-00276 | Printer, Sony UP D897 |
| CMP-00305 | Printer, Hybrid Graphic UP 990 |
| SWC-00040 | Footswitch, Double w/pushbutton |
| FAB-02351 | Control Panel, InSight |
| MEL-00084 | Radiological Imaging Unit |
| ASY-00893 | Assy, InSight HVPS |
| PCB-00046 | C-Arm PCB |
| ASY-00873 | Assy, Flex Arm |
| ASY-01329 | Assy, InSight XRC |
| ASY-00162 | C-Arm w/Carriage |
| ASY-01328 | Assy, Isolation XFMR |
| PWR-00015 | Power Supply, 28V, 100W |
| 110357 | Drive, 3.5" Floppy |
| CMP-00090 | DVD Ram Drive |
| 210511 | Assy, Cable Beam Limit |
| ASY-01323 | AC Inlet Module |
| ASY-01326 | Assy, Fan |
| ASY-00787 | Assy, Pedestal Caster Lock |
| MME-00216 | Caster, Front, InSight |
| MME-00217 | Caster, Rear, InSight |
| FAB-02290 | Cover, Tubehead, Front |
| FAB-02291 | Cover, Tubehead, Rear |
| FAB-02133 | Cover, Front |
| FAB-02132 | Cover, Rear |
| FAB-02239 | Cover, Side door |
| FAB-00054 | Cover, Right, II |
| FAB-00055 | Cover, Left, II |
| CMP-00137 | Media, Blank DVD |
| ASY-01325 | Assy, PC Speaker |
| 485-0074 | Holder, Lamp 4 LED |
| IND-00005 | LED Quad Yellow |
| ASY-00901 | Computer Pwr Swt/Led |
| CKB-00019 | Fuse 5x20, 10A, 250V, SB |
| 110426 | Joint Knob |

| 110447 | Brake Washer |
|---|---|
| 110655 | Brake Assy Cap |
| 110687 | Pivot Block Cap |
| ASY-01109 | Assy, X Laser |
| ASY-01110 | Assy, Y Laser |
| CKB-00006 | Fuse 3.15A SB |
| CKB-00010 | Fuse 0.8A SB |
| CKB-00012 | Fuse 10A |
| CKB-00005 | Fuse 6.3A |
| PCB-00071 | Audio Amp Bd |

# Chapter 4
# Calibration and Alignment Procedures

This chapter describes the calibration and alignment procedures for the Fluoroscan InSight system.

# Start-up

1. Login to Windows® XP as Administrator.

2. Start the InSight application. Logon as user name *service* password *frasel*. You will have to repeat the same login two more times to enter the application.

3. On the Image Acquisition screen, click **End Session**.

4. On the InSight Main screen select *System Configuration* menu, *Administrative Settings*. Uncheck the *Shut down Fluoroscan upon application shutdown* box. Click the Audit Mode On button. Click **OK**.

   Note: You will have to uncheck the *Shut down Fluoroscan upon application shutdown* box every time the InSight application program is started.

# Monitor / Touchscreen Calibration

1. Minimize the InSight screen.

2. Double-click the ELO icon in the Windows taskbar. If the ELO icon is not in the Taskbar, go to the Control Panel and double-click the ELO icon.

3. Click the align button and follow the on-screen instructions to calibrate the touchscreen.

4. Click the checkmark to complete the calibration.

Gamma settings:

1. Press the Menu button on the base of the touch screen.

2. Select the Gamma tab.

3. Use the scroll button to highlight the gamma selection.

4. Verify the monitor is set for DICOM.

5. Press the Menu button to exit

# Collimation

1. On the InSight main screen, select **System Configuration - Physician Preferences**.

2. On the Physician Preferences tab, set the Simultaneous kV/mA setting to Disabled.

3. On the InSight main screen, click **Perform**.

4. On the Select or Enter Patient screen type *Collimation* in Last Name field and the system's serial number in the Patient ID field. Click **Perform** (This step must be done every time a new patient name is required.

5. Remove the rear Laser on the C-arm.

6. Position the C-arm in the normal operating position (X-ray Head on top, Image Intensifier on the bottom).

7. On the Image Acquisition screen, select the Image Effects menu, Noise Suppression, High).

8. Use the **Up** and **Down** buttons to change kV to 57 kV and mA to .063mA.

9. Slide the Collimator shutter to the 6" position. Adjust the micro switch bracket as required to make contact. The micro switch should be bottomed when the Plate and Shutter Slide are positioned and fully engaged in the detent on the Ball Plunger. The micro switch should not disengage with slight movement of the Handle Beam Shutter and should not allow x-rays when the handle is moved out of the detent. If the handle is not in the 6" or 4" mode when an attempt is made to generate x-rays a message will appear on the monitor.

10. Loosen the two (2) collimator lock down screws on the bottom of the collimator assembly enough to allow the collimator to be adjusted.



Collimator Adjusting Screws (2)

Collimator Lock Down Screws (2)
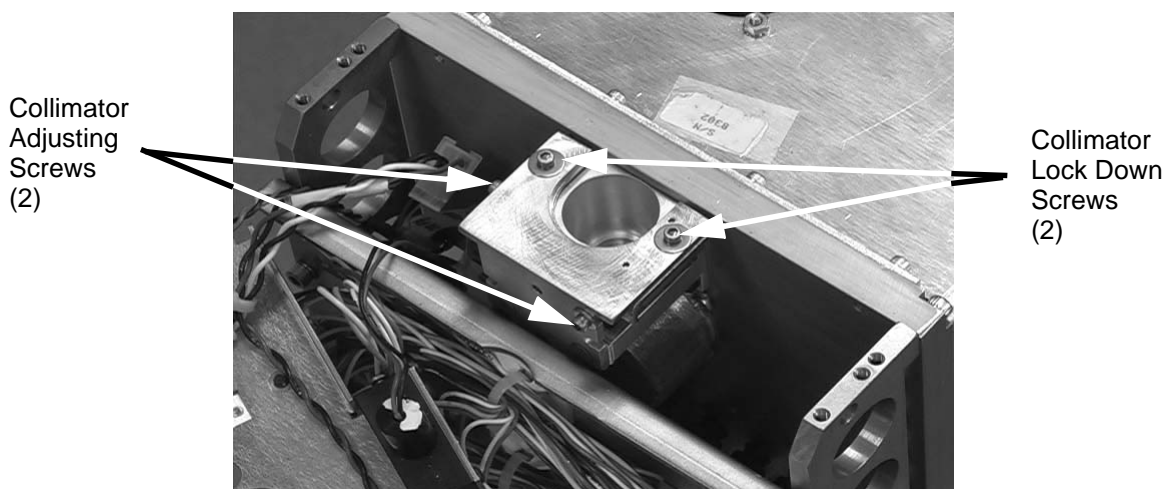
**NOTE: RADIATION IS BEING PRODUCED AT THIS TIME!     OPERATORS MUST WEAR A LEAD APRON.**

11. Depress the X-ray switch on the control panel or the footswitch to view the image on the monitor. This image shows that the system is out of alignment and the collimator must be adjusted.
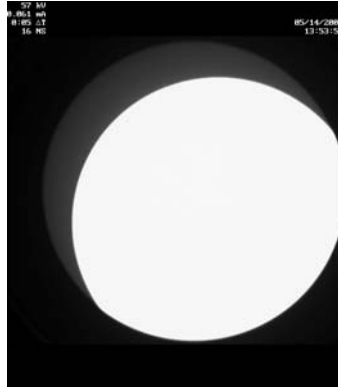


12. Rotate the image to the 12 o'clock position on the monitor by clicking Image Tools and clicking Rotate Right or Rotate Left and the rotate icon until the indexing circle is in the 12 o'clock position.
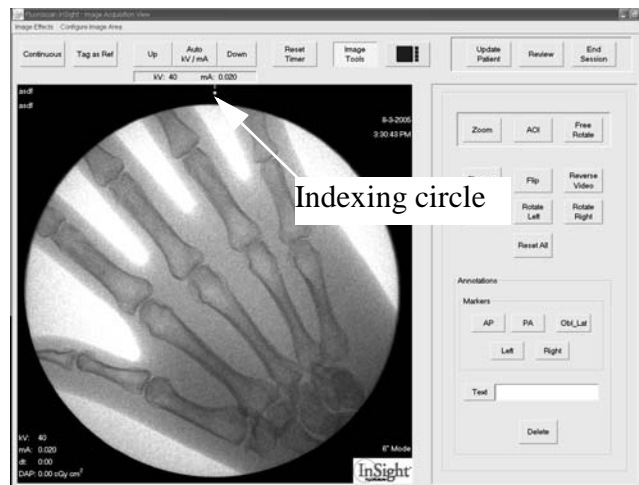


13. Adjust the two (2) collimator adjusting screws located on the front and side of the collimator body to obtain a circular image on the monitor. Refer to the picture in Step 10 on page 4-3.

14. Rotate the C-arm fully at 180 degree (expose x-ray at each position) to insure the images have equal amount of shading around image. The first image shows the shaded area at the top. The 6" collimation is complete when you are able to maintain the same amount of shading when rotating.
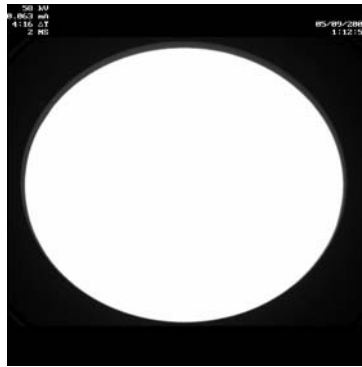


15. After collimating is set, tighten the two (2) 4-40 socket head screws that lock the collimator in position.

16. Loosen the two (2) button head screws located on the bottom of the Assy., enough to allow the collimator to be adjusted.

17. Center the assembly plate shutter slide to the smallest hole to collimate the 4" position of the Image Intensifier. At this time the 4" position should be shown on the lower portion of monitor. Adjust the micro switch bracket as required to make contact. (Adjust micro switch per step 3.7 for the switch).

18. Depress the X-ray switch on the control panel or footswitch to view the image on the monitor. Hold the switch in the ON position to complete x-ray alignment for the 4" position on the Image Intensifier

19. Adjust the lower collimator housing to obtain a circular image on the monitor.

20. Rotate the C-arm fully at 180 degree (expose x-ray at each position) until the image has no shaded area all around or that there is an equal amount of shaded area around the entire image. The 4" collimation is complete when you are able to maintain the same amount of shading when rotating.

21. After collimating is set, tighten the two (2) button head screws that lock the lower collimator into position.

22. Replace the rear Laser on the C-arm.

23. Ensure that the system was fully collimated. Once this is accomplished verify and take 4, 6 inch images at 90 degree intervals. Rename this image *Collimation* and the system serial number in the patient ID block. Save the image to the hard drive by stepping on the file Save pedal twice.

24. Rename image *Collimation 90* and the system serial number in the patient ID block. Verify and take an image at 90 degree. Save image to the hard drive by stepping on the file Save pedal twice.

25. Rename image *Collimation 180* and the system serial number in the patient ID block. Verify and take an image at 180 degrees Save image to the hard drive by stepping on the file Save pedal twice.

26. Rename image *Collimation 270* and the system serial number in the patient ID block. Verify and take an image at 270 degrees. Save image to the hard drive by stepping on the file Save pedal twice.

27. Place the UNWARP Phantom on the Image Intensifier. Rename this image to *WARP* and the system serial number in the patient ID block. Take an image. This image will be used for comparison in a later step. Once this is complete exit InSight.

# Laser Alignment

1.  Place laser alignment template (contained in Appendix A) on the image Intensifier. Make sure to rotate the template so that the vertical line on the fixture points to the C-arm. Adjust the fixture blocks so that the fixture doesn't move.

2.  Turn on the laser switch. Laser may need to be removed from block and focused. Reinstall laser in block. Adjust the side laser beam by loosening the 4-40 screws and setscrews. The laser block can be adjusted from side to side on the bracket and the laser rotated within the block and secured with the setscrew. Make the necessary adjustments. Once it is within the crosshair, tighten them down.

3.  Turn on the laser switch. Adjust the rear laser beam by loosening the 4-40 screws and setscrews. As with the side laser, the rear laser block can be adjusted from side to side on the bracket and the laser rotated within the block and secured with the setscrew. Make the necessary adjustment. Once it is within the crosshair, tighten them down.

4.  Ensure Laser was properly aligned.

## Laser Test

1.  Push the laser switch ON and wait a few seconds and push it again to turn it OFF. Make sure the laser turns on when the switch is pushed the first time and shuts OFF when you push it the second time.

2.  Push the laser switch ON and wait until the laser shuts OFF by itself (approximately 20 seconds).

# X-ray Controller Calibration

**NOTE: RADIATION IS BEING PRODUCED AT THIS TIME! OPERATORS MUST WEAR LEAD APRON WHILE XRAYS ARE BEING GENERATED. UNIT SHOULD NOT BE UNATTENDED.**

Instructions for Use of Calibration Tool

1.  From the InSight application select End Session and enter the System Configuration menu. From the System Configuration menu select Administrative Settings.

2.  From the Administrative Settings menu go to the System Shutdown area and deselect "Shut down Fluoroscan upon application shutdown".

3.  Select OK and Shutdown to exit from the InSight application.

4.  Remove the InSight system cabinet covers (left side cover on 08- series serial numbers) to gain access to the XRC board.

5.  Put the XRC board in the calibration mode by placing the jumper JW5 to position 2 & 3 and switch SW2 position 4 to the ON position.

6.  Insert the XRC Calibration software CD (SFW-00362) into the D: drive on the InSight.

7.  From Windows open the D: drive and select the XRC Calibration.bat file to begin the XRC Calibration routine.

8.  From the main menu of the calibration program select the Calibrate button.

9.  Wait until calibration is completed. This should not take more than 5 minutes (as indicated by the progress bar).

10. When the *Calibration Succeeded* message appears click OK. (If an error message appears instead, the error must be diagnosed and the XRC calibration routine should be run again. If the *Calibration Failed* message appears select the See Log for Details button and click OK for more information regarding the failure condition.)

11. Press the cancel button to close the application and remove the calibration disk.

12. Verify that the file XrcCalibration.data is in the C:\Program Files\Hologic\InSight\data directory and the file has the current time and date.

13. Remove the XRC board from the calibration mode by placing jumper JW5 to position 1 &2 and switch SW2 position 4 to off.

14. Launch the InSight application and verify correct system operation.

# Image Board Calibration (Unwarp/ Flat Field)

**NOTE: RADIATION IS BEING PRODUCED AT THIS TIME! OPERATORS MUST WEAR LEAD APRON WHILE XRAYS ARE BEING GENERATED. UNIT SHOULD NOT BE UNATTENDED.**

Instructions for Use of Calibration Tool

1. Place the InSight C-arm in the normal operating position with the x-ray source at the top and the Image Intensifier at the bottom.

2. Place the unwarp phantom (TLS-00354) over the image intensifier so that the mesh in the phantom aligns with the C-arm.

3. With the 6-inch collimator position selected take a continuous x-ray and position the phantom so that the mesh is not touching the edge of the image on the top, bottom, left or right. When properly aligned stop taking x-rays.
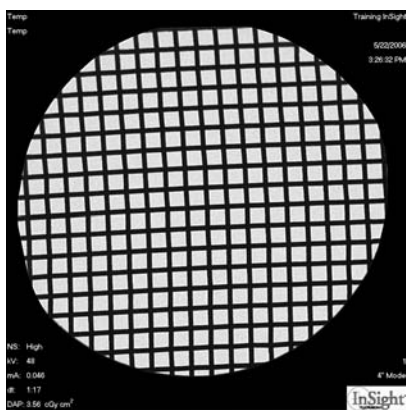


Incorrectly Positioned          Correctly Positioned
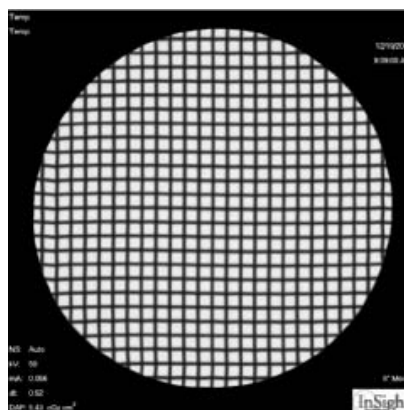
4. Change the collimator to the 4-inch position and take an x-ray to verify that the mesh is not touching the edge of the image on the top, bottom, left or right. If it is touching the edge of the image, adjust the position of the phantom until it is correct. If the phantom must be adjusted, verify the correct positioning in the 6-inch collimation position before continuing with this procedure.

5. When the phantom is properly positioned in the 4 and 6-inch collimation positions select End Session and enter the System Configuration menu. From the System Configuration menu select Administrative Settings. From the Administrative Settings menu go to the System Shutdown area and deselect "Shut down Fluoroscan upon application shutdown". Select OK and Shutdown to exit from the InSight application.

6. Put the XRC board in the calibration mode by placing the jumper JW5 to position 2 & 3 and switch SW2 position 4 to the ON position.

7. Insert the Image Board Calibration software CD (SFW-00361) into the D: drive on the InSight.

8.  From Windows open the D: drive and select the *ImageCalibration.bat* to perform the Image Board Calibration routines.

9.  Select the Start Warping Calibration button in the software window to begin the warping calibration routine.

10. Follow any instructions on the screen until the calibration is complete.

11. Remove the unwarp phantom from the image intensifier.

12. Select the Start Flat Field/Camera Gain Calibration button in the software window to begin the Flat Field Calibration routine.

13. Follow any instructions on the screen until the calibration is complete.

14. When calibration is complete select the Cancel button in the software window to close the calibration application.

15. Verify that the following files are located in C:\Program Files\Hologic\InSight\data:

    a. Warp4_Default.bin

    b. Warp6_Default.bin

    c. FF4_Default.tif

    d. FF6_Default.tif

    All files must have the current date and time.

16. Remove the XRC board from the calibration mode by placing jumper JW5 to position 1 &2 and switch SW2 position 4 to off.

17. Remove the calibration CD from the D: drive and launch the InSight application.

18. Verify correct system operation by performing an x-ray in manual mode with kv set to approximately 65. If the Warping Calibration was performed correctly the image should be round and not flat on any edge. If a flat area is found the Warping Calibration must be performed again.

19. Perform another x-ray in manual mode with the kv set to the minimum value. If the flat field/camera gain procedure was performed correctly there should be an even shading of the image and no hot spots should appear. If there are any hot spots or abnormalities the flat field/camera gain procedure should be performed again.

# kV Accuracy Test

1.  Set a DVM to measure DC Volts. Connect the (+) lead of the DVM to TP4 on the X-ray Controller board (kV feedback voltage from x-ray source) and the (-) lead to TP23 (28 Volt return).

2.  On the InSight application main screen, select the "System Configuration" tab, and then go to "Physician Preferences".   Set the "Simultaneous kV/mA" setting to "Disabled".

3.  Click **Apply**, then **OK**.

4.  At the Image Acquisition screen, select Manual kV/mA adjustment mode.

5.  Refer to the kV Accuracy Test Data table below. With x-rays on, use the kV/mA Up/Down buttons to adjust the kV displayed to the value shown in the first line of the "kV Indicated" column of the table. Allow the voltage to stabilize, then record the voltage indicated on the DVM on the same line in the "Measured kV Feedback" column of the table. Repeat for each "kV Indicated" value in the table.

    Note:   In some instances, the displayed kV value will toggle back and forth between the desired value and an adjacent (higher or lower) value. This is normal and should not affect the outcome of the kV accuracy test.

6.  On the InSight application main screen, select the System Configuration menu, Physician Preferences.

7.  Set the "Simultaneous kV/mA" setting to "Enabled".

## kV Accuracy Test Data

| kV Indicated | Nominal kV Feedback | Measured kV Feedback TP4 | Allowable Range | | |
|---|---|---|---|---|---|
| 43 | 2.24 | | 2.17 - 2.31 | P | F |
| 46 | 2.39 | | 2.32 - 2.46 | P | F |
| 49 | 2.55 | | 2.47 - 2.63 | P | F |
| 52 | 2.70 | | 2.62 - 2.78 | P | F |
| 55 | 2.86 | | 2.77 - 2.95 | P | F |
| 58 | 3.02 | | 2.93 - 3.11 | P | F |
| 61 | 3.17 | | 3.07 - 3.27 | P | F |
| 64 | 3.33 | | 3.23 - 3.43 | P | F |
| 67 | 3.48 | | 3.38 - 3.58 | P | F |
| 70 | 3.64 | | 3.53 - 3.75 | P | F |
| 73 | 3.80 | | 3.69 - 3.91 | P | F |
| 75 | 3.90 | | 3.78 - 4.02 | P | F |

# mA Accuracy Test

1. Set a DVM to measure DC Volts. Connect the (+) lead of the DVM to TP8 on the X-ray Controller board (mA feedback voltage from x-ray source) and the (-) lead to TP23 (28 Volt return).

2. On the InSight application main screen, select the System Configuration menu, Physician Preferences.

3. Set the "Simultaneous kV/mA" setting to "Disabled".

4. Click **Apply**, then **OK**.

5. Enter image acquisition mode and on the Image Acquisition screen, select Manual kV/mA adjustment mode.

6. Refer to the mA Accuracy Test Data table below. With x-rays on, use the kV/mA Up/Down buttons to adjust the mA displayed to the value shown in the first line of the "mA Indicated" column of the table. Allow the voltage to stabilize, then record the voltage indicated on the DVM on the same line in the "Measured mA Feedback" column of the table. Repeat for each "mA Indicated" value in the table.

   Note:   In some instances, the displayed mA value will toggle back and forth between the desired value and an adjacent (higher or lower) value. This is normal and should not affect the outcome of the mA accuracy test.

7. On the InSight application main screen, select the System Configuration menu, Physician Preferences.

8. Set the "Simultaneous kV/mA" setting to "Enabled".

## mA Accuracy Test Data

| mA Indicated (uA) | Nominal mA Feedback | Measured mA Feedback TP8 | Allowable Range | | |
|---|---|---|---|---|---|
| 30 | 1.50 | | 1.41 - 1.59 | P | F |
| 38 | 1.90 | | 1.84 - 1.96 | P | F |
| 46 | 2.30 | | 2.23 - 2.37 | P | F |
| 54 | 2.70 | | 2.62 - 2.78 | P | F |
| 62 | 3.10 | | 3.01 - 3.19 | P | F |
| 70 | 3.50 | | 3.39 - 3.61 | P | F |
| 78 | 3.90 | | 3.78 - 4.02 | P | F |
| 86 | 4.30 | | 4.17 - 4.43 | P | F |
| 94 | 4.70 | | 4.56 - 4.84 | P | F |
| 100 | 5.00 | | 4.85 - 5.15 | P | F |

# Beam Quality Checks

**(WARNING: X-rays are produced during this procedure.)**

**Note:** The Simultaneous kV/mA setting on the System Configuration - Physician Preferences tab must be set to Disabled.

1. Using a dosimeter, position the probe on the center of the Image Intensifier. Using the 6-inch FOV, set the system to 43 kV and 0.020 mA and press the footswitch. Align the probe to get the maximum mR reading. Next, increase by using the touch screen KV/MA to 49 kV and 0.032 mA. Next, increase by using the touch screen KV/MA to 75 kV and 0.100 mA.

2. Divide mR reading by two (2).

3. Select HVL attenuators totaling 2.4 mm/Al and place in the x-ray beam in front of the exit port and make another exposure. If necessary, add 1 mm attenuators, and continue making exposures until the approximate 50% reading is noted, do not go below the 50% reading. This is the HVL reading, which must be greater than or equal to 2.4 mm/Al.

# Image Quality / Resolution Checks

**(WARNING: X-rays are produced during this procedure.)**

**Note:** The Simultaneous kV/mA setting on the System Configuration - Physician Preferences tab must be set to Disabled.

1. In the InSight application rename patient name to *Image test* and patient ID to the system serial number.

2. Select the 6-inch field. The following checks are made in MANUAL Mode (Noise Suppression = High). Depress the X-ray foot pedal and adjust the power setting to 47 kV and 0.028mA. Place the Parallel Line Pairs Test Tool, Model 07-539 (Hologic P/N TLS-00542), horizontally in the beam directly against the SSD port and determine the number of line pairs per millimeter (lp/mm) least readily discernible from the screen image. A 6-inch C-arm must resolve a minimum of 7.0 lp/mm.

**Note:** **Steps 3 through 7 are normally not required. In the event of a specific customer issue, the Resolution Test Tool, Model 141 (Hologic P/N TLS-00543) can be obtained from your District Manager.**

3. Select the 6-inch field size. Place the Resolution Test Tool, Model 141 (Hologic P/N TLS-00543), in the beam directly against the image receptor. Set the kV to 49, the mA at .032 and determine the highest mesh number where the openings are clearly visible. The system must resolve a minimum of 40 Mesh.

4. Enable ADR, set Noise Suppression to High and place the Nuclear Associates Test Tool, Model 07-647 (Hologic P/N TLS-00544) on the image intensifier. Depress the X-ray foot pedal.

5. The system must resolve a minimum of 30 Mesh.

6. The four circles have a diameter of 2,4,6,8 mm. A minimum of 3 out of the 4 small circles must be visible. Identify the smallest diameter circle visible.

7. Verify that the low-contrast inserts are visible in both monitor adjustment squares at the bottom of the test tool. Print the image, save image to hard drive, and write system serial number and date on the printed image.

# File Save Test

**(WARNING: X-rays are produced during this procedure.)**

1. Start InSight.

2. Logon as user name *administrator* password *checkmate*.

3. On the Image Acquisition screen, shoot an image of the line pair phantom.

4. Click **Update Patient**.

5. Type *Test* in the Patient Last Name field.

6. Click **Apply Change**.

7. Click **Preview**.

8. Select an image.

9. Click **Export**.

10. Place blank floppy disk into the "A" drive.

11. Select floppy drive.

12. Select TIFF as file type.

13. Click **Export**.

14. Click **OK** on completion message.

15. Minimize InSight application.

16. Verify that a folder has been written to the disk in "A" drive.

17. Place DVD RAM disk in D drive.

18. Select the D drive from windows and right click then select " format".

19. Verify the following information 4.26 GB, FAT 32, default  label the disk with the system serial number (**note do not select quick format**).

20. Click **Start**

21. Click **OK** when format is complete.

22. Maximize Insight application

23. Select DVD drive.

24. Select Fluoroscan as file type.

25.  Click **Export**.

26.  Click **OK** on completion message.

27.  Minimize InSight application.

28.  Verify that a folder has been written to the DVD in "D" drive.

# System Cleanup

1.  Start InSight.

2.  Logon as user name *administrator* password *checkmate*.

3.  On the main screen select Tools menu, Delete Images.

4.  Delete all images that may have been created during testing.

# Chapter 5
# Periodic Maintenance Procedures

This chapter describes the Periodic Maintenance (PM) procedures for the InSight Imaging System.

## Decontamination

Prior to beginning PM, exterior surfaces of the InSight Imaging System must be decontaminated in accordance with hospital standards for biohazard substances. All precautions for blood born pathogens (e.g., wearing latex or vinyl gloves, etc.) must be observed. Disinfect using a 10% bleach solution.

## Cleaning

Clean exterior surfaces of the cabinet, the Flex-arm and the C-arm with a soft cloth or disposable lint-free tissue moistened with water, isopropanol or methanol. Wipe surfaces, do not scrub.

A commercial glass cleaner may be used to clean the monitor's touch screen.

## Mechanical Checks

### Wheels

Ensure all 4 wheels are secure, properly aligned and turn freely.

Ensure the locking mechanism functions properly in all three positions. Refer to "Caster Removal/Replacement" on page 3-41 if adjustment is required.

### Monitor

Ensure monitor mounting hardware is secure.

Ensure monitor tilts and swivels properly.

### Power Cord

Ensure that the power cord plugs are not damaged.

Ensure that the power cord insulation is not cut, split, frayed or otherwise damaged.

## Horizontal Flex Arm and C-arm

Ensure that all mounting hardware, including clevis to cabinet, arm to clevis, and flex-arm to horizontal, is tight.

The horizontal arm movement should be free and unrestricted.

The flex-arm movement, right to left and left to right, should be free and unrestricted.

The flex-arm movement, up and down, can be accomplished with a maximum of approximately 35 lbs. of force when the arm is fully extended from the cabinet.

With the flex-arm lock engaged, ensure that up and down movement is restricted.

Ensure that the C-arm brake functions properly.

Ensure that with the brake disengaged, the C-arm movement is free and unrestricted.

Check for proper security of the flex-arm to C-arm shaft set-screw. This is located at the very end of the flex-arm.

Inspect for excessive end-play in the C-arm rotation mechanism. If loose, remove C-arm and main pivot pin. Tighten internal bolt until rotation is hampered, but not restricted.

# Operational Checks

Prior to beginning operational checks, ensure that the system initializes properly and is, in general, functioning properly. If it is not, bring this to the attention of the customer immediately; point out any obvious discrepancies before continuing.

## Monitor

Ensure the X-ray On lights function properly.

Ensure brightness and contrast controls function properly.

## X-ray

With x-ray on, move C-arm in all directions and observe image on monitor to ensure the image remains circular.

## Calibration and Alignment

Perform the calibration and alignment procedures described in Chapter 4.

# PM Checklist

Copy the checklist below. Complete and retain for each PM performed.

**Customer Name:** _____   **Serial Number:** _____

**PM Performed By:** _____                **Date:** _____

| Procedure | OK? |
|---|---|
| Decontamination | |
| Mechanical Checks | |
|     Wheels | |
|     Monitor | |
|     Power Cord | |
|     Horizontal Flex Arm and C-arm | |
| Operational Checks | |
|     Monitor | |
|     X-ray | |
|     Monitor/Touchscreen Calibration | |
|     Collimation | |
|     Laser Alignment | |
|     Laser Test | |
|     XRC Calibration | |
|     Image Board Calibration | |
|     KV Accuracy | |
|     MA Accuracy | |
|     Beam Quality Check | |
|     Image Quality/Resolution Check | |
|     File Saving Test | |

# Addendum
# 08-Series Serial Number Differences

This addendum provides differences for InSight Imaging systems with serial numbers in the 08-Series. It includes a view of the major components, power distribution assembly, weight/dimension/clearance specifications, and removal and replacement procedures.

## InSight Major Components

The major components of the Fluoroscan InSight Imaging System are shown below.



| | | | | |
|---|---|---|---|---|
| **A** | Touch screen monitor | | **I** | Foot switch |
| **B** | Keyboard with integrated pointing device | | **J** | Foot switch shelf |
| **C** | Flex-arm | | **K** | Image printer shelf |
| **D** | C-arm | | **L** | X-ray ON light |
| **E** | X-ray source and collimator | | **M** | C-arm retainer bracket (located on side panel) |

| F | Radiological Imaging Unit | N | Base Cabinet |
|---|---|---|---|
| G | Computer On/Standby switch | O | Control Panel |
| H | Floppy disk & DVD RAM recorder | | |

# Base Cabinet Components

## Power Distribution Assembly

The power distribution assembly, located in the lower system cabinet, AC input power is provided through an input module located at the rear of the system. Fusing of 10A is provided for nominal input voltage of 100-120 VAC and 6.3A is provided for 220-240 VAC 50/60 Hz.

The secondary of the 750 VA isolation transformer is hard wired for 120V output. The output is fused, sent through an EFI line filter then a zero crossing relay prior to distribution. Two separate lines are fed 120 VAC. The first line of AC is fed to the internal outlet strip while the second supplies the 28 VDC power supply.

# InSight Product Specifications

## Weight/Dimension/Clearance

| Height | 63.5" (161 cm) |
|---|---|
| Width | 33" (84 cm) |
| Depth | 33.75" (86 cm) |
| Weight | 551 pounds (250 kg) |
| Ground Clearance | 3.875 in (9.8cm) |
| Door Size | 32 in minimum |
| Required Floor Space | 5ft x 6.6ft (1.5m x 2.0m) |
| Floor Capacity | 149.6 lb/ft², 30.64 kg/m² |

# Functional Description

An overall InSight System Block Diagram (BD-00008) is provided in Appendix F.

Refer to the InSight Interconnect Diagram (ID-00033) in Appendix F of this manual, for detailed interconnections between system components

## Power Distribution Chassis

The Power Distribution Chassis, located in the lower system cabinet, consists of an isolation transformer, DIN Rail, line filter to reduce line noise back to the power mains, a surge suppression relay to reduce inrush currents to the isolation transformer, and a 28 VDC power supply that applies DC voltage to the X-ray Controller board.

The output of the Power Input Module is fed to the isolation transformer, which always provides a nominal 120V on its secondary. The secondary output of the transformer is fed to the DIN Rail where it is fused, through the line filter and surge suppression relay, and back to the DIN Rail. The 120V is then applied to the 28 VDC power supply and to the cabinet's internal power strip.
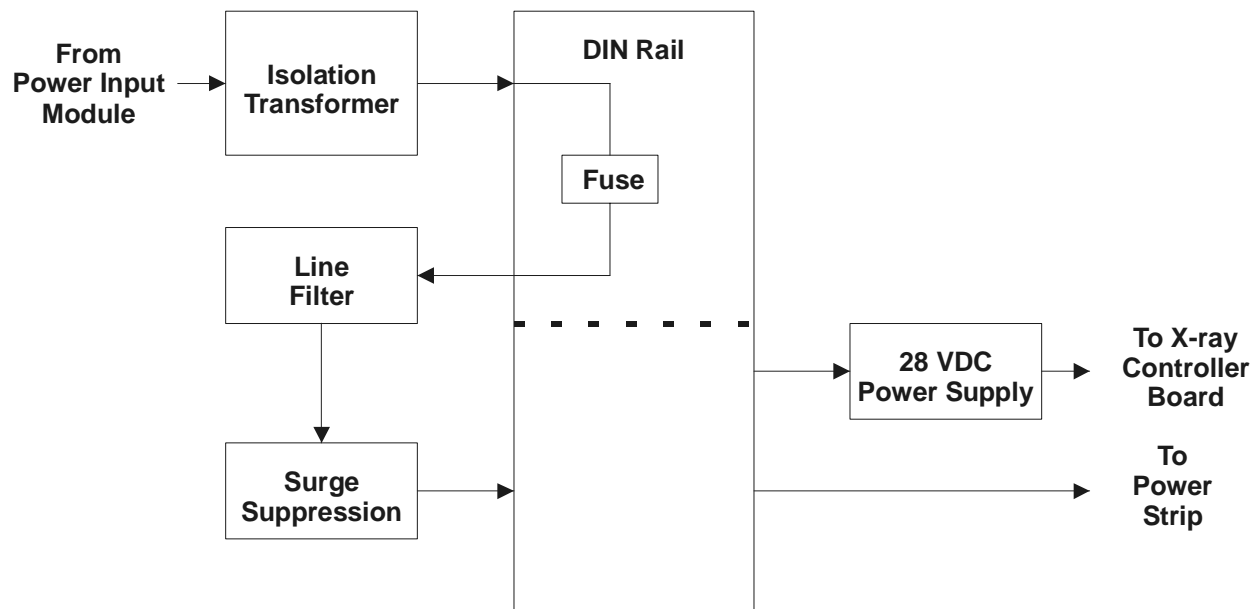
# Remove and Replace Procedures

This section provides a list of InSight Imaging System Field Replaceable Units (FRUs), their locations, and procedures for removing and replacing them on the system.

## Locations of InSight Field Replaceable Units (FRUs)

### System Cabinet

#### Upper System Cabinet

The upper system cabinet contains the computer chassis, computer battery backed power supply, system disk drives, and monitor DC power supply. The computer chassis contains the ATX Main board, Video Controller board, Image Processor board, Audio Amplifier board, and two chassis fans.

**Figure Addendum-1** Computer Chassis and System Disc Drives



Computer Chassis

DVD RAM Drive

Floppy Drive

Hard Drive

**Figure Addendum-2** Computer Battery Backed Power Supply



Computer Battery
Backed Power
Supply
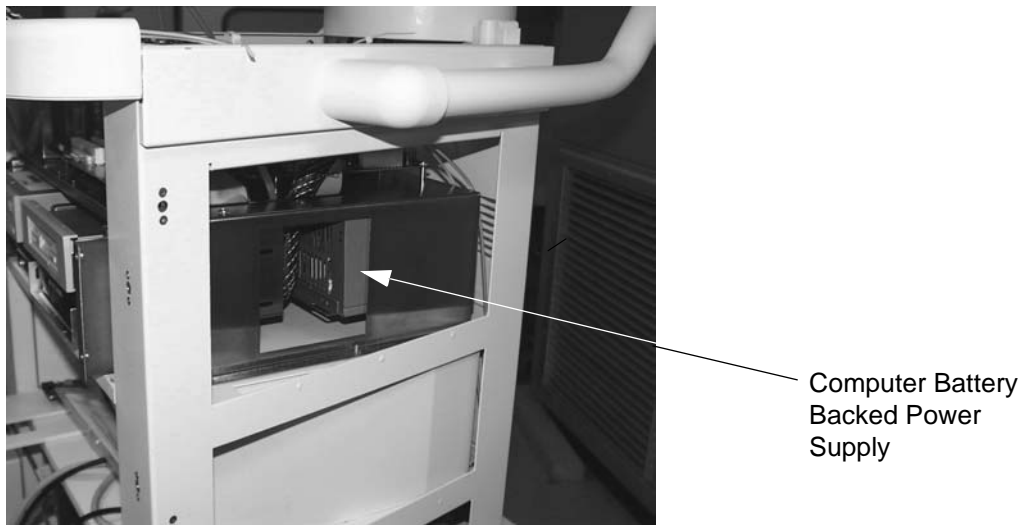
**Figure Addendum-3** Computer Chassis, PCBs
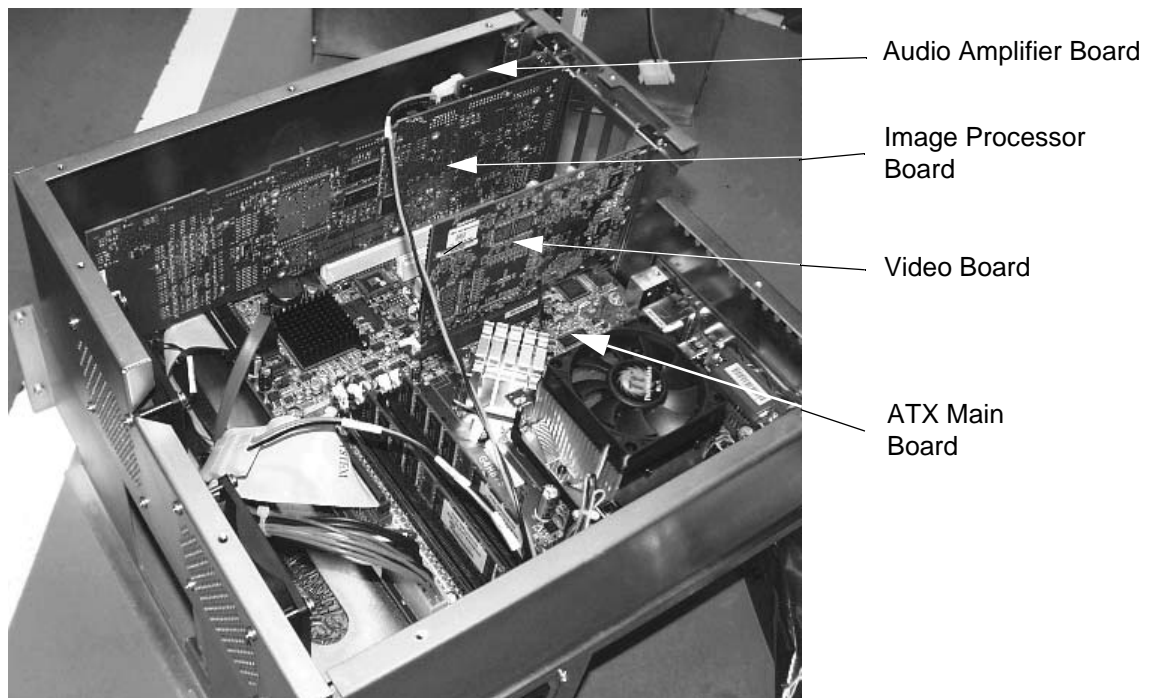


Audio Amplifier Board

Image Processor
Board

Video Board

ATX Main
Board

The monitor power supply is located in the upper system cabinet behind the computer assembly.

**Figure Addendum-4** Monitor Power Supply



Monitor Power Supply
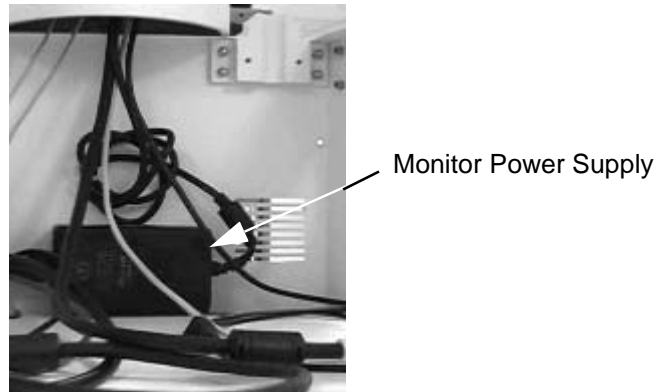
## Lower System Cabinet

The lower system cabinet contains the X-ray Controller (XRC) board, Power Distribution Chassis, and AC power strip. The Power Distribution Chassis contains the isolation transformer, DIN rail, and XRC controller board power supply.

**Figure Addendum-5** Lower System Cabinet



Isolation Transformer

DIN Rail

AC Power Strip

28V Power Supply

Power Distribution Chassis

X-Ray Controller Board
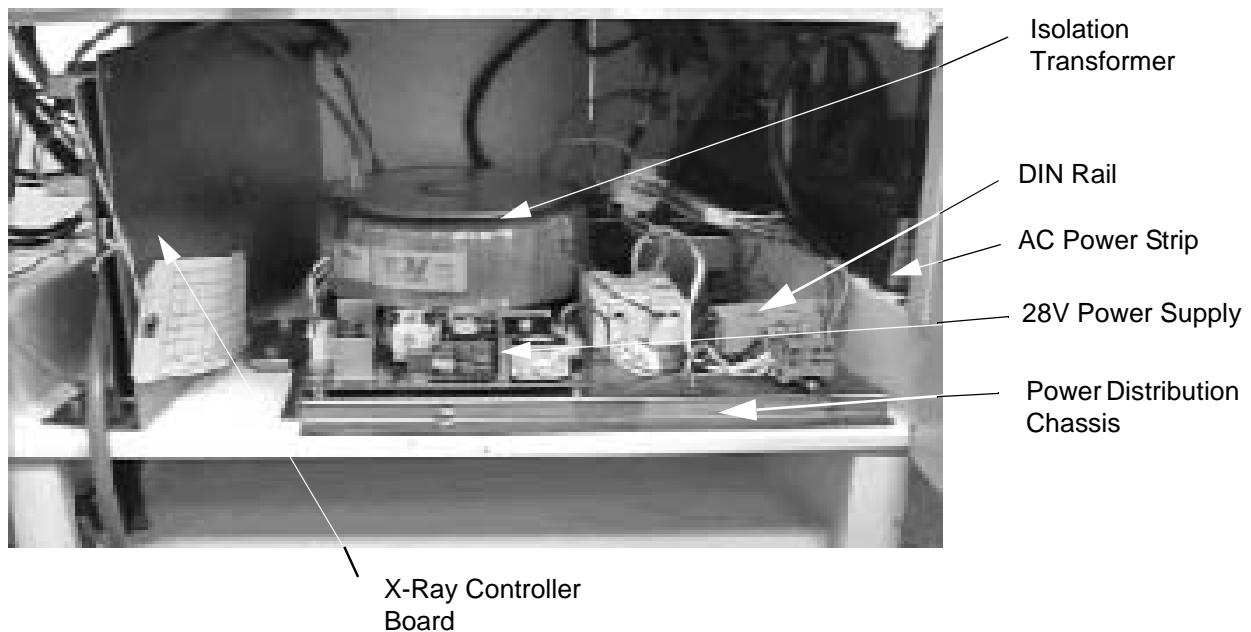
## Speaker and Cabinet Fan

Speaker and cabinet fan are located near the inside upper left corner of the rear cabinet wall.



Speaker
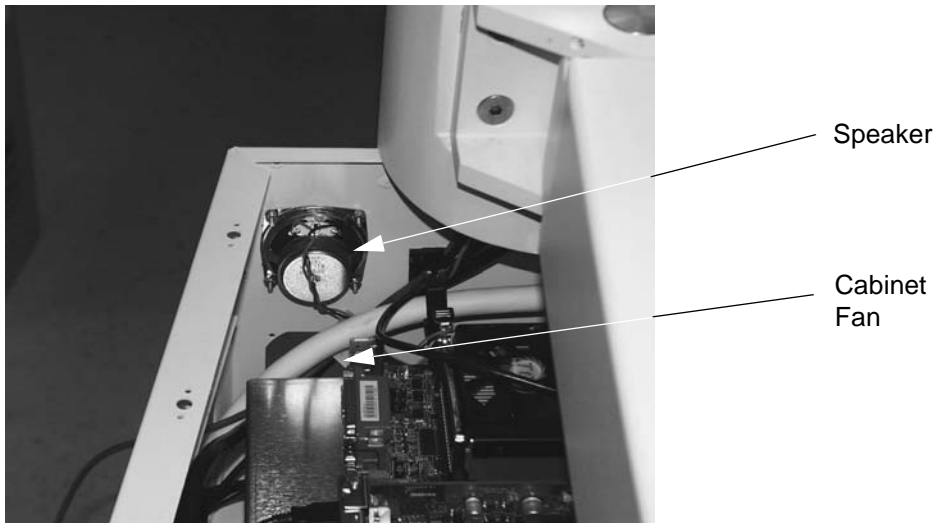
Cabinet
Fan

## Power Input Module

The power input module is located on the rear cabinet wall.
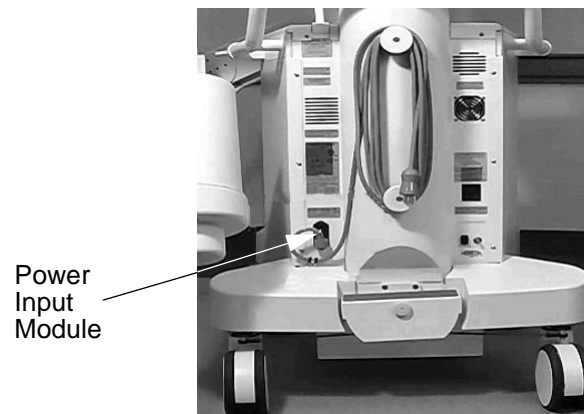


Power
Input
Module

# C-arm Assembly

The C-arm assembly contains the Articulation Unit, X-ray Head, and Image Intensifier with CCD camera.



X-ray Head

Articulation Assembly

Image Intensifier

## X-ray Head

The X-ray Head contains the Control Panel, C-arm I/O board, High Voltage Power Supply (HVPS) and X-ray Source assembly, Image Intensifier Power Supply, Collimator, and Positioning Lasers (attached to the Collimator).



C-arm PCB

Image Intensifier HVPS

Control Panel

HVPS and X-ray Source

Collimator

## Radiological Imaging Unit (RIU)
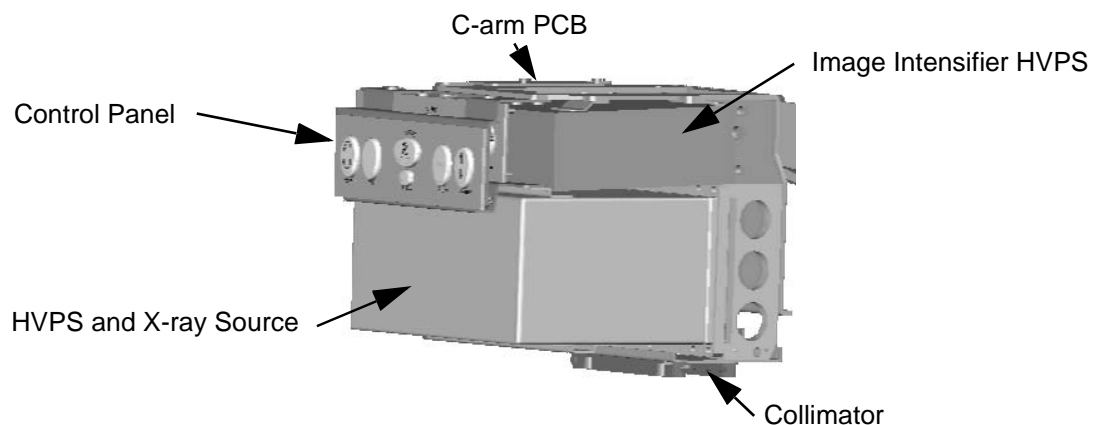
The RIU includes the Image Intensifier, CCD Camera, and the Image Intensifier Power Supply (located in the X-ray Head).



Image Intensifier

CCD Camera
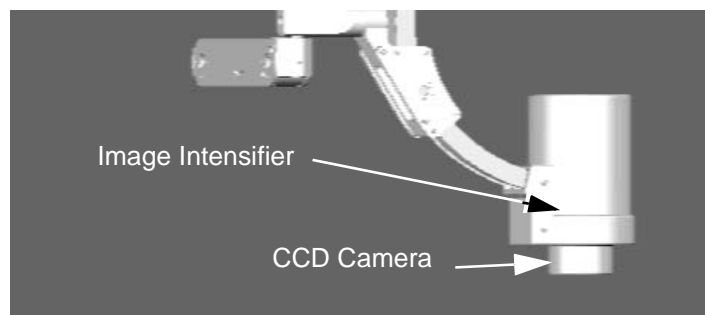
# FRU Procedures

Before removing/replacing FRUs, always shut down system software first, then turn power off using the front power switch and then unplug the power cable. Just turning off the power switch does not remove all the power to the instrument.

Whenever possible, always orient the C-arm so if you drop a screw, it falls to the floor and not into the HVPS or other component.

When removing a component, always lock the C-arm in place using the joint knob and the C-arm lever lock to prevent sudden movement from an unbalanced C-arm.

Whenever any cover is removed from the instrument, the person performing the FRU removal/ replacement procedure must wear a grounding wrist strap.

**ESD Precautions:** To prevent damage due to ESD (Electrostatic Discharge), you must take precautions when handling components. Remove any charges from your body by wearing an approved and properly grounded wrist strap. Keep PCBs and any assemblies containing PCBs in their ESD protective bag until you are ready to install them. Treat defective PCBs as new to prevent ant additional damage.

## System Cabinet Covers Removal/Replacement

Covers must be removed in the following order:

1. Side covers
2. Top cover
3. Front cover

Covers are fastened with a combination of screws, nuts and snap-on ball studs.



Remove the system cabinet covers by removing screws and snapping off the covers.

## Side Covers Removal/Replacement

Remove three screws securing each cover to the cabinet.
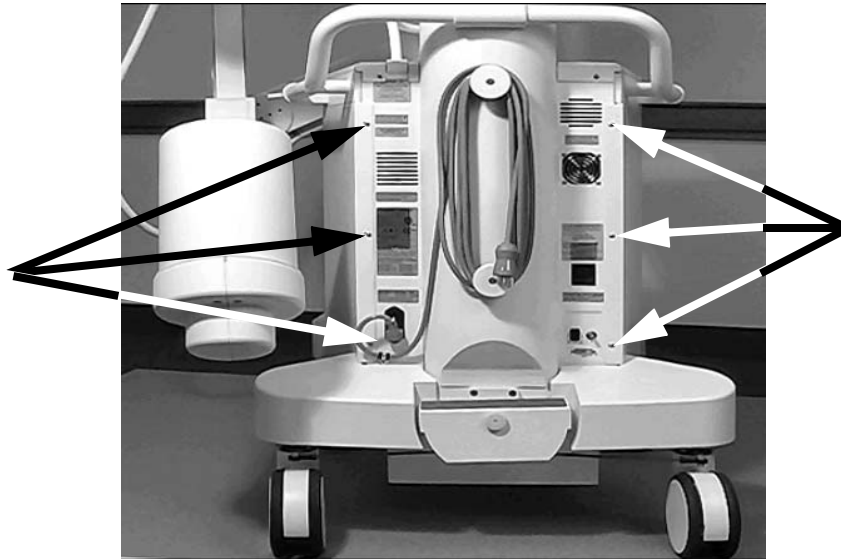


Snap off the covers.

## Top Cover Removal/Replacement

Remove System Cabinet side covers.

Remove two screws securing the cover to the cabinet.
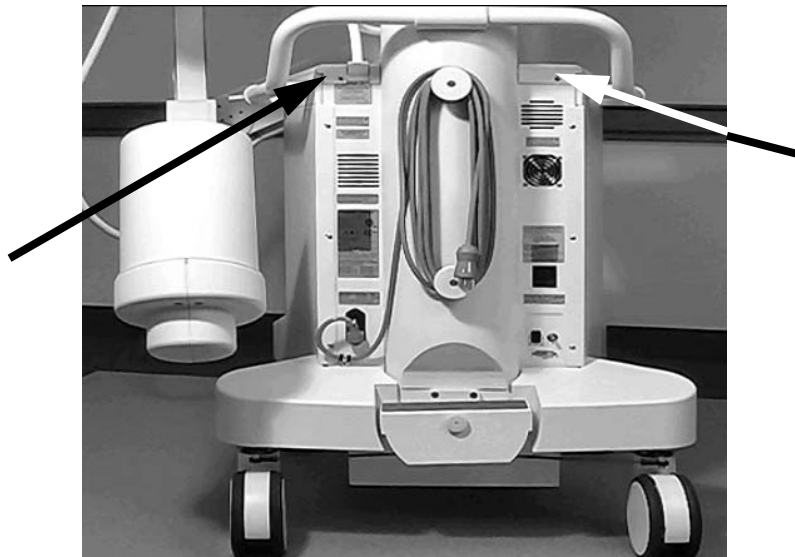


Snap off the top cover.

## Front Cover Removal/Replacement

Remove System Cabinet side covers.

Remove two screws (one per side) securing the cover to the cabinet.

Screws (located inside the front side rails)



Snap off the front cover.

# Computer Chassis Cover Removal/Replacement

Position monitor, keyboard and C-arm to provide access to top cover.



Remove System Cabinet side and top covers.

Remove nine screws securing the cover to the computer chassis and remove cover toward the front of the instrument.



This gives you access to all the components in the computer assembly.

# Video Controller Removal/Replacement

Remove system cabinet side and top covers.

It is not necessary to remove the Computer Assembly to replace the Video Controller board.

Remove the computer assembly cover (see "Computer Chassis Cover Removal/Replacement" on page Addendum-12.).

Video
Controller
Board

Video
Controller
Cables
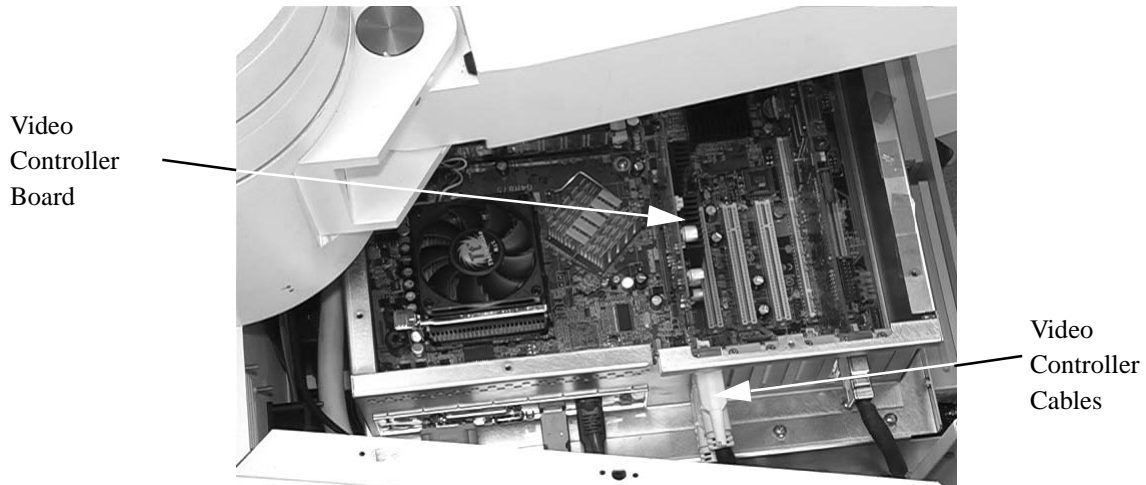
Remove the two video cables.

Remove the screw securing the controller board to the computer chassis.

Remove the controller board.

# Image Processor Board Removal/Replacement

Remove system cabinet side and top covers.

It is not necessary to remove the Computer Assembly to replace the Image Processor board.

Remove the computer assembly cover (see "Computer Chassis Cover Removal/Replacement" on page Addendum-12.).

Image
Processor
Board

Image
Processor
Cable
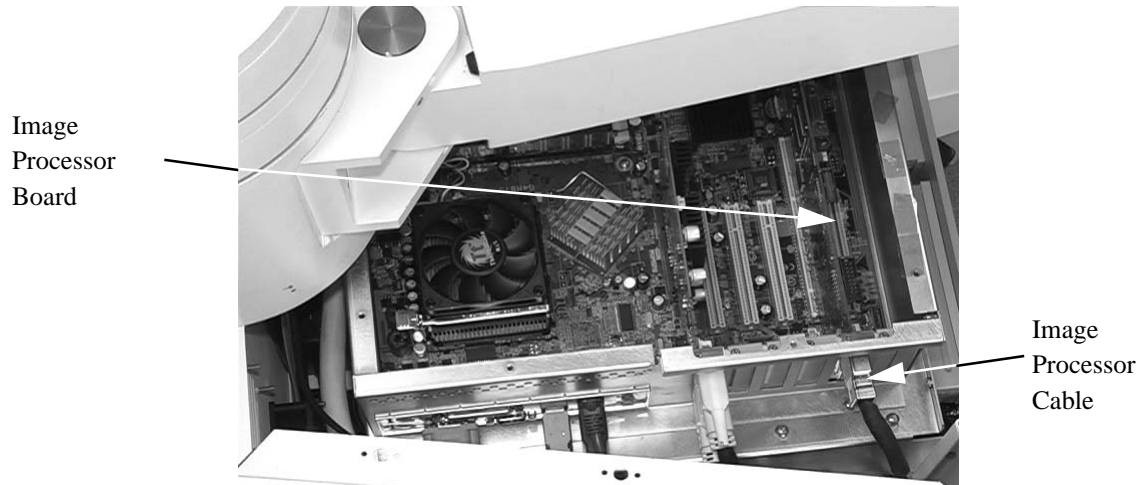
Remove the Image Processor cable.

Remove the screw securing the board to the computer chassis.

Remove the board.

## Audio Amplifier Board Removal/Replacement

Remove system cabinet side and top covers.

It is not necessary to remove the Computer Assembly to replace the Audio amplifier board.

Remove the computer assembly cover (see "Computer Chassis Cover Removal/Replacement" on page Addendum-12.).

Audio Amplifier Board ⎯⎯⎯⎯

Internal speaker Cable⎯⎯⎯
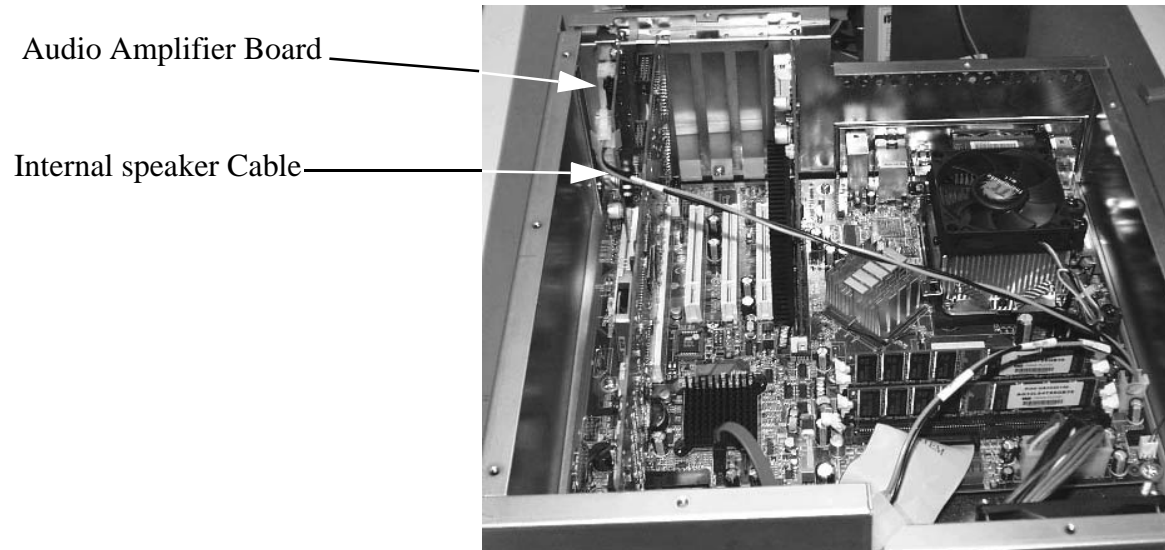
Disconnect the internal speaker cable from the Audio Amplifier board.

Disconnect the Audio Amplifier board to speaker cable.

Remove the screw securing the board to the computer chassis.

Remove the board.

# Computer Assembly Removal/Replacement

Remove cabinet side, top and front panels.

Remove front handle by removing screws under the handle end pieces. Slide the handle into one of the end pieces and rotate it out of the other end piece.

4 screws (located under the handle end pieces)



To remove, detach the front arm, by removing the screws located here

Remove two nuts on the right hand side of the computer chassis.
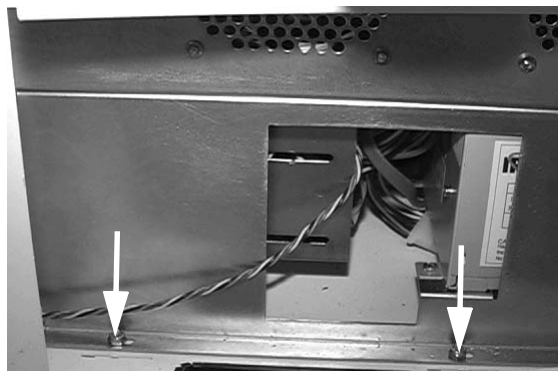
Remove two nuts on the left hand side of the computer chassis.
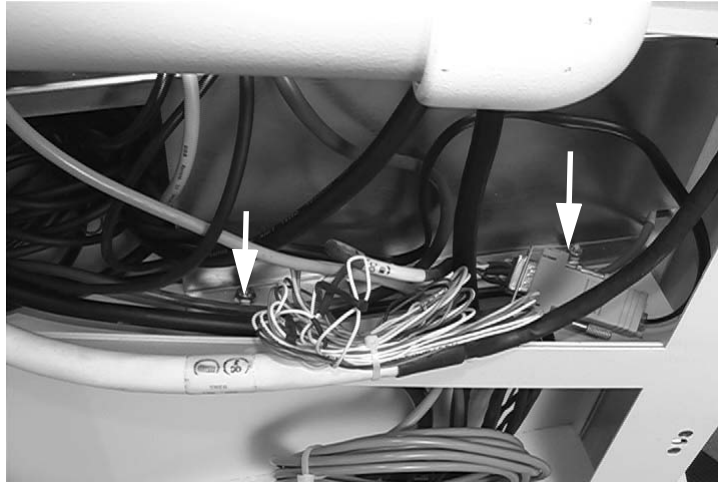


Remove the mouse, keyboard, serial, USB, network, video display, image processor, audio amplifier, and AC input cables.
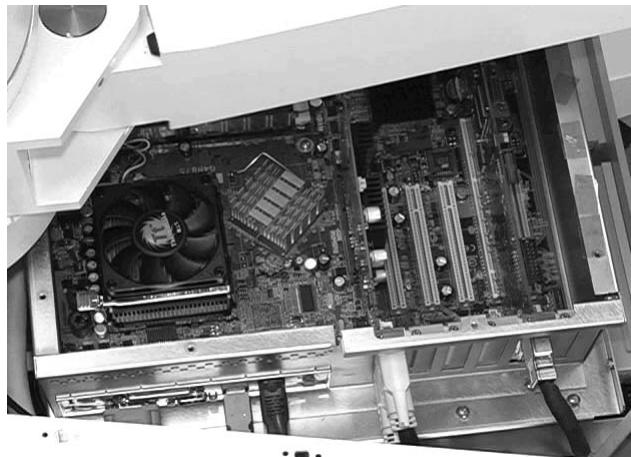


Disconnect the DC power cable connectors from the battery backed power supply to the X-ray Controller board and the cabinet fan. You may have to remove the system disc drive bays to gain access to these two connectors (see "System Disk Drives Removal/Replacement" on page Addendum-19.).

Lift the assembly off the four mounting posts and remove it toward the front of the instrument.

## ATX Main (Computer) Board

Remove the Computer assembly (see "Computer Assembly Removal/Replacement" on page Addendum-16.)

Remove the Computer chassis cover (see "Computer Chassis Cover Removal/Replacement" on page Addendum-12.).

Disconnect the two power cables.

Remove the video controller, image processor and audio amplifier boards.

Remove 10 screws.

In the figure below, the ATX Main board is shown unscrewed and removed from the chassis.



Screws (10)
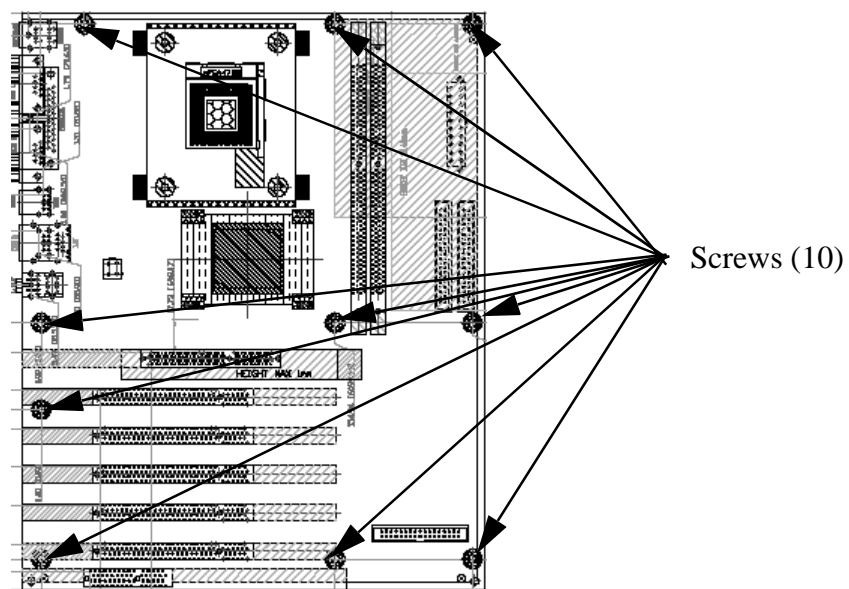
Lift the board off the mounting posts.

## Computer Battery Backed Power Supply

Remove the Computer assembly (see "Computer Assembly Removal/Replacement" on page Addendum-16.)

Remove the System Drive bays (see "System Disk Drives Removal/Replacement" on page Addendum-19.).

Remove five screws securing the power supply to the computer assembly.
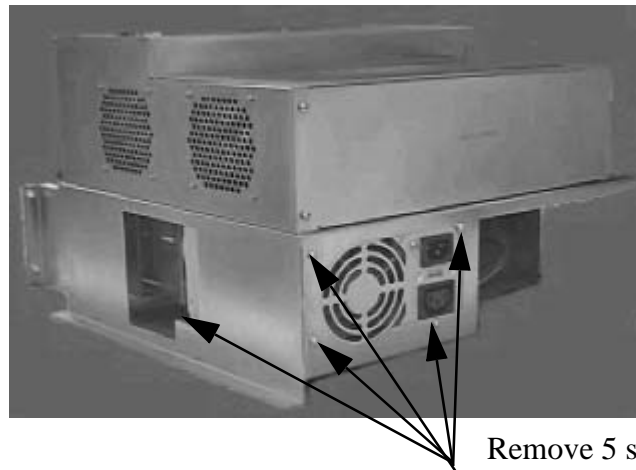


Remove 5 screws

Slide the power supply out of the computer assembly.

## System Disk Drives Removal/Replacement

Remove cabinet side, top and front panels.

Remove four screws securing the disk drives front panel to the computer chassis.
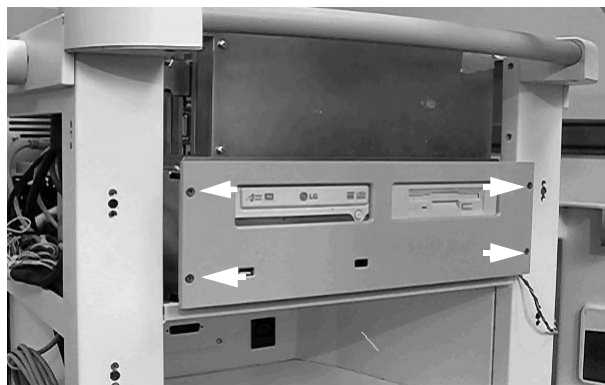


Be careful removing the cover, the USB cable is attached to the back of the cover.
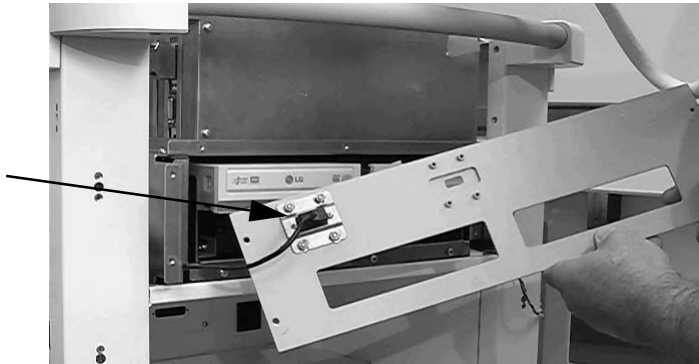
Remove two screws securing the drive bay to be removed.



Slide the respective bay out enough to remove the drive's power and interface cables.



Remove the respective drive by removing the screws (two on each side) securing the drive to the bay.

## 28 V Power Supply Removal/Replacement

Remove System Cabinet front cover.

Remove the AC in and DC out cables.

Remove four nuts on each corner of the board.

AC in

DC out

Lift the board off the four studs.

## Power Distribution Chassis Removal/Replacement

Remove System Cabinet front cover.

Remove two front screws.

Loosen two side screws.

Loosen
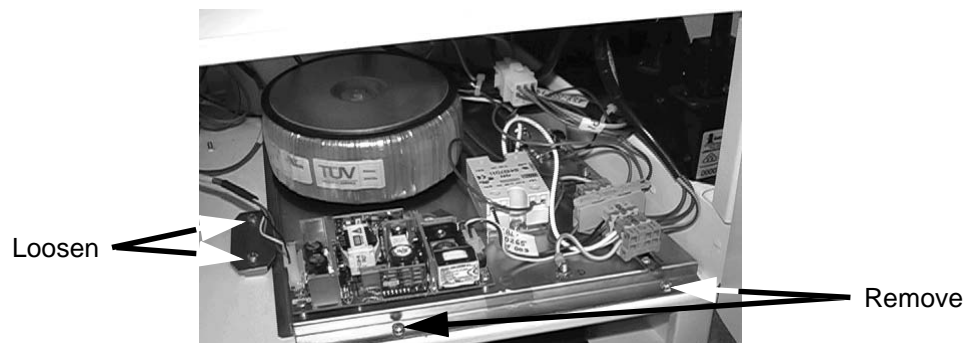
Remove

Remove the AC power input (Molex connector), 28V power output to the XRC Controller, and the AC output to the power strip cables.

XRC Power

Molex Connecto
to Power Input
Module
(Unplugged)

AC Power to
Power Strip
(Unplugged)

Slide the Power Distribution Chassis out of the unit.

## Power Input Module Removal/Replacement

Power Input Module is located on the back of the system cabinet.
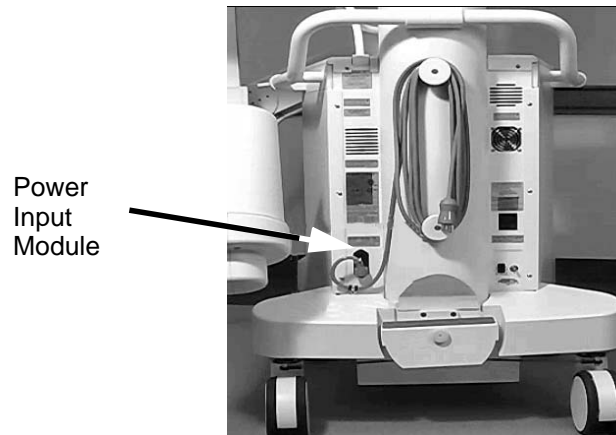


Power
Input
Module

Remove the AC cable connector from the module.

Use a small flat blade screwdriver to pry the module out.

The input power fuses are accessible after prying the module out.



## X-ray Controller Assembly Removal/Replacement

Remove system cabinet left side cover.

Disconnect the cables from the assembly.

Remove three nuts securing the XRC assembly to the lower system cabinet shelf.
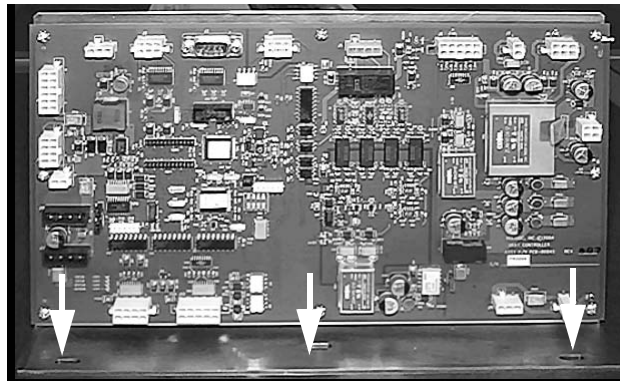


Remove the assembly.

# C-Arm Covers Removal/Replacement

Whenever possible, when removing/replacing C-arm FRUs, always orient the C-arm so if you drop a screw, it falls to the floor and not into the HVPS or other component.

Always lock the C-arm in place using the joint knob and the C-arm lever lock to prevent sudden movement from an unbalanced C-arm.

The X-ray Head has three covers. The Image Intensifier has two covers.

## X-ray Head Covers Removal/Replacement

Remove screw on back of X-ray Head.
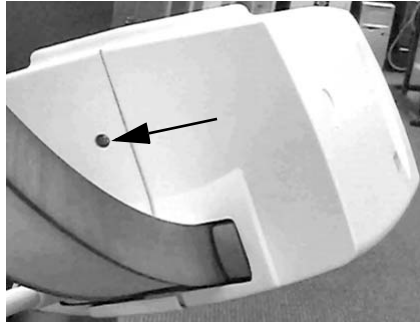
Remove screw on bottom of X-ray Head.
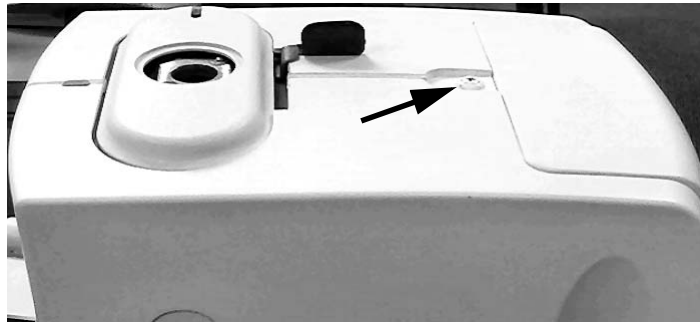
Remove the right side panel.

Remove three screws holding left side panel and remove panel.
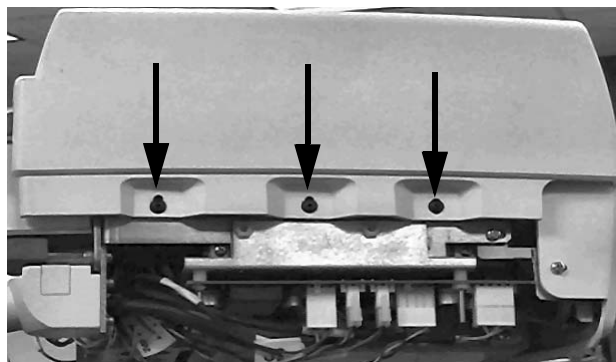
## Control Panel Cover Removal/Replacement

Remove three screws from lower side of Control Panel cover.
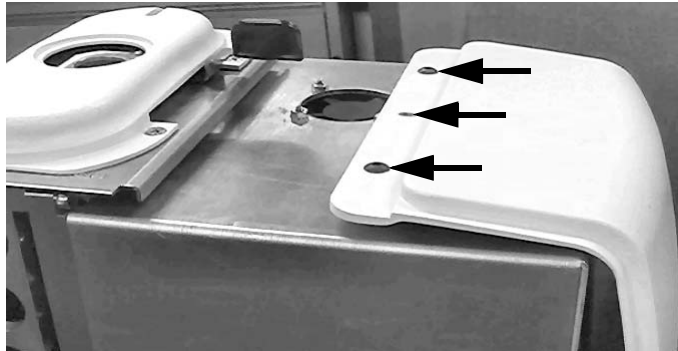


Remove two screws from upper side of Control Panel cover.
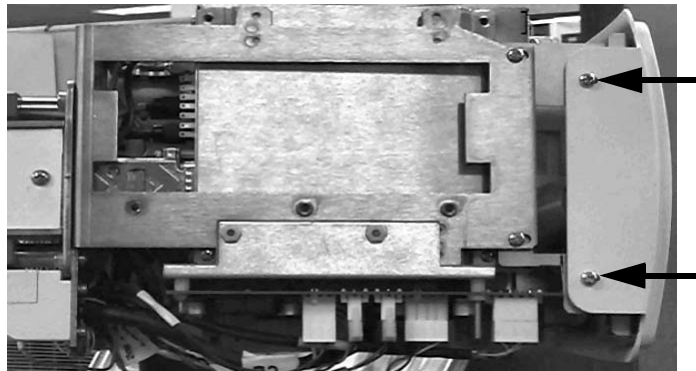


## Control Panel Removal/Replacement

Remove the X-ray Head covers.

Remove the Control Panel bracket by removing four screws.



Remove the interface cable and remove the Control Panel and bracket.

## C-arm I/O Board Removal/Replacement

The C-arm I/O board is removable from the top of the X-ray Head.

Remove the X-ray Head covers.

Unplug the C-arm I/O cables (7).

Remove two plastic nuts holding the board in place and remove the board.
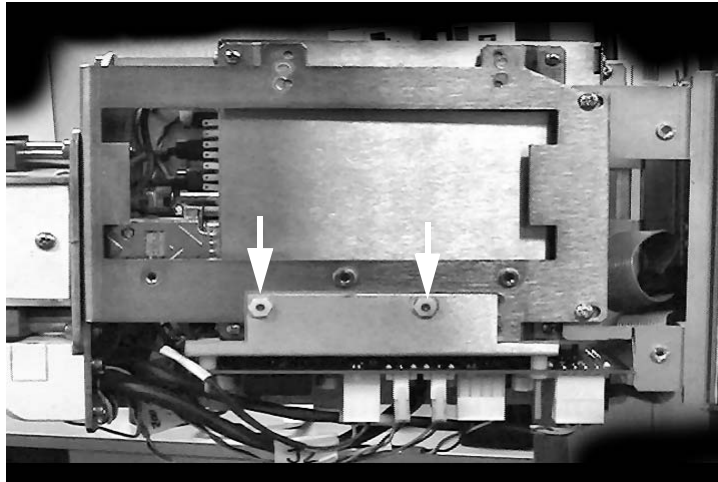


## Collimator Removal/Replacement

The Collimator is located on the underside of the X-ray Head.

Remove the X-ray Head covers.

Remove four screws securing the collimator to the X-ray Head plate.
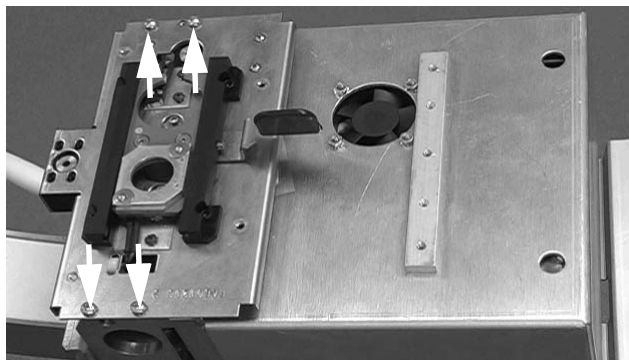


Flip the Collimator over and unplug the positioning laser cables.

Positioning
Laser
Cables



Collimator
Adjusting
Screws
(2)

Collimator
Lock Down
Screws
(2)



Secondary
Collimator
Adjustment
Screws

Positioning Lasers

## HVPS/X-ray Source Assembly Removal/Replacement

**Warning:** **When removing/replacing the HVPS/X-ray Source assembly, be sure to lock the C-arm in place. If the C-arm is unlocked, removing the HVPS/X-ray Source assembly will cause the C-arm to move suddenly and could cause damage to the unit and injury to you.**



C-arm Lever Lock

Joint Knob
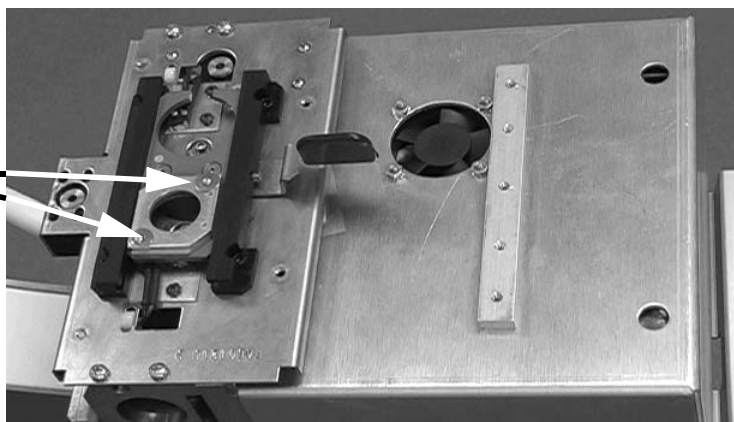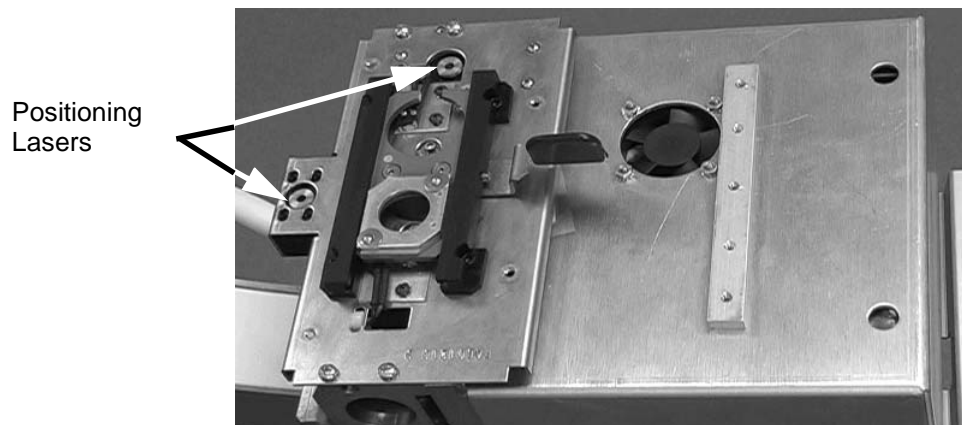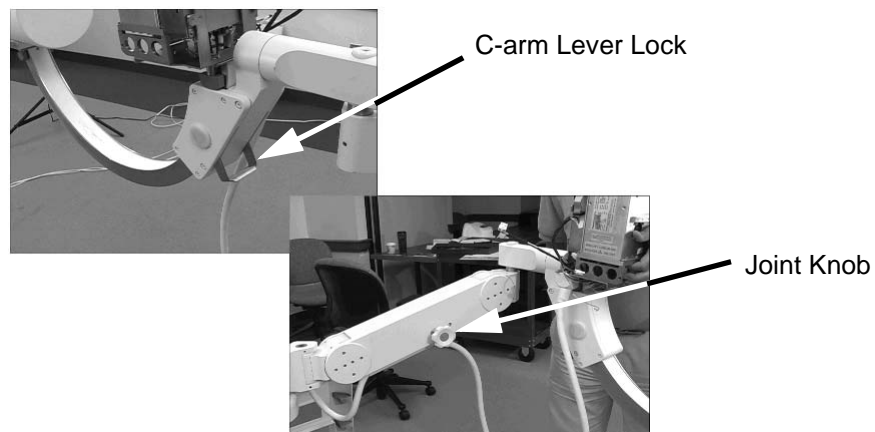
Remove the X-ray Head covers.

Remove the Collimator.

Rotate the C-arm to view the top of the X-ray Head.
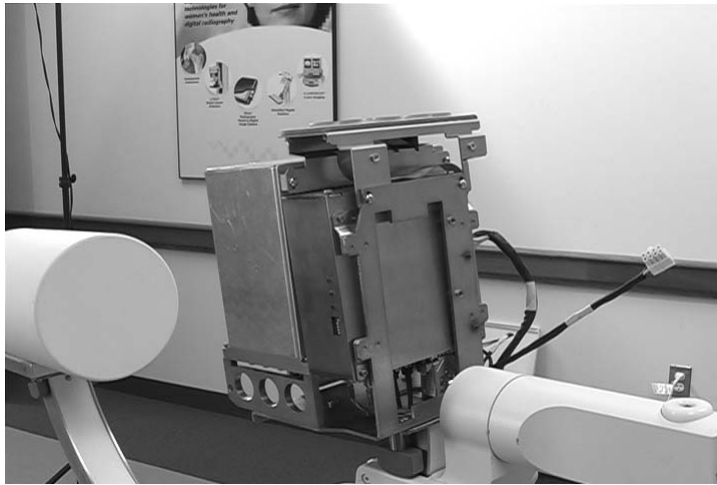
Remove two screws that attach the control panel plate.



Re-orient the C-arm to view the bottom of the X-ray Head.

Loosen six bolts located on the bottom of the mounting plate.
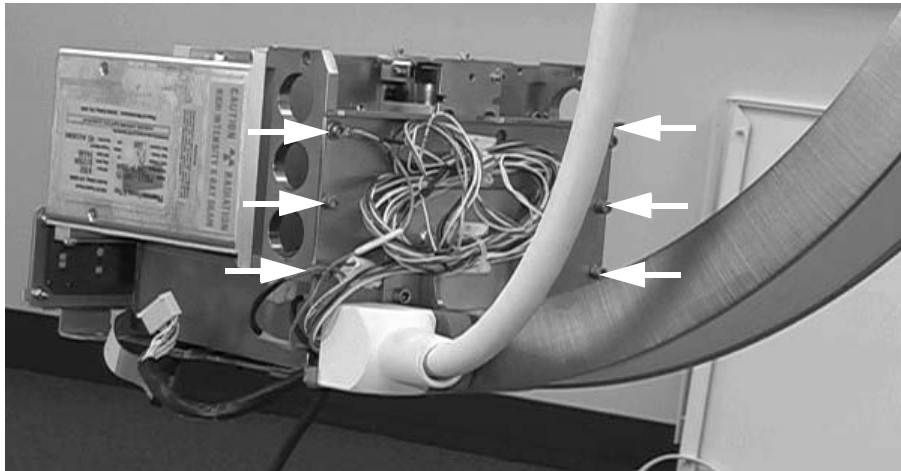


Rotate the C-arm so that the X-ray Head is positioned as shown below.

**Be sure to lock the C-arm in place**.



Finish removing the six mounting bolts located on the bottom of the mounting plate.

Lift the HVPS/X-ray Source assembly, from its mounting plate, unplug the interface cable, and remove the assembly.

# Radiological Imaging Unit (RIU) Removal/Replacement

**Notes: The RIU and power supply are a matched set and must be replaced as a pair.**

**Warning:  The C-arm must be solidly locked in position prior to the removal of the Image Intensifier. Otherwise when the weight of the Image Intensifier is removed the arm can quickly raise causing serious injury.**



C-arm Lever Lock

Joint Knob

The RIU is located in two places.



Image Intensifier
Power Supply
(located in X-ray Head)
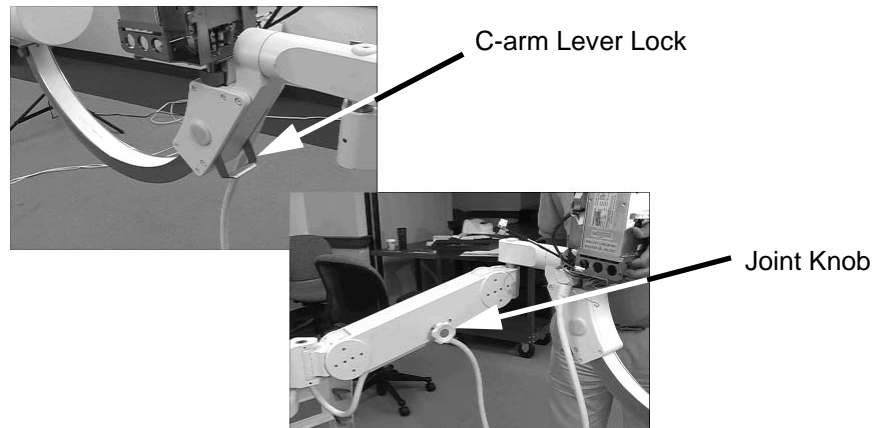
Image Intensifier,
CCD Camera, and Lens
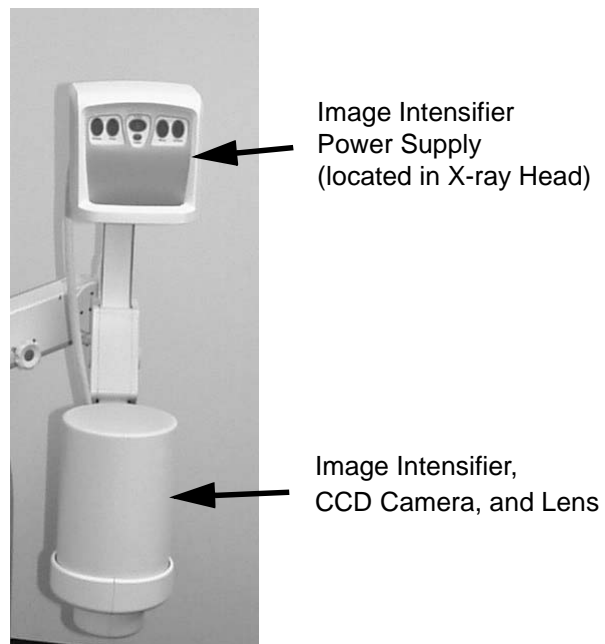
Remove the Image Intensifier covers (two side screws and two bottom screws).

Remove the X-ray Head covers (see "X-ray Head Covers Removal/Replacement" on page Addendum-24.).

Remove the +28V power connector and signal interface cable from the camera.



Power         Signal Interface

Position the C-arm so that the Control Panel is at the top.

Remove the four Phillips head screws mounting the power supply.

Rotate the power supply to gain access to the cables on the back of the power supply. Note the position of the cables and remove them by turning the lock nuts until they are loose and pull the cable out of the receptacle.



Remove the power supply.

Remove the lock nuts and o-rings from the power supply cables noting the position of the o-rings.

Attach a piece of string or wire to the power supply cables to use when routing the cables when installing the new image intensifier. This will be pulled through the C-arm when removing the cables and used to pull the new cables back into the proper position.

Remove the four allen head screws attaching the Image Intensifier to the C-arm.



Slowly lift and rotate the Image Intensifier while pulling the cables out of the C-arm. Remove the string or wire that was attached to the cables previously, leaving it routed through the C-arm, and place the image intensifier on a stable surface.

Position the new image intensifier close to the C-arm and attach the string or wire to the cables of the new Image Intensifier.

While pulling the cables through the C-arm carefully position the Image intensifier and attach it to the C-arm with the four allen head screws removed earlier.

Install the locknuts and o-rings on the power supply cables.

Attach the cables to the new power supply.

Rotate the new power supply into position and secure it with the four Phillips head screws removed earlier.

Insert the power cord and power InSight up.

Verify the collimation and adjust if necessary (see "Collimation" on page Addendum-3.).

Run the XRC Calibration routine (see "X-ray Controller Calibration" on page Addendum-8.).

Run the Image Controller board calibration routines (see "Image Board Calibration (Unwarp/ Flat Field)" on page Addendum-9.).

Backup the system to the DVD RAM.

# Monitor Removal/Replacement

Remove four screws from the back of monitor housing cover and remove the cover.
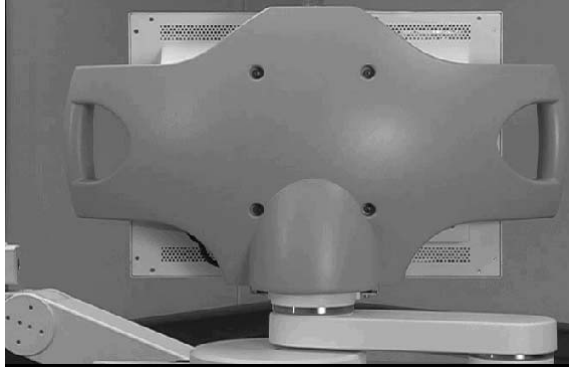


Detach all monitor cables including the X-ray On light cable.
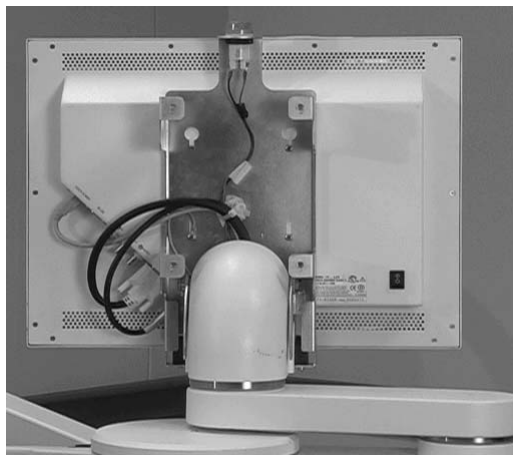


Remove two screws from the bottom of the monitor bracket. These are special screws. Be careful not to lose them.
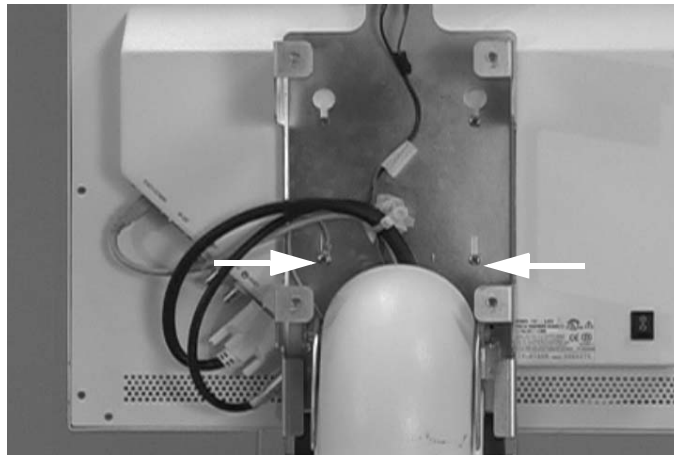
Loosen two screws from the top of the monitor bracket. Lift up on the monitor and pull it away from the bracket.
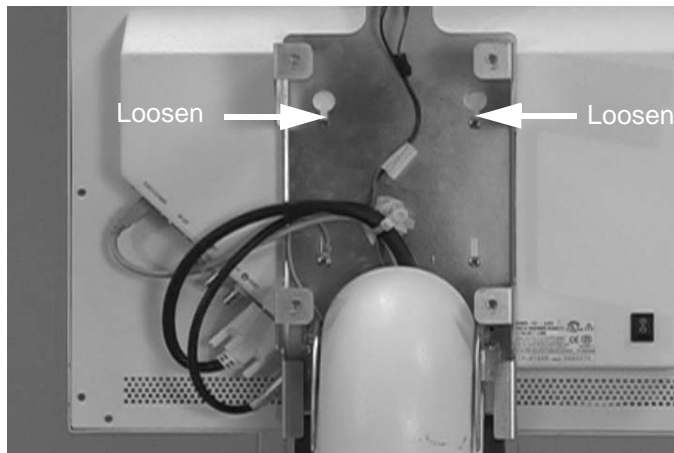
# Monitor Power Supply Removal/Replacement

The monitor power supply is located in the upper system cabinet behind the computer assembly. It is attached to the back wall of the system cabinet with VELCRO® strips.



Monitor Power Supply
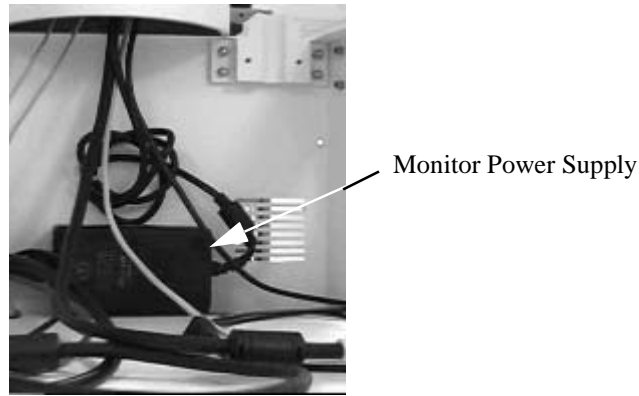
Remove the system cabinet side covers.

Disconnect the power supply's AC input cable from the power strip.

Disconnect the supply's DC cable from the monitor (see "Monitor Removal/Replacement" on page Addendum-37. for details).

Move the computer assembly forward enough to access the power supply (see "" on page Addendum-18. for details).

Pull the power supply away from the wall.

# Keyboard Removal/Replacement

Disconnect the mouse/keyboard cable from the I/O Ports panel of the Computer Assembly.



Mouse connector

Keyboard connector
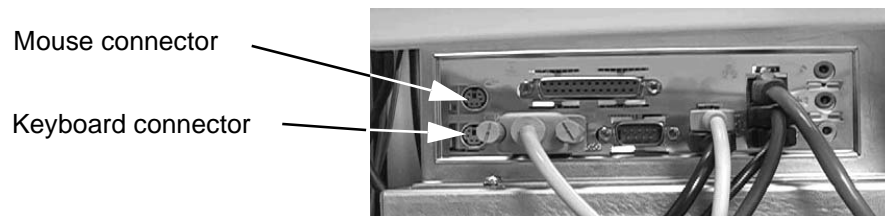
Remove the keyboard cable from the central turn table and the bottom portion of the keyboard tray arm.

Lift the keyboard and cable from the tray.

# Speaker Removal/Replacement

Remove System Cabinet left side and top covers.

Unplug the speaker cable from the Audio Amplifier board.

Remove four nuts and remove speaker.



Speaker

# Cabinet Fan Removal/Replacement

Remove System Cabinet left side and top covers.

Disconnect the cabinet fan power cable connector from the battery backed power supply. You may have to remove the system disc drive bays to gain access to these two connectors (see "System Disk Drives Removal/Replacement" on page Addendum-19.).

Remove four screws and nuts and remove the fan and two fan guards (one inside and one outside).



Cabinet Fan

# Fuses

There are three fuses located in the system cabinet, two in the Power Input Module and one located on the DIN Rail of the Power Distribution Chassis.

## Power Input Module Fuses

Remove the Power Input Module (see "Power Input Module Removal/Replacement" on page Addendum-22.).

The fuses are accessible after prying the module out.



Fuse ratings:

100 - 120V input - 10A Time Delay

220 - 240V input - 6.3A Time Delay

## DIN Rail Fuse

Remove the front panel.

It is not necessary to remove the Power Distribution Unit to replace the DIN Rail fuse.



Fuse holder
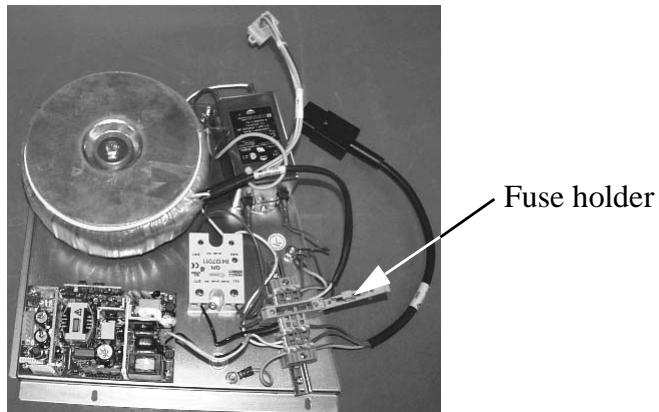
Fuse Rating:

0.8A Slow Blow

# FRU List

| Part Number | Description |
|---|---|
| CMP-00132 | Computer, InSight Assembly |
| CMP-00087 | Video Controller Bd, AGP P650 |
| CMP-00109 | Image Processing Bd |
| PWR-00029 | Pwr Sply, 200W ATX w/Battery |
| CMP-00139 | Keyboard w/Pointer, PS2 |
| CMP-00085 | Display,Mono,19.6", w/Touch |
| PWR-00044 | Pwr Sply, Display Monitor |
| CMP-00089 | Hard Disk Drive, 80GB, Serial |
| CMP-00276 | Printer, Sony UP D897 |
| CMP-00305 | Printer, Hybrid Graphic UP 990 |
| SWC-00028 | Footswitch, Triple No Guard |
| SWC-00040 | Footswitch, Double w/pushbutton |
| FAB-01059 | Control Panel, InSight |
| MEL-00084 | Radiological Imaging Unit |
| ASY-00893 | Assy, InSight HVPS |
| PCB-00046 | C-Arm PCB |
| ASY-00873 | Assy, Flex Arm |
| ASY-00776 | Assy, InSight XRC |
| ASY-00162 | C-Arm w/Carriage |
| ASY-00779 | Assy, Isolation XFMR |
| PWR-00015 | Power Supply, 28V, 100W |
| 110357 | Drive, 3.5" Floppy |
| CMP-00090 | DVD Ram Drive |
| 210511 | Assy, Cable Beam Limit |
| ASY-00841 | Assy, DIN Rail |
| ASY-00862 | AC Inlet Module |
| ASY-00900 | Assy, Fan |
| ASY-01013 | PC Chassis Fan |
| ASY-00787 | Assy, Pedestal Caster Lock |
| MME-00216 | Caster, Front, InSight |
| MME-00217 | Caster, Rear, InSight |
| FAB-01261 | Cover, Tubehead, Front |
| FAB-01262 | Cover, Tubehead, Left |
| FAB-01263 | Cover, Tubehead, Right |
| FAB-01264 | Cover, Foot Front, Left |
| FAB-01265 | Cover, Foot Front, Right |
| FAB-01266 | Cover, Front Panel |
| FAB-01267 | Housing, Monitor |
| FAB-01268 | Cover, Foot Rear, Left |
| FAB-01269 | Cover, Foot Rear, Right |
| FAB-00054 | Cover, Right, II |
| FAB-00055 | Cover, Left, II |

| | |
|---|---|
| CMP-00137 | Media, Blank DVD |
| ASY-00877 | Assy, PC Speaker |
| 485-0074 | Holder, Lamp 4 LED |
| IND-00005 | LED Quad Yellow |
| ASY-00901 | Computer Pwr Swt/Led |
| CKB-00019 | Fuse 5x20, 10A, 250V, SB |
| 110426 | Joint Knob |
| 110447 | Brake Washer |
| 110655 | Brake Assy Cap |
| 110687 | Pivot Block Cap |
| ASY-01109 | Assy, X Laser |
| ASY-01110 | Assy, Y Laser |
| CKB-00006 | Fuse 3.15A SB |
| CKB-00010 | Fuse 0.8A SB |
| CKB-00019 | Fuse 10A |
| CKB-00005 | Fuse 6.3A |
| PCB-00071 | Audio Amp Bd |

# Appendix A
# Laser Target Template

Use the following illustration as a template. Copy the template, cut it out and tape it onto the Image Intensifier cover. The axis that represents the horizontal must be parallel to the C-Arm; the vertical axis will be perpendicular to the C-arm.
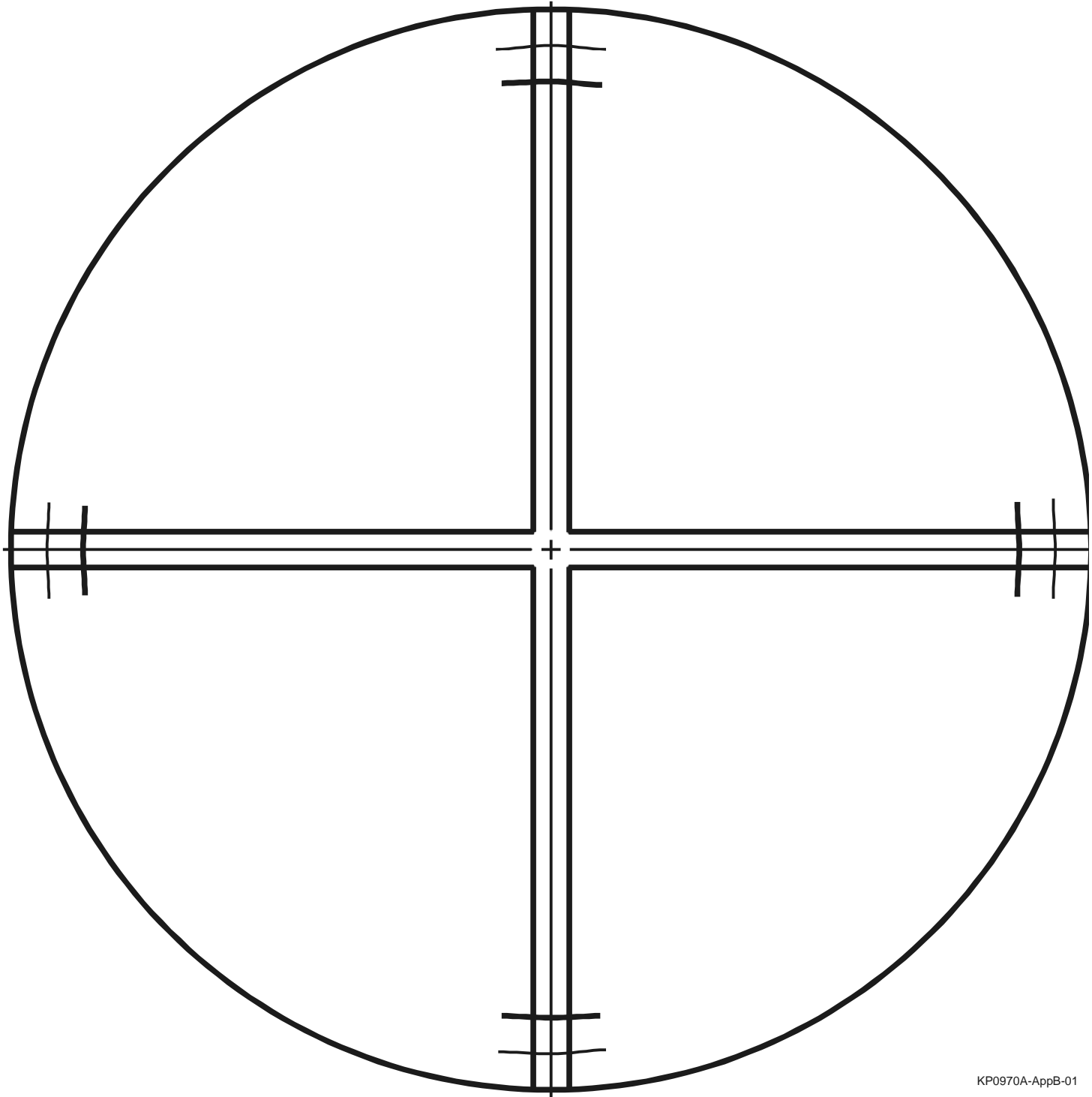
KP0970A-AppB-01

# Appendix B
# Attaching an External Video Monitor

InSight Fluoroscan can output either Composite video (CVBS) or S-video (Y/C). The Premiere Encore only outputs RS-170 (sometimes called RGB) video. These are three different video coding standards and are not compatible with each other.

For most applications that require attaching a second video monitor to the InSight Fluoroscan, Hologic Product Support recommends using the S-video output. Most screen projectors, VCRS, and other video equipment now support S-video and its output is a little better than composite video.

InSight uses a two-part adapter that connects to the DVI port on the back of the system. The first part is a DVI-a (Digital Visual Interface - analog) to VGA adapter and connected to that is a VGA to both S-video and Composite video adapter.
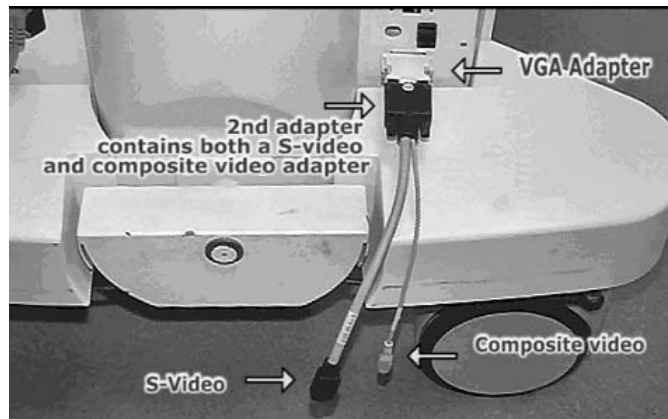


**Figure B-1** Video Adapters

Although it is possible to use the VGA adapter for screen projectors or computer monitors, it is not recommended. The screen projector has to support a resolution (either native or interpolated) of 1600x1200 pixels.

Normal video monitors do not support resolutions of 1600x1200.

# Troubleshooting

**Problem** - No Video Output at the External DVI Port

**Cause** - The Video Controller card may not be setup properly.

**To set up the Video Controller:**

| Step | Action |
|------|--------|
| **1** | From the InSight application select End Session and enter the System Configuration menu. From the System Configuration menu select Administrative Settings. |
| **2** | From the Administrative Settings menu go to the System Shutdown area and deselect "Shut down Fluoroscan upon application shutdown". |
| **3** | Select **OK** and **Shutdown** to exit from the InSight application. |
| **4** | Go to the Control Panel and select Matrox PowerDesk-HF. |
| **5** | On the Select a Category dialog, click **Multi-Display Setup**. |
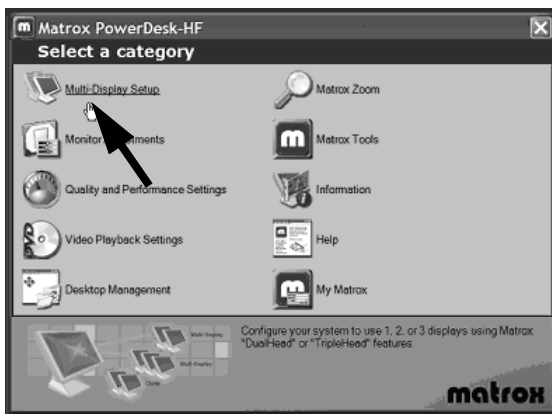


*The Multi-Display Setup dialog appears.*

| | |
|------|--------|
| **6** | On the Multi-Display Setup dialog, scroll down in the *Other display setups* section and click **2 displays. Clone mode (including features)**. |
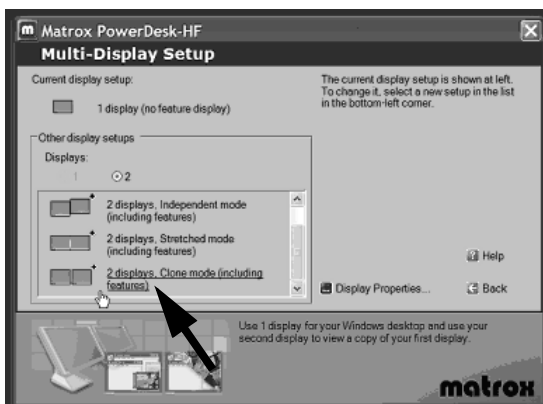
**Step    Action**

*The monitor will blank out and reset itself - this is normal.*

*The Multi-Display Setup window should look like the following:*
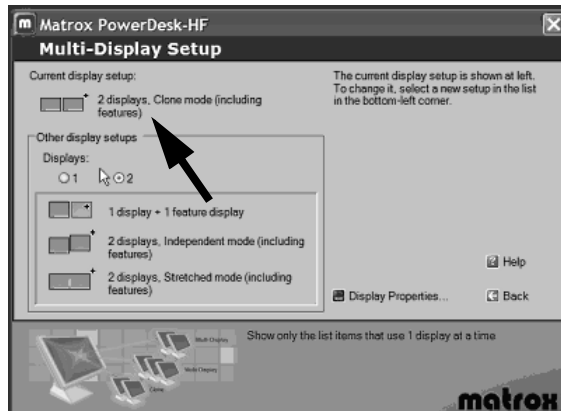


**7**    Click **X** in the upper right corner to close the Matrox PowerDesk-HF application.

*InSight Fluoroscan is now configured for attaching an external monitor.*

**Problem** - The external video monitor does not show the entire monitor screen. It just shows the Fluoroscan X-ray image.

**Cause** - The Video Controller card is not setup properly.

**To setup the Video Controller.**

**Step    Action**

**1**    From the InSight application select End Session and enter the System Configuration menu. From the System Configuration menu select Administrative Settings.

**2**    From the Administrative Settings menu go to the System Shutdown area and deselect "Shut down Fluoroscan upon application shutdown".

**3**    Select **OK** and **Shutdown** to exit from the InSight application.

**4**    Go to the Control Panel and select Matrox PowerDesk-HF

| Step | Action |
|------|--------|
| **5** | On the Select a Category dialog, select **Video Playback Settings**. |
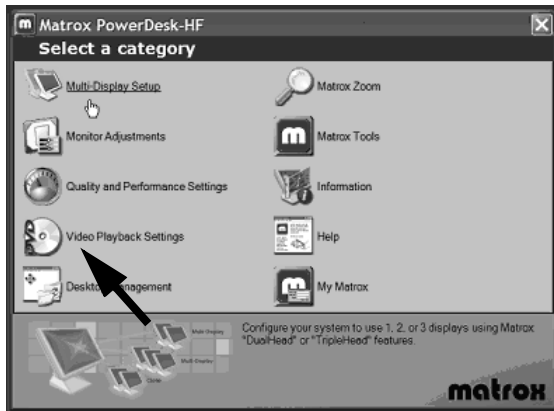


*The Video Playback Settings dialog appears.*

| | |
|------|--------|
| **6** | On the Video Playback Settings dialog, de-select **Use Pure Video DVD Max** (be sure there is not a checkmark in the checkbox). |



| | |
|------|--------|
| **7** | Click **Back** |
| **8** | Click **X** in the upper right corner to close the Matrox PowerDesk-HF application. |
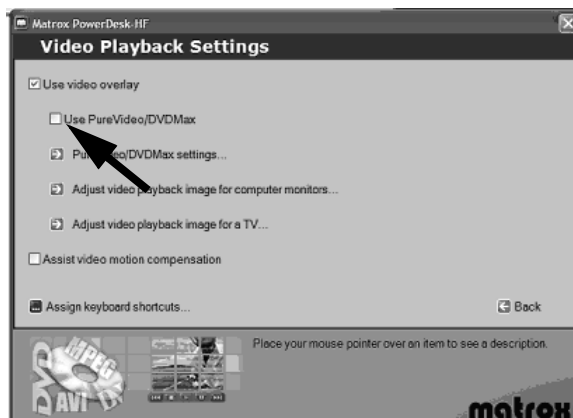
*InSight Fluoroscan is now configured to display Windows and the InSight application on the external video monitor.*

# Tip

Sometimes for external video equipment to "sync" or display an external video signal (S-video or Composite), you have to attach the external video equipment first and then reboot the InSight system for the external video to sync with the other video equipment.

# Appendix C
# Hologic InSight Connectivity Site Survey

A completed Connectivity Site Survey is required to complete the installation of your new equipment. A completed survey does not imply that your PACS and other network components will be properly configured to work with our system. It should be clearly understood that the completed survey form does not imply that the PACS, DICOM Printer and other DICOM / network components will be properly configured to work with our system. Additional work may be required of your IT / PACS administrator/vendor to accomplish this work.

Please FAX the completed form to:

**Connectivity Group**
**Hologic, Inc.**
**(781) 280-0671**

## Site Information

| | |
|---|---|
| Facility Name: | |
| Address: | |
| City: | |
| State: | |
| Country: | |

# Site Contact Information

| Main Site Contact |
| --- |
| Name: |
| Title / Role: |
| Phone #: |
| E-mail: |
| FAX #: |
| Other |

| Additional Site Contact |
| --- |
| Name: |
| Title / Role: |
| Phone #: |
| E-mail: |
| FAX #: |
| Other |

| Additional Site Contact |
| --- |
| Name: |
| Title / Role: |
| Phone #: |
| E-mail: |
| FAX #: |
| Other |

# Connectivity Information

## InSight Settings

| Serial Number |
|---|
|  |

## Network Settings:

| IP Address |
|---|
| Subnet mask |
| Gateway address (if needed) |
| DNS server addresses (if needed) |

## DICOM Settings:

| AE Title |
|---|
| Station Name (if needed) |
| Port Number (if needed) |

# DICOM devices InSight is connecting to (PACS, Printer, Worklist broker)

**Note:** For more than one DICOM printer and more than one PACS and/or viewing station copy these pages.

## DICOM Store Settings (PACS):

| AE Title |
|---|
| Host Name or IP Address |
| Port Number |
| Yes/No: Use as Storage Commitment Provider? (circle yes or no) |

## DICOM Print Settings:

| AE Title |
|---|
| Host Name or IP Address |
| Port Number |
| Destination Name |

**Worklist Settings:**

| |
|---|
| AE Title |
| Host Name or IP Address |
| Port Number |
| Yes/No: Use Performed Procedure Step? (circle yes or no) |

**Note:** The PACS Administrator may map the following InSight data fields to Worklist attributes (see InSight User Guide for more information):

1.Patient Name
2.Patient ID
3.Patient Sex
4.Procedure ID
5.Study Name
6.Start Date

# Primary PACS Provider and DICOM Printer Information

## PACS Vendor

| |
|---|
| Name: |
| PACS System Product Name: |
| Version: |

## DICOM Printer Manufacturer

| |
|---|
| Name: |
| Model Name: |
| Serial Number: |

# Appendix D
# Network and DICOM Setup

To set up the network and DICOM configuration on InSight you will need to:

- Coordinate with the customer
- Turn off *System Shutdown* in InSight software
- Change Windows® XP network settings
- Add / Edit routines for the different System Configuration settings, such as: System settings, DICOM Send Options, DICOM Print Options, and Worklist Configurations

**Points to consider when setting up a network with DICOM devices:**

The DICOM Standard supports inter-connectivity, not inter-operability. It is possible that not every DICOM device can talk to every other DICOM device. Every manufacturer of DICOM devices should have a DICOM Conformance Statement for that device. If some function or feature is not in the DICOM Conformance Statement, then that manufacturer does not support it. All vendors, including Hologic, only support what is in their DICOM conformance statement. The Hologic DICOM Conformance statements are located on the Hologic web site at http://www.hologic.com/cc/dicom.htm.

## Coordinating with Customer

Hologic support cannot repair the customers network.

Determining network values and DICOM values will require help from the customer's IT or PACS administrators. Ideally this information should be available before the install.

PACS administrators may want to see the DICOM Conformance statement for evaluating the InSight Network-DICOM Connectivity Parameters.

The common connectivity parameters are provided. There are additional site-specific parameters for Printers and Worklist providers. The rest of this document assumes that these values have been supplied with the InSight Connectivity Site Survey.

## InSight DICOM Settings

**Network settings:**

- Static IP Address
- Subnet mask
- Gateway address (if needed)
- DNS server addresses (if needed)

**DICOM Application Settings:**

- AE Title
- Station Name (if needed)

• Port number

# DICOM Device Settings

**DICOM Store Settings:**

• AE Title
• Host name or IP Address
• Port number
• Use as Storage Commitment Provider
• Include Annotation Files
• Include Raw Data

**DICOM Print Settings:**

• AE Title
• Host name or IP Address
• Port number
• Destination Name

**Worklist Settings:**

• AE Title
• Host name or IP Address
• Port number
• Use Performed Procedure Step

# Turning Off System Shutdown

The InSight application is always setup to shutdown the PC when the application is shutdown. During part of configuration it is necessary to leave Windows XP running.

To switch *System Shutdown* off:

1. Log into InSight application as *Administrator*.

2. On the Image Acquisition screen, click **End Session**.

3. From the **System Configuration** menu, select **Administrative Settings**.
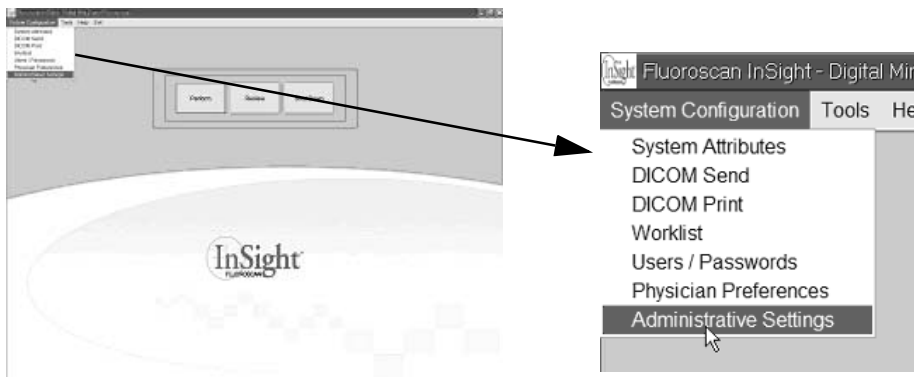
4. On the **Administrative Settings** window**,** uncheck the *System Shutdown* setting and click **OK**.
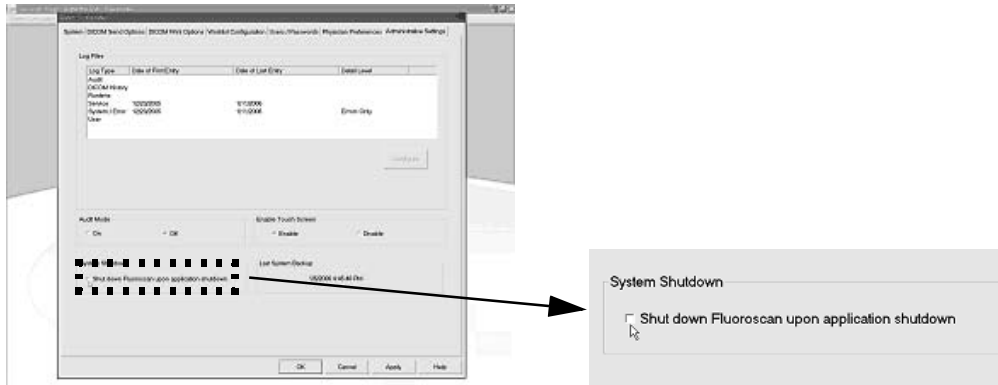


When you exit the InSight application the PC will not shut down and you will be able access the network settings in Windows XP.

**Note:** *System Shutdown* has to be switched off each time the InSight application is started.

## Change Windows XP Network Settings

1. Plug in a network cable (Cat5 type) into the back of the InSight.

2. On the InSight main screen, click **Shut Down** to exit the InSight application.

3. From the windows desktop, click **Start → Run**.
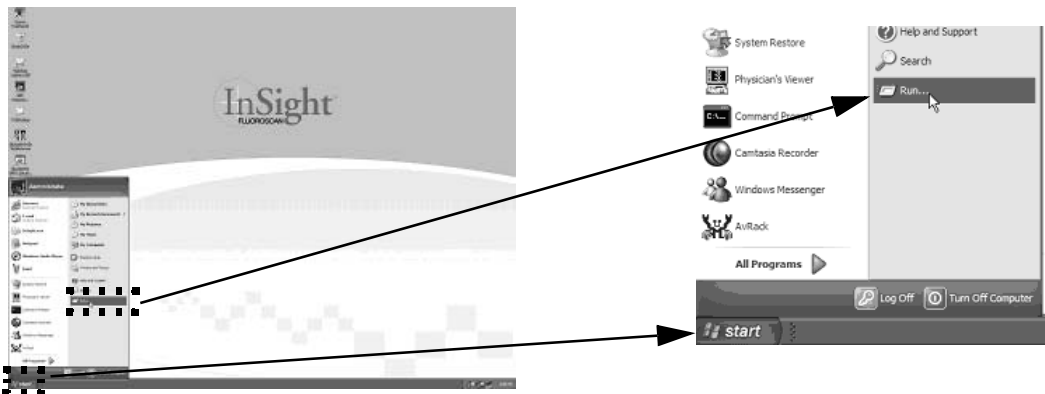


4. In the Run - Open text box, type **ncpa.cpl** and click **OK**.
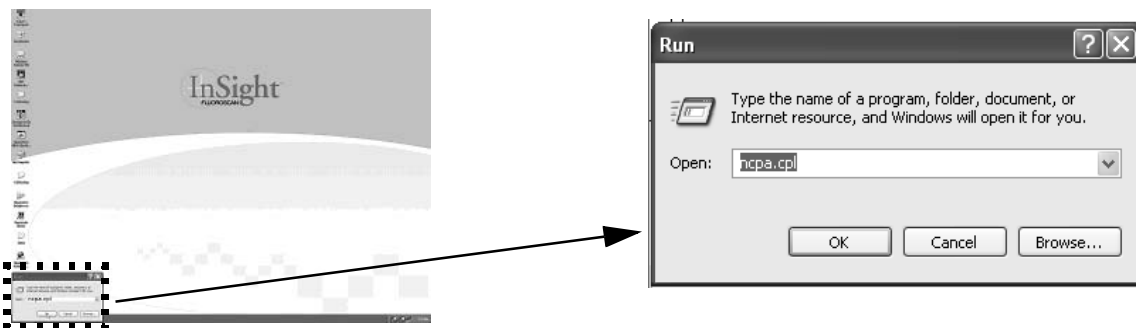
*The Networks Connections window appears.*

5.  Right mouse click **Local Area Connections** and select **Properties**.



*The Local Area Connection Properties window appears.*

6.  Scroll down and click **Internet Protocol (TCP/IP)** then click **Properties**.
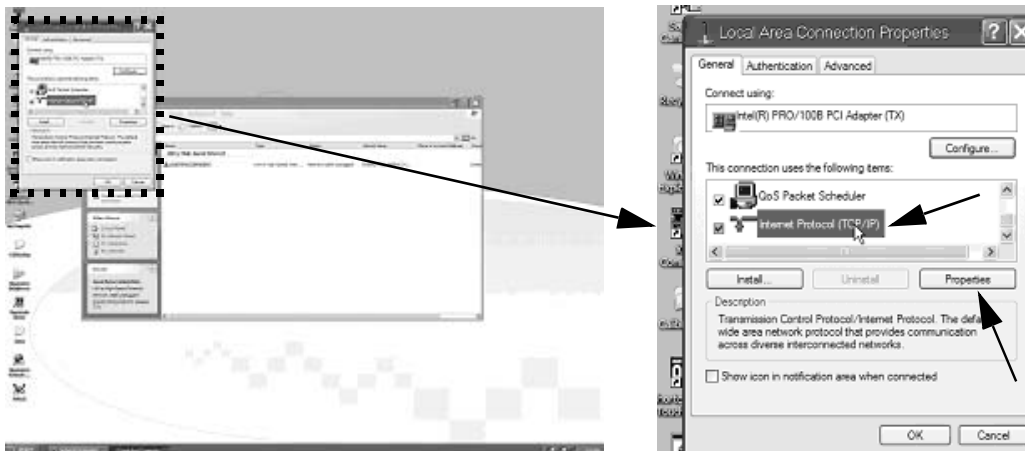


*The Internet Protocol (TCP/IP) Properties window appears.*

7.  If the customer's network supports IP settings assigned automatically, click the **Obtain an IP address automatically** radio button and go to Step 9. Otherwise, click the **Use the Following IP Addresses** radio button and continue with Step 8.
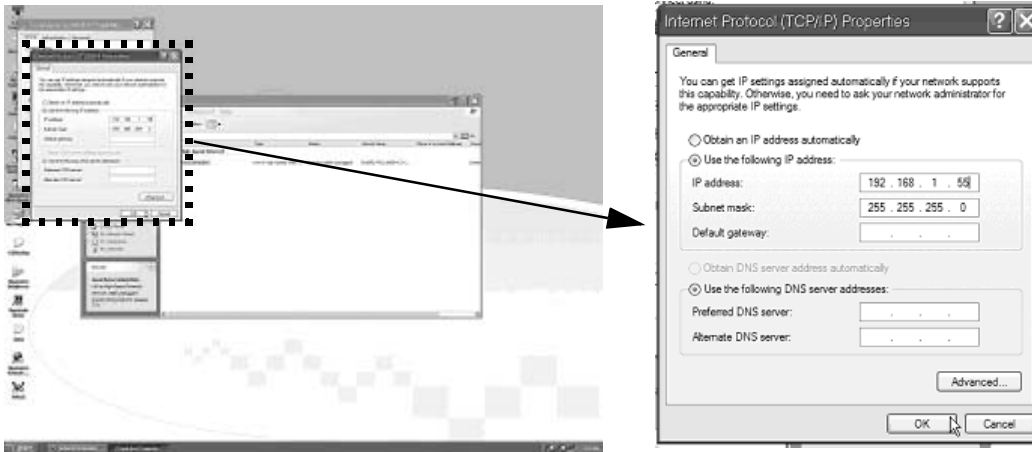


8.  Fill in the values for the IP Address, Subnet mask, Gateway address (if needed) and DNS server addresses (if needed).

9.  Click **OK**.

10. Shutdown and re-boot the InSight.

# Add / Edit System Configuration Settings

The following InSight configuration settings must be added or edited:

- System Settings
- DICOM Send Options
- DICOM Print Options
- Worklist Configuration

## System Settings

**To add or edit InSight System Settings:**

1. After the InSight re-boots, log into InSight software as "Administrator"

2. From the **System Configuration** menu, select **System Attributes**.

3. In the DICOM Application Information section, enter the InSight AE title and Station Name (if needed) - this is case sensitive.

    **Note:** If the IP Address shows 127.0.0.1, make sure the network cable is plugged in. It should show the new IP Address.
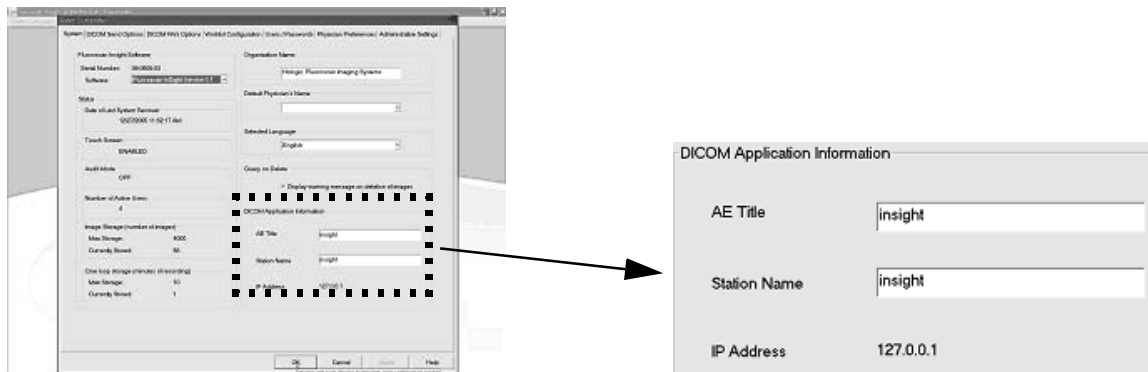


## DICOM Send Options

**To add or edit a DICOM Send connection:**

1. From the **System Configuration** menu, select **DICOM Send Options**.

2. To add a new destination click **Add Destination**.To edit an existing destination highlight the destination and click **Edit Destination**.

The example shows Add Destination, using the HOLX_PV connection.
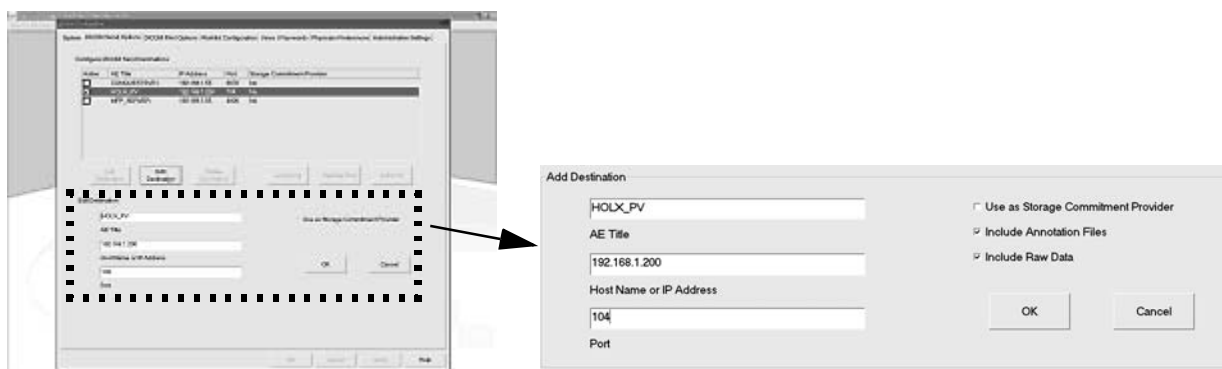


3. Enter/edit the destination AE Title (case sensitive), IP Address and Port number.

4. If the Send destination is to be used as a storage commitment provider, check the **Use as Storage Commitment Provider** check box.

5. If Annotation files and/or Raw Data are to be sent to the destination, check their respective check boxes.

6. Click **OK** in the Add/Edit Destination section.

7. Test local network connections/communications. (Refer to *Testing Network Connections/Communications* below for details.)

8. To enable a Send destination for use, check the box in the Active column. *These check boxes indicate which configured Send destinations can be used.*
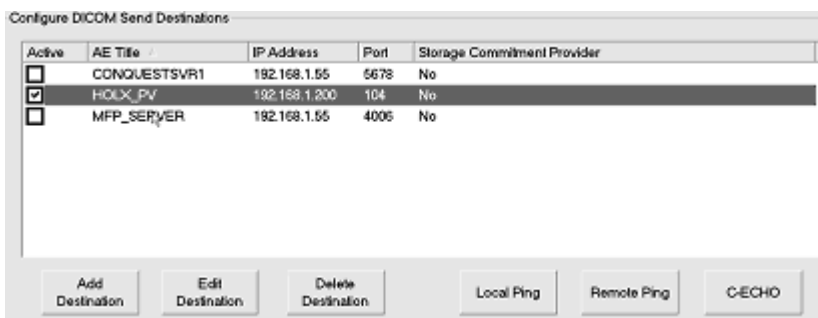


9. Click **OK** to save and exit all setup windows.

## *Testing Network Connections/Communications*

Ping is a command that performs a basic check of the network. **Local Ping** is used to confirm InSight is connected to local network. **Remote Ping** is used to confirm the destination is connected to the local network.

**C-ECHO** is a command that performs a basic check of DICOM communications.

**To test network connections and DICOM communications:**

1. Click **Local Ping** to verify InSight is connected to the local network.

2. For a DICOM Send or Print destination, click on a destination to select it.

3. Click **Remote Ping** to verify connection to the local network.

4. Click **C-ECHO** to verify DICOM communications.

    In this example, several destinations have already been setup.
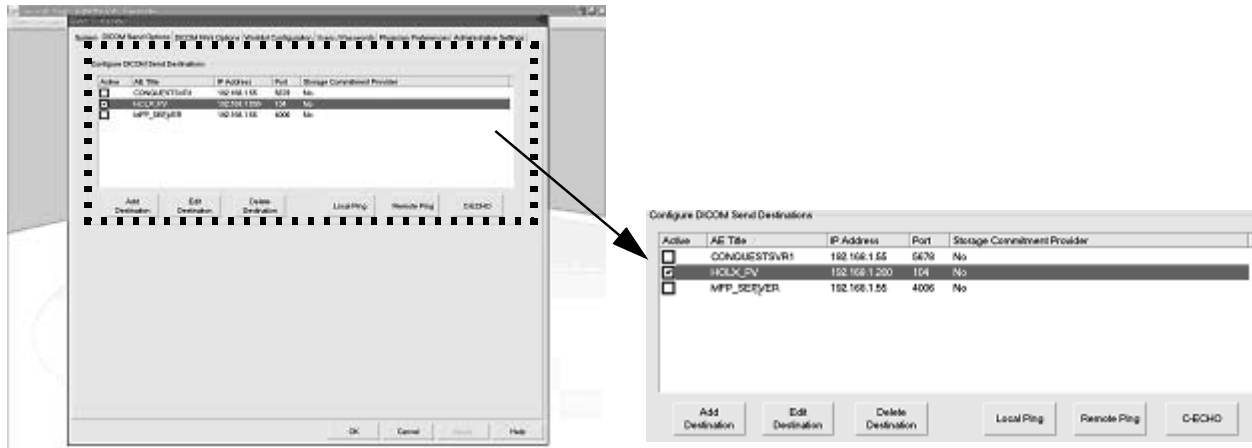


## *Teach People How to Test a Connection*

Consider this real world support call:

1. You installed the InSight in a room with a network connection. You plugged into the network plug on the wall, did the setup, and everything worked.

2. The next day the customer complains that the InSight is not working and can't send files to the PACS server.

**What went wrong?**

The InSight was moved to a different room and although there was a network plug on the wall, there wasn't any network wires connected to it. In this case both Remote Ping and C-ECHO would have failed.

If the customer tested the connection then they could have called their own IT department to fix the network problem, or at least rolled the InSight back to the room with the working network connection to send the files to the PACS server

It is always a good practice to test the connection whenever the InSight is moved. Testing a connection using Remote Ping and the C-ECHO buttons will take a much shorter amount of time than sending a series of images to a PACS server.

# DICOM Print Options

**To add or edit a Print Option:**

1. From the **System Configuration** menu, select **DICOM Print Options**.

2. To add a new printer destination click **Add Destination**.To edit an existing printer destination highlight the destination and click **Edit Destination**.
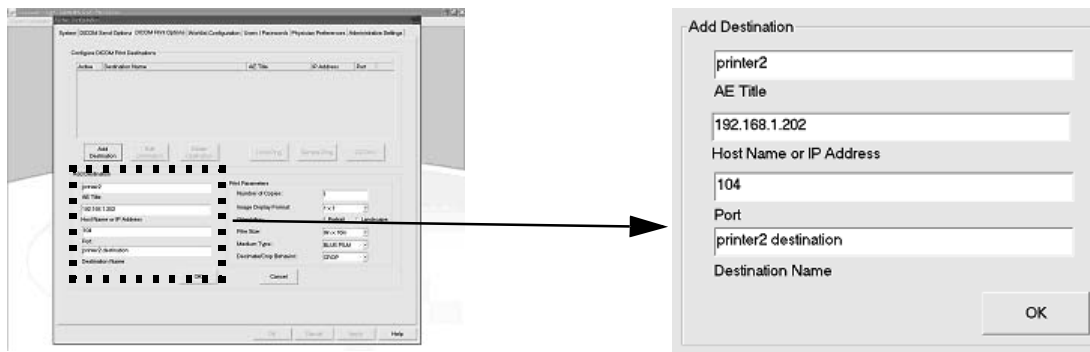


3. Enter/edit the destination AE Title (case sensitive), IP Address, Port number and Destination Name. *Destination Name allows a single printer destination to be used in multiple ways as specified by Print Parameters.*

4. Enter the Print Parameters. *These parameters are to be supplied by the customer.*
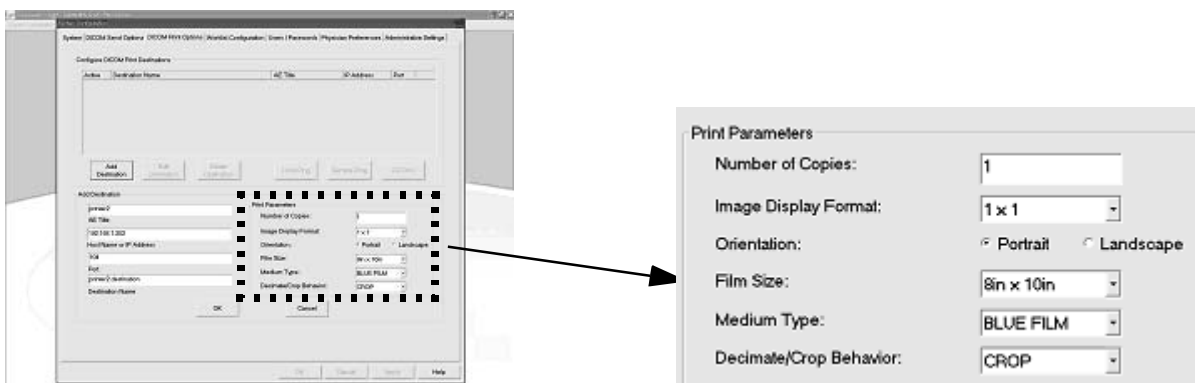


5. Click **OK** in the Add/Edit Destination section.

6. Test local network connections/communications. (Refer to *Testing Network Connections/Communications* on page D-7 for additional details.)

7. To enable a printer destination for use, check the box in the Active column. *These check boxes indicate which configured printer destinations can be used.*
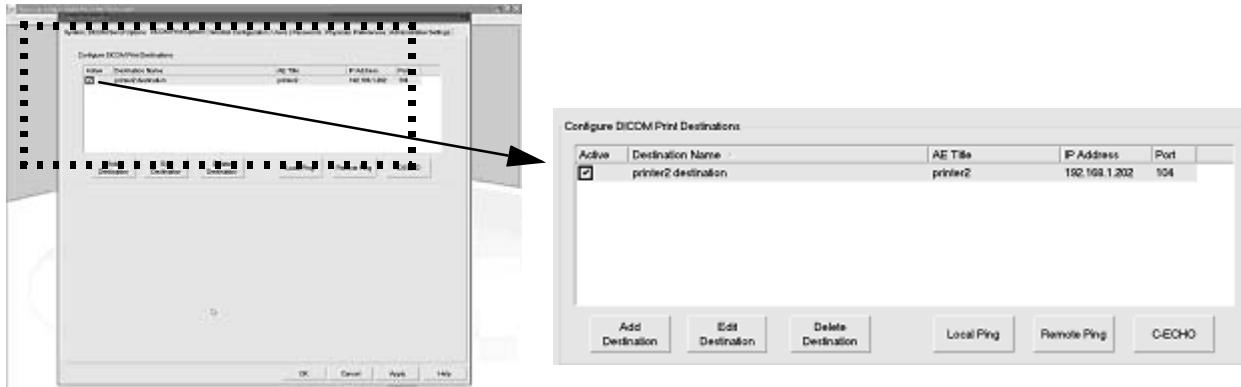


8. Click **OK** to save and exit all setup windows.

## Worklist Configuration

Minimum worklist configuration consists of:

- Identifying the worklist provider
- Identifying the requesting system and type of worklist to be requested (Query Parameters)
- Specifying if the worklist provider is to be notified when each worklist procedure is completed.
- Mapping worklist data fields to InSight data fields

**To configure Worklist:**

1. From the **System Configuration** menu, select **Worklist**.

2. In the *Worklist Provider* section, enter the AE Title, IP Address and Port number of the provider system.
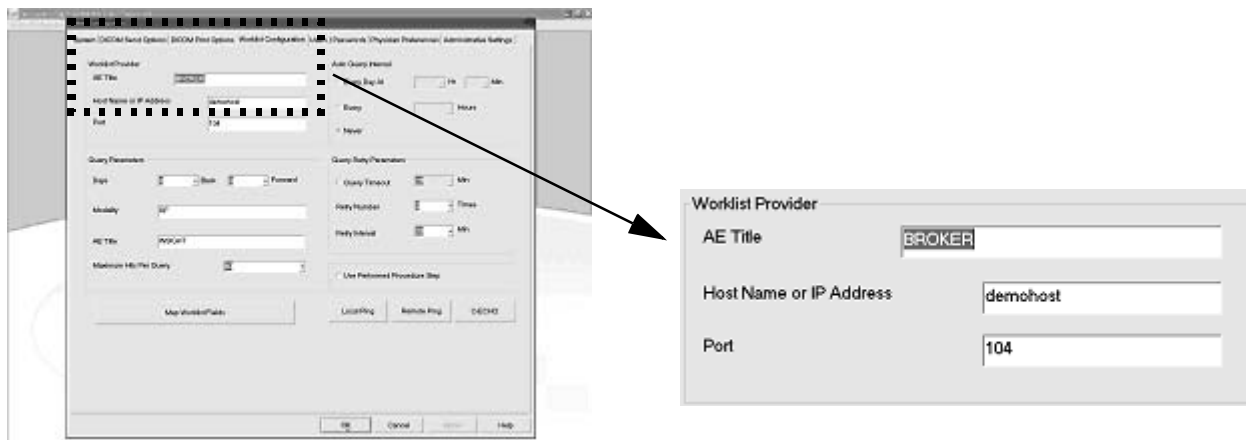
3. Test local network connections/communications. (Refer to *Testing Network Connections/Communications* on page D-7 for additional details.)
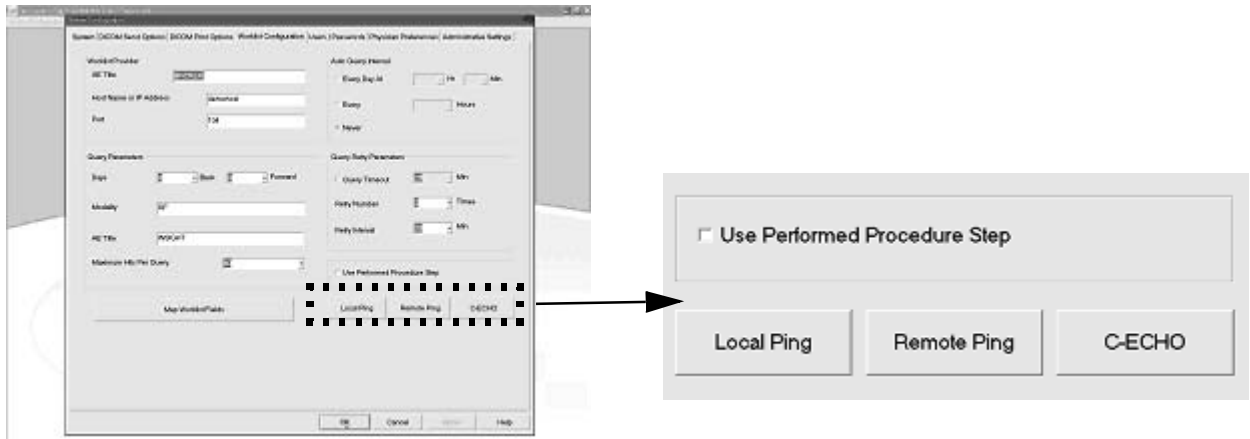


4. In the Query Parameters section, enter the the appropriate entries for filtering a worklist query, by either date range, Scheduled AE Title, or Modality. In example shown, the Query filter will find results for only work on the current day, and any modality or any Scheduled AE Title.
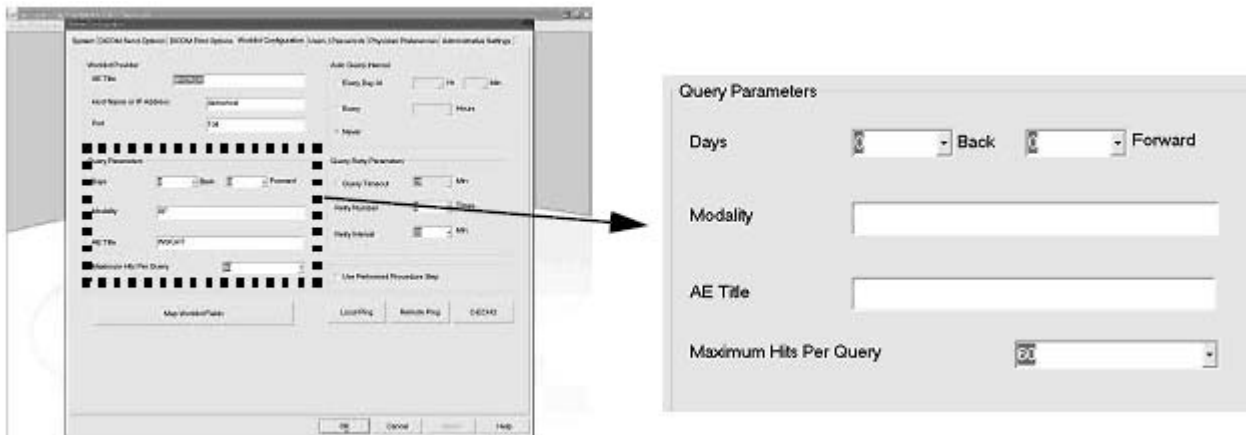


5. If the worklist provider is to be notified when each worklist procedure is completed, check the *Use Performed Procedure Step* checkbox. Otherwise uncheck the box.
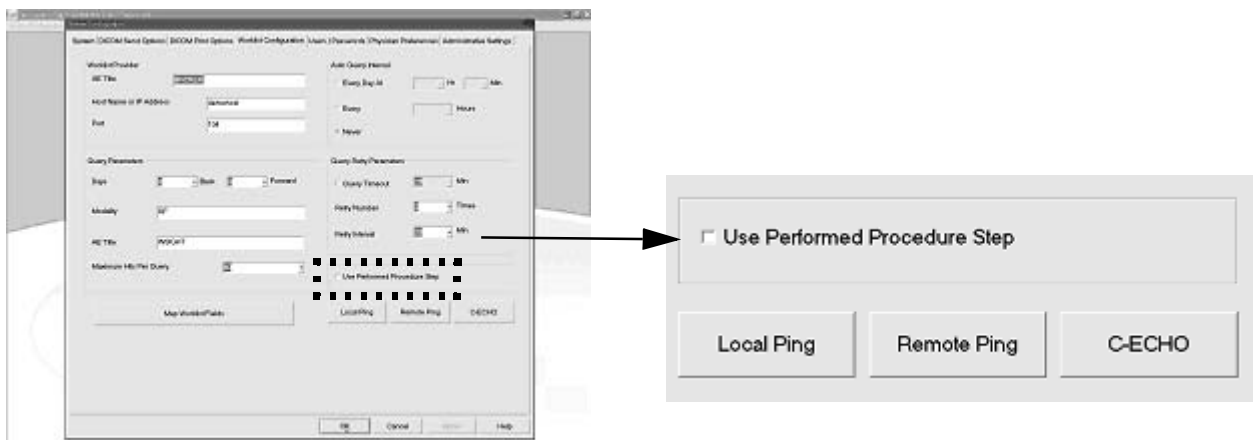
6. To map worklist data fields to InSight data fields, click **Map Worklist Fields.** *The Map Worklist Keys window appears*.
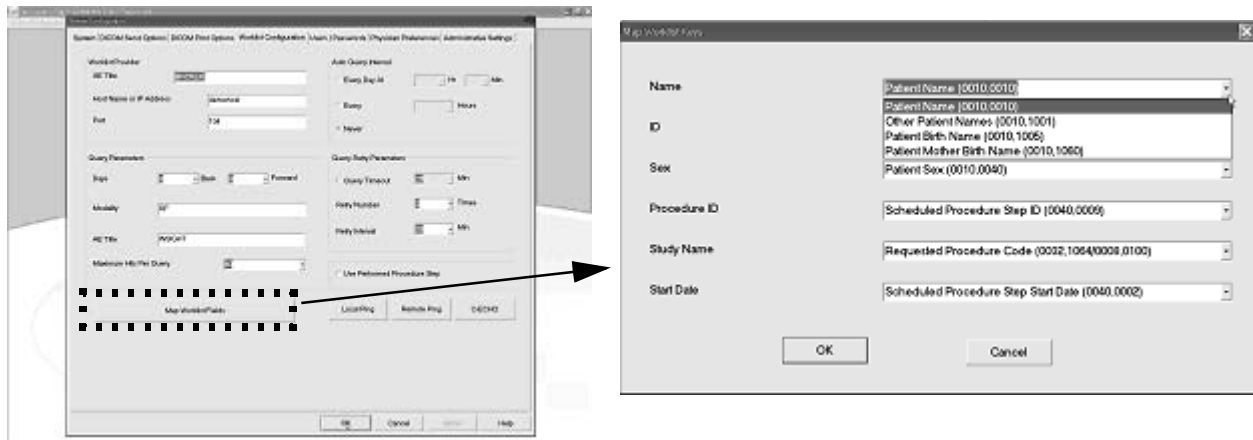


This step usually always requires the help of the PACS Administrator, and careful reading of the different manufactures DICOM Conformance statements to fill it out correctly.

**Note:** The C-ECHO button does not validate the Worklist fields.

Refer to the InSight DICOM Conformance Statement for more information.

**To map data fields:**

- Use the dropdown text boxes to select different field types.
- Click **OK** to return to the Worklist Configuration tab.

7. Click **OK** to save and exit all setup windows.

To set up the network and DICOM configuration on InSight you will need to:

- Coordinate with the customer
- Turn off *System Shutdown* in InSight software
- Change Windows® XP network settings
- Add / Edit routines for the different System Configuration settings, such as: System settings, DICOM Send Options, DICOM Print Options, and Worklist Configurations

# Appendix E
# Error Messages

# InSight Errors

(Displayed to the User)

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Backup/Recover** | Error reading from %1. | Error displayed while reading the free space reading the disk during backup. %1 indicates the label on the disk | Disk may have a problem. Replace the disk. |
| | %1 does not contain sufficient space to store the backup. | Insufficient space on the media. %1 indicates the label on the disk | Insert a different disk or delete files from the disk. |
| | Unable to backup required file: %1 | Error while creating the backup archive. %1 indicates the backup filename | Use a different disk |
| | Error writing backup to %1 | Error while writing the archived file to the backup media. %1 indicates the label on the disk | Use a different disk |
| | Error reading backup from %1 | Error reading the archive file while restoring it to the temporary folder.. %1 indicates the label on the disk | Use a different disk |
| | Unable to complete system recover. The system has been restored to its original state. \n InSight will now be restarted. | Error occurred while extracting the backup archive using the application path as the base extraction directory. Does a restore to the original files. | Something wrong with the backup archive. Use a different archived disk |
| | System recover complete. InSight will now be restarted. | Successes from recover. | No action required |
| | Error reading target media | Any error that is received other than the unformatted error while reading the media. | Use a different media. |
| | Data file upgrade conversion failed. | Error occurred during creation a process to run the data upgrade application | |
| | Warning: A more recent backup was created on %1\n\nAre you sure you wish to proceed with the recovery of backup dated\n%2? | Warning displayed if user try to recover old backup data. | Use the most recent backup archive. |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Image Calibration** | Error communicating with X-ray controller. | Error while enabling or disabling x-rays & setting the power level | Restart the application.<br><br>If still does not work, check the XRC board mode for consistency (both the switch and the jumper should correspond to either calibration mode or regular mode).<br><br>If the mode settings are correct, check the XRC board and replace if broken. |
| | Error initializing X-ray controller. | Error while initializing the XRC controller. | |
| | Error communicating with a camera. | Error while opening the camera port. These errors occur during flat field calibration and warp calibration. | Restart the application.<br><br>If does not help, check the camera, camera connector, and the image board, and replace the broken part. |
| | Error starting image acquisition. | Error while calling the snap and grab functions of the image board while performing the warp and flat field calibration. | Reboot the machine.<br><br>If does not help, check the image board and replace if broken. |
| | Error saving Warping bitmap file. | Error while saving the image bitmap to use for calibration while performing the warp calibration | Restart the application and try again. |
| | Error saving Warping calibration file. | Error while calculating the warp calibration and saving it to the calibration file. | Move the calibration phantom in slightly different position and repeat the calibration. |
| | Error copying warp bitmap file. | Errors copying the warp bitmap file, while in demo mode. It is using the previous acquired image as input. | Restart the application and try again. |
| | Error acquiring Flat Field black image. | Error acquiring the black image while performing the flat field calibration. This error is displayed whenever it tries to call the snap function of the image board. | Reboot the machine.<br><br>If does not help, check the image board and replace if broken. |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Image Calibration** (Cont.) | Error calculating Flat Field offsets. | Error while calculating the flat field gains and flat field offsets. | Restart the application and try again. |
| | Error calculating Flat Field gains. | | |
| | Error saving Flat Field correction file. | Error saving the flat field correction file. Could be either FF6_FILE or FF4_FILE. | |
| | Error loading image. | Error while loading the .bmp or the .tif file that is selected by the user while performing the flat field calibration | |
| | Failed to start X-rays. Ensure X-ray controller board is set to Calibration Mode. | Error turning on the x-rays while performing calibration. | Check the XRC board mode for consistency (both the switch and the jumper should correspond to either calibration mode or regular mode). |
| | Warp calibration failed to be completed. It is recommended that the calibration be repeated. | Displayed when calibration validation failed after pressing the Button Start Warp Calibration in the Image Calibration Dialog. | Restart the application and try again. |
| | Flat Field/Camera Gain calibration failed to be completed. It is recommended that the calibration be repeated. | Displayed when calibration validation failed after pressing the Button Start Flat Field Calibration in the Image Calibration Dialog. | |
| | The X-ray controller board is not set to Calibration Mode. \nX-rays must be started/ stopped by pressing/releasing the X-ray pedal when prompted. | Displayed when XRC is not in the calibration mode while user tried to initiate the Image Calibration Dialog. | No action required. |
| | InSight software not found. \n Please install InSight software before running this tool | Displayed when software failed to verify an existence of the InSight data, while user tried to initiate the Image Calibration Dialog. | Ensure InSight software is installed. |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Patient Selection / Update** (Errors) | No matching patients found. | Error displayed when performing a detailed query and we don't get any patients back from the search. The same error is displayed when we query the worklist. | Change the query parameters and run the query. |
| | No Studies matching the filter criteria were found. | Error displayed when the user enters all the search criteria and selects update list and we don't receive any studies back from the patient selection dialog. | Change the search criteria and try updating the list. |
| | Maximum number of hits per query reached. Remaining Worklist entries will be ignored. | Error returned while querying the DICOM worklist. | Narrow the query criteria: narrow date interval, add additional query parameters.<br><br>Change Maximum number of hits per query in the configuration Form. |
| | Query failed. | Error returned by the DICOM worklist query, when the user selects the query or query detail button and queries the worklist for information | Check DICOM trace messages. |
| | Can not create a Worklist request. | Error returned by the DICOM worklist query, when the user selects the query or query detail button and queries the worklist for information | Check Log file for reported error messages. |
| | Failed to connect to Network. | Error returned by the DICOM worklist query, when the user selects the query or query detail button and queries the worklist for information | Run Local Ping. If does not work, check if local machine attached to the Network.<br><br>Check configuration settings on local machine.<br><br>Run Remote Ping. If does not work, check if Remote machine attached to the Network.<br><br>Run C-echo. If does not work, check configuration settings on the remote machine. |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Patient Selection /Update** (Errors) (Cont.) | Failed to open association with Broker. Possible causes include: Local system is misconfigured or Broker is down. | Error returned by the DICOM worklist query, when the user selects the query or query detail button and queries the worklist for information | Run Local Ping. If does not work, check if local machine attached to the Network.<br><br>Check configuration settings on local machine.<br><br>Run Remote Ping. If does not work, check if Remote machine attached to the Network.<br><br>Run C-echo. If does not work, check configuration settings on the remote machine.<br><br>If Worklist still empty, check log files for possible error messages.<br><br>In config_system.xml file turn ON DICOM_trace option. Repeat querying operation and check log files for the possible error messages. |
| | Requested association rejected by Broker. | Error returned by the DICOM worklist query, when the user selects the query or query detail button and queries the worklist for information | Check DICOM trace messages. |
| | Can not process Worklist Query. Possible causes include: Missing critical data or invalid field format. | Error returned by the DICOM worklist query, when the user selects the query or query detail button and queries the worklist for information | Check DICOM trace messages. |
| | Query has been aborted. | Error returned by the DICOM worklist query, when the user selects the query or query detail button and queries the worklist for information | Self Explanatory |
| | A minimum of Patient Last Name and Patient ID must be filled in before processing. | Displayed while validating the information provided in the patient selection dialog. | Self Explanatory |
| | Modality value may not be empty. | Displayed when the validation fails in the patient worklist query dialog | Self Explanatory |
| | Requested Procedure ID value can contain any character except '\\ | 'Displayed when the validation fails in the patient worklist query dialog | Self Explanatory |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Patient Selection /Update** (Errors) (Cont.) | Accession Number value can contain any character except '\\ | 'Displayed when the validation fails in the patient worklist query dialog | Self Explanatory |
| | Maximum Hits per Query value must be a positive number between 0 and 999 | Displayed when the validation fails in the patient worklist query dialog. | Self Explanatory |
| | Start Study Date can not be after the End Study Date. | Displayed when the validation fails in the patient selection dialog | Self Explanatory |
| | End Study Date can not be later than today's date. | Displayed when the validation fails in the patient selection dialog | Self Explanatory |
| | | | |
| **Patient Selection / Update** (Messages) | Patient data has been modified. Press Update to accept change(s). | Displayed when the user updates the existing patient data. | Self Explanatory |
| | Changed data shall be used to update current Patient. Press Update button if you agree, Cancel if you don't. | Displayed when the user selects the review button in the patient selection dialog after updating the patient information | Self Explanatory |
| | Days Forward value must be a positive number between 0 and 99 | Displayed when validation fails in the worklist query dialog. | Self Explanatory |
| | Days Back value must be a positive number between 0 and 99 | Displayed when validation fails in the worklist query dialog | Self Explanatory |
| | | | |
| **System Configuration** | Please enter whole integer values | Error displayed by the configuration module when the fields require an integer value and the user enters a non integer value | Self explanatory |
| | Please enter the host name or the IP address of the Worklist Provider | Error displayed while performing the remote ping or c-echo from the worklist page. | Self explanatory |
| | Time has to be entered in min:sec format | Displayed when the user enters an invalid time format | Self explanatory |
| | The range of values allowed is between 0 seconds to 5 minutes | Displayed when the user enters a value, which is out of range or invalid. | Self explanatory |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **System Configuration** (Cont.) | Valid range for image rotation field is -360 to +360 in whole integer values | Displayed when the user enters a value, which is out of range for the image rotation field. | Self explanatory |
| | Unsuccessful echo from destination | Displayed when the c-echo function comes back with a failure. | Check if destination is configured correctly.<br><br>(Validate ID Address and host name) |
| | Destination computer not found | Displayed when the remote ping comes back unsuccessful. | Check if destination is configured correctly.<br><br>(Validate ID Address and host name) |
| | Not attached to local network | Displayed when local ping comes back with a failure. | Check if the computer is connected to a network connection. |
| | Please enter valid minutes between 0 and 59 | Displayed when the user enters a invalid minutes value in any of the fields that requires the user to enter minutes. | Self explanatory |
| | Please enter a value between 0 and 99 | Displayed when the user enters a value above or below the range for the days back, days forward and query number of times fields in the worklist tab. | Self explanatory |
| | Please enter a value for AE title in the worklist parameter group. | Displayed when the user selects c-echo in the worklist page without entering the AE title information. | Self explanatory |
| | Error accessing xml file. | Currently not used. | |
| | Data in the xml file is corrupt. | Not used. | |
| | The passwords you have entered do not match. | Displayed after failed validation of the user-entered password. | Self explanatory |
| | Please enter the correct current password. | Displayed after failed validation of the user-entered password. | Self explanatory |
| | Password field cannot be empty. | Displayed after failed validation of the user-entered password. | Self explanatory |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **System Configuration** (Cont.) | Last Name field cannot be empty | Displayed after failed validation of the user-entered Physician's Name in the Physicians Preference Page or User's Name in the User Password Page. | Self explanatory |
| | First Name field cannot be empty | Displayed after failed validation of the user-entered Physician's Name in the Physicians Preference Page or User's Name in the User Password Page. | Self explanatory |
| | User Name field cannot be empty | Displayed when the user tried to update the storage information in the User Password Page. If user name is not provided then user can't edit the info. | Self explanatory |
| | Error finding the user on the system | Not used. | Self explanatory |
| | User with this username already exists. Please provide a unique user name. | Displayed after failed validation of the user-entered User's Name. | Self explanatory |
| | Please enter a port number between 1 and 65536. | Displayed when user entered invalid Port Number in the DICOM Print Page, DICOM Send Page or Worklist Configuration Page. | Self explanatory |
| | Please enter a value between 0 and 999 | Displayed when user entered invalid Max Hits value in the Worklist Configuration Page. | Self explanatory |
| | Please enter valid hours between 0 and 23 | Displayed when user entered invalid Hour value in the Worklist Configuration Page. | Self explanatory |
| | An error occurred while attempting to switch languages. Please contact the Hologic Help Desk. | Displayed when failed to switch languages in the System Page. | Self explanatory |
| | Continuous Fluoro and Snapshot Fluoro are disabled. | Displayed a warning message if both continuous and snapshot fluro are disabled in the Physicians Preference Page. | Enable either the continuous fluoro or the snapshot fluoro buttons. You will be able acquire only cine images. |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| Utilities | No active DICOM send destinations configured | Displayed when the user tries to perform a DICOM send without configuring it. | Configure a DICOM send destination and ensure it is active before attempting to perform DICOM send. |
| | DICOM Configuration Error | Displayed if no DICOM store nodes configured and active are available. | Configure a DICOM print destination and ensure it is active before attempting to perform DICOM print. |
| | DICOM Send Queue Error | Displayed when failed to Delete selected entries from the list in the View Queue Dialog. | |
| | Failed to export image(s) to %1 | Displayed when failed to export images from the Export Dialog. | Check if export destination is available and have enough space for image storage. |
| | No active DICOM print nodes configured | Displayed when the user tries to perform a DICOM print without configuring it. | Configure DICOM print destination or activate existed destination. |
| | Failed to delete selected image(s) | Displayed when an error occurs while deleting the selected studies or selected images from a study. | |
| | Error reading target media | Displayed when an error occurs during an export. | Verify a disk in the drive you are attempting to export to.There may be problems with the disk, try using another disk. |
| | Error writing to target media | Displayed when an error occurs during an export | Check if export destination is available and have enough space for image storage. |
| | Insufficient space on target media for exporting selected image(s) | Displayed when an error occurs during an export | Insert a different disk or delete files from the disk. |
| | Insufficient space on target media for exporting selected image(s)\n \n Required: %1 KB \n Available:  %2 KB | Displayed when software failed to validate that the media has enough space to write file(s). | Insert a different disk or delete files from the disk. |
| | Unknown export format | Displayed when an error occurs during an export | (Indicates programming error - invalid export format specified. Should NOT be seen by user.) |
| | No selected images to export | Displayed when an error occurs during an export | Select images to export. |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Utilities**<br>(Cont.) | Failed to import %1 of %2 image(s) | Displayed when an import operation could not import all the images. | Archive disk may have corrupted images - try using a different archive disk. |
| | Please enter a valid InSight option license key. | Error displayed while installing the option and the option key entered is not valid. | Verify InSight option license key is correct. |
| | Invalid License Key | Displayed when validation for the License Key has failed on pressing Install button in the Options Install Dialog. | Verify InSight option license key is correct. |
| | Failed to update patient information | Error displayed when updating the patient data from the update patient dialog that is called from the main menu. | Retry update of patient information. |
| | Media is unformatted. Format now?\n\nNote: Formatting DVD-RAM media may take several minutes. | Displayed when we need to do an export operation and the media is not formatted. | Press "Yes" to format media. Press "No" to cancel export. After cancel, retry export with different disk. |
| | Failed to delete selected queue entries | Displayed when an error occurs while deleting an entry from the send queue entries | |

# Generic Errors

(Displayed to the User)

| Error Type & Source | Description | Cause | Action |
|---|---|---|---|
| **Generic Errors** | System Failure detected, Fluoroscan InSight instrument is not operable. Please contact Hologic Service. | Error detected while performing the XRCinit call during the pre-login check. The details part of the error may contain one or more of the following messages: Ram RW error, Rom Check Sum error, Stack Creep error, X-Ray Enable error, X-Ray mA error, X-Ray kV error, X-Ray general error, X-Ray power failure | |
| | A hardware failsafe failure has been detected. Please call Hologic Service. | Error while checking if the jumper is set or test bit is set for non-service user. This check is made while the system is coming up. | |
| | The Calibration check failed. \n The system needs to be calibrated. | This is the first time a calibration error occurs while checking to see if the machine has been calibrated when the logged in user is a service user. | |
| | The calibration check failed. \n Please recover your last system backup before proceeding. | This is the first time a calibration error occurs while checking to see if the machine has been calibrated if the logged in user is a non-service user. | |
| | The system is not calibrated. Please call Hologic Service. | This error is displayed when the non-service user recovers the system from the backup and is still getting an error while performing the calibration check. | |
| | The EEProm check failed. \nThe system needs to be calibrated. | Error is displayed while performing the eeprom check and the user is a service user. | |
| | The EEProm check failed. Please recover your last system backup before proceeding. | Error is displayed while performing the eeprom check and the user is a non-service user. | |
| | The EEProm check failed. \n Please call Hologic Service. | This error is displayed when the non-service user recovers the system from the backup and is still getting an error while performing the EEProm check. | |

| Error Type & Source | Description | Cause | Action |
|---|---|---|---|
| **Generic Errors** (Cont.) | The storage limit for image files and/or cine recordings has been exceeded. Images must be exported to external media then removed from the hard drive before any additional images may be saved. | Error while checking for storage limit. This check is done while performing the pre-login check, before staring a new session and after deleting the images. | |
| | Image Processor failed to start image acquisition. Please stop X-ray actuation. | Error received from the image processor module if it had trouble starting the acquisition. | |
| | Unable to restart last session. | Error could have occurred while getting the images for study or getting images from the temp folder or filling the image with raw data while restarting a previous session. | |
| | There is no storage room available for images, this image will not be saved. Please remove images from the system before starting the next session. | Error if we have reached the storage limit for either cine or non-cine images. This is displayed while saving the image. | |
| | New password and Confirmation password do not match. Please try again. | Error displayed by the change password dialog when the new password and the confirmation password do not match. | |
| | Old Password does not match the Log-in password. Please try again. | Error displayed by the change password dialog when the old password and the password of the login user do not match.Error displayed if the user after 3 attempts fails to login with the correct user name and password | |
| | The collimator is in an invalid position. Please move it to either the 4 or 6 position before starting X-rays again. The collimator control is under the X-ray control head. | Displayed during image acquisition, when no x-rays available because we still have a bad collimator.XRC error displayed during acquisition. | |
| | The collimator is in an invalid position. Please move it to either the 4 or 6 position before starting X-rays again. | During acquisition. XRC Error. | |
| | X-rays have been turned off. The system is trying to recover from an error. \n \n Please release X-ray control. l. | XRC error displayed during acquisition. | |

| Error Type & Source | Description | Cause | Action |
|---|---|---|---|
| **Generic Errors** (Cont.) | An unrecoverable error has occurred forcing the disabling of x-rays. If the problem continues after restarting the system, please call Hologic Service. | XRC error displayed during acquisition | |
| | The 5 minute limit for continuous X-rays has been exceeded and X-rays turned off. Please release X-ray control before proceeding. | XRC error displayed during acquisition. Did not see this message come up after the time has elapsed. | |
| | The buttons on the panel for print, save, rotate and adjusting power are not working. Please call Hologic for service. \n\n Please use foot pedal, keyboard or touch screen for these functions. | XRC error. | |
| | Ram RW error, | Error returned from XRC init | |
| | Rom Check Sum error, | Error returned from XRC init | |
| | Stack creep error, | Error returned from XRC init | |
| | X-Ray Enable error, | Error returned from XRC init | |
| | X-Ray mA error, | Error returned from XRC init | |
| | X-Ray kV error, | Error returned from XRC init | |
| | X-Ray general error, | Error returned from XRC init | |
| | X-Ray power failure, | Error returned from XRC init | |
| | System not connected to network | Displayed when a local ping from the review screen comes back with a failure. | |
| | | | |
| | After log in, do you want to continue the interrupted acquisition session to save images? | Displayed to the user if the user has aborted the program without saving the images. | Self explanatory |
| | It has been more than 30 days since you last backed up your system. | Displayed initially after the user logs in if the back has not been performed for more than 30 days. | Self explanatory |

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| Error Type & Source | Description | Cause | Action |
|---|---|---|---|
| **Generic Errors** (Cont.) | This system has been off for at least 2 weeks. It is suggested that an XRC warm up procedure be performed. See the users manual for this procedure. | Displayed when the user has not turned on the system for the past 2 weeks. | Self explanatory |
| | There are unsaved images from this session. \n \n Press 'Save Images' to save these images. \n   or \n Press 'End Session' to discard images and end the session. | Displayed when the user exits the session without saving the images. | Self explanatory |
| | One or more images have not been saved | User pressed Done button from the Review, perform or patient screen Trying to do ending or switch from calling view back to main view.Some or all acquired images was not saved. | Self explanatory |
| | Please wait, Updating patient data | Displayed when the data is being updated during a session when the user updates the patient information | Self explanatory |
| | Please wait, loading the interrupted session | Displayed when the user says yes to the do you want to continue interrupted acquisition….. message | Self explanatory |
| | Please wait, Loading data | Displayed when the user presses the review button in a review session. | Self explanatory |
| | You have taken %d of %d images allowed per session. | Displayed when the user has reached the memory barrier limit, which in most cases would be 150 and a max of 200. The message will say you have taken 150 of 200 images allowed per session | Self explanatory |
| | %d Images per session limit reached. \n x-rays will be disabled. \n Please save images and exit session to continue. | Displayed when the maximum limit of 200 images per session is reached. %d will say 200 in most cases. | Self explanatory |
| | Cannot open, read or write file '%s'.\nCall Hologic support. | Any file access error | Check file's existents and properties. |
| | Problem accessing requested drive '%s'.\nPlease check drive (and media, if removable)\nand retry (or cancel to exit) | Displayed when attempting to read/write to an unknown path.  Currently reported by the Export Log dialog. | |

| Error Type & Source | Description | Cause | Action |
|---|---|---|---|
| **Generic Errors** (Cont.) | Could not create a needed object\n(memory allocation error).\nCall Hologic support. | Memory error | |
| | Unable to access .RES file.\nCall Hologic support. | Error accessing the resource file | Check file's existents and properties. |
| | Unable to access the Registry.\nCall Hologic support. | Error accessing the registry | Check if Registry has directories and entries you tried to access. |
| | %s\nCall Hologic support. | Any kind of computation error | |
| | %s\nCall Hologic support. | Any kind of memory access errors | |
| | The printer is out of paper. \n Please add paper and then press Retry \n(or press Cancel to cancel printing). | Displayed when a printer has run out of paper. Currently not used. | |
| | Printer error - please check the printer\nand retry (or cancel to stop print). | Displayed: a printer's settings can't be read; a printer can't be found; a printer has run out of memory; trying to print an invalid image bitmap. | |
| | Illegal value in '%s'.\nPlease correct your data and retry\n(or cancel to exit). | Reported when user entered invalid value. Can be displayed or stored in the Log file. | |
| | Lost communications with the X-ray Source.\nCannot proceed!  Call Hologic support. | Reported when Communication with X-ray Source has failedCan be displayed or stored in the Log file. | |
| | Error communicating with the X-ray Source.\nCall Hologic support. | Reported when Communication with X-ray Source has failed.Can be displayed or stored in the Log file. | |
| | X-ray Source command failed.\nCall Hologic support. | Reported when Communication with XRC X-ray Source has failedCan be displayed or stored in the Log file. | |
| | X-ray Source hardware failure.\nCannot proceed! Call Hologic support. | Reported after x-rays is disabled because of hardware error.Can be displayed or stored in the Log file. | |
| | Missing DICOM configuration information\nprevents access to hospital system.\nPlease contact your system administrator. | Reported by the DICOM module whenever it can't read data from any of the DICOM XML files. | |

| Error Type & Source | Description | Cause | Action |
|---|---|---|---|
| **Generic Errors** (Cont.) | Cannot access hospital system.\nPlease check network, or contact\nyour system administrator. | Reported by the DICOM module whenever it can't open an association with a PACS. This is also reported when a remote/local ping fails for a worklist query. | |
| | The requested operation failed in the hospital system.\nPlease contact your system administrator. | Reported by the DICOM module when an unexpected response for a worklist query request is received from a PACS. | |
| | DICOM printer is out of film.\nPlease add film and retry\n(or cancel to stop print). | Reported when a DICOM printer has run out of film. Currently not used. | |
| | DICOM printer error.\nPlease check the printer and retry\n(or cancel to stop print). | Reported by the DICOM module when a DICOM printer's status can not be obtained. | |
| | Image board error.\nCall Hologic support. | Reported when communicating with Image Board has failed.Can be displayed or stored in the Log file. | |
| | Unexpected error.\nCall Hologic support. | Can be displayed or stored in the Log file. | |
| | External data error.\nCall Hologic support. | Reported when bad data is passed for the processing.Can be displayed or stored in the Log file. | |
| | %s\nCall Hologic support. | Can be displayed or stored in the Log file. | |
| | Error in serial communications with the camera | Reported when communicating with Camera has failed.Can be displayed or stored in the Log file. | |
| | Minor XRC error | Reported when minor XRC error is occurred.Can be displayed or stored in the Log file. | |
| | System recovery successful. Ok to continue image acquisition. | Reported after the system successfully recovered from the XRC failure. Can be displayed or stored in the Log file. | |
| | X-ray controller error. Cannot generate X-rays. | Error while enabling or disabling x-rays & setting the power level.Can be displayed or stored in the Log file. | |

| Error Type & Source | Description | Cause | Action |
|---|---|---|---|
| **Generic Errors** (Cont.) | The collimator is in an invalid position, and X-rays cannot be generated.  Please set the collimator to a valid position. | Reported when there is no x-rays available because we still have a bad collimator; prevents starting the image acquisition.Can be displayed or stored in the Log file. | |
| | X-rays have been on continuously for the maximum allowed time. | Reported when Maximum X-ray ON time exceeded. Can be displayed or stored in the Log file. | |
| | Panel error.  The panel control buttons aren't working. | Reported when buttons on the panel for print, save, rotate and adjusting power are not working.Can be displayed or stored in the Log file. | Use foot pedal, keyboard or touch screen for these functions. |
| | X-rays have been turned off.  System trying to recover from error.  Please release X-ray control. | Displayed when system trying to recover after x-rays is disabled because of hardware error. | |
| | | | |
| **Log File entree**<br><br>File access error - <file path> | Failed to add entry to Service Log | Could not open the specified log file | Make sure the file described in the error message exists, is not read-only, and has not been opened in another program; if the file does not exist or is read-only, the system has been installed incorrectly |
| Media access error - <export target drive> | Failed to export log file <file name> | Could not copy the log file to the export destination | Check everything that might cause a file copy error - missing source file, missing destination directory, no write permission for destination, destination file already exists and is read-only, etc. |

# Errors Generated by the List Generator Module

(Stored in the Log File and not displayed to the User)

Example of the Error:
MM/DD/YYYY  hh:mm:ss PM/AM  Error
Error Type: Text1
Description: Text2

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **List Control manipulation** Memory allocation error | CLstListImages::CreateLoader() failed | A call to an object constructor failed | Shut down and restart the system; check PC hardware |
| Memory allocation error | CLstListImages::CreateLayout() failed | A call to an object constructor failed | Shut down and restart the system; check PC hardware |
| Memory allocation error | CLstStudyList::CreateLoader() failed | A call to an object constructor failed | Shut down and restart the system; check PC hardware |
| Memory allocation error | CLstStudyList::CreateLayout() failed | A call to an object constructor failed | Shut down and restart the system; check PC hardware |
| Bad data | CImageLoaderReview1::SetFilter() got NULL image list from session | Can't review images because there are no images to review | None; system should continue normally |
| Bad data | CImageLoaderReview1::UpdateList() has NULL image list for session | Can't review images because there are no images to review | None; system should continue normally |
| Bad data | Selected image in CLstListImages::ShowPatientDetails() has no study | Can't display patient details because image has none | None; system should continue normally |
| Bad data | Error in CLstPatientDetails::SetStudy() | Can't read patient details | None; system should continue normally |
| Bad data | Error in CLstVistaDetails::SetStudy() | Can't read VISTA details for patient | None; system should continue normally |
| Bad data | CStudyLayoutXxx::UpdateRow() failed for row <row number> - missing data | Can't display patient (or worklist) data for a study because data is missing | None; system should continue normally |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **List Control manipulation** (Cont.) System call failed - <system error message> | CLstListImages::Create() failed to create main window | A call to the Windows operating system failed; error message may give more detail | If the system does not recover by itself, shut down and restart the system; check PC hardware |
| System call failed - <system error message> | CLstListImages::Create() failed to create image[<image number>] window | A call to the Windows operating system failed; error message may give more detail | If the system does not recover by itself, shut down and restart the system; check PC hardware |
| System call failed - <system error message> | CLstListImages::SetupScrollBar() failed to set scroll bar parameters | A call to the Windows operating system failed; error message may give more detail | If the system does not recover by itself, shut down and restart the system; check PC hardware |
| System call failed - <system error message> | CLstListImages::SignalSelection() failed to post message | A call to the Windows operating system failed; error message may give more detail | If the system does not recover by itself, shut down and restart the system; check PC hardware |
| System call failed - <system error message> | CLstListImages::SignalDoubleClick() failed to post message | A call to the Windows operating system failed; error message may give more detail | If the system does not recover by itself, shut down and restart the system; check PC hardware |
| Programming error | {message depends on exact error location} | These are always because of some kind of illegal condition in the code - always due to a bug | File a bug report.  Include the full, exact text of the Description: and any other information you can provide, in as much detail as possible. |

# Errors Generated by the Error and Log Data Interface Module

(Stored in the Log File and not displayed to the User)

Example of the Error:
MM/DD/YYYY  hh:mm:ss PM/AM  Error
Error Type: Text1
Description: Text2

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Error and Log Data output**<br>File access error - <file path> | Error opening log for reading | Could not open the specified log file | Make sure the file described in the error message exists; if not, the system has been installed incorrectly |
| File access error - <file path> | Error opening log for writing | Could not open the specified log file | Make sure the file described in the error message exists and make sure it's not read-only |
| File access error - <file path> | Error writing string to log | Could not write data to the specified (open) log file | Check remaining disk space, check PC hardware |
| File access error - <file path> | {message comes from exception object} | File exception thrown while trying to read the specified log file | The detailed message should provide clues about exactly what is wrong |
| Memory allocation error | {message comes from exception object} | An error occurred trying to process log file data | Shut down and restart the system; if this happens repeatedly, may be a PC hardware problem |
| Bad data | Format error in string, can't read | Could not read a time-span from temp.log | Temp.log will almost certainly have been re-written by the time you see this message.  File a bug report, and grab a copy of the current temp.log file. |
| Programming error | {message depends on exact error location} | These are always because of some kind of illegal condition in the code - always due to a bug | File a bug report.  Include the full, exact text of the Description: and any other information you can provide, in as much detail as possible. |

# Errors Generated during Image Acquisition.

(Stored in Log file and not displayed to the User)

Example of the Error:
MM/DD/YYYY  hh:mm:ss PM/AM  Function's Name  Description

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Camera Communications** Critical Errors | Error opening serial port for camera communications. | Hardware failure | Reboot the machine.If does not help, check the image board, camera, and camera cable and replace the malfunctioning part. |
| | Error getting comm state. | | |
| | Error setting camera gain. | | |
| | Error getting camera gain. | | |
| | Error processing camera command. | | |
| | Timeout has been reached while waiting for camera response. | | |
| | Error response received from the camera: | | |
| | Error writing to camera serial port. | | |
| | Error reading from camera serial port. | | |
| | Invalid camera synchronization mode: | | |
| | Camera communication port has not been specified. | | |
| | Error setting camera gain. | | |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Image Board operation** Critical Errors | Could not create Sapera RtPro object. | Error communicating with Image Board | Reboot the machine.<br><br>If does not help, check that the FPGA design file AncRtproBaseFlouroFull.cbf is still in place: C:\Coreco\Anaconda\Firmware\Hip<br><br>If the file is present, reinstall the Anaconda drivers.<br><br>If does not help, check the image board and replace if necessary |
| | Could not destroy Sapera RtPro object. | | |
| | RtProDesign object has not been created. | | |
| | Error resetting the FPGA functions. | | |
| | Error processing FPGA rotation. | | |
| | Error processing FPGA noise suppression. | | |
| | Error processing FPGA edge enhancement. | | |
| | Error processing FPGA dark fluoro. | | |
| | Error processing FPGA flip. | | |
| | Error processing FPGA motion detection. | | |
| | Error setting internal image board trigger. | | |
| | Error setting internal image board trigger frequency. | | |
| | Could not start the image acquisition process. | | |
| | Could not stop the image acquisition process, aborting. | | |
| | Could not abort the image acquisition process. | | |
| | Error processing live function. | | |
| | Error processing live image function for Noise Reduction. | | |
| | Error processing live image function for Motion Detection. | | |
| | Error processing live image function for Edge Enhancement. | | |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Image Board operation** Critical Errors **(Cont.)** | Error processing live image function for Flip. | Error communicating with Image Board | Reboot the machine.<br><br>If does not help, check that the FPGA design file AncRtproBaseFlouroFull.cbf is still in place: C:\Coreco\Anaconda\Firmware\Hip<br><br>If the file is present, reinstall the Anaconda drivers.<br><br>If does not help, check the image board and replace if necessary |
| | Error processing live image function for Dark Fluoro. | | |
| | Error processing live image function for Reverse Video. | | |
| | Error processing live image function for Rotation. | | |
| | Error starting image acquisition. | | |
| | Error starting cine loop acquisition. | | |
| | Error stopping the acquisition. | | |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Reading configuration data** Critical Errors | Invalid Image Board configuration parameter. | Configuration file config_system.xml is corrupted or missing. | Replace the file |
| | Error setting Image Board configuration parameters. | | |
| | No warp calibration file name specified. | | |
| | No Flat Field calibration file name specified. | | |
| | Specified pixel depth is not supported. | Configuration file Default.ccf is corrupted or missing | Replace the file. |
| | Error reading warp calibration file. | Warp calibration file Warp4_default.bin or Warp6_default.bin is corrupted or missing. | Perform the warping calibration |
| | Warp calibration file has invalid format. | | |
| | Error loading warp calibration data. | | |
| | Warp calibration data has not been loaded. | | |
| | Error reading Flat Field calibration file. | Flat Field calibration file FF4_default.tif or FF6_Default.tif is corrupted or missing | Perform the flat field calibration |
| | Flat Field calibration file has invalid format. | | |
| | Flat Field buffer has invalid format. | | |
| | Error loading flat field calibration data. | | |
| | Flat Field calibration data has not been loaded. | | |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Host image processing** Critical Errors | Could not create Sapera Processor object. | Sapera Image Processing module failure | Reboot the machine.

If does not help, reinstall the Sapera Processing library.

If does not help, contact Hologic software engineering |
| | Could not destroy Sapera Processor object. | | |
| | Error processing static image function for Rotation. | | |
| | Error processing static image function for Flip. | | |
| | Error processing static image function for Edge Enhancement. | | |
| | Error processing static image function for Dark Fluoro. | | |
| | Error processing static image function for Reverse Video. | | |
| | Error processing static image function for Zoom. | | |
| | Error processing static image function for AOI. | | |
| | Error processing display flags for static image. | | |
| | Error processing static image function for Rotation. | | |
| | Error processing static image function for Flip. | | |
| | Error processing static image function for Edge Enhancement. | | |
| | Error processing static image function for Dark Fluoro. | | |
| | Error processing static image function for Reverse Video. | | |
| | Error processing static image function for Zoom. | | |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Host image processing** Critical Errors (Cont.) | Error processing static image function for AOI. | Sapera Image Processing module failure | Reboot the machine. If does not help, reinstall the Sapera Processing library. If does not help, contact Hologic software engineering |
| | Error processing display flags for static image. | | |
| | Error processing static image function for Rotation. | | |
| | Error processing static image function for Flip. | | |
| | | | |
| **Saving/loading image files** Critical Errors | Could not save the image bitmap. | Error writing data to the hard drive | Check if there is enough space on the hard drive. If does not help, delete the image causing the problem. If does not help, reboot the machine. If does not help, reinstall the InSight software. |
| | Error saving image to temp directory. | | |
| | Error updating image presentation state file. | | |
| | Error updating image display flags. | | |
| | Error saving display flags into a file. | | |
| | Error saving image to permanent directory. | | |
| | Error creating a directory for cine loop. | | |
| | Error creating image directory. | | |
| | Error saving raw image. | | |
| | Error cleaning up the temp directory for a new session. | | |
| | Error creating video file. | | |
| | Error writing video frame to a file. | | |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Saving/loading image files**<br>Critical Errors<br>(Cont.) | Could not load the image bitmap. | Error reading data from the hard drive, or the file is missing or corrupted. | Delete the image causing the problem.<br><br>If does not help, reboot the machine.<br><br>If does not help, reinstall the InSight software. |
| | Error loading the image from file. | | |
| | Error getting raw image data. | | |
| | Error loading bitmap file from the hard drive | | |
| | Image has invalid number of bits allocated. | | |
| | Image has invalid number of bits stored. | | |
| | Image has invalid number of columns. | | |
| | Image has invalid number of rows. | | |
| | | | |
| **XRC Communications**<br>Critical Errors | X-ray Off error received from XRC. | Communication with XRC has failed | Check the XRC log and follow the XRC error description instructions. |
| | No X-ray Off event has been received. | | |
| | Error getting Xray power from XRC. | | |
| | Timeout has been reached waiting for X-ray On event. | | |
| | Timeout has been reached waiting for X-ray Off event. | | |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Various operation during regular operating flow**<br>Critical Errors | Error creating Sapera objects. | Software failure | Reboot the machine.<br><br>If does not help, reinstall the InSight software.<br><br>If does not help, contact Hologic software engineering. |
| | Error destroying Sapera objects. | | |
| | Could not create Sapera Acquisition object. | | |
| | Could not create Sapera Buffer object. | | |
| | Could not create Sapera Transfer object. | | |
| | Could not create Sapera View object. | | |
| | Could not create Sapera Flat Field object. | | |
| | Could not create Sapera Flat Field Transfer object. | | |
| | Could not destroy Sapera Acquisition object. | | |
| | Could not destroy Sapera Buffer object. | | |
| | Could not destroy Sapera Transfer object. | | |
| | Could not destroy Sapera View object. | | |
| | Could not destroy Sapera Flat Field object. | | |
| | Could not destroy Sapera Flat Field Transfer object. | | |
| | Error initializing Sapera Image Board buffers. | | |
| | Error initializing Internal Image Board buffers. | | |
| | Could not destroy Image Board buffers. | | |
| | The view object has not been created yet. | | |
| | Error setting a window to the Sapera View object. | | |
| | Error processing Sapera hardware overlay. | | |
| | Error emptying buffer. | | |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Various operation during regular operating flow** Critical Errors (Cont.) | One or more Sapera objects has not been created. | Software failure | Reboot the machine.<br><br>If does not help, reinstall the InSight software.<br><br>If does not help, contact Hologic software engineering. |
| | Error zooming image. | | |
| | The Image Board object has already been created. | | |
| | The Image Board object has not yet been created. | | |
| | Could not get access to the image buffer. | | |
| | There are no image buffers allocated. | | |
| | Invalid image processing function specified. | | |
| | Error getting buffer address. | | |
| | Trying to start image acquisition while in cine mode. | | |
| | Trying to start cine acquisition while in image mode. | | |
| | The argument has invalid value. | | |
| | No message window specified. | | |
| | No XRC Interface object specified. | | |
| | Error resetting static flags. | | |
| | Invalid argument has been passed to the function. | | |
| | Trying to invoke real function in demo mode. | | |
| | Error creating the image display. | | |
| | Error changing the image display. | | |
| | The acquisition process is not running. | | |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| **Various operation during regular operating flow** Critical Errors (Cont.) | Could not start video recording. | Software failure | Reboot the machine. If does not help, reinstall the InSight software. If does not help, contact Hologic software engineering. |
| | Could not create Video Recorder object. | | |
| | The video recorder has been already created. | | |
| | The video recorder has not yet been created. | | |
| | Error stopping video recording. | | |
| | Error creating video stream. | | |
| | Error setting video stream format. | | |
| | Session information is missing. | | |
| | Live image processing function called for static image. | | |
| | Error displaying bitmap for demo acquisition. | | |
| | Could not create the Image Board object. | | |
| | Error destroying the Image Board object. | | |
| | | | |
| **Image acquisitionNot** Critical Errors | Trying to start acquisition while previous one is still running. | The X-ray pedal pressed too fast | No action required |

# Errors Generated by the XRC Module

(Stored in Log file and not displayed to the User)

Example of the Error :
MM/DD/YYYY  hh:mm:ss PM/AM  Error
Error Type: Text1
Description: Text2
or
"XRC error code: <error code>": where error code and description can be found
 in XRC Error Codes table on page 37.

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| Image AcquisitionMinor XRC error | NAK reply to message <message text>, error <error code> | Received a missed-message response from the XRC | None; system should continue normally |
| Minor XRC error | ACK reply to message <message text> with unknown command <command code> | The XRC says it received a message, but we don't recognize the message | None; system should continue normally |
| Minor XRC error | XRC error code: <error code> | The XRC is reporting that it had an error | Depends on the type of error (error code).  See separate table of XRC error codes. |
| Minor XRC error | Starting OnAttemptRecovery() with status = <status flags>, panel = <panel error count>, missed = <missed message count> | The XRC module has recognized a problem and is trying to recover from it. | None; the system should recover by itself (or signal a more serious error) |
| Minor XRC error | Could not find message with timer ID <timer ID> | A message timer timed out, but we can't find the message | None; system should continue normally |
| XRC link lost | Could not open COM1 port - no communications<system error message> | When starting InSight, could not open the port to communicate with the XRC | Try powering down and re-starting the entire system; if that fails, there is a  hardware problem. The unit must be repaired. |
| XRC link lost | Could not set COM1 port properties - no communications<system error message> | When starting InSight, could not set up the port to communicate with the XRC | Try powering down and re-starting the entire system; if that fails, there is a  hardware problem. The unit must be repaired. |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| XRC link lost | KeepAlive() failed, X-ray Source presumed dead | The XRC has stopped responding to keep-alive messages | Try powering down and re-starting the entire system; if that fails, there is a hardware problem. The unit must be repaired. |
| XRC link lost | Timed out waiting for XRC reset. | The system failed to recover from a serious XRC error | Try powering down and re-starting the entire system; if that fails, there is a hardware problem. The unit must be repaired. |
| XRC communications error | Out of m_outgoing message slots | Trying to send a message to the XRC, but too many messages are still pending | None; system should recover by itself |
| XRC communications error | WriteFile( port <port handle> message <message text>) failed<system error message> | The low-level send operation for a message has failed | If the system does not recover by itself, try powering down and re-starting; if that fails, there is a hardware problem. The unit must be repaired. |
| XRC communications error | CXrciEngine::WaitForData() timed out waiting on command <command code> | The XRC did not reply to a command within the time out period | None; system should recover by itself (or more errors will follow) |
| XRC communications error | Incoming msg <message text> wrong size for cmd <command code> - is <size> bytes, should be <size> | A message received from the XRC was not formatted correctly | None; system should recover by itself (or more errors will follow) |
| XRC communications error | Incoming message <message text> has invalid command <command code> | A message sent by the XRC has an invalid command code | None; system should recover by itself (or more errors will follow) |
| XRC communications error | Incoming message <message text> had wrong checksum - is <hex number>, should be <hex number> | A message sent by the XRC has an invalid checksum | None; system should recover by itself (or more errors will follow) |
| XRC communications error | CXrciEngine::ReceiveMessages() input buffer overflow | Incoming messages from the XRC have come in too fast to process and filled the available space | None; system should recover by itself |
| XRC communications error | ReadFile( port <port handle> ) failed<system error message> | The low-level read operation failed for an incoming message | If the system does not recover by itself, try powering down and re-starting; if that fails, there is a hardware problem. The unit must be repaired. |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| XRC communications error | Delayed ReadFile( port <port handle>) failure<system error message> | The low-level read operation failed for an incoming message | If the system does not recover by itself, try powering down and re-starting; if that fails, there is a hardware problem. The unit must be repaired. |
| XRC communications error | Could not find message with timer ID <timer ID> | We failed to reply to an incoming message inside the time out period, and now we can't find the message | None; system should recover by itself |
| XRC communications error | Timeout on reply to outgoing message <message text>, status <message state> | We failed to reply to an incoming message inside the time out period | None; system should continue normally |
| Maximum X-ray time exceeded | | The status flags from the XRC indicate that the X-rays have been on continuously for too long | Operator should stop trying to use X-rays for a few seconds |
| No X-rays error | CXrciEngine::OnAttemptRecovery() recovery failed; status = <status flags> | The system failed to recover from a serious XRC error | Try powering down and re-starting the entire system; if that fails, there is a hardware problem. The unit must be repaired. |
| No X-rays error | Timed out waiting for XRC reset. | The system failed to recover from a serious XRC error | Try powering down and re-starting the entire system; if that fails, there is a hardware problem. The unit must be repaired. |
| System call failed - <system error message> | Could not create outgoing message timeout timer | Unable to create reply timer for an outgoing message | None; system should recover by itself (or more errors will follow) |
| System call failed - <system error message> | Could not stop outgoing message timeout timer <timer ID> | Failed to remove timer for previous message | None; system should recover by itself (or more errors will follow) |
| System call failed - <system error message> | Could not create incoming message reply timeout timer | Failed to create a timer while trying to process an incoming message | None; system should recover by itself (or more errors will follow) |
| System call failed - <system error message> | Could not create KeepAlive timer | Could not re-start the keep-alive loop during attempted error recovery or starting Acquisition mode | Try powering down and re-starting the entire system; if that fails, there is a problem. The unit must be repaired. |
| System call failed - <system error message> | Could not stop KeepAlive timer <timer ID> | Could not stop the keep-alive loop while trying to handle a serious error or exit from Acquisition mode | Try powering down and re-starting the entire system; if that fails, there is a problem. The unit must be repaired. |

| Operation & (Error Type) | Description | Cause | Action |
|---|---|---|---|
| Memory allocation error | Could not create OVERLAPPED event handle | An error occurred trying to start the basic message transmit or receive loop | Try powering down and re-starting the entire system; if that fails, there is a problem. The unit must be repaired. |
| Memory allocation error | Message received for slot<slot number> ], status <state code> not STATUS_FREE \n(prior message <message text>) | An incoming message was received before the previous message with the same serial number was processed | None; system should recover by itself (or more errors will follow) |
| File access error - <file path> | CXrciXRC::FakeCalibrate() failed | Could not read the default calibration file (at the start of calibration - either actual or faked) | Make sure the file described in the error message exists; if not, the system has been installed incorrectly |
| File access error - <file path> | CXrciXRC::RestoreCalibration() failed | Trying to restore calibration data from a file, could not read the input file OR could not write the calibration file | Make sure the file described in the error message exists and that the path is correct; if the path is for the standard calibration file, make sure it's not read-only |
| File access error - <file path> | CXrciXRC::CheckCalibration() failed to read calibration file | Could not read the calibration file on the PC while trying to verify calibration at start-up | Make sure the file described in the error message exists and that the path is correct; if not, the system has been installed incorrectly |
| Programming error | {message depends on exact error location} | These are always because of some kind of illegal condition in the code - always due to a bug | File a bug report.  Include the full, exact text of the Description: and any other information you can provide, in as much detail as possible. |

# XRC Error Codes

| Error Code | Cause | Action |
|---|---|---|
| 02 | Expected next character to be end-of-message, but it wasn't | None; system should recover by itself |
| 03 | The buffer for incoming characters is full | None; system should recover by itself |
| 04 | Bad value for a control code inside the receive message routine | None; system should recover by itself |
| 05 | Can't find a receive queue for an incoming message (they're all in use) | None; system should recover by itself |
| 08 | Bad value for the first character in a sequence number (for an incoming message) | None; system should recover by itself |
| 09 | Bad value for the second character in a sequence number or the whole number is bad (incoming message) | None; system should recover by itself |
| 0A | No transmit queue available for reply to Get Version Number command | None; system should recover by itself |
| 0B | Bad value for first character of command code (incoming message) | None; system should recover by itself |
| 0C | Bad value for second character of command code (incoming message) | None; system should recover by itself |
| 0D | Command code value is too big (incoming message) | None; system should recover by itself |
| 11 | Bad value for first character of check sum (incoming message) | None; system should recover by itself |
| 12 | Bad value for second character of check sum, or back check sum (incoming message) | None; system should recover by itself |
| 13 | Bad value for data character (incoming message) | None; system should recover by itself |
| 14 | Bad value for string data character (incoming message) | None; system should recover by itself |
| 20 | Could not find transmit queue for outgoing message (they're all in use) | None; system should recover by itself |
| 23 | Message has been transmitted, but transmit queue was not freed | None; system should recover by itself |
| 24 | Message has been transmitted, but transmit queue was not freed (different place in code) | None; system should recover by itself |
| 26 | Current sequence number (for outgoing message) is still in use | None; system should recover by itself |
| 27 | Current sequence number is still in use and all transmit queues are in use | None; system should recover by itself |
| 28 | Current sequence number is not available for outgoing message (different place in code) | None; system should recover by itself |

| Error Code | Cause | Action |
|---|---|---|
| 29 | All the transmit queues are in use | None; system should recover by itself |
| 2A | An unrecognized state has occurred in the function that finds transmit queues | None; system should recover by itself; should cause host PC to reset the XRC |
| 30 | The event list is out of space | None; system should recover by itself |
| 31 | The bus used to communicate with the I2C board is not free | None; system should recover by itself |
| 32 | The bus used to communicate with the I2C board is not free (different place in code) | None; system should recover by itself |
| 33 | The bus used to communicate with the I2C board is not free (different place in code) | None; system should recover by itself |
| 38 | Error in I2C board communications code | None; system should recover by itself |
| 39 | Error in I2C board communications code | None; system should recover by itself |
| 3A | Error in I2C board communications code | None; system should recover by itself |
| 3B | Error in I2C board communications code | None; system should recover by itself |
| 3C | Error in I2C board communications code | None; system should recover by itself |
| 3D | Error in I2C board communications code | None; system should recover by itself |
| 3E | Error in I2C board communications | None; system should recover by itself |
| 40 | Initial KV value is too far from target (during calibration) | Either the XRC/X-ray power supply hardware is broken, or the default calibration file is corrupted; system cannot be calibrated |
| 41 | Initial MA value is too far from target (during calibration) | Either the XRC/X-ray power supply hardware is broken, or the default calibration file is corrupted; system cannot be calibrated |
| 42 | Maximum possible input for KV does not reach target value (during calibration) | Either the XRC/X-ray power supply hardware is broken, or the default calibration file is corrupted; system cannot be calibrated |
| 43 | Maximum possible input for MA does not reach target value (during calibration) | Either the XRC/X-ray power supply hardware is broken, or the default calibration file is corrupted; system cannot be calibrated |
| 44 | Target KV value not obtained after maximum number of retries (during calibration) | Either the XRC/X-ray power supply hardware is broken, or the default calibration file is corrupted; system cannot be calibrated |
| 45 | Target MA value not obtained after maximum number of retries (during calibration) | Either the XRC/X-ray power supply hardware is broken, or the default calibration file is corrupted; system cannot be calibrated |

| Error Code | Cause | Action |
|---|---|---|
| 46 | Error in C-Arm I/O board communications | None; system should recover by itself |
| 47 | Error in C-Arm I/O board communications | None; system should recover by itself |
| 48 | Error in C-Arm I/O board communications | None; system should recover by itself |
| 49 | Error in C-Arm I/O board communications | None; system should recover by itself |
| 4A | Error in C-Arm I/O board communications | None; system should recover by itself |
| 4B | Error in C-Arm I/O board communications | None; system should recover by itself |
| 4C | Error in C-Arm I/O board communications | None; system should recover by itself |
| 4D | Error in C-Arm I/O board communications | None; system should recover by itself |
| 4E | Error in C-Arm I/O board communications | None; system should recover by itself |
| 50 | Error transmitting characters to host PC | None; system should recover by itself |
| 51 | Error transmitting characters to host PC | None; system should recover by itself |
| 52 | Error transmitting characters to host PC | None; system should recover by itself |
| 53 | Error transmitting characters to host PC | None; system should recover by itself |
| 54 | Error transmitting characters to host PC | None; system should recover by itself |
| 56 | Error communicating with the X-ray power supply hardware | None; system should recover by itself |
| 57 | Error communicating with the X-ray power supply hardware | None; system should recover by itself |
| 58 | Error communicating with the X-ray power supply hardware | None; system should recover by itself |
| 59 | Error communicating with the X-ray power supply hardware | None; system should recover by itself |
| 80 | Error communicating with the EEPROM | None; system should recover by itself |
| 81 | Error communicating with the EEPROM | None; system should recover by itself |
| 82 | Error communicating with the EEPROM | None; system should recover by itself |
| 83 | Error communicating with the X-ray power supply hardware | None; system should recover by itself |
| 84 | Error communicating with the X-ray power supply hardware | None; system should recover by itself |

| Error Code | Cause | Action |
|---|---|---|
| 85 | Error communicating with the X-ray power supply hardware | None; system should recover by itself |
| 86 | Error communicating with the X-ray power supply hardware | None; system should recover by itself |
| 87 | An invalid interrupt has been triggered | File a bug report; include as much detail as possible |
| 89 | Error communicating with the EEPROM | None; system should recover by itself |
| 8A | Error communicating with the EEPROM | None; system should recover by itself |
| 8B | Error communicating with the EEPROM | None; system should recover by itself |
| 8C | Error communicating with the EEPROM | None; system should recover by itself |
| 8D | Error communicating with the EEPROM | None; system should recover by itself |
| 8E | Error communicating with the EEPROM | None; system should recover by itself |
| 8F | Error communicating with the EEPROM | None; system should recover by itself |
| 90 | Error communicating with the EEPROM | None; system should recover by itself |
| 91 | Error communicating with the EEPROM | None; system should recover by itself |
| 92 | Error communicating with the EEPROM | None; system should recover by itself |
| 93 | Error communicating with the EEPROM | None; system should recover by itself |
| 94 | Error communicating with the EEPROM | None; system should recover by itself |
| 95 | Error communicating with the EEPROM | None; system should recover by itself |
| 96 | Error communicating with the EEPROM | None; system should recover by itself |
| 99 | Error in I2C board communications | None; system should recover by itself |
| 9D | Error in I2C board communications | None; system should recover by itself |
| 9E | Error in I2C board communications | None; system should recover by itself |
| 9F | Error in I2C board communications | None; system should recover by itself |
| A1 | Error in updating XRC status | None; system should recover by itself |
| A4 | An impossible condition has occured | File a bug report; include as much detail as possible |

| Error Code | Cause | Action |
|---|---|---|
| A5 | An invalid interrupt has been triggered | File a bug report; include as much detail as possible |
| A6 | An invalid interrupt has been triggered | File a bug report; include as much detail as possible |
| A7 | An invalid interrupt has been triggered | File a bug report; include as much detail as possible |
| A8 | An invalid interrupt has been triggered | File a bug report; include as much detail as possible |
| A9 | An invalid interrupt has been triggered | File a bug report; include as much detail as possible |
| AB | An invalid interrupt has been triggered | File a bug report; include as much detail as possible |
| AC | An un-implemented function has been called | File a bug report; include as much detail as possible |

# Appendix F
# Drawings