DELWORKS
DIGITAL RADIOGRAPHY
MEDICAL

X-Ray Acquisition Workstation

SERVICE MANUAL

DEL MEDICAL

Del Medical Customer Support

Monday thru Friday, 7:00 a.m. to 5:00 p.m. Central Time/

Technical Support & Customer Service:

- Use our Technical Support website: http://www.delmedicaltechsupport.com/contact.html
- Call us toll free at 1-800-800-6006 (US only) or 1-847-288-7000. Email us at tech_support@del-medical.com.

Please have the following information ready before making your service call:

- System Serial Number (S/N) — found on the identification tag on the rear of the PC.
- Software version. To find the software version, click on the Del Medical logo (top of Main Menu in Clinical Mode) for the About screen, or look for the Versions button (toward the bottom of the Service Mode menu).

Thank you for choosing Del Medical.

Del Medical's *DelWorks Digital Radiography* product is also referenced as *DelWorks DR* in this document.

DelWorks Digital Radiography

Service Manual

DEL MEDICAL

DelWorks Digital Radiography

an innovative diagnostic digital imaging application by Del Medical, Inc.

Applicable standards & compliance
FDA 510(k)
IHE Integration (see Appendix A)

This product conforms to the necessary IEC standards for patient safety and isolation as it is shipped from the factory. It is the responsibility of the end user and/or the installer to insure that when connected, as a system with other devices, all the rules of IEC6060 are met.

HIPAA logging: DelWorks Digital Radiography supports HIPAA Access Control Standards. Unique user identification and automatic logoff are implemented through user configuration and the login/logoff features of the Clinical mode. HIPAA Audit Control Standards are used in the Service Mode logs to record user actions.

8/23/10

Welcome

The Del Medical DelWorks DR adapts to the needs of the user. Its menu interface may be customized, and it supports multiple wired or wireless flat panel detectors. DelWorks DR defines convenience. Del Medical's open platform allows the technologist to adapt on the fly to changes in the industry and to clinical requirements.

DelWorks Digital Radiography

DelWorks DR is specifically designed for routine radiographic exposures where the image is captured on a digital sensor and stored as an electronic patient file in the computer. Acquired images are instantly viewable. DelWorks DR presents an intuitive touch screen. It supports cutting-edge flat panel detectors and offers integration with x-ray generators.

DelWorks DR's user-friendly interface is tailored to exceed the needs and requirements of today's busy work environment. It standardizes and minimizes the steps required from image acquisition to optimal viewing and storage.

User customizable acquisition profiles and work procedures can optimize patient throughput and image quality. With the use of advanced image processing algorithms, premium image quality is realized on the first view. Patient through-put is enhanced while minimizing user intervention by reducing or eliminating the need for retakes.

With the ability to support multiple flat panel detectors, DelWorks DR provides commonality for digital radiography. In addition, DelWorks DR's compatible panels fit most existing cartridge-based Bucky trays or chest units in radiographic rooms. This gives many clinics the economical option to upgrade almost any film-based system to a digital-based system.

This manual gives the Del Medical-trained and -authorized Service Technician instructions to set up the hardware and to configure the software for use of DelWorks DR. It also discusses the x-ray generator interface, flat panel detector, and connection to a DICOM network server. Most of the technician's work takes place in the Service Mode of DelWorks DR, but this work affects nearly every aspect of how radiologic technologists will use DelWorks DR Clinical Mode. Please refer also to the documentation that accompanies the x-ray detector. When an x-ray generator is integrated with the digital software, please also refer to the generator's manual.

We are pleased that you have chosen Del Medical. Thank you.

Contents

Figures

Tables

Part 1.Assemble Components of DelWorks DR

CHAPTER 1	# Equipment Handling

Preventive maintenance

About every 6 months — or whatever frequency your site requires —check the functionality and appearance of each major component of the imaging system. Inspect components for dust or debris. Clean with a dry soft cloth, if necessary.

Shut down all components of the system before cleaning. Follow these cautions when cleaning electronic components:

- Blow dust from the interior of the PC and from fan covers to permit air circulation.
- Never spray or squirt the liquids directly on any computer component. If you need to clean the device, spray cloth first, then rub the equipment to clean.
- Be cautious of all cleaning solvents or chemicals when you used for cleaning. Some individuals may be allergic to the ingredients.

Place no food, drink, or cigarettes around the computer.

Safety

Apply the directions here precisely to avoid damage to the System or any of its components, yourself, or others, loss of data, or corruption of files. The manufacturer assumes no liability for failure to comply.

Cautions

Mechanical. Use care to see that the image monitor is stable and cannot fall. Use mounting brackets if necessary.

To maintain adequate signals and power among the hardware components, use securing mechanisms to fasten cables and connectors.

See that cables used in DelWorks Digital Radiography and associated equipment cannot create trip or fall hazards.

Install the electronic components on secure and stable surfaces to prevent shifting and falling, to protect the equipment from damage, and to protect users of the equipment.

Electrical. Use the equipment in a space that is properly ventilated. Provide sufficient free space around he components to permit their ventilation. Some electrical components, if operated beyond the stated temperature range may emit toxic fumes. Do not permit components to overheat.

Isolation transformer: To reduce the risk of electrical shock, do not remove cover. Refer servicing to qualified personnel. The isolation transformer must be properly grounded. Use the external ground screw head stud. Grounding reliability can only be achieved when connected to a receptacle known to be equivalent to hospital grade. The outlets on the isolation transformer output 120 V AC, 50/60 Hz at 8 A maximum power factor 0.8 ±10%. Ambient operating temperature is 64-86ºF (18-30ºC).

Hardware. The UPS system-power conditioner combo unit (optional equipment) uses fuses. When replacing he fuses, use replacements with the same rating and capacity.

Software. Once operational, only properly trained and authorized personnel may use DelWorks DR to access patient records. Operating information about the Clinical Mode of DelWorks DR is available in the companion Operator's Manual.

Use no software other than that supplied by manufacturer on DelWorks Digital Radiography.

Patients. Do not position or use this system in a location where it may be subject to splashed or spilled liquids.

Review hardware safety requirements to ascertain whether the components may be cleaned and the best means of cleaning; see also preventive maintenance.

All personnel must wear dosimeters during every phase of installation, operation, and maintenance of the system and the equipment to which it is connected.

Servicing. Only properly trained and authorized personnel may install or configure DelWorks Digital Radiography.

The power source must meet the power supply requirements defined in the site planning guide. Use of the system outside these limits voids the product warranty.

This instrument contains high voltages capable of causing death. Do not connect additional multiple portable socket-outlet or extension cords to the system. Follow instructions for correct cabling of components.

Del Medical engages qualified translators who are trained in medical and computer terminology, and these translators are checked by editors who are similarly qualified, yet translated materials are the interpretation of the translator and are not considered Del Medical's responsibility. Each translation is based on the original English version release. At times, a translated manual may not be the same revision as its English counterpart.

Only properly trained service personnel may alter any hardware components except for Operator-permitted cleaning procedures or procedures supplied as instructions with a part provided by the manufacturer. Doing so could disrupt the functioning of the system and result in loss of images. Service personnel should contact manufacturer for applicable part numbers from the system's spare parts list.

Operation. Do not use this instrument in the presence of an explosive atmosphere, including flammable anesthetics. Failure to comply could result in fire and explosion.

Operate the system such that no patient contact with any part of the system is possible. Position the PC cabinet away from the patient and outside a 6-ft radius of diagnostic area. Attempt no maintenance, including troubleshooting, in the presence of any patients or unauthorized staff.

The system is interfaced with x-ray generating equipment. Follow the instructions for wearing proper lead shielding that came with the x-ray generator. Do not bypass the safeties provided by the x-ray generator during the installation or servicing of the hardware or software. Doing so could expose personnel to unnecessary radiation.

Environment. Follow procedures with regard to electromagnetic compatibility.

At the end of its useful life, this equipment and its accessories must be disposed of safely and in accordance with government regulations.

Miscellaneous. Transport and store the electronic components within recommended parameters (see below).

.Operate the electronic components, including the isolation transformer, within the parameters listed in Table 1.

TABLE 1. *Environmental parameters*

	Computer & peripherals		Isolation transformer
	Transport & store	Operate	Operate
Temperature	-4 – 131ºF (-20 – 55ºC)	50 – 90ºF (10 – 32Cº);	64 – 86ºF (18 – 30ºC)
Humidity	10 – 95% noncondensing	20 – 75% noncondensing	20 – 75% noncondensing
Air pressure	700 – 1060 hPa (10 – 5 lb/in^2, 0.7 – 1.0 atmosphere)	700 – 1060 hPa (10 – 15 lb/in^2, 0.7 - 1.0 atm)	700 – 1060 hPa (10 – 15 lb/in^2, 0.7 - 1.0 atm)

Room Readiness

DelWorks DR is shipped in several boxes banded to a standard wooden pallet. Keep the boxes upright at all times.

A packing list is attached to the outside of one box. Check this packing list when you first receive the shipment or if the items have been removed from the pallet when they are delivered to the x-ray room.

DelWorks DR is composed of sensitive electronic devices. Follow caution stickers regarding careful handling. *We recommend that you leave the components in their packaging until it is time to assemble them on site.* Flat panel detectors are sensitive and often require special handling including extensive acclimatization times. Refer to information about the detector in the pertinent chapter of this manual and to documentation that accompanied the detector.

To save time when troubleshooting problems and for the best image quality, the x-ray room components and peripheral devices must be in place, working properly, and configured before installing DelWorks DR. Check that the following are in place.

Packing list. Check the shipment for the packing list.

Room layout. Discuss with the site personnel the preferred location for each component. Sketch the room layout to assist with placement of the components and cabling of DelWorks DR.

Enough shelf or table space. A flat work surface (table or cart) is required to hold the Operator's controls. Check that the area has enough room for comfortable use of the keyboard and pointing device and that the table or cart is at a suitable height. If space is limited, consider using a retractable keyboard shelf (not supplied by Del Medical). Some configurations replace the physical keyboard with an on-screen touch keyboard. Consult the site personnel for their preferences. See page 28 for information on configuring the on-screen keyboard.

Suitable conduits. Refer to later chapters in this Manual for details on required cables, routing restrictions, cable sizes and lengths. Also, consider cables for other devices in the x-ray room and control room. See that there is an acceptable path for each cable.

Generator functioning. The generator must function properly before making any connections between it and DelWorks DR.

Power source. If the power source does not meet criteria as outlined in this Manual ("Power" on page 14), install the Del Medical power conditioner.

Image monitors. Consult site personnel to determine preferred location of the image monitors. Monitors are shipped with removable bases. Del Medical recommends you remove the tilt-swivel base from the monitor before mounting the monitor to an unstable surface such as a cart or hanging bracket. If using a cart, Del Medical recommends that you attach a handle to the cart for safe use of the cart and monitor. To attach the monitor to a cart or to a hanging bracket, consider how the monitor will be attached to the surface.

Blank disks. To test DelWorks DR's recording capabilities, you need at least one CD or DVD.

Network drop. The site must provide the network connection cable. Work with the site's network administrator to have this arranged. DelWorks DR supports 10/100/1000 Base-T connections.

Network information. The network address must be obtained from the local network administrator. This information can then be entered into DelWorks DR when the system parameters are set.

Remote DICOM services. The site must provide connectivity data for DICOM service classes, print, store, worklist, and so forth that are necessary for the particular site. Refer to the Pre-installation Site Survey for data forms, or contact Del Medical Customer Care (Call us toll free at 1-800-800-6006 (US only) or 1-847-288-7000. Email us at tech_support@delmedical.com.).

Basic tools needed.

Digital volt-ohm meter (20,000 Ω/V)
Phillips #1 and #2, blade type 1/8-inch, 1/4-inch screwdrivers
Metric hex key set (1.5 to 6 mm)
Dosimeter
Ruler
ESD wrist strap
X-ray phantoms: line pair resolution and 15-cm Lucite (homogeneous density). This is equivalent to 1½ inches of aluminum.

X-ray Generator Connections

Refer to the next chapter for information on your detector.

For generator integration, see "Generator Interface & GIM Test" on page 77.

DelWorks DR supports several flat panel detectors. The panels can connect with cables or through a wireless access point to the DelWorks DR operating computers.

THE SPECIFIED MAXIMUM VOLTAGE LEVEL
FOR THE GENERATOR INTERFACE SIGNALS
VARIES WITH THE MAKE AND MODEL OF THE X-RAY DETECTOR.

REVIEW THE PROPER VOLTAGE FOR EACH DETECTOR.

The interface of a digital detector to the x-ray system closely resembles the interface used by a film Bucky tray with a reciprocating anti-scatter grid. The x-ray exposure must be synchronized with:

Film Bucky. Motion of the grid.
Digital detector. Integration window of the device.

A minimum of three interface signals are required to operate DelWorks DR:

- PREP, prepare for exposure
- REQ, request to expose
- X-RAY_EN, expose enable.
-

Some host x-ray systems also require use of the RAD_READY interface line. If RAD_READY is enabled in the system configuration, both the REQ and the RAD_READY lines must be true for the exposure sequence to occur. See Table 2.

TABLE 2. *Generator input-output signals*

Signals	Output from	Input to	Explanation
PREP Required	Host x-ray system	DelWorks DR	Active when x-ray generator is preparing for exposure
REQ Required	Host x-ray system	DelWorks DR	Active when generator has completed PREP cycle and operator is calling for an exposure
X-RAY_EN Required	DelWorks DR	Host x-ray system	Active when (a) patient is open, (b) PREP and REQ inputs are true, and (c) detector is ready to acquire. When X-RAY_EN is active, x-ray exposure should initiate from the host x-ray system.
Optional	Host x-ray system	DelWorks DR	If x-ray system is configured to use RAD_READY input, both REQ and RAD_READY must be true to initiate an exposure. The RAD_READY line is typically not used.

Systems that have dual x-ray detectors are required to use the Select 1 and Select 2 input signals. These signals select detector #1 or detector #2, respectively. When a system has only one x-ray detector, these signals are optional.

Interface signal sources may vary depending on the specific detector used. Consult the detector interface section of this manual for detector-specific information. See "Generator Interface & GIM Test" on page 77.

PaxScan 4336R
X-ray Detector

From the Windows desktop, install the software for the PaxScan 4336R detector.
Use the Varian-supplied installation DVD.
The panel installs to `C:\IMAGERS\[PanelSerialNumber]` on the DelWorks DR PC.

This chapter discusses the specifications of the Varian PaxScan® 4336R x-ray panel (Figure 1). The panel has an amorphous silicon digital x-ray imager. It is a portable x-ray flat panel detector designed for mobile digital radiographic x-ray systems. It fits 14 x 17 inch standard Bucky trays (36 x 43 cm). The ruggedized outer shell has a handle. The panel can be used with or without the outer case.

FIGURE 1. *PaxScan 4336R detector*

Pixel data:
- Area, Total: 16.8 x 14.0 inches (42.7 x 35.6 cm), Active: 16.7 x 13.9 (42.4 x 35.3 cm)
- Matrix, Total: 3072 x 2560, Active: 3052 x 2540
- Pitch: 139 µm
Energy rating: Standard, 40-150 kVp

Size: 18.1 x 15.1 x 0.6 inches (46.0 x 38.4 x 1.5 cm)
Weight with cables: 8.6 lb (3.9 kg)

Power of I/O interface box: 100-240 V AC, 47-63 Hz up to 9 m from panel.

Position the Varian panel within 7.5 ft (7 m) of the Varian power supply and I/O interface/control module.
Position it within 11 ft (10 m) of the PC or the gigabit switch, if the switch option is used.

Cautions

- Consult PaxScan 4336R technical documents for proper installation and testing instructions.
- Work on a clean work surface.
- Protect the panel sensor from electrostatic discharge (ESD), scratches, dust, spills, and moisture. The electronic components are extremely sensitive to ESD, dust, dirt, oils, and other contaminants; therefore, use ESD precautions when working with electronic equipment.
- The panel becomes warm during use. Limit patient contact in line with warnings in manufacturer's recommendations.

Preventive maintenance

The panel can come into direct contact with patients and needs to be sterilized. The flat panel detector and connected cables are likely to be soiled during use. The specific material most likely to become soiled is the x-ray grade carbon fiber input window and magnesium housing. Cleaning, disinfection, and sterilization of the input window should be performed as needed.

Proper disinfection and sterilization requires that a disinfectant-sterilization solution be used. Wiping the surfaces with a soft cloth dampened with soap and water will generally clean the surfaces.

Note: The panel has no user-serviceable parts.[1]

Cables

Table 3 lists the cables required to connect the PaxScan 4336R detector to DelWorks DR.

TABLE 3. *Required cables for Varian 4336R detector & DelWorks DR*

Cable	Connections	Details
739-102-G1 flat panel detector cable. See Figure 2 for drawing.	Digital I/O board in tower PC ↔ x-ray generator & Varian supply I/O module	Connectors: 37 pin and 9 pin 50 ft See more on "Generator interface" on page 14
Varian-supplied 100 MB data cable	-	-
Varian-supplied detector-control module interface cable	-	-
098-699, PC keyboard cable	PC	6 ft
098-698, optical mouse cable	PC	6 ft

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1. Varian. PaxScan® 4336R Operating Instructions (P/N 3588). October 2008.
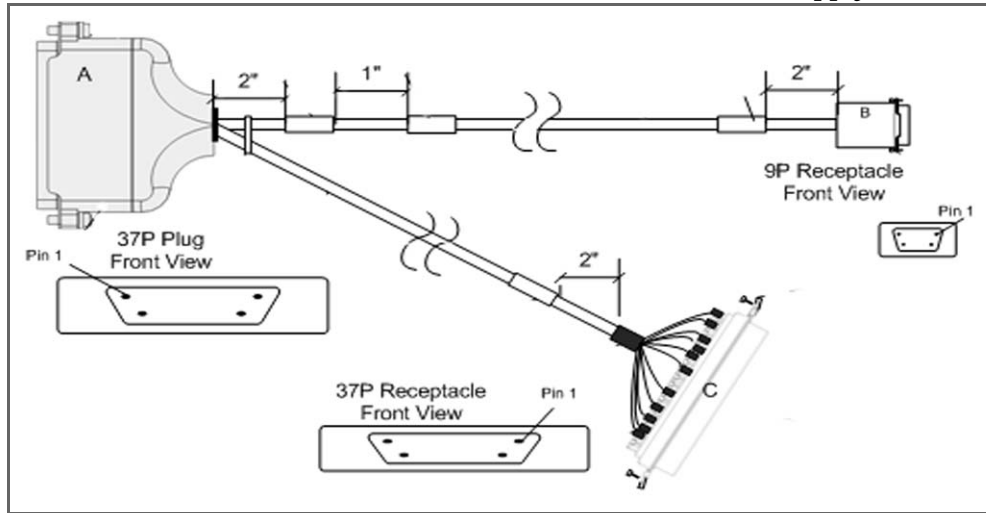
Cable connections

The PaxScan 4336R detector has three cable connections (see Figure 3):

- External power supply (I/O box) cable
- Category 5 or better Ethernet cable
- External synchronization cable.

The panel includes an attached cable. The cable connections are:

Power supply (I/O box). Interface between the detector and the DelWorks DR system. It provides power to the detector and an RJ-45 Ethernet. It is also an interface for the external synchronization.

> Connect the detector cable to the imager connector on the power supply. Plug the power supply into the main AC supply.

Gigabit Ethernet connection. Connect the Ethernet cable to the power supply (I/O box) connector and to a gigabit-capable interface at the DelWorks DR host computer.

External synchronization cable connection. Provides DelWorks DR with a means to synchronize the imager. This connector provides the connections for DelWorks DR I/O board and the Varian I/O box. The one output signal named EXPOSE_OK is intended to signal that the detector is ready for the generator to produce x-rays; the input named EXPOSE_REQ allows the user to trigger the panel readout.

> Connect this cable to the external synchronization connector on the power supply.[2]

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2. Varian. PaxScan® 4336R Operating Instructions (P/N 35858). October 2008.

FIGURE 3. *Cabling for PaxScan 4336R panel and DelWorks DR system*
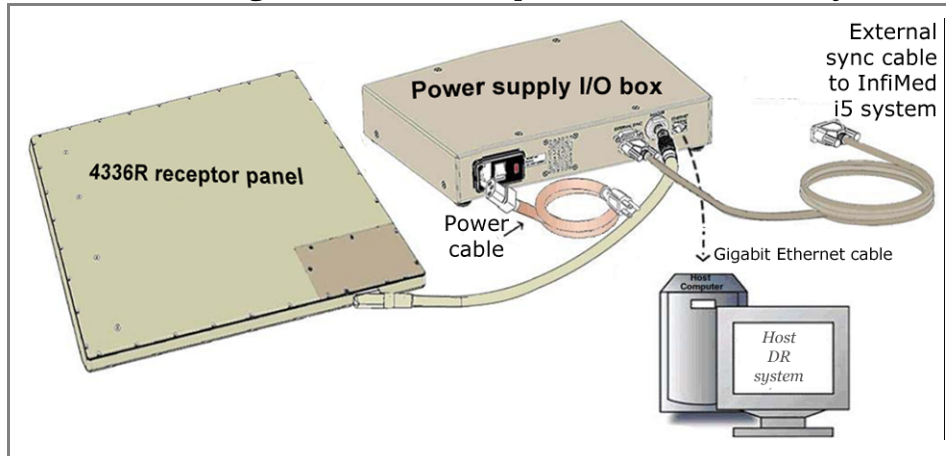
Generator interface

DelWorks DR's digital interface board accommodates all interfacing between the x-ray generator and the PaxScan 4336R detector. No interface signals are required between the host x-ray system and the detector. Input and output signals from the host x-ray must be direct current (DC) voltages greater than 5 V and less than 28 V when active.

DelWorks DR generates the I/O signals that the PaxScan 4336R detector requires to synchronize with the x-ray generator. The signals are V-PREP, V-REQ, and X-RAY-EN. The signals pass through DelWorks DR's digital I/O board to the detector via the DSub 9 connection of interface cable 739-102-G1.

The interface cable has part number 739-102-G1; see page 13 for illustration. Table 4 lists the signal lines. Figure 4 shows which signal lines are required and which are optional. Inputs have polarity. The input and reference for each signal must be selected according to the active state polarity of the host x-ray system.

TABLE 4. *Signal lines for PaxScan 4336R detector, cable 739-102-G1*

A signal	A pin #	Wire color
V_PREP 1+	4	Black
	N./C	Jumper
V_REQ 1+	7	White
	N./C	Jumper
	N./C	Jumper
V_X-RAY_EN 1-	34	Green
V_X-RAY_EN 1+	16	Brown
V_PREP 1-	5	Blue
V_REQ 1-	8	Orange
PREP +	12	Black
PREP -	30	White

B pin #	B signal
1	V_PREP 1+
2-4-5	PREP n
3	V_REQ 1+
2-4-5	XREG n
2-4-5	User ground
6	V_X-RAY_EN 1-
7	V_X-RAY_EN1+
9	Spare +
9	Spare +

C pin #	C signal
4	PREP +
26	PREP -
23	REQ +
26	REQ -
24	Select 1 +
29	Select 1 -
6	Select 2 +
7	Select 2 -
3	X-RAY_EN +
11	X-RAY_EN -

TABLE 4. *Signal lines for PaxScan 4336R detector, cable 739-102-G1 (Continued)*

A signal	A pin #	Wire color		B pin #	B signal		C pin #	C signal
REQ +	13	Red						
REQ -	31	Green						
Select 1+	14	Orange						
Select 1-	32	Blue						
Select 2+	15	White/black						
Select 2-	33	Red/black						
X-RAY_EN +	1	Green/black						
X-RAY_EN -	2	Orange/black						

FIGURE 4. *Interface between PaxScan 4336R detector & DelWorks DR system*
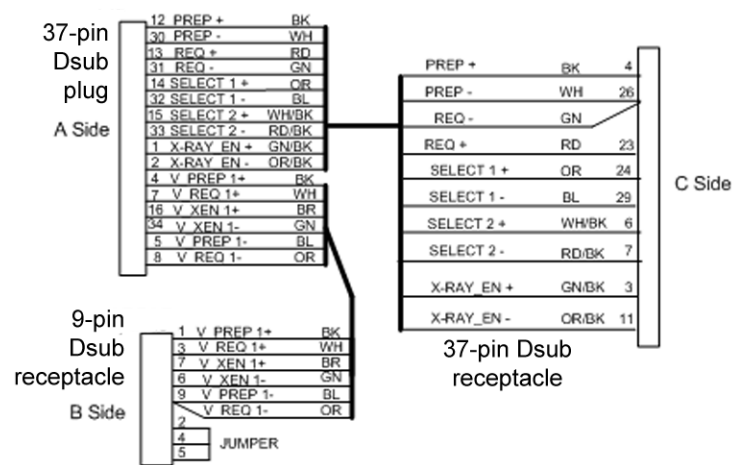
Installation

See schematic in Figure 5 showing components and cabling.

1. Place the 4336R supply/control I/O module on a flat work surface.
2. Connect the Varian-supplied 100-MB data cable to Ethernet connector of supply/control I/O module.
3. Connect one end of the Varian-supplied detector-control module Interface cable to the imager connector on the PaxScan 4336 supply/control I/O module.
4. Connect the other end of the Varian-supplied detector-control module interface cable to the connector on the 4336R detector.
5. Connect the panel's cable 739-102-G1 (9-pin DSub connector marked To 4336R) to the external synchronization cable connector on the supply/control I/O module.
6. Plug the standard power cable to the AC input of the supply/control I/O module.

FIGURE 5. *PaxScan 4336R detector & hardware connections*

FIGURE 5. *PaxScan 4336R detector & hardware connections*
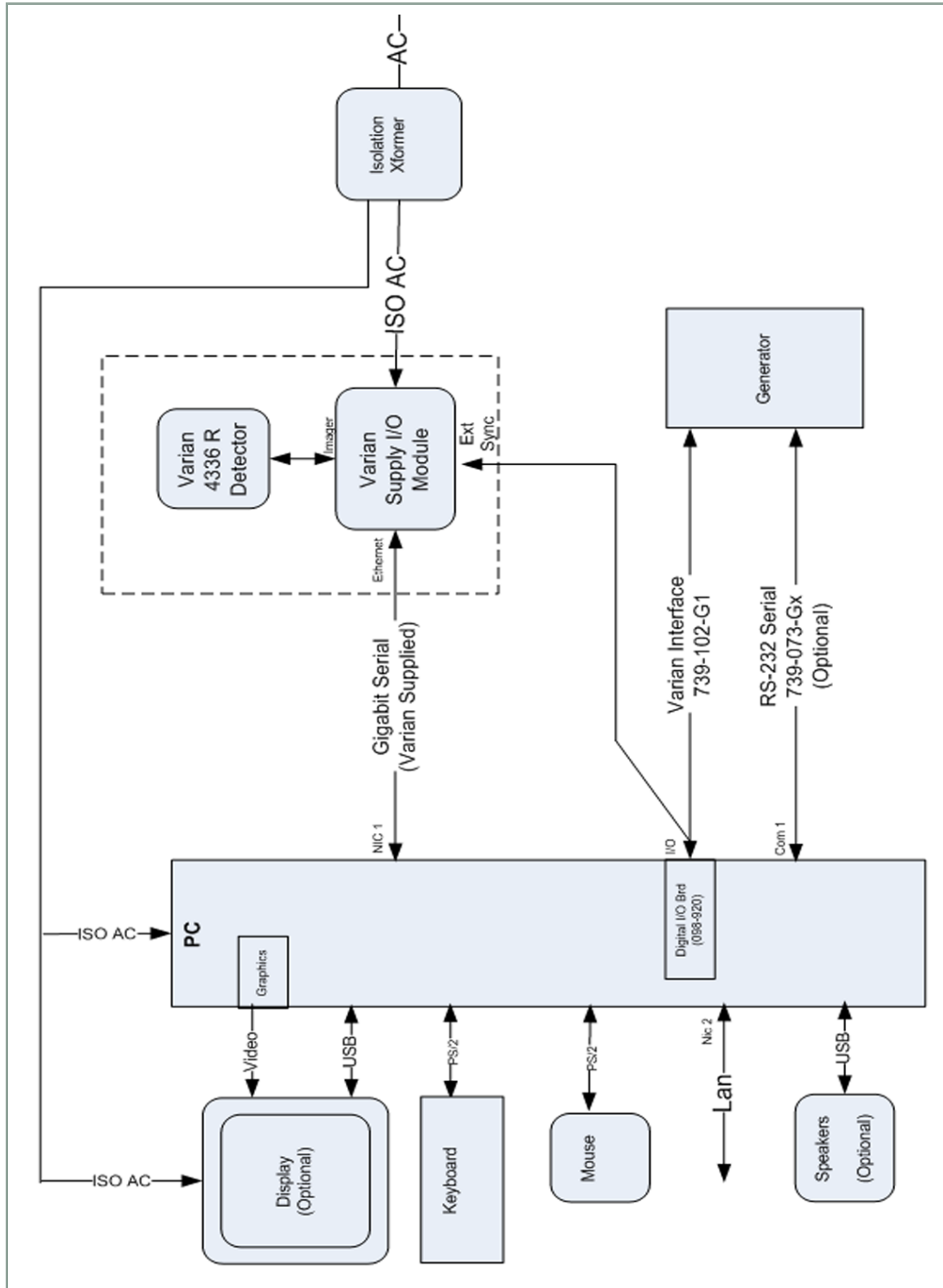
Configuration

Follow these steps to configure the PaxScan 4336R for DelWorks DR:

1. Enter DelWorks DR's Service Mode.
2. Select the Config option from the top of the Service Mode menu.
3. The configuration dialog window opens.
4. Select the Panel Configuration from options in the listing on the left of the configuration dialog.
5. In the right pane of the configuration window, click the Add button, and select the PaxScan 4336R panel. Table 5 lists configuration parameters for the panel.
6. When the Directory Selection dialog window pops up, select the directory to which the panel was installed `(C:\IMAGERs\[PanelSerialNumber])`.
7. You may rename the panel if you wish.

After configuration, touch or click the Verify Settings button to see if communication has been established. DelWorks DR responds with a pop-up window that (a) confirms successful communication or (b) notes that communication did not take place.

For a single panel, nothing else needs to be changed.

TABLE 5. *PaxScan 4336R configuration settings*

Parameter type	Parameters	Settings
Flat panel detector details	Detector name	User-entered text
	Panel serial number	Auto-generated when pane is installed
	Manufacturer name and model	PaxScan 4336R (read only)
General	Collect raw image data	On/off, Default = off Storage location: c:\DiagI5
	Digital I/O	1 or 2, Default = 1
Detector corrections	Varian offset	On/off, Default = on
	Varian gain	On/off, Default = on
	Varian defect	On/off, Default = on

Calibration

The panel permits detector corrections for Varian offset, Varian gain, and Varian defect. For specific calibration functions, follow on-screen prompts with DelWorks DR. Several images are acquired in the calibration procedure.

Note: If your x-ray generator is integrated with DelWorks DR, an icon showing that connection appears in the lower-right of the gain calibration window (see Figure 6). With an integrated generator, you may select this icon to bring up the generator interface. You may then adjust the x-ray techniques.

These are the steps for gain calibration:

1. Begin at Service Mode for DelWorks DR. Select Calib.
2. In the new window (Figure 6, left), select Gain.
3. Follow the on-screen instruction to set SID, collimator, and filter.
4. Click the Play button. The progress of the calibration displays in the middle-right of the calibration window (Figure 6, right). Note the newly updated instructions in the middle pane of the window.
5. When the panel says to provide a specific kV/mA (Figure 6, right), set the suggested values on the generator.
6. Expose the panel. If the exposure meets the required criteria, the panel's next requested exposure setting (kV/mA) is displayed.
7. Set those values, and expose.
8. Repeat until all images have been taken.
9. If all proceeds well, wait for a pop-up window indicating a successful calibration.

YOU MUST RESTART THE DELWORKS DR SYSTEM
AFTER A SUCCESSFUL CALIBRATION.

You may review the history of calibrations performed; select History in Figure 6. The parameters reported in the history are start and end dates, user name, date performed, calibration test type, and results (pass, fail, cancelled).

FIGURE 6. *Varian gain calibration: Left: Before, Right: During calibration*
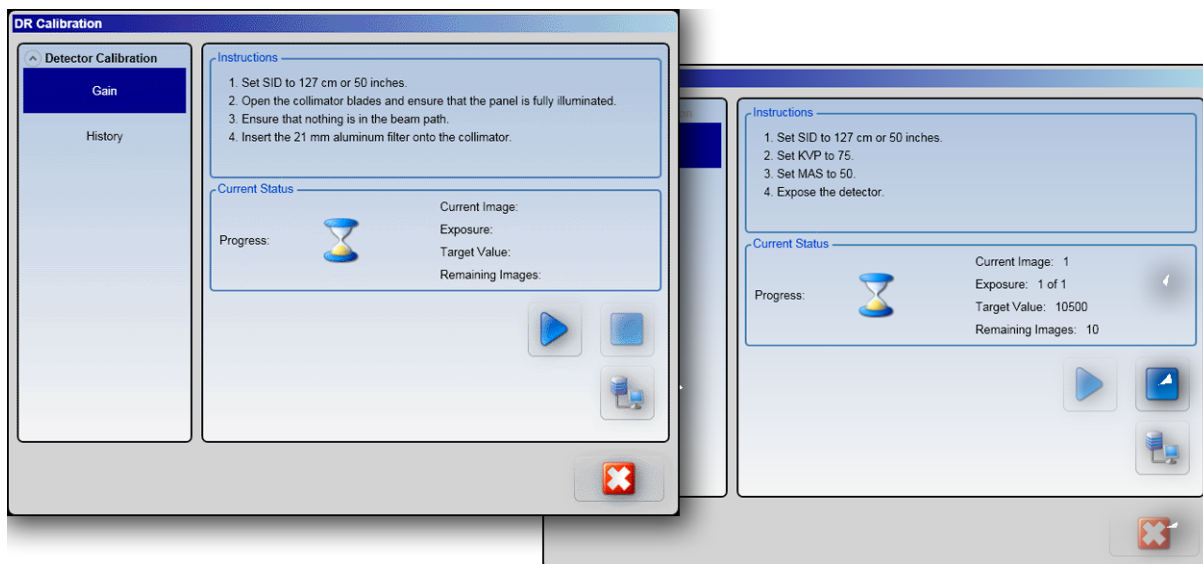
Integrated Generator

Select Generator Interface on the Service Mode menu. A new window displays (below). You may then (with the selection of Options) add new x-ray tubes or workstations and (with the selection of Configuration) organize the generator connection and default settings.

IT IS CRITICAL THAT THE CONFIGURATION & OPTIONS OF THE SETTINGS ESTABLISHED HERE IN THE SERVICE MODE OF DELWORKS DR MATCH EXACTLY THE CONFIGURATION AND CAPABILITIES OF THE HOST X-RAY SYSTEM.

FIGURE 7. *Generator interface*
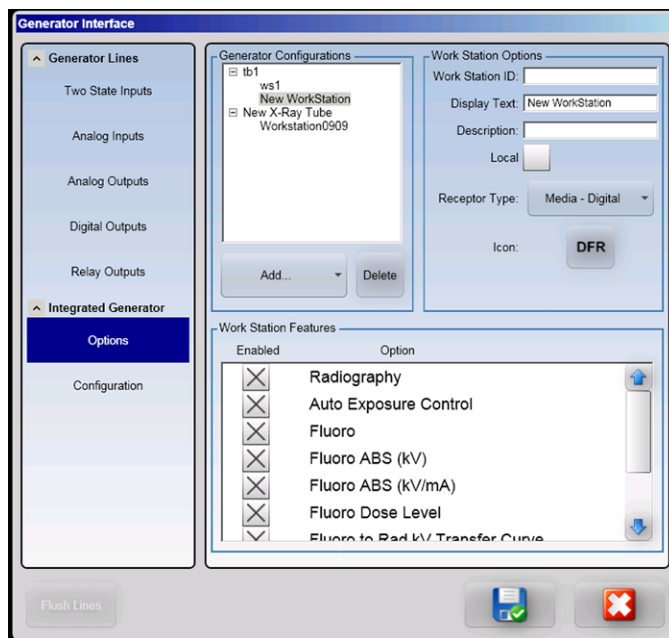
X-ray tubes & workstations

The Options setting displays the following:

Currently specified x-ray tubes and x-ray workstations are on the left. You may add or delete (see buttons in figure above). The information that you enter here will be used to describe the tube used for exposure in the Generator Interface dialog of DelWorks DR in both Service Mode and Clinical Mode. Thus, the technologist will begin with the generator interface that you set here. He or she may alter it before imaging, however. Configure the tube or workstation with the data listed in Table 6.

TABLE 6. *Configure x-ray tube or workstation*

When adding a tube	When adding a workstation
1. Give it a unique name of your choosing to identify it.	1. Give it a unique name of your choosing to identify it.
2. Give it a unique identifier of your choosing.	2. Give it a unique identifier. It must match the workstation's ID.
3. If you wish, add additional descriptive information.	3. If you wish, add additional descriptive information.
4. Select micro-focal spot if you wish to use this setting.	4. Specify if images are to be captured locally (by DelWorks DR). If selected, Local displays on generator interface in Service and Clinical Modes.
	5. Specify the receptor type: media-film, media-digital, or media-ignored.
	6. Specify the detector that will be used.
	7. Select an icon to identify the workstation.
Bottom pane: Enable, with an *X*, the controls you wish to use in the Generator Control dialog window in both Clinical and Service Modes.	

Configure integrated generator

Select Configuration on the Generator Interface window (see figure below), and then configure the generator by means of a set of drop-down menus (explained below but not shown). First set the view for the default patient dose, the default somatotype, and the communication settings.

Dose. Select the type that the generator supports. AKR/CAK displays the dose as Air Kerma (kinetic energy released in material) Rate and Cumulative Air Kerma. DAP/ADAP displays the dose as Dose Area Product (image data) and Cumulative Dose (Study data).

Somatotype (default patient size). Set the somatotype according to the clinic's preference. This is the default that will be used by the Acquisition Profile Generator APR.

Communication with generator. Set the communication parameters between DelWorks DR and the integrated generator (Com port, data bits, stop bits, baud rate, parity, flow control, and poll refresh). These values depend on the capabilities of the generator. Find these values in the documents that accompany the generator.

FIGURE 8. *Configure interface between DelWorks DR & generator*

Part 2. Configure the DelWorks DR System

FIGURE 9. *Service Mode menu*
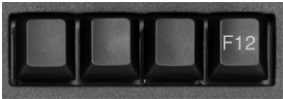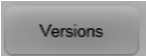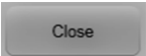
Summary: Access to Del-Works DR's Service Mode	1. Turn on the PC tower computer for Del-Works DR. 2. Login as a servicetech (typically). 3. Use password *Generation5*. 4. Begin at Clinical Mode. 5. Go to Service Mode. Next:
⬅ > 🔧	Enter Service Mode from Clinical Mode: 1. Select left-pointing arrow at bottom of the *Clinical Mode* menu area. 2. Function Menu Bar appears across bottom of screen. 3. Select Wrench. Service Mode menu appears (Figure 9).
Quick tips for service mode:	
F12	Bring up x-ray generator control menu, if generator is integrated.
Versions	Learn version of each software component of DelWorks DR, see listing of hardware components, review character of database, and view system options.
Close	Exit Service Mode (and return to Clinical Mode).
⬅ > 🚪	To exit completely from DelWorks DR, start in Clinical Mode: 1. Select green arrow at bottom of *Clinical Mode* menu to open the Functional Menu Bar across the bottom of the screen. 2. Select the closing-door icon on the Function Menu Bar.

CHAPTER 6 **Site-specific Configuration**

To begin to customize DelWorks DR for the clinical site and technologists, select Config from the Service Mode menu. A new window opens (Figure 10), and this window presents several aspects of DelWorks DR that may be customized for a site. The items are grouped by:

- System configuration
- Patient data
- Restore points.

The menu groups in the left pane may be collapsed. Click on the ^.

FIGURE 10. *Service Mode: Configure site information*

As you configure DelWorks Digital Radiography, you have several choices of accepting or rejecting the selections that are made. The row of icons along the bottom of the screen mean, respectively, (a) return to factory defaults, (b) back up configuration information including to removable media, and (c) restore configuration information.

When you have completed making changes, you may record them (click or touch the floppy-disc icon) or cancel the changes (square icon with white *X*).

Site info

See Figure 10. Site information is set at the Del Medical factory. You may change only:

- Site name
- Site address
- Tech support phone number.

The remaining fields, notably the serial number, are set by the manufacturer and should not be altered.

System options

When the Service Technician configures the System Options for DelWorks DR, he or she considers the work flow at the particular site. The equipment and habits of RTs at the site determine how the System Options are configured. To begin, select System Options from the main Service Mode menu under Config.

Auto send: enable / disable. If enabled, each image acquired will be sent to archive when the patient's session is closed. This feature cannot be enabled if no DICOM storage is available.

Log off Service Technician on exit. When set to True, the Application logs off the Service Technician when he or she closes DelWorks DR. Otherwise, if False, the Service Technician has access to the Windows desktop on exit.

Log reject reason. When this option is set to True, the technologist acquiring images must specify a reason each time he or she rejects an image, including images that are first rejected then later accepted. These reasons are collected in a log that the Operator, Superuser, and Service Technician may review in the Service Mode.

Technologist initials prompt: disabled / on open patient. If set to On Open Patient, the technologist is required to enter his or her initials before opening a patient's file. The initials mark the activity log named AuditLog.txt to document the users of DelWorks DR. Technologists select their initials from a predefined listing, and this listing is created in Clinical Mode. (See the *Operator's Manual,* part number 721-201-G2, for details.)

Auto delete: never auto delete / 50 / 75 / 90. This feature controls if and when patient files are automatically deleted from the hard drive storage of the DelWorks DR computer. In most clinics, patient records are maintained on the PACS system and not on an application computer such as the one that runs DelWorks DR.

If the selection is Never Auto Delete, patient files will never automatically be deleted from the Del-Works DR computer. The technologist will have to delete them manually as desired.

The patient's files can also be designated for auto-deletion when the hard drive of DelWorks DR's computer reaches 50, 75, or 90% of its capacity. How does this work? Say, the threshold of 50% is selected. Once the PC's hard disc reaches 51% of capacity, it deletes the oldest patient record(s) until the disc's capacity is again at or under the 50% threshold. The deletion of files continues in the background to keep the hard disc's storage where specified.

CAN Interface Card. Select none unless you have a device, such as a collimator, that is controlled by the CANBUS Interface. If you have such a device, select the ADLink card.

DR system options

Log reject reason. When this option is set to True, the technologist acquiring images must specify a reason each time he or she rejects an image, including images that are first rejected then later accepted. These reasons are collected in a log that the Operator, Superuser, and Service Technician may review in the Service Mode.

I/O card. Select the correct input/output card that DelWorks DR uses to communicate with an integrated generator. GIMDSelect ASP.

Auto advance. Auto advance applies to the individual work items in a work procedure, when a technologist is acquiring images for a patient's exam. When set to True, DelWorks DR moves ahead to the next work item (of the work procedure) as soon as the current image is accepted. If auto advance is False, the technologist must select the next work item after accepting the current work item's image.

Auto logout time out & screen saver wait time. Both of these features can aid a clinic's efforts to keep information confidential. DelWorks DR can be set up to logout the technologist after a given time period once a patient's record is closed; that is, the amount of time that elapses after the last patient was closed. Choose any number of minutes between 1 and 30. Use the up and down arrows to change the time period, or use the slider control beneath the number.

The same can be done for activation of DelWorks DR's screen saver. The screen saver will then activate after the selected number of minutes after the technologist's last input to DelWorks DR.

To disable either or both features, place an *X* in the box to the right of the up arrows.

Monitor look-up tables

This feature is awaiting future development for DelWorks DR.

Panel configuration

To add or remove panels, use the Panel Configuration function (see figure below). The top pane of the Panel Configuration window displays the panels that have successfully been configured to work with Del-Works DR. The fields that you see in the right-lower pane depend on the options that you have purchased with DelWorks DR.

ONCE A PANEL IS INSTALLED WITH THE DELWORKS DR SYSTEM,
IT CANNOT BE REMOVED,
UNTIL A SECOND PANEL HAS BEEN INSTALLED.
ONLY THEN CAN THE FIRST PANEL BE REMOVED FROM THE SETUP.

FIGURE 11. *Configure or add panel — DR*
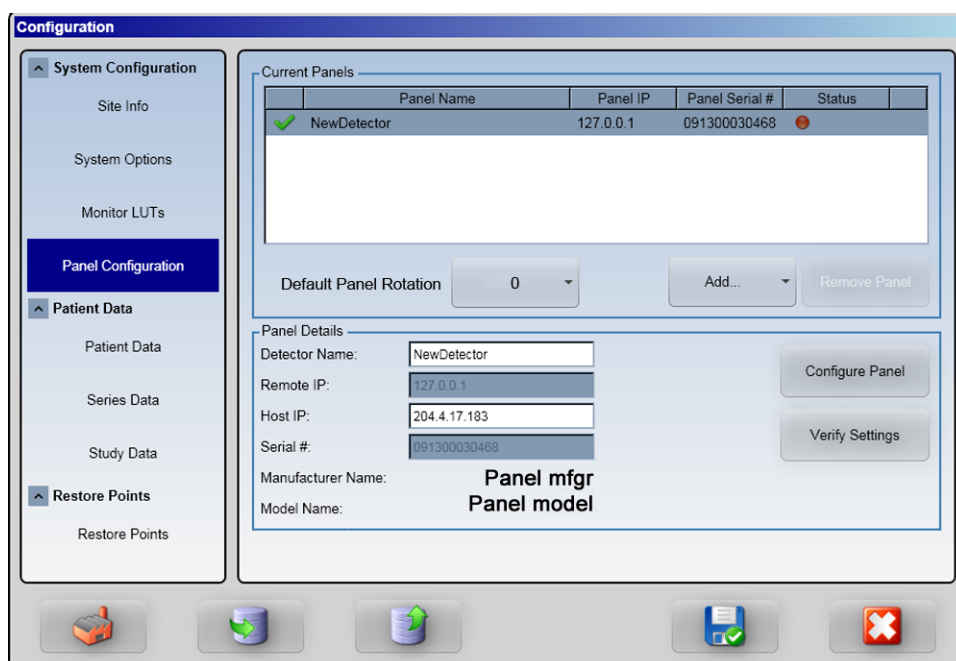
Add or remove a panel

To add a panel, touch or click the Add… button below the list of panels (figure above). This button opens a list of files on DelWorks DR's PC. Select the correct new panel.

To remove a panel, highlight the row with the panel's information (figure above, top pane), and then touch or click Remove Panel. *Note:* If this choice is not available, it is grayed-out.

Once the parameters describing the panel have been entered, touch or click Configure Panel for the configuration window. The window that you see depends on the panel that is attached to your DelWorks DR. Follow the on-screen prompts to complete the configuration of your panel.

Default panel rotation

As you work with DelWorks DR, you may find it convenient to orient the flat panel detector in one direction or another. Yet, to have the resulting image presented on the screen in the proper orientation, each image may need to be rotated.

Use the Default Panel Rotation option here (see figure above) to accommodate difference in which the panel is oriented when the image is taken and when the image is shown on the screen. The options are 0º, 90º clockwise, 90º counterclockwise, and 180º.

Verify settings

After configuration, touch or click the Verify Settings button (figure above) to see if communication has been established between DelWorks DR and the panel. DelWorks DR responds with a pop-up window that (a) confirms successful communication or (b) notes that communication did not take place.

Patient, series, & study data

The clinical site chooses the data it wishes to record as it acquires patient images. Three areas are configured here:

- Patient data
- Study data
- Series data.

Through this setup function, you specify fields, generally, as (a) required, (b) optional, or (c) unused.

Patient data

Patient data applies to the individual who is imaged. Select this option, and DelWorks DR displays all the fields available for record keeping for patient data. Along side each field is a drop-down menu. For each field, select among the following options: (a) required, (b) used, and (c) not used.

Series data

To define the data that apply to the images for a particular patient, select Series data just below Patient data.The fields available in series data are description, position, laterality, and body part examined. The drop-down menu for each of these options allows the choice between (a) used and (b) not used. None of these fields may be required.

Study data

To define the data that apply to the imaging examination for a patient, select Study data. The study may be described with the following fields: referring physician, performing physician, accession #, scheduled procedure description, requested procedure description, request3ed procedure ID, scheduled protocol code value, and patient sex. Your choice for each of these fields is (a) required, (b) used, and (c) not used. (The list of physicians is created in Clinical Mode. See the *Operator's Manual,* part number 721-201-G2*,* for details.)

The following fields are important to the functioning of DelWorks DR:
   • Scheduled procedure description
   • Requested procedure description
   • Requested procedure ID
   • Scheduled protocol code value.

One of these fields will be used in the Clinical Mode's work procedures. See the *Operator's Manual,* part number 721-201-G2*,* for details of how the technologist will use this feature. Additionally, you may need to consult with the site's IT department to see what field is being used to query the patients.

See page 39 for instructions about how this field is specified for DelWorks DR.

Restore points

Configuration information for the DelWorks DR is critical to its proper functioning. Therefore, DelWorks DR provides you with the facility both to backup and to restore configuration information. Use the Restore points option (Figure 12).

Restore data

If a configuration is found to be unsatisfactory and you wish to return to a configuration from an earlier date, you may select the date from which the data will be restored. You may also select the sets of data that should be restored. Choices are system configuration (info, system optionssite settings) and patient data (patient, series, and study data). *Note:* This function does not include panel configuration data.

Rather than use data from configurations that the Service Technician has made for your site, you may choose to return to the factory-default settings. To do so, select the factory building icon at the bottom of the window (Figure 12).

FIGURE 12. *Restore previous setup*
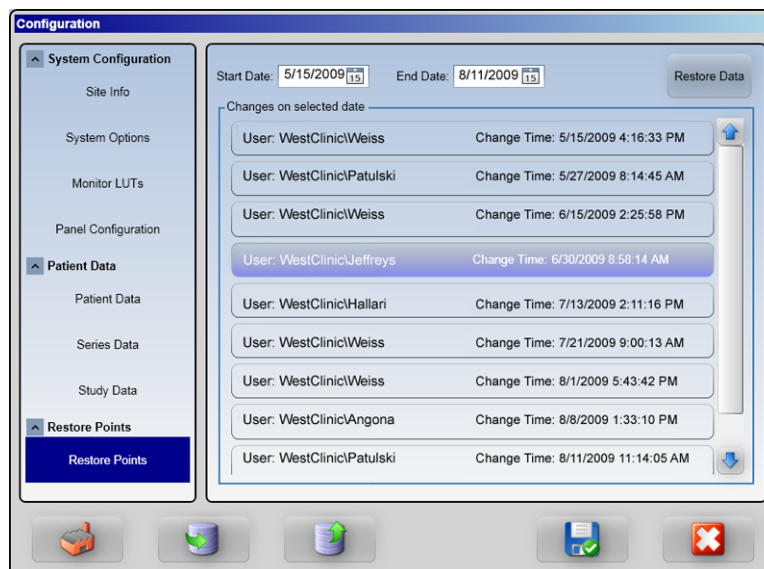
Follow these steps with the restore points function:

1. Select the range of dates for which you wish to evaluate changes in the configuration. For example, DelWorks DR may have been in operation for 6 months, but the unsatisfactory changes in the configuration may have taken place within only the last week. Use the calendar icons on the top of the restore points screen, then, to select dates encompassing only the last week.

2. Next, DelWorks DR lists each time the configuration was changed during the last week — or whatever time frame you have chosen, noting the user, date, and time. If changes had been made many times, you may need to scroll through the list.

3. From among these items, select the time at which the configuration was satisfactory. See highlighted item in Figure 12.

4. Touch or click Restore Data in the upper-right of the Restore points screen. A small window opens, and you click the data you wish restored. In that same window you may specify where the data is to be drawn from for the restoration.

5. Confirm you choice, and the configuration from that time is restored — writing over the previous configuration data.

Backup data

Use this same window to backup configuration data. Select the Backup icon. A new window pops up on the screen where you specify which data you wish to backup. You also specify the location where the data is to be backed up.

Frequent back-ups permit you to retrieve past useful configurations.

CHAPTER 7	# DICOM: Export, Import & Print

DelWorks DR can communicate with DICOM devices onsite or at remote locations. To begin configuring DICOM devices — printers, storage devices, worklists, or MPPS — touch or click DICOM on the Service Mode menu. This selection raises the DICOM Device Configuration screen (Figure 13).

At first, only the DVD player appears as a DICOM device. As you add network devices, you are asked to provide specific information about how the device behaves in relation to the network.

FIGURE 13. *Add DICOM devices*
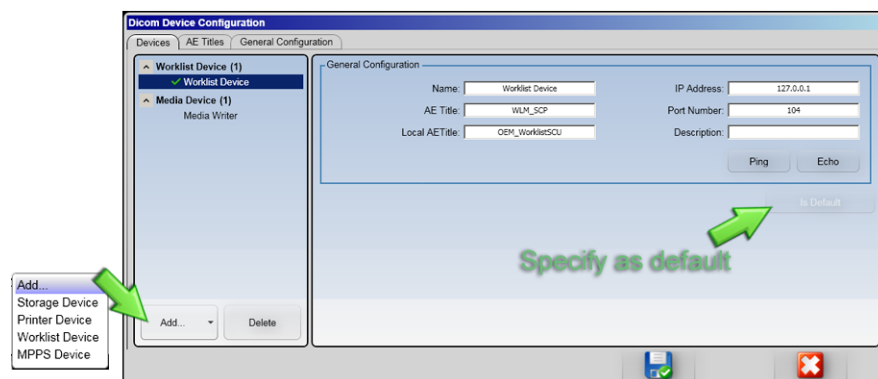
Configuration is accomplished through three general areas:

- Devices
- AE titles
- General configuration.

To save or cancel the changes, Touch or click the icons in the lower-right of the screen.

DICOM devices

The first page of the DICOM configuration screen lists the devices already configured with DelWorks DR, and it permits the addition or deletion of DICOM devices (Figure 13). The PC's DVD writer will have been configured at the factory and appears on the list. You may choose to have the disc ejected or not upon completion of writing (see *X* in box, Figure 13). This device cannot be deleted from the list of DICOM devices, but it may be disabled and thus rendered unusable.

To add a device, click the Add button in the lower left. It presents a drop-down menu from which you select the type of device you wish to add: printers, storage devices, worklists, or MPPS. Table 7 shows the maximum number of devices of each type that may be added.

TABLE 7. *Maximum DICOM devices*

Device type	Maximum no,
DVD	1
Storage	10
Printers	10
Worklist	5
MPPS	1

Table 8 lists the keyboard characters that may be used in the configuration, including names of DICOM devices.

TABLE 8. *Acceptable characters for DICOM configuration*

0 - 9	A - Z	a - z	<space>	!	"
#	$	%	&	'	(
)	*	+	,	-	.
/	:	;	<	>	=
?	@	[	]	\	^
_	'	{	}	|	~
Backslash may not be used in AE title fields.					

Default devices

If you set up multiple printers, storage devices, or worklists, you may specify which one of them is the default. If only one device is configured, the button that permits designation of a default is grayed out because that one device is the default. A check mark before the device's name indicates that it has been designated as the default in a category.

Common fields

The following information is required when configuring a Dicom device:

Name. Your choice. The technologists will see this name in Clinical Mode when they select a device.

AE title. (AE means *application entity.* Labels are case-sensitive.) The name of the remote device as used at the site. Ask the information technology department onsite or PACS staff for this name. See Figure 14, too.

Local AE title. (Labels are case-sensitive.) Local AE titles are summarized with the AE page of the Dicom configuration, and the data for this field comes from what you specify on that page. Name these titles as you wish with input from the local staff. This field is read-only and for reference.

IP address. Network address of the device. Ask local staff for this information.

Port number. As used by the Dicom service.

Description. Free-form portrayal of the device such as functions or location. Use up to 255 characters.

Ping & echo

As you configure the devices, you may test their network connections with ping and echo functions that DelWorks DR supplies with the configuration dialog screens.

Ping validates basic network connectivity between DelWorks DR and the Dicom device.

Echo verifies both network connectivity and Dicom communication.

Storage commit

Configuring a storage device requires you (a) to enable or disable Storage Commit and (b) to set the time out for Storage Commit. (A Storage Commit port of 2400 is also noted, but it is read-only here; edit it through the General Configuration tab. See "General configuration" on page 39. The port number is listed on the configuration screen here just so you can communicate it to site personnel.)

Storage commit is an additional verification that data has been archived to the network. When enabled, DelWorks DR specifically requests confirmation from the storage device that it has received the transferred images and that it has committed them to long-term storage. The requests and confirmations are invisible to the Operator.

Storage Commit for both the device and DelWorks DR must be configured the same; that is, if enabled on the storage device, it must be enabled on DelWorks DR, and vice versa. Site personnel should indicate how they wish Storage Commit to be set up.

Time out specifies the length of time, in seconds, that DelWorks DR will wait for a commitment response during a Storage Commit operation.

Printers

For each printer, where the printer supports the feature, you specify several printer properties (see Table 9): film sizes available; whether the border of the image is printed in black or white; the minimum and maximum density of the shades of gray in the image; the print layouts supported (though 1 x 1 cannot be disabled); whether the film is portrait or landscape; how data for magnification is handled; how empty space is printed when, for example, a 4 x 4 image format has only three images black or white; and whether trim (the area of the paper the printer cannot reach) is enabled or not.

TABLE 9. *Printer properties*

Property	Options, if supported
Minimum & maximum density of grays in image, may be disabled	0 - 400
Print layouts supported *Cannot disable 1-on-1*	1-on-1, 2-on-1, 2-on-1-vertical, 4-on-1, 6-on-1, 9-on-1, 12-on-1
Film sizes available	Inches: 14x17, 10x12, 10x14, 11x14, 14x14, 14x17 cm: 24x24, 24x30
Border density	Black, white, not supported
Film orientation	Portrait, landscape
Magnification type	None, replicate, bilinear
Empty film density	Black, white, not supported
Trim	Enable or disable

MPPS

Information about just-completed imaging tasks can be sent to an MPPS server (modality performed procedure step). When configuring MPPS, specify if the patient whose information is sent are (a) just those from the worklist or (b) include all patients (worklist, emergency, manually added).

AE titles

Use this screen to specify the local DICOM identifying information for the use of DelWorks DR. The names entered in these spaces must match exactly the names on the remote client device. Each field may be up to 16 characters, and no fields may remain blank. The values shown in Figure 14 are those that ship with DelWorks DR. If no DICOM printer has been configured, you may leave the value as-is.

FIGURE 14. *Local AE titles for devices (partial screen)*

General configuration

You set several parameters for the network behavior of DelWorks DR with the General Configuration screen.

Time outs. Specify the time, in seconds, that may elapse during DICOM communication operations before the operation is considered to have failed. Work with local IT personnel so that these time out parameters suit the local network's traffic loads.
Additionally, the Storage Commit port may be edited here.

Network & media export option. Choose the default settings that the technologist will see:

- Whether the images will be exported with image processing (true) or not (false)
- Whether annotations made on an image are exported as part of the image — embedded (true) or not (false).

    When a technologist chooses to export images, he or she may elect to use the default setting or to change it.

Worklist modalities. When the technologist makes a worklist query — to search for patients who meet specific criteria — only those with the modalities checked here will be included in the search. Patients with other modalities will be ignored.

Worklist specific configuration. Specify which field will be used to match a site-specific procedure with an existing procedure. The criterion of choice depends on the site's worklist. The choices, in a drop-down menu, are:

- Scheduled procedure description
- Requested procedure description
- Requested procedure ID
- Scheduled protocol code value.

This field is critical to enabling use of work procedures on DelWorks DR. See also "Patient, series, & study data" on page 31.

Auto [worklist] refresh. DelWorks DR updates the system's query of the worklist each time the Operator moves from the Patient List to the Worklist when this feature is True. The Operator must manually select refresh to update the query if this feature is False.

Examples: Adding DICOM devices

To add a DICOM device select the Add button (Figure 13), and select the appropriate device to be added.

DICOM storage devices

For storage devices enter the information listed below in the menu (Figure 15, and see Table 10).

TABLE 10. *Necessary information for DICOM storage devices*

Item	Source of information
Storage device name	Your choice, to suit site operators
AE title	IT administrator or worklist administrator
Local AE title	IT administrator or worklist administrator
IP address	IT administrator or worklist administrator
Port number	IT administrator or worklist administrator
Description, if desired	Not required

Check the Storage Commit box if the feature is supported by the worklist. Check with the hospital IT administrator or worklist administrator. See Figure 15.

FIGURE 15. *DICOM storage device — configuration example*

DICOM printers

For print devices enter the information listed below in the menu. See Figure 16and Table 11.

TABLE 11. *Necessary information for DICOM printers*

Item	Source of information
Printer device name	Your choice, to suit site operators
AE title	IT administrator or worklist administrator
Local AE title	IT administrator or worklist administrator
IP address	IT administrator or worklist administrator
Port number	IT administrator or worklist administrator
Description, if desired	Not required

Set up the printer-specific configuration items based on the printer's hardware options. Check with the hospital IT administrator or worklist administrator.

FIGURE 16. *DICOM printer device — configuration example*

Worklist devices

For worklist devices, enter the information listed below in the menu (Figure 17Figure and Figure 12)

TABLE 12. *DICOM worklist devices*

Item	Source of information
Worklist device name	Your choice, to suit site operators
AE title	IT administrator or worklist administrator
Local AE title	IT administrator or worklist administrator
IP address	IT administrator or worklist administrator
Port number	IT administrator or worklist administrator
Description if desired	Not required

FIGURE 17. *DICOM worklist device — configuration example*

MPPS device

For MPPS devices enter the information listed below in the menu (Figure 18 and Table 13).

TABLE 13. *Necessary information for DICOM worklist devices*

Item	Source of information
MPPS storage device name	Your choice, to suit site operators
AE title	IT administrator or worklist administrator
Local AE title	IT administrator or worklist administrator
IP address	IT administrator or worklist administrator
Port number	IT administrator or worklist administrator
Description if desired	Not required

Where the MPPS information will be sent
- Worklist only
- All DICOM devices.

FIGURE 18. *DICOM MPPS device — configuration example*

Using the site's network

Contact the hospital IT administrator for the following information (all fields may not be required by the hospital IT administrator):

- IP address
- Subnet mask
- Default gateway
- Preferred DNS server
- Alternate DNS server

With that information in hand, follow these steps:

1. Enter DelWorks DR Service Mode, and select Utilities.
2. Choose the Network Connections option. See icon at right.

3. Select the Local Area Network Connection 2 (Intel82566DM-2). See icon at right.

4. Select Internet Protocol (TCP/IP) and then the Properties button. See Figure 19.
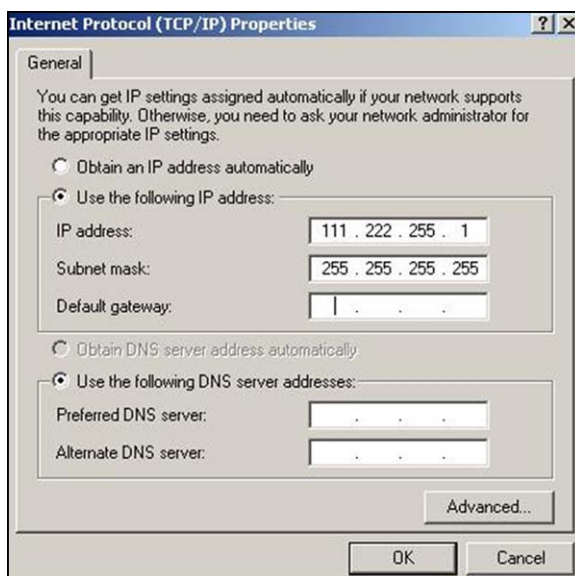
FIGURE 19. *DICOM example — LAN properties, Windows operating system*
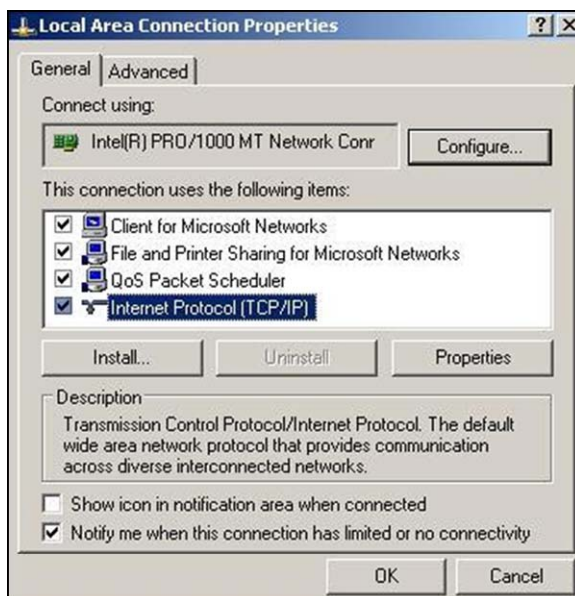
5. Enter the Information gathered above (IP address, subnet mask, and so forth). See Figure 20.

FIGURE 20. *Dicom example — network data, Windows operating system*

6. Select OK, and verify that the DelWorks DR system is connected to the hospital network.

CHAPTER 8   Acquisition Profiles

This chapter discusses (a) image acquisition profiles and (b) importing or exporting acquisition profiles. An acquisition profile sets up specific radiography parameters, including processing and generator techniques, that are applied to obtain an x-ray image of a part of the human body in a specific position. These already-programmed acquisition profiles can speed a technologist's work, but if the settings do not suit a particular clinical site, the Service Technician may alter them in Service Mode.

When a Service Technician configures DelWorks DR for a specific clinical site, he or she adds acquisition profiles to the PC. Acquisition profiles that have been added to the DelWorks Digital Radiography system may also be modified, as you wish. To begin, select Acq Profiles from the Service Mode menu.

To configure the image acquisition profiles and work procedures, begin at the Service Mode menu, and touch or click Acq Profiles. A new window opens that permits you to alter parameters for imaging positions and work procedures (Figure 21).

FIGURE 21. *Configure image acquisition profiles for DR*
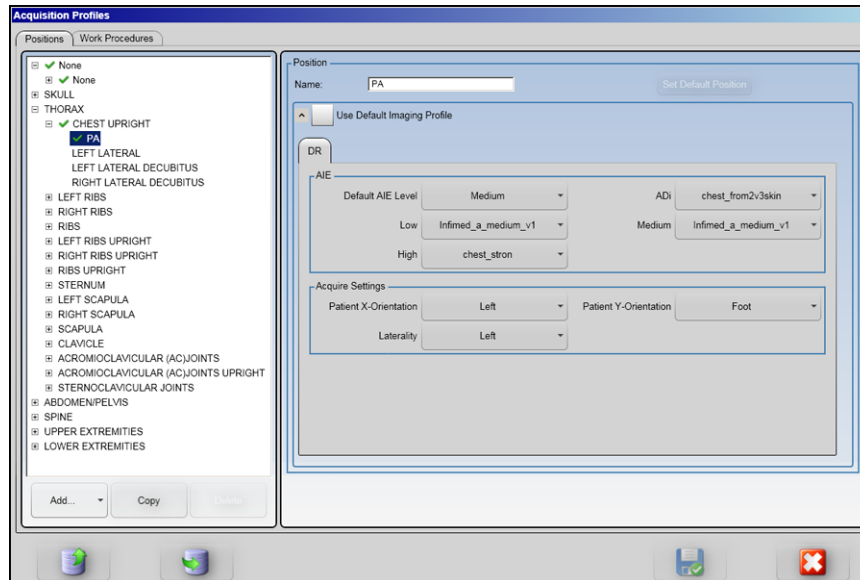
Positions

Choose the Positions tab to review or edit image acquisition specifications for exam positions (Figure 21). The left pane of this window provides navigation to the positions that would be used in a clinic. The plus sign before each body region and exam indicates that detailed information is nested beneath the item. A default region has been designated. (At first, when the system leaves the factory, the default is *None*.) Within each region, a default body part has been designated. Defaults are indicated with a check mark.

IMAGE PROFILES CAN BE MODIFIED IN CLINICAL MODE
DURING ACQUISITION OF IMAGES.
THE MODIFICATIONS ARE IN EFFECT UNTIL THE CURRENT PATIENT IS CLOSED.

Set the default

The original (factory-set) default region (None) is used when the technologist selects no profile and when no profile is matched to a worklist query. This profile is also used when positions are configured to Use the Default Imaging Profile; see white box in the right pane of Figure 21, upper-left; it is checked in this screen figure.

To change the default, select region, exam, or position in the left pane, touch or click Set Default Position in the upper right of the right pane. If the position has already been designated as the default, this button is grayed-out.

At each level of the hierarchy (Region → Exam → Position), only one item may be designated as the default. To learn the default exam or position under a specific region, touch or click on the plus sign by the region and expand the list under the region (Upper extremities → Forearm bone → Posterior has been

expanded in Figure 21). Expand the exam to learn the default exam, as Shoulder with Hip in the figure, and the default position, as Posterior with Anterior in the figure.
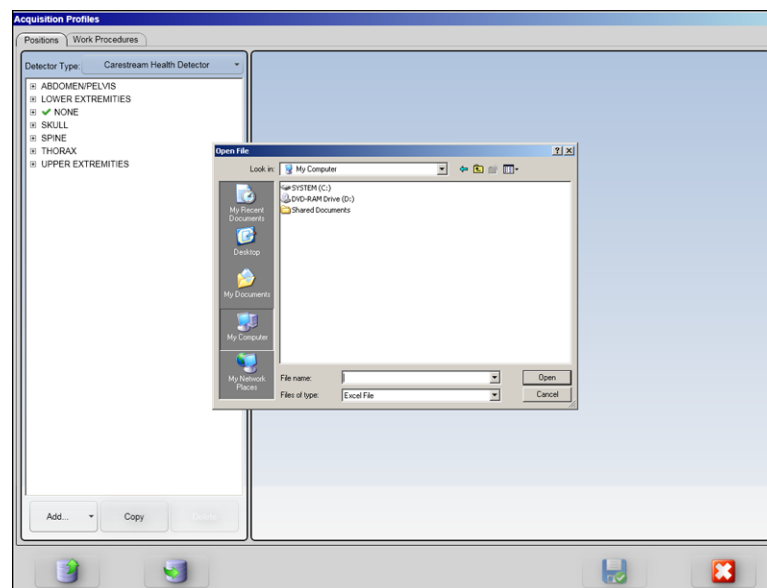
Import acquisition profiles

If you wish to import acquisition profiles, you may use the import function of DelWorks DR. Begin at the Acq Profiles button in Service Mode.

Flat panel detector:

1. Import acquisition profiles from the hard drive of DelWorks DR. Select the Import icon on the Acq Profile screen.
2. Select My Computer. See Figure 22.
3. Next select the following in sequence: APR_Settings → *[Detector Name]* → Ok.
4. DelWorks DR then loads the factory default acquisition profiles for the camera.

FIGURE 22. *Import acquisition profiles from hard disc*

Edit or export acquisition profiles

Acquisition profiles already on the system may also be exported to disc or USB drive. Once exported, they may be edited and then re-imported to the DelWorks DR system. Follow these steps:

1. Select the icon for export from the Acq Profiles window.
2. Choose the location to which you wish to export the acquisition profiles (for example, a USB memory stick).
3. Name the file.
4. Click Ok.

The export file is in the form of XML. Edit the file as you wish. Then, re-import the file using the instructions in "Import acquisition profiles" on page 47.

Add, copy, or delete items

Touch or click the buttons at the bottom of the left pane (Figure 21) to add, edit, or delete a region, exam, or position.

Adding items

When adding a region, exam, or position, the new item is placed in the navigation tree, and you define the new item in the dialog box at the top of the *right* pane. The new item is simultaneously defined in the left-side navigation tree as you enter the item in the right-side dialog box.

The first new position added to an exam is denoted as the *default*; if you add additional positions, you may re-assign the default. When you add a new position, but not when you add a new region or exam, DelWorks DR asks you to specify the settings of the acquisition profile. *The settings apply only to positions.*

THE NAME OF EVERY REGION, EXAM, & POSITION
ACROSS THE DELWORKS DR SYSTEM
MUST BE UNIQUE.

ONLY ONE REGION CAN BE THE DEFAULT REGION.
EACH REGION CAN HAVE ONLY ONE EXAM AS THE DEFAULT EXAM.
EACH EXAM CAN HAVE ONLY ONE POSITION AS THE DEFAULT POSITION.

Example — adding an acquisition profile

1. Click Add (Figure 21).
2. Select Region. Name the Region with a unique term pertinent to the item you are adding.
3. Click Add. Select Exam. Give this new Exam a unique and descriptive term
4. Click Add. Select Position. Give this new Position a unique and descriptive term.
   • If you select Use Default Imaging Profile (Figure 21), the parameters currently used in the Default profile will be attached to the new Region, Exam, and Position that you just created.
   • If that option is not selected, you may edit the following fields.

AIE settings. AIE settings refer to the data files that DelWorks DR uses to process images. The default AIE level is the setting used to display an image. This data file corresponds to the low, medium, or high data file. The specific file selected is dependent on the amount of processing desired.

(See "Automatic image enhancement — AIE" on page 50 for more information.)

Acquire settings. Specify the orientation and laterality settings that are used for Dicom compliance. Once specified, these settings are embedded in the image (and are seen in the Dicom header).

- For Patient x-orientation, specify anterior, posterior, left, right, head, or foot.

- For Patient y-orientation, specify anterior, posterior, left, right, head, or foot.

- For Laterality, specify left, right, both, or unpaired.

General: Select whether the image should be flipped for the default image display.

5. Select the save icon to keep the new data that you developed. If you exit without saving the changes, the changes are lost.

Copy items

When you copy a region, exam, or position, DelWorks DR appends "(Copy)" to the name of the region, exam, or position — depending on the level of the hierarchy at which you make the copy. If you copy a region, the exam(s) and position(s) of that region are also copied, yet only the name of the *region* will have the designation (Copy) appended to it.

You may then rename the copied item(s). When you copy a position, the copy will have the same settings as the original position. You may subsequently modify the settings as you wish.

Delete items

You may delete unneeded regions, exams, or positions; however, a default item cannot be deleted. To delete the default item, first re-assign the default; then, delete the original item. For example, to delete the default Posterior position under the Forearm Bone exam, first assign another position (for example, Lateral) as the default position for that exam, and then delete Posterior.

TABLE 14. *Radiography settings explained*

Field	Applicability	Options	Description
AIO, auto image optimization	Spot, serial	Contrast - - Contrast - Normal Contrast + Contrast ++	Adjusts the appearance of an image to suit site preferences.
Edge enhancement	Spot, serial	0, 1, 2, 3, 4	Emphasizes changes in the brightness of an image to sharpen the edges.
Invert	Spot, serial	White, black	Image is acquired with white or black polarity
Acquisition rate (frames per sec)	Serial	1, 2, 3, 3.75, 5, 6, 7.5, 10, 15	Default frame rate

Reverse axes

The image may be acquired with the horizontal or vertical axes reversed, too. To activate the reverse horizontal axis, for example, select the backward-*R* on the screen. You know this feature is active when the *R* has a blue background rather than gray. The settings made here apply both to radiography and to fluoroscopy.

FIGURE 23.

Automatic image enhancement — AIE

For each position, imaging parameters may be set or altered. To begin, make sure that the dialog area beneath the phrase Use Default Imaging Profile is expanded. If it is not, touch or click the *V* to the left of that phrase. See below for the AIE parameters that may be modified or assigned.

Parameter	Explanation
Default AIE level	Off, low, medium, high
ADi (auto-density)	Specify a look-up table
Low	Low contrast
Medium	Medium contrast
High	High contrast
Laterality	Left, right, both

Anatomical programmed radiography — APR

You may modify the generator's settings that will be used with each imaging position. APR is configured for the following three levels:

(a) region
(b) exam
(c) position.

The workstation's icon (*DR* in Figure 24) indicates the workstation that is affected by the APR configuration. You may select other integrated workstations. They will be listed below the current workstation's icon where, in the center of Figure 24, you see New Workstation or New X-ray Tube.

Expand the APR settings by touching or clicking the *V* adjacent to the box and phrase Use Default APR (see highlight in Figure 24). DelWorks DR shows the APR parameters that may be set if the box next to Use Default APR is not selected. When the box is selected, as in Figure 24, none of the parameters may be changed because the default settings are applied.

The APR settings apply to each position. To modify APR settings, first select the position of interest from the listing in the left pane. Next, specify generator APR parameters for each somatotype for that position. When you override the default settings for the current acquisition profile or work item, the items are highlighted such that they appear yellow on color monitors. See example of default somatotype above at right with Medium-sized Adult selected as the default and highlighted in yellow.

FIGURE 24. *Specifying APR settings*
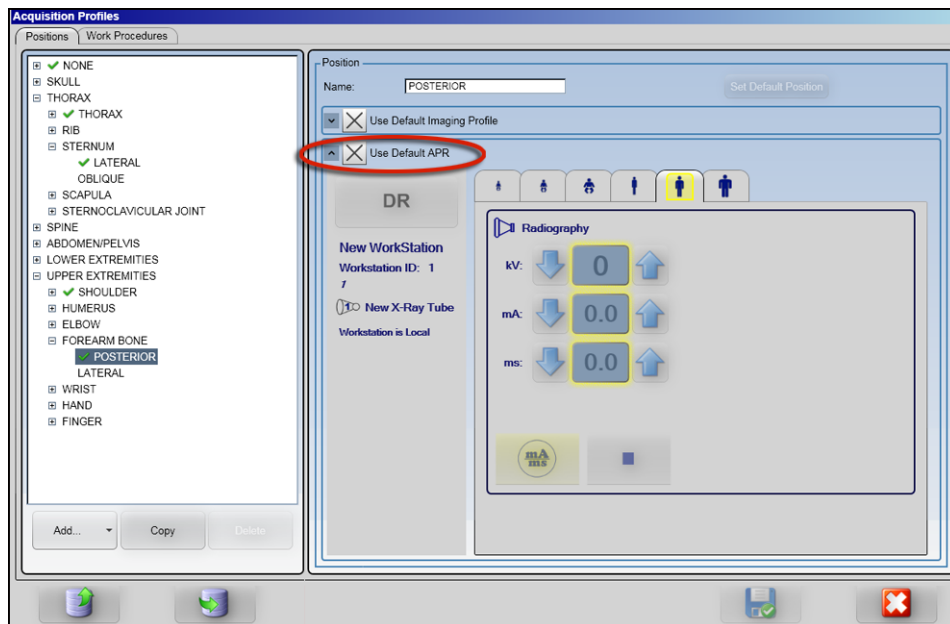

Radiography options

Set the radiography parameters for the selected position. Set kV, mA, and mAs as permitted by the generator. Next, select the initial technique that the generator will use to acquire an image for the position of interest; use the button that defaults at mA/ms to select that as the default; alternatively, select mAs or AEC. Use the adjacent button to select the focal spot as small or large.

- At the setting mA/ms, you may alter the settings for kV, mA and ms.

- For mAs, you may alter kV and mAs.

- For AEC, you have additional settings. See Figure 25. The additional settings are Density, Fields, and Film Screen. The generator determines AEC density. Match density to the detector's capability.

- For AEC field, select left, center, or right. In Figure 25, the right field is selected.

- Touch or click repeatedly the bar graph icon on the right to select the Film Screen. One bar means slow; two means medium, and three means fast.

FIGURE 25. *Acquisition profiles & AEC options*
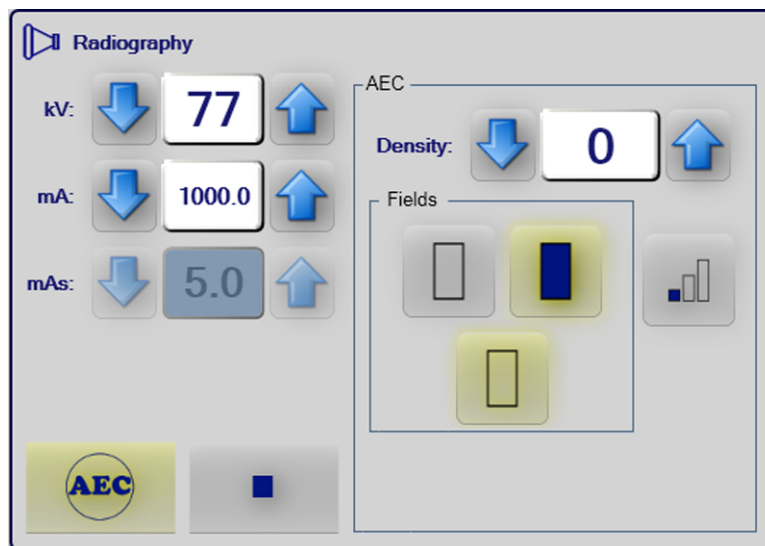
Work Procedures

Work procedures put related patient imaging positions (work items) in a defined sequence. DelWorks DR uses this sequence of positions to set image processing parameters as a patient's exam progresses. By invoking a work procedure, the technologist can efficiently obtain the necessary images for a patient's visit. An example of how a work procedure can be created is presented at the end of this chapter.

The Service Technician can configure work procedures from the Service Mode. Select the Acq Profiles button.

The work procedure can be matched with one of the following four DICOM fields:

- Scheduled procedure description
- Requested procedure description
- Requested procedure ID
- Scheduled protocol code value.

(For further information on these fields, see page 39 where the matching is implemented for DelWorks DR.)

Thus, when the patient is imported from a worklist, the necessary imaging positions are specified also. See Figure 26. (In this way DelWorks DR advances Integrating the Healthcare Enterprise [IHE] to promote efficiency. See appendix for more on IHE.) Del Medical usually uses data from the *Pre-installation Site Survey* to configure the work procedures. Therefore, configuration of the work procedures is not necessary during installation. If, however, DelWorks DR has not already been configured, the instructions below show how to do so manually. (Work procedures can also be imported and exported.)

Create a work procedure

The work procedures window, Figure 26, has three panes:

- Existing work procedures (left)
- Work items (right-top)

• Available positions (right-bottom).

Touch or click Add in the lower left of the left pane to create a new work procedure. In the upper right pane, modify the name of the work procedure, and, if you wish to integrate it with a worklist, give it a valid DICOM code. The DICOM code is unique to each work procedure. Personnel in charge of the site's HIS or RIS can provide a list of DICOM codes for the site's work procedures. The Service Technician matches the specific DICOM code with the HIS or RIS code in the DICOM device configuration. See "General configuration" on page 39.

FIGURE 26. *Configure work items in work procedure*
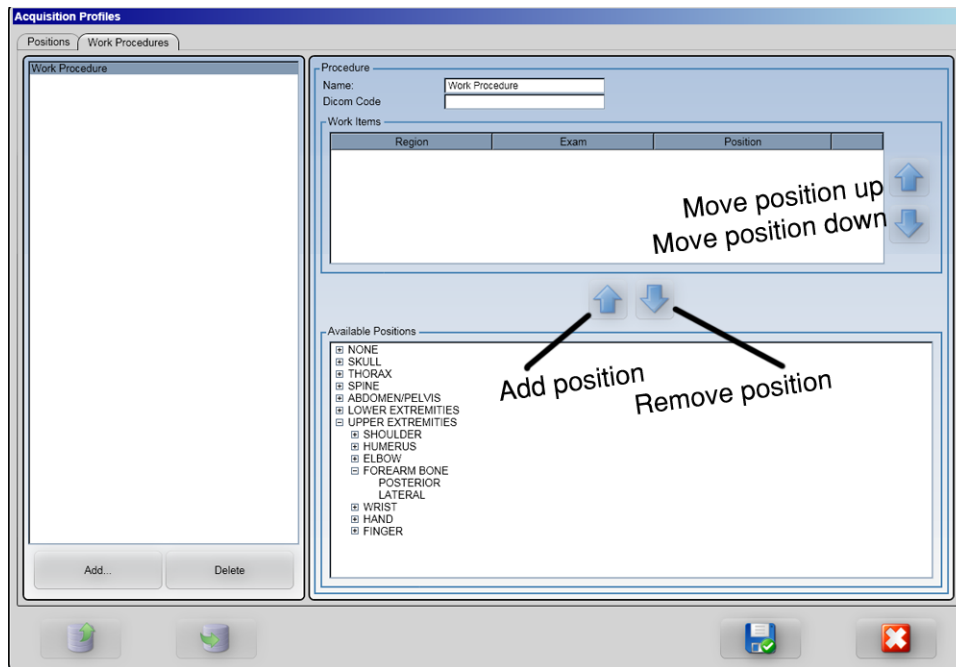
Next, select a position with its accompanying acquisition profile from the right-bottom pane, and add it to the new work procedure that is being built by touching or clicking the arrow indicated in Figure 26. The steps in the new work procedure appear in the upper-right pane — seen as blank in Figure 26. Add as many positions as necessary to comprise the new work procedure.

Reorder the positions in the newly built work procedure, if needed, with the arrows on the right side of the right-top pane. The following is an example general outline of a work procedure:

Work procedure:

   Work item #1:
   - Region
   - Exam
   - Position

   Work item #2:
   - Region
   - Exam
   - Position

Modify a work procedure

Touch or click a procedure in the left pane (Figure 26). This procedure and its associated DICOM code (if used) appear in the fields at the very top of the right-top pane.

Just as with creating a work procedure, modify the work procedure by adding or removing positions and their associated acquisition profiles, and reorder them in the sequence as necessary.

Example — Create work procedure

This example creates a new work procedure, two views of a chest, for DelWorks DR.

1. To begin, select Add (see Figure 26).
2. On the screen, "Work Procedure" is listed as the default name of the work procedure that you are about to create.
3. Change the name to "Chest 2 views."

Insert the DICOM code for one of the following:

- Scheduled procedure description
- Requested procedure description
- Requested procedure ID
- Scheduled protocol code value.

4. *Obtain this Dicom code item from the individuals at the site* who manage the HIS/RIS.

5. Expand Thorax (region). See Figure 27.
6. Expand Thorax (exam)
7. Select PA (position). Click the Up arrow at the middle of the screen.
8. Select Lateral (position). Click the Up arrow at the middle of the screen.
9. Click the Save icon to record the new work procedure.

To change the order of the steps in the work procedure, use the up and down arrows in the upper-right area of the screen. These arrows are labeled in Figure 26.

FIGURE 27. *Example: Create work procedure*
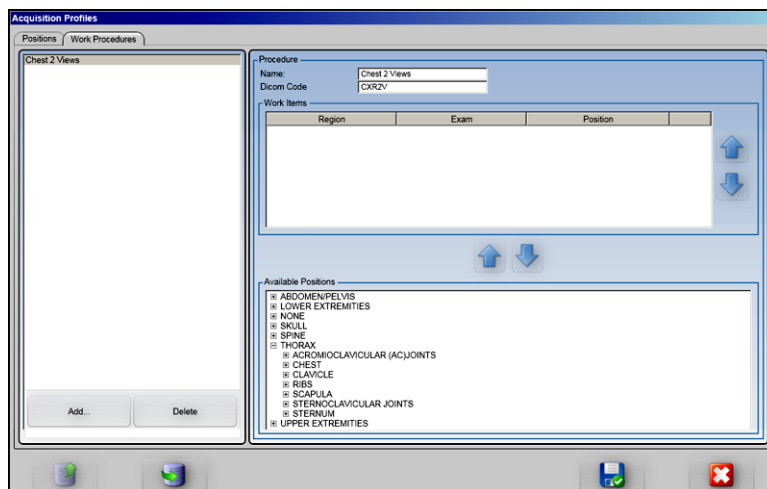
Manage Users

Different privileges can be allocated to specific users of DelWorks DR depending on the user's role. When creating accounts for users, assign membership to one of the following three groups:

- Operator
- Superuser
- Service Technician.

Operators have the least amount of latitude in using the system; Superusers have more, and Service Technicians have full access. Both Superusers and Service Technicians may assign users to DelWorks DR.

The assigned users may sign-on DelWorks DR and operate it. These users need not be actual individuals. An alias could be assigned to an individual or to a group of individuals.

Open the Users dialog window from the Service Mode main menu. Click on Users. The users dialog window (Figure 28) shows assigned users and their assigned groups in the left pane. View the names or aliases or individuals listed under each group by clicking on the up and down arrow characters (^ and v) next to each group name. To expand the list, click the down arrow. To collapse the list, click the up arrow.

To add or remove a user, click the appropriate icon in the lower part of the left pane. When you select the add icon, the right pane changes to permit you to add a new username and password and, with a drop-down menu, to assign the new user to a group.
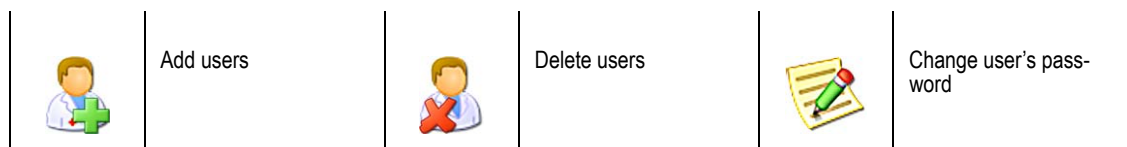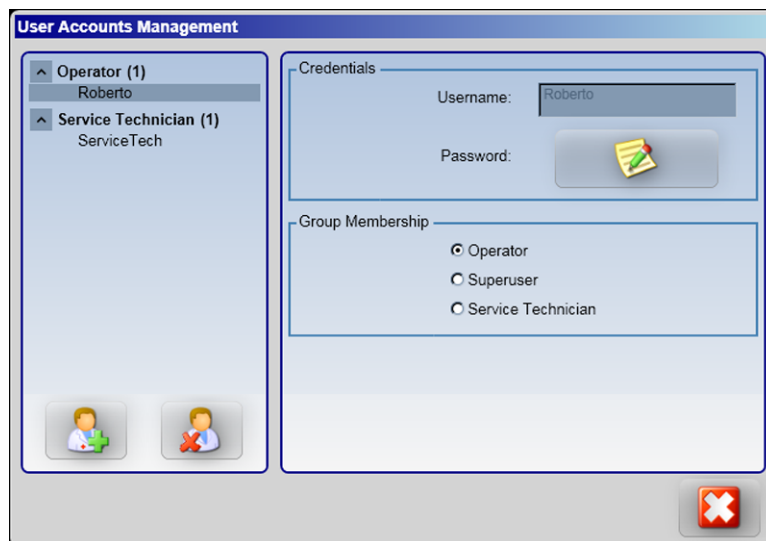
| | Add users | | Delete users | | Change user's password |

FIGURE 28. *Managing users of DelWorks DR*

Privileges of users

All users may operate DelWorks DR in Clinical Mode. In Service Mode, however, privileges are restricted. Operators have access only to the Log function, user preferences (language and location of interface Main Menu), image processing, and test pattern diagnostics. Superusers have access to those same functions plus:

- DICOM
- Acq Profiles
- Users.

Service Technicians have access to all service functions.

Calibrate

Detector

DelWorks DR supports panel calibration, but the types and processes of calibration depend on the panel that is connected to DelWorks DR. See the earlier chapter with specific information about your detector.

DelWorks DR also maintains records of each calibration performed.

To implement calibration, touch or click Calib on the Service Mode menu (Figure 9 on page 25). The new window that opens has options for calibration functions supported by your panel.

Figure shows the appearance of a typical calibration window of DelWorks DR when performing gain calibration.

	initiate calibration		Pause calibration (available for some detectors)		Interrupt or cancel calibration
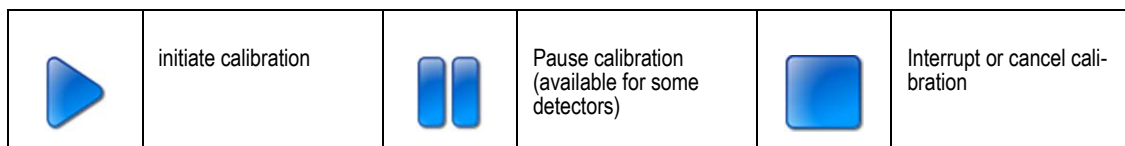
Calibration history

The History option in Calib of Service Mode displays a record of each calibration that was performed. To view the history, select the time frame of interest; use the calendar icons to set the start date and end date.

For each calibration, the history lists the user name, date performed, type of test and name of calibration along with the result of the test.

FIGURE 29. *Gain calibration & calibration history*
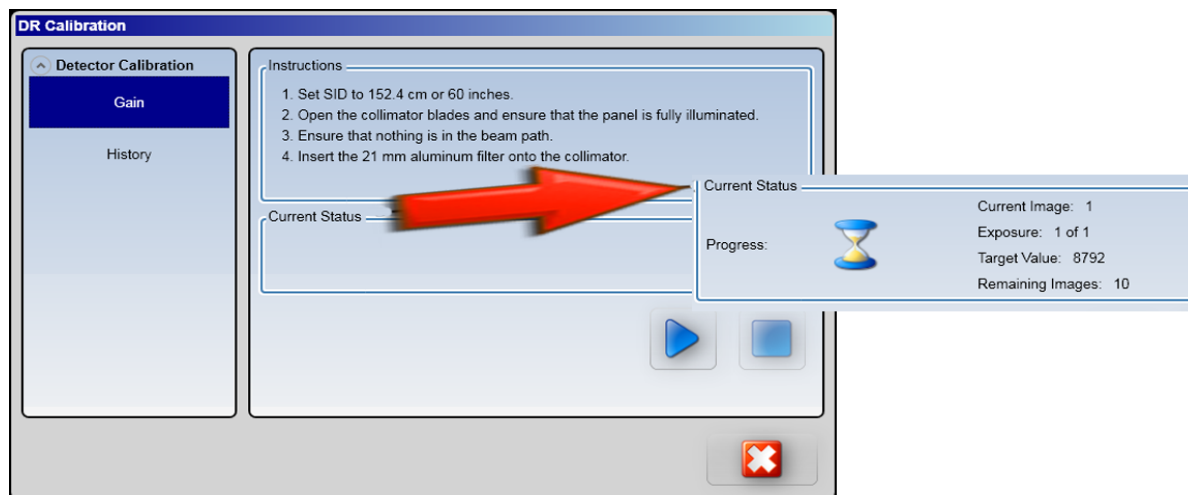
Part 3. After Setup of DelWorks DR System

System Diagnostics

As an aid to troubleshooting, DelWorks DR provides diagnostic tests that address the following: detector, data, the integrated generatorraw image , serial port communicationsstorage, GIM. To begin, click Diag on the Service Mode menu.

The initial diagnostics window shows the range of tests in the left pane (Figure 30). The right-lower pane displays a log of the progress of each diagnostic test performed. These diagnostic logs may be saved, and they may be later reviewed by means of the Logs option of the Service Mode menu.

FIGURE 30. *Initial diagnostics screen for DR*
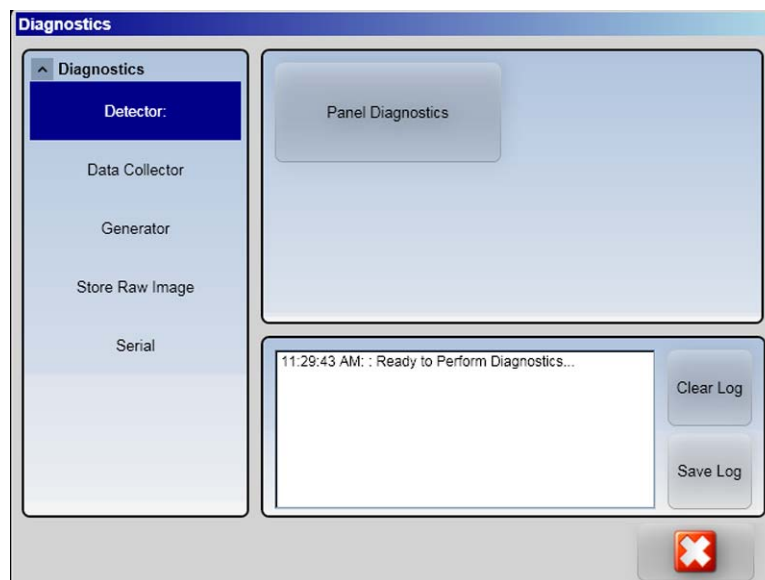
Detector

Each detector has an individual diagnostic tests. To perform the tests, touch or click Detector (Figure 30), and follow the instructions in the new window.

Data collection

DATA TO SAVE:

-- SYSTEM INFO
-- ERROR & DIAGNOSTIC LOGS
-- HIPAA LOGS
-- CONFIGURATION SETTINGS
-- ACQUISITION PROFILES
- PATIENT DATABASE (WITHOUT IMAGES)
-RESOURCES: LANGUAGE FILES USED IN THE DELWORKS DR INTERFACE.

DelWorks DR can collect data for backup and for record keeping. You may select which of these items to have the DelWorks DR system record. This feature is useful if you wish assistance from Del Medical in examining data issues with DelWorks DR.

Select the data to be collected by touching or clicking the box next to each category (seeFigure 31). An *X* in the box indicates that DelWorks DR will indeed collect data for that category.

Browse to choose where the collected data should be stored. In any event, DelWorks DR places the information in a file with the name *i5[date time].zip*.

Select Collect Data in the upper-right of the right-top pane. The task pane (right-bottom) displays progress.

The data are collected in a zipped file. The same data that you observe in the task pane (right-bottom) comprises the contents of this file.

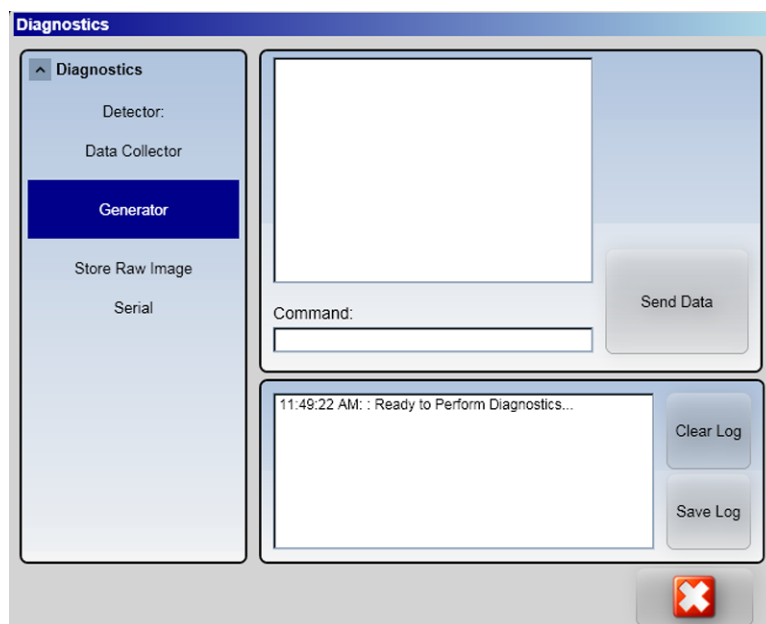**FIGURE 31.** *Data collection through diagnostics*
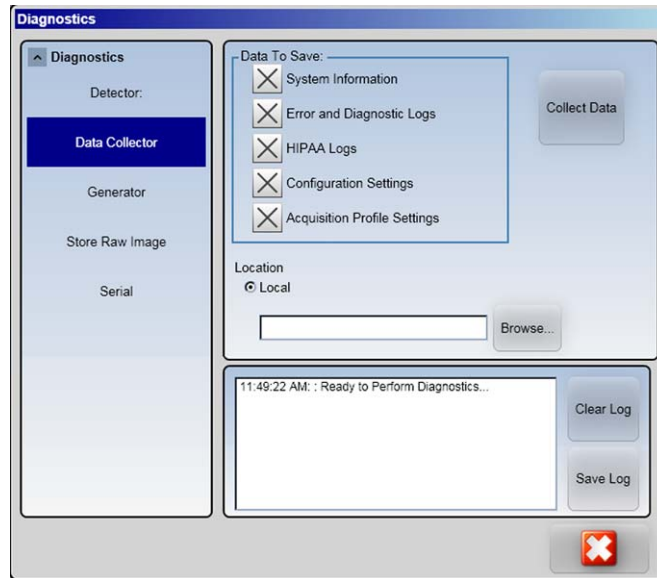
Generator

You may test the generator here (Figure 32). Insert a command in the appropriate location in the right-top pane, and press Send Data.

The task pane, right-bottom, shows the effect of the generator test.

You may save the log.

FIGURE 32. *Diagnostics: Test for integrated generator*

Raw image storage

If a clinical site has questions about the quality of images it is acquiring, Del Medical can assist. In some cases, Del Medical's assistance requires access to image data with no image processing added. Use the Store Raw Image feature of DelWorks DR (Figure 33).

The Service Technician can arrange to acquire this raw image data. Note that this dialog asks the Service Technician to specify where to store the raw image data. The data can then be downloaded and then sent to Del Medical for analysis.

FIGURE 33. *Diagnostics: Store raw image*
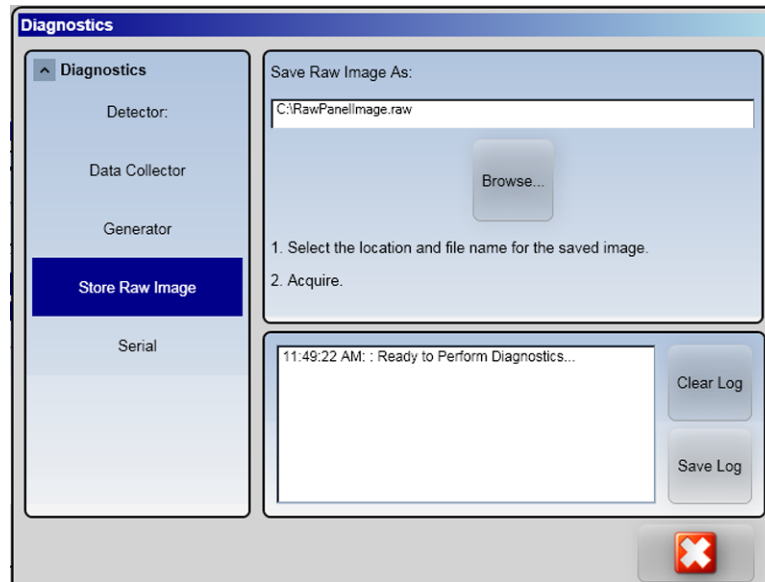
Serial ports

This diagnostic tool has limited value because hardware parts infrequently fail. You may use this diagnostic tool to test the serial ports that DelWorks DR uses to communicate with peripherals, including an integrated generator. This diagnostic test is a simple send-receive utility.

If the loop back test is to be examined, a loop-back terminator is required. The loop-back terminator is a simple connector that is a serial port with wires circling back on themselves. It uses a single female serial connector (051-787) with terminal 2 connected to 3, 4 connected to 6, and 7 connected to 8 (Figure 34).[3] Therefore, a signal is *sent* to the serial port, and that signal loops around and is *received* by the serial port. Serial port pin signals are defined in Table 15.

As with the other diagnostics, you may save the log of this test.

---

3. InfiMed, Inc. *RS232 Full Loopback connector Assy.* 726-098-G2, Rev. B. 12/17/2008.
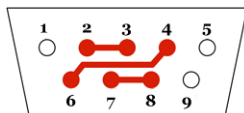
FIGURE 34. *Serial loop back terminator*

TABLE 15. *Function of pins on serial port*

Pin number	Function
1	Data carrier detect
2	Receive data
3	Transmit data
4	Data terminal ready
5	Signal ground
6	Data set ready
7	Request to send
8	Clear to send
9	Ring indicator
Outside case	Protective ground

Utilities

DelWorks DR permits the Service Technician to have access to several Windows operating system functions. The same function provides a convenient way to view DelWorks DR's own help files.

The utilities are used to set up the computer itself, such as setting up a specific keyboard for a language other than the default English.

FIGURE 35. *Utilities & help menu*
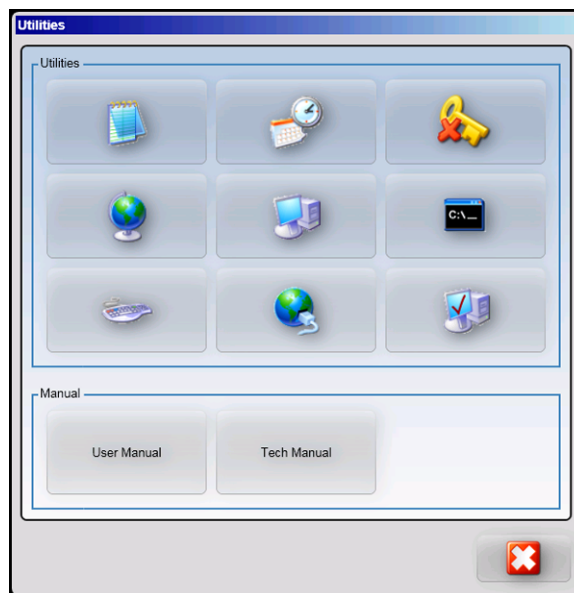
To access DelWorks DR utilities, click on the Utilities button at the lower-left of the Service Mode menu. The new window has two parts: Utilities and Manuals (see Figure 35). Table 16 lists the utilities that are illustrated in Figure 35 for DelWorks DR, and the use of each is explained below.

<div align="center">

TABLE 16. *Utilities available*

</div>

Notepad	Date & time	Clear site key
Regional & language options	Explorer	Command prompt (terminal)
Keyboard setup	Network connections	System properties

Notepad. Windows' Notepad is a simple text-based editor. Use it both to create unformatted text files, such as to modify XML files, and to read text files such as logs.

Date & time. Set the time and date and the formats for display of time and date with this function. If the computer hosting DelWorks DR is connected to the Internet, the computer can be made to synchronize its time with Windows Internet time.

Clear site key. *Note:* Removing the site key renders DelWorks DR inoperable. Have a new site key on hand before using this utility. The site key maintains registration information about DelWorks DR software. If the software is upgraded and the site key needs to be changed, use this utility.

Regional & language options. DelWorks DR is used around the world, and the computers that run it are set up for the specific location of use. Use this utility to establish the country of use and the language. Further, set preferences here for the formats of numerals, currency, and dates. The input device used for the language — generally a keyboard — is also specified here.

Explorer. Use this option to view all the files on this computer including such folders as My Documents. You can also view files throughout the network, if any. Desktop icons and shortcuts as well as the recycle bin are available through this utility.

Command prompt. Use this utility for terminal functions. It opens a window with a command prompt from the Windows' disk operating system (DOS) emulator. You can also view disk drives, folders, and files.

Keyboard. Use this utility for access to the Windows' Control Panel feature for the computer's keyboard. Set input preferences, cursor blink rate, keyboard hardware, and keyboard troubleshooting.

Network connection. Access network drives and network troubleshooting with this utility. It permits new connections, network setup, and changes to the Windows firewall. It also gives access to the Control Panel, My Network Places, My Documents, and My Computer.

System properties. Information about the computer running DelWorks DR is available through this utility. Use it to learn the version of Windows, registration, computer type, and computer name — used for the identifier on the network. It permits access to hardware through the device manager, to the drives and Windows update, and to the hardware profile. It also provides access to the computer's performance parameters, the user profile, startup and recovery parameters, the computer's environment, and the parameters used to restore the system, handling of Windows system updates, and remote access.

Logs & Records

DelWorks DR compiles and stores data to supply information on its operation. Data generated both about DelWorks DR system itself as well as the application of the system with patients.

FIGURE 36. *Logs of DelWorks DR*
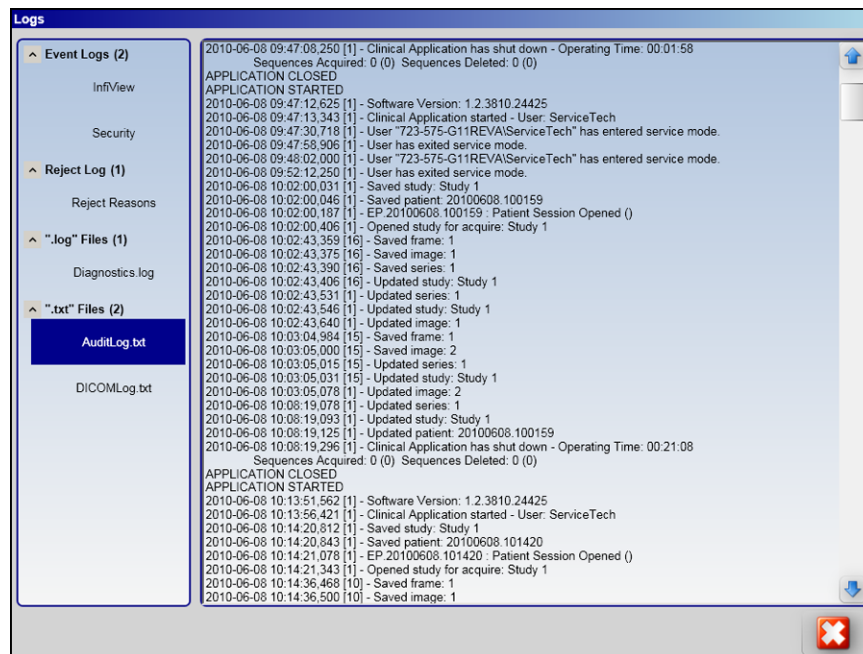
To view DelWorks DR logs, click Logs on the Service Mode menu. A new window opens, and the left pane of that new window (Figure 36) shows the following logs:

Event Logs (InfiView®, Security). The InfiView® report compiles errors at the DelWorks DR application level. The Security report records the identities of those who login to the DelWorks DR application.

Reject log. This log file keeps a record of the images that were rejected. See "System options" on page 28 for information on how this item is configured for a site.

.log files (Crash.log and Diagnostics.log). The Diagnostics.log is created when a Service Technician requests such a report on the system's functions. See "System Diagnostics" on page 63.

.txt files (AuditLog.txt). The Auditlog.txt report records the application of DelWorks DR system such as when DelWorks DR was started and ended. It also records the initials of the technologists who login and logout when such actions are required. (See page 28 for where technologists' initials may be required.)

The Dicom log records export, import, and print jobs that involve a Dicom device that has been configured with DelWorks DR. The logs record start and end of the job, type of job, data file, destination, status, remote IP address, remote port, copies, and Dicom device options such as density for printers.

The view of the name of the specific logs available under the four classifications may be collapsed or expanded using the up and down arrow characters (^ and v) next to each group name.

Modify Image Processing

DelWorks DR offers excellent image processing tools. Del Medical, the manufacturer, has specified x-ray image processing for multiple Region-Exam-Position combinations, and these settings are programmed into DelWorks DR. You may, however, modify these settings to suit your needs.

FIGURE 37. *Service Mode menu, lower area, image processing*
(cutaway image)
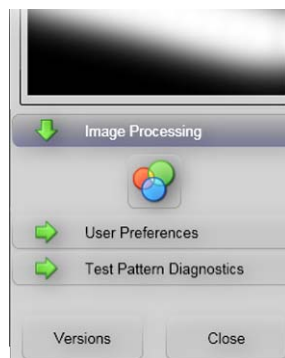
Begin with the three-item accordion menu in the lower part of the Service Mode menu (Figure 9). Touch or click Image Processing, and the menu opens to reveal the three overlapping circles of the image-processing icon. Select this icon, and a new window opens.

This new window (Figure 38Figure 38) permits you to work with an image that you have acquired. You can edit an acquisition profile with this tool.

FIGURE 38. *Image processing function with image preview*
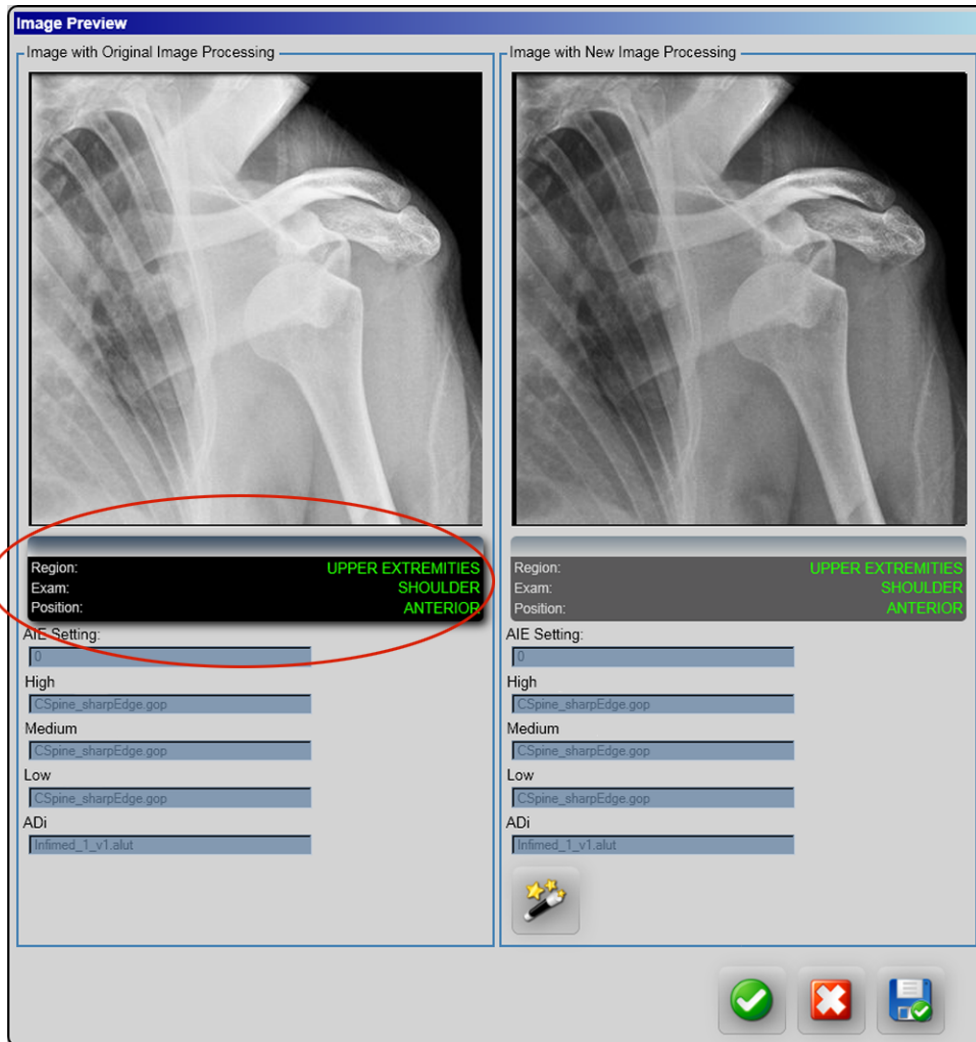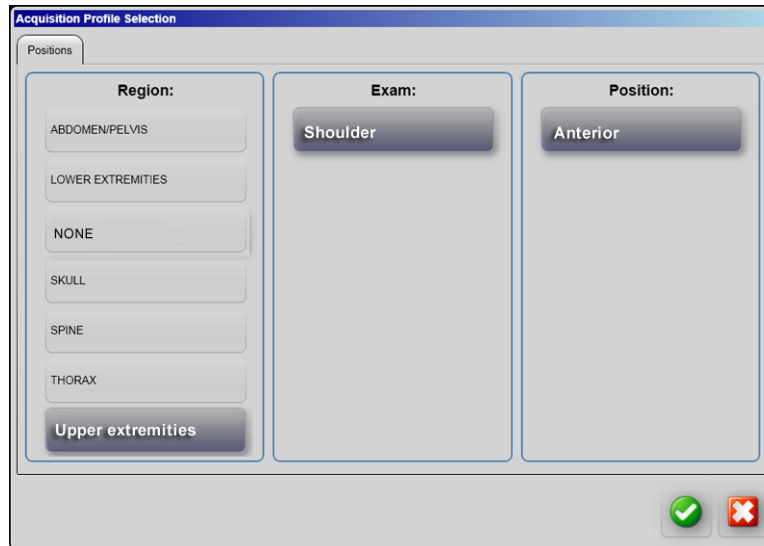
In modifying the image processing, you edit the acquisition profile for a specific Region-Exam-Position combination.

To implement this image processing function, first touch or click the black bar in the middle of the left pane of the Image Preview window (highlighted with a red oval in Figure 38Figure 38). Doing so opens another window that permits you to select region, exam, and position (Figure 38Figure 39). Once you have selected and accepted these items, that window disappears, and your selections show in the black bar of the Image Preview window (Figure 38). This is the acquisition profile that you will edit. Note the choices in the illustration:

• Region: Upper extremities
• Exam: Shoulder
• Position: Anterior.

FIGURE 39. *Modify acquisition profile*

Once you accept the acquisition profile, the window (Figure 38) disappears from the screen. You next alter the following image qualities:

Parameter	Explanation
Default AIE level	Off, low, medium, high
ADi (auto-density)	Specify a look-up table
Low	Low contrast
Medium	Medium contrast
High	High contrast
Laterality	Left, right, both

Touch or click the magic wand icon, and a new window opens that permits you to adjust the settings that govern the basic way in which images are acquired. The options available are shown with the DelWorks DR screen in Figure . Make your selections.

FIGURE 40. *Specify image-processing basis*
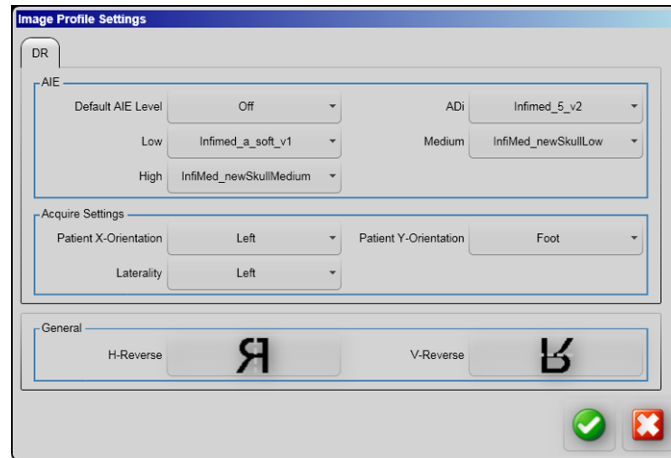
The current image profile settings are displayed in the left pane (Figure 38). You select new image profile settings in the right pane. As you see in Figure 38, an image with more contrast and less brightness was selected.

Save this new profile when it is acceptable. Use the buttons on the bottom of the Image Profile window (Figure 38) thus:

- Checkmark, accept changes and close.
- *X* reject changes and close window.
- Disk with checkmark: Accept changes and continue working on, for example, the image profile for another acquisition profile.

Statement of IHE Integration

TABLE 17. *IHE Integration Statement, May 4, 2009*

Vendor	Product name	Version
InfiMed	InfiMed i5	1.0

This product implements the transactions required in the IHE Technical Framework to support the IHE Integration Profiles, Actors, and Options listed below:

Integration Profile Implemented	Actors implemented	Options implemented
Scheduled workflow	Acquisition modality	PPS exception management Broad worklist Patient based worklist query Assisted acquisition protocol setting
	Performed procedure step manager	None
Patient Information reconciliation	Acquisition modality	None
Key image notes	Acquisition modality	None
Portable data for imaging	Acquisition modality	None
Consistent presentation of images	Acquisition modality	None
Consistent time	Acquisition modality	None

Internet address for InfiMed IHE information: http://www.infimed.com

Links to standards conformance statement for the implementation

DICOM	http://infimed.com/customercare/documentation http:///infimed.com/impdf/DICOM_Conformance.pdf/

Links to general information on IHE

North America: http://www.ihe.net	Europe: http://www/oje-europe.org	Japan: http://www.jira-net.or.jp/ihe-j

Index

Symbols

.log files 72

.txt files 72

A

acclimatization 7

acquisition profiles 45, 54, 64, 74, 75

    acquire settings 49

    default settings 46, 48

    DICOM 49

    example 48

acquisition rate 49

ADi (auto-density) 50, 75

AIE 48, 50, 75

AIO, auto image optimization 49

AuditLog.txt 72

authorized personnel 4, 5

Auto advance 29

Auto logout time out 29

axes reverse 50

B

Bucky 11

C

cables 4

calibration 18

    history 18, 59

cleaning 3, 4, 5, 12

Command prompt (terminal) 70

computer name 70

Crash.log 72

D

Date & time 70

defect 17, 18

diagnostics 63

Diagnostics.log 72

Dicom 8

DICOM.log 72

DNS server 42

dose 22

dosimeter 8

dosimeters 4

E

Edge enhancement 49

errors 64

ESD 12

Ethernet 13, 15

Event Logs (InfiView®, Security) 71

exit 25

F

fall 4

G

gain 17, 18, 19

GIM 63

ground 4