installation and configuration guide

RadWorks™ 6.0

Applicare Medical Imaging B.V.

Important

Using RadWorks implies that you have read and accepted the terms of the license provisions as laid down in this guide.

The information in this guide is subject to change without notice. GEMS IT Applicare assumes no responsibility or liability for any errors or inaccuracies that may appear in this book.

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March 2002

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- This Service Manual is available in English only.
- If a customer's service provider requires a language other than English, it is the customer's responsibility to provide translation services.
- Do not attempt to service the equipment unless this service manual has been consulted and is understood.
- Failure to heed this Warning may result in injury to the service provider, operator or patient from electric shock, mechanical or other hazards.

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- Si le technicien du client a besoin de ce manuel dans une autre langue que l'anglais, c'est au client qu'il incombe de le faire traduire.
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- Não tente reparar o equipamento sem ter consultado e compreendido este Manual de Assistência Técnica.
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Contents

Foreword

A RadWorks workstation is highly configurable. The user interface can be adapted to specific needs and workflow. You can connect the workstation other workstations, to image archives and to HIS-RIS systems, create reports to particular specifications, and much more.

This guide describes how to configure these many aspects of RadWorks. It also describes how to initially install RadWorks, and how maintenance it and troubleshooting if necessary.

The guide is meant to be used by system administrators rather than end users. For general information on how to make user-specific settings and actually use RadWorks, see the RadWorks User Guide.

Chapters 1 and 2 describe how to install RadWorks. Chapters 3 through 11 show you how to configure the optional RadWorks modules. Information on how to maintain the RadWorks system is contained in Chapters 13, while chapter 14 provides useful information on how to troubleshoot particular issues. Appendix A provides a list of error messages while Appendix B offers lists of DICOM tags you may find it useful to refer to when making DICOM-specific settings.

When installing RadWorks on multiple systems, you can often save a great deal of time and effort by copying the configuration information from one station to others - see chapter 12 for more on this.

We wish you every success with setting up and configuring your RadWorks system.

The RadWorks development team
Zeist, The Netherlands
March 2002

Conventions used in this guide

In instructions, where you must select a submenu from a menu, these selections are listed as **Menu → Submenu**.

Buttons and other items you must click are **Bold**.

The root directory for RadWorks is given as %ROOT%. So the path to the \bin subdirectory in the RadWorks root directory is rendered as %ROOT%\bin. The default root directory is C:\AMI_60, but you can install into a different directory.

Key to note icons

A note offering additional information on an aspect described in the text.

An aspect of particular importance to take note of.

Read this.

A tip or trick to help you get more out of Centricity DA.

CHAPTER 1

Preparing for installation

This chapter lists the different versions of RadWorks and the hardware and software they require, and describes what needs to be done prior to installation on a Windows workstation.

IN THIS CHAPTER

Since medical imaging requirements differ widely between locations and types of use, RadWorks comes in a number of versions and offers many optional modules. This means that each system need only have the functionality its particular users need. Systems can range from just basic viewing stations through to powerful multi-monitor radiology workstations including all the functionality described in this manual.

This means that system requirements may vary. More complex RadWorks setups require more capable hardware, and some options require optional Windows components to be installed. This chapter describes the hard- and software required for various RadWorks systems, and it guides you through preparing the workstation for installing RadWorks.

Part of those preparations are changes to Windows' configuration (networking and dial-in setup). For in-depth information on these subjects, see Windows reference books, Microsoft TechNet and on-line documentation, such as "The Windows 2000 FAQ" by John Saville (www.windows2000faq.com) and the "The Windows NT FAQ" by John Saville (www.ntfaq.com).

RadWorks versions and modules

This section lists the available RadWorks versions and modules.

Versions

To allow systems precisely tailored to specific needs, there is a vast range of options when configuring RadWorks. Please consult your distributor with your exact requirements if you are considering changing your system.

RadWorks systems are available in several versions intended for particular types of use. *Diagnostic* is the high-end system positioned specially for diagnostic use by radiologists. It supports multiple high-resolution monitors (2000 x 2500 pixels), printing and MPR/MIP. *Review* is a more basic system for referring physicians. The *Standard* version is generally used in wards, operating theaters and ICUs and for the radiologist on call.

The *Educational* version is similar to Diagnostic, but is meant for educational purposes only.

Workgroup Server allows multiple users to access a single, shared database and work much more flexibly as a team. Once a study has been sent to the Workgroup Server, all clients will be able to see it in the Data Selector and view it. When one client opens the study to work on it, the other clients can still open the study for viewing only (they can add presentation states, key notes and structured reports). Study status changes made by the editor are automatically transmitted to the viewers. The Workgroup Server can also be used as a workstation. You cannot run the Quality Control Module or the Data Acquisition Module on a Workgroup Server, and we do not recommend running the Single Media Archive Module on the server.

The users have *Workgroup Clients* to access the server. A Workgroup Server supports up to ten Clients. You cannot run the Quality Control Module, Single Media Archive or the Data Acquisition Module on a Workgroup Client.

Modules

Each type of RadWorks system can be further enhanced by additional modules which cover specific tasks. Some modules are included as standard in some versions. If a module is not included in a version, it can often be added to it.

Multi-Monitor module

This allows RadWorks to use multiple monitors in various configurations. It is included as standard in RadWorks Diagnostic and is optional for the other versions.

Print module

This supports background printing to DICOM 3.0-compliant imagers. Both color and monochrome printing are supported. The module also offers a file export option to BMP and TIFF file formats which is useful for reporting, teaching files, creating slides and presentations. You can print series or studies in pre-defined film layouts which can be selected from the layout pool. The virtual film sheet (presentation sheet) offers the ability to compose and post process print jobs on the fly. A single film sheet can be made up of images from different modalities, and images can be included more than once on the same sheet with different settings. Printing to Windows-supported printers is included in RadWorks; you do not need the Print module for that.

Single Media Archive module

This allows archiving patient and study data on any media supported by Windows 2000/NT (CD-R, Jaz/zip disks etc.). An indexing tool provides archive and media management, allowing you to keep a record of which patients studies are located on which disk. The data is written to the media in the DICOM 3.0 Part 10 format, thus, guaranteeing a growth path towards mass archiving in the future.

Data Acquisition module

This can be used to acquire data from systems that are not DICOM 3.0 compliant. It supports film digitizers from several major vendors (Lumisys, Howtek and Vidar), frame-grabbers, document scanning and graphics file import.

MPR/MIP module

This allows Multi Planar Reconstruction (MPR) and Maximum Intensity Projection (MIP) on 3D data sets of MR and CT slices. MPR is an algorithm that computes cross-sections as if the slices had been acquired in a different direction. MIP computes images that primarily show the pixels with the highest values and is excellent, for example, at showing blood vessels in angiography.

MPR/MIP cines can be created, saved to disk and sent to other systems for review. Collections of individual MPR or MIP frames can also be created and saved along with the original images.

MPR and MIP only works with specific data set types, see ‘Requirements for MPR and MIP’ in chapter 6 for details.

Quality Control module

This allows various quality control tasks to be undertaken at designated workstations within the hospital.

Images that are acquired in certain modalities are routed to such quality control workstations before they enter the network. Studies can be opened for adding or changing patient demographics before they are saved and stored in the hospital’s archive, or before they are routed to other clinical workstations for viewing and reporting. Previous studies can also be (pre-)fetched from the hospital’s archive and used, for example, to adjust the window width and level settings or orientation of a CR image to comply with previously acquired CR studies. You can also re-sort images within a series, or delete images that have no clinical relevance.

If the hospital information system is capable of generating a DICOM 3.0 Modality Worklist, part of the quality control work can be automated. For example, the patient demographic information that is part of a worklist entry can be automatically inserted in a study.

Wavelet compression

This option allows you to use the compression based on the Wavelet algorithm when sending studies using teleradiology.

Integration module

This permits custom tooltabs, menus and pop-up menus (customizable for each user) to be added to RadWorks. They will typically provide single-click access to other applications such as a word processor, a web browser (with a particular HTML page loaded) or HIS/RIS functions, all from within RadWorks. It is particularly powerful as the basis of close integration between RadWorks and other systems.

Availability of modules

The following table lists the RadWorks versions, and the modules that can be added to them.

Modules that are part of all RadWorks versions are:

- Windows Print,
- JPEG compression / decompression,
- Teleradiology.

	RadWorks version			
Options	**Standard**	**Review**	**Diagnostic**	**Workgroup Server**
Data Acquisition	Option	Option	Option	Not available
Integration	Option	Option	Option	Option
Multi-Monitor (up to 4)	Option, up to 2	Option	Included	Option
Single Media Archive	Option	Option	Option	Clients only
Quality Control	Option	Option	Option	Not available
DICOM Print	Option	Option	Included	Included
Wavelet Compression/Decompression	Option	Option	Option	Option
MPR/MIP	Not available	Option	Included	Option
Viewing & reporting limitations				
Filters	2	10	10	10
Cine	1	16	16	16
Save alterations annotation/report (in general: saving changes)	No	Yes	Yes	Yes
Viewing Matrix RadWorks supports a resizable application matrix that begins at 800 x 600 pixels.	max. 1200 x 1600	These have been successfully tested with a matrix of 2000 x 2500 pixels per monitor.		

Modules available with RadWorks versions

Recommended hardware

Depending on the RadWorks license you have, Applicare recommends minimum hardware specifications. This is a guideline, and the final choice will depend on budgets, available hardware on site, etc. If you decide to run RadWorks on a less capable hardware configuration than our recommendation, you will most likely experience degraded performance.

When you add one or more RadWorks Modules to an existing system, you may need to upgrade the hardware.

Although RadWorks will run on systems with slower processors and/or less memory, the following hardware is recommended for good performance:

RadWorks performance will increase on a multi-processor machine, because the software supports Symmetric Multi Processing (SMP).

You should increase your RAM if you plan to run RadWorks concurrently with other Windows applications or on a multi-monitor configuration.

- 800 MHz Pentium III processor. When you upgrade an NT 4.0 system from RadWorks 5.1 without changing the hardware, you can expect performance similar to RadWorks 5.1.
- 128 MB RAM minimum for Windows NT 4.0, 256 MB recommended (see ‘Memory and disk space requirements’ on page 22).
- 256 MB RAM minimum for Windows 2000, 512 MB recommended (see ‘Memory and disk space requirements’ on page 22).
- 6-9 GB SCSI hard disk, preferably, Ultra Wide or Ultra-2. (see ‘Memory and disk space requirements’ on page 22).
- Fast graphics card with at least 8 MB RAM and capable of displaying 256 shades of gray. For color display, 16 million colors are required, 16 MB RAM is recommended.
- A non-interlaced monitor with a refresh rate of at least 70 Hz and a resolution of at least 800 x 600 pixels is required, although a resolution of 1024 x 768 or greater and a 19-21 inch monitor size is recommended.
- Keyboard and mouse.
- A high-speed analog modem, ISDN terminal adapter, 100 Mbit/s Ethernet or ATM connection if teleradiology is used.
- A RadWorks-compatible frame grabber board if frame grabbing is used.
- SCSI card for digitizer connectivity if a digitizer is used.
- Special graphics adapters if multi-monitor capabilities are used.

Memory and disk space requirements

If you plan to regularly view large studies like CR images, multiframe studies or MPR/MIP, use the 'recommended', rather than the 'minimal' amount of RAM specified. Increasing the amount of RAM will always improve performance – the more memory the better. RadWorks' image caching feature will use all available RAM for better viewing performance.

The optimal capacity of the hard disk depends on the usage of the PC. If it is used for medical imaging only, a capacity of a few GB will be sufficient for normal usage. If you want to store many images and studies for a longer period of time, you might consider using disks with higher capacity. RadWorks itself takes up about 300 MB, the demo data takes up another 360 MB. You need the disk space mainly for studies; the amount of space you need depends on how you use RadWorks.

Hardware recommended for Workgroup systems

For a Workgroup Server/Client system, you need the same hardware as for a stand alone system, with these exceptions:

Server

- If the server will also be used as a client, a dual processor system is recommended.
- 512 Mb RAM.
- 9 Gb hard disk (10,000 rpm or faster).

Client

Same as for a RadWorks stand-alone system.

Network

100 Mbps or faster.

Software requirements

RadWorks 6.0 runs under the following computer operating systems:

- Microsoft Windows 2000 Professional with Service Pack 2, or
- Windows NT 4.0 with Service Pack 6a or later.

Windows 2000 is preferred. RadWorks 6.0 will not run under any other Windows version.

If you wish to use hanging protocols and /or reporting, install a scripting host (JavaScript or VBScript). You can add these by installing Microsoft Internet Explorer 5.01 or higher, or the Windows Scripting Host.

If you want to use a Word template in reporting, you must also install Microsoft Word 2000.

RadWorks has built-in teleradiology capabilities. In order to be able to use them, the following Network Protocols need to be set up, depending on how the computer is connected (will it move images via a LAN/WAN, or via a modem link?):

TCP/IP	For LAN and WAN communications, and use of modem / ISDN. DICOM 3.0 can only communicate using this protocol.
RAS	For use of modem / ISDN.

Network protocols

You can add these during the Windows installation, or you can add them to an existing installation.

Windows service packs can be downloaded from the Microsoft web site.

Software recommended for a Workgroup Server

- Microsoft Windows 2000 Server with Service Pack 2, or Microsoft Windows NT 4.0 Server.

Make sure you have a sufficient number of client connection licenses with your Windows license.

Before you install RadWorks on a Windows 2000 workstation

Before you install RadWorks, you must set up networking. If you have a multiple-monitor setup, you must also (install and) configure your monitors.

Below are described the preparatory steps for a Windows 2000 system. If you are installing on Windows NT, see 'Before installing on Windows NT 4.0' on page 25.

Configuring multiple monitors

1. Install the video adapters and monitors.
2. In the Display configuration applet in the Control Panel, configure your monitors: Arrange the monitors the way you will use them, and set the resolution, color depth and refresh frequency for each monitor.

Before installing on Windows NT 4.0

Before installing RadWorks on your Windows NT workstation, you will need to configure networking and also possibly the multi-monitor settings.These are described in this section.

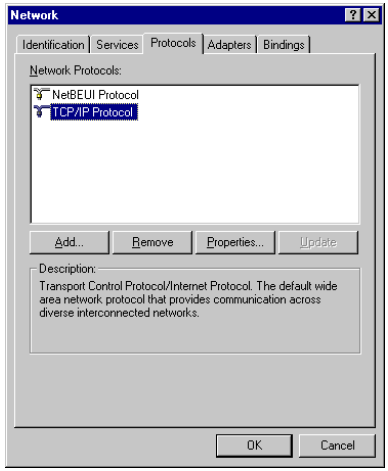
If you are installing on a Windows 2000 workstation, see 'Before you install RadWorks on a Windows 2000 workstation' on page 24.

Network configuration

Consult with your network administrator about network settings

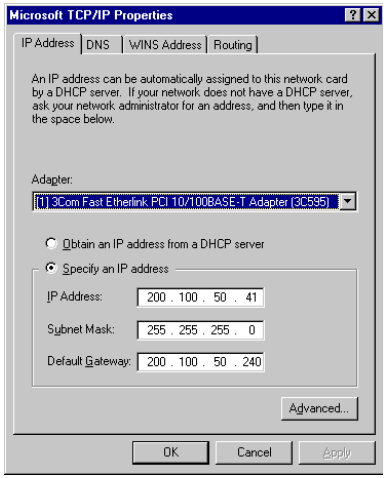
Once the TCP/IP Protocol has been installed during Windows NT Setup, you can modify its properties if and when necessary.

1. Open the Control Panel.
2. Open the Network manager.
3. Click the **Protocols** tab.



4. Select **TCP/IP Protocol**.

5 Click **Properties**.



6 During Windows NT Setup you will have been prompted to enter the IP settings. Check to see whether the settings are still correct.

7 Click the **DNS** tab.

8 Add the IP address of the DNS Service.

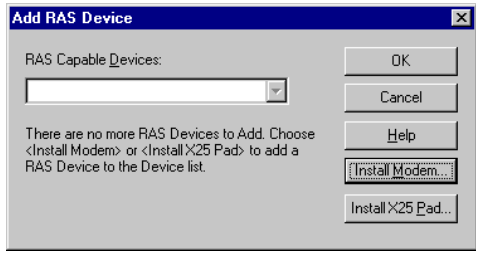
9 After adding or editing network settings, restart the computer for the changes to take effect.

Remote Access Service configuration

The Remote Access Service (RAS) has to be set up if RadWorks is to receive and/or send images using an analog modem or an ISDN interface card. RAS is not necessary for receiving or transmitting images if the RadWorks system will only be connected to a local area network.

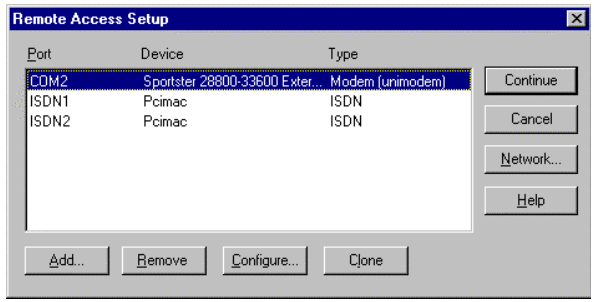
Adding an analog modem to the PC can be done during Windows NT setup or at a later stage using the Modems Properties in the Control Panel folder. Run the ‘Install New Modem’ wizard to install a new analog modem.

Adding an ISDN interface card is best done after installation of Windows NT by using the Network Properties icon in the Control Panel.

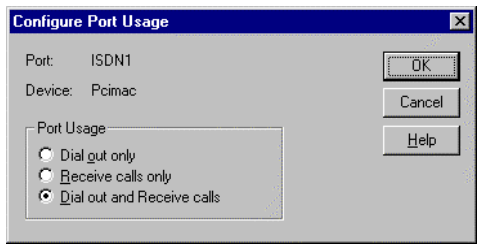


If Windows NT detects any RAS capable devices they will be listed here.

Once a RAS device has been added it needs to be configured to either transmit (Dial out only) or receive (Receive calls only) or both (Dial out and Receive calls).

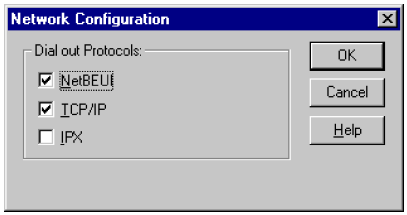


The choice made in the Configure Port Usage window will determine the contents of the Network configuration.



DICOM transmissions use the TCP/IP protocol.

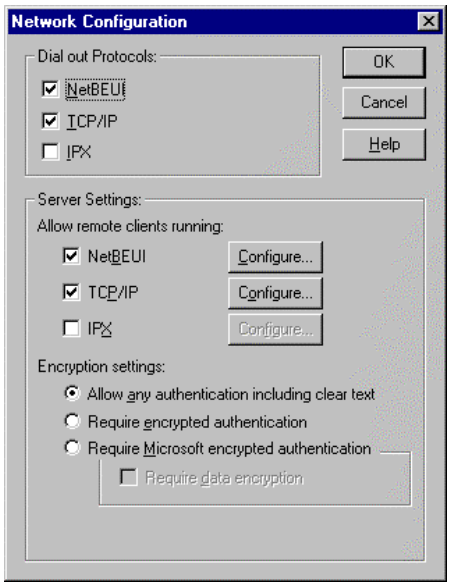
Setting up RAS to transmit



Setting up RAS as a dial out service you need to choose which Dial out Protocol will be used in the Network Configuration of the RAS device.

The encryption settings can be set when a RAS Address Book entry is created. This is described later on in this chapter.

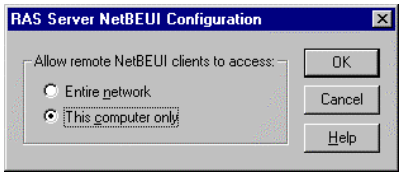
Setting up RAS to receive calls



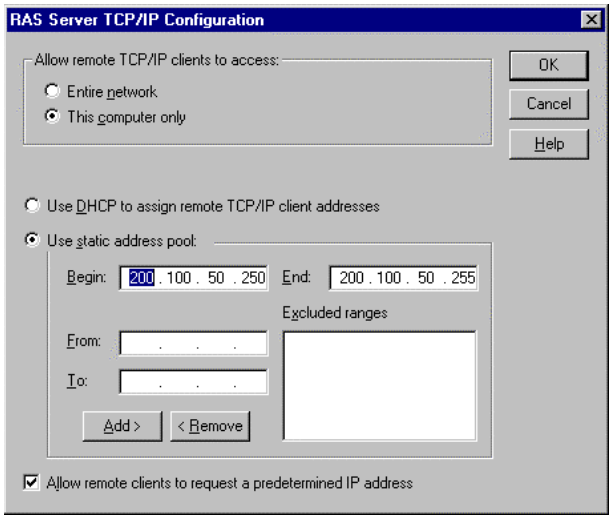
The Network Configuration window changes as soon as you have set the RAS device to Receive Calls.

Prior to setting up the system to receive calls from another system determine which Dial out Protocol to use. Make sure both systems are configured for the same Protocol(s).

The Server Settings allow you to configure the network accessibility:



Then depending on the local situation you can activate DHCP to assign remote TCP/IP client addresses. If DHCP is not being used it is necessary to use a static address pool.



Since the client will dial directly into a system you may choose any IP address you see fit, provided it does not conflict with IP addresses being used within the local area network.

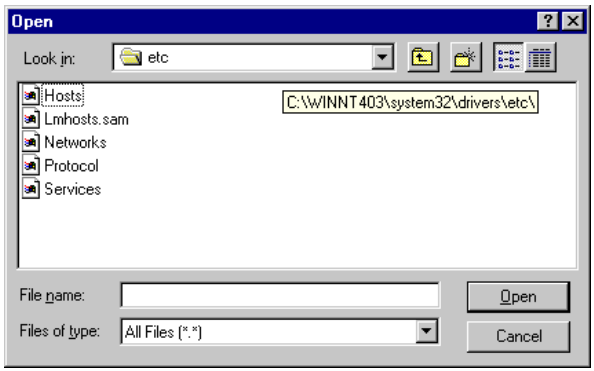
The first address will always be assigned to the RAS Server and the second to the client.

The encryption settings can be set in the last section of the Network Configuration. Make sure the client uses the same as is set here. This will be described later on during the RAS installation.

Setting up local host information

If you are able to connect to the other computer using its IP address, but you are not able to connect to the other computer using its host or NetBIOS name, there may be a name resolution problem. There are many methods to accomplish name resolution on a network, including the following:

- Domain Name Service (DNS)
- Windows Internet Name Service (WINS)
- HOSTS files
- LMHOSTS files.



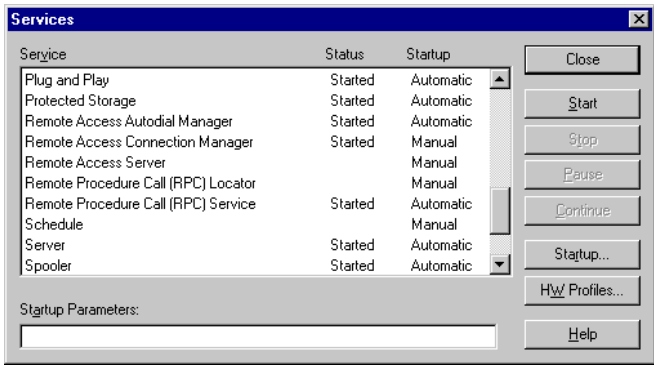
Detailed information about setting up and troubleshooting local host information is included in this chapter.

To prepare a RadWorks system for receiving images via a remote connection start the Remote Access Service and configure the Remote Access Server.

Activating the Remote Access Server

1 Open the Services control panel.

2 Select the Remote Access Server in the list. By default, the startup for this service is set to Manual. The service needs to be started in order to receive calls.

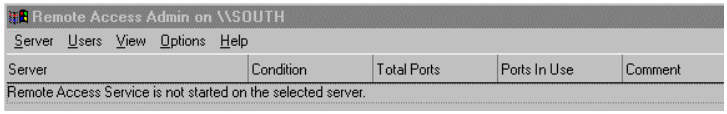


3 Click **Startup...**, and change the startup setting to Automatic. That way the Server will always be available, and you won't have to start it manually.

To start the Server, you can also use the Remote Access Admin (**Startup menu →Programs → Administrative Tools**).

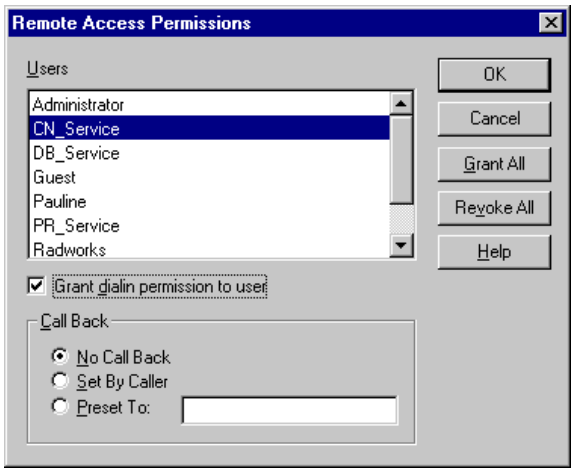
Setting dial in permissions

If the Remote Access Admin has been started and the Server has not, a message will be displayed.



From the Server menu, start the Remote Access Server.

You can set dial-in permissions for users to protect a Windows NT system from unwanted callers. From the Users menu, select the **Permissions** option to set these permissions.



Users listed here have been added either by the System Administrator or software installation programs.

RadWorks creates several users. One of them, CN_Service, is part of the Connection Service and needs to have dial-in permission on the Server. To set permissions:

1. Select the user in the list.
2. Check the **Grant dial-in permission to user** check box.

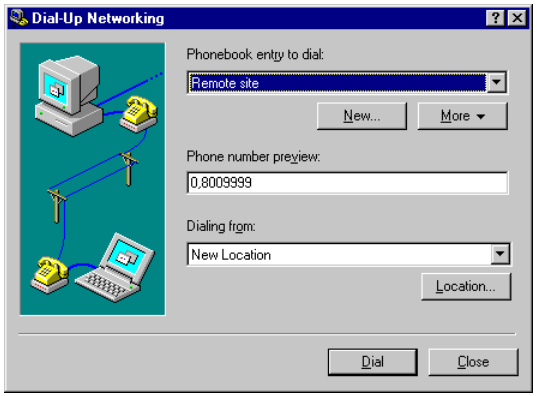
Applicare recommend you test the RAS connection prior to installing RadWorks. The next section describes how to create a Phonebook entry for dialing the remote system.

Creating a RAS Phonebook entry

The client system needs to know which phone number to dial. Use Dial-Up Networking in the 'My Computer' folder, to set this up.

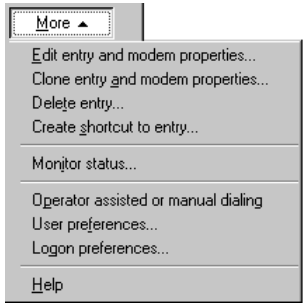
For detailed information on all options not discussed in this section, refer to the Windows NT help files and manuals.

1. When you create a new entry, a wizard will guide you through creating the entry.



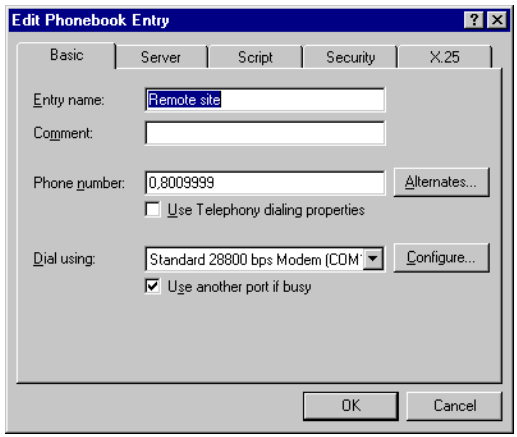
Once these steps have been completed (name, phone number and device to use) you can edit the entry to refine its settings.

2 Click **More** and select the option **Edit entry and modem properties** from the menu.

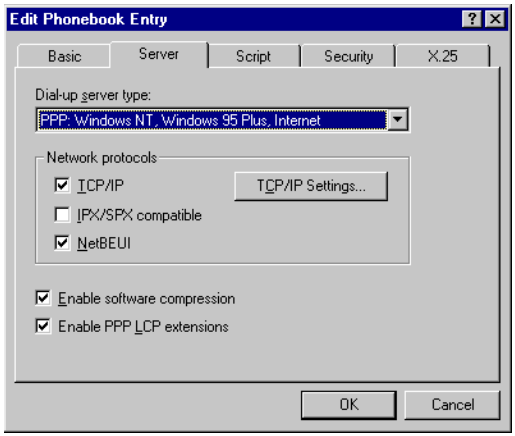


Make sure you have all the relevant information at hand before proceeding to edit the Phonebook Entry.

3 For 'Entry name', type a descriptive name; make clear which site will be called. RadWorks uses this name to add a Teleradiology destination.

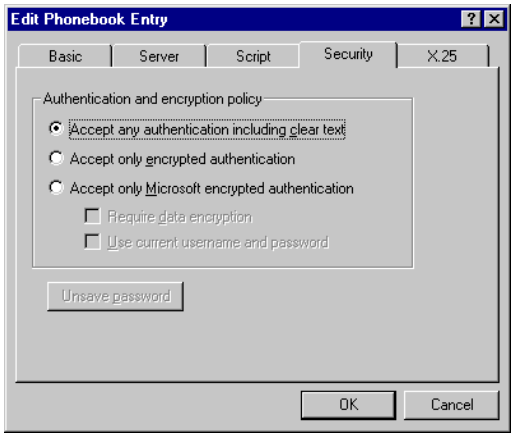


4 Use the next tab in the dialog window to configure the server settings of the remote site. The default server type is displayed in the illustration and doesn't usually need to be changed.



5 Typically, the network protocols will be TCP/IP . If the remote system is configured to assign an IP address to the client, then the default TCP/IP settings will not need changing.

6 The Security setting in the Phonebook Entry should be the same as was set in the Network Configuration on the Remote Access Server.

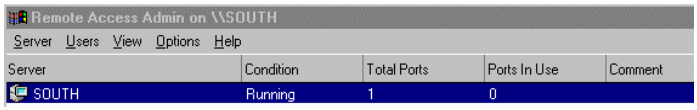


7 RadWorks does not need any login script; such a script is sometimes used to logon to the server of an Internet Provider. If you ever connect to an X.25 network, refer to the appropriate documentation.

Testing Remote Access Server

Once RAS has been setup on both client and server, test the modem communication between the two systems.

1. Use Dial-Up Networking to dial the remote computer with the entry you just created.



2. Verify that the Remote Access Server on the system that will receive the call has started correctly.

3. Select the remote systems' Phonebook Entry and dial: click **Dial**. Enter CN_Service as the user and Service20 as password. If both systems have been setup correctly with RAS and RadWorks the remote system will authorize the dialing system to access it.

Configure multiple monitors

1. Install the video adapters and monitors.

2. In the Display configuration applet in the Control Panel, configure the monitors: Arrange the monitors the way you will use them, and set the resolution, color depth and refresh frequency for each monitor.

RadWorks licensing

The RadWorks software requires an electronic license file. This contains the codes which enable you to access those parts of RadWorks you have purchased.

Whenever the RadWorks' Services are started or accessed, a license check is performed. If the requested license is not available, the Service(s) will not start and RadWorks also may not.

Electronic licensing and the MAC address

When placing an order for an electronic license, the MAC address (physical or Ethernet address) of the network interface card in the license server or standalone computer is required so the necessary license file can be created.

To obtain the MAC address, either ▶

Open a Command Prompt window and type the command:

```
ipconfig /all
```

or

Run the Lmtools executable, supplied on the RadWorks 6.0 CD-ROM, and open the System Settings property sheet. This is the preferred method.

The program files and documentation for Lmtools are included on the RadWorks 6.0 CD-ROM (\3rdparty\flexlm directory).

These steps are not required when using a local license file. You only need the FLEXlm toolkit for license server installations.

FLEXlm toolkit

RadWorks uses the FLEXlm toolkit for electronic licensing. It consists of four parts.

1. Lmtools.exe:
   FLEXlm tool to obtain MAC address, install the FLEXlm Services, perform diagnostics, etc.
2. Lmgrd.exe:
   The license manager program, which starts a Windows service when the server is started.
3. Amidmn.exe:
   Applicare-specific program, which validates the license file.
4. Lmutil.exe:
   Command Prompt version of Lmtools.

Installing the FLEXlm Service

The Lmtools program allows you to configure the FLEXlm Service for RadWorks 6.0. Copy the four files (Lmtools.exe, Lmgrd.exe, Amidmn.exe, Lmutil.exe) from the CD-ROM to a permanent directory (e.g. C:\FLEXlm) on your hard disk.

1. Start Lmtools.
2. On the first tab (Service/License File), select **Configuration using Services**.
3. On the last tab (**Configure Services**), select an appropriate service name.
4. Provide the paths to the requested files, lmgrd.exe and the server license file. Applicare supplies license files with the extension *.dat.
5. Check the **Use Services** and **Start Service at Powerup** checkboxes.
6. On the fourth tab (Start/Stop/Reread), the service is now displayed. Click **Start Service**. The service is started as soon as the message 'Using license: <license file name>' is displayed.

The FLEXlm license server is now installed.

In the Services control panel, the service will be displayed as being started and will automatically start at boot time.

To see if the service is functioning and how many licenses it has issued, use the Server Status and Server Diagnostic tabs.

About license files

Dependencies

If the Database, Connection and Print service do not start automatically with the license file when the computer restarts, do the following.

1. Use regedt32 to edit the HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services keys for the Database, Connection and Print Services.
2. Double-click **DependOnService** and add:
   - LanmanWorkstation if you are using Windows NT 4 Server.
   - LanmanServer if you are using Windows NT 4 Workstation
   - Lmhosts.

3 Repeat this for all three Services.

When the computer is restarted, all services should start.

MAC address only contains zeros

If your computer is not connected to the network the MAC of your Ethernet card will be displayed as zeros.

Running lmhostid will return "000000000000". You need to disable the Media Sense on your system.

See the web page: ‘How to Disable Media Sense for TCP/IP in Windows 2000’. The Internet address is:

http://support.microsoft.com/support/kb/articles/Q239/9/24.asp

Multiple MAC addresses

If you run lmhostid or lmtools on a Windows 2000 system with one network card, and you get multiple Ethernet addresses, remove the NetBeui and IPX/SPX protocols. Alternatively, use the Ethernet address that does not change when you restart the computer.

Using a dongle

If your setup does not allow the use of electronic licensing, you can order a dongle (hardware license key) from your distributor instead.

A dongle is a piece of hardware that has to be connected to the parallel port of the computer. Always use LPT1 if more than one parallel port is available.

Normally, licenses do not expire. However, demonstration and evaluation dongles have an expiry date. A warning dialog box will appear when you start RadWorks and the license is due to expire in seven days or less.

You may need to access the BIOS setting of the PC in order to change the parallel port setting to bidirectional or ECP/EPP.

CHAPTER 2

Installing RadWorks

This chapter describes the installation procedure for your RadWorks 6.0 software.

IN THIS CHAPTER

This chapter describes the procedure for installing the RadWorks software. It is recommended that you read this chapter carefully before installing RadWorks on your system.

Who should install RadWorks?

To install RadWorks you need to log on as a user with administrator rights. This will ensure that all configuration settings performed by the administrator and the rights to install RadWorks will be available to all RadWorks users.

Check your logon rights using the **User Manager in the Start Programs Administrative Tools Group**. Double-click the **Administrators Group** to see if your logon name is in the Member list. If you start the setup without the necessary rights you will not be able to install RadWorks.

If in doubt about your logon rights, contact your system administrator.

Before you start...

Make sure you have the correct license file, or dongle, before you install RadWorks.

Running RadWorks Setup

If all the hardware and software requirements for using RadWorks 6.0 are met, you can run the RadWorks Setup program (setup.exe on the RadWorks installation CD).

Welcome

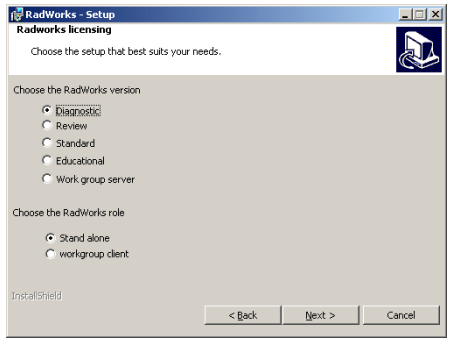
1 After Setup has started, a Welcome screen is displayed. Click **Next >** to continue.
The Setup may update the Windows Installer on your computer. If this happens, you will be prompted to reboot the computer.

Destination folder

2 By default, Setup will install your RadWorks program files in C:\AMI_60. To place these files in another folder, click **Change...** and specify a different location. It is recommended that you select a folder directly at the root level, not inside another folder.

3 Click **Next >** to continue. At any time during the installation, you can click **< Back** to return to previous screens and change settings.

RadWorks type and role



4 Choose the RadWorks product you want to install by clicking the appropriate selection button under **Choose the RadWorks type**. You should have the appropriate license for whatever version of RadWorks you select.

5 In **Choose the RadWorks role**, the difference between a Standalone and a Workgroup server installation is that the server's database and services will be shared so the Workgroup clients can access them.

6 Indicate under **Choose the RadWorks role** whether you want to install RadWorks on a standalone computer or a Workgroup client. Only select Workgroup client if the machine is to be connected solely to a Workgroup server.

When you install a Workgroup client, this enables you to view studies stored on the Workgroup server. During the Workgroup client setup you will be asked to enter the hostname of the Workgroup server.

A Workgroup client cannot use the Quality Control, the Data Acquisition Module or the Single Media Archive module.

RadWorks licensing mechanism

7 If you are using a license file, select **License file** and then **Browse...** to specify the path on your local hard disk of the license.

8 If you are using a license server, select the **License server** option, specify the file name for the local copy of the license, and enter the name of the server with the license.

9 If you are using a dongle, select **Dongle**.

If you use a local license file, we recommend you disconnect your computer from the network during installation. If you install the license while the computer is connected to the network, the license will only be valid while the computer is connected to the network.

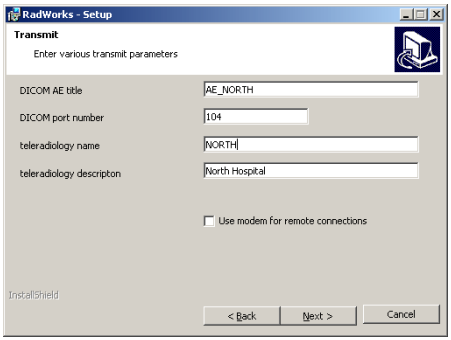
Modules

10 Click the icons of the modules you want to install, and, either, select **This feature will be installed on local hard drive** to install the module, or **This feature will not be available**, if not. 'X' is displayed next to modules that will not be installed. Only mark licensed modules for installation.
Note that you don't actually select the Acquisition module itself but options in that module.

Only install the modules you have a license for. The setup program does not check the license content of the Dongle or license file.

Don't select the actual Data Acquisition module but the options it contains.

Transmit



The Transmit screen is not displayed when you install a Workgroup client.

11 Specify in the **DICOM AE title** field the Application Entity Title of the computer you are installing RadWorks on.

DICOM AE Titles have to be uniqe in a network environment.

12 Use the **DICOM port number** field to indicate the port number your system will use to send and receive data. This number does not have to be unique.

13 Enter the **Teleradiology name** and **Teleradiology description**, to name and describe the computer you are installing RadWorks on.

14 Check the **Use modem for remote connections** check box, if you use a modem to connect to the network.

15 Click **Next >** to continue.

Miscellaneous

16 Check the **Tools** check box if you want RadWorks Setup to install vendor-specific tools (this option may not be present in your version).

17 Check the **Demo Data** check box, so RadWorks Setup includes sample studies when it installs RadWorks. These studies, which are not required for everyday use of RadWorks, contain images from a wide range of modalities and are useful for learning about RadWorks. However, they do take up a significant amount of disk space - about 350 MB.

The sample studies will also significantly extend the installation time for RadWorks. You can also install these studies after setting up RadWorks by copying them from the RadWorks installation CD to the RadWorks Database\Input folder.

18 Check the **Configure Multi Monitor** check box, if you want to use RadWorks on more than one monitor.

19 Click **Next >**.

20 If you previously checked the **Configure Multi Monitor** check box, select your monitor configuration. This will prepare the multi-monitor settings in RadWorks. If your configuration is not listed, select one that is similar. You can always change the multi-monitor settings from within RadWorks. If you did not select the **Configure Multi Monitor** check box, this screen will be appear.

21 Click **Install**.
The progress bar displays how far RadWorks Setup has progressed. The installer may start up separate installers for e.g. the VOB CD-writing package. Go through these installers: the default choices are acceptable.

Installation complete

22 Click **Finish**, to complete the setup.

System check

Setup will check whether the Remote Access Manager services have been installed.

RAS

The following only applies to Windows NT 4.0. RAS is automatically installed with Windows 2000.

The Remote Access Service Manager must be installed on the system if you want to use a modem for remote connections. If the setup does not find the service, you will be unable to use a modem after RadWorks is installed. You can also install RAS after installing RadWorks. To setup and install the Remote Access Service Manager, see 'Remote Access Service configuration' on page 26 for more information.

Upgrading from a previous version

When you run the setup on a system that has RadWorks 2.1, 4.0, 5.0 or 5.1 installed, the setup will automatically upgrade the existing installation to RadWorks 6.0.

Even if you do not have a previous version of RadWorks installed the setup will search for it. Depending on the hard disk size this might take a few moments.

If Setup detects a previous version on the system, you will be asked whether you wish to continue and have Setup upgrade your existing version. You cannot have two versions installed on the same system.

If you choose to continue with the upgrade, the previous RadWorks settings (remote views, destinations, origins, etc.) and the image data will be automatically migrated during the installation; you will also be able to keep the DICOM AE Title and port number. If you don't have RadWorks 5.1 installed, the RadWorks 6.0 default port number will be 3140 when you install it.

The services of the previous version will be removed during the upgrade procedure.

Setup will detect which services and modules were installed; these will already be selected in the Setup screens. Run Setup with only these modules. If you want to add new modules, in the Windows Control Panel select **Add/Remove Programs** → **RadWorks** and click the **Change** button.

All image data will be migrated (moved) to the \%ROOT%\Database\Local directory (including archiving directories).

All local database files will be converted to the DICOM part 10 format.

RadWorks 6.0 does not support Converters. If your installation relies on Converters you have created, you should *not* upgrade to RadWorks 6.0.

After the upgrade, the old RadWorks services will have been removed.

Multi-monitor settings will also be migrated to RadWorks 6.0.

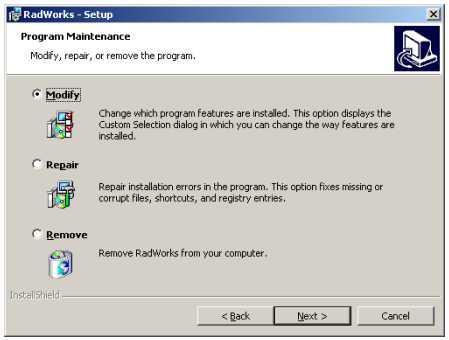
RadWorks 6.0 will be installed in the same folder as the previous version.

Modifying or removing a RadWorks installation

To modify or remove your current installation of RadWorks, use **Add/Remove Programs** in the Control Panel.

To modify or remove a RadWorks installation ▶

1. In the Control Panel, open **Add/Remove Programs** and then **RadWorks 6.0**.
2. Click **Change** to modify the installation, or **Remove** to remove RadWorks entirely.
3. In the RadWorks installer, click **Next >** and select **Change** to open the Program Maintenance screen or **Remove** to remove RadWorks.



4. Select the task you wish to perform and click **Next >**.

A summary of each task is given below:

Task	What it does
Modify	Installs or removes modules from your configuration.
Repair	Reinstalls your RadWorks program files.
Remove	Completely removes RadWorks from your system (this is the same as using the 'Add/Remove Programs' option in the Control Panel).

Options on the Program Maintenance screen

Important note if RadStore or WebViewer is also installed

When uninstalling RadWorks, its registry keys are removed as well. RadStore and WebViewer use the same license file. So, if you uninstall RadWorks, any RadStore or WebViewer installation will also also lose its license.

Backing up system settings

You can create backups of the system settings. These can then be used to restore a computer's settings after RadWorks has been reinstalled.

Examples of system settings include user profiles, destinations to image archives, print layouts, new printer definitions, views and auto-routing rules.

After you have configured a local machine, you can create backups of system settings and load them by running the RadWorks Settings Tool program located in the RadWorks Bin folder.

To create a backup file▶

1. Start RadWorks, adjust it as you wish and close RadWorks again.
2. In the RadWorks Bin folder, run **RadWorks SettingsTool.exe**.
3. In the RadWorks Settings Tool dialog box, click **RadWorks System**.
4. In the RadWorks System Settings dialog box, click **Backup**.
5. In the Save As dialog box, find the location where you want to save the backup file, enter its name in the **File name** field and click **Save**.
6. Click **Close** in both the RadWorks System Settings and RadWorks Settings Tool dialog box.

To restore a previously created backup ▶

1. In the RadWorks Bin folder, start the **RadWorksSettingsTool.exe** file.
2. In the RadWorks Settings Tool dialog box, click the **RadWorks System** button.
3. In the Available Settings section of the RadWorks System Settings dialog box, select the backup you want to restore, and then click **Restore**.
4. Click **Close**, in both the RadWorks System Settings and RadWorks Settings Tool dialog box.

Working with user groups and profiles

When RadWorks is installed, two new groups are installed in User Manager. One of these is RW_USER. You can add users to this group to make them users of RadWorks.

Creating user profiles

User profiles allow users to start RadWorks with the settings they need for their tasks. They allow, for example, a radiologist to have all features required for advanced viewing and diagnosis, while providing the radiographic technologist with the features that person needs.

You can create user profiles for different groups of users by making the appropriate adjustments within RadWorks and then running the RadWorks Settings Tool program located in the RadWorks bin folder.

To create a user profile ▶

1. Log into Windows with the name of the user you want to create a profile for. Do not log in as an administrator.
   If you log in as an administrator, the settings you make are system-wide, not user-specific.
2. Start RadWorks and adjust the user settings required for the user group you are creating.
3. In the \bin folder, start the **RadWorksSettingsTool.exe** file.
4. In the RadWorks Settings Tool dialog box, click **User**.
5. Click **Save** in the RadWorks User Settings dialog box.
6. In the Save As dialog box, enter the name in the **File name** field and click **Save**.

To load a user profile ▶

1. To load the profile in the registry, select the profile in the Available Settings section of the RadWorks User Settings dialog and then click **Load**.
2. Select the profile with its.xml extension in the Open dialog box, and click **Open**.
3. Click **OK**, to implement the selected profile in the RadWorks Settings Tool message box and view the results in the Loaded Setting section of the RadWorks User Settings dialog.

If you want to clear the user profile currently loaded in the registry, click **Clear** and **Yes** to confirm in the RadWorks Settings Tool message box.

Click **Delete**, to remove a profile from the list of available profiles. This does not remove a profile from the registry if it has been loaded earlier with the Load button.

When a user starts RadWorks for the first time, he will see the RadWorks dialog box. Here he can select a user profile, after which RadWorks starts up with the settings that were configured for the selected user profile. Users can also *not* select a profile (by clicking **Cancel**). RadWorks will then start with the default settings.

Each time the user, subsequently, starts RadWorks, it will automatically use the selected profile.

Software patches

A few software issues may be discovered after the final release. These are registered in a bug-tracking database. Should a major issue arise, depending on its type and frequency of occurrence, a software update (software patch) will be released as soon as it has been resolved.

Patch release

As soon as the R&D department has released a patch, it is made available to the distributors.

A patch file is always accompanied by release notes, which should be read before the patch is applied.

It is also recommended that the latest software patch is applied after a new installation or an upgrade.

Contact your RadWorks distributor for information on the latest available patch.

You may not need to apply the patch, unless it is labeled as mandatory. If the latter is the case, it means that a serious problem, which can occur on the majority of the installed base, has been fixed.

Applying a patch

When a software patch file is executed, it will stop the RadWorks Services, extract the binary files and copy them to their respective directories, and then restart the services.

Version check

The About box contains the following information:

RadWorks version, build number and Software Patch number.

Installing workgroup servers and clients

Installation

Installation of either a Workgroup server or a Workgroup client does not require special steps; just select the appropriate option during the normal setup.

To set up a Workgroup client, you do need to know the host name of the Workgroup server.

The Workgroup server can also be used as a ‘normal’ RadWorks system. When doing so, it will use one of the concurrent user licenses.

If a client station is licensed to use a RadWorks module, this module has to be installed on the Workgroup server as well.

Limitations

The Single Media Archive, Quality Control and Data Acquisition modules are not available on a Workgroup client.

Data issues

Executables and DLLs are stored on the client. Services and data reside on the server. Service settings can therefore only be changed on the server.

The client uses the database on the server. When one client opens the study to work on it, the other clients can still open the study for viewing only (and they can add presentation states, key notes and structured reports).

Performance issues

Factors which can influence the performance, are:

- Speed of the server. The server should be a fast machine with a large memory.
- Speed of the network. A 100 Mbit/s network is recommended.
- Network architecture. A dedicated network, physically separated from the LAN, will improve the Workgroup performance dramatically. New technologies like Storage Area Networks based on fibre channel can be considered.
- Total number of clients, a maximum of ten.
- Number of clients simultaneously viewing different studies.

Data updates

Changes made to the database, queues, and other shared data are immediately updated on the other systems in the workgroup.

Log files

The RadWorks log is stored locally.

Workgroup client configuration

A workgroup client needs remote access to the `HKEY_LOCAL_MACHINE\SOFTWARE\AMI` key on the server.

If the client has administrator rights on the server, this will not be an issue. If not, a few changes to the registry on the server are required.

To grant the client access rights on the server ▶

1. Create a domain account for the Workgroup Clients in the domain users group.
2. Back-up your registry and, using REGEDT32, select the following registry key:

   ```
   HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\SecurePipe-
   Servers\winreg
   ```

3. Select **Security** → **Permissions** to add domain users and give them full control. (This means that this remote user has the same rights as if he were logged on locally).
4. Make sure the domain users have full control to the key:

   ```
   HKEY_LOCAL_MACHINE\SOFTWARE\AMI
   ```

Now a user without administrator rights can start a RadWorks Workgroup client.

CHAPTER 3

Configuring teleradiology

This chapter describes how to set up and configure a RadWorks workstation to receive and send images (teleradiology).

IN THIS CHAPTER

The current version of RadWorks can send and receive images in DICOM format, including Keynote Objects, Structured Reports, and Presentation States. For downward compatibility, it can also receive images in the AMI format.

Before you configure RadWorks to send and receive images, you should check that the system has been set up correctly for communications, either over a local area network or via dial-up networking.

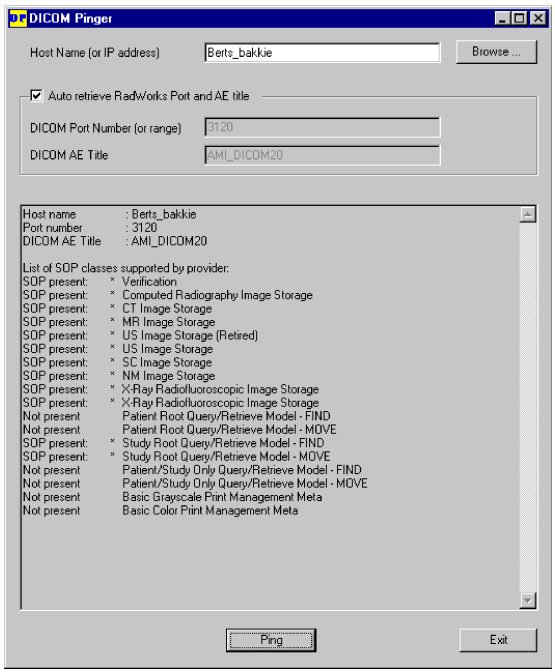
Preparing the workstation for teleradiology

For detailed descriptions of the dialogs used in configuration, click Help in the dialog.

Receiving DICOM images requires preparation of both RadWorks and the sending site, whether that is another RadWorks system or a third-party system.

Testing the DICOM association

We recommend testing the association to ensure that the remote system and RadWorks have been correctly configured. There is a utility to test the DICOM association: DCMPing. (this can be found in the %ROOT%\BIN directory)



Setting up the Connection Service

Configuring Connection Service properties

You need administrative rights to change most of these settings.

We recommend you only alter the default settings if this is strictly necessary. For detailed information on the settings, see the online help (click Help in the configuration dialog box).

DICOM Application Entity Title

The DICOM Application Entity Title, which is entered during RadWorks installation, is set in the **Configuration → Generic...** menu.

We recommend using unique AE Titles when setting up more than one RadWorks workstation in a network. The port number need not be unique across the network.

Receive settings

1. Select **Configuration → Connection Service** from the menu bar in the Data Selector and click on the **Receive** tab. The settings on this tab apply to both AMI and DICOM format images.
2. Optionally enable **Verify Origin** to increase system security.
3. Enabling **Auto Decompression** will decrease loading time when viewing, but will increase storage space.
4. Add the location of the post processing .dll in the **Post Process** field if the Quality Control Module has been installed and you want to use Auto Matching, or the Repair tool.
5. The **RadWorks 5.1 Receive** settings on this property page usually do not need changing.
6. Enable **Auto Compress Studies** to indicate that studies entering the system via the Connection Service should be compressed before they are actually stored in the database.
7. The Format and Parameters drop-down lists allow you to select the appropriate compression format and compression specific parameters for compressing incoming studies.

Wavelet lossy compression will only be displayed as an option if the Wavelet Compression module has been installed and a license for the module is present.

If for some reason the compression fails, a log message at warning level will appear in the connect.log, and the study will be stored as is. Failure to compress will never lead to rejection of the received study.

After the Connection Service has received a study, after auto-decompressing the study (if configured) will be auto-compressed (if configured). After completion of both steps, the study will be sent to the Database Service for storage in the local database.

DICOM settings

8 Select the **DICOM** tab of the Connection Service Properties dialog box. The settings in this tab apply to receiving and sending images.

9 Set the Maximum Number of Associations if desired. This defaults to 4, but is essentially unlimited. The practical limit, however, is between 16 and 30 associations depending on CPU power, installed RAM and I/O speed.

10 Set the PDU Packet Size if required. This is a minimum of 4096 bytes and a maximum of 4194304 bytes; the default value is 16 KB.

Setting up and configuring destinations

To configure a new remote teleradiology site you will need to have administrator rights and a certain amount of technical information from the new site you want to send to. If you are uncertain about configuring a destination, contact your system administrator or distributor.

Although it is possible, Applicare does not recommend you give multiple destinations the same AE Title, since in DICOM 3.0 the AE Title is considered to be unique in a network situation. Should you do so, resolving a destination could be difficult when, for example, a study is retrieved from RadWorks by another system.

You can add new sites to send studies to, or change details of existing destinations.

To add a teleradiology destination ▶

1. Select **Connection** → **Destinations…** from the menu bar in the Data Selector.
2. In the Destinations dialog box, click **Add**. A dialog opens.
3. Enter the **name** of the new destination.
   The name will be displayed in the list box on the Teleradiology Tooltab.
   The name field must be unique. The system will check this when you enter a name.
4. Enter the **Host Name** (DNS name) of the new destination.
5. Optionally, you can enter a **description**.
6. If you want to access the destination via RAS: check the **Use RAS** checkbox.
   If you select this option, a new dialog window will appear for specifying RAS parameters. If the **Use RAS** check box is grayed out, RAS has not been installed on the system and cannot be used for connecting to destinations.

7 Select the **Options**: **Study Status ID**: if this is ON, RadWorks sends only the changes to a Study Status instead of transferring all the images (saving time). The status changes are sent via a DICOM Study Management N-Set or N-Event message.
N-SET: requests the status change.
N-EVENT: reports that the status has been changed.
You can set the message type once you have created the destination (the **Modify** dialog has these options).
The receiving DICOM entity must support this feature (few do at the moment).
When the destination is a RadWorks 5.1 workstation, select '**RadWorks 5.1 format**'. This will convert Presentation States, Structured Reports and Keynote Objects into the proprietary RadWorks 5.1 formats before sending them. You can also use this option to send this data to other systems that do not understand this data. When the destination does not understand the data, the entire study will be rejected. You can set these options here, and you can override them when you send a study.

Unchecking this checkbox is a DICOM violation. There are a number of archives that will overwrite an image upon "repeated reception of the same image", i.e. they will overwrite the original uncompressed image and replace it with the new (lossy compressed) image, which is probably not intended behavior. Unchecking the box is only recommended in very tightly controlled workflows, like the two cases described here.

The **Change SOP instance UID on lossy compression** option should be ON. When it is ON, the image number (UID) is changed when an image is compressed with a lossy algorithm, ensuring that the lossy version does not overwrite the (not compressed, higher-quality) original. There are only two cases where switching this OFF may be useful:
- when on the remote system Keynote Objects, Presentation States and Structured Reports lose their links to an image due to the UID change.
- when the destination does NOT send back the images, but creates annotations to the compressed images and sends back the annotations only: the annotations need to be associated with the original images, not the compressed copies.

8 Select the **IODs** that will be sent to this destination. You can select e.g. only the **Presentation States**, **Key Images** and **Structured Reports**: this limits the amount of data that gets transferred. The **Other IODs** are DICOM data that RadWorks will store, but cannot change. The IODs are optional because not all destinations can use these data. When the destination is a RadWorks 6.0 workstation, you can select all the options.

9 Click **Next** >.

If you use the same AE Title on all RadWorks workstations on the same LAN and perform a retrieve action on one of them, the remote system will send the images to the first DICOM AE Title the remote system finds.

10 Enter the DICOM AE Title for the remote system.
We recommend you give each machine a unique AE Title.

11 Enter the DICOM port number for the remote system.
The DICOM port number does not have to be unique. Most modalities have a fixed port number, which can be found in the DICOM Conformance Statement of that modality.

12 If RAS is installed on the system and you have also selected the 'Use RAS' option, another dialog will appear with RAS settings.

To change an existing site (destination) ▶

1 Select **Connection** → **Destinations…** from the menu bar in the Data Selector.

2 In the Destinations dialog box, select a destination (click in the first column) and then click **Modify**.

3 Change any of the items in the Destination Properties dialog box (refer to the on-line Help for details on the tabs and all parameters).

You can also double-click the left most column of a destination to modify it.

Identification

If the RadWorks system needs to be able to send to various departments within the same hospital you can add more details about each destination in the Identification tab.

Connection Parameters

The Connection Parameters tab contains the destination information.

The Backup Destination drop-down list includes all the destinations that have been defined for your system. If the destination you require is not listed, you will need to set it up. See 'Setting up and configuring destinations' earlier in this chapter.

The **Backup Destination** is used to provide redundancy: if sending to a destination fails, RadWorks will send the study to the backup destination. This makes sure the workflow remains intact (if RadWorks could not send the study, it could not be deleted from the sending system). To prevent an endless loop of directions, the redirection process will stop as soon as the Backup Destination equals the primary destination. You can configure circular references, though. RadWorks will only check for a circular redirection when it actually transmits studies.

Transmission Parameters

The type of destination you add determines which default Transmission Parameters you select.

You choose the default transmission format in this tab. It is still possible to alter it when you submit a Send Job.

The studies can be sorted according to priority set here, and a Priority column has been added in the Send Queue dialog window.

We strongly recommend you test the compression parameters and decide which ratio is acceptable. The quality of the image versus the transmission time forms the basis for such a decision.

Format

This sets the file format for the images. With lossless compression, you can return to the original image quality after decompression, this is not the case with lossy compression.

Setting up and configuring origins

When your system is connected to a network, any properly equipped DICOM compliant system connected to that network could query your database and even send you studies. In many situations, especially, when specific security measures are already in place, this will not matter a great deal. But there may be circumstances when you want to restrict access to your system to specific known systems.

In RadWorks, you do this using ‘origins’. When another system tries to communicate with yours, you can tell RadWorks to check the origin (specific details of the other system), and only allow communication if this origin is one of a pre-configured set of permitted origins. If not, your system will not accept the connection. In this case, the other system will not be able to query your system or send it data.

Setting up origin verification

When RadWorks is first installed, the origins feature is not active. To use origins, you will first need to turn it on.

To turn on origin verification ▶

1. Select **Configuration** → **Connection Service…** from the menu bar in the Data Selector.
2. Check the **Verify Origin** check box on the Receive tab of the Connection Services Properties dialog box.

Once you have set up RadWorks to verify the origins of other systems, build a database of origins which RadWorks should accept.

The New Study Status field in the Origin Properties dialog lets you specify whether an incoming study from the origin should be assigned a specific status. Whatever status a study might have when arriving at your system, this will be overwritten by whatever you select here.

This is particularly useful when communicating with non-RadWorks systems to ensure that studies have a known status.

Setting up an origin

The Origins section of the Filing tooltab shows all the remote systems or sites that have sent studies to your RadWorks system. You can pre-configure Origins to control from which sites and systems your local system can receive data.

1. Select **Connection → Origins…** from the menu bar in the Data Selector.
2. Click **Add** in the Origins dialog box.
3. Type the appropriate information in the Origin Properties dialog box. (The Name, Host Name and DICOM AE Title are mandatory fields). For more information on what you should enter here, click **Help**.

Automatically locking and unlocking studies

Studies can be locked in RadWorks to prevent their accidental deletion and the loss of data this would cause. Locking and unlocking can be performed manually in the Data Selector (see the User Guide). It is, however, also possible to have RadWorks lock studies automatically as soon as they are received, thus, immediately protecting the data they contain.

You can set up this automatic locking for just some or all of the sites you receive data from (using Origins). The origins for which automatic locking is important, depend on your workflow. It may, for example, not be necessary to automatically lock studies received from an archive (since these studies will always remain in the archive even if deleted on the local system). On the other hand, it may be very important that newly-created studies received for diagnosis are not deleted (at least not until some further action has been taken).

To set whether or not RadWorks will lock incoming studies from a particular origin, you must modify the properties of that origin.

To automatically lock studies from a particular origin ▶

Select **Connection** → **Origins…** from the Data Selector menu bar. In the Origins dialog box, click the first column of the origin you want to have automatic locking from, and click **Modify...**. In the Origin Properties dialog box, make sure the **Lock Received Study** check box is checked.

IA series or images can be received from an origin with automatic locking enabled. Images, which the user previously unlocked, could however be appended to a study stored on the receiving system. In this case, the automatic locking will override what the user did – RadWorks will lock the whole study again when it adds the series and/or images to it.

Automatically unlocking studies

Automatically locking studies is very valuable in many situations. However, locked studies cannot be deleted manually, nor can they be deleted automatically using the Delete After Send option. In some cases, it may be desirable to have an automatic unlocking facility to, for example, allow studies sent to an archive using storage commitment to be deleted.

RadWorks' automatic unlocking feature is the counterpart of automatic locking, except that it applies to studies that are *sent* rather than received. For each destination that your system sends studies to, you can specify whether studies should be automatically unlocked. It may be appropriate for some destinations (such as an archive), but not for others (such as a radiologist's home system or an ER department), which may not be safe storage sites for studies.

To set whether RadWorks unlocks outgoing studies to a particular destination, or not, you modify the properties of that destination:

To automatically unlock studies going to a particular destination ▶

Select **Connection → Destinations…** from the Data Selector menu bar. In the Destinations dialog box, click the first column of the destination you want to enable automatic unlocking for, and click **Modify...**. Click the Transmission Parameters tab in the Destination Properties dialog box and make sure the **Unlock Study After Send** check box is selected.

Unlocking individual studies when you send them

Apart from having RadWorks automatically unlock studies, you can specify for particular send jobs that the sent studies should be unlocked when you create those send jobs.

Prepare the send job for sending in the usual way, but before clicking **OK** in the Send To… dialog box to submit the job, click **the Advanced…**. Click the **Transmission Parameters** tab of the Advanced Transmission Properties dialog box and make sure the **Unlock Study After Send** check box is selected.

Overriding automatic unlocking of studies for individual studies

If RadWorks has been set up to automatically unlock studies sent to the destination you are sending to, you can have the studies for a particular send job *not* unlocked. When you create send jobs you can, as it were, ‘override’ the RadWorks default setting concerning unlocking studies. To do this, make sure that the **Unlock Study After Send** check box on the Transmission Parameters Tab of the Advanced Transmission Properties dialog box is not checked.

Compression in teleradiology

Teleradiology is, of course, a very powerful tool for distributing image information quickly to where it is needed. Many types of study are, however, very large and telecommunications links often comparatively slow, so studies can take a considerable time to send in uncompressed form. RadWorks, therefore, offers a variety of ways of compressing images before sending them (and decompressing them at the other end).

Lossless or lossy?

With lossy compression, some image detail is irretrievably lost. This may render the image unsuitable for diagnostic purposes.

When selecting a form of compression to use when sending studies, the most fundamental choice is between *lossless* and *lossy* compression. As the name implies, lossless compression means that none of the information in images is lost – when decompressed on the other system, images will appear exactly as they were before they were sent. This is not the case with lossy compression – some of the image detail will be lost in the compression and decompression process. The advantage of lossy compression is that it achieves greater compression and hence smaller and faster transmission jobs than lossless compression.

Generally, it is best to use lossless compression – when you are sending images over a reasonably fast network or sufficient time is available even over a connection of limited bandwidth. For low bandwidth connections and/or when time is at a premium, you may well need to use lossy compression.

RadWorks will not compress images in a lossy way if the image is already lossy or has been lossy compressed previously.

The options

Once an image has been compressed with a lossy compression, you cannot apply another lossy compression option.
Images that are stored in a lossless compression format can be converted to another compression format.

RadWorks offers a much wider choice besides lossy or lossless. Depending on how your system is configured, you can choose some or all of these options when sending studies using teleradiology.

DICOM 3.0 ► is not a compressed format at all. Images are sent in uncompressed form. It is part of the DICOM standard and allows images to be transferred between systems from different manufacturers. Use for transmitting images with no loss of quality over relatively high-bandwidth links.

JPEG Lossy ► is a lossy form of compression which, as part of the DICOM standard, allows images to be readily transferred between different manufacturers' systems. Use for sending images when bandwidth and transmission time are an issue.

If sent to older RadWorks (5.1 and down) versions, the actual transfer syntax used will be a DICOM transfer syntax (DICOM JPEG Lossy). NOTE: In that case only unsigned 8- & 12- bit images can be compressed.

If sent to another RadWorks 6.0 system, the actual transfer syntax used will be a private transfer syntax (JPEG Lossy) for images other than unsigned 8- & 12- bit images. NOTE: In that case all images can be compressed, except for images containing image overlays and RGB bi-plane.

DICOM JPEG Lossless ▶ like the lossy version, this is a format which, as part of the DICOM standard, allows images to be readily transferred between different manufacturers' systems. Compression is not as high as for the DICOM lossy format, but image quality is not diminished.

This transfer syntax can only handle 2-16 monochrome and 8-bit RGB images.

ZLIB ▶ an all-purpose lossless compression method.

Wavelet ▶ lossy Wavelet compression which produces high levels of compression. It is NOT part of the DICOM standard. You need to buy a separate licence to use this.

If sent to older RadWorks (5.1 and down) versions, the actual transfer syntax used will be a plain DICOM (3.0) transfer syntax.

JPEG and Wavelet – what compression factor?

If you are using JPEG lossy compression, the lower the quality factor, the higher the compression ratio used. A quality factor of 10 will, therefore, produce much higher compression but poorer image quality than a quality factor of 50.

As with other forms of lossy compression, the results you achieve will depend very much on the types of images you send. If unsure about what quality factor to use, you may wish to experiment with various settings using a selection of images which are typical of what you normally transmit.

Automatically compressing and decompressing studies as they are received

Automatic compression for received studies works separately from compression applied to studies that are stored (see 'Saving hard disk space by compressing studies' in chapter 3 of the User Guide).

To compress studies using Wavelet compression, your system will need to have the Wavelet module installed.

If automatic compression is on, RadWorks stores images it receives in a compressed format, without changing that format.

To save disk space, you can configure RadWorks to automatically compress studies when they are received.

To automatically compress studies as they are received ▶ select Configuration → Connection Service... from the Data Selector menu bar. On the **Receive** tab of the Connection Service Properties dialog box, check the **Auto Compress Studies** check box and select the format from the **Format** drop-down list. If the format accepts compression parameters, specify these by selecting them from the **Parameters** drop-down list.

Automatically decompressing incoming studies

While you may wish to have studies compressed as they arrive to save disk space, compressed studies take longer to display since RadWorks has to decompress the images first. If performance is a higher priority than cutting down on disk space requirements, you can have RadWorks decompress all incoming studies that have been compressed so they are ready to be displayed as quickly as possible. You can choose whether RadWorks should decompress only lossless compressed studies, only lossy compressed studies, or both.

To automatically decompress studies as they are received ▶ select **Configuration → Connection Service...** from the Data Selector menu bar. On the **Receive** tab of the Connection Service Properties dialog box, check the **Auto Decompress Lossless Compressed Studies** check box and/or the **Auto Decompress Lossy Compressed Studies** check box.

Working with Wavelet compression

If you plan to use lossy Wavelet compression on a routine basis, you can experiment sending several basic types of studies with varying compression factors to find the most acceptable ones for you.

If you select Wavelet as the format for sending, you can also select a compression factor in the same dialog box. If the supplied factors are not sufficient, you can configure new ones in the Connection Service Properties of the Configuration drop-down menu in the Data Selector.

Wavelet is claimed to be one of the most effective compression algorithms for medical teleradiology. Clinical studies indicate that a higher compression ratio can be achieved while maintaining image quality than could be achieved using more conventional compression methods. This means that Wavelet requires less transmission time, which can be essential in situations where the infrastructure is not always completely reliable or access time is at a premium. A further benefit is that Wavelet-compressed files use much less disk space at the receiving site than uncompressed files.

RadWorks provides lossy Wavelet compression. To make Wavelet compression available to RadWorks users in a form that has been clinically tested, Applicare has used a third party toolkit that functions transparently with the RadWorks software.

How to tell it you have Wavelet compression installed...

If you have Wavelet compression installed on your system, Wavelet will be one of the options in the Format drop-down list in the Send to… dialog box (click **Send** on the Teleradiology tooltab in the Data Selector to view this).

Compression and decompression

The Wavelet Module can compress jobs with various lossy compression factors. In addition, the receiving RadWorks 6.0 system, it will automatically decompress a Wavelet compressed study when it is opened for viewing. Studies, series or image selections that have been sent using Wavelet compression will display a non-erasable message to this effect along with the compression factor.

Configuring storage commitment

The mechanism defined in DICOM for network-based data storage, the Storage Service Class, allows a sender (SCU) to transmit study images to a receiver (SCP). However, the Storage Service Class does not specify the safekeeping of data: there is no commitment that the SCP will do more than accept the transmitted studies.
Safekeeping is done via a separate Service Class: the Storage Commitment Service Class.

The SCP implementation defines how it provides its commitment to storage. Certain SCPs may commit to permanently store the studies (e.g. an archiving system) while other SCPs may commit to provide storage for only a limited amount of time.

Once the SCP has accepted the commitment to store the studies, the SCU may decide that it is appropriate to delete its copies of the studies. DICOM Storage Commitment does not demand a byte-to-byte comparison of the data. Also a checksum of the image data is not compared. For a successful Storage Commitment, it is verified that at least the following is identical at the source and the destination: Study UID, Series UID(s), and the number of images.

An alternative destination can be configured (at destination level) for Storage Commit. When the storage commit request must be sent to a different destination than the images, a new DICOM association is opened on which the Storage Commit request is sent. An empty Storage Commit destination (default) means that the Storage Commit request will be sent to the same destination as the images.

Setting a time-out value

You can set a maximum time for your system to wait for an answer from the other system before indicating that storage commitment has not succeeded. If this time has exceeded, the job in the send queue receives the status Error.

To set a time-out value for storage commitment ▶

1. Select **Configuration** → **Connection Service…** from the Data Selector menu bar.
2. Click the **Maintenance** tab, in the Connection Service Properties dialog box.
3. Set the time (in hours) in the **Time Out DICOM Storage Commitment** field.

Setting up auto-routing

RadWorks supports multiple auto transmit protocols. You can send to multiple destinations using a trigger mechanism with or without a set of rules and based on the origin of the study.

Use this type of transmission, for instance, when the hospital's radiologist is at home on call and has access to a RadWorks system, or on a Quality Control workstation which allows automatic transmissions to an archive after Matching and saving studies.

Only a user with administrator rights can configure the Auto Transmit Protocol. Other users will only be able to use and modify the Basic Protocol.

End users will only be able to select one destination for auto transmissions, which will be triggered as soon as the system receives studies.

The option Delete After Send overrides the setting of the Destination properties.

Setting up basic automatic routing

While you can create highly sophisticated auto transmission setups in RadWorks, for many users the facility of automatically forwarding incoming studies to another system will suffice. Setting up such basic automatic transmission is covered here. For details on setting up more sophisticated automatic transmission, see 'Setting up advanced automatic transmission' later in this chapter.

<basic protocol> in the Auto Transmit dialog box is a basic 'auto transmit protocol' included when RadWorks is installed. To create more sophisticated auto transmission, you will need to create new auto transmit protocols. See 'Setting up advanced automatic transmission' later in this chapter.

If the destination you want is not displayed in the Destinations drop-down list in the Auto Transmit Basic dialog box, it has not been set up properly on your system. See 'Setting up and configuring destinations' earlier in this chapter.

To automatically forward received studies to another system ▶

1. Select **Configuration → Auto Routing…** from the menu bar in the Data Selector. If you are logged on with administrator rights, go to step **2**. If you do not have administrator rights, go straight to step **3**.
2. Click **<basic protocol>**, (in the Name column) and then **Modify** in the Auto Route dialog box.
3. Select a destination from the drop-down list, in the Auto Route Basic Teleradiology dialog box
4. Click **Send Immediate**, to forward incoming studies immediately to the destination. Click **Transmission Time**, if you want to specify a particular time that incoming studies should be sent (possibly to take advantage of lower telephone call rates), or **Delay Time** if you want to specify a delay before the studies are sent to the destination. Set the transmission time or delay time appropriately.
5. Check the **Delete After Send** check box, to remove the study from your system after it has been sent successfully.

If auto transmission has been set, this will be shown by the indicator in the Send section of the Teleradiology tooltab.

You can turn off the automatic sending of studies in the Auto Transmit dialog box.

To turn off auto-routing ▶ Select **Configuration → Auto Routing…** from the menu bar in the Data Selector. In the Auto Route dialog box, click **<basic protocol>** (in the Name column) and then **Modify**. Select <none> from the Destination drop-down list in the Auto Route Basic Teleradiology dialog box.

Automatic transmission and the Auto Transmit Basic dialog box

If the text Auto Transmit to the left of the indicator on the Teleradiology tooltab is not active, at least one protocol besides the basic protocol is active. So if you turn the basic protocol off, studies may still be automatically forwarded by another protocol.

The Auto Transmit indicator light on the Teleradiology tooltab indicates whether the basic protocol is operating. The indicator is on, if studies will be automatically forwarded according to the basic protocol. The indicator is off, if the basic protocol is switched off.

End users will only be able to select one destination for auto transmissions, which will be triggered as soon as the system receives studies.

The option Delete After Send overrides the setting of the Destination properties.

Setting up advanced auto-routing

Earlier in this chapter, there was a description of how to set up automatic transmission. This, however, only lets you select a single destination and a limited choice about how the auto-routing is to take place. In fact, you can create many auto-routing configurations in RadWorks to meet a wide range of requirements, based on *filter criteria*, *rules*, *origins* and *triggers*.

Filter criteria and rules

How auto-routing takes place is determined by *filter criteria* and *rules*.

A filter criterion might, for example, specify that the modality of a study should be CT or MR. This could then be used to send only CT or MR studies to a particular destination. Another filter criterion might be that the status of the study should be Authorized. Then auto-routing could be set up only for authorized studies.

A rule combines filter criteria. Thus, the two filter criteria given as examples above could be combined so that only Authorized CT or MR studies are sent to a particular destination. Any DICOM field can be used to specify filter criteria and rules, allowing very specific and potentially very complex conditions for auto-routing to be created.

Auto-routing protocols

Another term used in RadWorks is *auto-route protocol*. This contains a rule specifying when auto-routing should be started as well as a list of destinations and origins. When performed, an auto-routing protocol generates one or more jobs in the teleradiology send queue. Auto-routing protocols also let you specify whether studies should be deleted from the system after being sent, the time at which transmission is scheduled, the delay before transmission, and other aspects of the transmission process.

In other words, when you create an auto-routing protocol you define exactly what should happen when a given event occurs.

Triggers

Events that can start auto-routing are called *triggers* in RadWorks. The triggers currently available in RadWorks are listed in ‘Setting Auto-Transmit triggers’ on page 73.

Working with auto-routing protocols

You will require administrator rights to create, modify, delete or disable auto transmit protocols.

Setting up a system to use auto-routing involves stating what should happen (defining an auto-routing protocol) and under what circumstances this should happen (specifying a trigger for the protocol). You can set up a number of auto-routing protocols linked with various triggers.

You manage auto-routing protocols using the Auto Route dialog box. This shows a list of the auto-route protocols currently installed on the system.

To see the auto-route protocols that have been installed ▶

Select **Configuration** → **Auto Routing…** from the menu bar in the Data Selector.

Use the Copy button in the Auto Transmit dialog box to help create a new auto transmit protocol which is similar to the one that was created created previously.

To create or modify an auto route protocol ▶

Select **Configuration** → **Auto Routing…** from the menu bar in the Data Selector. To create a new auto-route protocol, click **Add**. To change an existing protocol, click its name in the first column of the Auto Route dialog box and click **Modify**. In the Auto Route Protocol dialog box, set appropriate values on the General, Rule, Teleradiology, Move to folder and Archive tabs.

For detailed help on any item, click **Help**.

Once you have created auto route protocols, you may, subsequently, wish to remove them.

To permanently remove (delete) an auto route protocol ▶

Select **Configuration** → **Auto Routing…** from the menu bar in the Data Selector. Select the auto route protocol you want to delete (click its name in the first column of the Auto Transmit dialog box) and then click **Delete**.

You may, however, wish to disable the auto-route protocol without deleting it completely, so that you can reinstate it at some later time.

To (temporarily) disable an auto-route protocol ▶

Select **Configuration** → **Auto Routing…** from the menu bar in the Data Selector. Select the auto-routing protocol you want to disable (click its name in the first column of the Auto Route dialog box) and then click **Modify**. On the General tab of the Auto Transmit Protocol dialog box, select **<disabled>** from the Auto Transmit Trigger drop-down list.

Setting Auto-Transmit triggers

Depending on which RadWorks add-on has been installed, various triggers can be chosen:

Trigger name	Description
<disabled>	Disables the Auto Transmit functionality. If a Quality Control trigger has been defined and the Module is removed from the system, the QC triggered Auto Transmit Protocol will not be removed, but will be disabled.
Study Received	When a study from the selected origin(s) has been received
Key Images Defined	When Key Images have been defined and saved with the study, and the Study Status has been set to 'Authorized'.
Save after Viewing	When a study has been saved after viewing it; this also applies when using Special Commands
Save after Acquisition	When an acquired study has been saved (only possible if the Data Acquisition Module has been installed)
Save after QCM	When a study from the selected origin(s) has been received and has been modified and saved (only possible if the Quality Control Module has been installed)
QC Match Successful	When a study from the selected origin(s) has been received and the study demographics have successfully been matched with a DICOM modality worklist (only possible if the Quality Control Module has been installed)
QC Match Failed	When a study from the selected origin(s) has been received and a match event has failed (only possible if the Quality Control Module has been installed)
Study Status ID changed	When you change the Study Status for a study in the Data Selector.

Auto-transmit triggers and what they do

Setting the Auto Route Teleradiology properties

Destinations, added by selecting **Connection → Destinations..**.and clicking the **Add** button, will be displayed on the Teleradiology tab of the Auto Route Protocol dialog box.

When the Priority is set to <Mixed> the study will be sent with the priorities defined for the different destinations. However, when you select a single value, such as 'High', the priority settings of all destinations will be overridden with this new value. Likewise, the destination's transmission format will not be overruled by the settings here, when the format is set to <Mixed>.

The options Send Immediate, Transmission Time and Delay Time will always override those of the individual destination's settings.

Setting Auto Route Rules

In many cases, it may be necessary to add filter criteria, so only certain studies will be sent automatically after the Auto Route protocol has been triggered.

Adding a filter criterion allows you to use 'AND' or 'NOT' as a condition.

You can also use wildcards by typing an asterisk as prefix and/or suffix (e.g. *b* or *hair*). You cannot use a wildcard as part of a range.

If you type a value, then press enter, that value will be added to the grayed out line at the bottom of the dialog window and the Value field is emptied. Typing a new value using the same DICOM tag will add that value to the existing one.

You can create more complex rules by adding rules in scripts. Once a rule has been edited you can no longer modify it with **Modify**.

Duplicate jobs

You can define two or more Auto Transmit protocols for the same trigger. Consequently, duplicate jobs may appear in the Send Queue: the same study is sent twice to the same destination. There are cases when this is what the user wants: e.g. to send a highly compressed study immediately, and the uncompressed study later during the night. However, in some cases the duplicate job is not submitted to the Send Queue.

The duplicate job is only submitted, if “extra data” will be sent by the duplicate job. “Extra data” are:

- The whole study instead of only the key images.
- An uncompressed (or lossless compressed) study instead of a lossy compressed study.
- The study with the same lossy compression format, but with a lower compression rate (= less affected images).
- The study with a different lossy compression format than in the first job.

Duplicates are only detected for jobs generated by the same trigger, or jobs generated by simultaneous triggers (e.g. ‘Study Received’ and ‘QC Match failed’, or ‘Save After Viewing’ and ‘Key Images Defined’).

The order of the jobs (“which is the first and which is the second job” in the description above) is determined by the job priority and the transmission time.

Auto-routing configuration examples

This section includes a number of examples of how to configure auto-routing.

Example 1

All studies received during office hours are sent to destination 1, and studies outside office hours are sent to destination 2.

1. Add Destination 1 and Destination 2 by selecting **Connection** → **Destinations..**.and clicking the **Add** button.

2 Create two Auto Route protocols, one that is activated between 9:00 AM and 5:00 PM and the other that is activated between 5:00 PM and 9:00 AM.

3 Set the trigger as ‘Study Received’ and from all origins.

4 Select the destinations, Destination 1 and Destination 2, respectively.

Example 2

A received study is auto routed to Destination 1 uncompressed and to Destination 2 compressed.

1 Add Destination 1 and Destination 2 by selecting **Connection** → **Destinations...**and clicking the **Add** button.

2 Set the default transmission parameters for the Destination 1 to uncompressed and Destination 2 to compressed.

3 Create two auto transmit protocols, select Destinations 1 and 2, but do not change the Origins, Transmission Format and Compression Parameters settings (use default).

4 Set the trigger for both to ‘Study Received’

Example 3

After viewing and authorization, CT studies must be auto transmitted to Destination 1 and MR studies must be auto transmitted to Destination 2.

1 Add Destination 1 and Destination 2 by selecting **Connection** → **Destinations...**and clicking the **Add** button.

2 Create two Auto Transmit protocols with the trigger set to ‘Save after Viewing’.

3 Create rules for Destination 1:
DICOM tag 0008.0061, value *CT*
DICOM tag 0032.000A, value AUTHORIZED.

4 Create a rule for Destination 2:
DICOM tag 0008.0061, value *MR*
DICOM tag 0032.000A, value AUTHORIZED.

Example 4

When a radiologist is on call, CR studies must be sent compressed, and all other studies must be sent uncompressed to him.

1 Add two Destinations by selecting **Connection** → **Destinations...**and clicking the **Add** button.

2 Create two Auto Transmit protocols with the trigger set to ‘Study Received’ and from all origins.

3 For the first protocol, select a compression format and add the rule: DICOM tag 0008.0061, value *CR*

4 For the second protocol, no compression format and add the rule: NOT (DICOM tag 0008.0061, value *CR*)

Example 5

Six remote sites transfer un-reported studies to the hub, which RadWorks receives. For example, CT's Bone have to be sent on to Radiologist 1, all other CT's to Radiologist 2, MR’s Neuro to Radiologist 3 and all other MR's to Radiologist 4.

Configuration:

1 Add the 4 different destinations by selecting **Connection** → **Destinations...**and clicking the **Add** button.

2 Add the 6 different origins in the **Connection** → **Origins** menu option.

3 Create 4 Auto Transmit protocols with the trigger set to ‘Study Received’ and select the six specific origins in each protocol.

4 Set the rules:
Radiologist 1:
DICOM tag 0008.0061, value *CT*
DICOM tag 0018.0015, value Bone
Radiologist 2:
DICOM tag 0008.0061, value *CT*’
NOT DICOM tag 0018.0015, value Bone
Radiologist 3:
DICOM tag 0008.0061, value *CT*
DICOM tag 0018.0015, value Neuro
Radiologist 4:
DICOM tag 0008.0061, value *CT*
NOT DICOM tag 0018.0015, value Neuro

Troubleshooting an origin and a destination

First check your network connections to confirm the remote site information (even another workstation in your LAN could be set up as a remote site).

Verifying the network IP address

1. Open the Control Panel.
2. Double click **Network**.
3. Click the **Protocols** tab in the Network dialog box.
4. Double click **TCP/IP Protocol**.
5. In the Microsoft TCP/IP Properties dialog box, click the **WINS Address** tab. Check the Primary WINS server IP address to confirm its accuracy: if the address is accurate, you can also check that the connection is active by pinging it.

Pinging a remote site

1. Open a command prompt (in NT 4: MS-DOS Prompt).
2. At the command prompt, type ‘ping’[space][the IP address of the remote site].
3. Verify the returned ‘Reply from…’ IP address.

Checking the Host Name to IP address mapping

1. Go to the C:\Winnt\system 32\drivers\etc folder.
2. Open ‘Hosts’ with Notepad. This file contains the mapping of IP addresses to host names.
3. Read the instruction given in the file and, on a new line, enter the IP address followed by spaces and then the host name (the host name must be a single word) of the remote system.
4. Save the ‘Hosts’ file.
5. If you are concerned about security, right click the ‘Hosts’ file and select Properties from the pop-up menu.

CHAPTER 4

Configuring the Viewing Section

This chapter describes the installation and configuration of the RadWorks Viewing Section.

IN THIS CHAPTER

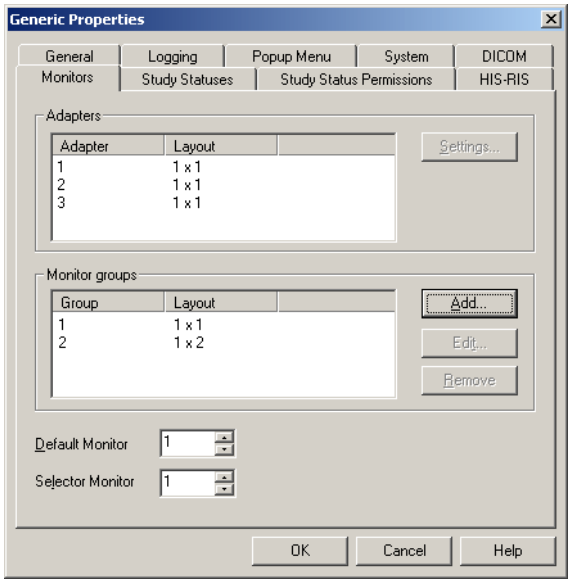
You can define in detail how to view images in RadWorks. Some of this configuration depends on your monitors, the rest you can set.

Configuring multiple monitors

While most of the configuration of multiple monitors can be done in Windows, RadWorks still needs to know how to use your monitors.

To set these properties, log on as a system administrator.

1 Select **Configuration** → **Generic** from the menu bar in the Data Selector and click the **Monitors** tab.



The monitor numbers in this dialog box correspond to the numbers on the Settings tab of the Display control panel.

2 For each adapter, set the arrangement: click **Settings**, and specify how many rows and columns of monitors are connected to that adapter.

3 Optionally, define monitor groups. A group must have monitors with the same resolution and/or color space. Monitors in a group must be adjacent to each other. For each group, you can set the font, the scale factor, and whether the monitors are portrait and/or color monitors.

4. Set the ‘Default Monitor’.
5. Set the ‘Selector Monitor’ - this determines where the Data Selector will appear.
6. Restart RadWorks.
7. Select the **Configuration** → **Viewing Properties** menu, and click the **General** tab.
8. If you have more than one monitor group: in the ‘Monitor Groups’ box, set which monitor groups will be used as the viewing area.
9. In the ‘Hanging Protocols group’ box, select the monitor group to display the Hanging Protocols on. All other monitors will display the default single viewport.

The other settings on this tab are for the Viewing properties.

Viewing properties

You must log on as an administrator to be able to alter all the properties. If you do not have administrative rights you will only be able to change 'non-ghosted' properties.

The next sections describe the options in the **Configuration → Viewing Properties** dialog. Refer to the online help for more detailed information about each tab of this dialog.

General tab

Select the Direct View option to view images as they arrive (see below).

View Images as they arrive

This feature consists of three items:

- Direct view of items in a remote view (or archive).
- Direct view of worklist items that are not local.
- Wait mode for receiving new studies from a selected origin (monitoring mode).

After restarting RadWorks, right click in the Data Selector and select 'Receive new study' in the menu that appears, to enable Monitoring mode. When you select this, a dialog box appears that allows you to choose the origin for the studies.

To view Remote View studies, select a study in the active Remote View, right click, and select 'View' instead of 'Import' in the menu that appears.

Pop-up menu tab

Here, both administrators and end-users can decide which menu items will be available in the Viewports and the Worklist windows. Select the items you want to be available.

Cutlines tab

Here, you can set preferences (line color, style) for cutlines and their labels.

Require Frame of Reference

When determining whether cutlines can be computed between multiple series this option decides whether those series need to have the same "Frame of Reference" UID (DICOM tag 00200052). By default this option is checked, meaning that multiple series need to have the same Frame of Reference UID for cutlines to be computed.

In case the Frame of Reference UIDs are different or absent, and it is known (as declared by the modality manufacturer) that the series are still spatially related to each other, this option can be disabled to still allow cutlines to be computed and displayed. However, this may result in the incorrect display of the cutlines.

Applicare will not take any responsibility for the display results of the cutlines if this option is disabled.

Compose set description

Select the way you want to identify a series of images in the Cutline Sets section of the Cutline Tooltab; e.g., by series number, study description or body part etc. Show Image Information tells RadWorks to indicate the number of images in a series when it displays the set description.

View the results of your settings in the pane below the drop-down list and check box.

Compose Label

Compose Label determines how you want to display labels. A label consists of three parts. Select from the first drop-down list the first part of the label. Use the second drop-down list to select a separator and the third list to define the third part of the label.

View the results in the pane below the drop-down lists.

Patient Info/Cine tab

De-activate the Patient Information window if you are setting up an educational system. This will ensure the privacy of the patients.

You may also want to disable the Viewport Annotations, or edit them so that patient related information will not be available in the Viewports.

You can specify the number of cines RadWorks can simultaneously run. RadWorks sets this to 4 by default. The minimum is 1 and the maximum is 16.

Pictorial tab

Define the properties of the Pictorial Index. You use this tab to create more or less room, provide more or less information or define the fonts and style of study or series headers in the Viewing Section. You also define the kind of information that will appear in headers.

Modalities tab

The initial zoom factor in Viewing can be clipped to a user definable value that is modality dependent.

The administrator can set an upper boundary to the initial zoom factor. After changing the zoom settings, the clipping is disabled. The clipping is re-enabled when the study is loaded again or if the reset button is clicked.

Viewport Annotation tab

For each modality, you can set which information is to be displayed along the edges of each image. Private attributes (those with an odd DICOM group number, for example 00191010) can also be included when the private tag is known from, for instance, the sending modality console. This can be useful to display special scanner options such as contrast settings.

Contents not enclosed by '@' characters will be shown literally in the Viewports and can be used for additional explanations.

Date Time will be shown in the format specified in the Regional Settings control panel.

The contents of a tag is displayed formatted (patient names have commas instead of ^).

Tags which contain a sequence will display all items in the sequence, separated by backslashes. You can also select one item from the sequence, using the syntax:
@xxxxyyyy[n]aaaabbbb@
of the sequence with tag (xxxx,yyyy) display from the n-th sequence item, the value with tag (aaaa,bbbb).

Nested sequences are also supported.

Both sequence and non-sequence items can be suffixed by an index and/or be followed by a format string (in that order).

Index: @...[n]@: display the n-th value in a multi-valued element.

Invalid indices will result in empty values.

Format: @...%format@: displays the value, formatted according to a C-style format string.

Examples:

Definition	Example of contents	Explanation
@00100010@	Sylvia Delors	Patient name is displayed

ST: @00180050@ mm	ST: 3 mm	@00180060@ is substituted with the image value ‘3’
@00200013%i@	17	The value 00017 from the tag 00200013 is formatted using %i resulting in 17
@frame@	1	Frame number is displayed on the individual frames, since there is no DICOM tag available
(F@frame@/@00280008@)	(F3/12)	Will display frame number # of ## frames in brackets. Default setting for XA studies
TR: @00180080%.1f@ ms	TR: 2000.0 ms	The value 005.500000E+03 from the tag 00180080 is formatted using %.1f giving a result with one decimal
@00080008@	ORIGINAL\PRIMARY	image type, the tag has multiple items as content
@00540410[0]00080104@		displays the first item in the ‘Patient Orientation Code Sequence’
@00080008[0]@	ORIGINAL	Index
@00200013%04X@	000E	image number is 14 (000E hexadecimal = 14 decimal)

Navigation buttons

You can change the position of the navigation buttons in the Viewing Area:

1. Select **Configuration** → **Viewing...** from the Data Selector menu bar.
2. Click the **General** tab of the Viewing Properties dialog box.
3. Click **Configure**. The Navigation Buttons dialog opens.
4. From the drop-down list, select where you want the buttons to be displayed.
5. You can check some of the checkboxes of the buttons to display them.

The Up Series and Down Series buttons allow you to navigate between the series. If a study only contains one series, these buttons will not be displayed.

The Prev and Next buttons allow you to navigate through studies in the Worklist. These buttons work like the ones in the bottom right area of the tooltab.

The Back button returns you to the Data Selector. This button works like the buttons in the bottom right area of the tooltab.

Configuring annotations

Setting up calipers

A caliper can be added to images in the Viewing Section. The caliper will only be displayed if size information is present in the image (in the Pixel Spacing DICOM tag 0028,0030).

The caliper is displayed in the center right side of the viewport. Other annotations will not be displayed in the calipers area.

To switch calipers on for each modality ▶

1. Select **Configuration** → **Viewing...** from the menu bar in the Data Selector.
2. Click the **Viewport Annotations** tab.
3. Select the modality.
4. Check the **Show Caliper** check box.

Once you have switched this on, you can use the caliper. Open a suitable study, click the **Annotation and Measurement** tooltab and check the **Show Caliper** check box.

Setting preferences for measurements

Use the Distance tool on the Annotation and Measurement tooltab to drag distance lines across images.

To set preferences for these lines ▶

1. Open the **Configuration** → **Viewing** dialog.
2. Click the **Image Annotations** tab.
3. Check the **Tickmarks** check box to show tick marks on the distance lines.
4. Set the minimal number of pixels between two ticks (experiment with this setting so the tick marks are at a usable distance on your monitors).

Working with hanging protocols

Hanging protocols allow RadWorks to manage the order and layout of viewports. They also allow the positioning the images from current and prior studies. You can use the hanging protocols on both single and multi-monitor systems.

RadWorks implements two types of hanging protocol: *default* and *automated*.

The basic difference between these is that the automated hanging protocols allow you to define selection criteria, whilst the default hanging protocols do not.

Managing hanging protocols

Select **Viewing** → **Hanging Protocols Manager** from the Data Selector menu bar. The 'Hanging Protocols Manager' dialog box displays a list of all the available hanging protocols. With the buttons below the list you can create, modify, copy, disable, delete, import or export hanging protocols. With the arrow buttons to the left of the list, you can set the priority of a specific protocol. You can select the group (default or automated hanging protocols) via the radio buttons.

To add or modify a hanging protocol ▶

1. To add a hanging protocol, click **New**.
2. To modify an existing hanging protocol, select the protocol you want to modify and click **Modify**.
3. Adjust the settings in the Hanging Protocol Editor (click **Help** for detailed information on the options).
4. If you want to change the layout definition or select a specific hanging protocol under certain conditions, click **Wizard** (see next section).

Using the wizard will generally be sufficient to create the hanging protocol selection you want to use. You can fine-tune the hanging protocol with the Fine tuning button in the Hanging Protocol Editor. This allows you to edit the VB script that defines the Hanging Protocol. Only change this if you are familiar with Visual Basic.

Wizard

There are three wizards that guide you through the main features of the protocol:

- Layout design wizard,
- Hang criteria wizard,
- Selection criteria wizard.

With the layout design and hang criteria wizards you define how the selected studies are presented. By using the wizard, you actually create or modify a two-part script.

The first part of the script contains the layout (the positioning of series areas and image areas) and hang criteria (the placement of a scout image for example).

The second part of the script is a VB script. This part contains the selection criteria definitions. With the selection criteria, you can make rules to select specific study data to apply to the layout design and hang criteria.

If the set of studies you select for viewing match the selection criteria, the studies are presented in the way you defined the layout design and hang criteria. If there are more hanging protocols with valid selection criteria, the one with the highest priority will be applied. The higher the position in the list with protocols in the Hanging Protocols Manager, the higher its priority.

Also, if there are multiple hanging protocols with one or more of the same selection criteria, you should place the protocol with the most selection criteria at the top of the list.

Fine-tuning

You can make modifications to the ‘programming code’ that makes up a hanging protocol using the **Fine Tuning** button.

When you are adding or modifying a default hanging protocol, you cannot edit the ‘Hanging Protocol Selection Criteria’ function area, because this function only applies to automated hanging protocols. The selection criteria script is displayed on a grayed background.

The ‘Hanging Protocol Fine Tuning’ dialog box displays two editable text boxes. Only the second box, containing the selection criteria definitions, will be parsed each time the user opens study data.

The second box contains Hanging Protocol Selection Criteria. This code consists of a function that validates the protocol based on the selected array of data (data_selection) as the input variable. The code loops through the supplied data selection. The code in the loop can set the function return variable to TRUE or FALSE if given conditions are met or not met. For example, if the modality of all data series is equal to 'MR' the function returns TRUE.

The text displayed in the gray areas above and under the second text box contains information about the protocol itself and the editor.

Comment text in the boxes is preceded by a single quote ('). It is recommended to maximize the 'Hanging Protocol Fine Tuning' dialog when you are editing one of the boxes.

Hanging protocol definition

The first editable area does not contain VB Script language but a structured language developed by GEMS IT Applicare, which can only be read by the RadWorks program. With this language, a custom layout can be defined by dividing the viewing area in series and image areas. You can also add hang criteria in this area like the pinning of a scout image and the positioning of an AP or LR image. The following layout functions can be used.

Element	Description
[L	begin layout
[S	begin series area
[V	begin image area (also called viewport)
]	End of L, S, V
LayoutName("Name")	Function for setting the name for this layout function:
SplitNone	Use the full area for just one view area
SplitHor X	Divide the selected series into X rows; X is a number.
SplitVer Y	Divide the selected row of the selected series in Y number of rows.
PinProp AllCutlineSets	Pin the image. Do not select a particular cutline set.
HangCriteria(0x80008,IS,"LOCALIZER")	Position image with DICOM tag 'Image Type' equals "Localizer".
HangCriteria(0x185101,IsEqualTo,"AP" "PA")	Position AP / PA images.
HangCriteria(0x185101,IsEqualTo,"LR" "RL")	Position LR / RL images.
HangCriteria(0x80060,IsEqualTo,"MR")	Position to DICOM tag modality.

Possible layout functions

Element	Description
No(x)	Sequential number of Series or image. This is currently not used by RadWorks, but can be in one of the future releases or Service Packs.
TimeOrder(MostRecent)	Position to time order.
WindowProp(518,1549,Linear)	Position with set windowing levels.
ZoomProp(Relative,1.000000)	Position with set zoom factor.
AnnotationProp(None)	Position with set level of annotation.
OrientationProp("L\F")	Position with set orientation.

Possible layout functions

Example:

- The name of the layout is TechRef.
- There are 2 series in the viewport.
- There are 6 images in each series.
- The 6 images are configured with 3 rows with 2 columns.
- The first picture of the first series is the scout image.
- Position AP / PA images first.

Result code:

```
[L LayoutName("TechRef") SplitVer 2  LAYOUT 'TechRef' with 2 columns
    [S No(0) SplitHor 3   divide FIRST SERIES in 3 rows
[ SplitVer 2          divide first row in 2 columns
   [V No(0) PinProp AllCutlineSets     pin the first image if the DICOM
   tag
      HangCriteria(0x185101,IsEqualTo,"AP" "PA")position AP,PA images
   first
            HangCriteria(0x80008,IsEqualTo,"LOCALIZER")  Image Type
   contains "LOCALIZER"
    V] end scout image area
   [V No(0)  V]second image area
]end of first row
[ SplitVer 2           divide second row in 2 columns
   [V No(0)  V] first image area
   [V No(0)  V] second image area
] end of second row
[ SplitVer 2          divide third row in 2 columns
   [V No(0)  V] first image area
```

```
   [V No(0)  V] second image area
] end of third row
    S] end of FIRST SERIES AREA
   [S No(0) SplitHor 3   divide SECOND SERIES in 3 rows
      HangCriteria(0x185101,IsEqualTo,"LR" "RL")        position LR,RL
   images secondly
[ SplitVer 2           divide second row in 2 columns
   [V No(0)  V] first image area
   [V No(0)  V] second image area
        ] end of first row
[ SplitVer 2           divide second row in 2 columns
   [V No(0)  V] first image area
   [V No(0)  V] second image area
] end of second row
[ SplitVer 2          divide third row in 2 columns
   [V No(0)  V] first image area
   [V No(0)  V] second image area
] end of third row
    S] end of SECOND SERIES AREA
L]end of LAYOUT definition
```

Hanging protocol selection criteria

Regularly check the syntax with the Check button next to the box you are editing.

The second editable area contains VB Script language. As already stated, the best way to create the selection criteria is to use the Selection Criteria Wizard by clicking the **Wizard** button in the Hanging Protocol Manager. With this script, a custom selector can be defined by applying certain conditions in it. If, however, you desire very specific selections, you will need to use the scripting tool. The scripting statements shown below can be used.

Statement	Description
For study... Next	With this statement the script loops through the selected studies.
For series... Next	With this statement the script loops through the series of the selected studies.

Scripting statements

Statement	Description
For tag... Next	With this statement the script loops through the tags stored in tag_descr. These tags are a restricted set of tags. The tags are: BodyPartExamined ContrastBolusAgent EchoTime ImageOrientation ImageType Modality PatientOrientation PatientPosition Protocol RepetitionTime SeriesDescription SeriesInstanceUID StudyDescription StudyInstanceUID ViewPosition SeriesInStudy ImagesInSeries ImagesInStudy StudiesInDataSelection SeriesInDataSelection Keep in mind that tag_descr is case sensitive. It is possible to expand the list of available DICOM tags by adding them as keys to the registry. HKEY_LOCAL_MACHINE\SOFTWARE\AMI\RadWorks\6.0\Modules\Viewing\HangingProtocols\DICOMTags\Default. Note: Do not create too many keys because it might decrease the performance of your system.
LBOUND (ARRAY [,DIM])	Returns the lower bounds for all dimensions of an array, or the lower bound for a specified dimension. ARRAY must be an array. DIM must be a scalar integer with a value in the range 1 to n, where n is the rank of ARRAY. Results: The result type is default integer.
UBOUND (ARRAY [,DIM])	Returns the upper bounds for all dimensions of an array, or the upper bound for a specified dimension. ARRAY must be an array. DIM must be a scalar integer with a value in the range 1 to n, where n is the rank of ARRAY. Results: The result type is default integer.

Scripting statements

Sample script

Apply this hanging protocol only for selected series containing CT modalities with a localizer image (also called scout or pilot image). This localizer image should not be the only image in the series.

```
Function CheckSelectionCriteria_TechRef(data_selection)
  CheckSelectionCriteria_TechRef = false


  For study = LBound(data_selection, 1) To UBound(data_selection, 1)
    For series = LBound(data_selection, 2) To UBound(data_selection, 2)


      ScoutPresent = false
      ImagesPerSeries = 0
```

```
      For tag = LBound(data_selection, 3) To UBound(data_selection, 3)
 tag_descr = data_selection(study, series, tag, 0)
    tag_value = data_selection(study, series, tag, 1)
 tag_count = data_selection(study, series, tag, 2)
 If tag_descr = "" Then
   Exit For
 End If
 If tag_descr = "ImagesInSeries" Then
      ImagesPerSeries = tag_value
 End If
 If tag_descr = "Modality" Then
   If tag_value <> "CT" Then
     Exit Function
   End If
 End If
 If tag_descr = "ImageType" Then
   If tag_value = "LOCALIZER" Then
     ScoutPresent = TRUE
CheckSelectionCriteria_TechRef = TRUE
   End If
 End If
      Next
      If ScoutPresent = TRUE Then
If ImagesPerSeries = 1 Then
  CheckSelectionCriteria_TechRef = FALSE
        End If
      End If
    Next
  Next
End Function
```

Explanation of the sample script

Declaration of the function. Return the result as Boolean. Take the array data_selection as input.

```
Function CheckSelectionCriteria_TechRef(data_selection)
```

Init the return value as FALSE from the function. Assume the selection is incorrect.

```
    CheckSelectionCriteria_TechRef = FALSE
```

Next, loop through the studies in the selected data.

```
   For study = LBound(data_selection, 1) To UBound(data_selection, 1)
```

Now, loop through the series in the selected study.

```
For series = LBound(data_selection, 2) To UBound(data_selection,
2)
```

Declare and initialize the required local variables. Mark the scout image as not found and the number of images per series as 0.

```
ScoutPresent = false
ImagesPerSeries = 0
```

Loop through the tags in the selected series.

```
For tag = LBound(data_selection, 3) To UBound(data_selection,
3)
```

Next, retrieve tag information from the data selection array. Store them in local variables.

```
tag_descr = data_selection(study, series, tag, 0)
tag_value = data_selection(study, series, tag, 1)
tag_count = data_selection(study, series, tag, 2)
```

Stop the search ASAP. If out of tags then leave the series loop. Go to the next series.

```
If tag_descr = "" Then
  Exit For
End If
```

Put number of images in this series in a local variable ImagePerSeries.

```
If tag_descr = "ImagesInSeries" Then
    ImagesPerSeries = tag_value
End If
```

Next, specify your selection criteria.

Example: Check if modality is not MR.

First check if tag_descr equals “Modality”.

```
If tag_descr = "Modality" Then
```

Don’t select data other than with the CT modality. Check if tag_value does NOT equal “CT”.

```
If tag_value <> "CT" Then
```

Stop selecting by exiting the function. Hence the function return value stays FALSE.

```
Exit Function
```

Correctly end the IF .. THEN conditions with END IF statements

```
End If
```

```
End If
```

Check if tag_descr equals “Imagetype”.

```
If tag_descr = "ImageType" Then
```

Check if tag_value of “ImageType” contains the string “LOCALIZER”.

```
If tag_value = "LOCALIZER" Then
```

Mark scout image by setting variable ScoutPresent as TRUE.

```
ScoutPresent = TRUE
```

Return function variable as TRUE.

```
CheckSelectionCriteria_TechRef = TRUE
End If
End If
Next
```

If, after looping all the tags, a localizer image is found.

```
If ScoutPresent = TRUE Then
```

Check if the number of images equals 1.

```
If ImagesPerSeries = 1 Then
```

If the number of images equals 1, return the function variable as FALSE.

```
CheckSelectionCriteria_TechRef = FALSE
End If
End If
```

Correctly end the FOR .. NEXT statements with NEXT.

```
Next
Next
```

Correctly end the declaration of the function.

```
End Function
```

Combined statements

Combined statements like the following example.

```
If tag_descr = "Modality" Then
  If tag_value <> "MR" Then
    CheckSelectionCriteria_TechRef_ = false
    Exit Function
  End If
End If
```

Can be replaced with:

```
If tag_descr = "Modality" And tag_value <> "MR" Then
```

```
    CheckSelectionCriteria_TechRef_ = false
    Exit Function
  End If
```

This often saves some code. It's up to you what style of programming you apply. Choose your programming style preferably in such a way that the source code is easily readable.

You can also use the OR function on the tag selections.

```
  If tag_descr = "Modality" Then
    If tag_value = "MR" or tag_value = "CT" Then
      CheckSelectionCriteria_TechRef_ = false
      Exit Function
    End if
  End If
```

In this example MR and CT modalities are not allowed.

Or you can use the ElseIf statement on the tag selections in combination with And and Or.

```
  If tag_descr = "Modality" and tag_value <> "MR" Then
     CheckSelectionCriteria_TechnicalReferenceManual = false
     Exit Function
  ElseIf tag_descr = "ImagesInSeries" and (tag_value < "2" or tag_value
     >= "9") Then
     CheckSelectionCriteria_TechnicalReferenceManual = false
     Exit Function
  End If
```

In this example MR modalities are not allowed. For all other modalities, only the series with 2 images or more, but no more than 9 images in it will return TRUE.

Most elegant would be the following use of the Select Case statement instead of separate If .. Then statements. To make the source better readable you better add the loop variable behind the Next statements. It also prevents errors by improper use of the For .. Next statement

```
  Function CheckSelectionCriteria_TechRef(data_selection)
    CheckSelectionCriteria_TechRef = false

    For study = LBound(data_selection, 1) To UBound(data_selection, 1)
      For series = LBound(data_selection, 2) To UBound(data_selection, 2)

        ScoutPresent = false
        ImagesPerSeries = 0
```

```
      For tag = LBound(data_selection, 3) To UBound(data_selection, 3)
 tag_descr = data_selection(study, series, tag, 0)
    tag_value = data_selection(study, series, tag, 1)
 tag_count = data_selection(study, series, tag, 2)

         Select Case tag_descr
           Case "":
             Exit For
           Case "ImagesInSeries":
             ImagesPerSeries = tag_value
           Case "Modality":
      If tag_value <> "CT" Then
       Exit Function
     End If
   Case "ImageType":
     If tag_value = "LOCALIZER" Then
       ScoutPresent = TRUE
CheckSelectionCriteria_TechRef = TRUE
     End If
 End Select
      Next tag
      If ScoutPresent = TRUE And ImagesPerSeries = 1 Then
CheckSelectionCriteria_TechRef = FALSE
      End If
    Next series
  Next study
End Function
```

Data selection array

Before RadWorks starts evaluating the first hanging protocol, it collects only a subset of DICOM tag contents in the active study selection. The data selection can consist of a single study or multiple studies selected by the user. This collected data is stored in an array named data_selection.

Only the tags named in the registry key(s) ‘HangingProtocols\DICOMTags’ are aggregated. Tags occurring multiple times with the same value are stored just once for evaluation performance reasons. For each occurrence the `tag_count` is incremented.

Tags are collected per study and series separately, not per image. That is done for reasons of speed. There is no need for it to collect tags per image either.

The following counter variables are filled before evaluation of selection rules starts:

- SeriesInStudy number of series in study'
- ImagesInSeries number of images in series'
- ImagesInStudy number of images in study'
- StudiesInDataSelection number of studies in `data_selection`
- SeriesInDataSelection number of series in `data_selection`

These counters are added as a tag in the data_selection array.

Aggregation of all DICOM tags in the currently selected studies, named in the registry key(s) of 'HangingProtocols\DICOMTags'.

Declaration

dim data_selection(study_index, series_index, tag_index, 3), where:

- data_selection(study_index, series_index, tag_index)(0)= tag_descr
- data_selection(study_index, series_index, tag_index)(1)= tag_value
- data_selection(study_index, series_index, tag_index)(2)= tag_count

Improving performance

- Reduce the number of rules that need to be evaluated. Disable all unused protocols.
- Reduce the number of tags that are aggregated in the `data_selection` array. E.g. aggregate tags for certain modality types only. You might even want to remove some of the default DICOM Tags from the list if performance is an issue.
- Make VB Script exit from the function fast if the current study does not match the criteria. Make the detailed selection after making a rough selection first.
- Do not build infinite loops!

Multi-selectable hanging protocols

It is possible to perform actions on one or more hanging protocols (delete, copy, etc.).

Import and Export Hanging Protocols

It is possible to import/export hanging protocols from/to an XML file.

When selecting more than one hanging protocol they will be exported into one XML file, which can be viewed with Microsoft Internet Explorer 5.0 or higher.

RadWorks does not automatically add the extension .XML to the filename.

Orientation of image

The orientation of an image is based upon LR indications from DICOM header and can be used in a Hanging Protocol.

The hanging protocol editor is extended with an orientation section, which can be used to add the orientation property to either the series area or the viewport.

As with the markers in the viewports the orientation of the image is derived from either the image orientation or patient orientation values. In case of a mismatch the function is disabled.

Adding new DICOM tags as hang criteria

By default RadWorks comes with a limited number of hang criteria based on DICOM tags. You can add more in modality specific keys (CT,MR, CR of Default) by editing the following registry key:

```
HKLM\Software\AMI\RadWorks\6.0\Modules\Viewing\HangingProto-
   cols\DICOMTags
```

The value name equals the description (no spaces allowed) and the REG_DWORD value equals the group plus element values of the DICOM tag (e.g. 00080008).

After restarting RadWorks the new DICOM tag will be added in the drop-down list of the Hanging Protocol Manager and in the ‘help’ text in the Fine Tuning section

Hanging protocol for T1/T2

You do not have to declare T1Sag, ..., T1Ax. Also, you have to initialize them outside the study for-loop, so this protocol can also be used for sagittal and axial series divided over multiple studies. If you verify the tag-value, always use upper case! Verify the booleans T1Sag, .., T1Ax at the end (if all studies are checked).

```
CheckSelectionCriteria_Brain_Auto2series_vert = TRUE    ' IMPORTANT: Do
   not remove this line!

T1Sag = FALSE

Flair   = FALSE

T2Ax  = FALSE
```

```
T1Ax  = FALSE
For study = LBound(data_selection, 1) To UBound(data_selection, 1)
For series = LBound(data_selection, 2) To UBound(data_selection, 2)
For tag = LBound(data_selection, 3) To UBound(data_selection, 3)
```

' Retrieve tag information:

```
tag_descr = data_selection(study, series, tag, 0)
tag_value = data_selection(study, series, tag, 1)
tag_count = data_selection(study, series, tag, 2)
```

' Stop search as soon as possible:

```
If tag_descr = "" Then
```

' Ready with this series, check next series

```
Exit For
End If
```

' Check If SeriesDescription tag equals "Brain T1 Sag", "Brain

```
Flair Axial", "Brain T2 Axial", or "Brain T1 Axial"
If tag_descr = "SeriesDescription" Then
If tag_value = "BRAIN T1 SAG" Then
T1Sag = TRUE
ElseIf tag_value = "BRAIN FLAIR AXIAL" Then
Flair = TRUE
ElseIf tag_value = "BRAIN T2 AXIAL" Then
T2Ax = TRUE
ElseIf tag_value = "BRAIN T1 AXIAL" Then
T1Ax = TRUE
End If
End If
```

' Check if the number of series in study is 2

```
If tag_descr = "SeriesInDataSelection" Then
If tag_value < 1 Then
CheckSelectionCriteria_Brain_Auto2series_vert =
FALSE
Exit Function
End If
End If
Next
Next
Next
CheckSelectionCriteria_Brain_Auto2series_vert = T1Sag And Flair And
   T2Ax And T1Ax
```

Hanging protocols and upgrading RadWorks

- The three groups of default hanging protocols will be joined into one large set.
- The hanging protocol name will be changed to <original name> + <previous group it belonged to>.
- Duplicated hanging protocols will be removed from the list.

Hanging Protocol Permissions (policy file) are also merged. The AMI.adm file is not automatically upgraded.

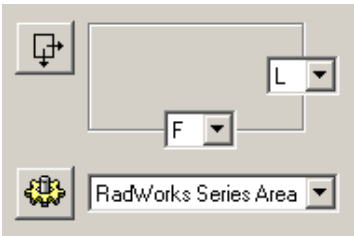
Plug-ins

You can add plug-ins to add to RadWorks's image manipulation functions. Once a plug-in is added, it can be accessed from the Layout Tooltab in the Viewing Section, and it can be made part of a Hanging Protocol.

To add a Plug-in ▶

1. Log in as an administrator.
2. Select **Configuration** → **Plug-in Definitions**.
3. Click **Add**.
4. Select the Category for the plug-in.
5. From the Select Component drop-down list, select the plug-in you want to add.
6. Click **Modify** to change the description for the plug-in.
7. Click **Configure** to change the settings for the plug-in.
8. Click **OK**.

In the Hanging Protocol Editor, you can now select the available plug-ins in the Series and Image Properties area.



CHAPTER 5

Integrating with HIS-RIS and worklists

This chapter describes how to integrate RadWorks with external systems (HIS-RIS systems and worklist providers).

IN THIS CHAPTER

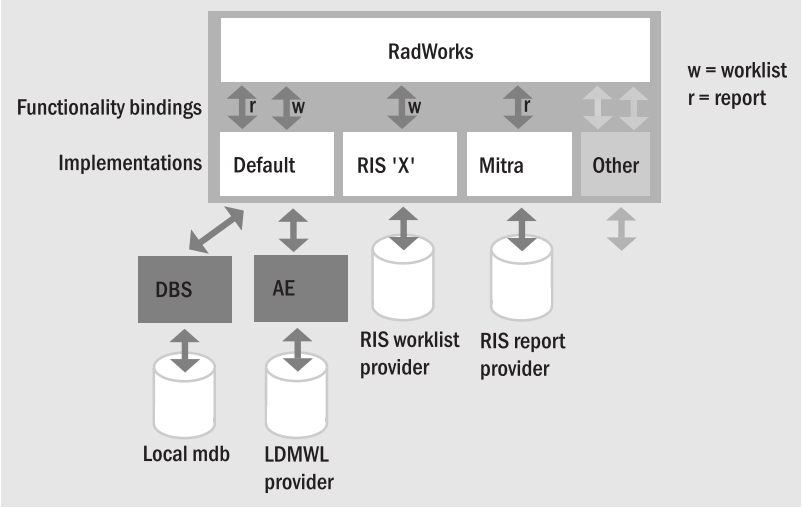
Most RadWorks systems will be used as part of a much wider and extensive hospital system. It is hence vital that it can communicate with all kinds of other systems. To assist in this, RadWorks has an open interface to external data sources:

- The information displayed in the Data Selector is not limited to a (filtered/sorted) view of the local database, but it can also present study or work item lists provided by external sources.
- Reports may be retrieved from and stored in external databases.
- Other applications (typically, RIS or HIS) can be notified of database changes and study status changes on the RadWorks station.
- RadWorks can commit certain actions depending on the acknowledgement of an external application via transactions.

Implementations and functionality

The RadWorks modules that interface with external applications are called 'HIS/RIS Implementations'.

Each HIS/RIS implementation can interface with certain functionality in RadWorks by binding them to one of the four functionality connectors: *worklist*, *report*, *notification*, *transaction*. See the diagram below.



Currently, the following implementations have been developed for RadWorks:

Name	Short name	Supplied with RadWorks	Included in default Setup
Default HIS/RIS Implementation	Default	Yes	Yes
Mitra PACS Broker implementation	MitraPB	Yes	No
CallExe Implementation	CallExe	Yes	No

Available HIS/RIS implementations

The *Default* implementation interfaces with the local database and DICOM sources (C-FIND/C-MOVE SCPs and DICOM Modality Worklist providers).

The *MitraPB* implementation makes report retrieval (read-only) possible through a Mitra PACS Broker. The broker translates DICOM-like query requests from RadWorks to HL-7 (or other proprietary protocols supported by the Mitra), which the broker passes on to a HIS/RIS.

One generic implementation is supplied (*CallExe*) that can call an executable with a number of configurable command-line parameters. The called executable will in turn communicate with the external source to retrieve or deliver the data.

In some cases, a specific implementation will have to be developed to interface to a particular external application. Contact your distributor for further information.

General

When exchanging patient data with a HIS/RIS, you can configure when RadWorks considers patients to be the same. Select **Configuration → Generic...** from the menu bar in the Data Selector, and on the General tab of the Generic Properties dialog box, select a **Compare Patients on** radio button to compare Patient Names, Patient IDs, or both.

Adding an implementation and binding to functionality ▶

1. Open the HIS-RIS manager via **Configuration → Generic → HIS-RIS**.
2. Click **Add** to add a new implementation.

   Implementations come in the form of a DLL file. Make sure you have enabled ‘Show all files’ in the Windows Explorer, otherwise the browse option will not show the DLL files.

Refer to the implementation's online help for information on configuring the various implementations.

3 Configure the implementation (if applicable).
Most implementations offer a configuration dialog, which is accessible by highlighting the implementation and clicking Configure. In most cases, the configuration dialog has a Help button that can give implementation-specific configuration details.

4 To bind an implementation to a functionality, highlight the functionality and click **Modify**. Check the box for the implementation you want to bind.
You can select more than one implementation per functionality. However, it is not recommended (read: useless) to use more than one for the Report functionality, since you only want to retrieve and send reports to one system.

The following paragraphs list the functionalities.

Reporting

After binding an implementation other than the default one, select **Configuration → Reporting** to configure RadWorks to retrieve reports through the HIS-RIS implementation.

See the Reporting chapter for more details.

Worklists

RadWorks can act as a client for worklist providers.

Lists provided by external sources can be filtered and sorted with Worklist Views. You can define multiple views on the same source list. Views are stored per user and you can easily switch between the different views.

You can create a Worklist that has multiple sources. You can, for example, create a Worklist that lists studies from two archive systems, or you can create a Worklist that lists current studies in the local database, and their priors form both the local database and an archive.

You can create Worklists that have a DICOM part 10 archive (CD-ROM) as a source.

HIS/RIS implementations provide List Types. You can see the available list types when you configure the implementation, select **Configuration → Generic**, on the **HIS/RIS** tab, select the implementation and click **Config**.

The List Types you add here, can be used to configure a worklist and they appear in the **Database → View Properties** menu, in the **List** drop-down list.

The number of list types defined by DICOM is limited. Currently, only a Patient Root Query List, Study Root Query List and DICOM Modality Worklist are defined. These are the List Types that will show up if you have only loaded the Default HIS/RIS implementation.

The purpose of the **RadWorks Worklist** tab in the Default HIS/RIS implementation is to provide worklist support based on the contents of the studies that are available locally. For example, in a situation where both new studies and old exams (priors) are sent to the same workstation, it can be used to generate worklists for reading and verifying. Thus, provided that a proper workflow is in place, it becomes possible to offer worklists.

By offering better worklist support it is easier for the users to automatically select the right studies for viewing, and improve their workflow and speed of reading.

For details on defining Worklist Views, see the RadWorks 6.0 User's Guide.

Notifications and transactions

A Notification is a message that an event has happened in RadWorks (e.g. Study Arrived). No answer is expected from the external application.

A Transaction is a message that an event has happened in RadWorks that expects a response from the external application. RadWorks can act differently depending on the returned response.

Information about the events that trigger notifications and transactions, and the content of the messages will be documented separately. Contact GEMS IT Applicare to receive the information.

Creating a worklist with a DICOM part 10 source ▶

1. Select **Configuration** → **Generic**, and click the **HIS-RIS properties** tab.
2. Select the Default HIS-RIS Implementation.
3. Click **Config**.
4. Click the **Study** → **Patient** tab, add the CD player as a DICOM Volume, and click **Add**.
5. In the Type list, select DICOM Volume.
6. Select the CD-ROM player as the source.
7. Insert a DICOM CD, and click **Test** to test the connection to the volume.

8 To view the CD's contents, import the studies to the local database, or use 'DirectView'.
To enable the users to use DirectView, select **Configuration** → **Viewing** → **General** tab, then select the DirectView option.

9 Create a new Worklist View for the CD.

Tags indexed in the local database

The following DICOM and proprietary tags are used to display information in the Data Selector:

- You can query these fields in the local database.
- You can add these fields as a column in the Data Selector.

To change or add to this list, please contact your distributor.

Tag	Description
AMI	Origin
AMI	Folder
0010,0010	PatientName
0010,0020	PatientID
0010,0030	PatientBirthdate
0010,0040	PatientSex
0008,0020	StudyDate
0008,0030	StudyTime
0008,0060	Modality
0008,0050	Accesionnumber
0020,0010	StudyID
0008,0018	StudyInstanceUID
0008,0090	Referring Physician
0008,1030	Study Description
AMI	Nr Of Series
AMI	Nr Of Images
0028,0010	Rows
0028,0011	Columns
AMI	ReceiveDateTime
0008,1060	Reading Physician

DICOM tags used in local database

0008,1050	Performing Physician
0018,1030	Protocol Name
0018,0015	BodyPart Examined
0008,0080	Institution Name
0008,1010	Station Name
0008,1040	Institution Department Name
0032,1030	Reason For Study
0010,1000	Other Patient ID

DICOM tags used in local database

Configuring CallExe

CallExe is a HIS/RIS interface that forwards part of the interface functions to a HIS/RIS executable. The following interface functions are forwarded to the HIS/RIS executable:

- Retrieve results and interpretations.
- Store results and interpretations.
- Sending notifications.

CallExe communicates with the HIS/RIS executable using command line parameters and text files. The actual communication with the HIS/RIS system is done by the HIS/RIS executable. The advantage of this approach is that the HIS/RIS executable can be developed and tested independently from RadWorks.

How it works

CallExe implements the report interfaces methods:

- QueryResults.
- QueryInterpretations.
- RetrieveResult.
- StoreResult.

CallExe implements the Notification interface method:

- Notification.

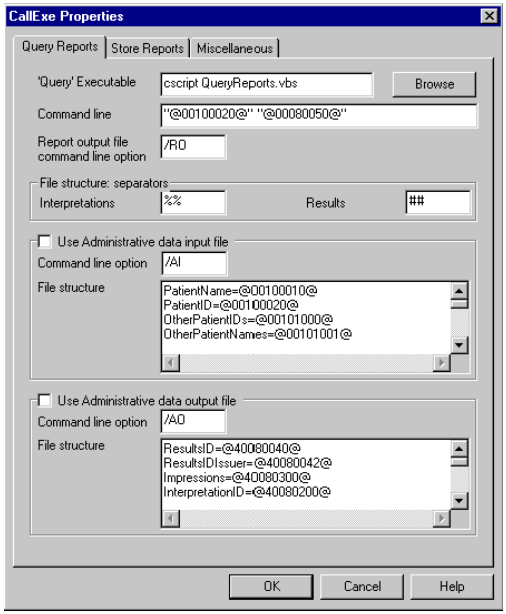
When RadWorks broadcasts a notification (and CallExe is configured to 'listen' to this), CallExe will call the executable specified in the configuration with a set of DICOM tags specified at the command prompt. The CallExe configuration indicates which DICOM tags from the notifications are added to the command prompt.

Sample configuration of CallExe for reporting

With the HIS-RIS tab of the Generic Properties window, CallExe can be added to the list of implementations. Subsequently, CallExe must be added to the Report and the Notification functionality. When CallExe is selected from the list of implementations and the Config button is clicked, the Properties window appears. The Properties window has three tabs that are explained in the following sections.

Query Reports tab

The ‘Query’ Executable field is used to specify the HIS/RIS executable that handles the retrieval of a report text from the HIS/RIS system.



The Command line field specifies the parameters that are passed to the HIS/RIS executable. Any DICOM value from patient level or study level can be passed by specifying the DICOM tag between ‘@’ characters.

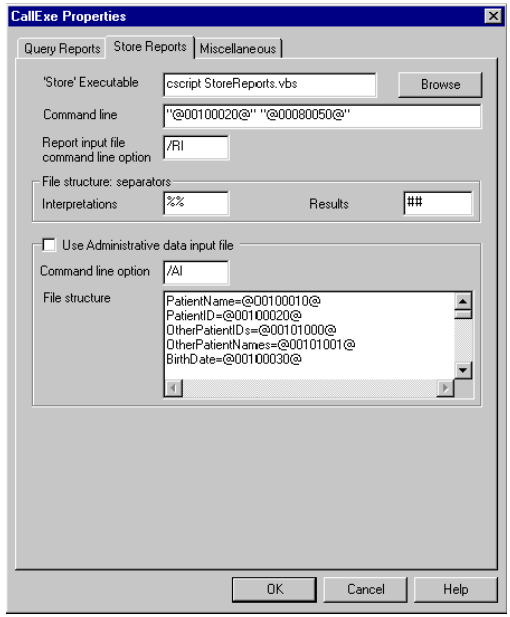
CallExe will append one extra parameter to the command line that specifies the text file where the report text must be stored. The Report output file command line option field can be used to prefix this parameter.

With the two separator fields, it is possible to define a file structure for the text file with the report text. In the following example, the report text of two results with two interpretations are passed from the HIS/RIS executable to CallExe:

```
Report text of Interpretation 1 of Result 1
%%
Report text of Interpretation 2 of Result 1
##
Report text of Interpretation 1 of Result 2
%%
Report text of Interpretation 2 of Result 2
##
```

The Use Administrative data input file is used to pass additional patient / study data from RadWorks to the executable using a text file. The Use Administrative data output file is used to pass additional patient / study data from the executable to RadWorks using a text file. In both cases, CallExe will generate and append the name of the text file as an extra parameter to the command line. If required, the Command line option field can be used to prefix this parameter.

Store Reports tab



You use the ‘Store’ Executable field to specify the HIS/RIS executable that handles the storage of a report text to the HIS/RIS system.

The Command line field specifies the parameters that are passed to the HIS/RIS executable. Any DICOM value can be passed by specifying the DICOM tag between ‘@’ characters. CallExe will append one last parameter to the command line that specifies the text file where the report text is stored. You can use the Report input file command line option field to prefix this parameter.

With the two separator fields you can define a file structure for the text file with the report text. In the example below, the report text of two results with two interpretations are passed from CallExe to the HIS/RIS executable:

Report text of Interpretation 1 of Result 1

%%

Report text of Interpretation 2 of Result 1

##

Report text of Interpretation 1 of Result 2

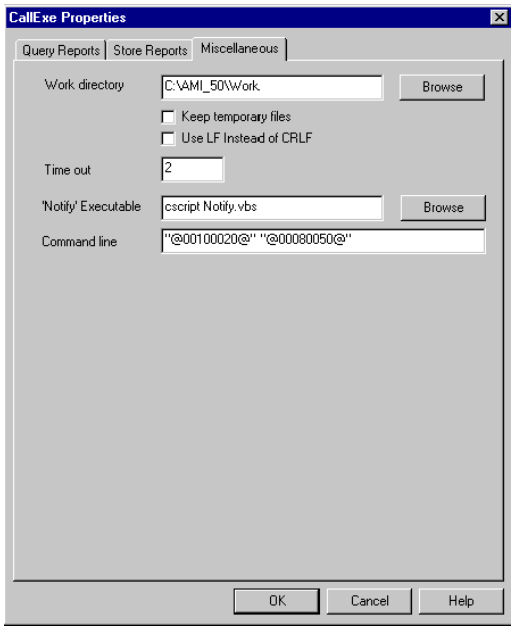
%%

Report text of Interpretation 2 of Result 2

##

The Use Administrative data input file is used to pass additional patient / study data from RadWorks to the executable using a text file. CallExe will generate and append the name of the text file as an extra parameter to the command line. If required, the Command line option field can be used to prefix this parameter.

Miscellaneous tab



The Work directory field specifies the location of the files that are used for exchanging information between RadWorks and the executable.

The ‘Notify’ Executable field is used to specify the HIS/RIS executable that handles the notifications sent by RadWorks.

The Command line field specifies the parameters that are passed to the HIS/RIS executable. Any DICOM value can be passed by specifying the DICOM tag between '@' characters.

With the Keep temporary files check box enabled, temporary files are kept for debugging purposes.

LF is used instead of CRLF to support the UNIX format (with just a single LF character to split the lines).

The Time out field specifies the time out value in seconds for DICOM queries.

Example using VB Script

You can also use the Windows Scripting Host and a VB Script instead of an executable. This has the advantage that no compiler is needed to create the executable and that the scripts can be changed easily.

The Windows Scripting Host (cscript.exe) can be found in the C:\WINNT\System32 directory or can be downloaded from http://msdn.microsoft.com/scripting/default.htm. The following sections describe the scripts that are used for the storage and retrieval of a report text and for the logging of notifications.

Querying Reports

The QueryReport.VBScript uses the Patient ID and the Accession NR to retrieve a report text from a text file in the Temp directory. If the text file does not exist, the report text is empty.

```
'Arguments: Patient ID, Accession NR, Report Option, Report Output
Const ForReading = 1
Const ForWriting = 2
Set objFSO = CreateObject("Scripting.FileSystemObject")
Set objArgs = WScript.Arguments
If objArgs.Count = 4 Then
strFileName = "C:\Temp\" + objArgs(0) + "_" + objArgs(1) + ".txt"
Set objReport = objFSO.OpenTextFile(objArgs(3), ForWriting, True)
If objFSO.FileExists(strFileName) = True Then
Set objFile = objFSO.OpenTextFile(strFileName, ForReading, False)
Do While objFile.AtEndOfStream <> True
objReport.WriteLine(objFile.ReadLine())
Loop
objFile.Close()
End If
objReport.Close()
End If
```

```
Set objFSO = Nothing
```

Storing Reports

The StoreReport.VBS script uses the Patient ID and the Accession NR to store a report text in a text file in the Temp directory. If the report text is empty, the text file is deleted.

```
'Arguments: Patient ID, Accession NR, Report Option, Report Input
Const ForReading = 1
Const ForWriting = 2
Set objFSO = CreateObject("Scripting.FileSystemObject")
Set objArgs = WScript.Arguments
If objArgs.Count = 4 Then
strFileName = "C:\Temp\" + objArgs(0) + "_" + objArgs(1) + ".txt"
Set objReport = objFSO.OpenTextFile(objArgs(3), ForReading, False)
If objReport.AtEndOfStream = True And objFSO.FileExists(strFileName) =
   True Then
' Delete the text file for an empty report
objFSO.DeleteFile(strFileName)
Else
Set objFile = objFSO.OpenTextFile(strFileName, ForWriting, True)
Do While objReport.AtEndOfStream <> True
objFile.WriteLine(objReport.ReadLine())
Loop
objFile.Close()
End If
objReport.Close()
End If
Set objFSO = Nothing
```

Notifying

The Notify.VBS script writes the arguments (including the notification, which is the first argument) to the file Notify.txt.

```
'Arguments: Notification, ...
Const ForAppending = 8
Set objFSO = CreateObject("Scripting.FileSystemObject")
Set objArgs = WScript.Arguments
If objArgs.Count > 1 Then
Set objFile = objFSO.OpenTextFile("C:\Temp\Notify.txt", ForAppending,
   True)
objFile.Write(Date + Time)
For I = 0 To objArgs.Count 1
objFile.Write(", " + objArgs(I))
```

```
Next
objFile.WriteLine("")
objFile.Close()
End If
Set objFSO = Nothing
```

Using SimCmdLn.exe with CallExe for reporting

The SimCmdLn executable is a sample application that simulates a RIS query according to an ID and, subsequently, places the result in an output file that is read by RadWorks in order to be displayed in the Viewing part's report area.

This application was written as a console application for Windows.

The code below is sparse and does not make use of MFC classes. Furthermore, it is mostly plain "C-style" code, with a couple of C++ dependencies, like comment style and local variable definition.

The code is purely meant as an example and provided as such. No claims can be made in case of possible malfunction.

Select **Configuration → Generic...** from the menu bar in the Data Selector and then click the HIS-RIS tab of the Generic Properties dialog box to add the CallExe.DLL (from the \bin directory) to the list of available implementations. Bind the Functionality to the Reports function (make sure it is the only Reports implementation!).

Select the CallExe line and click **Config**, in the Implementations box. Enter C:\AMI_60\samples\reports\SimCmdLn.exe, in the ‘Query Executable’ field on the first tab (Query Reports) - assuming RadWorks was installed in the default location.

Do the same on the second tab (Store Reports), in the ‘Store Executable’ field.

Make sure that the file SimCmdLn.exe is in your c:\AMI_60\samples\reports directory

Create a temporary directory called c:\AMI_60\temp.

In RadWorks, select **Configuration → Reporting** and set the following values:

- Uncheck report storage in local database.
- Double-click the default reporting profile entry.
- Select HIS/RIS interface as the type of remote reporting, and click **Next** >.

- Set the Type of Multi line Edit Control to Plain text and set Location on the screen to Vertical split – Additional info at left.

Select **Configuration → Generic** from the menu bar in the Data Selector and then the **HIS-RIS** tab of the Generic Properties dialog box, and then configure the CallExe implementation as follows:

- On the first tab Query Reports, in the field Command line enter
  /DEF "xxx yyy" /PID "@00100020@"
  (including the quotes).
- On the second tab Store Reports, in the field Command line enter
  /DEF "xxx yyy" /PID "@00100020@" /RO
  C:\AMI_60\temp\rpt@00100020@.txt
  (including the quotes).

After editing and saving a report in RadWorks, the report is stored as a text file in the c:\AMI_60\temp directory.

CHAPTER 6

Configuring reporting

This chapter describes the configuration of the Reporting Module.

IN THIS CHAPTER

The reporting functionality in RadWorks is very flexible. It offers handles for implementing customized reporting, but some fine-tuning (writing templates and/or HTML files) may be necessary. Reports use the Structured Reporting part of the DICOM standard.

The options in RadWorks 5.1 for editing reports were a Plain Text edit box, an MS-Word Template document or an HTML page. These remain with the current versions, but the contents of the report are now stored in a DICOM Structured Report and can be queried, stored, retrieved etc. in standard DICOM fashion. Each Structured Report contains all study and patient information.

Storage of these reports on third-party systems is possible if the third-party system that supports the DICOM Structured Report storage SCP. Optionally, RadWorks can convert the report to the format used in RadWorks 5.1 (where the information was stored in private tags), so the report can be stored on any system that supports image storage. Reports stored like this cannot use some of the new functionality available in RadWorks 6.0.

Structured Reports are available in three levels of complexity: basic, enhanced and comprehensive. Basic reports are e.g. plain-text reports, while enhanced reports can contain pixel co-ordinates and hyperlinks for viewing. RadWorks can display all three report types, plus hyperlinks in enhanced reports. Currently, no interface is available to create links to pixel co-ordinates.

A study can have multiple Structured Reports. These reports can be unrelated (second opinions, etc.) or versioned (several versions of the same report). When a report is versioned, you have the option to keep the older version or to overwrite it.

By default, the most recent report is displayed with a study. You can select older reports: they are listed as separate studies in the data selector, and if you select ‘Show Reports’ for a study, the viewer opens with two panes, one for the most recent report, and one with a drop-down list that allows you to select all older reports.

Once the study is declared Authorized, the report´s Verification data (verifier, date, time, verification status) and Completion Status are filled in and the report becomes Read-Only. If you have multiple reports, all reports except the most recent one are read-only.

Templates are included with RadWorks for several report types. These offer the full reporting functionality. You can use these templates as the basis of your own templates.

Reporting options

There are a number of options for implementing reports. For example, reports can be created in XML, MS Word and HTML as well as plain text. Click **Help** for more explanation of the options in the **Configuration** → **Reporting** dialogs.

The description of setting up plain text reports also contains information on how to setup the display of additional information next to the report. This is the same for all types of reports.

Setting up reports in plain text

Requirements

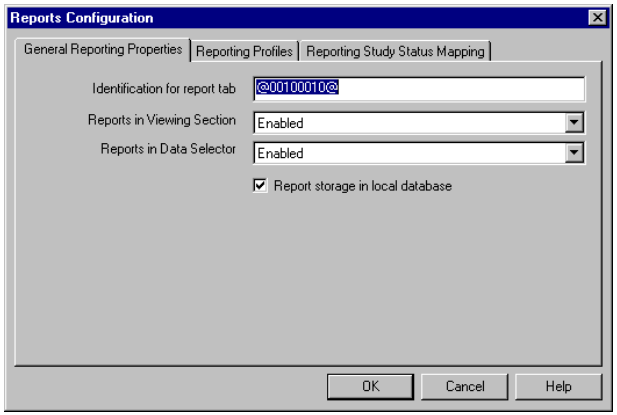
None

Preparations

None

To configure reports ▶

1 Select **Configuration** → **Reporting...** from the menu bar in the Data Selector.



2 On the **General Reporting Properties** tab of the Reports Configuration dialog box, select the DICOM tag that identifies which report you are currently looking at, when viewing multiple reports.

3 Specify if a user can view the report in Reports in Viewing Section and/or the Reports in Data Selector.

4 Check the **Report storage in local database** checkbox, if the report is stored locally.

5 On the **Reporting Profiles** tab, create profiles to use with a specific study status. A default profile is always available.

6 Redefine the default profile: click **Modify**.

7 In the **Type of Multi Line edit control** edit box, select **Plain Text**.

The **Additional Info**rmation settings are used if multiple reports exist: the Additional Info pane is used to display older reports.

8 The **Location on the screen** controls where the additional reports are displayed (Top/Bottom, Left/Right).

9 The **Structured Reports HTML File** is the template that will be used to display the additional reports.

10 In the **Structured Reports ID** box, enter DICOM tags you want to display with the additional reports, so you can distinguish between the main report and the additional ones.

11 Click **Finish** to save the settings for the selected profile.

Setting up reporting for MS Word

Requirements

MS Word 8.0 or higher

Preparations

Install MS Word.

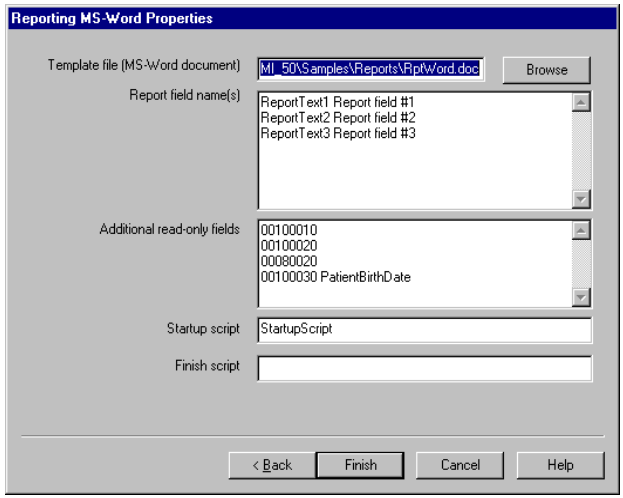
The template must contain fields where RadWorks can place information. An example is provided in the \samples\reports directory. This sample contains macros. By default, Word warns you about macros in your document. You can set Word's Macro security level to medium (only one warning when you open Word) or low (no warnings at all) to avoid seeing these warnings. But do this only if you are confident that no documents that macro viruses will ever be opened on the workstation.

The template is only used to display the information. The information is stored in the database as plain text. This means you cannot use Word's formatting options in the text (contents). You can apply formatting in the template.

To configure RadWorks for MS Word ▶

1. Select **Configurations** → **Reporting**.
2. Click the **Report Profiles** tab, to create profiles to be used with a specific study status.
3. Redefine the default profile: click **Modify**.
4. In the **Type of Multi Line edit control** edit box, select **Container with MS Word**.

5 Click **Next** to go to the next dialog.



6 Click **Browse,** and go to correct template in the “Template file” field.

7 In the **Report Field name(s)** edit box, specify the name(s) of the field(s) in the Word document where the report text should be inserted.

In this edit box, every line represents one Word field. The first word on the line is the name of the field. The rest of the line is the name that will appear in the report (the field’s title).

A field in an MS Word document can contain a maximum of 255 characters.

8 In the **Additional read-only fields** edit box, specify optional DICOM tags. When you open a report, these tags are looked up in the database, and the information in them will be inserted in the Word file. For example, the Patient Name (00100010) helps identify the report quickly. These are read-only: if you edit this information in the report, the changes will NOT be put into the database.

In this edit box, every line represents one Word field. The first word on the line is the DICOM tag of the database entry you want to put in the report field. The second word (optional) is the name of the database field you want to put in the report field.

9 Click **Finish** to save the settings for the selected profile.

Setting up for XML reports

Requirements

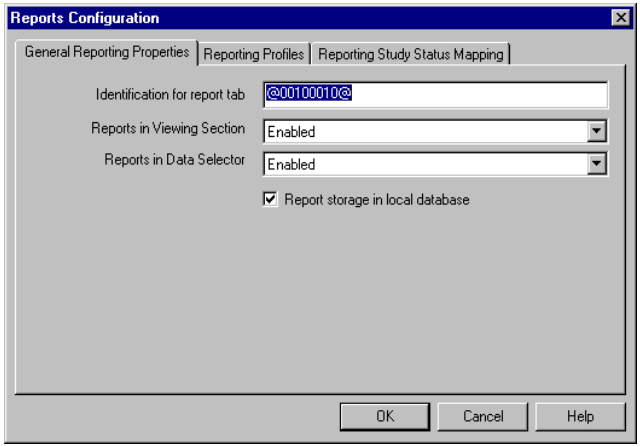
None

Preparations

None

To configure reports ▶

1 Select the **Configuration** → **Reporting** menu.



2 In the **General Reporting Properties** tab, select the DICOM tag that identifies which report you are currently looking at, when viewing multiple reports.

3 Specify if a user can view the report in Reports in Viewing Section and/or the Reports in Data Selector.

4 Check the **Report storage in local database** checkbox, if the report is stored locally.

5 In the **Reporting Profiles** tab, create profiles to use with a specific study status. A default profile is always available.

6 Redefine the default profile: click **Modify**.

7 In the **Type of Multi Line edit control** edit box, select **Container with XML**.

The **Additional Info**rmation settings are used if multiple reports exist: the Additional Info pane is used to display older reports.

8 The **Location on the screen** controls where the additional reports are displayed (Top/Bottom, Left/Right).

9 The **Structured Reports HTML File** is the template that will be used to display the additional reports.

10 In the **Structured Reports ID** box, enter DICOM tags you want to display with the additional reports, so you can distinguish between the main report and the additional ones.

11 Click **Next** >.

12 In the **HTML Script File**, enter the HTML framework that will be used to display the report.

13 In the **XML Report Prototype File**, enter the XML template that will be used when you create a new report.

14 In the **Is ready to leave** edit box, enter a script to check if the user entered all the required parameters before exiting the report.

15 Click **Finish** to save the settings for the selected profile.

Setting up externally stored reports – HIS/RIS

Requirements

Interface to HIS/RIS system

Preparations

Install the HIS/RIS in the **Configuration** → **Generic** → **HIS/RIS** tab and make sure that you selected Reporting to work with this interface.

To configure an externally stored report ▶

1. Select **Configuration** → **Reporting**.
2. Uncheck the checkbox **Report storage in local database** in the **General Reporting Properties** tab.
   Instead of retrieving the report text from the local database, RadWorks now queries the RIS to see if a report is available and displays it with the chosen Multi Line edit control (see Setting up reports in plain text and Setting up reporting for MS Word).
3. In the **Report Profiles** tab, create profiles to be used with a specific study status. Select the **default** entry and click **Modify**.
4. In the **Type of remote reporting** drop-down menu, select **HIS-RIS interface**.
5. Click **Next** >.
6. In the **Type of Multi Line edit control** edit box, select the file format for the report.
7. Select the **Amendment behavior**.
8. The **Additional Info**rmation settings are used if multiple reports exist: these settings control the layout of all reports except the main (latest) one. The default values are a complete list of available tags.
9. Click **Finish**.

Setting up externally stored reports – Browser

Requirements

Interface to HIS/RIS system with an HTTP interface.

Preparations

The HIS/RIS does not have to be configured in the **Configuration** → **Reporting** → **Generic** tab. We will not use a HIS/RIS connection, but an HTTP connection.

Configuration

1. Select **Configurations** → **Reporting**.
2. Uncheck the checkbox **Report storage in local database** in the **General Reporting Properties** tab.
3. In the **Report Profiles** tab, create profiles to be used with a specific study status. Select the **default** entry and click **Modify**.
4. In the **Type of remote reporting** drop-down menu, select **Browser**.
5. Click **Next** >.
6. In the **URL (plus command line) or HTML file** field, enter the URL plus the query parameters for the Browser interface. The query parameter can consist of DICOM tags.

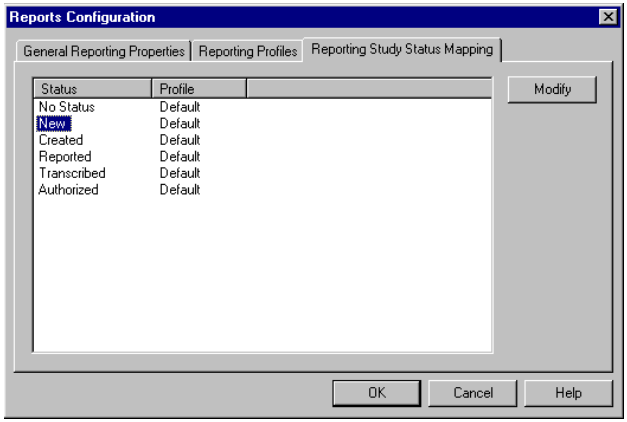
   An example: ”http://Server/Study.dll? GetReport&UID=@00200010@”
7. Use the **Set tags** script to specify which read-only fields should be passed on to the HTML file.
8. In the **‘Save’ script** edit box, enter a script that will notify the HIS/RIS that a user has requested to save the report.
   If there is another way to save a report, you can leave this field empty. The same goes for the other scripts in this dialog.
9. In the **Is ready to leave** edit box, enter a script to check if the user entered all the required parameters before exiting the report.

Study status mapping

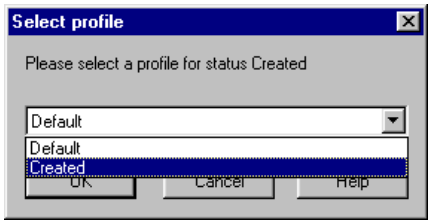
RadWorks offers you the option to link a reporting profile to a study status. This allows you to, for instance, specify an MS Word template to create the report and a read-only HTML template for displaying the report, once the report has been authorized.

To link a reporting profile to a study status ▶

1. In RadWorks, select **Configuration** → **Reporting**.
2. In the 'Reporting Study Status Mapping' tab, specify the link status should be linked to which profile.



3. Select a status and click **Modify**.



4. Select the desired profile and click **OK**. The profile is now assigned to the study status.

Reviewing reports from a Mitra PACS Broker

Requirements

Interface to Mitra PACS Broker (MitraPB) system with a text interface.

Preparations

To retrieve reports through the MitraPB▶

1. Add the MitraPB in the **Configuration** → **Generic** → **HIS-RIS** → **Implementations** list.
2. Bind the MitraPB implementation to the reporting functionality (next section in the same dialog).
3. Select **Configuration** → **Reporting** → **General Reporting Properties**, and make sure that 'Report storage in local database' is unchecked. This makes RadWorks look for external reports.

Configuration

The aim of the MitraPB implementation DLL is to find a unique match of the currently selected study in RadWorks with a report entry in the Mitra PACS Broker.

Reports are requested from the MitraPB using the values of DICOM tags in the header of the current study.

1. The first stage is that RadWorks requests all study entries matching the Patient level tag from the MitraPB. You specify this tag in the Patient Identification Tag box in **Configuration** → **Generic** → **HIS-RIS** → **MitraPB implementation** → **Configuration**. Normally, the only usable tag for this is Patient ID (0010,0020). If no patient match is found, RadWorks will stop the report fetching procedure.
2. From all entries the MitraPB returns, RadWorks checks if there are entries matching the Study Identification tag, beginning with the first tag that is listed.

You can specify multiple tags (use CTRL-Enter to insert more tags) for the study level, and these tags are matched in their listed order.

- If a unique match is found, that report will be retrieved.
- If there is no matching entry, RadWorks will check the next listed tag. If there are no further tags listed, the report window displays a blank report.

- If multiple matches are found, RadWorks will continue with the next tag, to narrow down the matches to one unique match. If this does not result in a unique match, RadWorks will display 'The report could not be fetched' in the report window. Refer for more detailed information about the failure reason to the RadWorks.log (look for the [RF] and [RISx] messages).

Troubleshooting

Successful matches depend largely on the mapping of HL7 elements to 'DICOM' elements by MitraPB. MitraPB has a set of configuration options to connect both.

You can apply several text conversions / processing functions on the data, concatenate values from multiple HL7 elements into one DICOM element, etc. This can help, but may result in unforeseen matching failures.

Uppercase/lowercase

By default, RadWorks starts querying on the patient level (=Follow Server). This is configurable with the Query Level option on the MitraPB **Implementation → Configuration** dialog. (Query levels: Follow Server / Patient / Result / Study).

If you know beforehand that in general there is no matching possible on the Patient level, you can skip this step, and start querying at Study level. Note, that the same applies as for the Patient level query; if no unique match is found on the first tag, the report fetching procedure stops.

Matching on StudyUID only can be tricky, because the MitraPB has the capability to create StudyUIDs when the HIS-RIS does not supply the info. These automatically generated StudyUIDs will never match the one in the study on your local RadWorks database.

On the other hand, in an ideal world the HIS-RIS would know all StudyUIDs, beforehand. The matching process could be as simple as starting on Study level and just setting up the StudyUID as the matching tag (0020,000D).

Compatibility with other systems

Previous RadWorks versions, and many other systems, do not support Structured Reports. If such a system receives an Structured Report, it may reject the whole study. If this happens, you can disable the sending of a Structured Report (in the Send dialog, or when configuring the Destination, see the chapter on 'Configuring teleradiology' on page 53). You can also set RadWorks to send the study in the RadWorks 5.1 format.

CHAPTER 7

Configuring printing

This chapter describes how to configure RadWorks to print with Windows and DICOM printers and image file export.

IN THIS CHAPTER

All RadWorks versions can print to Windows printers. The RadWorks Print Module also supports DICOM 3.0 compliant laser imagers (or print servers). Both monochrome and color printing is supported. The module allows for simultaneous connection to multiple printers. You can enter routine print jobs in the Data Selector with a few commands. In the Viewing Section, RadWorks 4.0 offers a versatile “virtual” film sheet to create sophisticated print jobs on the fly.

Printing is a background process in RadWorks. You can continue viewing and reporting while RadWorks processes print jobs.

In addition, this module offers file export facilities in the TIFF (Tagged Image File Format) and BMP (Windows Bitmap) formats. This can be of interest to users who want to include high quality digital images in slide shows, teaching presentations, or reports.

Setting up a printer

The ability to configure printers may be restricted to system administrators.

The following sections will show you three basic printer configurations. Parameters not essential to the situation will be skipped. For more information on these, see the online Help.

The installation of the RadWorks Print Module is a prerequisite for these scenarios. This is done during RadWorks setup.

Setting up a DICOM printer

In this section, a Codonics printer will be used as an example. In general, the procedure can also be used for other DICOM printers.

Requirements

- RadWorks Print Module.
- DICOM printer.

Preparation

The DICOM printer will be controlled via the network. Ask the system administrator for the host name, AE title and port number of the printer. The default AE title and port number of the printer can be found in the printer’s DICOM Conformance Statement. Various values that have to be entered when you connect the printer to RadWorks can also be found here.

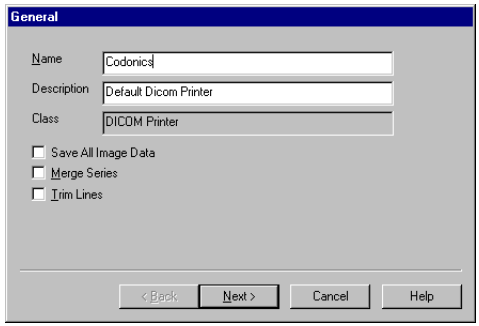
Configuration

1 Select **Print** → **Destinations...** from the Data Selector menu bar. A list of print destinations is displayed.

2 If the printer you are installing already exists there, you can simply select or copy it and modify the parameters. Otherwise, click **Add**. A wizard will guide you through the installation process.

3 Select the type of printer in the Add Print Destination dialog box, in this case a DICOM printer.

4 Enter a name for the printer destination list in the Name field and a more detailed description of the printer in the Description field, and click **Next** >.



5 Enter the printer's AE title, host name and port number. For the Codonics printer, the AE title is "PRINT_SCP" and the port number is "104". The host name can be an IP address. Select the type of processing that will be done. The Codonics is a "PROCESSOR".

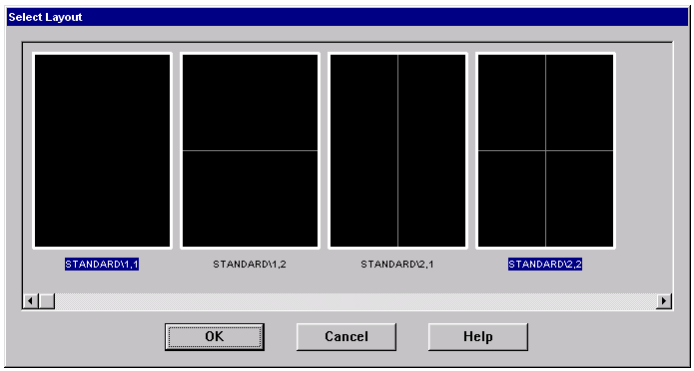
6 Select the type of supported magnification ("BILINEAR") and the type of media ("PAPER"), and click **Next >.**

7 Specify which media formats are supported. The Codonics can handle 8 inch x 10 inch.
The Codonics is not completely DICOM compliant here. The way to specify the media size is "8X10IN" instead of the DICOM "8INX10IN". This was fixed in a newer model, so please read the Conformance Statement carefully. Specify the correct format.
Click **Next** >.

8 The header can only be used for Windows printers. It cannot be modified when defining a DICOM printer. Click **Next** >.

9 Select the supported layout. A “STANDARD\1,1” is always supported. Click **Change** to add other layouts from the Layout Pool. How to add layouts to this pool will be explained later on. The Codonics supports “STANDARD\1,1”, “STANDARD\2,2”, “STANDARD\2,3” and “STANDARD\3,3”. Click **Next** >.

10 Click the layouts from the pool to select them. The names of the selected layouts will be highlighted. Click **OK** to return to the wizard.



11 Check the Monochrome, Color or Both radio button, according to what the monitor supports. The Codonics 1600 series, for instance, supports color.

12 RadWorks is now ready to install the Codonics printer. Click **Finish** to add the Print Destination to the list.

13 Close the Print Destination list.

14 Click the **Print** tab.

15 Select the new destination.

16 Select a study.

17 Select a layout (preferably STANDARD\1,1). Click **Print**, to check that the printer prints properly.

Color printing takes three times as long as monochrome printing. This is because of separate information transmission for Red, Green and Blue.

Setting up a Windows printer

In this section, a HP LaserJet 5 printer will be used as an example. In general, the procedure can also be used for other Windows printers.

Requirements

- Windows printer

Preparation

Windows will have control over the Windows printer. RadWorks can only use the default printer.

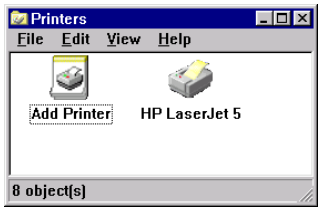
Configuration - Windows 2000

1. In the Windows Start menu, select **Start** → **Settings** → **Printers** and double click the **Add Printer** icon in the Printers window. The Add Printer wizard starts.
2. Click **Next** >.
3. Depending on how your printer is connected, select '**My Computer**' or '**Network printer**'.
4. Find and select the printer you want to print with.
5. Select whether this will be the default printer.
6. Click **Finish**.

Configuration - Windows NT 4

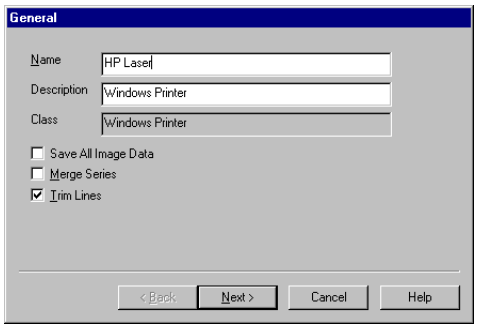
1. In the Windows Start menu, select **Start** → **Settings** → **Printers** and double-click the **Add Printer** icon in the Printers window.
2. Depending on how your printer is connected, select the My Computer or Network printer server radio button, and click **Next** >.
3. If you selected the My Computer radio button, select the port the printer is connected to.
4. Select the correct manufacturer ("HP") and printer type ("LaserJet 5").
5. Specify the name of the printer ("HP LaserJet 5"), select the Yes radio button to use this printer as the default printer, and click **Next** >.
6. Set the sharing option.
7. Windows is now ready to add the printer. Click **Finish** to add and print a test page.

The Printers folder now looks like this:



Configuration - RadWorks

1. Select **Print** → **Destinations**. A list of print destinations will be displayed.
2. If the printer you are installing already exists there, copy it and modify the parameters. Otherwise, click **Add**. A wizard starts which will guide you through the installation process.
3. Select the type of printer you want to add a new print destination for, in the Add Print Destination dialog box, and click **Next >**.
4. Enter the display name for the printer destination list and a more detailed description of the printer.



For unmodified images, RadWorks will use the data in the original study when printing the images. If, however, the study containing the images is deleted after submitting the job and before RadWorks has been able to actually print the images, it will not be possible to print them. To prevent this possibility, you should check the Save All Image Data check box. Doing this will, however, slow down the submission of your print jobs since more information has to be saved

5 Check or uncheck the **Save All Image Data** check box. If this is checked, the pixel data of all images is saved. If unchecked, only modified image pixel data (such as filtered images) will be saved for composed print jobs. Check the **Merge Series** check box, if you want RadWorks to continue printing new series on the same sheet as the previous one when printing multiple series. Check the **Trim Lines** check box, if you want trim boxes to be printed around the images. Click **Next >**.

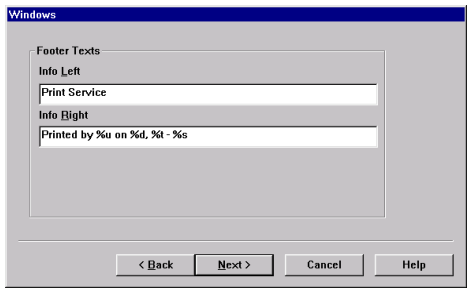
6 Enter the footer text. You may want to add predefined fields to your text. RadWorks supports the following specifiers for predefined fields:

%d = date

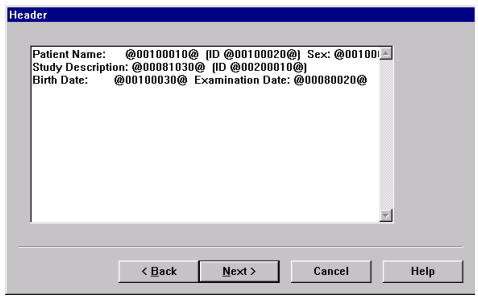
%s = sheet m of n

%t = time

%u= \\host\user. Click **Next >**.



7 Enter the header text. The header text can consist of DICOM tags. For a complete list of DICOM tags, see the appendix on ‘Listings of DICOM Tags’ on page 389. Click **Next >**.



8 A Windows printer supports all possible layouts, so you don't need to change the Layouts list. Click **Next >**.

9 Select the color support for the printer. The LaserJet 5 is monochrome. Click **Next >**.

10 RadWorks can now install the Windows printer. Click **Finish** to add the print destination to the list.

11 Close the Print Destination list.

12 Click the **Print** tab.

13 Select the new destination.

14 Select a study.

15 Select a layout.

16 Click **Print**, to test if the printer will print.

Notes on the Windows printer wizard

The minimum bitmap size is the smallest size of the image sent to the printer. If an image in RadWorks is smaller than this, it will be enlarged to the minimum size before printing. Setting a high value will ensure that annotation is always easy to read even for very small images. The default bitmap size is 384 x 384 pixels. This offers good legibility for most purposes.

If the Use Original Size check box is checked, the minimum bitmap size is ignored and images will always be printed at a size which corresponds to their pixel dimensions.

If color support is set to Monochrome, all images (including true-color ones) will be printed in monochrome tones. If it is set to Color, all images (including monochrome) will be converted to true-color before printing. If Both is selected, the image type determines how it is printed.

Setting up a file printer

In this section, a TIFF 'printer' will be used as an example. In general, the procedure can also be used for other file printers.

Requirements

- RadWorks Print Module.

Preparation

None.

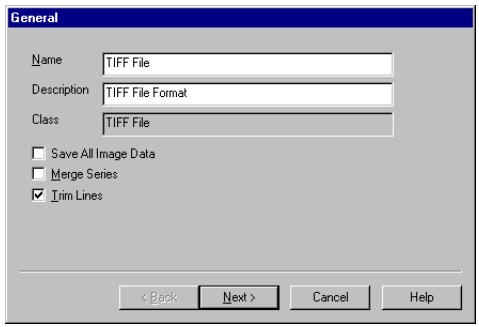
Configuration

1. In RadWorks, select **Print Destinations**, to display a list of Print Destinations.

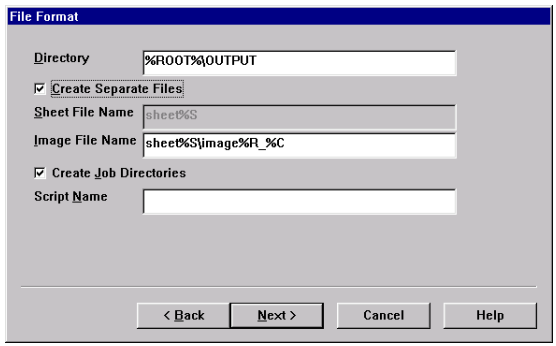
2. If the printer you are installing already exists there, select or copy it and modify the parameters. Otherwise, click **Add** button. A wizard will guide you through the installation process.

3. Select the type of printer, in this case a TIFF file (there is no difference between the installation of a TIFF or a BMP file printer), and click **Next** >.

4. Enter the display name for the Printer Destination list in the Name field, and a more detailed description of the printer in the Description field. Click **Next** >.



5. Enter the output directory ("%ROOT%\OUTPUT" is default) and specify the output format, in the Directory field.

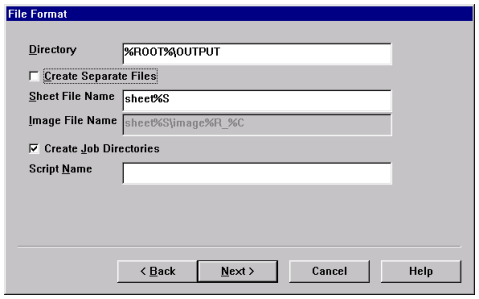


6. Check the Create Separate Files check box to create a separate file for each image. By default, this option is selected. The files are stored in a directory structure like %ROOT%\OUTPUT\ sheet<nr>\image<rownr>_<columnnr>.

7 Uncheck the ‘Create Separate Files’ check box to create one file per sheet. The files are stored in a directory structure like %ROOT%\OUTPUT\sheet<no.>. Specifiers are:

```
%c, %C  = column
%r, %R  = row
%s, %S  = sheet
%i, %I  = image (of session)
%j, %J  = image (of sheet)
```

8 Capital letters generate numbers starting at 1. Lower case letters generate numbers starting at 0. Click **Next** >.



9 The header is not used, so you don’t need to change anything in this panel. Click **Next** >.

10 A file supports all available layouts, so you don’t need to change anything in this panel.Click **Next** >.

11 Let the Print Service decide what type of color support to use. Select the **Both** radio button.

12 RadWorks can now install the File printer. Click **Finish** to add the Print Destination to the list.

13 Close the Print Destination list.

14 Click the **Print** tab.

15 Select the new destination.

16 Select an image.

17 Select a layout.

18 Click **Print**, to check if the image file has been created.

Creating custom print layouts

Access to layout configuration may be restricted to administrators.

RadWorks has a ‘layout pool’ which contains a wide range of pre-defined layouts for printing images. You can select these layouts when defining a new printer (destination). This means that specific layout options can be provided for each particular printer.

If you want to print using a special layout not included in the layout pool, you should first add this to the layout pool and then make this layout available for the particular printer or printers.

The Help also describes how to configure a DICOM printer to produce slides.

To create a custom print layout ▶ select **Print** → **Layout Pool…** from the menu bar in the Data Selector. In the Layout Pool, click **Add…** In the Add Layout dialog box, enter the desired rows and columns matrix and a name for your new layout. Click **Preview >>** to see the result of your configuration before you save it. Check the Advanced check box to directly enter the text in the configuration window. Click **Help** for details on how to set up the layout.

Do not delete layouts that are already being used by existing printer configurations, since they will also be deleted from the layouts available for those printers.

The Layout Pool displays all the layouts that have been pre-defined on your system. Use the scroll bar to view them. You cannot edit existing layouts, but you can delete as well as add them. To delete a layout, click **Delete**.

Configuring printers

Editing, copying and removing printers

Apart from adding new printers, you can also edit the configuration of existing printers.

To reconfigure printers, you may require system administrator rights to your system.

To edit, copy or remove a printer ▶ select **Print** → **Destinations…** from the menu bar in the Data Selector. In the Print Destinations dialog box, select a printer (click the printer's name) and then click **Modify**, **Copy** or **Delete**.

Double-click on a destination name to view detailed information on a particular printer/file export option.

If you click **Modify**, you will see a tabbed configuration box with all the options described above.

If you click **Copy**, you can copy an existing configuration to a new printer. Enter a new name and description in the Copy Print Destination dialog box, then modify the settings as appropriate.

Configuring how images are exported as bitmaps

How bitmap files are exported can be configured in a similar way as for printers. When RadWorks is installed, destinations are provided to allow you to put all images to be exported into a single file or to save each image as a separate file. See the Help for examples of notation and an explanation on how to use script files.

Connecting to a DICOM device

To connect DICOM devices ▶

1. Make sure the printer is correctly installed, switched on and ready for input.

2. Make sure you have a copy of the DICOM conformance statement of the printer.

3. Make sure RadWorks is correctly installed and you have a Print license.

4. Make sure the printer will accept associations from the RadWorks station.
   Some printers force you to register all applications that will print to them. The printer manual will detail how to do this. Generally, you will need:
   - the host name or IP address of the machine RadWorks runs on (configured when the computer was put into the network), and
   - its Application Entity title (can be set using the **Configuration → Generic → DICOM** dialog).

5. Launch a command prompt.

6. Try executing “ping <IP address of the printer>”.
   If this fails, there is a faulty network connection, the printer is not switched on, or generally, the printer cannot be found on the network. Contact your system administrator.

7. Try executing “ping <host name of the printer>”.
   If this fails, your DNS does not work correctly, the printer is not known to the DNS, or there is no DNS (Domain Name Server). If there is no DNS, add the IP address and host name of the printer to your \WinNT\System32\Drivers\Etc\Hosts file.

This works only if you use the TCP/IP protocol.

8. Try executing “dcmecho2 <AE Title of the printer> <host name of the printer>:<port number of the printer>”.
   You can find this utility in the Bin directory in your AMI root.

   If the command fails, with the error ‘failed to request association’ the port number of the printer was not set correctly. You can find the port number of the printer in the DICOM conformance statement that came with the printer. Some printers allow you to change the port number. In that case, use the printer diagnostics to find out the new port number.

This command works only if the printer supports C-ECHO.

If the command fails with the error ‘association rejected’ the AE title was not set correctly. You can find the AE title in the DICOM conformance statement of the printer. Some printers allow you to change the AE title. In that case, use the printer diagnostics to find the new AE title.

9 Launch RadWorks.

10 Add a new DICOM printer destination. Change the name, description (optional), host name, port number and AE title. For most DICOM destinations, the other defaults will suffice. See also ‘Notes on specific printers’ on page 161.
Be sure to copy the information from the DICOM conformance statement.

11 Switch these options off: Print Job Event Reports, BFS Print Support, Trim Support, Use Presentation LUT and Compose Sheet (from the DICOM tab in the Print Destinations dialog). The Print Service will use a minimal set of features to print now.

12 Try to make a print. Do so by selecting a single 1-image study and printing to a one-up (STANDARD\1,1) layout. All print destinations (known to Applicare) support this layout.

If this doesn’t work, open the Print Queue dialog and view the Error Information. This should provide information about the settings in the Print Destinations Dialog to change.

BFB errors reflect wrong entries on the DICOM Film tab, whereas BFS errors represent errors in the DICOM tab.

To find out other capabilities of the printer, check its DICOM conformance statement and adjust the various settings in the Print Destinations Dialog (one at a time). In particular, when testing N-EVENT-REPORTs, the time-out should have a small value to prevent serious lock-up in case of printer failure.

Inside DICOM Print configuration

This section explains the items in the dialog that opens when you select **Print → Destinations**, and you modify a DICOM printer. The items marked DCS (DICOM Conformance Statement) are the DICOM tag names.

On the **DICOM** tab:

- AE Title
  (DCS: AE title)
  The AE title of the printer, as set default (or changed using the printer setup).
- Host Name
  The host name of the printer. The Domain Name Server (DNS) or the Hosts file provides this.
- Port Number
  (DCS:port number)
  The printer port number, as set default (or changed in the printer setup).
- Destination
  (DCS:Basic Film Session -or- BFS, tag (2000,0040))
  Defined terms are MAGAZINE and PROCESSOR. If the printer has a built-in processor, the setting should be PROCESSOR, otherwise, MAGAZINE.
- Print Priority
  (DCS:Basic Film Session -or- BFS, tag (2000,0020))
  Defined terms are LOW, MED, HIGH. This defines the relative priority of jobs from different workstations (jobs from a single workstation are sent by the Print Service based on the priority set on the Print Tab in the Data Selector).
- Session Label
  (DCS:Basic Film Session -or- BFS, tag (2000,0050))
  A label which identifies the Print Job during the print process. May or may not be printed on the film.
- Enable Print Job Event Reports
  (DCS:somewhere in the introduction)
  The Print Job N-EVENT-REPORT mechanism is used to transmit status information from the printer to RadWorks in a asynchronous way. The status information can refer to the printer or the print job. RadWorks currently does not handle printer status information. It can, however handle print job status information. If you check this

box, RadWorks will halt subsequent job processing until it receives a READY signal from the printer.
To avoid lock-up, a time-out can be specified (see below). DCS may or may not be accurate as to this information. In theory, checking this box for a printer that does not send N-EVENT-REPORTs on the print job will not harm, as the Print Module tries to determine the printer's capability to send N-EVENT-REPORTs anyway. However, some printers wrongly signal that they will send N-EVENT-REPORTs, though they don't. For such printers, turn this flag off. See 'Notes on specific printers' on page 161 for known cases.

- Time-out
  (not in DCS)
  The N-EVENT-REPORT handling is error-prone in the sense that missing a single N-EVENT-REPORT might cause the Print Service/ Printer pair to enter an infinite wait situation. The Print Service will sit idling until the printer sends an N-EVENT-REPORT, while the printer will wait for the Print Service to drop the association (as the printer sent an N-EVENT-REPORT, which somehow never got across). The time-out is provided to end such a deadlock situation by silently proceeding as if the job printed well after the specified interval.

- Compose Sheet
  (not in DCS)
  Usually the Print Service lets the printer determine the placement of images, as dictated by the layout as supplied in the Layouts tab of the Print Destinations Dialog and subsequently selected from one of the print tabs. However, if you check this box, the Print Service will compose the filmsheet itself and send it as a large 1-up (STANDARD\1,1 layout) to the printer. Some bitmaps may be so large that the printer cannot handle them. So its usually safe to keep this option turned off. However, if your DICOM printer does not handle a badly needed layout, you can check this box to handle it anyway. The Print Service handles any conceivable layout (which can be typed in the Add Layout dialog of the Layout Pool).

  Note that checking the Compose Sheet box makes the 'Use True Size' box on the Image tab unavailable.

- BFS Print Support
  (either not in DCS or in introduction)
  DICOM specifies two ways of printing filmsheets.
  a. Issue a separate print command for every filmsheet (Basic Film Box BFB).
  b. Issue a single print command for the complete job (Basic Film

Session BFS).
The DICOM standard requires DICOM printers to support both a and b. However, some printers fail to support b). This checkbox can be used to change the behavior of the Print Service from issuing a single print command for the BFS to issuing multiple print commands, one for every BFB.

- Trim Support
  Is ON by default. Switch OFF only if your printer does not support trim lines.
- Use Presentation LUT
  Is ON by default. Switch OFF to be able to specify a LUT other than the default one, e.g. for troubleshooting color matching issues.

On the **DICOM Film** tab:
Items marked * will not be sent to the printer if they are left empty.

- Magnification
  (DCS:Basic Film Box, tag (2010,0060))
  Defined terms are REPLICATE, BILINEAR, CUBIC or NONE. Some printers despite the standard do not support NONE. In the case of CUBIC, fill in Smoothing as well.
- Smoothing
  (DCS:Basic Film Box, tag (2010,0080)) *
  If supported, and if Magnification is CUBIC, the smoothing type is a vendor-specific string which determines the actual type of CUBIC interpolation.
- Medium Type
  (DCS:Basic Film Session, tag (2000,0030))
  Defined terms are PAPER, BLUE FILM and CLEAR FILM. Be sure to set the correct type, as this is a common cause of problems. See below for defaults.
- Config Info
  (DCS:Basic Film Box, tag (2010,0150)) *
  A vendor-specific string which can be used to specify things not in the DICOM standard. It may, e.g., be used for the definition of a lookup table to use. Consult DCS for more details.
- Densities/Border
  (DCS:Basic Film Box, tag (2010,0100))
  Defined terms are BLACK, WHITE and an integer specifying the density in 1/100ths of optical density (OD). E.g., 150 specifies 1.5 OD.

- Densities/Empty Image
  (DCS:Basic Film Box, tag (2010,0110)) *
  As Densities/Border, but for image boxes that are not filled with an image (as, e.g. trailing images on the last sheet of a Data Selector job).

- Densities/Minimum and Densities Maximum
  (DCS:Basic Film Box, tags (2010,0120) and (2010,0130)) *
  Minimum and maximum densities to use when determining printer range. If you use these settings, you usually need to make a couple of prints to determine the correct settings. The DCS may or may not give an interpretation of these fields. There appears to be some inconsistency across printers handling this attribute.

You can typically leave the Minimum and Maximum empty. Change these in cases of too light/too dark films only. Note that BLACK or WHITE is not a valid choice here.

- Basic Annotation Box Support
  The Print Service requests the DICOM Basic Annotation Box at the negotiation of the association. If this succeeds, it prints a text line in the box. The following tags are supported:
  - Annotation Position (tag 2030.0010) (see Basic Annotation Box in Conformance Statement)
  - Annotation Format (tag 2030.0020) (see Basic Annotation Box).
  - Annotation Display ID (tag 2010.0030) (see Basic Film Box)

  The Annotation Format is basically a text string possibly containing:

```
%u replaced by user name/computer
%t – time when the print job was submitted
%d – date when the print job was submitted
```

  The default configuration is position = 1, display ID = 1, format = %d %t %u.

On the **DICOM Media** tab:

The date and time formats used are those set in the Control Panel applet Regional Settings.

- DICOM Media
  (DCS:Basic Film Box, tag (2010,0060) - FILM SIZE ID)
  This is a single multi-line edit control which allows you to enter the supported media sizes. Little error checking is performed, so type the definitions carefully. The format is

```
<number>INX<number>IN
```

  or

```
<number>CMX<number>CM
```

  Some typical examples are

```
8INX10IN
14INX17IN
```

(typed as the definition above; a single film size on a single line).

If a device supports the ‘requested image size’ (DCS:Basic Gray-scale/Color Image Box, tag (2020,0030)) attribute, it can be used for ‘True Size’ printing.

Configuring presentation sheets

IA daily routine in many hospitals is to have ‘morning rounds’ meetings to discuss clinical cases. During these presentations, only the most important images from a study are shown, summarizing the study for the participants.

Clinical presentations are also used for educational purposes.

RadWorks 6.0 facilitates presentation sheets, which allow you to place all relevant images from multiple studies on one sheet for presentation purposes.

This feature offers the ability to create a ‘snapshot’ of a number of studies, both new and priors. Since no detailed, modality specific demographics are available in this snapshot. The study can be used for presentations only.

Performing diagnosis on this type of study can lead to interpretation mistakes, also because it is possible to combine images from different patients on the same sheet. To prevent the possibility of error, a descriptive message (Presentation Sheet) will be displayed as a permanent annotation on the top-center of the viewport.

This feature is intended to create Presentation Sheets of the same patient. If a Presentation Sheet is created from different patients, when submitted to printer the print job will be saved as the Presentation Sheet study with the first patient in line.

The implementation of presentation sheets in RadWorks allows the user responsible for preparing the ‘Morning Rounds presentation’ to ‘Print’ a composed sheet to the Presentation Sheet printer. These virtual sheets will then be converted into a new study, which becomes available in the Data Selector. The user can select these and previous studies (when available on the local database) for display.

Hanging protocol

To display the presentation sheets correctly, a specific hanging protocol is required. This hanging protocol has been copied to the AMI_60\Samples\HangingProtocols directory and must be imported via the Hanging Protocols Manager.

New local worklist definition

For quick access to presentation sheets, create a new worklist definition. This worklist is user-specific.

To create a worklist▶

1. Select **Configuration** → **Generic...** from the Data Selector menu bar.
2. Click the **HIS-RIS** tab and, in the Functionality area, make sure that the RadWorks Default Implementation is bound to the Worklist Functionality.

3. In the Implementations area, select the **Default HIS/RIS Implementation** item.
4. Click **Config**. Click on the **RadWorks Worklist** tab of the 'Configure RadWorks Default HIS/RIS Implementation' dialog box.
5. Click **Add**, and on the General tab of the RadWorks Worklist dialog box, give the worklist an appropriate description in the **Description** field.
6. In the **Type** drop-down list, select **Review**.
7. Go to the **Active Studies** tab and, in the Source area, click **Add**.
8. Add 'Local RadWorks' as a source.
9. In the Query area, click **Add**.
10. In the Field dialog box, click >>.
11. From the list, select the StudyDescription DICOM tag. Double-click the tag to close the drop-down box.
12. In the **Query Value** field enter: Presentation Sheet*
13. Go to the **Prior Studies** tab.
14. In the Source area, click **Add**.
15. Add 'Local RadWorks' as a source.
16. Click the **OK** buttons to exit the configuration.
17. Restart RadWorks.
18. Create a new Worklist View and select 'Presentation Sheet' from the list in the Add View dialog.
19. Make the Presentation Sheet worklist view active.
20. You can insert the DICOM tag 'Prior' (3109,100C) as a new column to view priors.

Creating a Presentation Sheet printer

You can also print to the Presentation Sheet by selecting a study in the Data Selector, but then you would print the entire study instead of a selected number of key images.

The Presentation Sheet is a component of the Printer Service and requires a license for the DICOM Print Module.

Use the Add Printer wizard to create a printer destination based on this printer class. The first step in the wizard is the Printer Class: select **Presentation Sheet**.

Use this new destination to create a print job for a Presentation Sheet in the Viewing Section.

Jobs you have printed to this destination will show up in the Presentation Sheet worklist.

Notes on specific printers

Below are given some notes on specific popular DICOM printers you may have to configure.

Kodak MLP190

AE Title: KODAK_MLP190 (not configurable)

Port number: 5040 (configurable)

Software version 1.6.09 is known to correctly reject the Print Job SOP class (as requested when the Print Job Event Report flag is set). Older versions may not correctly do this, so its usually safer to keep the flag off for these versions. Older software versions may also fail to implement the print command on the BFS so uncheck the BFS Print Support check box if in doubt.

A way to check the software version is to turn on ALL logging for the Print Service (Configuration/Print Service/Logging, Logging Level=ALL) and reboot as stated. Then start an association with the minimal set (as described in chapter 0). After a successful association, check the Print log file (in the AMI\Print directory) and find the printer status report the software version is shown just after the line ‘Printer N-GET response received’.

Codonics 1600MD

(system software version 1.5.0, ImageWeb 1.0)

AE Title: PRINT_SCP (not configurable)

Port number: 104 (not configurable)

Contrary to what the DICOM standard says, this device does not support Print Job Event Reports. Uncheck the box. Medium Type should be PAPER for this device. This version of the software does not support requested image size.

A way to check the software version is to surf to http://<host name>. Click ‘current version’ to see the software version. Click ‘printer status’ to see if a DICOM implementation is available.

It seems that the Codonics printer does not accept the TIFF’s that RW produces; use BMP’s instead. You can open a telnet session on the Codonics to follow the process. Log on as user “root”.

Kodak 8700 Print Server

(software versions 1.0 and 1.5)

AE Title: PrtSCP

Port number: 1024

Software version 1.0 correctly implements N-EVENT-REPORTs. Version 1.5 was only very basically tested with, but appears to support N-EVENT-REPORTs as well. Both versions correctly implement the requested image size attribute.

Sterling Linx Print Server

(software version 2.7.1)

AE Title: IMS_PrintServer

Port number: 2000

Software version 2.7.1 should implement N-EVENT-REPORTs. Software capabilities depend on the attached camera. The DCS details which cameras support which layouts.

The requested image size attribute is (as yet) not supported.

Fuji MF Print Server

(software version 1.0)

AE Title: unknown

Port number: unknown

Due to a bug, the Fuji software incorrectly drops the association after the first image is received. Another bug prevents AE Title using capitals from being authorized. Currently, the device cannot communicate correctly using DICOM. After Fuji's software release B-03, this bug should be fixed. It has not been tested yet. The Basic Film Session is not supported.

CHAPTER 8

Configuring the Integration Module

This chapter describes how to configure the Integration Module.

IN THIS CHAPTER

The purpose of the Integration Module is to allow tooltabs and menu items to be added to RadWorks. These tooltabs and menu items can contain web links and shortcuts to applications or HIS-RIS functions.

All changes made in the Integration Module are system-wide. This means all users will be able to use, edit and delete the new menus, menu items and tooltabs.

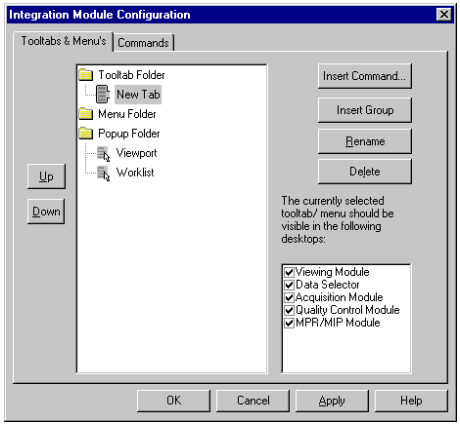
The information flows one way, for instance, there is usually no confirmation if the launched application(s) or web page(s) display the requested information.

Configuring the Integration Module

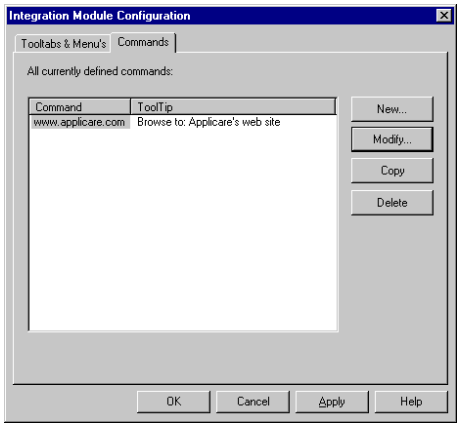
The following information will guide you through the steps for adding tooltabs and menu items using the Integration Module.

To start configuring the Integration Module ▶ select **Configuration ➔ Integration Module** from the RadWorks menu bar.

The Tooltabs & Menus tab in the Integration and Module Configuration dialog box allows you to add the tooltabs, menu items and pop-ups.



The Commands tab allows you to add commands.



To add a command or a menu to a tooltab, you first create the command and then add it to the Tooltabs & Menus tab.

The easiest way to proceed is to first add all the commands you wish to use.

The following sections provide more specific information on how to insert and configure tooltabs, menus, pop-up items and commands.

Inserting a tooltab

To insert a new tooltab ▶ select **Configuration → Integration Module** from the RadWorks menu bar.

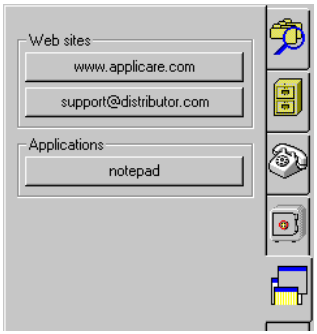
1 Select the **Tooltab Folder** in the folder list on the Tooltabs & Menus tab of the Integration Module Configuration dialog box.

2 Click **Insert Tooltab**. A new tooltab with the default name 'New Tab' is created.

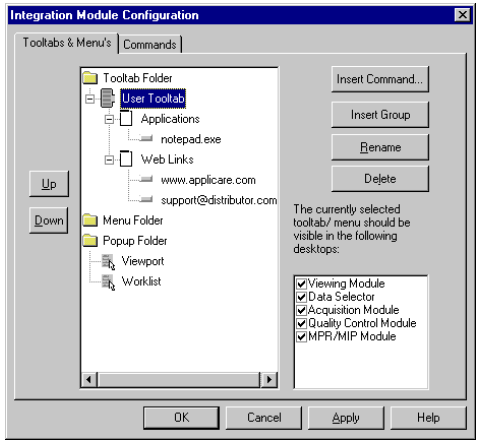
3 To name the tooltab, select the tooltab and click **Rename**, type the name you want and select the adjacent icon again.

4 You can add a command or a group to the new tooltab for more information on inserting commands). A group contains several commands in a titled box in the Data Selector of RadWorks. Notice the buttons under the Web sites and Applications section in the illustration below. The 'www.applicare.com' and 'support@distributor.com' buttons were created in a group called 'Web sites', whereas the 'notepad' button was created in a group called 'Applications'. (See 'Inserting a command' on page 171 for more information on inserting commands.)

The captions and functions of these buttons depend on the item you select in the list.



These tooltabs appear as follows in the Integration Module Configuration dialog box:



5 By default, new tooltabs are displayed in all installed modules. However, you can determine in which modules they will be displayed by checking the check boxes in the list of modules in the bottom-right corner of the Integration Module Configuration dialog box.

6 Click **OK**, to complete the configuration and restart RadWorks to view the changes.

7 To remove a tooltab, select it and click **Delete**.

Inserting a menu item

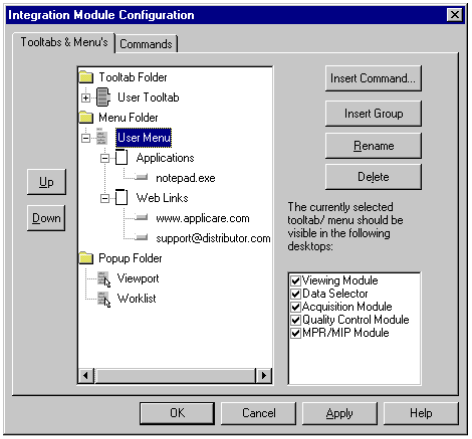
To insert a new menu item ▶ select **Configuration ➔ Integration Module** from the Data Selector menu bar.

1 Select the **Menu Folder** in the folder list on the Tooltabs & Menus tab of the Integration Module Configuration dialog box.

2 Click **Insert Menu**. A new tooltab with the default name 'New Menu' is created.

3 To name the new menu select it, and click **Rename**, type the name you want and select the adjacent icon.

4 On the new menu, you can insert a group or a command. A group appears as a submenu that can contain one or more commands. See the following illustration of a menu with submenus:



5 By default, new menus are displayed in all installed modules. However, to determine in which modules they will be displayed check the check boxes in the list of modules in the bottom-right corner of the Integration Module Configuration dialog box.

6 Click **OK**, to complete the configuration and restart RadWorks to view the changes.

7 To remove a menu item select it, and click **Delete**.

The captions and functions of these buttons depend on the item you select in the list.

Inserting a popup menu item

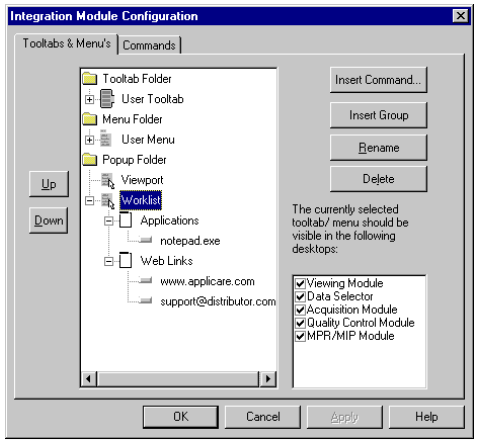
You cannot add your own popup menus. You may, however, add popup groups and commands to the Worklist and Viewport menus.

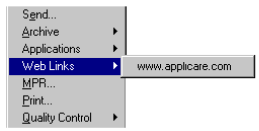
To insert a new popup menu item ▶ select **Configuration ➔ Integration Module** from the RadWorks menu bar.

1. Select the **Worklist** or **Viewport** items below the Popup Folder in the folder list on the Tooltabs & Menus tab of the Integration Module Configuration dialog box.
2. Select the item to which you want to add a Command or Group.
3. Click **Insert Group**, to insert a group or **Command** to insert a command. A group is a submenu.
4. To name a new group select it, and click **Rename**. Type the name you wish and reselect the adjacent icon.

   Below is an example popup menu with submenus:

The captions and functions of these buttons depend on the item you select in the list.





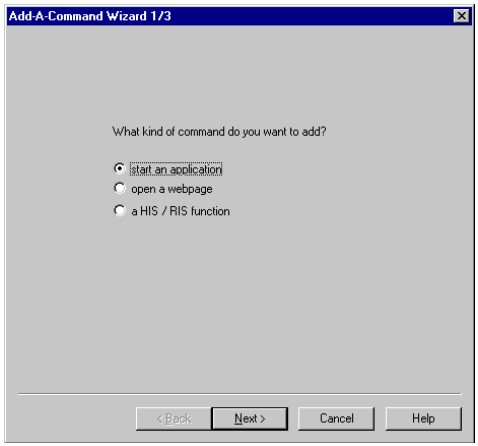
5 By default, new popup items are displayed in all installed modules. However, you can determine the modules in which they will be displayed by checking the check boxes in the list of modules in the bottom-right corner of the Integration Module Configuration dialog box.

6 Click **OK,** and restart RadWorks to view the changes.

7 To remove a group or command, select it and click **Delete**.

Inserting a command

A wizard offers three options to add new commands.



A command can either start an application (such as Microsoft Word), open a web page (such as an HTML-based report) or invoke a HIS-RIS function.

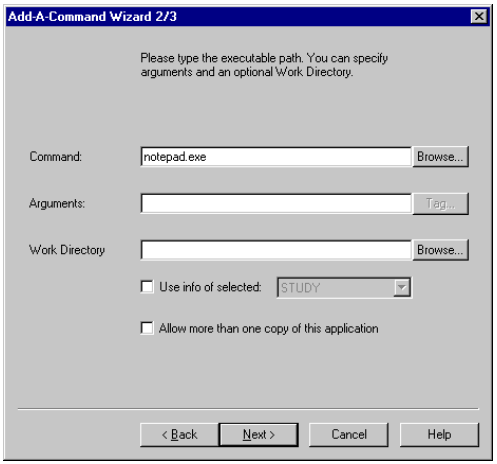
Starting an application with a command

To insert a command to start an application ▶

1 Select the **Commands** tab on the Integration Module Configuration tab (select **Configuration ➔ Integration Module** from the Data Selector menu bar)

2 Check the **Start an application** radio button on the first page of the Add-A-Command Wizard. Click **Next** >.

1 In the **Command** field of the Add a Command wizard, enter the application's name and path, or click **Browse** to locate it. Then find the file in the dialog.:



2 In the Work Directory field, you can define a different working directory for the application than for the executable. Enter the path or click **Browse...** to locate a directory.

3 Another option is to select a DICOM tag from a selected Study, Series, Image or Result, if a RIS client is installed on the RadWorks system. If so, check the 'use info of selected' check box, select which data you want to see (Study, Series, Image or Result) and enter the DICOM tag in the Arguments edit box. Then click **Tag** to add a DICOM tag, and select the tag.

4 Check the 'Allow more than one copy' box to allow you to launch more than one copy of the program. Make sure that the program supports this.

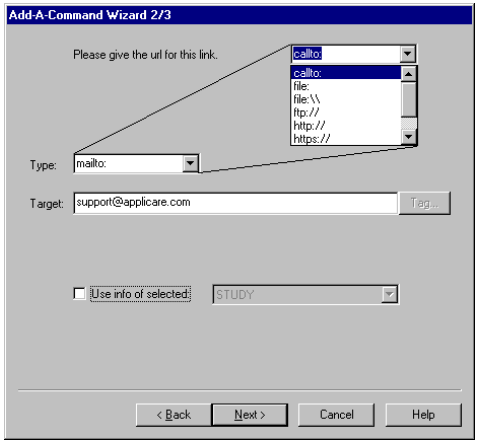
Opening a Web page with a command

To insert a command to open a Web page ▶

1 Select the **Commands** tab on the Integration Module Configuration dialog box (select **Configuration ➔ Integration Module** from the Data Selector menu bar).

2 Check the **Open a web page** radio button on the first page of the Add-A-Command Wizard. Click **Next >**.

3 Select the Type of URL you want to open from the **Type** drop-down list.



4 Enter the Target (a path and file, or an e-mail address).

5 You can forward information if the target allows this. Check the **Use info of selected check box** checkbox, and select the required information to forward it.

If the system is connected to e.g. a Mitra PACS Broker with a web interface you can specify the Patient ID tag as URL.

Accessing a HIS-RIS function with a command

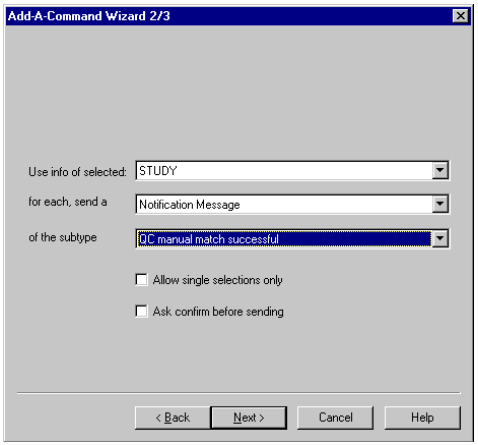
You can either send a Notification or a Transaction message to a HIS/RIS system. The message has the contents of the selected subtype.

To insert a command to access a HIS-RIS function ▶

1 Select the **Commands** tab on the Integration Module Configuration tab (**Configuration ➔ Integration Module** from the RadWorks menu bar).

2 Click a **HIS / RIS function** on the first page of the Add-A-Command Wizard. Click **Next** >.

3 Select the type of information you want to use from the **Use info of selected** drop-down list.



4 Select the type of message you want to send from the **for each, send a** drop-down list.

5 Select the message subtype you want to send. The following subtypes are available:

Type	Message
Teleradiology	submit started
Teleradiology	send successful
Teleradiology	send failed
Teleradiology	study received
Storage	commit successful
Storage	commit failed
Print job	submitted
Print job	successful
Print job	failed
Print job	printing
Print job	suspended
QC	match successful

Overview of subtypes

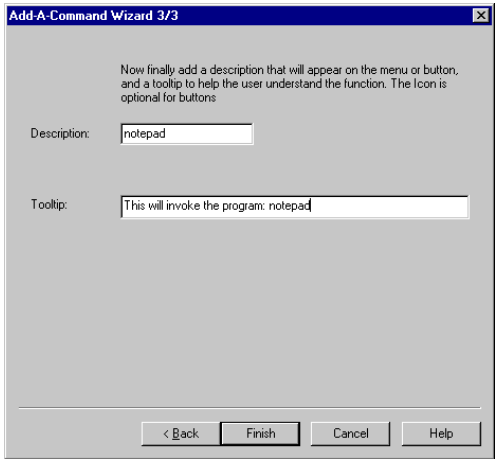
QC	match failed
QC	completed successful
QC	failed
QC	image changed
QC	manual match successful
QC	image deleted
QC	image rotated
ROUTE_WORKLIST	
Viewing	started
Viewing	cancelled
Viewing	suspended
Viewing	dictated
Viewing	reviewed
Viewing	verified
Key images	modified / created
Study	updated
Study	Status changed
Make	stat study
Make	key study

Overview of subtypes

Completing the Command Wizard

To complete the wizard, add a description and a comment.

The button on the Tooltab and a menu item display what you enter in the **Description** field.The list of available commands display what you enter in the **Comment** field.



CHAPTER 9

Configuring Quality Control

This chapter describes how to configure the RadWorks Quality Control Module.

IN THIS CHAPTER

The RadWorks Quality Control Module contains features intended to allow various quality control tasks to be undertaken at designated workstations ('Quality Control Workstations') within a hospital. These workstations are generally located between an acquisition device (such as a CT scanner) and the hospital's network. They perform a 'gatekeeper' function by ensuring that acquired images and studies are correct and have the right patient information associated with them before they are made available at other locations on the network.

Preparations for configuring Quality Control

The Quality Control Module works closely with the Connection Service, especially when you set it up for auto matching or intend to configure the Auto Routing Protocol with Quality Control triggers.

This means that the workstations must be configured in various areas, before you can actually configure the Quality Control Module itself.

Configuring the HIS-RIS implementation

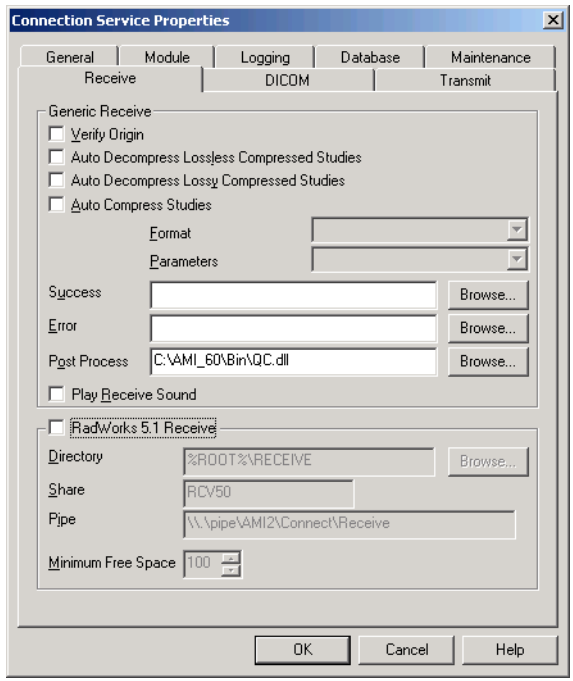
If the Quality Control Module is also to be connected to a HIS or RIS system RadWorks has to be configured in such a way that it can communicate with the HIS/RIS and be able to obtain worklists for matching purposes.

Typically this is done by selecting **Configuration → Generic...** from the Data Selector menu bar **a**nd then the HIS-RIS tab of the Generic Properties dialog box. See the HIS-RIS and Worklists Integration chapter in this guide for more information.

Configuring the Connection Service for auto matching

The Quality Control Module or the Connection Service perform auto matching. You use the Quality Control Module to start auto matching. To do this, select a set of studies and then start the auto matching functionality. Alternatively, you can configure the Connection Service to auto match all incoming studies. In both cases, matching is based on the origin of the study and a user-defined rule.

To configure the Connection Service to auto match incoming studies (triggered by the study origin), select **Configuration → Connection Service...** from the Data Selector menu bar **a**nd then the Receive tab of the Connection Service Properties dialog box. Enter the dynamic link library QC.dll in the Post Process field as shown below.



Restart the Connection Service after adding the Post Process file.

Adding destinations for auto transmission

It is possible to use specific Quality Control Module triggers, such as saving a study or matching a study, to send studies automatically to another workstation or archive.

To prepare the system for this, you will first have to add destinations and configure the Auto Routing Protocol. See the Teleradiology chapter of this guide for details.

Adding origins

The Auto Routing Protocol and the auto matching function both use origins to trigger certain actions.

To prepare the system for either of these, you will hence first have to add any origins that are required. See the Teleradiology chapter in this guide for details.

Adding special study statuses

Auto matching is a background process. It is, therefore, independent of Study Status Permission settings.

During a QC session, the user will need to know whether a study has been successfully matched or not. The Quality Control Module has the capability to set the study status depending on the match result.

We recommend adding two QC-specific study statuses, Matched and Unmatched for example.

Adding worklist views

Creating DICOM modality worklist views is required when the user will what to use (Auto) matching.

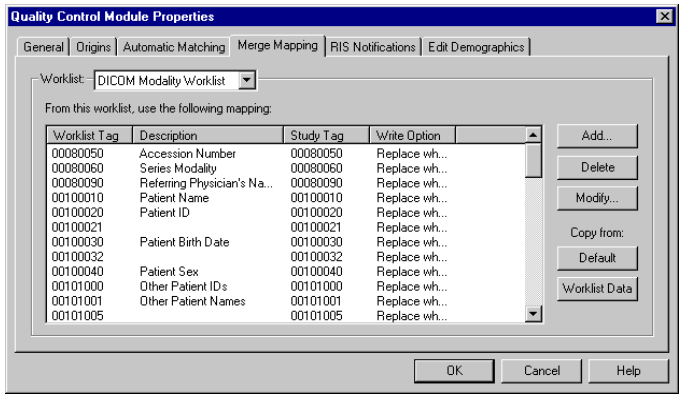
See the on-line Help and the User's Guide for further information on how to configure these.

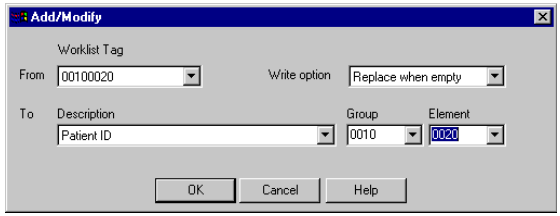
Setting up (auto) matching

Merge mapping

By default, RadWorks will replace tags during matching (automatic or manual).

As each worklist can have a different layout the Quality Control Module allows you to configure the merging / matching for each individual worklist.



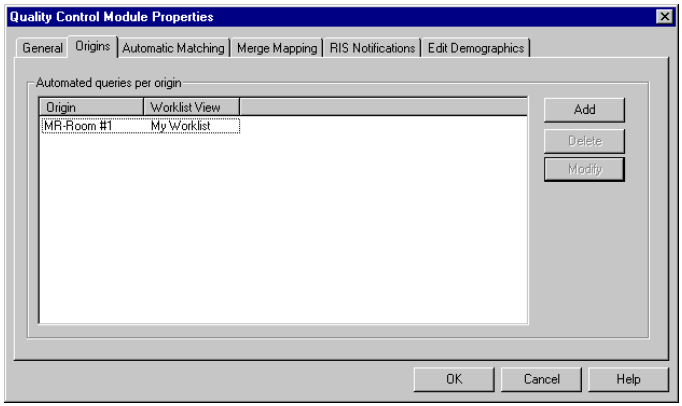


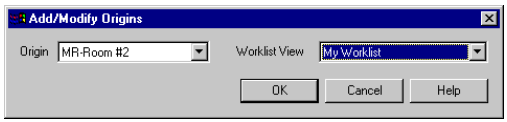
During a QC session, the user can select the relevant worklist view and the entry to match the opened study with. Write options set in the Merge Mapping properties will then be applied.

The administrator can set up a 'default' mapping, which is then used by default on all worklists. The default mapping is configured by selecting the item <default> from the Worklist drop-down list and then adding / modifying / deleting tags.

Origins and worklist views

After configuring origins and (DICOM) modality worklist views, you can configure the Quality Control Module to use a specific worklist for (auto) matching each origin.

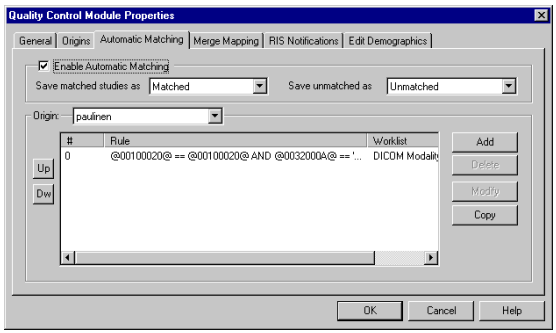




Auto matching

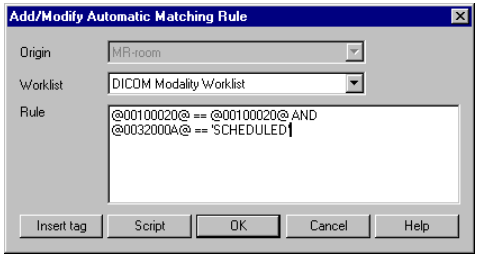
When you set up a system for auto matching, you should make sure the correct dynamic link library has been configured in the Connection Service to automatically match an incoming study.

Then define which rule(s) to use during auto matching.



You can define more than one rule for each origin and move their priorities Up or Down. The first rule that produces a unique match will be used.

Rules specify a worklist where to search for data and a query specific for that worklist.



An Administrator or a user with administrative rights must type the rules.

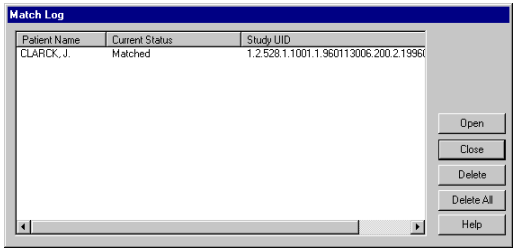
Syntax for a rule:

```
@<Worklist tag>@ == @<Study tag>@ AND …. AND
   @<Worklist tag>@ == '<string>'
```

You are advised to test all rules before using the Auto Matching in practice.

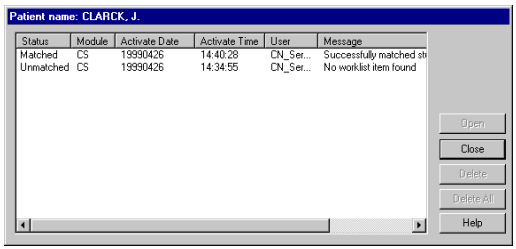
Logging auto matching

On the Quality Control tooltab, users can click **Log** in order to view the matching history of the studies added to the RadWorks system during automatic matching.



Each entry in this dialog will have the status ‘Matched’ or ‘UnMatched’ (the exact name of statuses depends on the system configuration).

To display a second dialog with more detailed information, select an entry and click **Open** (or double click the entry)

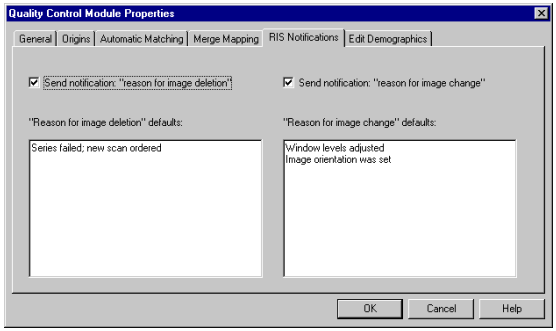


Typical log messages are:

No worklist item found	None of the match rules could identify a unique match. Please verify if the information is available on a worklist or whether the match rule is valid.
Too many entries found: <number>	None of the match rules returned a unique match. The <number> will tell the number of matches that were found while using the last match rule.
Successfully matched with rule: <number>	Informs you which rule was responsible for the successful match.
No merge list available	No merge list was specified in the configuration.
Could not insert all worklist items into study	One of the worklist items could not be merged into the DICOM header. See the RadWorks.log file for more information.
Merging successful	Worklist items are successfully merged into the study object.

Log messages and their meanings

Setting up RIS notifications



If the RadWorks system has been configured to connect to a HIS or RIS system, you can configure RadWorks to send notifications each time a study has been changed. This will apply after for instance Study Status ID changes (either in the Data Selector or the Viewing Section), image manipulations (added window levels, flip/rotate actions, etc.) or any other type of action, which causes RadWorks to save the study.

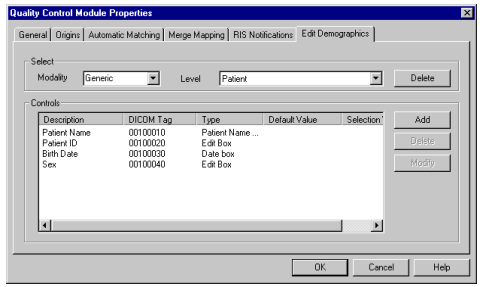
Make sure the Notification functionality is linked to the appropriate HIS-RIS implementation. See the ‘HIS-RIS and Worklists Integration’ chapter of this guide for details.

The Connection and Database Services must be restarted for the changes to take effect.

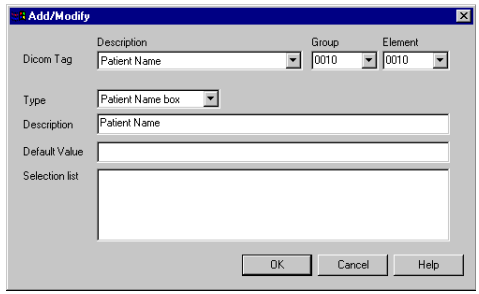
Editing demographics

DICOM tags can be edited with the Quality Control Module as long as it is part of a patient, study, series, or image object. (See the appendix of this guide for a list of all available DICOM tags.)

Below is described how to configure the Quality Control Module for editing the patient demographics.



In this dialog, an administrator can configure which tags are editable for which modality and at which level.



1. To add a tag, click **Add**.
2. In the new dialog, enter the desired tag (by description of by group / element). Enter the field Type (Date box / Drop list / Edit box / ML edit box / Patient box / Time box).
3. In the Default Value field, enter an optional default value
4. If you selected the “drop list” type, enter the possible entries the users can choose from.
5. Click **OK,** so the user can edit the tag the next time the Quality Control Module is started.

In order to create a selection list of more than one item, press Enter to advance to the next line in the Selection List box.

You can specify modality specific tags. For instance, the Transducer type (0017:6031) for Ultrasound. This tag cannot be edited if a CT study is open.

The Study Status ID (0032:000A) is another useful tag. This tag stores the Study Status ID the worklist uses.

Sending Modality Performed Procedure Step messages

RadWorks is able to send MPPS messages using the HIS/RIS Dll called Mpps.dll in the AMI_60/bin directory. You can add this HIS/RIS Implementation with the Add button on the HIS-RIS tab of the Generic Properties page (select **Configuration → Generic...** from the Data Selector menu bar).

After adding the implementation, you should configure the Mpps.dll (using the **Configure** button, after you selected the line Modality Performed Procedure Step [Mpps.dl]) and add it to the Transaction Functionality item in the lower list. (Select **Transaction**, click **Modify**, clear all checkboxes except for Internal and Modality Performed Procedure Step (Mpps.dll) and click **OK)**.

The following new registry keys are created automatically when the Mpps.dll is installed (values are examples):

```
HKEY_LOCAL_MACHINE\SOFTWARE\AMI\AMIL\6.0\HIS_RIS\Implementation\Mpps
"FileName"="Mpps.dll"
"CalledAETitle"="MWLSERVER"
"CalledHost"="3.220.158.129"
"CalledPort"=dword:000008ca
"PerfProcStepIdFormat"=PPS@00080050@
```

After the application is restarted, the Quality Control module can send MPPS messages. You can see this when you click **Save** or **Back**. The Save Dialog will be extended with a Modality Performed Procedure Step combo box, asking users whether they wish to send the message or not. The combo box is only enabled if you matched the study related to a DICOM Modality Worklist item.

If ‘Declare the item completed’ is selected, the Quality Control module will send the MPPS message to the server until it succeeds. If this operation fails, the user can click **Retry**, (this may be helpful if the server was temporarily down) or **Cancel,** in which case the Save or Back operation cannot continue. The only way to save the study in this case is to select ‘Do not declare the item completed’. This implies the user will return to the study.

If you want to declare a worklist item invalid, select Discontinue from the right mouse button menu of the Modality Worklist control.

MPPS data structure and sources

In the current QC implementation, the data from a study is completed (or corrected) with the data from a worklist item. This procedure is called matching. For MPPS the worklist has a second use: reporting of work that has been performed in order to trigger a workflow system. The MPPS IOD definition, therefore, contains both data from the study (that got its data partially from a match procedure) and from the worklist item itself (data that was necessary for the workflow process, but was not saved in the study). The following list displays the MPPS items and the data source.

MPPS Field	VR	DICOM Tag	Source, additional comment
Patient's Name	PN	0x00100010	Patient
Patient ID	LO	0x00100020	Patient
Patient's Birth Date	DA	0x00100030	Patient
Patient's Sex	CS	0x00100040	Patient
Referenced Patient Sequence	SQ	0x00081120	Work list item
>Referenced SOP Class UID	UI	0x00081150	Work list item
>Referenced SOP Instance UID	UI	0x00081155	Work list item
Scheduled Step Attribute Sequence	SQ	0x00400270	Newly created by RadWorks, containing 1 item
>Study Instance UID	UI	0x0020000D	Study, possibly from Worklist (configurable)
>Referenced Study Sequence	SQ	0x00081110	Study, possibly from Worklist (configurable)
>>Referenced SOP Class UID	UI	0x00081150	Study, possibly from Worklist (configurable)
>>Referenced SOP Instance UID	UI	0x00081155	Study, possibly from Worklist (configurable)
>Accession Number	SH	0x00080050	Study, possibly from Worklist (configurable)
>Placer Order Number/Imaging Service Request	SH	0x00402006	Worklist
>Filler Order Number/Imaging Service Request	SH	0x00402007	Worklist
>Placer Order Number/Imaging Service Request	LO	0x00402016	Worklist
>Filler Order Number/ImagingService Request	LO	0x00402017	Worklist
>Requested Procedure ID	SH	0x00401001	Worklist
>Requested Procedure Description	LO	0x00321060	Worklist

>Placer Order Number/Procedure	SH	0x00401006	Worklist
>Filler Order Number/Procedure	SH	0x00401007	Worklist
>Scheduled Procedure Step ID	SH	0x00400009	Worklist
>Scheduled Procedure Step Description	LO	0x00400007	Worklist
>Scheduled Action Item Code Sequence	SQ	0x00400008	Worklist
>>Code Value	SH	0x00080100	Worklist
>>Coding Scheme designator	SH	0x00080102	Worklist
>>Code Meaning	LO	0x00080104	Worklist
Performed Station AE Title	AE	0x00400241	Filled in by RadWorks,
Performed Station Name	SH	0x00400242	-
Performed Location	SH	0x00400243	-
Performed Procedure Step Start Date	DA	0x00400244	First Image of first Series: Acquisition Date
Performed Procedure Step Start Time	TM	0x00400245	First image of first Series: Acquisition Time
Performed Procedure Step ID	SH	0x00400253	RadWorks, generated from configurable tags
Performed Procedure Step End Date	DA	0x00400250	RadWorks, system date
Performed Procedure Step End Time	TM	0x00400251	RadWorks, system time
Performed Procedure Step Status	CS	0x00400252	RadWorks
Performed Procedure Step Description	LO	0x00400254	-
Comments on the Performed Procedure Step	ST	0x00400280	-
Performed Procedure Type Description	LO	0x00400255	-
Procedure Code Sequence	SQ	0x00081032	Worklist
>Code Value	SH	0x00080100	Worklist
>Coding Scheme Designator	SH	0x00080102	Worklist
>Code Meaning	LO	0x00080104	Worklist
Modality	CS	0x00080060	Study
Study ID	SH	0x00200010	Study

Performed Action Item Sequence	SQ	0x00400260	Worklist
>Code Value	SH	0x00080100	Worklist
>Coding Scheme Designator	SH	0x00080102	Worklist
>Code Meaning	LO	0x00080104	Worklist
Performed Series Sequence	SQ	0x00400340	Study, 1 item for every series in the study
>Performing Physician's Name	PN	0x00081050	Series
>Operator's Name	PN	0x00081070	Series
>Protocol Name	LO	0x00181030	-
>Series Instance UID	UI	0x0020000E	Series
>Series Description	LO	0x0008103E	Series
>Retrieve AE Title	AE	0x00080054	RadWorks, System AE-Title
>Referenced Image Sequence	SQ	0x00081140	Series, 1 item for every image
>>Referenced SOP Class UID	UI	0x00081150	Image
>>Referenced SOP Instance UID	UI	0x00081155	Image
>Referenced Standalone SOP Instance Sequence	SQ	0x00400220	-
>>Referenced SOP Class UID	UI	0x00081150	-
>>Referenced SOP Instance UID	UI	0x00081155	-
Anatomic Structure Space or Region Sequence	SQ	0x00082229	-
>Code Value	SH	0x00080100	-
>Coding Scheme Designator	SH	0x00080102	-
>Code Meaning	LO	0x00080104	-
Total Time of Fluoroscopy	US	0x00400300	First Image of first Series:
Total Number of Exposures	US	0x00400301	First Image of first Series:
Distance Source to Detector SID	DS	0x00181110	First image of first Series:
Distance Source to Entrance	DS	0x00400306	First image of first Series:
Entrance Dose	US	0x00400302	First image of first Series:
Exposed Area	US	0x00400303	First image of first Series:

Image Area Dose Product	DS	0x0018115E	First image of first Series:
Comments on Radiation Dose	ST	0x00400310	First image of first Series:
Billing Procedure Step Sequence	SQ	0x00400320	-
>Code Value	SH	0x00080100	-
>Coding Scheme Designator	SH	0x00080102	-
>Code Meaning	LO	0x00080104	-
Film Consumption Sequence	SQ	0x00400321	-
>Number of Films	IS	0x21000170	-
>Medium Type	CS	0x20000030	-
>Film Size ID	CS	0x20100050	-
Billing Supplies and Devices Sequence	SQ	0x00400324	-
>Billing Item Sequence	SQ	0x00400296	-
>>Code Value	SH	0x00080100	-
>>Coding Scheme Designator	SH	0x00080102	-
>>Code Meaning	LO	0x00080104	-
>Quantity Sequence	SQ	0x00400293	-
>>Quantity	DS	0x00400294	-
>>Measuring Units Sequence	SQ	0x00400295	-
>>>Code Value	SH	0x00080100	-
>>>Coding Scheme Designator	SH	0x00080102	-
>>>Code Meaning	LO	0x00080104	-

Dynamics

The MPPS HIS/RIS Interface function Transaction() receives a dcmset containing all necessary data to send both a MPPS N-CREATE and an N-SET. This set could contain a Referenced Study Component Sequence from the study involved, which is supposed to contain 0 or 1 sequence items containing the MPPS Instance UID (0008,1155). If this Referenced Study Component tag is present in the input set and contains one item, an N-GET is performed to query the SCP for the existence of the MPPS IOD. If it does not yet exist, a new UID is generated and used to issue an MPPS N-CREATE. In either case, the transaction is completed with an MPPS N-SET. The MPPS UID that was used for the MPPS operation is returned to the caller, in order to copy the UID to the study involved.

When sending a MPPS Discontinued message, no study is involved, so there is no place to retrieve a possible MPPS Instance UID from. Inherently, a discontinue message will always consist of a MPPS N-CREATE ('IN PROGRESS'), immediately, followed by a MPPS N-SET Message, with the MPPS Status ID set to 'DISCONTINUED'.

MPPS information sent to HIS/RIS system

There are two occasions when MPPS information is sent to the HIS/RIS system:

Discontinued

When a study is selected from the Modality Worklist in the QC module and the Discontinue action is selected from the right mouse button menu, the corresponding MPPS information is sent to the HIS/RIS system (with the Performed Procedure Step Status set to 'DISCONTINUED'). The following DICOM values are passed with the MPPS information:

Field	Tag	Type
Patient's Name	(0010,0010)	PN
Patient ID	(0010,0020)	LO
Patient's Birth Date	(0010,0030)	DA
Patient's Sex	(0010,0040)	CS
Referenced Patient Sequence	(0008,1120)	SQ
>Referenced SOP Class UID	(0008,1150)	UI
>Referenced SOP Instance UID	(0008,1155)	UI

DICOM values sent with status set to 'Discontinued'

Scheduled Step Attribute Sequence	(0040,0270)	SQ
>Study Instance UID	(0020,000D	UI
>Referenced Study Sequence	(0008,1110)	SQ
>>Referenced SOP Class UID	(0008,1150)	UI
>>Referenced SOP Instance UID	(0008,1155)	UI
>Accession Number	(0008,0050)	SH
>Placer Order Number/Imaging Service Request	(0040,2006)	SH
>Filler Order Number/Imaging Service Request	(0040,2007)	SH
>Placer Order Number/Imaging Service Request	(0040,2016)	LO
>Filler Order Number/Imaging Service Request	(0040,2017)	LO
>Requested Procedure ID	(0040,1001)	SH
>Requested Procedure Description	(0032,1060)	LO
>Placer Order Number/Procedure	(0040,1006)	SH
>Filler Order Number/Procedure	(0040,1007)	SH
>Scheduled Procedure Step ID	(0040,0009)	SH
>Scheduled Procedure Step Description	(0040,0007)	LO
>Scheduled Action Item Code Sequence	(0040,0008)	SQ
>>Code Value	(0008,0100)	SH
>>Coding Scheme designator	(0008,0102)	SH
>>Code Meaning	(0008,0104)	LO
Performed Station AE Title	(0040,0241)	AE
Performed Station Name	(0040,0242)	SH
Performed Location	(0040,0243)	SH
Performed Procedure Step Start Date	(0040,0244)	DA
Performed Procedure Step Start Time	(0040,0245)	TM
Performed Procedure Step ID	(0040,0253)	SH
Performed Procedure Step End Date	(0040,0250)	DA
Performed Procedure Step End Time	(0040,0251)	TM

DICOM values sent with status set to ‘Discontinued’

Performed Procedure Step Status	(0040,0252)	CS
Performed Procedure Step Description	(0040,0254)	LO
Comments on the Performed Procedure Step	(0040,0280)	ST
Performed Procedure Type Description	(0040,0255)	LO
Procedure Code Sequence	(0008,1032)	SQ
>Code Value	(0008,0100)	SH
>Coding Scheme Designator	(0008,0102)	SH
>Code Meaning	(0008,0104)	LO
Modality	(0008,0060)	CS
Study ID	(0020,0010)	SH
Study Identifier Performed Action Item Sequence	(0040,0260)	SQ
>Code Value	(0008,0100)	SH
>Coding Scheme Designator	(0008,0102)	SH
>Code Meaning	(0008,0104)	LO
Performed Series Sequence	(0040,0340)	SQ
>Performing Physician's Name	(0008,1050)	PN
>Operator's Name	(0008,1070)	PN
>Protocol Name	(0018,1030)	LO
>Series Instance UID	(0020,000E	UI
>Series Description	(0008,103E	LO
>Retrieve AE Title	(0008,0054)	AE
>Referenced Image Sequence	(0008,1140)	SQ
>>Referenced SOP Class UID	(0008,1150)	UI
>>Referenced SOP Instance UID	(0008,1155)	UI
>Referenced Standalone SOP Instance Sequence	(0040,0220)	SQ
>>Referenced SOP Class UID	(0008,1150)	UI
>>Referenced SOP Instance UID	(0008,1155)	UI
Anatomic Structure Space or Region Sequence	(0008,2229)	SQ

DICOM values sent with status set to ‘Discontinued’

>Code Value	(0008,0100)	SH
>Coding Scheme Designator	(0008,0102)	SH
>Code Meaning	(0008,0104)	LO
Total Time of Fluoroscopy	(0040,0300)	US
Total Number of Exposures	(0040,0301)	US
Distance Source to Detector SID	(0018,1110)	DS
Distance Source to Entrance	(0040,0306)	DS
Entrance Dose	(0040,0302)	US
Exposed Area	(0040,0303)	US
Image Area Dose Product	(0018,115E	DS
Comments on Radiation Dose	(0040,0310)	ST
Billing Procedure Step Sequence	(0040,0320)	SQ
>Code Value	(0008,0100)	SH
>Coding Scheme Designator	(0008,0102)	SH
>Code Meaning	(0008,0104)	LO
Film Consumption Sequence	(0040,0321)	SQ
>Number of Films	(2100,0170)	IS
>Medium Type	(2000,0030)	CS
>Film Size ID	(2010,0050)	CS
Billing Supplies and Devices Sequence	(0040,0324)	SQ
>Billing Item Sequence	(0040,0296)	SQ
>>Code Value	(0008,0100)	SH
>>Coding Scheme Designator	(0008,0102)	SH
>>Code Meaning	(0008,0104)	LO
>Quantity Sequence	(0040,0293)	SQ
>>Quantity	(0040,0294)	DS
>>Measuring Units Sequence	(0040,0295)	SQ
>>>Code Value	(0008,0100)	SH

DICOM values sent with status set to ‘Discontinued’

>>>Coding Scheme Designator	(0008,0102)	SH
>>>Code Meaning	(0008,0104)	LO

DICOM values sent with status set to 'Discontinued'

Completed

Each time, a match for a local study is done successfully from within the QC module (either manual or automatic), the dialog below will appear when the study is saved. When 'Declare the item completed' is selected, the corresponding MPPS information is sent to the HIS/RIS system (with the Performed Procedure Step Status set to 'COMPLETED').

No MPPS information is sent to the HIS/RIS system when automatic matching is done outside of the QC module.

The following DICOM values are passed with the MPPS information:

Field	Tag	Type
Patient's Name	(0010,0010)	PN
Patient ID	(0010,0020)	LO
Patient's Birth Date	(0010,0030)	DA
Patient's Sex	(0010,0040)	CS
Referenced Patient Sequence	(0008,1120)	SQ
>Referenced SOP Class UID	(0008,1150)	UI
>Referenced SOP Instance UID	(0008,1155)	UI
Scheduled Step Attribute Sequence	(0040,0270)	SQ
>Study Instance UID	(0020,000D	UI
>Referenced Study Sequence	(0008,1110)	SQ
>>Referenced SOP Class UID	(0008,1150)	UI
>>Referenced SOP Instance UID	(0008,1155)	UI
>Accession Number	(0008,0050)	SH
>Placer Order Number/Imaging Service Request	(0040,2006)	SH
>Filler Order Number/Imaging Service Request	(0040,2007)	SH
>Placer Order Number/Imaging Service Request	(0040,2016)	LO
>Filler Order Number/Imaging Service Request	(0040,2017)	LO
>Requested Procedure ID	(0040,1001)	SH

DICOM values sent with status set to 'Completed'

>Requested Procedure Description	(0032,1060)	LO
>Placer Order Number/Procedure	(0040,1006)	SH
>Filler Order Number/Procedure	(0040,1007)	SH
>Scheduled Procedure Step ID	(0040,0009)	SH
>Scheduled Procedure Step Description	(0040,0007)	LO
>Scheduled Action Item Code Sequence	(0040,0008)	SQ
>>Code Value	(0008,0100)	SH
>>Coding Scheme designator	(0008,0102)	SH
>>Code Meaning	(0008,0104)	LO
Performed Station AE Title	(0040,0241)	AE
Performed Station Name	(0040,0242)	SH
Performed Location	(0040,0243)	SH
Performed Procedure Step Start Date	(0040,0244)	DA
Performed Procedure Step Start Time	(0040,0245)	TM
Performed Procedure Step ID	(0040,0253)	SH
Performed Procedure Step End Date	(0040,0250)	DA
Performed Procedure Step End Time	(0040,0251)	TM
Performed Procedure Step Status	(0040,0252)	CS
Performed Procedure Step Description	(0040,0254)	LO
Comments on the Performed Procedure Step	(0040,0280)	ST
Performed Procedure Type Description	(0040,0255)	LO
Procedure Code Sequence	(0008,1032)	SQ
>Code Value	(0008,0100)	SH
>Coding Scheme Designator	(0008,0102)	SH
>Code Meaning	(0008,0104)	LO
Modality	(0008,0060)	CS
Study ID	(0020,0010)	SH
Study Identifier Performed Action Item Sequence	(0040,0260)	SQ

DICOM values sent with status set to ‘Completed’

>Code Value	(0008,0100)	SH
>Coding Scheme Designator	(0008,0102)	SH
>Code Meaning	(0008,0104)	LO
Performed Series Sequence	(0040,0340)	SQ
>Performing Physician's Name	(0008,1050)	PN
>Operator's Name	(0008,1070)	PN
>Protocol Name	(0018,1030)	LO
>Series Instance UID	(0020,000E	UI
>Series Description	(0008,103E	LO
>Retrieve AE Title	(0008,0054)	AE
>Referenced Image Sequence	(0008,1140)	SQ
>>Referenced SOP Class UID	(0008,1150)	UI
>>Referenced SOP Instance UID	(0008,1155)	UI
>Referenced Standalone SOP Instance Sequence	(0040,0220)	SQ
>>Referenced SOP Class UID	(0008,1150)	UI
>>Referenced SOP Instance UID	(0008,1155)	UI
Anatomic Structure Space or Region Sequence	(0008,2229)	SQ
>Code Value	(0008,0100)	SH
>Coding Scheme Designator	(0008,0102)	SH
>Code Meaning	(0008,0104)	LO
Total Time of Fluoroscopy	(0040,0300)	US
Total Number of Exposures	(0040,0301)	US
Distance Source to Detector SID	(0018,1110)	DS
Distance Source to Entrance	(0040,0306)	DS
Entrance Dose	(0040,0302)	US
Exposed Area	(0040,0303)	US
Image Area Dose Product	(0018,115E	DS
Comments on Radiation Dose	(0040,0310)	ST

DICOM values sent with status set to ‘Completed’

Billing Procedure Step Sequence	(0040,0320)	SQ
>Code Value	(0008,0100)	SH
>Coding Scheme Designator	(0008,0102)	SH
>Code Meaning	(0008,0104)	LO
Film Consumption Sequence	(0040,0321)	SQ
>Number of Films	(2100,0170)	IS
>Medium Type	(2000,0030)	CS
>Film Size ID	(2010,0050)	CS
Billing Supplies and Devices Sequence	(0040,0324)	SQ
>Billing Item Sequence	(0040,0296)	SQ
>>Code Value	(0008,0100)	SH
>>Coding Scheme Designator	(0008,0102)	SH
>>Code Meaning	(0008,0104)	LO
>Quantity Sequence	(0040,0293)	SQ
>>Quantity	(0040,0294)	DS
>>Measuring Units Sequence	(0040,0295)	SQ
>>>Code Value	(0008,0100)	SH
>>>Coding Scheme Designator	(0008,0102)	SH
>>>Code Meaning	(0008,0104)	LO

DICOM values sent with status set to ‘Completed’

CHAPTER 10

Setting up single media archives

This chapter describes the installation and configuration of the Single Media Archive functionality in RadWorks.

IN THIS CHAPTER

With RadWorks, users can store images in a single media archive. This means they can copy images from their local RadWorks database to a read-write storage medium such as a zip disk or even a floppy disk. It also means they can copy images to a read-only storage medium such as a CD-R or DVD-R disk.

Setting up RadWorks to copy data to single media

The steps for settings up RadWorks to copy data to external media differ slightly depending on whether the media to be written to is read-write or read-only. Both possibilities are covered below.

To configure single media archiving for use with a read-write medium ▶

1. Select **Configuration** → **Single Media Archive** from the Data Selector menu bar. In the Configure Single Media Archiving dialog box, select **Read-Writable** from the Media Type drop-down list.
2. Enter in the Device field, the drive of the device and the path to which you are copying data to or from, or click the **Browse…** button.
3. Enter in the **Total Size** field, the storage limit of the medium you are using.
4. Use the **Block Size** field, to define the size of the blocks you want for your read-write medium. The recommended setting is 4.
5. Check the **Store images JPEG Lossless compressed** check box, if you want to store your images using JPEG Lossless format.
6. Check the **Copy files** check box, to indicate that you want to copy additional items to your read-write medium. Then enter the path from where you want to copy those items (or use the **Browse…** button). An example of such an item might be the RadWorks CD Viewer. Note, that you copy the contents of entire folders, not individual files.
7. Check the **Delete after archiving** check box, if you want the study deleted after it has been copied, and then click **OK**.

To configure single media archiving for use with a read-only medium ▶

1. Select **Configuration → Single Media Archive** from the Data Selector menu bar. In the Configure Single Media Archiving dialog box select **Read-Only** from the Media Type drop-down list.
2. Enter in the Device field, the drive of the device to which you are copying data to or from, or click the **Browse…** button.
3. Specify in the **Total Size** field the storage limit of the medium you are using. For CD this is 650 or 720 MB; for DVD, 2.9 GB or 4.3 GB, depending on the DVD and the device you are using.
4. In the **Block Size** field, define the size of the blocks you want for your read-only medium. The recommended setting is 4.
5. Click the **Store images JPEG Lossless compressed** check box, if you want to store your images using JPEG Lossless format.
6. Check the **Copy files** check box, to indicate that you want to copy additional items to your read-only medium. Then enter the path from where you want to copy those items (or use the **Browse…** button). An example of such an item might be the RadWorks CD Viewer. Note that you copy the contents of entire folders, not individual files.
7. In the **Image directory** field, type in the path and directory where you want your images to go on your CD or DVD, or use the **Browse…** button.
8. Check the **Verify burned contents** check box, if you want a message stating that your data has been has been copied to the CD.
9. Check the **Delete after archiving** check box, if you want the study deleted after it has been copied, and then click **OK**.
   Note that this option will only be performed after data from the local database is archived, not with archiving data you selected.

Setting up RadWorks to copy from a read-write medium

Just as users can copy data from RadWorks to single media, they can also do the reverse. That is, they can copy from a read-write medium to RadWorks, provided the workstation is set up as detailed below.

The first step entails creating a worklist to which you can copy data.

To create a worklist to which you can export data ▶

1. In the Data Selector, select **Configuration** → **Generic** from the menu bar.
2. Click on the **HIS-RIS** tab in the Generic Properties dialog box. In the Implementations section, select **Default HIS-RIS implementation (**RadWorks **Default)**. Then click **Config…**.
3. Select the **Study/Patient** list tab in the Configure RadWorks Default HIS/RIS Implementation dialog. Then click **Add**.
4. In the Patient/Study List dialog, enter a name in the **Description** field for the study list you want to create and select from the Type list the kind of list you want to make; e.g., Study list or Patient list. Click **Add** again.
5. Select **DICOM Volume** from the Type list in the Source dialog box. Next, type in the drive of the device containing the images you want to import into your RadWorks worklist.
6. Click **Test** to see whether your connection will work. If a message appears stating that the connection has failed, go back and correct any mistakes you have made and check if the storage device you are connecting to contains data. Otherwise, click **OK** until you reach the Data Selector. Furthermore, make sure you have a read-write medium to copy data from.
7. Exit RadWorks and restart it.

Copying data from a read-write medium and viewing it in RadWorks

Once you have configured the worklist view, users can view it in RadWorks and export their data from the read-write medium back to RadWorks.

To view studies from a single medium archive in a worklist view ▶

1. In the Data Selector, select **Database** → **Add view** from the menu bar.
2. In the Add View dialog, specify the **Description** field by typing in a description for your new study list.
3. From **List**, select the new worklist you created.
4. Use the **Copy settings from** list to indicate the list whose settings should apply to the worklist you created.
5. Click **OK**, and view the worklist by selecting it from the Worklist View drop-down list on the Data Selector tooltab.
6. Double-click the study to view it. Note that you can only view the study if the Direct View checkbox on the General tab of the Viewing Properties dialog box is checked (select **Configuration** → **Viewing** from the Data Selector menu bar to view this). If you want to import the study, select it, right-click it and then left-click **Import** from the shortcut menu. RadWorks will return the file to the worklist view where it came from.

CHAPTER 11

Configuring data acquisition

This chapter describes the installation and configuration of the RadWorks Data Acquisition Module.

IN THIS CHAPTER

With RadWorks, it is possible to connect to a wide variety of input devices using the Data Acquisition Module. This chapter lists which devices are supported and explains how to install them.

Supported devices

This version of RadWorks contains support for and is tested with the following devices:

Digitizers

- Howtek 450
- Howtek 850 / 960
- Howtek Scanmaster DX
- Lumisys Lumiscan 75 (also tested with LS50, LS85)
- Vidar devices (e.g. VXR-12, Diagnostic Pro)
- TWAIN devices (e.g. document scanner, digital camera, etc.)

Frame grabbers

- Matrox Meteor I (only for Windows NT 4.0 systems)
- Matrox Meteor II
- Data Translation Mach DT3153
- Matrox Pulsar (only for Windows NT 4.0 systems)
- Foresight HI*DEF and I-60

Utilities

- Frame Grabber Emulator: for demonstration purposes.
- Frame Digitizer Emulator: for demonstration purposes.
- Graphic File & Clipboard Reader: for importing BMPs and non-compressed TIFF files, importing from the clipboard.

The emulators can be used to test the behavior of the Frame Grabber and Digitizer software (or to demonstrate both).

The Setup program for RadWorks installs most device drivers automatically, but some need additional manual work.

Key features of supported digitizers

The key features of digitizers supported by RadWorks are shown in the table below.

	Type	OD	DPI	Rescan	Feeder
Howtek Scanmaster-DX	CCD	.01-3.4	512 (8K)	Yes	No
Howtek 850 / 960	CCD	.01-3.6	584 (8K)	Yes	Yes
Howtek 450	CCD	.01-3.6	292 (4K)	Yes	Yes
Vidar VXR-12	CCD	.01-3.0	300	Opt.	No(t yet)
Vidar Diagnostic Pro	CCD	?	?	Yes	Yes
Lumisys LS75	Laser	.05-3.5	256	No	Yes (6)
Lumisys LS85	Laser	.03-4.1	512	No	Yes (6)

Key features of supported digitizers. OD = Optical density, the degree of light that passes through a film (0 = White and ~3.5 = Black)

Key features of supported frame grabber boards

Frame grabbers offer the ability to import images from modalities without DICOM or other digital image interfaces which have a video output signal (endoscopes, microscopes, etc.).

The Meteor and Mach boards are in the lower price range and support color.

The Pulsar and Foresight are more expensive, are monochrome, but support higher sampling rates and non-standard video signals.

Matrox Meteor I

This frame grabber is not supported on systems running Windows 2000.

- 4 composite color, Y/C or monochrome input channels,
- NTSC/PAL/SECAM, RS-170/CCIR, no support for non-standard signals,
- 8-bit digitalization,
- Max. sampling rate: standard (approx. 21MHz),
- PCI,
- No frame memory, uses DMA to Host memory,
- Optional RGB module, optional TV module,

- Programmable region of interest (ROI); only for non-RGB signals.

A typical application of this board is color or monochrome acquisition of standard video signals.

RGB should be used when available, since superior quality is obtained. Y/C is, however, lost.

Matrox Meteor II

This frame grabber is supported on systems running Windows 2000.

- 4 composite color, Y/C or monochrome input channels
- NTSC/PAL/SECAM, RS-170/CCIR, no support for non-standard signals
- 8-bit digitalization
- Max. sampling rate: standard (approx. 21MHz)
- PCI
- No frame memory, uses DMA to Host memory
- Optional RGB module, optional TV module
- Programmable region of interest (ROI); only for non-RGB signals

Data Translation Mach DT3153

- 3 composite color, Y/C or monochrome input channels
- NTSC/PAL
- PCI
- No frame memory, uses DMA to Host memory
- Programmable region of interest for acquisition.

The board has the option of real-time ('direct') video overlay in video memory, but RadWorks does not use this feature.

Matrox Pulsar

- 4 monochrome analog input channels
- 10-bit digitalization, high frame-rates
- Max. sampling rate: 45MHz
- PCI
- Supports non-standard video signals
- 2Mb Frame memory, 2Mb overlay memory

- Displaying capabilities on-board (max. 1600x1200x256 colors)
- Optional 16-bit Digital (TTL) interface. Typical application: grab from devices that produce non-interlaced video signals
- Line-scan cameras
- Old CT scanners
- PC monitors

Foresight HI*DEF Plus

RadWorks supports 8-bit capturing only, and does not use overlay.

- 4 monochrome analog input channels, 4 TTL level input channels
- 8-bit digitalization, high frame-rates
- Max. sampling rate (pixel rate): 140MHz
- Horizontal Frequency: Up to 78kHz
- ISA
- 2Mb Frame memory
- Supports non-standard video signals. Typical application: grab from devices that produce non-interlaced video signals
- Line-scan cameras
- Old CT scanners
- PC monitors

Foresight HI*DEF Accura

- 4 monochrome analog input channels, 4 TTL level input channels
- 8/10-bit digitalization, high frame rates
- Max. sampling rate (pixel rate): 150MHz
- Horizontal Frequency: Up to 105kHz
- PCI
- 4Mb Frame memory
- Supports non-standard video signals. Typical application: grab from devices that produce non-interlaced video signals
- Line-scan cameras
- Old CT scanners
- PC monitors

RadWorks Acquisition Module Setup

Use the **Add/Remove Programs** control panel to install the devices described in the previous section.

Before installing, read the complete section with specifics concerning the device you want to install. Before installing the software, make sure you have installed the necessary hardware for the computer.

For more information on installing the hardware, see the specifics in sections 'Installation and configuration of digitizers' on page 225 and 'Installation and configuration of frame grabbers' on page 232.

The table below lists when RadWorks Setup (via Add/Remove Programs) will install the necessary device drivers and in which cases you need to install the hardware vendor's software prior to running RadWorks Setup

Device	Drivers
Matrox Meteor	Installed by Setup
Matrox Pulsar	Installed by Setup
Mach DT3153	Run Mach installation software
Foresight HI*DEF Plus	Installed by Setup
Foresight HI*DEF Accura	Installed by Setup (select HI*DEF Plus)
Howtek Scanmaster DX	Install SCSI device Run WNASPI software
Howtek MultiRad 850	Install SCSI device Run WNASPI software
Howtek MultiRad 450	Install SCSI device Run WNASPI software
Vidar VXR-12	Install SCSI device Run WNASPI software
Lumisys Lumiscan	Installed by Setup
Frame Grabber Emulator	-
Digitizer Emulator	-
Graphics File & Clipboard Reader	-
TWAIN device driver	Installed by Setup

Device driver installation

For some devices you can find additional software in the 3RDPARTY folder on your RadWorks CD-ROM.

Software

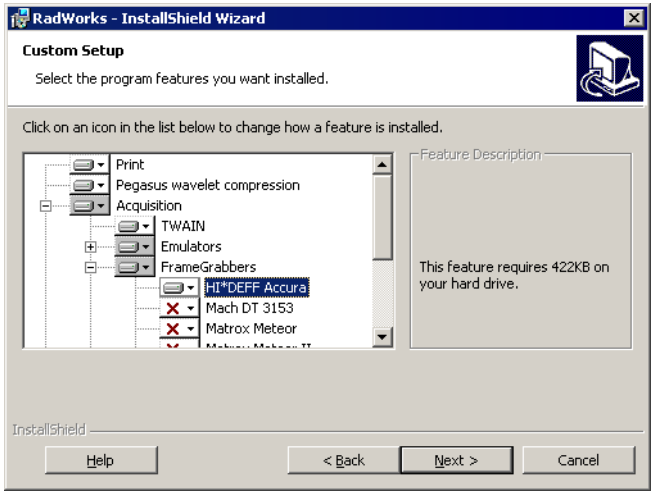
The general part of the Acquisition Module is installed automatically if you install an Acquisition device.

To install the Acquisition Module and acquisition devices ▶

1. Make sure you are logged on with administrative rights. Otherwise the Setup program will not install the device drivers.

2. In the **Add/Remove Programs** control panel, select RadWorks and click **Change**.
   The RadWorks installer starts.

3. In the **Custom Setup** dialog, select the device(s) you want to install.



4. During the installation of the devices, additional dialogs may appear with device-specific options. Enter the required information (see the relevant sections later in this chapter).

5. You are now ready to install the selected components. Click **Finish** to proceed.

6. The Setup Report informs you what has been installed, removed or not installed. Check the relevant lines of the Setup Report to see if the installation was successful.

Configuring the Acquisition Module

The configuration parameters related to acquisition are distributed over three different locations:

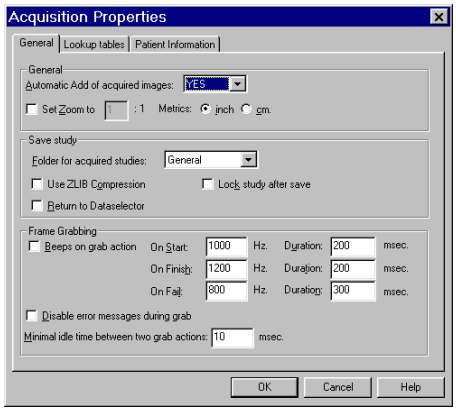
1. The General Acquisition properties dialog box (to access this, select **Configuration** → **Acquisition...** from the Data Selector menu bar).
2. Hardware specific settings (Device Management): To access this, select **Acquire** → **Devices…** from the Data Selector menu bar.
3. Acquire action settings. To access, click **Image Types** in the Acquisition module.

1 and 2 contain parameters that only need to be configured once when you install a new device, and can only be performed with administrative rights. 3, however, contains parameters that the user may wish to change for each individual acquire action.

Configuring acquisition properties within RadWorks

To configure acquisition properties within RadWorks, select **Configuration → Acquisition...** from the Data Selector menu bar.

Settings on the General tab:



Automatic Add of acquired images

If Yes is selected here (default), acquired images are added to the series.

Set Zoom to

If this checkbox is checked, a default zoom factor for new acquired images can be defined here. This can be useful when using a frame grabber in continuous mode. If the zoom factor is set to 1:1, nothing extra is required to display the image, which speeds up the refresh rate for the screen. This option is unchecked by default.

Metrics

Select these to be displayed in centimeters or inches (default).

Save Study section:

Folder for acquired studies

Newly acquired studies are saved to this folder. One of the locally available folders can be chosen.

Use ZLIB Compression

If enabled, a study is compressed before it is saved. The compression method used is ZLIB. When enabled, the size of the saved study is much less then uncompressed (up to 10 times), but save time is longer (up to twice compared to uncompressed).

Send study after save to

This option allows you to automatically transmit newly acquired studies to a pre-defined destination. In the drop-down list, you can select destinations that have been defined in the **Connection menu ➔ Destinations** option of the Data Selector.

Return to Data Selector

If you use the Acquisition Module you will want to continue with a new acquisition after saving the previous one. Enabling this option will automatically close the Acquisition Module after each save action.

Frame Grabbing section:

- Beeps on grab action
  This is a useful option when using remote controls. If enabled, and the current acquisition device is a frame grabber, an acquisition action will be preceded and followed by a beep.
- On Start .. Hz, On Finish .. Hz, On Fail .. Hz
  Frequency of start, finish and fail beep.
- Duration: .. msec
  Length of a beep in milliseconds.

Disable error messages during grab

When grabbing an image with a frame grabber, errors may occur. A lot of data has to be transferred from the card to the main memory, especially, in continuous mode. To prevent the continuous mode from breaking, you can switch off the error messages during a grab action. A good idea is to enable this option during the configuration of the system, and to disable it during normal use.

Minimal idle time between grab actions

You use this option to optimize system behavior during continuous mode. This time is the minimal idle time (in milliseconds) between two consecutive grab actions, which the system can use to perform other actions, like re-computing the Pictorial Index.

Settings on the Look-up tables tab

Devices

Lists the acquisition devices which have been installed on the system.

LUT area

Description

Name of the look-up table

Depth

Bit-depth of the images where this LUT may be applied to. Usually, 8 or 12 bits.

Type

- User: a user-defined LUT will be used.
- Internal: (one of the) internal LUT(s) of the device will be used.

Photo interpretation

- Monochrome:
  the LUT will consist of one plane; so one plane needs to be defined under ‘Planes’.
- Color:
  the LUT will consist of 3 planes: R, G and B. Hence, three planes have to be defined under ‘Planes’. The color option can only be selected if the device supports it.

Planes

Here you enter the actual definition of a user-defined LUT.

A definition of a LUT exists of 1 or 3 lines, depending on the ‘Photo interpretation’ setting above.

One-line definitions are for monochrome images, 3-line definitions for color RGB images, with 1 line for each plane.

Each line must contain 2 or more values, which must be within the pixel range. For an 8-bit depth image, this is from 0 to 255, for 12 bit images this is 0 to 4095.

What are Look Up Tables (LUT), and what are they used for?

Look Up Tables are used to map an acquired pixel value from one value to another.

The electronics used to scan an image, in most cases produce a non-linear output. This means that compared to viewing the film on a lightbox, some gray value ranges may be darker (less contrast) and some gray value ranges may be lighter on the scanned image.

By applying a correction LUT on an acquired image, this “error” in particular pixel value ranges on the scanned film may be corrected.

Some digitizers (such as Vidar) have an internal correction LUT, which is calibrated for that specific model, which can be used by RadWorks.

When an image is acquired, the LUT will be applied to the acquired image data, before the image is displayed.

How does it work?

You enter a LUT definition by entering a series of values per plane.

The pixel range (determined by the bit-depth) for the image is divided in (# value + 1) sections. The first pixel value starts at 0 and ends at the first entered value. The following section starts at the first entered value, and ends at the next entered value, and so on. The last section ends at 255 (or 4096). Intermediate values are linear interpolated.

Example 1

Bit depth: 8 bits

‘Planes’ values: 10 100 150 200

RadWorks will add a 0 before the first value and the maximum value as last value.

Now the list looks like this: [0][10 100 150 200][255]

This means that the pixel range of 0..255 will be subdivided in 5 sections, each with length 51

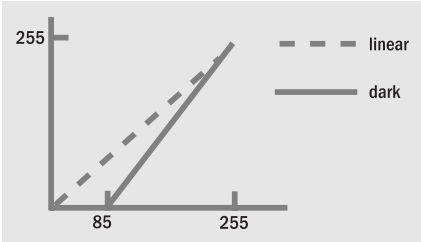
Acquired:	Will be mapped to:
[000..051]	[000..010]
[051..102]	[010..100]
[102..153]	[100..150]
[153..204]	[150..200]
[204..255]	[200..255]

Look-up table mappings for example 1

LUT[0] = 0, LUT[51] = 10, LUT[102] = 100, LUT[153] = 150, LUT[204] = 200, LUT[255] = 255.

The intermediate values of the LUT are linear interpolated.

A pixel is acquired with value 51. This value is looked up in the LUT. LUT[51] = 10, thus, the pixel value 51 will be replaced by value 10



8-bit dark LUT example

Example 2

We want to suppress the dark area of a B/W film completely and use the full available pixel range for the upper half of the acquired gray values. This way we can enhance the contrast in the light area.

Bit depth: 8 bits and ‘Planes’ values: 0 128

RadWorks will add a 0 before the first value and the maximum value as last value.

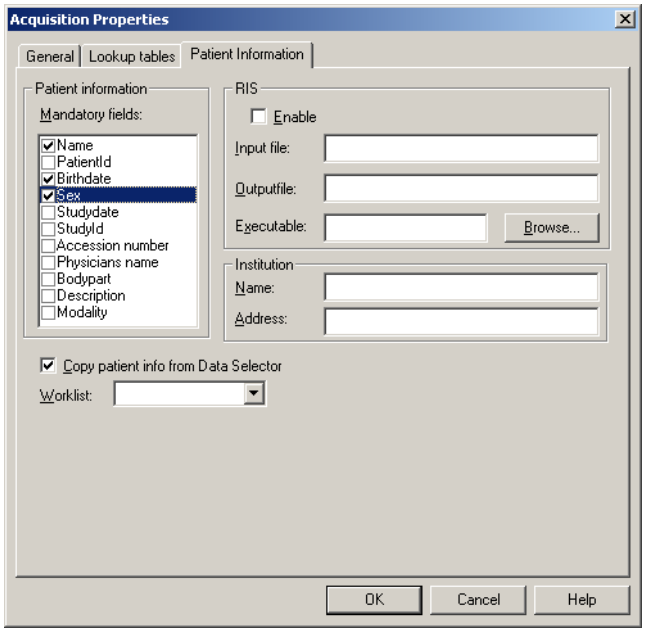
Now the list looks like this: [0][0 128][255]

This means that the pixel range of 0..255 will be subdivided in 3 sections, each with length 85.

Acquired:	Will be mapped to:
[000..085]	[000..000]
[085..170]	[000..128]
[170..255]	[128..255]

Look-up table mappings for example 2

Settings on the Patient Information tab



Mandatory fields

If you check the 'Mandatory fields:' checkboxes, the user will have to complete these fields before a study can be saved.

Enable

If checked, the Patient information dialog box in the acquisition screen has a section which can query a RIS system.

The RadWorks system does not query the RIS system itself, but the user can specify another program that does the job. This program is started with two parameters: the input and the output file. RadWorks waits for the termination of this program, after which the output file is read, and the results are placed in the appropriate fields.

Input file

RIS input file name. This file is written by the Acquisition module, and contains just one line:

ID=xxx

where xxx is the RIS identification number entered by the user.

This does not need to be an ID, but can be any field that uniquely identifies a patient in the external RIS system.

Output file

RIS output file name.

Copy patient info from Database selector

If this option is enabled, patient information from the study currently selected in the Data Selector will be copied to the Patient Information dialog when the Acquisition Module is entered.

Remarks

- The ‘ID’ and ‘Status’ lines in the output file are mandatory. All other lines are optional. If lines are missing, the items in the Patient/Study details dialog in RadWorks will remain blank. RadWorks can be configured to make some items ‘non-mandatory’. By default, all items are mandatory.
- When writing a line to the output file, start with the identifier, followed by ‘=’, followed by a value. Everything following the ‘=’ is assumed to be part of the value, except the new-line characters (\r\n).
- Note of the following format specifications for the values:

Field	Remarks
ID	ID that was present in the input file
Status	OK RIS_ERROR ERROR
PatientName	64 characters maximum
PatientID	16 characters maximum
BirthDate	Format: dd-mm-yyyy
Sex	M(ale) or F(emale) or O(ther)
StudyDate	Format: dd-mm-yyyy
StudyTime	Format: hh:mm
ReqPhysician	64 characters maximum
StudyID	16 characters maximum
Description	64 characters maximum

Format specifications

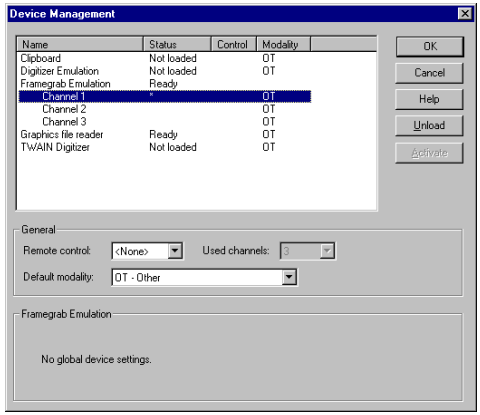
Bodypart	64 characters maximum
Executable	Executable which queries the HIS/RIS system, and produces the Output file.

Format specifications

Hardware-specific settings (device management)

The hardware specific settings for each device can be modified in the Device Management dialog box. To access this, select **Acquire ➔ Devices…** from the Data Selector menu bar

The Device Management dialog box shows a list of acquisition devices that are currently installed and their status (ready/not loaded).



The ‘Ready’ status line marked with ‘*’ is the active device. This is the device that acquisition will start up with.

The lower part of the dialog contains global settings for the device that is currently highlighted in the list area.

The ‘used channels’ setting: reducing this number to the number of channels actually in use prevents users from selecting an unused channel.

Remote control: select the serial port which the Remote Control for the selected channel is connected to.

Default modality: select the default modality you want to use.

Acquire action settings (Image Types)

Default modality

This dialog box consists of three sections: A common part, a section dependent on the type of acquisition device: Frame grabber or Digitizer, and a device-specific part.

Description	Name used to save image type As soon as you type a new name, or modify an existing name, the 'New' button will be activated. Clicking the New button will save the current set of parameters as a new image type.
Height	Height of the acquired image
Offset top	Offset from top of the film or video signal
Width	Width of the acquired image
Offset top	Offset from the left of the film or video signal
Photometric Interpretation	Select one of the possible (DICOM) photometric interpretations for this device MONOCHROME1: zero value = white; max value=black MONOCHROME2: zero value = black; max value=white RGB
Bit Depth	Select one of the possible bit depths for this device.
Lookup Table	If in the general acquisition configuration LUTs are defined for this device, they can be selected here.
Auto update interval	Time between the start of two grab actions.
Resolution	Select one of the available resolutions.
Default rescan image type	If a device supports rescanning, it is possible to define a rescan image type. This is an image type which must be already defined, and which is used to rescan a selection, e.g. at high resolution.

Installation and configuration of digitizers

Setting up a Lumisys LS75 digitizer

Frame Grabber sizes are given in pixels, digitizer sizes in inches or centimeters, dependent on the global acquisition setting.

Requirements

- Lumisys LS75 digitizer
- Lumisys LS75 interface (DCB–Data Control Board), that comes with the digitizer.
- Lumisys LS75 Control Interconnect Cable, that comes with the digitizer.
- Free ISA slot in PC.
- RadWorks Distribution CD-ROM

To install the hardware ▶

1. Take anti-static measures to protect the printed circuit board you are going to install.
2. Check whether the 6 dip switches on the Lumisys interface board are set to their default setting (S1-S6:on-off-on-off-off-off = Mem:D0000-D7FFF; I/O:100h-11Fh).
3. Check whether the jumper JP1 on the Lumisys interface board is set to its default setting IRQ5.
4. Install the Lumisys interface board in a free ISA slot in the PC.
5. Connect the Lumisys digitizer to the PC with the interconnection cable.

To install the software ▶

The driver for the Lumisys board is supplied on the RadWorks distribution CD-ROM and is installed automatically when running the RadWorks Setup.

If the Lumisys interface board is removed, the driver has to be removed manually.

1. Make sure you are logged in with administrator rights. Otherwise, the Setup program will not install the device drivers or add the Registry keys.
2. Install the ‘Lumiscan 75’ component of the RadWorks Acquisition Module: in the **Modules** dialog of the RadWorks setup, select ‘Lumiscan 75’. The Lumisys driver should not yet be detected in the ‘System Information’ report. In order to let Windows load the newly installed device driver, restart the PC.

3 Copy CLUT.DAT into the WINNT\System32\Drivers directory.

The LSDT Windows NT device driver automatically loads this 'Correction Look Up Table' during the driver loading process.

If the CLUT.DAT file is not found the driver will default to a 1:1 correction LUT and a warning message will be logged to the System Event Log.

Under DOS, this file was named CLUTXXXX.DAT where XXXX is the serial number of the scanner system. This file is stored in C:\. You can use this CLUTXXXX.DAT that Lumisys supplies with the digitizer and rename it to CLUT.DAT, or create a new CLUT.DAT using the Lumisys tools. Only one CLUT.DAT file may be present on the system!
Refer to the Lumisys documentation for details.

Configuration

1. Start RadWorks and select **Acquire ➜ Devices…**. See 'Device management' on page 227 for an explanation of the Device Management dialog box.
2. Highlight the 'Lumiscan 75' line, and make any necessary changes to the device settings in the bottom part.
3. To load the 'Lumiscan 75' device, click **Load**.
4. To activate one of the devices (default device), highlight the device and click **Activate**.

When you have finished...

To test your digitizer click the **Acquisition** tab, click **Acquire Image(s)**, then click **Scan** to start digitizing.

RadWorks Setup should have installed the items in the table below.

Hardware:	LUMISYS ISA card
Device driver:	LSDT.SYS
Name of device in control panel:	Lsdt
Registry Keys:	Imported from ACQ_LS75.TXT on the CD-ROM.
Files:	%ROOT%\BIN\LUMISYS.DLL WINNT\System32\LSDTAPI.DLL WINNT\System32\Drivers\LSDT.SYS WINNT\System32\Drivers\CLUT.DAT

What is installed

Device-specific configuration options

Device management

In the Device Management dialog box, the “Use Film Feeder” option can be enabled. When it is, and the user clicks **Scan**, a dialog box appears in which the number of films to be scanned can be entered.

Image types

‘Resolution mode’ may be set to ‘Fixed’ (a fixed number of dots per inch will be used) or Variable (2048 dots are used for the whole line, so the actual DPI will vary with the width of the film).

‘Pixel averaging mode’ may be selected. See the Lumisys documentation for more information.

Setting up Lumisys Lumiscan 85

When using the Lumisys LS85, two Registry keys need modification:

```
Key: Software\AMI\RadWorks\6.0\Modules\Acquire\Devices\Lumiscan75
Value: Desc=Lumiscan 85
Value: MaxDPL=4096
```

Setting up a Howtek Scanmaster DX

The Scanmaster DX supports rescanning of a selected area.

Requirements

- Howtek Scanmaster DX digitizer
- SCSI card
- SCSI cable
- RadWorks distribution CD-ROM

To install the hardware ▶

1. Take anti-static measures to protect the printed circuit board you are going to install.
2. Install the SCSI card in a free slot in the PC.
3. Install the SCSI software; see section ‘General note about SCSI devices’ on page 248.
4. Connect the digitizer to the PC with the SCSI cable.

To install the software ▶

The Scanmaster DX is a SCSI device and does not need an additional Windows device driver.

1. Make sure you are logged on with administrator rights. Otherwise, the Setup program will not add Registry keys.
2. Install the 'Howtek Scanmaster DX' component of the RadWorks Acquisition Module: in the **Modules** dialog of the RadWorks setup, select 'Howtek Scanmaster DX'.

To configure ▶

1. Start RadWorks and select **Acquire ➔ Devices…**.

See the section about the Device Management screen.

2. Highlight the 'Howtek Scanmaster DX' line, and make any necessary changes to the device settings in the bottom part.
3. To load the 'Howtek Scanmaster DX' device, click **Load**.
4. To activate a device (default device), highlight the device and click **Activate**.

When you have finished...

To Test your digitizer, select the **Acquisition** tab, click **Acquire Image(s)**, and click **Scan** to start digitizing.

The Setup should have installed the following:

Additional software	Adaptec EZ-SCSI 4.0 or higher
Registry Keys	Imported from SCNM_KEY.TXT on the CD-ROM.
Files	%ROOT%\Bin\HOWTEK.DLL WINNT\System32\Drivers\CLUT.DAT

What has been installed

Additional software

The Scanmaster is supplied with software you can use to test the Scanmaster. Check the supplied disk for the 'Programs' directory. This directory contains a few test programs. If, for example "s_rescan.exe" produces an error message when run, RadWorks will not function properly either. So, if these tests fail, correct them before using RadWorks.

Device-specific configuration options

Device Management

The Howtek Scanmaster DX has no global device parameters.

Image Types

“Logarithmic Data Acquisition” can be enabled or disabled. See Howtek documentation for more information.

Setting up a Vidar VXR-12 digitizer

Requirements

- Vidar VXR-12 DX digitizer
- SCSI card
- SCSI cable
- RadWorks distribution CD-ROM

To install the hardware ▶

1. Take anti-static measures to protect the printed circuit board you are going to install.
2. Install the SCSI card in a free slot in the PC.
3. Install the SCSI software; see section ‘General note about SCSI devices’ on page 248.
4. Connect the digitizer to the PC with the SCSI cable.

To install the software ▶

The Vidar VXR-12 is a SCSI device and does not need an additional Windows device driver.

5. Make sure you are logged on as an Administrator or as a user with administrative rights, otherwise, the setup program will not add Registry keys.
6. Install the ‘Vidar VXR-12’ component of the RadWorks Acquisition Module: in the **Modules** dialog of the RadWorks setup, select ‘Vidar VXR-12’.

To configure ▶

1. Start RadWorks and select **Acquire ➔ Devices…**.

See section ‘Device management’ on page 227 for an explanation of the Device Management screen.

2 Highlight the ‘Vidar VXR-12’ line, and make any necessary changes to the device settings in the bottom part.

3 To load the ‘Vidar VXR-12’ device, click **Load**.

4 To activate one of the devices (default device), highlight the device and click **Activate**.

Finished

- To Test your digitizer, select the **Acquisition** tab, click **Acquire Image(s)**, and click **Scan** to start digitizing.

Summary and where to look when installation was not successful

The Setup program should have installed the following:

Additional software	Adaptec EZ-SCSI 4.0 or higher
Registry Keys	Imported from the file VXR_KEY.TXT on the CD-ROM.
Files	%ROOT%\Bin\VIDAR.DLL

Device-specific configuration options

Device Management

- “Auto Eject Film”: when Auto Eject Film is enabled the digitized film is removed from the scanner after digitizing, otherwise it remains loaded. Disabling it makes easy re-scanning of areas of a film possible.
- “Calibrate” button: use when sliders on the digitizer were not in the widest position when the digitizer was turned on.

Image Types

- “Exposure time” on larger exposure time, scans are slower, but noise reduction in dark areas may be achieved.
- “Dark Enhance” can be enabled or disabled. See the Vidar documentation for more information.

Look Up Tables (LUTs)

In the **Configuration ➔ Acquisition** dialog, there is a tab page ‘Look Up tables’. The VXR has a few internally defined Look Up Tables, which can be used. To define one, select the VXR-12 from the device list. Now it is possible to select the “Internal” type. From the internal LUTs listed in the drop-down box, select the one you want to use. In the ‘Planes’ field, enter the values to use with the chosen lookup table. In the next table, the available LUTs are listed.

Table Name	Parameters: (Low / High limit)
Histogram equalized	0 / 100
Linear Histogram based	0 / 100
Linear Histogram independent	0 / 4095
Linear OD	N/A
Logarithmic	N/A
Power based	1 to 10
Square root	

For instance, to define a Power based LUT, select “Power based” from the drop down list, and in the planes field enter the power value, e.g. 5. If you select the Histogram equalized table, two values must be entered in the Planes field, the minimum and maximum value, e.g. 30 and 100 (%).

Installation and configuration of frame grabbers

Performance of frame grabber workstations in continuous mode

If the continuous mode of a Frame Grabber is switched on, a lot of data is transported from the Frame Grabber card to the display. For example, one RGB image of 576 x 768 pixels results in 576 x 768 x 3 = 1.3 MB data which has to be transported from the Frame Grabber card to the display. This has great influence on the overall performance of the system.

There are several factors that are important to the performance of a Frame Grab workstation during continuous mode.

First, there are two configuration options in **Configuration ➔ Acquisition ➔ General**: 'Set Zoom to 1: 1', and 'Minimal idle time between two grab actions' on the same page.

When the Zoom factor is set to 1:1, no additional computing is required before a grabbed image is displayed. This can speed up the continuous mode considerably.

The "Minimal idle time between two grab actions" sometimes has to be increased on slower machines. Otherwise the system has no time to handle other processes, like mouse movements, keyboard input etc. On fast systems however, it is possible to set this time to 0 msec, without any performance problems.

Furthermore, it is advisable not to grab the whole image, if not all image data is required. In the 'Image Type' dialog it is possible to define an ROI (offset from top and left, and horizontal and vertical size in pixels). If the installed board supports it, only the required region is grabbed. If not, a whole image is grabbed, but only the ROI is displayed, which can also be much faster.

In the '**Configuration ➔ Acquisition ➔ General**' dialog, there is one more important option: "Disable error messages during grab". During transfer of the data from the frame grabber card, errors may occur. If these occur during continuous mode, they would break the continuous mode. To prevent this, the display of error messages during a grab action can be suppressed. When switched off, the error messages will still be logged to the RadWorks log file, but not displayed to the user.

It is good practice to enable error messages during setup and maintenance, and to disable them during normal use.

Setting up a Matrox Meteor frame grabber board

The paragraphs from “Requirements” to “Finished” describe the basic installation steps for a Matrox Meteor Frame Grabber board. Non-essential parameters will be skipped. For more information about them, see the paragraphs following ‘Finished’.

Requirements

- Matrox Meteor frame grabber board
- Matrox Meteor video input cable
- Latest Matrox Meteor drivers for Windows
- Free PCI slot in PC.
- RadWorks distribution CD-ROM

To install the hardware ▶

1. Take anti-static measures to protect the printed circuit board you are going to install.
2. Install the Matrox Meteor board in a free PCI slot in the PC.

To install the software ▶

1. Make sure you are logged on as an Administrator or as a user with administrative rights, otherwise, the setup program is unable to install device drivers.
2. Install the ‘Matrox Meteor’ component of the RadWorks Acquisition Module: in the **Modules** dialog of the RadWorks setup, select ‘Matrox Meteor’.

- The Matrox Meteor driver should not yet be detected in the ‘System Information’ report.
- Accept the DMA memory buffer size of 1Mb when you are only acquiring monochrome or composite color images. Increase the buffer size to 3Mb when you are grabbing RGB images.
- Restart your computer, to allow the operating system to load the newly installed device driver.

See section ‘General notes about device drivers’ on page 250.

3. After restarting, check whether the ‘Matrox Meteor’ device driver has loaded properly.

To configure ▶

1. Start RadWorks and select **Acquire ➔ Devices….**
2. Highlight the ‘Matrox Meteor’ line, and make any necessary changes to the device settings in the bottom part.
3. To load the ‘Matrox Meteor’ device, click **Load**.
4. To activate a device (default device), highlight the device and click **Activate**.

Matrox Meteor Signal Types	
M_RS170	RS-170, 640x480 pixels, 12.5MHz, analog
M_RS-170_LOW	RS-170, 512x480 pixels, 10.0MHz, analog
M_CCIR	CCIR, 768x576 pixels, 14.8MHz, analog
M_NTSC	NTSC, 640x480 pixels, 3x8 bits, 12.5MHz, composite
M_NTSC_RGB	NTSC RGB, 640x480 pixels, 3x8 bits, 12.5MHz
M_NTSC_YC	NTSC Y/C (S_VHS), 640x480 pixels, 3x8 bits, 12.5MHz
M_NTSC_LOW	NTSC, 512x480 pixels, 3x8 bits, 10.0MHz, composite
M_NTSC_YC_LOW	NTSC Y/C (S_VHS), 512x480 pixels, 3x8 bits, 10.0MHz
M_PAL	PAL I, 768x576 pixels, 3x8 bits, 14.8MHz, composite
M_PAL_RGB	PAL I RGB, 768x576 pixels, 3x8 bits, 12.5MHz
M_PAL_YC	PAL Y/C (S_VHS), 768x576 pixels, 3x8 bits, 12.5MHz
M_SECAM	SECAM, 768x576 pixels, 3x8 bits, 14.8MHz, composite
M_ SECAM _RGB	SECAM RGB, 768x576 pixels, 3x8 bits, 12.5MHz
M_ SECAM _YC	SECAM Y/C (S_VHS), 768x576 pixels, 3x8 bits, 12.5MHz

The Meteor/RGB version of the Meteor board has a Y/C connector, but it is disabled. Therefore, it is not possible to grab an image with the Meteor/RGB from a Y/C signal.

Finished

1. Connect your video source to the frame grabber using the video-input cable.
2. To test your Frame Grabber click the **Acquisition** tab, click **Acquire Image(s)**, and click **Grab** to acquire an image.

Summary and where to look when installation was not successful

The Setup program should have installed the following:

Device driver	METEOR.SYS, MTXDMAx.SYS
Name of device in control panel:	Matrox Meteor
Registry Keys:	Imported from the file ACQ_MMET.TXT on the CD-ROM
Files	%ROOT%\Bin\MATROX.DLL WINNT\System32\Drivers\METEOR.SYS WINNT\System32\MIL.DLL WINNT\System32\MILMET.DLL WINNT\System32\MILPUL.DLL WINNT\System32\MILHOST.DLL WINNT\System32\MILVHOOK.DLL WINNT\System32\MILVGA.DLL WINNT\System32\MILTIFF.DLL

Additional Software

The Meteor driver is installed during the Setup, but it can be installed directly using the MILDRV.EXE program that is on the RadWorks CD-ROM. Use this to view the error information when the driver installation fails.

Device specific Configuration Options

During Setup the DMA memory buffer size is set to 3 MB by default. Sometimes, it may help to set this to a higher value when the RadWorks Acquisition software returns errors (depends on other devices using DMA memory). You set the size directly via the registry key:

```
Key: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Session Man-
   ager\Memory Management

Value: NonPagedPoolQuota

Value: NonPagedPoolSize
```

Give the same value to NonPagedPoolQuota and NonPagedPoolSize. The value is in bytes. Typical values are 3MB (0xFA000 hexadecimal) or 6MB (0x1F4000 hexadecimal).

Device Management

"Signal Type": The Signal Type specifies the video format of the signal that will be grabbed via this input channel. you can select the signal type from a pre-defined list.

You can only use one channel, if the input signal is 'PAL_RGB'. The signal type of the first channel must be "M_PAL_RGB", and the RGB input signal must be connected to channel 1, 2 and 3, and the synchronization on channel 4.

"VCR/VTR": When the input device is a VCR or a VTR (video cassette recorder), the VCR/VTR option should be enabled to improve the synchronization to the input signal.

The "DCF File" option is obsolete here (not applicable for Matrox Meteor).

Setting up a Matrox Pulsar frame grabber card

The paragraphs from "Requirements" to "Finished" describe the basic installation steps for a Matrox Pulsar frame grabber board. Non-essential parameters will be skipped. For more information about them, see the paragraphs following 'Finished'.

Requirements

- Matrox Pulsar frame grabber board
- Matrox Pulsar video input cable
- Latest Matrox Pulsar drivers for Windows
- Video signal source with known specifications
- Free PCI slot in PC
- RadWorks distribution CD-ROM

Hardware Installation

1. Take anti-static measures to protect the printed circuit board you are going to install.

Some models of the Matrox Pulsar board provide their own VGA output. Using the DIP-switches, the card can be configured such that it uses the pre-installed VGA card (e.g. a Matrox Millennium).

2. Check whether the 2 DIP-switch settings are set to ON in case the on-board VGA of the Pulsar is not used, but another VGA board is used instead, as described above.

3. Install the Matrox Pulsar board in a free PCI slot in the PC.

To install the software ▶

1. Make sure you are logged on as an Administrator or as a user with administrative rights, otherwise, the setup program cannot install device drivers.

2. Install the ‘Matrox Pulsar’ component of the RadWorks Acquisition Module: in the **Modules** dialog of the RadWorks setup, select ‘Matrox Pulsar’.
   The Matrox Pulsar driver should not yet be detected in the ‘System Information’ report.

3. Select a DCF file.
   This DCF file depends on the video source that will be acquired from. Click Help, to display a list of DCFs that are available on the CD-ROM. Type the name of the file you want to use.

   If no appropriate DCF is available, you have to create a DCF yourself. In that case, select a standard DCF file such as VCR_PAL.DCF from the list, and select the correct DCF later via the Device Management dialog.

4. Restart the computer, to allow operating system to load the newly installed device driver.

See section ‘General notes about device drivers’ on page 250.

5. After restarting, check whether the ‘Matrox Pulsar’ device driver has loaded properly.

Configuration

On the Device Management dialog it is possible to select a Digitizer Configuration File (DCF). Select the one appropriate to the current signal type. It is possible to select a different DCF File for each channel.

1. Start RadWorks and select **Acquire → Devices…**.

See section ‘Device management’ on page 227 for an explanation of the Device Management screen.

2. Highlight the ‘Matrox Pulsar’ line, and make any necessary changes to the device settings in the bottom part.

- Enter an appropriate DCF file name for this input channel.

3. To load the ‘Matrox Pulsar’ device, click **Load**.

4. To activate a device (default device), highlight the device and click **Activate**.

Finished

1 Connect your video source to the frame grabber using the video-input cable.

Refer to the Pulsar installation manual for details on attaching a video source.

2 To test your Frame Grabber click the **Acquisition** tab, click **Acquire Image(s)**, and click **Grab** to acquire an image.

Summary and where to look when installation was not successful

The Setup program should have installed the following:

Device driver	PULSAR.SYS, MTXDMAx.SYS
Name of device in control panel	Matrox Pulsar
Registry Keys	Imported from the file ACQ_MPUL.TXT on the CD-ROM
Files:	%ROOT%\Bin\PULSAR.DLL WINNT\System32\Drivers\PULSAR.SYS WINNT\System32\MIL.DLL WINNT\System32\MILMET.DLL WINNT\System32\MILPUL.DLL WINNT\System32\MILHOST.DLL WINNT\System32\MILVHOOK.DLL WINNT\System32\MILVGA.DLL WINNT\System32\MILTIFF.DLL

Additional Software

The Pulsar driver is installed during the Setup, but it can be installed directly using the MILDRV.EXE program that is on the RadWorks CD-ROM. Use this to view the error information when the driver installation fails.

Device specific Configuration Options

Device Management

“DCF File”: specify the DCF file to be used for this channel

Device specific troubleshooting

- If the device driver doesn’t start, and you have also installed a Matrox Millennium graphics card in your system, look in the Event Viewer for the reason. If one of the error messages is: “The information from Pulsar, (): Resource conflict in memory ranges..”, there might be a problem with the Matrox Millennium driver. Install the latest mga64 drivers. They can be found on the Matrox web site, or on the Applicare support server.

- The Pulsar card fails on a motherboard that does not support the PCI bridge feature on the Pulsar. The system then returns the error message: “The information from the Pulsar, (): Error occurred when getting PCI configuration”. Select a system with a motherboard that supports PCI bridging.

Matrox Intellicam

If none of the supplied DCF-files are applicable, you have to create a DCF yourself. In that case, use the Matrox Intellicam Software (version 2.0) for DOS or Windows. Files created with earlier versions of Intellicam may not be compatible with ones created with version 2.0.

The Matrox Intellicam documentation provides excellent help for creating a video source definition file, and includes a Video Specification Form to help you identify and document the features of your video source and a good glossary terms is included.

You will need a good specification of the video signal from the modality vendor, without that, it will be very hard to create a good video signal source definition.

Setting up a Data Translation Mach DT3153

The paragraphs from “Requirements” to “Finished” describe the basic installation steps for the HP DeskScan device. Non-essential parameters will be skipped. For more information about them, see the paragraphs following ‘Finished’. Requirements:

- DT3153 PCI frame grabber board
- DT3153 PCI video input cable
- Free PCI slot in PC.
- RadWorks distribution CD-ROM

To install hardware ▶

1. Take anti-static measures to protect the printed circuit board you are going to install.
2. Install the DT3153 PCI board in a free PCI slot in the PC.

On some Pentium Pro machines, problems could occur because of the used PCI chipset. The NATOMA 82440 is working fine, but from the Orion 82450 chipset it is known that it causes problems.

To install software ▶

1. Make sure you are logged on as an Administrator or as a user with administrative rights, otherwise, the setup program will not install device drivers.
2. Install the device driver. Install it from the Device driver disk that is supplied with the Frame Grabber card, or the one that can be found in the 3rdparty\DT3153 directory on the RadWorks CD-ROM.
3. In the Start menu, select **Settings ➔ Control Panel ➔ MultiMedia** icon.
4. Select Add on the Device tab and select the first entry (unlisted or updated drivers).
5. Click **OK,** and enter the location where the Mach software can be found (directory 3rdparty\DT3153\NT4_0\).
6. When asked to enter a card name (or alias), enter “DT 3153” for instance. Use the same alias when configuring the Mach card from the RadWorks software.
7. When the configuration menu comes up, configure the Mach card with at least 4MB and 50 or 60 Hz (often 50 for Europe, 60 for the US).
8. In order to let NT load the newly installed device driver, the PC must be rebooted.

See section ‘General notes about device drivers’ on page 250.

9. After restarting, check whether the ‘DT3153 Frame Grabber’ device driver has loaded properly.
10. Install the ‘Mach DT3153’ component of the RadWorks Acquisition Module: in the **Modules** dialog of the RadWorks setup, select ‘Mach DT3153’ in the ‘Component Selection I’ screen.
11. The Mach DT3153 driver should already be detected in the ‘System Information’ report.
12. Enter the alias you entered when installing the device driver (e.g. “DT 3153”).
13. Furthermore, you will get a message reminding you that you have to install the Mach driver, which you already did.

To configure ▶

1 Start RadWorks and open the **Acquire ➔ Devices…** menu.

See section ‘Device management’ on page 227 for an explanation of the Device Management screen.

2 Highlight the ‘Mach DT3153’ line, and make any necessary changes to the device settings in the bottom part.

3 Select the appropriate Signal Type from the list.

4 Click **Load**, to load the ‘Mach DT3153’ device’.

5 Make one of the devices active (default device) by highlighting the device and click **Activate**.

Finished

1 Connect your video source to the frame grabber using the video-input cable.

2 To test your Frame Grabber, select the **Acquisition** tab, click **Acquire Image(s)**, and click **Scan** to start digitizing.

Summary and where to look when installation was not successful

The Setup program should have installed the following:

Device driver	DT3153.SYS, DT3153.DRV
Name of device in control panel	DT3153 Frame Grabber
Registry Keys	Imported from the file ACQ_MACH.TXT on the CD-ROM
Files	%ROOT%\Bin\MACH.DLL WINNT\System32\Drivers\DT3153.SYS WINNT\System32\Drivers\DT3153.DRV WINNT\System32\OLFG32.DLL WINNT\System32\OLIMG32.DLL WINNT\System32\DTCOLORSDK.DLL

Additional Software

Not applicable.

Device specific Configuration Options

Device Management

“Driver Alias”: the alias assigned to the device driver during installation (applies to the board). See section Software installation above.

"Signal Type": you can select the signal type from a pre-defined list.

Device specific troubleshooting

- If the grabbed image looks distorted, possibly the card is configured at the wrong frequency (60 Hz instead of 50 Hz, or the other way around). You can change the settings via 'Start menu | Settings | Control Panel | Multimedia | Devices | Other Multimedia devices | DT-Open Layers DT3153 Mach Series Frame Grabber | Properties'.

Setting up an Foresight HI*DEF Plus or Accura frame grabber

The paragraphs "Requirements" until "Finished" will show you the basic steps for installing the Foresight HI*DEF Plus (ISA) or Accura (PCI) frame grabber. Parameters not essential to the situation will be skipped. You can find more about them in the paragraphs following "Finished".

Requirements

- Foresight HI*DEF Plus or Foresight Accura frame grabber board
- Foresight video-input cable
- video signal source with known specifications
- Free ISA slot in PC for HI*DEF Plus or PCI slot for HI*DEF Accura.
- RadWorks distribution CD-ROM

To install hardware ▶

1. Take anti-static measures to protect the printed circuit board you are going to install.
2. Check the jumper settings on the board.
   - The default I/O address range is 2D0h-2DF.
3. Install the Foresight HI*DEF board in a free ISA/PCI slot in the PC.

To install software ▶

1. Make sure you are logged on as an Administrator or as a user with administrative rights, otherwise the setup program will not install device drivers.
2. Install the 'Foresight HI*DEF Plus' component of the RadWorks Acquisition Module: in the **Modules** dialog of the RadWorks setup, select 'Foresight HI*DEF Plus' in the 'Component Selection I' screen.

3 The Foresight HI*DEF Plus driver should not be detected in the 'System Information' report.

4 The board requires a CHP file to configure the board for the given signal type.
Copy the appropriate CHP file to the %ROOT%\Bin directory.
A few samples are given in the directory 3rdparty\Foresight\Chp on the RadWorks CD-ROM. If none is suitable, you have to create a CHP file, using the HDP_AUTO.EXE or HDPSETUP utility. See the HI*DEF documentation, for more information.

5 In order to let NT load the newly installed device driver, the PC must be rebooted.

See section 'General notes about device drivers' on page 250.

6 After restarting, check whether the 'hd4nt' device driver has loaded properly.

Configuration

1 Start RadWorks and select **Acquire ➜ Devices…**.

See section 'Device management' on page 227 for an explanation of the Device Management screen.

2 Highlight the 'Foresight HI*DEF Plus' line, and make any necessary changes to the device settings in the bottom part.

3 Enter an appropriate CHP file name and path.

4 Load the 'Foresight HI*DEF Plus' device by clicking 'Load'.

5 Make one of the devices active (default device) by highlighting the device and pressing 'Activate'.

Finished

1 Connect your video source to the frame grabber using the video-input cable.

2 Test your frame grabber by selecting the 'Acquisition' tab, press the 'Acquire Image(s)' button, and press 'Grab' to acquire an image.

Summary & where to look when installation was not successful

The RadWorks Acquisition Setup program should have installed the following:

Device driver	HD4NT.SYS
Name of device in control panel	Hd4nt
Registry Keys	Imported from the file ACQ_HDEF.TXT on the CD-ROM.
Files	%ROOT%\Bin\FORESIGHT.DLL WINNT\System32\DriversS\HD4NT.SYS WINNT\System32\HDPW32NT.DLL WINNT\System32\HD_TW32.DLL

Additional Software

HDPSETUP.EXE and HDP_AUTO.EXE are utilities delivered by Foresight for creating and editing CHP files (video signal specification files).

HDP_AUTO is Foresight's Auto-SYNC utility, which automatically scans the video inputs of the Foresight HI*DEF Plus/Accura and tries to detect the type of signal that is connected to it. The result is stored in a CHP file. Auto-SYNC is only intended to give you a .CHP file that is pretty close to what you need; you will still need to adjust some of the parameters. Use HI*DEF Plus Setup (HDPSETUP) to do the final adjustments to your configuration file.

HDPSETUP is a CHP-file editor/testtool.

The tools require an expanded memory manager to be present, so you need to boot from a DOS floppy. Some environment variables need to be set before running the tools.

CHP files are ASCII text files and may be edited with a normal text editor as well.

Device specific Configuration Options

Device Management

"CHP File": specify a CHP file to be used for this channel.

The board requires a CHP file to configure the channel for a given signal type. A few samples are given in the directory 3rdparty\Foresight\Chp on the RadWorks CD-ROM. If none is suitable, you have to create a CHP file, using the HDP_AUTO.EXE or HDPSETUP.EXE utility. See the HI*DEF documentation, for more information.

Installing and configuring TWAIN devices

This section describes the support for TWAIN devices.

TWAIN defines a standard software protocol and Application Programming Interface (API) for communication between software applications and image acquisition devices.

(See http://www.visionshape.com/whitepaper.html to read more about the TWAIN standard).

Currently the RadWorks TWAIN interface has only been tested with the HP ScanJet Scanners (Source DeskScan II 2.5). No guarantees can be given for other TWAIN devices.

Therefore the installation and configuration will be explained for the HP DeskScan document scanner.

The HP DeskScan supports rescanning of a selected area.

The paragraphs “Requirements” until “Finished” will show you the basic steps for installing the HP DeskScan device. Parameters not essential to the situation will be skipped. You can find more about them in the paragraphs following “Finished”.

Requirements

- HP DeskScan
- SCSI card
- SCSI cable
- RadWorks distribution CD-ROM

To install the hardware ▶

1 Take anti-static measures to protect the printed circuit board you are going to install.

2 Install the SCSI card in a free slot in the PC.

3 Install the (Adaptec or other) SCSI driver software.

See ‘General note about SCSI devices’ on page 248.

4 Connect the document scanner to the PC with the SCSI cable.

To install the software ▶

The HP DeskScan is a SCSI device that operates via TWAIN and does not need an additional Windows device driver.

1. Make sure you are logged on as an Administrator or as a user with administrative rights; otherwise the setup program will not add Registry keys.
2. Install the HP DeskScan software (version 2.3.1.a or higher). This can be obtained from the Hewlett Packard web site (http://www.hp.com), or from the directory \3rdparty\DeskScan on the RadWorks CD-ROM. See the README.TXT in the directory \3rdparty for installation instructions.
3. After installing the DeskScan software, the Start menu contains a group named HP DeskScan II. These programs can be used to test the connection to the scanner. If these work properly, it should also work properly from the RadWorks Acquisition Module.
4. In order to let Windows load the newly installed TWAIN source and device drivers, allow the installation program to reboot the PC.
5. After the PC has rebooted, test the ScanJet with the ScanJet applet in Control Panel.
6. Install the 'TWAIN Scanner' component of the RadWorks Acquisition Module: in the **Modules** dialog of the RadWorks setup, select 'TWAIN Scanner' in the 'Component Selection III' Screen.

To configure

1. Start RadWorks and select **Acquire ➔ Devices…**.

See section 'Device management' on page 227 for an explanation of the Device Management screen.

2. Highlight the 'TWAIN Scanner' line, and make any necessary changes to the device settings in the bottom part.
3. Select a **document scanner** (DeskScan II) as **Source**.
4. Load the 'TWAIN Scanner' device by pressing 'Load'.
5. Make one of the devices active (default device) by highlighting the device and pressing 'Activate'.

Finished

Test your Document Scanner by selecting the 'Acquisition' tab, press the Acquire Image(s)' button, and press 'Scan' to start digitizing.

Summary and where to look when installation was not successful

The Setup program should have installed the following:

Additional software	Adaptec EZ-SCSI 4.0 or higher DeskScan 2.3.1.a or higher
Registry Keys	Imported from the file TWAIN_KEY.TXT on the CD-ROM.
Files	%ROOT%\Bin\RWTWAIN.DLL

Known problem:When the German Windows version is used, it is not possible to start the RadWorks Setup after an installation of the DeskScan 2.5 software. Suggested is to install RadWorks and the Acquisition module completely before doing a DeskScan setup.

Device specific Configuration Options

Device Management

“Source”: Before using the TWAIN digitizer, a source must be selected. Select a document scanner here.

“Force Scan”: First action of user must be a scan with the TWAIN device, regardless of the currently active device. In some countries it is required to store a scan of a patient card together with the patients images.

“Enable Source UI”: If the option Enable Source UI is enabled, the user cannot use the predefined Image Types. These buttons are removed from the Acquisition Tab. When the Digitize button is pressed, the User Interface of the selected TWAIN source is activated. After scanning an image, the image is inserted into RadWorks.

Installing and configuring the acquisition utilities

The Graphics File and Clipboard Reader can be installed for inserting image data from graphic files and the Windows clipboard. The emulators can be installed to test or demonstrate the frame grabbing and digitizing functionality of RadWorks.

To install the hardware ▶

No additional hardware is required.

To install the software ▶

For the frame grabber emulator, the digitizer emulator and the graphics file & clipboard reader, run the Acquisition Setup program and select the appropriate devices.

1. In the **Modules** dialog of the RadWorks setup, select the appropriate devices in the 'Component Selection III' Screen.

Summary

Registry Keys	See the following files: EDIG_KEY.TXT for the Digitizer Emulator EFRG_KEY.TXT for the Frame Grabber Emulator FDEV_KEY.TXT for the Graphic File and Clipboard reader.
Files	%ROOT%\Bin\FILEDEV.DLL

General note about SCSI devices

To access a SCSI device from the RadWorks Acquisition Module, the Adaptec EZ-SCSI 4.0 (or higher) software must be installed. It must be installed before the RadWorks Acquisition Module is installed. This is not freeware, so it is not on the RadWorks CD-ROM. Upgrades can be downloaded from the Internet (http://www.adaptec.com).

When the Adaptec software is installed, there should be a program group labeled Adaptec EZ-SCSI 4.0. One of the programs in this group is the SCSI explorer. When started, all attached SCSI devices should be listed on the Interrogator tab. If not shown here, check the following:

- The PC was powered up before the SCSI device. Shut down, switch off the computer, switch on the SCSI device, and start the computer.

When two or more SCSI cards are installed, it is possible that those cards have the same ID in the list on the SCSI Explorer Interrogator tab. This should not cause any problems, because it is the ID as seen from the SCSI bus, not internal in the system.

- Each SCSI device has a SCSI address, or also named a SCSI ID. Two SCSI devices cannot have the same SCSI address. If that is the case, shut down the computer and the devices, and change the SCSI address. Most devices have a SCSI address wheel, which can be adjusted with a small screwdriver.
- The system crashes when starting the SCSI Explorer. Install the latest WNASPI drivers. They can be found on the Adaptec Web site, or in the directory \3rdparty\Adaptec on the RadWorks CD-ROM.
- Maybe the SCSI card has not been mounted correctly into the system, or the SCSI cables are not connected correctly. Shut down, and check.

General notes about device drivers

Some devices require a device driver. The RadWorks Setup program installs them. After installation, the system has to be rebooted to allow Windows to load and start the newly installed device driver. If the device driver did not start correctly, the message “At least one driver failed to start” will be displayed at logon.

- To check the status of the device driver, select **Settings ➔ Control Panel ➔ Devices** from the Start menu. In the device list, search for the required device driver. The status should be “Started”.
- If the device is not started, select **Programs ➔ Administrative Tools ➔ Event Viewer** from the Start menu. If a device driver could not start, error messages are logged here. Errors are marked with a red Stop sign.

Another tip is to check whether the device is visible in the Windows Diagnostics. Start this from the Start menu, select **Programs ➔ Administrative Tools ➔ Windows diagnostics**.

To see which resources a device is using, click the **Resources** tab and then select **Devices**. The device should be listed here. Double clicking the device name to display more detailed information. Also, when you select ‘IRQ’ the device should be visible. If not, there might be an interrupt problem. Maybe, the acquisition device is claiming an interrupt or that an I/O port is used by another device. If so, refer to the acquisition device’s manual on how to change this.

CHAPTER 12

Multi-user environments and security

This chapter describes how to use RadWorks in a multi-user environment and security and auditing options.

IN THIS CHAPTER

The aim of the multi-user capabilities of RadWorks is to allow multiple users to share a single RadWorks installation on a computer (sequentially, in time) while seeing only the work and studies that they have to do, as well as being able to store their preferred settings.

In addition, the users can log on to different computers to be able to do their job on those machines while maintaining their personal settings and configurations.

To achieve this, RadWorks uses a combination of mechanisms:

- With Windows' roaming user profiles and policies, a user can log into any system on the network and use his own Windows settings and preferences.
- With the RadWorks Settings Tool, a user's settings in RadWorks can be copied to any RadWorks station on the network.

When you copy the RadWorks settings, the hardware configuration of these machines need to be comparable (in terms of number of monitors, screen resolution, etc.) in order not to compromise the work.

Some of the subjects in this chapter are specific to your Windows version. For in-depth information on profiles and policies we refer you to Windows documentation, Microsoft TechNet and on-line documentation, such as "The Windows NT FAQ" by John Saville (www.ntfaq.com) and "The Windows 2000 FAQ" by John Saville (www.windows2000faq.com).

Windows configuration

You can use the following procedure for both Windows NT 4 and Windows 2000 systems.

You need the policy editor (poledit.exe) program for this procedure. If you use Windows 2000, copy the poledit program from a Windows NT 4 system or installation CD. Windows 2000 uses a new system for administering these policies, but the old policy editor can still be used.

Roaming (roving) profiles

Customers may want to maintain their RadWorks settings when they move around the hospital. Normally, all changes a user makes to his system are saved locally, in the \WINNT\Profile\<user name> directory. In order to allow the user to use those settings network-wide, the user profile has to be stored on a network share, so that it can be downloaded each time the user logs on. When the user logs off, the network profile is updated, and a copy of the profile is saved locally.

Contact the system administrator of the site to set it up, or you can configure roaming profiles on a Windows NT 4.0 Server as follows:

First create a Default User:

1. Log on to a workstation as a user without Administrator rights. Set up your desktop and change the settings that you want to change. Log off from the workstation. The profile is created at this point.

2. Log back onto the workstation as a user who has Administrator rights to the local computer, as well as in the domain. In the System tool in Control Panel, click the **User Profiles** tab. Select the user's profile that you created in the previous step.

3. Click **Copy To**, which will display a dialog box that allows you to specify where the profile is going to be copied, as well as being able to specify who is 'Permitted to Use this profile'. To create the Default User Profile (base profile) you should permit the group 'Everyone' to be able to use the profile. Next, in the 'Copy To:' field, type the server and the share name, as well as the profile name where you want to copy this profile to (click **Browse,** to locate the computer and directory you want to copy the profile to).

   It should be in this format:

   ```
   \\Servername\Sharename\Profilename
   ```

   Copy this profile to the Netlogon share and rename the profile Default User. This will enable Windows to create a new profile based on this profile for a user who does not already have a central or local profile.

4. Now, when you log on to a computer, in the System Control Panel, on the User Profiles tab, the logon user profile type should be Roaming.

The profile name will actually be a directory name and the profile consists of the entire directory, and all subdirectories and files.

This Default User profile will be used to create new Roaming Profiles as well as new local profiles.

To disable profiles stored locally to RadWorks ▶

1. Start the registry editor (regedit.exe).

2. Open HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon
3. Create a value called DeleteRoamingCache of type DWORD
4. Set the value to 1

RadWorks settings

Whenever a user logs off, the RadWorks settings are copied to the Server and becomes part of the roaming profile.

RadWorks only registers changes made by the current user to the default settings and stores them in the HKCU\Software\AMI\RadWorks\6.0\ key.

For example, when a user has added a new Automated Hanging Protocol on a single monitor RadWorks system, this will be available to him whenever that user logs on to a similar RadWorks system (one monitor). This will not be the case if the user logs on to a multi-monitor RadWorks system!

Windows security settings

This tool is part of a Windows NT 4.0 Server installation, or can be purchased as part of the NT resource toolkit.

The System Policy Editor is used to manage the permissions and settings for users in an environment with multiple workstations.

Feature overview

- Support multiple groups and multiple users (accounts).
- Use the normal log-on procedure of Windows 2000/NT.
- Support both domain controllers (roaming profiles) and local machines (local profiles) for storage of permissions, features, and user settings.
- Permissions can be set RadWorks wide or Module wide.
- Features/Simplification can be set per group, user or computer.
- Configuration can be set per group or user that override system (domain or local) settings.

Users

The System Administrator can also install a screen saver protected with a password with the default Windows profile.

Several categories of users can be defined that use RadWorks for different purposes, e.g. radiologists, referring physicians, administrators, radiographers and nurses.

These groups should have different rights to do certain tasks, i.e. a radiologist is allowed to view a study while it has not yet been reported, whereas, a referring physician may only view a study when it has been verified. Likewise, support personnel may, for example, have the right to delete studies from the local system, whereas, this is not the case for referring physicians.

Also there is a permission that defines who can define the security on the system. By default, this permission is held by (local) system administrators or domain administrators, but it could also be given to existing or new groups or individual users.

In addition, these users (whether of the same category or not) will want to change their settings or preferences, without changing the settings of other users.

Defining the security model

To allow a security model to function properly each user has a separate account for identification purposes when logging on to the computer . Therefore, an account needs to be created for each user. This is done in the usual Windows 2000/NT fashion using the “User Manager” of the “Administrative Tools”. Create appropriate groups of (logically related) users, to simplify the definition and maintenance of the security model, so permissions can be granted or removed from groups of users at once rather than per user.

IYou can configure the domain server so a user can only log on to one or several workstations. How long a user may access the computer can also be configured. If a 2000/NT server is not available, the accounts have to be (re)created on every computer the user wil log on to.

If a Windows domain server is available on the network and the local workstations are part of the domain you can define so-called domain accounts, so a user can automatically log on to any workstation on the network.

Once these accounts have been defined, the security model can be created. The System Policy Editor (poledit.exe) should be used for this purpose. Policies (.pol files) are defined based on template files (.adm files) . These policies can contain settings for users, groups, and computers. They reside either on local workstations or on a network server.

A RadWorks template is supplied on the RadWorks CD ROM. Copy this file to the (hidden) INF directory in the Windows NT Server directory, which is the default directory for .ADM files.

For demonstration purposes, you may want to set up a policy file on a standalone system, such as a laptop.

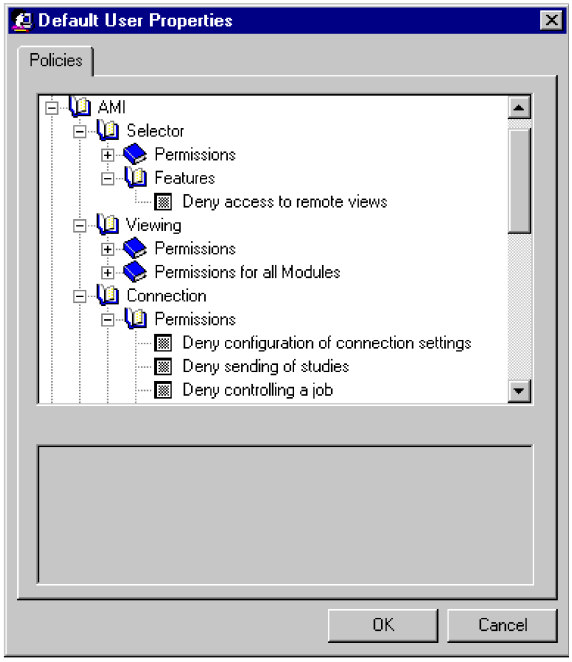
To set up a policy file ►

1 Save the policy file in the \WINNT\Inf directory.

2 Open the following registry key: `HKLM\System\CurrentControlSet\Control\Update` and add the following value: NetworkPath REG_SZ \%systemroot%\Inf\<policy filename>

3 Change the value of the key UpdateMode to 2

The System Policy Editor divides policies into two main groups, namely Users and Computers. You can add individual users or groups to a policy and ,subsequently, define permissions and settings which differ from the default values. The following figure displays a sample policy in the System Policy Editor with the properties for one user shown.



Performance

The multi-user capabilities are not expected to have an impact on existing performance. Even when using roaming profiles (profiles stored on the server). These are cached locally upon logging on to the workstation, so there is no performance penalty once the user is logged in. However, it may take longer for users using roaming profiles to log on and off to the workstation.The reason is that the roaming profile has to be downloaded from or uploaded to the Windows 2000/NT server.

Reliability and safety issues

To a large extent the multi-user capabilities depend on Windows 2000/NT security. The administrator or system engineer must create the security model and should reflect the current workflow in which users do not have too many capabilities.

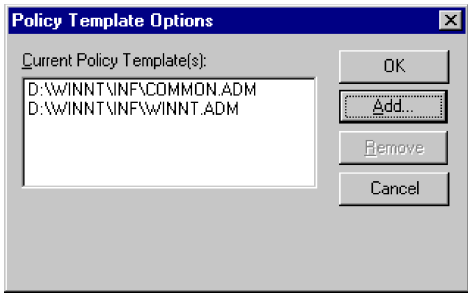
If a domain server is not available on the network, the security model can differ between machines.

Creating a RadWorks policy file

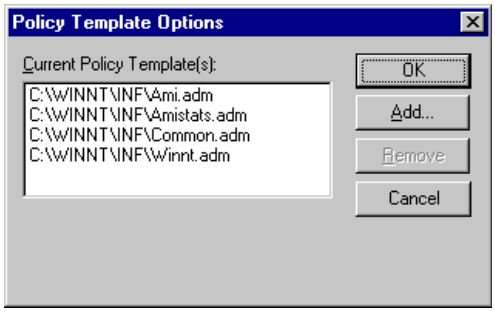
To set policies for RadWorks users, create a new policy file and add the RadWorks templates to it.

Create and edit a policy file ▶

1. Copy the RadWorks template from the Template directory on the RadWorks CD-ROM to the WINNT\INF directory.
2. Start the Policy Editor.
3. Select **Options** → **Policy Template**, to display the following dialog box.



4. By default, two templates are available. Click **Add**, browse to the WINNT\INF directory and select the RadWorks template.

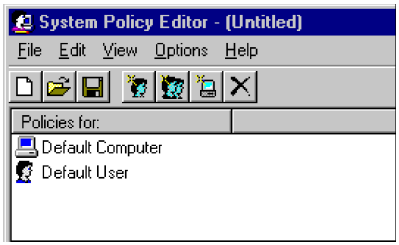


5 Click **OK**.

6 If you already have a policy file, open it. If not, create a new one.

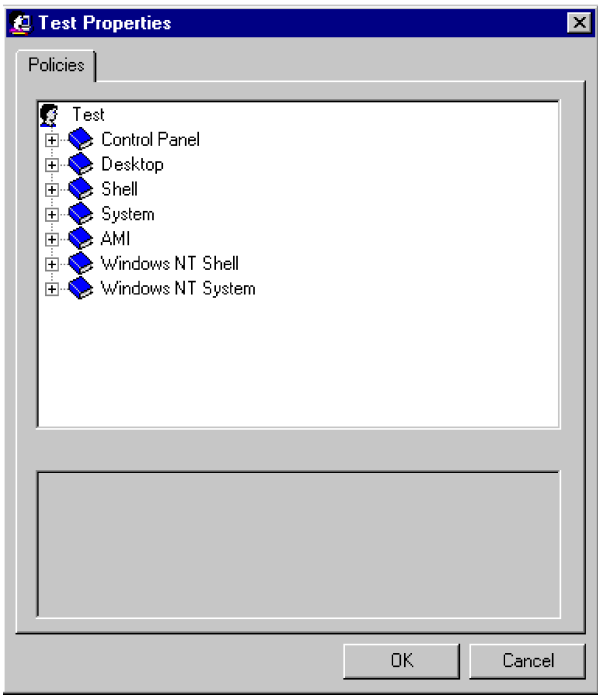
Create new policy

When you select to create a new policy, two components will be available.



The Policy Editor works like the User Manager; you can add Computers, Groups and Users. The latter will automatically be added to the User (Domain) Manager, once the Policy has been saved.

To edit the policies, select the newly added Computer, Group or User. Then select **Edit** → **Properties**.



Editing RadWorks permissions

Open the AMI tree and browse through the various permissions and features. Check or uncheck check marks to change permissions.

Overview RadWorks Permissions

RadWorks distinguishes between two types of permissions:

RadWorks wide (permissions)

These permissions enable / disable features which are available throughout the RadWorks product line, independent of added modules.

Module wide (features)

These permissions enable / disable features which are available in a specific part of the RadWorks product line or which are dependent on added modules.

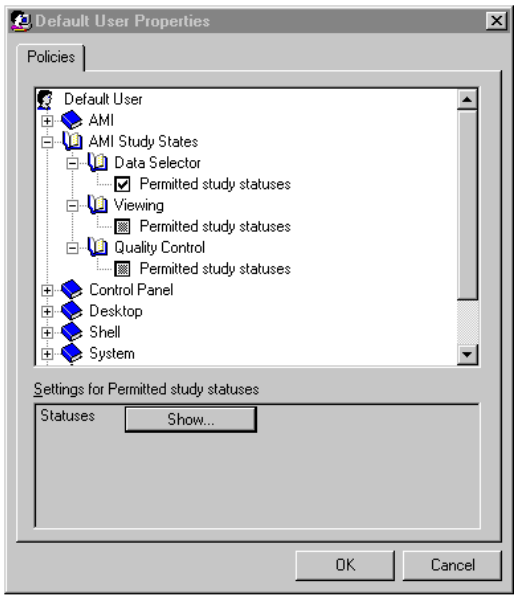
By default, all features are enabled during the installation of RadWorks and can only be disabled by using the Policy Editor on a Windows NT Server.

Contents of the RadWorks Permissions policy template (AMI.adm)

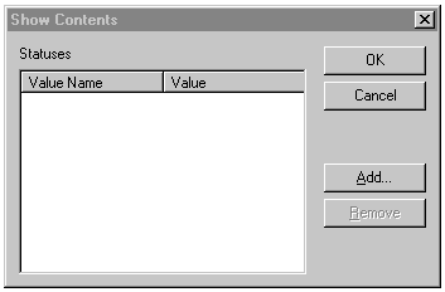
The purpose of this template is to either allow or deny a user or a group certain actions within RadWorks.

Contents of the RadWorks States policy template (AMIStat.adm)

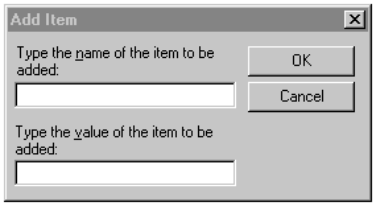
The purpose of this template is to pre-set study statuses for a user or a group of users.



To display a list of the permitted statuses, click **Show** at the bottom of the dialog window.



If the list is empty, or if you wish to add to existing statuses, click **Add**.



RadWorks Settings tool

With the RadWorks Settings tool, you can create a file that contains RadWorks' settings, and copy these to another computer. See 'Creating user profiles' on page 48.

RadWorks access control

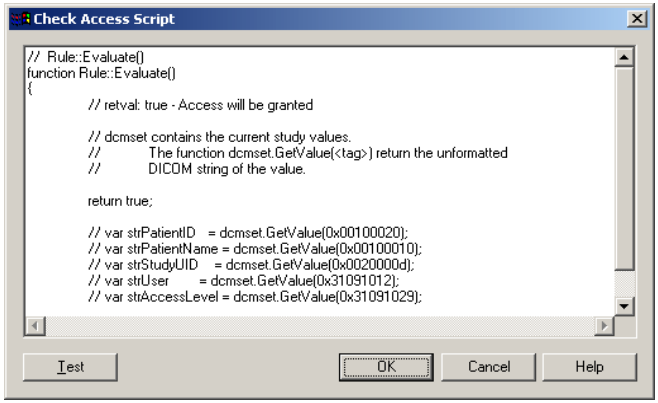
RadWorks has functionality to control access to specific study data, to comply with HIPAA requirements. Access control is implemented as a HIS-RIS transaction. It is normally handled by the Default HIS/RIS Implementation, but it can be integrated with other external applications.

The internal HIS/RIS implementation has been extended to process this transaction and call a (configurable) script. This script is called before proceeding with the requested action. If the script returns false the access is denied.

Use the internal HIS/RIS configuration dialog to control access to RadWorks ▶

1. Select **Configuration** → **Generic...** from the Data Selector menu bar.
2. Click the HIS-RIS tab of the Generic Properties dialog box and select the 'Internal HIS/RIS Implementation'.
3. Click **Modify**.
4. Check the 'Check Access Control' check box.
5. Click **Script** to change the script that does the actual checking.
6. Bind the 'Transaction' functionality to the 'Internal HIS/RIS Implementation'.

This is a sample Access Control script:



This sends the User name, Access Level (i.e. type of access) and Workstation name, along with the Patient ID, Patient Name and Study ID for which access is requested.

Audit trail

RadWorks can log actions performed on study data in order to create an audit trail as required by HIPAA. This is implemented as a HIS-RIS notification.

Normally, it is handled by the Default HIS/RIS Implementation, but it can be integrated with other external applications.

With the Default HIS/RIS Implementation, it offers basic logging to a plain text file.

To enable logging ▶

1. Select **Configuration** → **Generic...**. from the Data Selector menu bar.
2. Click the **HIS-RIS** tab.
3. Select 'Internal HIS/RIS Implementation'.
4. Click **Modify**.
5. Check the Log Audit Trail box.

A log file (auditlog.log) will be created. A typical log line made by the internal implementation logs the user name, the system name, a description of the action, the patient name and id, and the study instance UID (if applicable).

The following actions are logged:

Action	Audit Trail message	RW	DBS	CS	PS
Start RadWorks	RadWorks started	x			
Stop RadWorks	RadWorks stopped	x			
Access granted/ denied	Log all IsAccessAllowed() calls	x	x	x	x
Query database	Query <param>	x	x		
Remote Query database	Query <param>		x		
Info dialog	Info	x			
Move to folder	Move to <to>		x		

Actions logged

Compress folder	(De)compress		x		
Send (data selector)	Send			x	
Send (viewing)	Send			x	
Auto-route	Send			x	
Storage-Commit received	Storage Commit			x	
MPPS messages	MPPS			x	
Report load (via HIS/RIS DLL)	Report load	x			
Report save (via HIS/RIS DLL)	Report save	x			
Print (data selector)	Print				x
Print (virtual film sheet)	Print				x
Print (viewport)	Print				x
Delete study	Delete		x		
Delete series	Delete		x		
Delete image	Delete		x		
Delete by maintenance	Deleted by maintenance		x		
Delete after send	Deleted after send		x		
(un)lock	(un)lock		x		
set status	StudyStatusId <old status> <new status>		x		
View image (standard)	View	x			
View image (with save)	View	x			
Open for QC	QC Open	x			
Open copy for QC	QC Copy	x			
MPR/MIP	View	x			
Create new images (MPR/Acq)	Image created	x			

Actions logged

Save study changes	Save	x			
Archive (copy study to)	Archive store		x		
Import from Archive	Archive import		x		
Study via input directory	Receive		x		
Receive study	Receive from <origin>			x	
Integration module (exe)	Run exe	x			
Integration module (HIS/RIS)	Run HIS/RIS	x			
Integration module (web)	Run web	x			

Actions logged

CHAPTER 13

System maintenance

This chapter describes how to maintain the RadWorks workstation.

IN THIS CHAPTER

Once you have your RadWorks workstation installed, it is important to keep it running optimally. RadWorks contains many features to help you maintain the system.

The Database Service is one of the underlying services of RadWorks. It is responsible for the file handling in the local database. It contains options to manage the data, e.g. to prevent too much data on the workstation's harddisk.

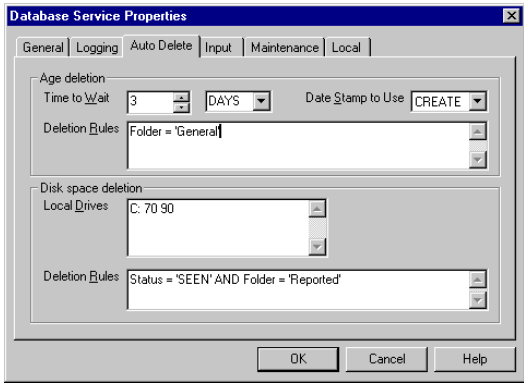
Automatically cleaning up data

The hospital wants the system to check every morning at 9.00 AM and every evening at 6.00 PM for images received three days ago which are still on the disk. The hospital also wants the system to delete reviewed images that are in the 'General' folder, if less than 10% of the disk space is free.

Auto Delete

The Auto Delete function will allow you to automatically delete files from the database, to free more disk space. This will be done according to the SQL rules you specify. The Auto Delete function is activated during a Maintenance run of the Database Service.

Select **Configuration** → **Database Service** and click the **Auto Delete** tab, to display the following dialog box.



There are two auto deleting methods. Age deletion and disk space deletion.

Age deletion

Age deletion will delete images, which have been on the system for a certain time. In this case, Time to Wait is 3 DAYS and Date Stamp to Use is CREATE. The SQL-rule should specify that this deletion rule only applies to the 'General' folder, so the complete SQL-rule will be:

```
31091009 = 'General'
```

(note the single quotes around the value of the field). If there is no SQL-rule defined, the Auto Delete will not work. You can separate statements with a return. They will be executed from top to bottom.

Date stamp to use

Type of data stamp to use in the checking of the age of the data. This can be:

- CREATE: time the data was created (= data added to local database).
- MODIFIED: time the data was saved last (e.g. saving window levels)

Disk space deletion

Disk space deletion will delete images when the used disk space reaches a limit. In this case it is set to 90%. Specify on which drive the Disk Deletion should take place ("C:"), specify the allowed amount of used disk space after the deletion ("70%"), and specify the maximum allowed amount of used disk space ("90%"). Just as in the Age deletion, if there is no SQL-rule defined, the Auto Delete will not work. You can separate statements with a return. The system will check after each line if the required amount of free disk space is reached. If not, the next statement is executed.

Deletion is performed on a First In First Out basis (FIFO).

SQL rules

SQL rules exist of a number of Boolean expressions which can contain the words AND, OR and can contain brackets '()' for ordering. The following variables are stored by the Data Selector and can be used in the SQL rules:

DICOM Tag	Description
[dcm31091002]	Status (Applicare's proprietary statuses NEW and SEEN)
[dcm0032000A]	Status1 (DICOM Study Status ID)
[dcm31091008]	Origin
[dcm31091009]	Folder

Variables stored by Data Selector

DICOM Tag	Description
[dcm00100010]	PatientName
[dcm00100020]	PatientID
[dcm00100030]	PatientBirthDate
[dcm00100040]	PatientSex
[dcm00080020]	StudyDate
[dcm00080030]	StudyTime
[dcm00080050]	AccessionNumber
[dcm00200010]	StudyID
[dcm00080090]	ReferringPhysician
[dcm00081030]	StudyDescription
[dcm00080060]	Modality

Variables stored by Data Selector

Examples:

To find all studies from a modality:

```
dcm00080061 like '%MR%'
```

The 'like' statement is used because the Modality tag can contain multiple values. Presentation states, for instance, are listed as modalities.

To find all studies from referring physician 'Jansen', with modalities MR or CT:

```
dcm00080090 = 'Jansen' AND (dcm00080090 = 'MR' OR dcm00080090 = 'CT')
```

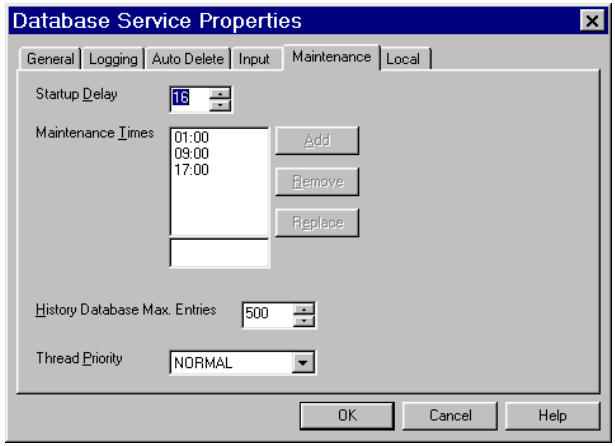
Maintenance Run

In the maintenance run, the Database Service checks the consistency of the database and executes the Auto Delete command(s) at the set Maintenance Times.

Consistency checks are, for example:

- Compare contents of local.mdb with data files in the RadWorks folders. If the data is not found in the local.mdb, but in a folder, it is added to the local.mdb

- Select **Configuration → Database Service**, and click the **Maintenance** tab to display the following dialog box.



When the service is started, a maintenance run is done after the Startup Delay has expired. This delay (in seconds) gives the Database Service enough time to start up completely. After the Service started correctly and the initial Maintenance Run is completed, the system will perform three regular Maintenance Runs at the specified Maintenance Times. You can modify these times or add new ones, according to the customer's requirements. In our scenario, they should be set to 9.00 and 18.00.

If you want to increase or decrease the Thread Priority, you can set it from IDLE (least priority) to HIGH (most priority).

RadWorks software patches

A Software Patch is used to distribute resolved (severe) deficiencies that have become evident after a release. A Software Patch is a single executable that is run on a system on which RadWorks has been installed. It updates existing executables and DLLs at the binary level.

How to apply a software patch

Before applying a software patch it is best to read the accompanying release notes or any internal documentation supplied by your own company first.

When you have determined that a particular RadWorks systems needs to be patched, run the patch.

The patch program will automatically stop all the RadWorks Services, then unpack the compressed binaries and copy them to their appropriate directories. During this part of the patch, the program checks for the existence of a file, then checks the version of the file and, subsequently, overwrites the file with the new version.

When encountering problems

When encountering problems (for example, one of the Services was not stopped and the Software Patch was not able to change a file) some error message will typically be displayed. Correct the problem and rerun the Software Patch. Note that there is no harm in running the Software Patch more than once because on subsequent runs the program will notice that the files already have been modified and, consequently, do nothing.

How to verify what software patch level a system has

There are two ways you can check which Software Patch level a RadWorks system has:

The 'About' box

Start RadWorks and select **Help ➔ About**.

The build number displayed in the 'Version' box is the build number of the RadWorks executable (RadWorks.exe), which may differ from the build number of the other binaries. When you click **Details**, the system lists in detail which version of each file is installed and which patches have been applied. When a patch is listed with "install date unknown", that means the patch was part of the original installation (instead of being applied at a later date). For example, when all patches up to level 9 read "install date unknown", that means your installation CD-ROM contains RadWorks 6.0 at patch level 9.

Healthpage

The RadWorks Healthpage (\bin\Healthpage.exe, see ‘Getting system information’ on page 283) gives status information on RadWorks. Click **Version of Files** to see which patch level the system has.

Upgrading

RadWorks 1.x to RadWorks 6.0

It is not possible to upgrade version 1.x to RadWorks 6.0. If you have a RadWorks 1.x system, you can install RadWorks 6.0 on the same system whilst keeping the 1.x version.

Remove RadWorks 1.x manually as described in the RadWorks 1.3 manual.

RadWorks 1.x is not Y2K compliant. Technical support s no longer provided for this version.

RadWorks 1.x was designed to run on Windows NT 3.51 systems. Upgrading such a system, usually, also means new hardware and a Windows 2000 license.

RadWorks 2.1, 4.0, 5.x to RadWorks 6.0

This subject is covered extensively in the Installation Chapter.

Known upgrade issues

This paragraph contains information on possible problems that might occur during an upgrade process.

If you encounter problems that are not discussed here, don't hesitate to send an E-mail to support@applicare.com.

Windows

- The RadWorks 6.0 services use ODBC (MS-Access driver). This can lead to problems with other applications trying to install/delete ODBC drivers. Before installing such an application stop all RadWorks 6.0 services.
- Do not run any previous version of RadWorks on the same machine (if you can not avoid this, use a different Windows NT boot for each installation).
- Use caution when installing beta and/or pre-release 3rd party software on RadWorks 6.0 systems.

Dongles and license files

Dongles can not be downgraded.

- When upgrading an existing RadWorks 2.1, 4.0 or 5.x system you will also need to obtain RadWorks 6.0-specific dongle upgrade codes. You can then upload these codes into the dongle (using **Upgrade.exe**, found in the \bin directory).

Viewing

- Although the minimum resolution in which RadWorks 6.0 is allowed to run is 800x600 (SVGA), you may experience some problems displaying tooltabs with that resolution. We recommend you run RadWorks in at least 1024x768 (XVGA).

Connection Service

- When creating a new destination the port number is set to 104 by default. When adding a RadWorks 2.1 system as a destination using DICOM, change the port number to 3120, when adding a RadWorks 4.0 or 5.x system as a destination using DICOM, change the port number to 3140.

Workgroup Server

Users connected to server

In RadWorks Workgroup Clients, the Help menu contains a 'Users…' item. Click this item and a dialog box appears that will query the server for the active connected clients. Click **Refresh** to query the server again.

Monitoring the performance of the Database Service

In the **Configuration** → **Database Service** → **General** tab the 'Performance monitoring' checkbox is displayed. When this feature is enabled, a new log file (default name DBS_Performance.log) will be created that contains a line for each function called. These lines have the following syntax:

```
<time> [thread] <function>: <status>
```

<status> can have one of four values:

- BEGIN function is called,
- START functionality is started (START-BEGIN is wait time),
- FAILED functionality failed,
- END functionality successfully performed.

This feature is meant for measuring the usage/performance of a workgroup server. Only use it for diagnostic purposes and turn it off during normal operation.

The logging level is automatically set to ‘ALL’ and can only be changed in the registry:

```
HKLM/Software/AMI/Database/5.0/Performance/Logging
```

Valid levels are: NONE, LOW, NORMAL, HIGH and ALL.

Making backups

Since RadWorks is highly configurable, it is recommended that you make backups of the following after the system is configured to your satisfaction and all settings are working correctly.

Copy the following RadWorks files to a safe location:

- %ROOT%\connect\connect.mdb
- %ROOT%\print\print.mdb
- %ROOT%\ait\ait.mdb
  (if the Single Media Archiving module is installed)
- %ROOT%\samples\reports*.*
  (if the user has created report templates and stored them in this directory)

Copy the following Windows files to a safe location:

- \winnt\profile\<user name>\ntuser.dat

where <user name> is the name of each user working with RadWorks. This file contains the complete `HKEY_CURRENT_USER` registry hive, which includes the personal settings of RadWorks. Create subdirectories per user on the safe location and copy the relevant ntuser.dat file to its appropriate directory.

Exporting Registry settings

Make sure the exported file has the correct (user) name.

The RadWorks Settings tool allows you to easily create backups of the RadWorks settings in the Registry. You can backup the system-wide settings (in the `HKEY_LOCAL_MACHINE\Software\AMI` hive) and user-specific settings (in the `HKEY_CURRENT_USER\Software\AMI` hive).

To back up Registry settings ▶

1. Start the RadWorks Settings tool. In the \bin directory, start RadWorksSettingsTool.exe.
2. To back up the settings for the user that is currently logged in, click RadWorks User.
3. To back up the system-wide settings, click RadWorks System.
4. For both settings, you can specify a location. The settings are exported as an XML file.

5 You can move user settings between computers. This way you can ensure a user has his own settings on each RadWorks station he uses.

Defragmentation

Hard disks can become heavily fragmented when a large number of files are stored and deleted at regular intervals. Fragmented image data files can be the result and will cause performance deterioration. Applicare therefore recommends you defragment RadWorks systems regularly, or at least check the fragmentation percentage of the system.

Moving local database to a different drive

The database service (DATABASE.EXE) will still run from C:

Database\Input, Database\History and Database\Work will remain operational on C:

Archive buffers will still by default be created under the database root directory on C:

To move the local database (and images directories) to a different drive than the RadWorks program files ▶

1. Install RadWorks 6.0 on your local drive (for example, drive C).
2. Stop the database service.
3. Copy the folder C:\AMI_60\DATABASE to drive F, or another available drive. If you use another available drive, replace the drive letter “F” in the following text by the appropriate drive letter.

Type the following in regedit:

1

[HKEY_LOCAL_MACHINE\SOFTWARE\AMI\Database\6.0\Databases]

[HKEY_LOCAL_MACHINE\SOFTWARE\AMI\Database\6.0\Databases\Local]

“Description”=”Local Database”

“Directory”=”F:\\DATABASE\\LOCAL”

“DatabaseFile”=”F:\\DATABASE\\LOCAL\\LOCAL.MDB”

[HKEY_LOCAL_MACHINE\SOFTWARE\AMI\Database\6.0\Databases\Local\General]

“Directory”=”F:\\DATABASE\\LOCAL\\GENERAL”

2

[HKEY_LOCAL_MACHINE\SOFTWARE\ODBC.INI\DatabaseIndex]

“Driver”=”C:\\WINNT\\System32\\odbcjt32.dll”

“DBQ”=”F:\\DATABASE\\LOCAL\\LOCAL.MDB”

“DefaultDir”=”F:\\DATASE\\LOCAL”

Start the database service.
Studies will be stored in the General Folder on drive F.

- Note that processes between the ‘Input’ and ‘Work’ directory are still performed on your local drive C.

- Note that newly created folders are also placed in the F:\DATA-BASE\LOCAL directory.

Starting and stopping the services

RadWorks Healthpage

You can use the RadWorks Healthpage (%ROOT%\bin\Healthpage.exe, see 'Getting system information' on page 283) to start and stop the RadWorks services.

CtrlsrvW.exe

CtrlsrvW.exe is an utility that lists all RadWorks services and their status and allows you to start and stop them.

Getting system information

The RadWorks Healthpage (\bin\Healthpage.exe) provides an overview of the system. It lists version numbers, free disk space, and some statistics on the services (these are mainly useful during troubleshooting).

To export the status report to a file, click **Make Status File**.

To view the information available in the local database, click **Database Column Definitions**. If a DICOM tag is listed here, you can view the information in the Data Selector by adding a column that displays this tag (right-click a column boundary, then select **Insert Column**).

CHAPTER 14

Troubleshooting

This chapter describes steps you can take when you encounter problems with RadWorks.

IN THIS CHAPTER

All RadWorks services use log files to output information, error messages and warnings. In case you encounter any problems look there first for possible causes.

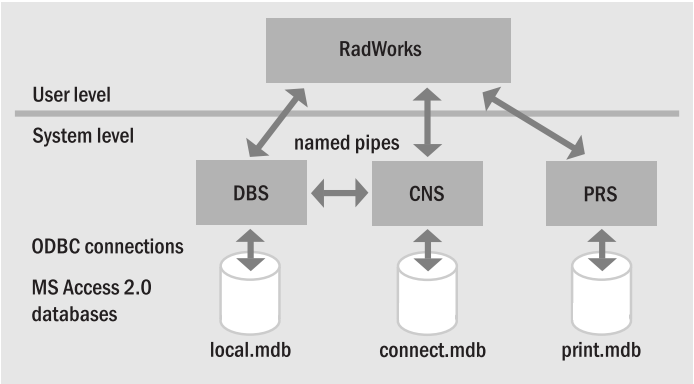
RadWorks is supplied with several utilities, to enable troubleshooting using the console mode.

What to do if the system locks up

Initial steps to unlock the system ▶

1. Open the **Health Page**, or the **CtrlSrvw.exe** (both can be found in the %ROOT%\bin directory).
2. Stop the services.
3. When the services have been stopped, restart them.
4. Return to RadWorks.

System Overview



Tips on how to diagnose

Running a Service in Console Mode

It is possible to run a Service in “console mode”. In this mode, information that will be written to a log file is also displayed in a window.

To run a service in console mode ▶

1. Start the system as usual, and then stop the service (use the **Health Page** or **CtrlSrvW**, both are in the %ROOT%\bin directory).
2. Set logging level and logging type:
   Open the **Configuration** → **Connection service** (or → **Database service**, or → **Print service**, as appropriate) menu.
3. Select the **Logging** tab.
4. Set the Logging Level to **ALL**.
5. Make sure the Logging Type **CONSOLE** check box is checked.
6. Open a Command Prompt.
7. Change directory to %ROOT%\BIN.
8. Register the service so it can be run in console mode:
   Connection service: type `connect /regserver`
   Database service: type `database /regserver`
   Print service: type `print /regserver`
9. In **CtrlSrvW**, the service will disappear from the list.
10. Start the service:
    Connection service: type `connect`
    Database service: type `database`
    Print service: type `print`

    This will start the service as a foreground application (in a new Command Prompt window), so you can watch the logging in ‘real-time’

To increase the screen buffer size of the window, so you can scroll back ▶

1. Right-click the title bar of the command prompt window.
2. From the menu, select **Properties.**
3. Open the **Layout** tab.

4 Set the **Screen Buffer Size - Height** to 400 lines.

To end console logging ▶

1 Close the Command Prompt window that contains the logging information. This will stop the service.

2 In a Command Prompt, register the service so it can be run as a service:
Connection service: type `connect /service`
Database service: type `database /service`
Print service: type `print /service`

3 Start the service (use the **Health Page** or **CtrlSrvW**, both are in the %ROOT%\bin directory).

Providing log files and other important information

If severe problems occur, technical support may ask you to make information available to them for troubleshooting.You can supply the log files, or a status file which contains registry information, logs and database information (the connection origins and destinations, print destinations and layouts, and the local database structure).

The services, and RadWorks itself automatically create log files. The logging level is set to “NORMAL”, by default. If the log file does not supply you with enough information, you can increase the logging level.

To increase the logging level ▶

1 Stop all the relevant services (use the **Health Page** or **CtrlSrvW**, both are in the %ROOT%\bin directory).

2 Move the existing log files (%ROOT%\log) to a safe location.

3 Set the logging levels for all the relevant services and RadWorks to 'ALL'. Use the following table.

Component	Log file	How to set the level to 'ALL'
Connection Service	%ROOT%\log\Connect.log	Configuration → Connection Service, Logging tab: Logging Level = ALL
Database Service	%ROOT%\log\Database.log	Configuration → Database Service, Logging tab: Logging Level = ALL

Logging

Print Service	%ROOT%\log\Print.log	Configuration → Print Service, Logging tab: Logging Level = ALL
RadWorks main program	%ROOT%\log\RadWorks.log	Configuration → Generic, Logging tab: Logging Level = ALL

Logging

4 Start the relevant services again.

To export the Status file▶

1 Open the **Health Page** (in the %ROOT%\bin directory).

2 Click **Make Status File**.

3 Select a name and location for the file.

Understanding the log files

The structure of a line in a log file is:

```
1999/05/16 10:06:20.362: <I> [DCM] Association instantiated success-
  fully
```

Codes used in the log files

Thread codes

DBS= database service

CNS= connection service

PRS= print service

RW= RadWorks application

Code	Occurrence	Thread name	Purpose
[A]	CNS	Association thread	
[A-CONN]	DBS	ArchiveConnect thread	
[C.P.x]	RW,DBS,CNS,PRS	ClientProtocol worker thread	Listens to active pipe connection with other process
[CS]	DBS, CNS, PRS	ClientInterface Manager thread	Waits for connections from other processes that want to communicate with this process
[I]	DBS	Input thread	Scans the input directory for new files
[M]	DBS, CNS, PRS	Maintenance thread	Performs scheduled maintenance runs.
[PI-dp]	PRS	DICOM Printing thread	Handles DICOM print requests
[PI-ff]	PRS	FileFormat Printing thread	Handles Print-to-File requests
[PI-wp]	PRS	Windows Printing thread	Handles Windows print requests
[RISx]	RW, DBS	RIS connection thread	
[R13]	CNS	Release 1.3 receive thread	Waits for AMI protocol connections from 1.3 systems
[SCP]	CNS	DICOM SCP thread	Listens on TCP port for incoming associations
[SCP-x]	CNS	DICOM worker thread	Handles active association instance
[S.LC.x]	DBS	ServerProtocol worker thread	AMI-DBS-LOCAL protocol
[S.P.x]	DBS	ServerProtocol worker thread	

[S.QR.x]	DBS	ServerProtocol worker thread	AMI-DBS-QR protocol Executes a.o. DICOM query requests
[ST]	CNS	Storage Commitment thread	
[TC]	RW	TimerConnect thread	
[TR]	CNS	Transmission thread	Performs send jobs
[U]	DBS	UpdateQueue thread	

SendEvent(<Event>) Event codes

Event Code	Meaning
65537 (0x10001)	SendQueue changed
65538 (0x10002)	SendLog changed
65539 (0x10003)	ReceiveLog changed
65540 (0x10004)	OnGoing Transmission changed
65541 (0x10005)	OnGoing Receive changed

License files

MAC address detection in Windows 2000

When the system detects that there is no Active Network link, the network card drivers will not be bound to the NIC, and a 00-00-00-00-00-00 MAC address will be returned. For a windows 2000 system you can try the following:

10-Base2 or coaxial (RG-58) Ethernet cable is not a connection-based media. Because of this, Windows 2000 does not attempt to detect a "connect" state if this type of cabling is used.

NetBEUI and IPX do not recognize Media Sense.

Summary

Windows 2000 contains the "Media Sensing" feature. You may use this feature on a Windows 2000-based computer using Transmission Control Protocol/Internet Protocol (TCP/IP) to detect whether or not your network media is in a "link state". A "link state" is defined as the physical media connecting or inserting itself on the network. For example, assuming a 10bt or 100bt physical media, Ethernet network adapters and hubs typically have a "link" light to indicate the current connection status. This is the same condition in which Windows 2000 can detect a link. Whenever Windows 2000 detects a "down" state on the media, it removes the bound protocols from that adapter until it is detected as "up" again. There may be situations where you may not want your network adapter to detect this state, and you can configure this by editing the registry.

More information

You can edit the registry to prevent media sensing.

There are some side effects of disabling the "Media Sensing" feature. For example, if you have a machine with two network adapters, and you have the "Media Sensing" feature enabled, if one network adapter does not work, it is unbound, and associated routes are removed so that all traffic goes through the other network adapter (assuming a default gateway is there). Also, if you are a roaming (portable) user, the "Media Sensing" feature is what provides the ability to connect to any network and have everything work, without restarting, release and renewing, and so on. After disabling Media Sense and restarting, Windows 2000 still shows the "Network Disconnected" icon on the TaskBar and the 'ipconfig' command still shows a "Media State .....: Cable Disconnected" message when the cable is disconnected. However, the Network Interface is bound to TCP/IP and you can verify this by looking at the route table --you can use the "route print" command-- which shows the interface IP address (you are also able to ping the IP address assigned to the NIC).

For information about how to edit the registry, view the "Changing Keys and Values" Help topic in Registry Editor (Regedit.exe) or the "Add and Delete Information in the Registry" and "Edit Registry Data" Help topics in Regedt32.exe. Note that you should back up the registry before you edit it. If you are running Windows NT or Windows 2000, you should also update your Emergency Repair Disk (ERD).

To prevent your network adapter from detecting the link state ▶

1. Use Registry Editor (Regedt32.exe) to view the following key in the registry:

   `HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Tcpip\Parameters`

2. Add the following registry value:

   Value Name: DisableDHCPMediaSense

   Data Type: REG_DWORD -Boolean

   Value Data Range: 0, 1 (False, True) Default: 0 (False)

   Description: This parameter controls DHCP Media Sense behavior. If you set this value data to 1, DHCP, and even non-DHCP, clients ignore Media Sense events from the interface. By default, Media Sense events trigger the DHCP client to take an action, such as attempting to obtain a lease (when a connect event occurs), or invalidating the interface and routes (when a disconnect event occurs).

3. Restart your computer.

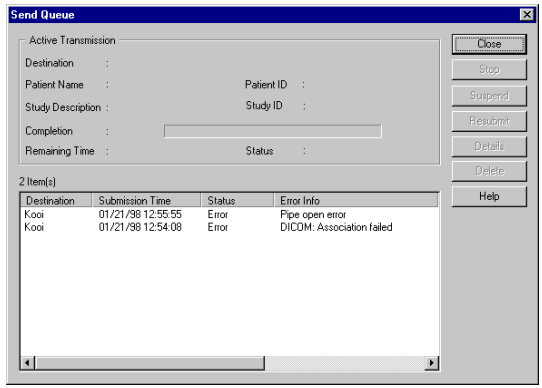
Data acquisition solutions

If you experience any trouble, check and try the following:

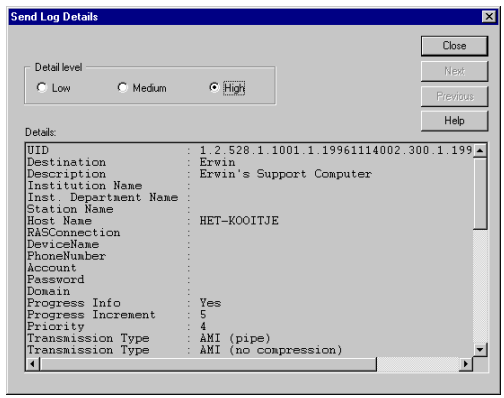
- Read the relevant section(s) in this documentation entirely and carefully.
- If the device is a SCSI device, read section 'General note about SCSI devices' on page 248.
- If the device uses a device driver, read section 'General notes about device drivers' on page 250.
- Check the Radworks.log file in the %ROOT%\Log directory for error messages.
- Get the latest version of the driver software for the hardware you are trying to install. The drivers on the RadWorks CD-ROM might be an older version.
- Do you have the appropriate license? If not, upgrade your license.
- Try the installation procedure on a 'clean' Windows system.
- When acquiring large studies, the message "Your system is running low on virtual memory…" etc. may appear. If this is the case, enlarge the size of the Virtual Memory in **Control Panel ➔ System ➔ Advanced ➔ Performance Options**.

Teleradiology solutions

RadWorks transmission problems



Transmissions that fail remain in the Send Queue. Select the Destination in the list and read the Details.



If the low detail level does not supply you with enough information select the high level option.

Display private tags in Remote View from RadWorks 4.0/5.x

In RadWorks 6.0 a bug was fixed, which showed wrong tags in a C-FIND response. This fix has consequences for older versions. Private tags may not be displayed correctly when performing a Remote View from a RadWorks 4.0 or 5.0 system on a RadWorks 6.0 system.

This can be fixed by changing the DICOM dictionary registry

```
HKEY_LOCAL_MACHINE\Software\AMI\AMIL\5.0\DicomDict\Elem<xxx>
```

Change tag value 0x310900xx into 0x310910xx.

Communication (error) messages

When sending or receiving association requests the connect.log file can contain very specific (error) messages, informing you what happened during the communication.

The following errors are all RadWorks-related	
Error message	**Possible cause and solution**
Unknown error.	Default error, when all other messages are not applicable.
Database error.	The CS cannot connect to the DBS. This can be due to insufficient rights, or simply because the DBS is not running.
Study unknown error.	The DBS cannot give the CS the study the CS is requesting for transmission. The study may have been deleted before the transmission actually started.
Study cannot be deleted.	The DBS cannot delete the study that the CS has asked to be deleted. The CS asks for studies to be deleted if the 'Delete after Send' flag is enabled for a particular transmission job.
Memory allocation error.	The CS cannot allocate a file copy buffer. It may be that the block size for file copies has been set unusually large (e.g. many megabytes). See section 8.3.4.
Study load error.	The CS cannot load a study. This indicates invalid data. Try viewing the study by selecting it from the data selector.
Study save error.	The CS cannot save a temporary study. This is typically used for compressed transfers, where data is first compressed, then saved, and then transmitted. It could be that there is not enough disk space available for the intermediate copy. It can also be that the work directory for the CS is not setup properly.
Identification error.	The CS is not allowed to talk to the remote CS, because of identification problems.
Transmission details error.	The remote CS cannot accept the data that is about to be transmitted, since the parameters are incorrect.
Out of disk space.	The remote CS refuses the transfer since not enough disk space is available on the remote system.
Transmission refused.	The remote CS simply refuses the transfer (no reason given).
Transmission interrupted.	The transmission was interrupted due to some error (e.g. line disconnect?)
Transmission cancelled.	The user cancelled the transmission while it was active.

Communication-related errors

Compression negotiation error.	The remote CS does not accept the compression parameters requested by the sending CS.
Compression error.	The selected data cannot be compressed. This is likely due to particular properties in the selected data.
Study does not exist any-more.	The study has been deleted while the transmission was active.
Study open error.	The study file cannot be opened on the sending system.
Study read error.	The study file cannot be read on the sending side.
Destination open error.	A copy of the study file cannot be created on the receiving system. This is likely a security problem with the receive share on the remote system.
Destination write error.	During the creation of the copy on the receiving system, something went wrong. The receiving system may be out of disk space, or may have crashed.
The following errors are all RAS-related	
Error message	**Possible cause and solution**
RAS: not enough mem-ory.	The RAS functionality of NT does not work properly. This may be an inconsistent RAS installation. Please check RAS by making manual calls.
RAS: Line busy.	The line is busy. No connection can be made.
RAS: No answer.	The call is not answered. No connection can be made. Please check if the remote system is switched on and properly configured to answer calls.
RAS: No carrier.	The call is answered but no modem carrier is detected. No connection can be made. Please check if the remote system is switched on and prop-erly configured to answer calls.
RAS: No dial tone.	A dial tone is not available. It is not possible to make a call. Is the modem plugged in to the telephone line? Do you need to dial an extension first to get an outside line?
RAS: No active ISDN line.	There is not active ISDN line. It is not possible to make a call. Is the ISDN modem plugged in to the telephone line?
RAS: No ISDN channels available.	The ISDN line is in use by other devices. There are no free channels available.
RAS: Authentication fail-ure.	The login failed due to authentication problems. Does the account dialing into the remote system (typically CN_Service) have dial-in permissions on the remote side? Are the passwords correct?
RAS: Other RAS error.	Any other RAS error.
RAS: Unknown RAS error.	Unknown RAS error.

Communication-related errors

Remote Access Service (RAS) could not be loaded.	RAS is not setup properly on the sending system. Please check your RAS configuration and try to do manual calls first to check RAS.
The following errors are all DICOM-related	
Error message	**Possible cause and solution**
DICOM: Parameter error.	The sending system is not setup properly for DICOM transmission. Is the AE Title for the sending system specified? Does the sending system have a valid host name?
DICOM: Study load error.	The CS cannot load a study. This indicates invalid data. Try viewing the study by selecting it from the data selector.
DICOM: Internal error.	The CS detected an internal problem in the DICOM library.
DICOM: Association failed.	The CS could not establish a connection with the remote DICOM system. This is typically a configuration error. Check the host name, AE Title and port number for the remote system. This may also be due to configuration issues on the remote system.
DICOM: SOP class rejected.	The requested SOP class is not accepted by the remote system. The transfer cannot be carried out. This may be due to configuration issues on the remote system, like transferring data to RadWorks 5.1 without checking the RadWorks 5.1 format checkbox. To correct this: In the Connection → Destinations menu, select a destination, click Modify, then on the Transmission Parameters tab, check the RadWorks 5.1 format checkbox.
DICOM: Conversion error.	An error occurred while creating DICOM messages. This may indicate invalid data. Try viewing the study by selecting it from the data selector.
DICOM: Remote system out of resources.	The remote system indicates that it is out of resources. This can be a disk space or memory problem. Please check the remote system.
DICOM: Format error.	The remote system could not read and/or understand the DICOM message that was sent.
DICOM: Generic storage error.	The storage request failed on the remote system. There is no further specification.
DICOM: JPEG Compression Error.	The study cannot be compressed into DICOM JPEG format. This can be due to many reasons: It is already compressed in some other compression format. The study contains different bit-depths for the images. DICOM JPEG cannot handle this. The study contains signed pixel data. DICOM JPEG cannot handle this.
The following error is Wavelet-related	
Error message	**Possible cause and solution**
No wavelet compression license available.	Wavelet compression is requested but is not licensed. Please select a different compression format.

Communication-related errors

Storage commitment messages

The following messages can be displayed in the Send Queue or in the Send Details:

- Storage commitment: Not supported by SCP

  The SCP does not support storage commitment. More precisely, it does not support the "Storage Commitment Push Model SOP Class" with class UID 1.2.840.10008.1.20.1.

- Storage commitment: Internal error constructing N-ACTION

  Internal error that should never happen. The N-ACTION (= Storage Commitment Request) could not be constructed.

- Storage commitment: Internal error unpacking N-EVENT-REPORT

  The N-EVENT-REPORT (= Storage Commitment Result), received from the SCP, is unreadable.

- Storage commitment: Time out

  An Storage Commitment Request has been sent, but a Storage Commitment Result has never been sent back by the SCP.

- Storage commitment: N-ACTION sent, but SCP cannot process the request

  An N-ACTION (= Storage Commitment Request) has been sent, but for some reason the SCP cannot sent back an N-EVENT-REPORT (=Storage Commitment Result). The most probable reason is that the SCU's DICOM parameters are not or not correctly known at the SCP site.

- Storage Commitment: Result received, but general failure

  A Storage Commitment Result has been received, but with failure reason 0110H ("General Failure" according to the DICOM standard)

- Storage Commitment: Result received, but one or more images not stored

  A Storage Commitment Result has been received, but with failure reason 0112H ("One or more images not stored" according to the DICOM standard)

- Storage Commitment: Result received, but referenced SOP class not supported

A Storage Commitment Result has been received, but with failure reason 0122H ("Referenced SOP class not supported" according to the DICOM standard), i.e. the image modality is not supported by the SCP.

- Storage Commitment: Result received, but class/instance conflict

  A Storage Commitment Result has been received, but with failure reason 0119H ("Class/instance conflict" according to the DICOM standard). It means that the images with the requested UIDs are present but with another modality than specified in the Storage Commitment Request.

- Storage Commitment: Result received, but duplicate transaction UID

  A Storage Commitment Result has been received, but with failure reason 0131H ("Duplicate transaction UID" according to the DICOM standard). Each Storage Commitment Request contains a transaction UID, which should be unique. Apparently the SCP has received an earlier Storage Commitment Request with the same transaction UID as in the present Storage Commitment Request.

TCP/IP communication issues

The following information can also be found on the Microsoft TechNet CD ROM and in the knowledge base on Microsoft's website, and has been included in this guide for your convenience.

Article number: Q169790

Article last modified on 10-03-1997

The information in this article applies to:

- Microsoft Windows NT Workstation version 4.0
- Microsoft Windows NT Server version 4.0

Summary

This article describes how to troubleshoot some common network communication problems you may experience when you use TCP/IP as your network protocol. These problems usually fall into one of the following two categories:

- You are unable to connect to a specific IP address.
- You are unable to connect to a specific host or NetBIOS name.

If you are unable to connect to a specific IP address, the problem is related to basic connectivity. If you are able to connect to a specific IP address, but you are not able to connect using the host or NetBIOS name for that IP address, the problem is related to name resolution.

More Information

To determine whether the problem is related to basic connectivity or name resolution, use the following procedure to determine whether you can connect to a specific IP address.

Connect to an IP Address

Try to connect to another computer on your network using its IP address and the TCP/IP program or utility of your choice. Web browsers, ftp, and Telnet are some programs and utilities commonly used to connect to other computers with TCP/IP.

If you do not know the IP address for the Windows computer that you are attempting to connect to, run the IPCONFIG /ALL command at a command prompt on the other computer.

If you cannot connect to the other computer using its IP address, there is a basic connectivity problem. Use the information in the "Unable to Connect to a Specific IP Address" section below to resolve your issue. If you can connect to the other computer using its IP address, but you are not able to connect using the host or NetBIOS name of the other computer, there is probably a name resolution problem. Use the information in the "Unable to Connect to a Specific Host or NetBIOS Name" section below to resolve your issue.

Unable to connect to a specific IP address

Follow the procedures in each of the following sections in order. After you finish each procedure, check to see if you can connect to the other computer using its IP address.

Check Your TCP/IP configuration

When you use TCP/IP as your network protocol, an incorrect TCP/IP setting (such as an incorrect IP address or an incorrect subnet mask) can cause communication problems. To determine whether Windows has recorded an error due to an incorrect TCP/IP setting, examine the Event Viewer system log and look for any entry with TCP/IP or DHCP as the source. To read an Event Viewer entry, double-click the entry.

If Event Viewer records a DHCP error, report the error to your network administrator.

If you receive TCP/IP errors in the Event Viewer system log, resolve each error received as indicated by the error message. For example, if you receive an error stating that the IP address parameter is incorrect, you should verify that your IP address is valid.

If there are no errors in the Event Viewer system log:

To make sure that the correct TCP/IP configuration information is being used ▶

1. Use the IPCONFIG command to determine your computer's basic TCP/IP settings. To do so, type "ipconfig" (without quotation marks) at a command prompt.
2. Verify that the IP address and subnet mask displayed by the IPCONFIG command are the correct values for your computer. If you are not sure what the correct values are, contact your network administrator.

Ping the loopback address

Use the PING command to verify that TCP/IP is working properly. To do so, ping the loopback address (127.0.0.1) by typing the following command at a command prompt:

```
ping 127.0.0.1
```

You should receive a response similar to the following:

```
Pinging 127.0.0.1 with 32 bytes of data:
Reply from 127.0.0.1: bytes=32 time=<10ms TTL=128
Reply from 127.0.0.1: bytes=32 time=<10ms TTL=128
Reply from 127.0.0.1: bytes=32 time=<10ms TTL=128
Reply from 127.0.0.1: bytes=32 time=<10ms TTL=128
```

Ping your computer's IP Address

You must be logged on as a user with Administrator rights to complete these steps.

If you can ping the loopback address successfully, attempt to ping your own IP address by typing "ping <IP address>" (without quotation marks) at a command prompt, where <IP address> is your computer's IP address.

If you do not know your computer's IP address, you can obtain that information by typing "ipconfig" (without quotation marks) at a command prompt.

You should receive a response similar to the following:

```
Pinging <###.###.###.###> with 32 bytes of data:
Reply from <###.###.###.###>: bytes=32 time=77ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=80ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=78ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=79ms TTL=28
```

where <*###.###.###.###*> is your computer's IP address.

If you receive an error message at this point, there may be a communication problem between Windows and your network adapter. To correct this problem:

Remove and reinstall your network adapter driver ▶

You must be logged on as a user with Administrator rights to complete these steps.

1. In the Control Panel, double-click Network, and then click the Adapters tab.
2. Click your network adapter driver to select it, click **Remove**, and then click **Yes**.
3. Click **Close**, and then click **Yes** to restart your computer.
4. Log on as a user with administrator rights.
5. In the Control Panel, double-click **Network**, and then click the **Adapters** tab.
6. Click **Add**, click your network adapter driver to select it, and then click **OK**.
7. Use the dialog box(es) provided to configure your network adapter, and then click **OK**.

8 When prompted, type the path for the Windows source files, click **Continue**, and then click **Close**.

9 When you are prompted for your TCP/IP configuration information, provide the appropriate values, and then click **OK**. If you are not sure what the appropriate values are, contact your network administrator.

10 Click **No** when you are prompted to restart your computer. If you have installed a Windows Service Pack, you need to reinstall the Service Pack before you restart your computer.

11 Restart your computer.

If you are unable to ping your computer's IP address after removing and reinstalling your network adapter driver, contact the manufacturer of your network adapter to verify that you are using the appropriate Windows driver for your network adapter.

Clear the Address Resolution Protocol (ARP) cache

The address resolution protocol (ARP) cache is a list of recently resolved IP address to Media Access Control (MAC) address mappings. The MAC address is the unique physical address embedded in each network adapter.

If an entry in the ARP cache is incorrect, TCP/IP packets may be sent to the wrong computer. To display all mappings currently in the ARP cache, use the ARP command by typing "arp -a" (without quotation marks) at a command prompt. You should receive either a "No ARP Entries Found" message (if the ARP cache is empty) or a response similar to the following:

```
Interface: 10.1.1.3 on Interface 2
Internet Address      Physical Address      Type
10.1.1.7              08-00-02-06-ed-20     dynamic
10.1.1.254            08-00-02-0a-a3-10     dynamic
```

To remove any incorrect entries in the ARP cache, clear all entries using the following command:

```
arp -d <IP address>
```

where <IP address> is an Internet address stored in the ARP cache. Use this command for each entry in the ARP cache until all entries have been deleted.

For more information on the syntax, options, and usage of the ARP command, type "arp -?" (without quotation marks) at a command prompt.

Verify the Default Gateway

Use the IPCONFIG command to determine the IP address that your computer uses to access your default gateway. To do so, type “ipconfig” (without quotation marks) at a command prompt. Verify that the IP address displayed for your default gateway is correct. If you do not know the correct IP address for your default gateway, contact your network administrator.

When you have verified that you have the correct IP address for your default gateway, use the PING command to verify that you can ping your default gateway’s IP address. You should receive a response similar to the following:

```
Pinging <###.###.###.###> with 32 bytes of data:
Reply from <###.###.###.###>: bytes=32 time=77ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=80ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=78ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=79ms TTL=28
```

where <###.###.###.###> is the IP address of your default gateway.

If your default gateway is not connected to the network or not functioning properly, you may receive a response similar to the following:

```
Pinging <###.###.###.###> with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.
```

If you cannot successfully ping your default gateway’s IP address, contact your network administrator to verify that your default gateway is connected to the network and functioning properly.

Ping the IP address of the other computer

Try to ping the IP address of the other computer. To do so, type “ping <IP address>” (without quotation marks) where <IP address> is the IP address of the other computer. You should receive a response similar to the following:

```
Pinging <###.###.###.###> with 32 bytes of data:
Reply from <###.###.###.###>: bytes=32 time=77ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=80ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=78ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=79ms TTL=28
```

where <###.###.###.###> is the IP address of the other computer.

If there is an improperly configured router between your computer and the other computer, or if there is a problem with the other computer, you may receive a response similar to the following:

```
Pinging <###.###.###.###> with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.
```

If your computer is on a different subnet than the other computer, try to ping the other computer from a computer that is on the same subnet as the other computer. If you cannot ping the other computer from a computer on the same subnet, ensure that the other computer is connected to the network and that you have the correct IP address for the other computer. If you can ping the other computer from a computer on the same subnet, contact your network administrator to resolve any routing problems that may exist on your network.

Verify persistent route table entries

Any computer using TCP/IP as a network protocol has a route table. The route a network packet takes from one computer using TCP/IP to another computer using TCP/IP is determined by the route table of the computer that sent the network packet.

Your computer's route table is automatically rebuilt each time you restart your computer. You or your network administrator can add persistent (static) entries to your computer's route table. Persistent entries are automatically reinserted in your route table each time your computer's route table is rebuilt.

To view your computer's route table, use the ROUTE command. To do so, type "route print" (without quotation marks) at a command prompt. You should receive a response similar to the following:

Active Routes:

Network Address	Netmask	Gateway Address	Interface	Metric
0.0.0.0	0.0.0.0	10.1.1.254	10.1.1.3	1
10.1.0.0	255.255.0.0	10.1.1.3	10.1.1.3	1
10.1.1.3	255.255.255.255	127.0.0.1	127.0.0.1	1
10.255.255.255	255.255.255.255	10.1.1.3	10.1.1.3	1
127.0.0.1	255.0.0.0	127.0.0.1	127.0.0.1	1
224.0.0.0	224.0.0.0	10.1.1.3	10.1.1.3	1
255.255.255.255	255.255.255.255	10.1.1.3	10.1.1.3	1

Verify with your network administrator that all persistent entries in your computer's route table are valid.

For more information on routing, route tables, and the ROUTE command, see the following article in the Microsoft Knowledge Base:

TCP/IP Routing Basics for Windows

Article number: Q140859

Use the TRACERT command

The TRACERT command reports each router or gateway crossed by a TCP/IP packet on its way to another host. To use the TRACERT command to trace the route between your computer and the other computer, type “tracert <IP address>” (without quotation marks) at a command prompt, where <IP address> is the IP address of the other computer. You should receive a response similar to the following:

```
Tracing route to <IP address> over a maximum of 30 hops:
1   <10 ms   <10 ms   <10 ms  <###.###.###.###>
2    50 ms    50 ms    51 ms  <###.###.###.###>
3   250 ms    80 ms    50 ms  <###.###.###.###>
Trace complete.
```

where each <###.###.###.###> is the IP address of a different router.

If there is a problem with one of the routers that the network packet tries to cross, you may receive a response similar to the following:

```
Tracing route to <IP address> over a maximum of 30 hops:
1   <10 ms   <10 ms   <10 ms  <###.###.###.###>
2     *        *        *     Request timed out.
3     *        *        *     Request timed out.
4     *        *        *     Request timed out.
```

If there is a configuration error on one of the routers between your computer and the other computer, you may receive a response similar to the following:

```
Tracing route to <IP address> over a maximum of 30 hops:
1   <10 ms   <10 ms   <10 ms  <###.###.###.###>
2    50 ms    50 ms    51 ms  <###.###.###.###>
3  <###.###.###.###>  reports: Destination net unreachable.
```

You may also receive a response similar to the one above when there is a proxy or a firewall between your computer and the other computer.

If you are not able to obtain a successful response using the TRACERT command to trace the route between your computer and the other computer, contact your network administrator to determine if there is a routing problem between your computer and the other computer.

For more information on the TRACERT command, see the following article in the Microsoft Knowledge Base:

Using TRACERT to Ttroubleshoot TCP/IP problems in Windows

Article number: Q162326

Verify Server Services on the other computer

Verify that the appropriate server services are running on the other computer. For example, if you are attempting to use the Telnet tool to connect to the other computer, make sure that the other computer is configured as a Telnet server.

To verify that the appropriate server service is running on the other computer, attempt to connect to the other computer from another computer that is on the same subnet as the other computer. If you cannot connect to the other computer from a computer on the same subnet, contact the network administrator to verify that the server service is configured and functioning properly on the other computer. If you can connect to the other computer from a computer on the same subnet, contact your network administrator to resolve any routing problems that may exist on your network.

Check IP Security on the server

Port settings for services on the other computer may be different than the port settings you are using to connect. The following chart lists some standard port settings for various protocols:

```
Port:   Protocol:
----  ---------
80      HTTP
21      FTP
23      Telnet
70      Gopher
```

Use the Telnet tool to verify that the other computer is configured to permit connections on the same port you are using to connect. To do so, type the following line at a command prompt:

```
telnet <IP address> <port>
```

where <IP address> is the IP address of the other computer and <port> is the port you are attempting to make a connection on. For example, if you are attempting to make an ftp connection to the other computer on port 21, type “telnet <IP address> 21” (without quotation marks).

If you do not receive an error message, the other computer is configured to permit connections on that port. You should be able to make a connection using the appropriate service on that port.

If you receive an error message, the other computer may not be configured to permit connections on that port. Contact the network administrator to obtain a valid port number for the service on the other computer.

Unable to connect to a specific host or netbios name

If you are able to connect to the other computer using its IP address, but you are not able to connect to the other computer using its host or NetBIOS name, there may be a name resolution problem. There are many methods that can be used to accomplish name resolution on a network including the following:

- HOSTS files
- Domain Name Service (DNS)
- LMHOSTS files
- Windows Internet Name Service (WINS)

If you are uncertain which methods are used to accomplish name resolution on your network, contact your network administrator. Follow the procedures in each of the following sections in order. After you finish each procedure, check to see if you can connect to the other computer using its host name or NetBIOS name.

Check the HOSTS File

The HOSTS file is a text file that you can edit with any text editor (such as Notepad). If your network uses HOSTS files for host name resolution and you cannot connect to the other computer using its host name, there may be an invalid entry in your HOSTS file. Search your HOSTS file for the host name of the other computer, verify that there is only one entry per host name, and then verify that the entry for the host name of the other computer is valid.

For more information on the HOSTS file, see the sample HOSTS file in the WINNT\System32\Drivers\Etc folder.

Check Your Domain Name Service (DNS) Configuration

A Domain Name Service (DNS) server provides host name resolution. If your network uses DNS for host name resolution and you cannot connect to the other computer using its host name, there may be a problem with your computer's DNS configuration or with the DNS server on your network.

To determine if there is a problem with your computer's DNS configuration, follow these steps:

1.Type “ipconfig /all” (without quotation marks) at a command prompt to display the IP address of your DNS server. If the IP address for your DNS server is not displayed, contact your network administrator to obtain the IP address for your DNS server.

2.Verify that you can communicate with your DNS server by pinging your DNS server’s IP address. You should see a reply similar to the following:

```
Pinging <###.###.###.###> with 32 bytes of data:
Reply from <###.###.###.###>: bytes=32 time=77ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=80ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=78ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=79ms TTL=28
```

where <###.###.###.###> is the IP address of the DNS server.

If you cannot ping the IP address of your DNS server successfully, contact your network administrator to verify that you have the correct IP address for your DNS server and that your DNS server is connected to the network and functioning properly.

If you can ping the IP address of your DNS server, but cannot resolve the host name of the other computer, your DNS server may not be resolving host names properly. If more than one DNS server is available on your network, configure your computer to use a different DNS server. If another DNS server resolves the host name of the other computer properly or if there is no other DNS server to use, contact your network administrator to correct the problem with the original DNS server.

When you have verified the correct IP address for your DNS server, update your computer’s TCP/IP settings. If you are using a dial-up connection to connect to your network, you need to change only the TCP/IP settings in your Dial-Up Networking phone book entry with the correct IP address for your DNS server.

To change or add a valid IP address for your DNS server in your computer’s TCP/IP settings ▶

1. In the Control Panel, double-click **Network**, and then click the **Protocols** tab.
2. Click **TCP/IP Protocol** to select it, click **Properties**, and then click the **DNS** tab.
3. If you are adding a DNS server, click **Add**. If you are editing an existing server, click the IP address for the appropriate DNS server, and then click **Edit**.

4 Type the correct IP address for the DNS server, and then click **OK**.

5 Click **OK**, and then click **OK** again. You may need to restart your computer after this step.

To change or add a valid IP address for your DNS server for a Dial-Up Networking phone book entry ▶

1 In Dial-Up Networking, click the appropriate entry in the Phone book Entry To Dial box.

2 Click **More**, and then click **Edit Entry And Modem Properties**.

3 Click the **Server** tab, and then click the **TCP/IP Settings** button.

4 Click **Specify Name Server Addresses**, and then type the correct IP address in the Primary DNS box.

Check the LMHOSTS file

The LMHOSTS file is a text file that you can edit with any text editor (such as Notepad). If your network uses LMHOSTS files for NetBIOS name resolution and you cannot connect to the other computer using its NetBIOS name, there may be an invalid entry in your LMHOSTS file. Search your LMHOSTS file for the NetBIOS name of the other computer, verify that there is only one entry per NetBIOS name, and then verify that the entry for the NetBIOS name of the other computer is correct.

If there are any #INCLUDE entries or any #BEGIN_ALTERNATE to #END_ALTERNATE blocks of lines in your LMHOSTS file, temporarily disable all such lines or blocks of lines by placing the pound (#) character and one space at the beginning of each line to be disabled.

If disabling these lines or blocks of lines resolves the problem, re-enable the lines or blocks of lines one at a time until the problem reoccurs. When you have determined that a specific line or block of lines causes a problem, check the LMHOSTS files that the lines point to.

For more information on the LMHOSTS file, see the Lmhosts.sam sample file located in the WINNT\System32\Drivers\Etc folder.

Check your Windows Internet Name Service (WINS) configuration

A Windows Internet Name Service (WINS) server provides NetBIOS name resolution. If your network uses WINS for NetBIOS name resolution and you cannot connect to the other computer using its NetBIOS name, there may be a problem with your computer's WINS configuration or with the WINS server on your network.

To determine if there is a problem with your computer's WINS configuration ▶

1. Type "ipconfig /all" (without quotation marks) at a command prompt to display the IP address of your WINS server. If the IP address for your WINS server is not displayed, contact your network administrator to obtain the IP address for your WINS server.

2. Verify that you can communicate with your WINS server by pinging your WINS server's IP address. You should see a reply similar to the following:

```
Pinging <###.###.###.###> with 32 bytes of data:
Reply from <###.###.###.###>: bytes=32 time=77ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=80ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=78ms TTL=28
Reply from <###.###.###.###>: bytes=32 time=79ms TTL=28
```

   where <###.###.###.###> is the IP address of the WINS server.

If you cannot ping the IP address of your WINS server, contact your network administrator to verify that you have the correct IP address for your WINS server and that your WINS server is connected to the network and functioning properly.

If you can ping the IP address of your WINS server, but cannot resolve the NetBIOS name of the other computer, your WINS server may not be resolving NetBIOS names properly. If more than one WINS server is available on your network, configure your computer to use a different WINS server. If another WINS server resolves the NetBIOS name of the other computer properly or if there is no other WINS server to use, contact your network administrator to correct the problem with the original WINS server.

When you have verified the correct IP address for your WINS server, update your computer's TCP/IP settings. If you are using a dial-up connection to connect to your network, you need to change only the TCP/IP settings in your Dial-Up Networking phone book entry with the correct IP address for your WINS server.

To change or add a valid IP address for your WINS server in your computer's TCP/IP settings ▶

1. In Control Panel, double-click Network, and then click the Protocols tab.

2. Click TCP/IP Protocol to select it, click Properties, and then click the WINS Address tab.

3 Type the correct WINS server IP address in the Primary WINS Server box, and then click OK.

4 Click Close, and then click Yes to restart your computer.

To change or add a valid IP address for your WINS server for a Dial-Up Networking phone book entry ▶

1 In Dial-Up Networking, click the appropriate entry in the Phone book Entry To Dial box.

2 Click More, and then click Edit Entry And Modem Properties.

3 Click the Server tab, and then click the TCP/IP Settings button.

4 Click Specify Name Server Addresses, and then type the correct IP address in the Primary WINS box.

Using the RadWorks utilities

The RadWorks utilities reside in the \bin sub-directory of the directory into which RadWorks has been installed (the default is \AMI_60). They can prove useful for a wide range of tasks.

Checkpal.exe

Checkpal is a Win32 application that attempts to create a palette with 256 gray values. If correct, the gray-scale ramp should not show any clear blocks, but show a seamless transition from black to white. The existence of blocks indicates the use of a wrong video mode, or a limitation in the video driver or video card. Double-click to launch it.

CtrlsrvW.exe

CtrlsrvW is a windows utility to change the execution status of a service or driver. It lists all RadWorks services and their status and allows you to start and stop them.

Dcmecho2.exe

Dcmecho2 is a command line utility to establish an association and issue a C-ECHO command to a DICOM service on a RadWorks system or any other DICOM system that supports the Verification SOP class (C-ECHO SCP service). This utility is typically used to test the most basic form of DICOM connectivity. It can be regarded as the “ping” utility (frequently used for basic testing of TCP/IP networks) for DICOM.

Syntax:

```
Dcmecho2 [-s port] [-t title] [-v] title host:service
        [-s port]   Port number for running in SCP (server) mode
        [-h name]   Host name for this machine
        [-t title]  Title for this (local) Application Entity
        [-v]        Verbose mode
        title       Title of called (remote) Application Entity
        host        Hostname of server
        service     Port number on server
```

Note that with the -s option the title, host, and service parameters may be omitted to accept any Application Entity.

Example:

```
dcmecho2 AE_DIAG1 diag1:3140
1999/08/26 14:05:01.927: <A> Association requested successfully from AE
   'AE_RadWorks' at address RadWorks:3140
```

```
1999/08/26 14:05:02.258: <A> Successfully received C-ECHO response
```

DcmPing.exe

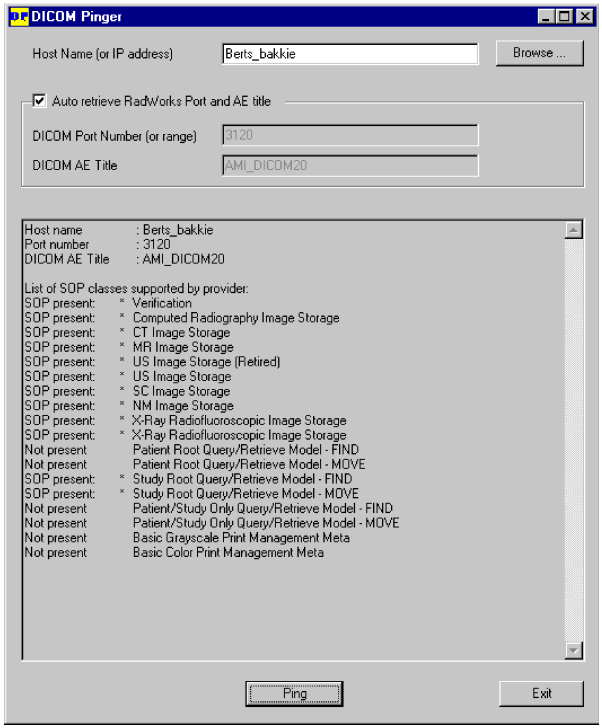
DcmPing is a utility to test the connection with a DICOM server or another RadWorks workstation (comparable to the Dcmecho2 command line utility). A successful response displays a number of standard SOP classes supported by the DICOM server.

If you do not know the host name, you can browse through the network neighborhood by clicking the browse button.

You can choose to retrieve the DICOM port number and the AE Title automatically (default setting) or enter the DICOM port number and AE Title manually. This option is not available on the Windows 2000 system.

When you click the Ping button an association request will be sent to the remote system.

If the remote system is not available or does not have an AE Title or port number, the program will inform you that the association failed. If it is successful, you will see information very much like shown in the figure below.



Dcmsend2.exe

Dcmsend2 (a command line utility) can be used to test C-STORE SCP support on a DICOM system by sending a study to this system via the C-STORE SCU class. This utility is meant for basic testing, and will typically be run after the Dcmecho2 utility was found to run properly.

Syntax:

```
DCMSend2 [-t title] [-v] [-d] [-p] title host:service data_file
       [-t title]  Title for this (local) Application Entity
       [-v]        Verbose mode
       [-d]        Data to send is in raw DICOM format
       [-x]        Data to send is in raw DICOM format with Explicit VR
       [-p]        Data to send is in DICOM Part 10 format
       [-s]        Use a single association per image
       title       Title of called (remote) Application Entity
       host        Hostname of server
       service     Port number on server
       Without the [-d] option:
       data_file   Name of AMI dataset file without extension
                   (no .MET or .IMG)
       With the [-d] option:
       data_file   Name of raw DICOM file (multiple files may be
                   gives separated by spaces)
```

Example:

```
dcmsend2 AMI_DICOM20 machine:3120 c:\temp\study
       (Application Entity title is AMI_DICOM20; host is machine; port
       number is 3120).
```

Example:

```
dcmsend2 -x -p AE_VIEWING40 machine:3140 c:\temp\dicomPart10study.tmp
```

License.exe

License is a command line utility to inspect the license codes present in a dongle. If a dongle is present on the parallel port, the contents of the dongle will be listed.

Syntax:

```
license
```

Example:

```
C:\AMI_60\BIN>license
License expiry : 31-12-1999 (dd-mm-yyyy)
License type   : Dongle
```

```
Serial number  : 19990512029
OEM            : No OEM
Product type   : RadWorks Diagnostic
License        : Multi Monitor
License        : Print
License        : MPR/MIP
License        : Data Acquisition
License        : Single Medium Archive
License        : Quality Control
License        : Wavelet Compression
License        : Workgroup Server: 2 concurrent users
```

RunLCfg.exe

RunLConfig is used from within RadWorks to display the license configuration dialog available in the **Configuration → Licensing…** menu.

Tiffconv.exe

TIFF converter is a small windows utility to convert (a number of) TIFF files to the RadWorks native format.

To convert TIFF files to the RadWorks native format ▶

1. Enter the Patient Data.
2. Select the input files to be converted by clicking the **Browse** button next to the input file(s) box. You cannot change the input files or output directory by entering a path.
3. Select the output directory by clicking the **Browse** button next to the output directory box.
4. Click **Convert** to convert the files. A progress indicator will pop up to show the progress of the conversion process. After reading the TIFF files and writing the output, control returns to the dialog box and you can select a new set of input files. The settings for input and output directories are preserved.

Dcmscp.exe

This is a command line tool that will receive DICOM C-STORE commands and store the resulting files in temporary files on the hard disk.

Syntax:

```
dcmscp portnumber [transfersyntax]
```

The program will wait for an SCU to connect and will then write the incoming DICOM data to disk. You can use the optional transfer syntax argument to force the acceptance of C-STORE commands using that particular transfer syntax only.

For some common transfer syntaxes the following symbolic names are available:

```
il = 1.2.840.10008.1.2 (Implicit Little Endian)
el = 1.2.840.10008.1.2.1 (Explicit Little Endian)
eb = 1.2.840.10008.1.2.2 (Explicit Big Endian)
jp8 = 1.2.840.10008.1.2.50 (JPEG  8 bit Default)
jp12 = 1.2.840.10008.1.2.51 (JPEG 12 bit Default)
jpll= 1.2.840.10008.1.2.70 (JPEG Lossless Default)
```

For instance, to capture input normally sent to the Connection Service (CS), stop the CS, and type:

```
dcmscp 104
```

The utility will store the captured input as .tmp files in the \bin directory.

Just typing **dcmscp** will display a brief overview of the command syntax.

DICOM repair utility

This utility is Origin-specific, it runs a script for every image in a study received by the Connection Service. The script can access any DICOM field in patient, study, series, or image objects and can change its value.

When installed and configured, the functionality works as follows:

1. A study is received by the Connection Service.
2. The origin is looked up.
3. The script for the origin is loaded.
4. The script is run for every image.
5. If the script returns false for one or more images, it stops and does not apply repair actions to any of the images.
6. When the script is run successfully for all images, the change information is applied to all images.
7. After the post-process step is completed, the study is saved and added to the database.

It will only apply changes when all images in a study can be correctly repaired.

You can only change DICOM fields that are stored in the AMI format, but you can't change DICOM fields themselves.

The repair feature is implemented using a similar mechanism as QC automatching. This mechanism is extended so it can run more than one post process. The repair functionality itself is in a post process dll (repair.dll). The functionality in this dll will be called after receiving the images and before adding them to the database.

The repair functionality runs this script over all the images. If all scripts are run successfully, the collected changes are applied to the images.

A script has two objects:

- dcmsetImage : Contains the image information. Via dcmsetImage.GetValue() an unformatted DICOM value can be queried and used to make decisions etc in the script.
- dcmsetRepair : Contains all the changes that must be applied to the image. Via dcmsetRepair.SetValue() an unformatted DICOM value can be set. This will be used to overwrite the old value (or create a new one).

For configuration, use the RepairCfg application. With this application the repair functionality can be enabled/disabled, scripts can be added, modified and deleted.

After creating the Origins in RadWorks you can select the appropriate origin and click **Default**. This will enter a default script into the dialog window.

Click **Test** to parse the script to see if there are errors. Please note that this is a limited test.

Check the **Enable** check box to enable the script.

When the Repair Script is enabled it will apply to the Origin you specified.

In the **Configuration → Connection Service** menu, on the **Receive** tab, the 'Post Process' field will be automatically updated with the 'repair.dll' entry. If the system has already been set up for automatic matching, then the new entry will be appended to the existing entry, 'qc.dll'.

Remotely control a Windows system

Imagine the following situation: You have a Windows server that is physically inaccessible but reachable by TCP (it is at a remote site, for example). You have the Administrator account for the machine, but you cannot accomplish the task you need to perform using the standard NT management tools. In addition, the remote system doesn't have a remote control program installed. In this situation, you can install AT&T Laboratories Cambridge's Virtual Network Computing (VNC), a freeware remote control tool, without physically accessing the machine.

To set up and use VNC on a remote system ▶

1. Determine the Administrator password of the remote machine.
2. Download the VNC package (server and viewer) from: http://www.uk.research.att.com/vnc
3. Make sure you have the Regini, Shutdown and Netsvc tools (part of the Microsoft Windows 2000 Server Resource Kit and the Microsoft Windows NT Server 4.0 Resource Kit) .
4. Extract the VNC files from the distribution package. The simplest way to accomplish this task is to install VNC on a test machine. The installation automatically creates the C:\program files\orl\vnc directory, which includes all but one of the files that you need to run VNC. The missing file is omnithread_ rt.dll, and you can find it in the \winnt\system32 directory. Copy the missing file to the C:\program files\orl\vnc directory.
5. Use the following commands to copy the VNC directory to the target machine:

```
NET USE \\<remote machine IP>\IPC$ /user:administrator password
MKDIR "\\<remote machine IP>\C$\program files\orl\vnc"
COPY "c:\program files\orl\vnc" "\\<remote machine IP>\C$\program files\orl\vnc"
```

6. For the VNC server to run, you'll also need to create registry entries on the target machine. To load the remote target machine's registry, use the following command:

```
REGINI -m \\<remote machine IP> vnc.regini
```

   The Regini command registers the VNC server as an automatic startup service on the remote machine. In addition, it sets the default VNC password as the remote machine's password.

7 Start the VNC server on the remote server. You can use two methods to start VNC on the remote machine: You can use the ‘At’ command to schedule VNC to start, or you can use Shutdown (see the last step) to force a shutdown. The ‘At’ method is less disruptive but requires the Scheduler service to be running on the remote system. The Scheduler service isn't started by default, so you might need to use the following command to start it manually:

```
NETSVC \\<remote machine IP> schedule /start
```

8 To use the ‘At’ method to schedule the VNC server to start, execute the following command to read the time on the remote server:

```
NET TIME \\<remote machine IP>
```

9 Schedule an At command to run a couple of minutes after the time that the previous command returned, as the following example shows:

```
AT \\<remote machine IP> 00:00 "c:\program files\orl\vnc\win-
vnc.exe"
```

10 Wait a few minutes and launch vncviewer.exe to connect to the remote machine.

11 If you’re not using the scheduler, remotely reboot the server:

```
SHUTDOWN \\<remote machine IP> /R /Y /C /T:0
```

After the reboot, the VNC server will be running as a service.

CHAPTER 15

Using a SQL Server database

This chapter describes how to use an SQL database with RadWorks.

IN THIS CHAPTER

The feature explicitly does not apply to the Archive Index Tool.

It is possible to store RadWorks data in an SQL Server database, instead of storing it in MS Access database files. The feature is not meant to replace the use of MDB-files in general, but to offer an alternative path. The feature applies to the Database Service (local database and history database), to the Connection Service, to the Print Service.

Installing SQL Server 7.0

1. Install SQLServer. It does not need to be installed on the same computer as RadWorks.
2. Apply SQL Server 7.0 SP1.
3. Install the MDAC 2.01 upgrade.
4. On the SQL Server machine, run the SQL Server enterprise manager and create a new database called RadWorks.
5. From the SQL Server enterprise manager select this new RadWorks database and then open the **Tools → Query Analyzer** menu.
6. Open the file RadWorksLink.sql
(this can be found in the directory \release\templates on the RadWorks 6.0 installation CD-ROM) and run it. The database will now be created.
7. On the RadWorks computer, from the **Control Panel → Administrative Tools** folder, select the **ODBC Data Sources** applet. On the **System DSN** tab, check if the DSN RadWorksLink is already available. If it is, modify it; otherwise create it.
8. To create the DSN, click Add.
9. In the **Select a driver…** wizard, select **SQL Server**.
10. In the **Name** edit box, enter **RadWorksLink**.
11. In the **Description** edit box, you can enter a description of the driver.
12. In the Server edit box, select the SQL Server machine: this could be (local) or the machine name.
13. Click **Next**:

14 On the ‘How should SQL Server…’ page, select **With SQL Server authentication…**

15 Select the checkbox **Connect to SQL Server…**.

16 In the Login ID edit box, enter **sa**.

17 Leave the Password field empty.

18 Click **Next** >.

19 Select the checkbox **Change the default database to**.

20 Select **RadWorks** as the default database. Leave all other fields as default.

21 Click **Next** >, then **Finish**.

22 In the dialog that appears click **Test Data source** and verify it succeeds.

23 Install RadWorks (all modules) on the RadWorks computer.

24 Find the file RadWorksLink.reg (in the directory \release\templates on the RadWorks installation CD-ROM) and double-click it (in Windows 2000, click **OK**) It installs a number of registry values.

Installing SQL Server 2000

1. Install Win2K (with Service Pack1), Internet Explorer 5.0 SP1, and then SQL Server. SQL Server does not need to be installed on the same computer as RadWorks. During installation: in 'authentication mode' choose 'mixed mode'. For the 'sa' login, check 'Blank Password'. Finish the set-up. SQL 2000 has a bug considering the password for the 'sa' login, which actually isn't empty. Follow this workaround:
2. Run the SQL Server Enterprise Manager and connect to your system by double-clicking on it.
3. Scroll to //Security/Logins/ in where you'll find the 'SQL Server Login Properties - sa' dialog.
4. On the **general** tab you'll notice that the edit box for Password isn't empty. Empty it, then click **OK**.
5. The program will ask you to create a new Password. Leave it empty, then click **OK**.
6. Restart the program.
7. Run the SQL Server Enterprise Manager and create a new database called RadWorks.
8. From the SQL Server enterprise manager select this new RadWorks database and then open the **Tools → Query Analyzer** menu.
9. Open the file RadWorksLink.sql
(this can be found in the directory \release\templates on the RadWorks 6.0 installation CD-ROM) and run it. The database will now be created.
10. Close the Query Analyzer and refresh the Service Enterprise Manager (F5). Tables now can be found under RadWorks/Tables.
11. On the RadWorks computer, from the **Control Panel → Administrative Tools** folder, select the **ODBC Data Sources** applet. On the **System DSN** tab, check if the DSN RadWorksLink is already available. If it is, modify it; otherwise create it.
12. To create the DSN, click Add.
13. In the **Select a driver…** wizard, select **SQL Server**.

14 In the **Name** edit box, enter **RadWorksLink**.

15 In the **Description** edit box, you can enter a description of the driver.

16 In the Server edit box, select the SQL Server machine: this could be (local) or the machine name.

17 Click **Next**:

18 On the 'How should SQL Server…' page, select **With SQL Server authentication…**

19 Select the checkbox **Connect to SQL Server…**.

20 In the Login ID edit box, enter **sa**.

21 Leave the Password field empty.

22 Click **Next** >.

23 Select the checkbox **Change the default database to**.

24 Select as the default database **RadWorks**. Leave all other fields default.

25 Click **Next** >, then **Finish**.

26 In the dialog box that appears click **Test Data source** and verify it succeeds.

27 Install RadWorks (all modules) on the RadWorks computer.

28 Find the file RadWorksLink.reg (in the directory \release\templates on the RadWorks 6.0 installation CD-ROM) and double-click it (in Windows 2000, click **OK**) It installs a number of registry values.

Performance tuning

If performance of the SQL server is insufficient, you may need to add indexes to fields in the TblDatabaseStudy database. See the SQL Server documentation for more information. Which fields to index is a trade-off: indexing makes finding studies faster, but slows down other operations (e.g. adding and deleting studies).

APPENDIX A

Error, warning & other messages

When you are using RadWorks there are various messages which may pop up. Some of these are *error* messages. These often relate to a problem with the way RadWorks was installed or configured, or how it interacts with other software components. It may also be the result of attempting to perform an inappropriate action. Should a problem occur, RadWorks is designed to provide detailed information on what has happened in order to assist you or the system administrator resolve it as quickly and easily as possible.

When using RadWorks you will generally also see *warning* messages. These typically appear when you are attempting to perform some action which involves deleting information or changing the system in some irreversible way. They will also appear when you attempt to perform some action which is not allowed (attempting to remove a locked study for example).

This appendix lists all the messages you might encounter when using RadWorks, along with further explanation of what they mean and possible solutions.

The messages are listed according to the section of RadWorks in which they occur.

General

Error message	Cause of message
Cannot display on-line Help. The Help files may be missing or corrupt.	The required help files could not be found on your system. Setup may have failed. Consult your system administrator.
The Online User Manual cannot be displayed. To view this, Acrobat Reader must be installed on your system. This is available on the RadWorks installation CD, or you can download the latest version from www. adobe.com.	Acrobat Reader was not available on your system to display the Online User Manual. If the problem persists after installing Acrobat Reader, or if you can view other Acrobat files on your system, the manual.pdf file may be missing or corrupt. Contact your system administrator.
Cannot use empty filename	For export functionality a filename must be specified.
No valid DICOM field entered!	The DICOM field does not contain a valid DICOM field.
There is no valid Dongle attached to the system. Please check if the Dongle is connected properly	The dongle cannot be found. Make sure it is properly connected to your printer port.
The Dongle has expired on (dd/mm/yyyy) <date>. Please connect a valid Dongle to your system	Your dongle has expired. Contact your supplier for an update.
Cannot request a valid license from the license manager	The system cannot obtain a valid license from the license manager. Please contact your administrator or supplier.
You cannot enter an empty time	You must specify a time.
At least one field must be selected	For export functionality at least one field must be selected.
Only one application can be started at a time	You can run only one copy of RadWorks on a workstation at any one time.
Cannot use empty separator	For export functionality a separator has to be specified.
No valid field	The queried field does not contain a valid value.
Do you want to overwrite file <file>?	You have specified an existing filename; proceeding will overwrite the current file.
Field must be a valid DICOM field	The specified value is not a valid DICOM field.
You must select a shortcut before clicking Remove	In the Select Shortcut box, select one of the assigned shortcuts before clicking **Remove**.
No value for DICOM field entered!	The DICOM field has not been specified.
Field should not be empty	A value for the field must be specified.

Error message	Cause of message
The <number> is assumed to be the month. Proceed?	Warning message to inform the user of how the date is processed.
Not a valid date: <date>. Date must be formatted as: <date>	An incorrect date was entered. Correct the date according to the format.
Not a valid time: <time>. Time must be formatted as: <time>	An incorrect time was entered. Correct the time according to the format.
You must select a macro before clicking Create	Before typing the shortcut key you have to specify the command (or macro).
No shortcut key has been defined	You must add a shortcut key for this special command.
Description cannot be empty	The description field must be specified.
Please specify a valid length	During calibration a valid length must be specified.
No item selected	You have not selected a item in the list.
Are you sure you want to change the ROOT directory?	Changing the ROOT directory can have many negative consequences. Check you configuration thoroughly after changing the ROOT directory.
Reset All will set all shortcuts back to their defaults. Any shortcuts you have created will be forgotten. Are you sure you want to do this?	Warning message that if you proceed all shortcuts will be reset to the default values.
Are you sure you want to reset the positions of the toolbars?	All window positions of RadWorks will be reset. The default window positions will be restored. This cannot be undone.
The application must be restarted for the changes to take effect	If the user has changed some of the default hanging protocols and wants to see the changes on the layout tooltab in the Data Selector, the application will have to be restarted.
Invalid DICOM field	The entered DICOM field is not a valid DICOM field.
An internal error occurred in the application. It must terminate immediately	An internal error occurred in the application. No recovery is possible. The application will be terminated to ensure data integrity. Please contact your distributor.
You cannot enter an empty date	Specify a valid date.
Empty query is not allowed!	Empty queries are not allowed. Note that this is a setting of the view.
Invalid time <time>	Specify a valid time.

Error message	Cause of message
<directory> is not relative to the ROOT directory <ROOT directory>. Do you want to set it anyway?	The specified directory is not relative to the ROOT directory and specifying this may cause problems later on.
No description entered. Please enter a description	To be able to refer to a Window Level you need to enter a description.
Please specify a description	To store a new Window Level a description has to be provided.
The Description already exists. Please change	While storing a new Window Level a description was used that already exists. Change it to make it unique.
Exit application?	Click **OK** to exit the application, otherwise click **Cancel**.
Could not connect to local database	The system was unable to connect to the Database Service. Check that this is running.
The application must be restarted to obtain the default window positions	Restart the application in order to obtain the default window positions again.
Could not lock study after saving it	An error occurred while locking the study.
One of the unused channels is still activated	The number of used channels could not be set because a channel with a higher number was still activated.
If you select a different device now, you will not be able to cancel this dialog. Proceed?	When a different device is selected the settings for that device are saved before you can continue with entering data for the other device.
Delete image type <name>?	This message is displayed to confirm if you really want to remove the image type.
External clients exist. If you quit the application, the clients may crash. Do you want the application to suspend exiting until the last client has left?	Other applications have connected to RadWorks via the COM interface,. They may fail or crash when you force the application to exit. If you click Yes, the application will suspend until all other applications have left.
Check at least one modality, or select ‘Any modality’	When you have checked the ‘Modality’ radio button, you must check at least one of the modalities in the list.
Could not start import of data	One of the studies could not be imported.
The save action is canceled, because the study status is not correct	If you are trying to save one study, the message states the current study status. If you are trying to save multiple studies, the message specifies for each study the patient name and the study status.

Data Selector

Error message	Cause of message
<Action>: Can only be performed on studies in local database	The requested action can only be performed on studies in the local database. If you want to perform the action on the study, import it to the local database first.
No selection available	General message when no selection has been made in the worklist view.
Do you want to delete the font?	Warning that continuing will delete the font.
Do you want to delete the filter?	Warning that continuing will delete the filter.
No field selected	No field has been selected to be removed or added.
Description must be unique	The description of a view must be unique.
Description may not be empty	Each view must have a unique description.
Incorrect directory! Directory must be empty (for default) or a full path	The specified directory path is incorrect. A full path specification must be provided.
Locked study in selection. Can only delete data from unlocked studies	One or more studies in the selection is locked. Studies must be unlocked before they can be deleted.
No folder selected	When clicking the **Delete** button for folders, a folder must be selected.
No selection available	No selection was made before the selected command (delete or move for example).
Not all selected data could be moved	General message when not all selected studies could be moved. This may be due to the fact that they are in use by other parts of the system (teleradiology or printing for example) or because they are already present in the destination folder. Note that some studies in the selection may have been moved.
Empty description is not allowed	When filling in the settings for a remote view, the Description field may not be empty.
No folder selected to edit	When clicking the **Edit** button for folders a folder must be selected.
Folder name may not be empty	When adding or editing a folder, the folder name cannot be empty.
Series in selection. Can only lock complete studies	Only complete studies can be locked. When one or more series are selected the lock command is not performed on any selected item.

Error message	Cause of message
Remote View could not be deleted	General error when the remove view could not be deleted.
Remote View could not be created	General error when the remote view could not be created.
New folder name must be unique	The folder already exists. All folders must have unique names.
No folder specified	No folder was specified for the compression.
Can only compress studies in local database	Only studies in the local database can be compressed.
Not all studies could be compressed	Not all selected studies could be compressed.
Selection of studies of same patient is only possible when only one study is selected.	Select just one study.
Data is in use by another part of the system or by another system	It may be that the study is currently being printed or send to another system, making it temporarily unavailable.
Not all selected data could be imported	General message when not all selected studies could be imported. Note that some studies may have been imported after this message.
Can only move studies or patients in local database	Only studies or patient in the local database can be moved. (You cannot move studies in worklists.)
Can only set status of studies in local database	Only statuses of studies in the local database can be set.
Not all selected studies could be locked	General message when not all selected studies could be locked.
Series in selection. Can only set status complete studies	Only the study statuses of complete studies can be changed. When one or more series are selected, the study status change command is not performed on the selected item.
Cannot delete Results or Interpretations	The selection contains results and/or interpretations. These items cannot be deleted via the worklist control.
Status could not be set on all studies	General message when not all studies statuses can be set.
Folder name could not be changed	General error when the Database Service could not change the folder name.
Study status could not be set	General message when the study status could not be set by the Database Service. This may be because the study is in use.

Error message	Cause of message
Field should not be empty	During configuration of the Data Selector columns, a particular field cannot be left empty.
Series in selection. Can only move complete studies	Only complete studies can be moved. When one or more series are selected the move command is not performed on any selected item.
Could not load all data	General message when the study/series could not be loaded. This may occur when other parts of RadWorks are using this data (e.g. when the data is being transmitted to another site).
Folder name can only contain a-z, A-Z, 0-9 or spaces	The name of a folder can only contain a-z, A-Z, 0-9 and spaces. Note that @#$%^ etc. are not allowed.
Incorrect parameters	General error when the settings supplied in the dialog box are not correct.
Folder already exists	It is not possible to add a folder with a name that already exists.
Can only edit folders of local database	Only folders of the local database can be edited. Note that folders of remote RadWorks systems can be seen, but cannot be edited.
Image(s) in selection. Can only delete complete studies or series	The selection contains one or more images. RadWorks can only delete complete studies and/or series.
Default folder cannot be deleted	The default folder cannot be deleted because it is needed for receiving new studies.
Folder could not be deleted. Folder contains one or more studies	Folders can only be deleted when empty. Check if the folder still contains studies.
Not all selected data could be deleted	General message when not all selected data could be deleted. Note that locked studies cannot be deleted.
Folder could not be created	General error when the Database Service could not create the folder.
Remote View could not be edited	General error when the remote view could not be edited.
Can only delete folders from local database	Folders can only be deleted from the local database and not from remote databases.
Can only delete local data	Studies can only be deleted from the local database and not from remote databases.
No Remote View selected	When adding or editing a remote view, a remote view must have been selected.

Error message	Cause of message
Could not connect with local database	General message when RadWorks cannot connect to the local database.
Can only add folders to local database	Folders can only be added to the local database and not to remote databases.
Last view cannot be deleted	The last view cannot be deleted. RadWorks needs at least one view to work properly.
No worklist active	General error when no worklist control is active. Click on a worklist control to make it active.
Are you sure you want to delete this column?	Confirm that you want to delete the column.

Integration module

Error message	Cause of message
Command validation failed. Check your Integration Module configuration.	It was not possible to execute the command. The command may refer to a file no longer available.
Command failed: Selections at this level are not supported by this type of worklist.	
Command failed: Selection type is not allowed	The type of selection required by the command is not available on the currently active worklist. This may occur when you a command taking patient level selections is invoked on a non-patient worklist.
IntgModu: No license found for integration module	You tried to start the integration module without a licence for it.
Command failed: No selection was found	A command requiring a selection was invoked when the active worklist had no valid selection.
Command failed: Multiple selection not allowed as argument	You invoked a command on a selection with multiple items for a command that can only take a single selection as an argument.
Command failed: The query selection returned an error.	The command you invoked tried to query the current worklist. This produced a problem.
The application must be restarted for changes in the selector desktop to take effect.	When you close the Integration module configuration, all changes will take effect immediately except for the Data Selector. It will be updated when you restart RadWorks.

Viewing

Error message	Cause of message
User defined name is invalid. The edit field should not be empty and the name should not contain any white spaces. Please define a valid name for this special command	The user defined name is invalid because the edit field should not be empty and the name should not contain any white spaces.
OK to delete zooming preset?	Click **OK** if you want to delete the zooming preset, otherwise click **Cancel**.

Error message	Cause of message
User defined name already exists, please define another name	The name for the Special Command already exists and therefore you have to specify a different name.
Are you sure you want to abandon this job?	Warning message to inform you that proceeding will abandon the active job.
A composition dialog box is already on-screen. Please close that dialog box first	Only one composition dialog box can be on-screen at a time. Both the Compose Print Job and Compose Teleradiology Job dialog box are composition dialog boxes. This means that you cannot have a Compose Print Job dialog box and a Compose Teleradiology Job dialog box on-screen at the same time.
Cannot save data. Do you want to exit without saving?	The system was unable to save a study correctly. This is probably due to a configuration problem (most likely the work directory setting).
You cannot change the patient while a composition dialog box is on-screen. Please close the dialog box first.	Close the composition dialog box before changing the current patient or study.
Unable to display image format	An attempt was made to view data of which the image format is not supported by RadWorks.
This monitor is not calibrated correctly	The monitor is not calibrated correctly. Recalibrate the monitor.
Your monitors are not calibrated, true size will become disabled in Viewing	Due to the fact that the monitors are not calibrated, true size viewing will not be available in the Viewing Section.
The name already exists. Please choose another name	When attempting to add settings for a new modality, the system detected that the modality is already in use. Either select this modality from the drop-down list or change the modality name to make it unique.
Cannot execute Special Command due to incorrect study status of the following studies: <List of Studies> Save Action Canceled.	System was unable to execute the Special Command because you are not allowed to change current study status to desired study status.
No data to load	There are no patients available to load.
No viewing desktop available	There is no desktop for viewing available.
Failed to insert name	Insertion of name failed. Contact your system administrator.
Could not load data	The system was unable to load a study correctly. The study may not be a valid RadWorks data file.
No selection available	You attempted to view data while no study was selected.

Error message	Cause of message
No data to paste	No data was exported so there is nothing to paste to the clipboard.
You cannot leave Viewing while a composition dialog box is on-screen. Please close the dialog box first.	Please close the composition dialog box before leaving the Viewing Section.
Could not load data selection	The system was unable to load a study correctly. The study may not be a valid RadWorks data file.
Export to clipboard failed	The system was unable to export the data to the clipboard. Please check if the clipboard is empty and that you are not trying to export too much data.
Keep settings failed	The system was unable to save the export settings to the Registry.
Could not save all data	The system was unable to save a study correctly. This is probably due to a configuration problem (most likely the work directory setting).
No data to export	No data was exported so there is nothing to write to disk.
Cannot execute Special Command due to incorrect study status. (Current study status is <status>.)	The system was unable execute the Special Command because of an inappropriate study status.
Cannot use empty separator	For export functionality a separator has to be specified.
Unable to add to current study/studies	The system was unable to add the selection to the currently loaded combination of studies and series. Select all data that you want to view and reload all data instead of adding to the current set.
Are you sure you want to remove <modality>?	Ensure that you really do want to delete settings from the Registry.
Cannot delete registry key <key>	Error message that the system failed to delete a Registry key.
Could not create cine link	The system was not able to create the cine link.
Construction dialog failed	The system was unable to create the dialog. The image is probably empty.
Save failed	The system was unable to successfully complete a save operation. Please exit the study without saving data.
No permission to mark/unmark Key Images	You do not have the permission to mark or unmark images as key images.

Error message	Cause of message
Mark/unmark Key Images in this modality has been disabled	The ability to mark and unmark key images has been turned off for that particular modality.
Selected items are from different patients	Warning when going into Multi View mode that the selected items are from different patients.
The application must be restarted for the changes to take effect	The system (or RadWorks) must be restarted for the changes made during configuration to take effect.
Cannot change current study status to desired study status. (Desired study status is <status>.)	The system was unable to change the study status to the desired study status. Check that you have the permission to set the study to the desired status.
Do you want to overwrite file <file>?	Warning that you that you have specified an existing filename, and proceeding will overwrite the current file.
No next item available	There is no next item available for viewing.
No previous item available	There is no previous item available for viewing.
You have applied a non-linear window level. If you save this study it will be stored as a linear window level.	RadWorks can only store linear window levels with the images. If you decide to save this study, the window levels will be saved as linear window levels.
Name cannot be empty	You must specify a name.
You have no permission to write to file <file>	You do not have permission to write to the specified file. Specify a different file.
Change Viewport Areas is not yet supported for this monitor system (multiple rows)	Your monitor system configuration contains multiple monitor rows. The ‘Change Viewport Areas’ functionality is not supported for this monitor configuration.
The monitor IDs read from the registry are invalid: probably no monitor IDs or more than 2 monitor IDs.	One or both monitor IDs are not within the boundaries of the system monitor configuration. For example, if you have a multi-monitor system with four monitors next to each other, and no monitors on top of each other, then the monitor ID values have to be 1, 2, 3 or 4.
The first monitor ID you entered is larger than the second monitor ID value. This is not correct.- The monitor configuration of e.g. viewing must be specified within the boundaries of the system monitor configuration.	Reasons why the verification of the entered monitor IDs or monitor configuration failed.
The specified monitor IDs must be less than or equal to the system monitor count.	Reasons why the verification of the entered monitor IDs or monitor configuration failed.

Error message	Cause of message
You have applied a non-linear window level. If you save this study it will be stored as a linear window level	While viewing your patient you applied a non-linear window level. If you want to save this study the non-linear window level will be saved as a linear window level. The reason is that the non-linear function type and slope cannot be stored in DICOM.
No next/previous item is available	You tried to go to the next/previous item in the list, but there is no next or previous item.
Select Annotation First	Annotations and measurements can only be pasted when an annotation has been cut or copied first.
Font size (xx) must be between <min> and <max> points.	Enter a font size between the limits specified.
This command is irreversible. Do you want to proceed?	What you are about to do cannot be undone. Click Yes to proceed anyway with the irreversible action.
This image is not suitable for overlay purpose	The image you selected cannot be used for overlay purposes.
Copying this annotation to clipboard failed, because there is no annotation to clip	You cannot copy non-existent annotation.
Pasting an annotation from clipboard failed, because clipboard is empty	There is no annotation on the clipboard, so you cannot paste it.
Are you sure you want to paste the xxx to all images in this series?	Please confirm that you want the shutter or annotation to be copied to all images in the series.
An image is found that already contains a mask. Do you want to continue and skip this image?	A ‘Paste To All Images’ found an image that already contains a mask. An image can have only one mask. Answer **Yes** to leave the image alone and continue, or **No** to stop.
Insert the image next to this one?	Inserting the image failed. You can click Yes to insert the next image.
There are no objects to paste	Nothing is on the clipboard, so you cannot paste it.
Insert the image next to this one?	Inserting the image failed. You can click Yes to insert the previous image.
The Window Level Set ‘xxx’ has become empty. The Set ‘yyy’ is now loaded	This is to inform you that the a more general window level set is loaded instead of a more specific one.
OK to delete zooming preset?	If you click OK, the zoom preset will be deleted.
A new Window Level Set ‘<modality>, <body part>’ will be created. Do you want to copy the presets from the Window Level Set ‘<modality>’	If you click Yes here, the window level set for <modality> will be used as the basis for the newly formed body part-specific window level set.

Error message	Cause of message
Are you sure you want to remove the specified item?	If you click Yes the current item will be removed; if you click No the item will remain in the list.
Only one Filter Set can be modified at the time	You cannot modify multiple filter sets at the same time.
Are you sure you want to delete filter set?	You should be sure that you want to delete the specified filter set.
No Filter Set selected	You need to select one or more filter sets.
The last applied window level is a non-linear window level and cannot be saved as such	If you want to save the window level it will be saved as linear window level.
The filter set name you specified already exists.	You should specify a different name.
Only one Filter Set can be copied	You cannot copy multiple filter set items at the same time. Select a single filter.
No Filter selected	You need to select a filter.
Cannot modify multiple filters. Please select one filter	It is not possible to modify multiple filter set items at the same time. Select one single filter.
The name you entered is already existing, please enter a unique filter name	The filter name you specified is already being used. Specify a different name.
It is not allowed to create a kernel filter without kernel values	You have not specified the kernel values for this kernel filter.
Please enter a unique filter name	You must enter an unique filter name.
It is not allowed to enter a modality name with the prefix ‘Filter’	You prefixed the modality name with ‘Filter’. This is not allowed. Enter a different modality name.
Cannot delete system default	You are trying to delete the default filter set. You cannot do this.
Please specify a valid Modality identifier	The modality you have specified is invalid.

Reporting

Error message	Cause of message
Could not show study report	The report for this study may be present but could not be shown. Contact your system administrator.
No Default printer available	You are attempting to print one or more reports that were shown in plain text. Probably the default printer has not been configured. Specify a default printer before attempting to print.
Failed to initialize printer	You are attempting to print one or more reports that were shown in plain text. Probably the default printer is not correctly configured. Contact your system administrator.
The Profile Name <name> already exists. Please enter a unique name	Enter a unique profile name.
The Profile name should not be empty. Please enter a unique name	Enter a non-empty profile name.
No selection available	You should first select at least one item, containing one or more studies, in order to show their report(s).
Could not save report <report>	The report could not be saved for some reason. Contact your system administrator.
The report could not be printed / Report <report> could not be printed.)	Only the first <no.> reports were printed) / None of the reports were printed
A printing error occurred. Contact your system administrator.	
Selection too large, You can show reports for 10 studies at maximum	If you want to show the reports for multiple studies in the Data Selector, make sure that the selection comprises 10 studies as a maximum.
Could not load study	Data could not be loaded. Data may be in use by another part of the RadWorks system / Data is locked by <user> on <computer> since <time>
An error occurred when trying to open a study for showing the report from the Data Selector. Contact your system administrator.	
No previous selection available	You clicked the **Previous** button while there was no previous item available in the active worklist.
No next selection available	You clicked the **Next** button while there was no next item available in the active worklist.

Error message	Cause of message
No reports available for this selection No selection available	You should first select at least one item, containing one or more studies, in order to show their report(s).
Could not create reporting dialog	The system was not able to show the report dialog box in the Data Selector. Contact your system administrator.
Could not add study report	The system was not able to show one of the (multiple) reports in the Data Selector. Contact your system administrator.
Could not set study report	The system was not able to show one of the reports in the Viewing Section. Contact your system administrator.
Could not load report module	The Report Module was not loaded correctly, so reports cannot be shown. Contact your system administrator.
The report text could not be displayed in the browser control	You used an alternative data entry mechanism for entering reports (MS Word, HTML) but the system did not succeed in showing the report in the document. You will not be able to see the contents of the report (if any) and the report will be read-only. Contact your system administrator.
Could not show all reports for this selection	
Could not show the report(s) for this selection	None of the reports for the selected studies could be shown. Contact your system administrator.
You reached the maximum content size of this report text, being 10240 characters. If you used a PASTE command, the inserted text may have been truncated.	The database field in which the report is stored has a maximum size of 10240 characters. If you type text into a plain text control, this message will appear when you reached that maximum. If you reached it by pasting text, the pasted text may have been truncated. In this case you are advised to check the end of your text.
Could not display study report	In the Viewing Section, the report was not displayed properly. Please contact your system administrator.
The additional tags could not be displayed in the browser control	Additional tags can be displayed in both HTML and MS Word reporting. Not all of the field defined here were filled with the correct values. This is not generally a serious problem, but it should not occur. Contact your system administrator.
The report appears to be <number> characters long, while the maximum size is 10240 characters. Do you want to truncate it?	The report MS Word template document or HTML file allowed you to make a report which was too long. You must choose between truncation or re-editing (i.e. shorten it manually). In the future your template should prohibit you from entering a report this size. Contact your system administrator to arrange this.

Error message	Cause of message
Could not reload study for report ‘<report>’	After you saved or discarded the changed report, the report text was not restored properly. Contact your system administrator.

Hanging protocols

Error message	Cause of message
Redraw layout failed	Drawing of the hanging protocol failed.
Splitting this area into <number of rows> x <number of columns> series areas failed. <reason>	You have tried to split a series area into new series areas which are too small to display (see <reason>). Most of the time this is not a useful action. If you really want to perform this split, enlarge the Hanging Protocol Editor dialog box and try again.
Splitting this area into <number of rows> x <number of columns> viewport areas failed. <reason>	You have tried to split a viewport area into new viewport areas which are too small to display (see <reason>). Most of the time this is not a useful action. If you really want to perform this split, enlarge the Hanging Protocol Editor dialog box and try again.
Adding window property for this series area failed. <reason>	(Idem for *zoom*, *annotation*, *cine*, *pin*, *criteria*, *time ordering*). You have tried to add a window property for this series area. The reason why this fails is specified by <reason>. You have probably entered invalid window parameters.
Adding window property for this viewport area failed. <reason>	(Idem for *zoom*, *annotation*, *cine*, *pin*, *criteria*, *time ordering) You* have tried to add a window property for this series area. The reason why this fails is specified by <reason>. You have probably not set a pin or cine for this viewport or entered invalid window parameters.
No selection available	General message when no selection is available in the Worklist Control.
No valid DICOM field entered!	The DICOM field does not contain a valid DICOM field.
Script error <error number>: <error description> Ln <line number>, Col <column number>: '<error line>'	The selection criteria have a VB-script error in line <error line>.
Creating script-engine failed	One of these four errors might occur if Internet Explorer is not (properly) installed. Test this by running Internet Explorer.
Setting host window failed	
Adding top-level item failed	
Setting script state to connected failed.	
Empty layout name is not allowed	You have to specify an unique name for this hanging protocol.

Error message	Cause of message
A name length of <length> is too long. Maximum number of characters allowed is <maximum length>.	You have to specify a name with length <maximum length>, because this name is also used in the VB-script as identifier.
Name <name> is already in use	You have to specify an unique name for this hanging protocol.
Name <name> is already in use (by <name without special characters>)	You have to specify an unique name for this hanging protocol. You have probably specified a new one with special characters (e.g. '&') which is allowed. The name is only unique however if you can replace all the special characters by underscores ('_') and it is not the same as the name of another existing hanging protocol (with all its special characters replaced by underscores ('_')).
Specify Hang Criteria for the pinned viewport	You have pinned a viewport but you have no hang criteria specified for it. This means that the application cannot find out which image has to be pinned in this viewport. Specify a DICOM criterion or Time Order criterion.
Specify Hang Criteria for the viewport containing a cine	You have added a cine to a viewport but you have no hang criteria specified for it. This means that the application cannot find out which images have to be displayed in cine mode. Specify a DICOM criterion or Time Order criterion.
Both layout definition and selection criteria are not correct. Do you want to leave anyway? If YES, the previous correct version will be applied	Both the layout definition and selection criteria are not correct. If you leave this dialog box, the layout definition and the selection criteria are set to the last correct version which is the version of the last correct 'Check' you performed. Try to solve the layout definition first and then solve the errors in the selection criteria.
The layout definition is not correct. Do you want to leave anyway? If YES, the previous correct version will be applied.	The layout definition is not correct. If you leave this dialog box, the layout definition will be set to the last correct version, which is the version of the last correct 'Check' you performed. Otherwise click **Check** to check the layout definition to find out what is wrong.
The selection criteria is not correct. Do you want to leave anyway? If YES, the previous correct version will be applied.	The selection criteria is not correct. If you leave this dialog box, the selection criteria will be set to the last correct version, which is the version of the last correct 'Check' you performed. Otherwise click **Check** to check the selection criteria to find out what is wrong.
No items available	There are no hanging protocols in the list.
Layout definition is NOT correct.	The layout definition is not correct. Possible reasons are:
Empty Layout Definition	The layout definition is empty.
Parse Error	The layout syntax is not correct.

Error message	Cause of message
Invalid Layout Name	The layout name has been changed. This is only allowed in the Hanging Protocol Editor dialog box.
Layout definition is correct	This message informs you that the layout definition is correct.
Selection criteria is NOT correct. <Reason>	The selection criterion is not correct. Possible reasons are:
Empty Selection Criteria	The selection criterion is empty.
Script error <error number>: <error description>	Ln <line number>, Col <column number>: '<error line>'
The selection criteria has a VB script error in line <error line>.	You specified an incorrect return value!
Use <return value>	The function return value has been changed. The return values should always be equal to <return value>.
Creating script-engine failed	Setting host window failed
Adding top level item failed	Setting script state to connected failed.
One of these four errors might occur if Internet Explorer is not (properly) installed. Test this by running Internet Explorer.	Selection criteria is correct
This message informs you that the selection criterion is correct.	Are you sure you want to delete this hanging protocol?
(To exclude this hanging protocol you can also disable the hanging protocol.)	This message appears to warn you that you are about to delete a hanging protocol and to inform you that another option is to disable the hanging protocol so you can always enable it again.
Are you sure you want to discard your changes?	General message when clicking the **Cancel** button. You will lose your changes if you click **Yes**.
Please select one item	In the hanging protocol manager, the action you selected can only be applied to a single selection.
The hanging protocol xxx was designed for a different monitor system configuration	You are trying to import a hanging protocol which does not match your monitor configuration. It will not be imported.
The hanging protocol xxx is an automated (so not a default) hanging protocol. Do you want to import this hanging protocol anyway?	The protocol you want to import belongs to the 'wrong' class. If you click Yes, it will be imported anyway.
The syntax of hanging protocol xxx is not correct	The hanging protocol has somehow become corrupt (the file for import may have been corrupted). The hanging protocol will not be inserted. Try recreating the file for import (by re-exporting a set of protocols for example).

Error message	Cause of message
Select one of the wizards first	You need to select one of the Hanging Protocol Wizards before clicking OK.
Export to XML file failed	The export of the hanging protocol failed. The disk may be full.
Import from XML file failed	The import of the hanging protocol failed. The file may be corrupt.
The hanging protocol xxx was exported for module yyy. Do you want to import this hanging protocol for module zzz anyway?	The hanging protocol in the file was exported for another module. If you click Yes this problem will be corrected for you.
There are no wizards installed in the xxx module	No wizards are available for the Hanging Protocols for module xxx.
Empty hanging protocol name is not allowed	You cannot create give a hanging protocol an empty name.
A name length of is too long. Maximum number of characters allowed is 255	You cannot create or rename a hanging protocol with a name containing over 255 characters
Import succeeded	The Hanging Protocols were successfully imported.
Export succeeded	The hanging protocols were successfully exported.
First select a rule in the list	You must first select the rule that you want to edit or remove
The Selection Criteria Wizard can only be used for automated hanging protocols	Only automated Hanging Protocols have selection criteria, so this wizard cannot be used for default Hanging Protocols.

MPR/MIP

Error message	Cause of message
The selected image range is sparse (the slice thickness is smaller than twice the slice distance). This may lead to interpolation artifacts. Are you sure you want to continue?	If the images are spaced too far apart, data will be lacking and the rendering results may be unsatisfactory. Some studies however, have incorrect information about slice thickness; they may still render useful images.
Cannot load study	Loading the study failed.
Study not suitable for MPR/MIP. The selection was rejected because: <reason>	The study you selected does not contain any suitable series or image ranges which can be used for the stated algorithm. The <reason> details why.
The name must be unique and non-empty	Pixel range defaults must have unique names. The one you typed already exists.
No selection available	To start MPR or MIP you must first make a selection in the Local Database.
Save data failed. Leave module anyway?	An error occurred when saving the data. If you click **Yes** now, your new images/series will be lost.
Failure while creating cine	An error occurred during the creation of the cine. A cine will not be shown.
The selection had to be split up because: <reason>	You made a selection, but as a whole it is not useful for MPR or MIP. However, some sub-range of it can be used for MPR or MIP. You will see a dialog box which enables you to choose a range.
The running cine is not saved. Are you sure you want to leave the module?	You have a cine running and are attempting to leave MPR/MIP. If you click **Yes** the cine will not be added (and your changes will be lost).
Cannot create zero size cine	The cine you requested has zero size (either zero degrees for a rotation cine or zero mm for a translation cine). It makes no sense to create a cine using these parameters.
Study is not local	You tried to start MPR or MIP on a study that is not local (e.g., from a remote view). Make sure the study is in your local database by importing it.
Save failed	Saving the new cine series failed.
The running cine is not saved. Are you sure you want to reset (and lose the cine)?	Clicking **Reset** will mean you will lose the cine. If you want to save your cine first, click **No** and then **Save** on the Cine Creation tooltab. You can safely reset after this.
Active viewport does not contain an image	The active viewport is empty; the MPR/MIP module is not able to find out which study you want to use for MPR or MIP.

Error message	Cause of message
Must have a single selection	You have multiple items selected. The MPR/MIP module expects a single selection. Select only the study you want to use for MPR or MIP.
No active list available	None of the local or remote views is active. Activate a list by clicking its header.
No image available in viewport	The active viewport doesn't contain an image; the MPR/MIP module is not able to find out which study you want to use for MPR or MIP.
No active viewport	No viewport is currently active; the MPR/MIP module is not able to find out which study you want to use for MPR or MIP.
<message concerning workgroup server>	The study cannot be used for MPR because someone else on the same workgroup server is using it.

Teleradiology

General

Error message	Cause of message
Connection Service currently not available	The Connection Service is not running. Typically the system will have to be rebooted or the service may need to be (re-)started.
No item selected	You are attempting to apply an operation to an item in a list box but no item is selected. Select an item in the list box.
No item(s) selected	You are attempting to apply an operation to a range of items in a list box but no items are selected. Select at least one item in the list box.
You do not have a valid license to send a study	The system cannot find a license that permits sending studies. Please verify your license. If you have a dongle license, check that the dongle is still connected to the parallel port of the computer.

Destination dialog box

Error message	Cause of message
Name <name> already exists. Please use a unique name	You are attempting to add, copy or modify a destination with a name that is already in use. Please use a unique name for each destination.
Passwords are not identical	The two passwords that were entered are not identical. Please make sure the password and the reconfirmed password are identical.
This field cannot be left empty	The specified field must have a value. Specify one.
This field cannot contain just spaces	The specified field must be filled with a real value that contains more than just spaces. Specify one.
Are you sure you want to delete destination '<name>'?	You are about to delete the destination. If you do this you will lose the information for the destination.
Please specify valid compression parameters	Invalid compression parameters were specified. Specify compression parameters that are valid for the current situation.

Origin dialog box

Error message	Cause of message
Name <name> already exists. Please use a unique name	You are attempting to add, copy or modify an origin with a name that is already in use. Use a unique name for each origin.
Cannot delete origin <name>	The origin could not be deleted. Reboot the system and try again.
Cannot modify origin <name>	The system cannot modify its origin database. This may indicate an installation or configuration failure.
Are you sure you want to delete origin ‘<name>’?	You are about to delete the origin. If you do this you will lose the information for the origin.

Receive Log dialog box

Error message	Cause of message
Could not access key: <key>	Part of the configuration information for export functionality cannot be accessed. This may indicate an installation or configuration failure.
Cannot open file: <name>	The export information cannot be saved to the specified file. Check that a valid file name has been specified.

Send Queue and Send Log dialog boxes

Error message	Cause of message
Could not access key: <key>	Part of the configuration information for export functionality cannot be accessed. This may indicate an installation or configuration failure.
Cannot open file: <name>	The export information cannot be saved to the specified file. Check that a valid file name has been specified.

Send To dialog box

Error message	Cause of message
You are not licensed to send a study	The system cannot find a license that permits the sending studies. Verify your license. If you have a dongle license, check that the dongle is still connected to the parallel port of the computer.
Can only send studies from local database	It is not possible to submit a teleradiology job for items selected in remote views. Select studies in your local database view only.
Please select a destination	You must select a destination if you want to submit a transmission job. Select a destination on the Teleradiology tooltab.
Could not send all selected items	The system could not submit all selected studies for teleradiology. Examine your selection.
No destinations available	Add a destination before trying to submit a teleradiology job.

Error message	Cause of message
Please specify valid compression parameters	Invalid compression parameters were specified. Specify compression parameters that are valid for the current situation.
No selection available	Select one or more studies before trying to submit a teleradiology job.

Auto Transmit

Error message	Cause of message
Cannot delete system default	This auto transmit protocol is the system default and you cannot delete it. To disable this protocol, set its trigger type to <Disabled>.
Auto transmit protocol (system default) has been removed. Call your administrator.	Restart RadWorks. If the problem persists, call your system administrator.
Are you sure you want to delete protocol?	Deleting an auto transmit protocol cannot be undone. Click OK to continue with deleting.
No protocol selected	Select an auto transmission protocol first.
More than one protocol selected	Select only one protocol and try again.
Rule cannot by modified with Add/Modify/Delete button.	You have already edited the script with the Edit button. Use it again if you want to modify the script. In the Edit Script dialog box, you can also delete the entire script. After closing the dialog box the Add/Modify/Delete buttons will be enabled again.
After editing script, the rule cannot be modified	Rules cannot be changed once you have edited them. Click **OK** if you are confident of your JScript programming skills.
Script error <Code>: <Description>. In line <Line no.>, column <Column no.>: <Script line>.	The syntax of the JScript you entered is not correct. Modify the script at the cursor position.
Syntax error in:	Check the syntax of the values you entered. Check that all values are between quotes, separated by commas. For example: MR, CT.
Extra character(s) not expected	Check the syntax of the values you entered. Check that all values are between quotes and separated by commas. For example: MR, CT
No value(s) entered	Enter one or more values. Do not use quotes ().
No wildcard characters allowed for a value range. Remove it or enter a single value.	In a range, do not use wildcard characters such as *, or ?.
No wildcard characters allowed for a value range. Remove it.	In a range, do not use wildcard characters such as *, or ?.
No quotes needed here	Enter the value without quotes ().
No valid field	You have not entered a DICOM field, have not entered an existing DICOM field. Please enter the field.
No filter criterion selected	Select a filter criterion first.

Error message	Cause of message
<Name> is a reserved key word; please enter another name.	Enter another destination name.
Cannot get destination list	The system could not retrieve a list of destinations. Check that valid destinations have been entered for your system.
Cannot modify Auto Transmit parameters	The system cannot modify its Auto Transmit parameters. This may indicate an installation or configuration failure.

Configuration

Error message	Cause of message
The system must be rebooted for the changes to take effect	This appears after configuration when the system settings have been changed. Reboot the system as recommended.
DICOM AE Title <AE Title> already exists for <Origin or Destination> <Name> OK to continue ?	Press Cancel and enter another AE Title. Alternatively, press OK to enter the duplicate AE Title. We do not recommend entering duplicate AE titles since this is not in accordance with the DICOM standard.

Compose Teleradiology Job dialog box

Error message	Cause of message
The selected image is already contained in the job	The specified image(s) could not be added because it was (they were) already selected for the teleradiology job.
<number> image(s) could not be added, because they were already selected	The specified image(s) could not be added because it was (they were) already selected for the teleradiology job.
A composition dialog box is already on-screen	Only one instance of the Compose Teleradiology Job or Compose Print Job can be active at the same time.
No destinations available	Add a destination before trying to invoke the Compose Teleradiology Job dialog box.
Please select a destination	You must select a destination if you want invoke the Compose Teleradiology Job dialog box. Select a destination on the Teleradiology tooltab.
Please select at least one image	At least one image should be available in the Compose Teleradiology Job dialog box before you submit it.
The image cannot be added. It is not an original image	An attempt was made to, for example, add a filtered image to the Compose Teleradiology Job dialog box. It is only possible to add unmodified images.
<No.> image(s) could not be added, because it was/they were already selected	The series have already been added to the Teleradiology job.

Export dialog box

Error message	Cause of message
At least one field must be selected	For export functionality at least one field must be selected.
Cannot use empty filename	For export functionality a filename has to be specified.
Cannot use empty separator	For export functionality a separator has to be specified.
Do you want to overwrite file ‘<name>’?	Check that you want to overwrite an existing file. This will happen if you proceed without specifying a different file name.

Converter module

Error message	Cause of message
The system must be rebooted for the changes to take effect	Restart your system.
Please fill in a valid directory name	The input directory name you specified is not valid (you forgot to specify a drive letter for example).
Are you sure you want to delete the selected converter?	You are about to delete the selected converter. Proceed only if you really wish to do this.
Please select a converter to remove	You did not specify a converter that should be removed.
The converter name cannot be the same as a Base Format name! Please use a unique name	Specify a unique name as the converter name.
Converter <converter> already exists! Please use a unique name	Specify a unique name for the converter.
Directory <dir> does not exist, do you want to create it?	Click **Yes** to create the specified directory.
Directory <dir> is read-only. You need to have write access to use it	Select a directory to which you have write access.
Please restart the AMI Converter Service for the changes to take effect	You must restart your AMI Converter Service. You can do this using the Control Panel, or by using the CtrlSrvW.exe utility in the RadWorks Utils folder (directory).
Could not create directory. Generic Error	Due to some error the converter service failed to create a new input directory. This message is displayed when no particular cause could be determined.
Please fill in all fields	One of the fields that should be completed is still empty.
Acquisition	
Invalid filename <filename>	The operating system reported an error when accessing the RIS input file.
Delete lookup table <Name>?	Confirm that you wish to delete this lookup table.
<Name> already in the list. Replace?	You have used a name to identify an image type that is already being used.
Could not read Acquisition settings	An error occurred during reading the acquisition configuration parameters. The acquisition keys in the NT registry might be damaged.

Error message	Cause of message
Device not ready	The Acquisition of a new image cannot be started because the acquisition device is not ready. Wait a few seconds or try to locate the source of the problem.
Only administrators are allowed to configure Acquisition	The Configuration | Acquisition dialog box can only be accessed if the current user has administrative rights.
Only administrators are allowed to configure Acquisition Devices	The Device Management dialog box can only be accessed if the current user has administrative rights.
Active channel must be one of the used channels	You are attempting to select a channel which is not marked as a used channel in the Device Management dialog box. You must select a used channel.
Save data was not successful	AN error occurred while saving the study data. The data has not been added to the Data Selector. There may be insufficient disk space.
Add data to folder <name> unsuccessful	After saving the data it should be added to one of the data folders in RadWorks. Perhaps this no longer exists.
Close not possible. There will be no active device left	There must be at least one device active. Otherwise the Acquisition Module cannot be started.
One of the unused channels is still activated	You are attempting to decrease the number of used channels of a device, but one of the channels is indicated as the default active one.
Default acquisition device undefined	One of the loaded devices must be indicated as the default active one.
No default device could not be activated. Repair or select another one first.	The default active device reported an error when it was started. Check its configuration or select another device as the default.
Error <number> on open file <filename>	The file <filename> could not be opened due to error <number>. Refer to the OS documentation for further explanation of this error.
Error allocating conversion memory buffer	The memory allocation needed to create a temporary conversion buffer failed. There may be insufficient memory available. Try to make more memory available.
Not a valid date: ‘<date>’. Date must be formatted as: ‘<today’s date>’	You entered the date in an invalid format. Enter the date as in the example.
Not all mandatory patient fields are filled in	Before a study can be saved, all mandatory fields must have a non-empty value. Ensure that all fields are completed and try again.

Error message	Cause of message
Add data to folder <folder> unsuccessful	When saving, the data could not be added to the specified folder. Check that the folder exists.
Do you want to save your data?	Should acquired data be saved before the Acquisition Module is left.
Only one acquisition desktop allowed at a time	It is not possible to start the Acquisition module twice.
Selection does not contain image data	It is not possible to add a selection to the Pictorial Index or to rescan it if it does not contain a minimum of 2x2 pixels of image data. It is possibly located outside the image.
Device channels not defined	The channels of a device are not defined.
Submitting of study to station <station> failed	Auto send of an acquired study failed. See send log for details.
Match only possible at patient or study level	Patient information data match can only be done if the selected item is a patient or study.
No patient selected.	You attempted to match a patient from the worklist without a patient being selected. Select a patient first.

General acquisition device messages

Error message	Cause of message
Acquisition settings not available	No image type has been defined. Create one using the image type dialog box.
Bit depth not set	The bit depth has not been se in the current image type.
Native output of device not set	The output of the device, monochrome or color, has not been defined
Output of device not set.	The output of the device, monochrome or color, has not been defined
Invalid photointerpretation.	The photo-interpretation has not been defined for the current image.
Wrong LUT. ColorMode and LUT do not match.	A color LUT has been selected for a monochrome image, or vice versa.
Wrong LUT. Bit depth doesn't match with current setting.	A 12-bit LUT has been selected for an 8-bit image, or vice versa.
Could not read image type.	An error occurred during the read of an image type from the NT Registry.
Could not save image type.	An error occurred during the save of an image type to the NT Registry.
Could not delete image type.	An error occurred during the deletion of an image type from the NT Registry.
Resolution not valid.	The resolution has not been set or has an invalid value
Could not lock study after saving it	An error occurred while locking the study.
One of the unused channels is still activated	The number of used channels could not be set because a channel with a higher number was still activated.
If you select a different device now, you will not be able to cancel this dialog. Proceed?	When a different device is selected the settings for that device are saved before you can continue with entering data for the other device.
Delete image type <name>?	This message is displayed to confirm if you really want to remove the image type.
HIS/RIS	
Please enter a RIS identification number	Before the RIS program can be started, a RIS identification number must be given. Enter a number.
Could not open RIS executable <ris.exe>	The RIS executable does not exist or is invalid.

Error message	Cause of message
RIS Executable not defined	The RIS program has not been defined. This should be done in Configuration | Acquisition | Patient Information.
RIS Input file not defined	The RIS input file has not been defined. This should be done in Configuration | Acquisition | Patient Information.
RIS Output file not defined	The RIS output file has not been defined. This should be done in Configuration | Acquisition | Patient Information.
RIS Output file <filename> does not exist	The output file which should be created by the RIS executable could not be found.

LUT

Error message	Cause of message
Too few entries for definition of lookup table.	A LUT must have at least 2 entries.
Invalid LUT: value greater than table size	For an 8-bit LUT the largest value is 255, for a 12-bit LUT it is 4095.
No planes defined in LUT	The ‘Planes’ field in Configuration | Acquisition | Lookup Tables has not been completed.
A monochrome LUT must have one plane	For a monochrome LUT only one plane is used.
A color LUT must have three planes	A color LUT must have three planes: R, G and B.

File devices

Error message	Cause of message
File type <filetype> not supported.	Files of type <filetype> cannot be read.
Could not open file.	The file could not be opened for reading.
Data in file has been changed.	During acquisition the contents of the file have changed.
Can’t open clipboard - maybe it is in use by another application	Retry, check if another application is using the clipboard.
Error in data on clipboard.	The clipboard contains invalid data.
Unsupported clipboard format: <format>	The data format of the data currently on the clipboard is not supported.
Compressed bitmaps not supported	Compressed bitmaps are not (yet) supported. Try to decompress them with another software package.
Data on clipboard has been changed.	During acquisition the contents of the clipboard changed.
<file> is not a valid bitmap file.	<file> appears to be an invalid bitmap file.
TIFF data is corrupted	TIFF file contains corrupted data.
Bitmaps with <number> colors not supported.	Bitmaps which contain an image with <number> of colors are not supported.
Non-RGB and non-grayscale image	Only RGB and grayscale images can be read.

Error message	Cause of message
Response curves not supported	The TIFF file contains response curves which are not supported.
Fax compression not supported	The TIFF file is Fax compressed, which is not supported.
Multi-page file not supported.	The TIFF file contains multiple pages, which is currently not supported.
LZW Compression not supported	The TIFF file is LZW compressed, which is not supported
Color maps not supported	The TIFF file contains color maps, which are not supported
Unsupported tag X, X, X	The TIFF file contains a tag (indicated by X,X,X) which is not supported

ScanmasterDX

Error message	Cause of message
HOWTEK: Scan open error: %d	Error on opening device. Possibly incorrect SCSI card. Only SCSI-2 is supported.

HI*DEF Plus

Error message	Cause of message
HI*DEF: Error %d. See file HPDERROR.DAT or manual for more information	See the Imagraph documentation for further information about the error.
HI*DEF: MemBase or IOBase not specified	The NT Registry keys are not defined. Invalid installation.
HI*DEF: Invalid board handle	The NT Registry contains an invalid reference to a board.
HI*DEF: Unable to open board at IO address <X>	Return Code = <X>
The HI*DEF Plus board could not be found at the address specified.	HI*DEF: CHP file not specified
The board configuration file must be specified in the Device Management dialog box	HI*DEF: Error <x> reading file <file>
Invalid format or file does not exist	The specified configuration file (CHP) is invalid or could not be found.
HI*DEF: Width must be divisible by four	The with of an image to be acquired must be divisible by four.
HI*DEF: Time Out occurred while waiting for command ready	Video signal possibly not present.

LS75

Error message	Cause of message
LUMISCAN: Requested and real size do not match	Not all scanned data could be stored.
The scanner reports that the scanned image is larger than the size as given in the image type. Adjust the size in the image type dialog box.	LUMISCAN: For variable resolution, dpi has to be in the range 256...<number>

Error message	Cause of message
If variable resolution is chosen in the image type dialog box, the maximum resolution depends on the width of the film. Here the maximum dpi for the current film width is given.	LUMISCAN: For an image with width <width>,
the fixed resolution has to be in the range 55 - <number> dpi	If fixed resolution is chosen in the image type dialog box, the maximum resolution depends on the width of the film. Here the maximum dpi for the current film width is given
LUMISCAN: To scan an image with height <height>, dpi has to be at least <number>	If an image is scanned with variable resolution, the minimal dpi depends also on the height of the film.
LUMISCAN: Scanned dpi <number> differs from requested dpi <number>	Not all requested dpis are available. If not, the scanner adjust it to the nearest available.

Mach DT 3153

Error message	Cause of message
DT3153: Could not open device	The device driver not installed or started
In the Device Management dialog box, an incorrect (or no) alias has been given for device.	
DT3153: Could not allocate frame buffer	Device driver not installed / started

Meteor

Error message	Cause of message
Could not allocate board	E: The Meteor board could not be activated:- Maybe device driver not installed or started
Possible conflict of device driver with graphics card (other Matrox card)	
Signal type not specified	The Meteor signal type must be specified in the Device Management dialog box

Pulsar

Error message	Cause of message
Pulsar configuration (DCF) file not specified	The DCF must be specified in the Device Management dialog box for each channel used.
File <filename> does not exist	The specified Pulsar DCF does not exist.

TWAIN

Error message	Cause of message
TWAIN ERROR: %d	Generic error message from the TWAIN device. See the TWAIN documentation.

Error message	Cause of message
At least one scan with current device must be done	The Force Scan option is enabled in the Device Management dialog box and at least one scan should be done with the TWAIN device before another device can be selected.
TWAIN: Could not load TWAIN_32.DLL	The TWAIN_32.DLL is not installed on the system.
TWAIN: Invalid TWAIN_32.DLL	The TWAIN_32.DLL is corrupted.
Could not open TWAIN Source manager	An error occurred when opening the TWAIN source manager.
TWAIN Source not defined	The TWAIN Source must be defined in the Device Management dialog box.
Exception on TWAIN command	An exception occurred when a TWAIN command was executed by the TWAIN source.
Data source <Sourcename> not available	The Source may be in use by another application. If not, you can try the following (experienced users only):- Start the Task Manager, Select the Processes tab and check whether the following processes are running: DeskScan.exe, TWUNK_16.exe. If you are sure that these two processes are not being used by other processes, kill them and retry.
Error in TWAIN Data Source or Data Source Manager	An error occurred on the TWAIN side. Retry, restart RadWorks. If the problem persists, reboot.
Parameter out of range	One of the supplied parameters to the TWAIN source is out of range.
Capability not supported by source	The currently attached TWAIN source does not support the required capability

Vidar

Error message	Cause of message
VXR-12: No SCSI found	Error occurs on loading the VXR-12. The PC has no SCSI, or Adaptec EZ SCSI software not installed.
VXR-12: Error on opening SCSI toolkit	Vidar SCSI Toolkit could not be opened.
VXR-12: Scanner not found	No VXR-12 scanner attached to the PC or VXR-12 scanner switched on after the PC.
VXR-12: Calibration failed. Maybe sliders are not in widest position	The calibration of the VXR failed. If sliders are in the widest position there is possibly a hardware problem.
Rescan initialization failed: Film is already ejected	The rescan failed because the film was no longer available.
Invalid resolution selected (<resolution> dpi)	The resolution could not be set because that value is not supported by the scanner.
Invalid exposure time selected (<exposure time> units)	The exposure time could not be set because that value is not supported by the scanner.
Scan initialization failed: Failed to load film	An error occurred while loading the film into the scanner.
Exposure time changed since last scan. Recalibrate?	When the exposure time has been changed, recalibration of the scanner is recommended.
Calibrate VXR digitizer now?	This message is displayed to confirm if you want to calibrate the digitizer because calibrations could take several minutes.
Scan initialization failed: Invalid scan parameters	An error occurred when initializing the scanner. Check that the scanner is installed correctly.

Printing

Error message	Cause of message
Are you sure you want to delete the selected layout(s)?	If you confirm the operation, the selected layout(s) will be deleted from the layout pool (and hence no longer be available for Print Destinations).

Error message	Cause of message
Please select a layout first	You must select a layout before you can start a Compose Print Job dialog box.
Discard changes in Layout Pool?	If you confirm the Cancel action, all modifications made to the layout pool will be discarded.
Failed to initialize printer	The print command could not be executed because the printer could not be initialized.
No Default printer available	Specify a default printer before trying to print.
Please select a layout first	You must select a layout before you open the Compose Print Job dialog box.
Study(s) could not be printed	(Some of) the selected studies could not be printed.
No selection available	Before you can print studies, you must select them in the local database.
Please supply a host name	DICOM Print Destination needs a host name.
X Size should be at least 100	If you check the Advanced check box on this property page, you must fill in the maximum film size in the X and Y directions. Neither can be less than 100 pixels.
Y Size should be at least 100	If you check the Advanced check box on this property page, you must fill in the maximum film size in the X and Y directions. Neither can be less than 100 pixels.
Please supply a name	Print Destinations must have a unique name.
Please supply an Application Entity title	DICOM Print Destination needs an Application Entity title.
No default printer selected	To be able to print to a Windows printer you must install one. Using the **Start** button on the NT desktop, select Settings/Printers and choose Add Printer to add a printer to your system.
Job too large - too many image boxes; cannot be printed	If there are too many image boxes, a Virtual Film Sheet job cannot be printed. Reduce the number of images in this job (divide it up) or use the Data Selector to print the study.
Job too large - too many sheets; cannot be printed	The composed job was too large and could hence not be printed. Delete some sheets or split the job up.
No default printer selected. Use Setup... to select a printer	To be able to print to a Windows printer you must install one. Using the **Start** button on the NT desktop, select Settings/Printers and choose Add Printer to add a printer to your system.

Error message	Cause of message
Print destination ‘<name>’ is currently busy. A busy destination cannot be deleted	The destination you selected to delete is currently busy (handling a print job). You cannot delete a busy destination. Please retry when the print job has finished.
Print Service currently not available	The Print Service is no longer available. Restart the service.
Are you sure you want to clear this sheet (all images will be cleared)?	If you confirm the action, all the images on the current (visible) sheet will be cleared.
Cannot use remote view	You can only print studies from the local database, but you have selected one from a remote view. You may need to make the local database active by clicking on its header.
Selection not available	The selection in the Data Selector is not available.
Error saving while submitting print job	There was an error while saving the Print Job. Your hard disk may be out of storage space.
Print Destination is currently busy. Changes will take effect only after the current job	The Print Destination you are about to modify is currently busy (handling a print job). The changes you make will take effect after you have confirmed the modifications and the current job has finished.
Cannot open file: <name>	The export output file cannot be opened. Type a new file name to save the export results to.
Job could not be printed	There was an error while printing the job.
Discard changes in Layout Pool?	If you confirm the Cancel action, all modifications made to the layout pool will be discarded.
Print Destination not available	The Print Destination is not (or no longer) available. The Print Service may have died. Restart the service.
No Print Destination or Layout selected.	You must select a destination and layout before you can print a job.
Layout name already in use	The (modified) layout name is already in use. Choose another one.
Please select a destination first	First select a destination before opening a Compose Print Job dialog box.
Incorrect layout	You tried to create an invalid layout. Retry using a correct definition (see on-line Help for details).
Are you sure you want to delete this sheet (all images will be deleted)?	If you confirm the action, the current (visible) sheet will be deleted, as well as the images on it.

Error message	Cause of message
Cannot get work directory path	There is an inconsistency in the registry settings. The requested action (e.g., submission of a Print Job) cannot be performed. Use the Print Service configuration to correctly set the work directory for the Print Service.
Are you sure you want to delete the selected layout(s)?	If you confirm the operation, the selected layout(s) will be deleted from the layout pool (and hence no longer be available for Print Destinations).
The system must be rebooted for the changes to take effect	The changes made in the configuration dialog box will only come into effect after the computer is rebooted.
Please supply at least one medium size	DICOM Print Destination needs at least one medium size.
Please choose a new name as this destination already exists	The name you typed for the new print destination already exists. Destination names must be unique. Choose a new name.
No item(s) selected	You are attempting to delete or modify items but none have been selected.
No layout	You did not type a layout definition prior to trying to add it.
Viewport cannot be printed	Something went wrong when printing the viewport.
Please select a printer first	You need to select a printer (use the tooltabs to do so), before you can print the viewport. Print/Image can be used to send the image to the Windows Printer.
Do you really want to print xxx copies ?	You have selected more than the configured maximum of copies. Press Yes to print them anyway. You can change this number in the Print Configuration.

Archiving

Error message	Cause of message
Incorrect Study Date	The Study Date that was entered in the query dialog box is not a valid date. Use the correct separator and syntax (e.g. DD/MM/YYYY, MM/YYYY or YYYY).
Incorrect Birth Date	The Birth Date entered in the query dialog box is not a valid date. Use the correct separator and syntax (e.g. DD/MM/YYYY, MM/YYYY or YYYY).
Delete column?	A warning that you are about to remove a column from the currently displayed list.
The system must be rebooted for the changes to take effect	The configuration for the Archive part of the Database Service may have changed. You need to stop and start the Database Service and RadWorks to use the new configuration. If you reboot your system you will be certain that the new configuration has been put into effect.
The volume name <name> is already used in the Archive Index. Please specify a different name.	You are trying to add a volume that already exists in the Archive Index. While it is not possible to do this directly, you can replace the old version by first deleting the old volume from the Archive Index and then adding the new version of the volume again.
This volume already exists in the Archive Index	You are attempting to add a volume that already exists in the Archive Index, which you cannot do. It is, however, possible to replace the old version by first deleting the volume from the Archive Index and then adding the new version of the volume again.
Are you sure you want to remove Archive <Archive>?	You are about to remove an archive definition. Confirm that you really want to do this.
Could not read DICOMDIR file in specified directory	Either no DICOMDIR file is present in the specified directory or the DICOMDIR file could not be read.
Could not show studies	The studies in the Archive Index could not be displayed. Restart the Archive Index Tool. If the problem persists, the Archive Index is probably corrupt.
Error during edit Volume Sheet	An error occurred while editing a volume description. The volume list might not have been updated correctly. You can either requery the volume list or restart the Archive Index Tool.

Error message	Cause of message
Could not get a flush lock from the Archive Manager	During a flush operation the archive is locked. This means that the archive cannot be used for any operation in order not to disturb the flushing process. If by some chance another operation is running, the flush lock will not be obtained and the flushing cannot take place. Try the operation again a few seconds or minutes later. If this does not succeed, consult your system administrator.
It is not allowed to have the same Archive-ID for both the destination and the Verification Archive	When you use an archive buffer you could create a second archive for the target volume device in order to create a copy of your buffer to the target volume. The system offers you the possibility of checking whether the contents of your buffer and the volume managed by the second archive manager completely match. Enter <none> if you don't want to use the verification option or select a second archive for verification.
Error during changing the Study State	An error occurred while editing a study state. The study list might not be updated correctly. Either requery the study list or restart the Archive Index Tool.
It is not possible to flush the archive, because it doesn't contain any studies	You tried to start the flush operation to copy the buffer to a target volume while the buffer was empty. This operation only make sense for buffers that are not empty.
Could not Get Study UIDs of selected studies	A serious error occurred while trying to delete or move back a study from an archive (buffer). Consult your system administrator.
Cannot delete registry key <name>	A serious error occurred while trying to remove an archive definition from your registry. Please consult your system administrator.
It is not possible to flush the Archive because its total size exceeds the predefined maximum	You tried to start the flush operation, but the actual size of the archive buffer exceeds the predefined maximum for the target device. This could only happen if the maximum size of an existing non-empty archive buffer is set back to a lower value. As a solution, your system administrator could raise this maximum capacity, but this solution is probably not desirable. The other solution is to remove studies from your buffer (Move Back or Delete) until the total size of the buffer is less than the maximum capacity. You can check this using the Estimate Size command.
Move to buffer failed	A serious error occurred while trying to move/export a study to the archive (buffer). Consult your system administrator.
You are not licensed to perform Single Media Archive operations	The system detected that there was no license to perform archive operations. Check if your dongle is still connected or contact your system administrator.

Error message	Cause of message
Could not show volumes	The volumes in the Archive Index could not be displayed. Restart the Archive Index Tool. If the problem persists, the Archive Index is probably corrupt.
Please select a Volume Type	The volume type that is currently entered on the volume sheet is not correct. You should select or enter a valid volume type.
Delete selected volume(s)?	You are about to delete the selected volumes from the Archive Index. Confirm that you really want to do this.
One or more of the volumes is not lent	You are trying to return a volume that was not marked as lent, which you cannot do. Deselect this volume and try again.
No selection available	You tried to start an archive operation (Move/ export/ delete/ Move back) without having selected any study.
Field should not be empty	You are trying to edit or create a column without specifying a name. Enter a name.
Are you sure you want to cancel the <name> job?	Confirm if you want to cancel the current operation.
Are you sure you want to move <studies> back from the archive?	Confirm if you want to move back the selected studies from the archive (buffer).
Are you sure you want to delete <studies> from the archive?	Confirm if you want to delete the selected studies from the archive (buffer).
Could not get information on archive contents (Archive ID <id>)	The archive's general information could not be found. Please consult your system administrator
Could not run command to flush the buffer	The file designated as the executable or batch file that performs the flush operation was not found. Consult your system administrator.
Could not create directory <path>, due to error nr <number>. Please create it manually or select an existing directory before you restart your system	When you click the **New** button on the Configuration | Archiving |Archives Tab, the configuration tries to create a new directory to store your archive contents (buffer) even though you have not clicked the **OK** button. If the system cannot create this directory there is nothing really amiss. Perhaps the permission rights for creating this directory are not correct. However, the system now refers to a directory that does not exist. You can either click **Cancel**, remove the archive by clicking **Remove**, keep the archive and select an existing directory and click **OK**, or keep the archive and click **OK** and create the referenced directory manually. On restarting the database service, the system will look for the referenced directory and if it does not exist the archive will not be available.

Error message	Cause of message
Could not create directory <name>, due to error nr <number>. Please create it manually or select an existing directory before you restart your system	When creating a new archive definition, RadWorks will create a new archive directory for you. If this creation process fails you could create it manually and assign it later in this archive definition. If this message occurs, just continue to configure your archive. Before closing the dialog box and rebooting your system, check if the archive directory for this newly created archive definition actually exists. If it does not, create it manually e.g. using NT Explorer. Then close RadWorks and reboot the system. If the archive does not become enabled, check the database log for the reason.
Error during returning volumes	A general error occurred while returning the selected volumes. Restart the Archive Index Tool and check for any inconsistencies.
Estimation of file sizes failed	The estimation could not be performed. Possibly the archive was occupied by a maintenance process. Also, the Database Service may not be responding or the archive might have been disabled due to a consistency error. After a number of retries, ask your administrator to check the archive.
Export to buffer failed	The Export to buffer job could not be started. Possibly the archive was occupied by a maintenance process. Also, the Database Service may not be responding or the archive might have been disabled due to a consistency error. After a number of retries, ask your administrator to check the archive.
Error during lending volumes	A general error occurred while lending the selected volumes. Restart the Archive Index Tool and check for any inconsistencies.
Incorrect Borrow Date	The Borrow Date that was entered in the query dialog box is not a valid date. Use the correct separator and syntax (e.g. DD/MM/YYYY, MM/YYYY or YYYY).
Return selected volume(s)?	You are about to return the selected volumes.
Move back from archive failed	The move back job could not be started. Possibly the archive was occupied by a maintenance process. Also, the Database Service may not be responding or the archive might have been disabled due to a consistency error. After a number of retries, ask your administrator to check the archive.

Error message	Cause of message
Delete from archive failed	The delete job could not be started. Possibly the archive was occupied by a maintenance process. Also, the Database Service may not be responding or the archive might have been disabled due to a consistency error. After a number of retries, ask your administrator to check the archive.
Export to archive failed	The Export job could not be started. Possibly the Archive was occupied by a maintenance process. Also the database Service may not be responding or the Archive might have been disabled due to a consistency error. After some retries ask your administrator to check the Archive
Export to buffer failed	The Export to buffer job could not be started. Possibly the Archive was occupied by a maintenance process. Also the database Service may not be responding or the Archive might have been disabled due to a consistency error. After some retries ask your administrator to check the Archive.
Could not open Index Tool database	The Archive Index Tool could not open the selected Index Tool database. The user should check the ODBC parameters of the Archive Index Tool in the configuration of the archive module. Also check whether the path and name of the Index Tool database are correct.
Please specify a Volume Name	The volume name on the volume sheet dialog box is empty. The user should enter a unique volume name.
Incorrect Verification Date	The Verification Date that was entered in the query dialog box is not a valid date. Please use the correct separator and syntax (e.g. DD/MM/YYYY, MM/YYYY or YYYY).
Only studies from the local database can be moved/exported to the archive	You can only move studies from the local database to the archive.
You selected one or more series. It's not possible to work with archives on a series level	In order to move / export / delete / move back with regard to an archive, you should make a selection at study level.
Volume successfully added!	This message appears to inform the user that the volume is successfully added to the Archive Index.
Are you sure you want to perform a verify operation?	Click **Yes** if you want to start the verification operation, in which the contents of the buffer and the target volume will be checked.

Error message	Cause of message
Could not get information on Remote View	Before a delete or move back operation can be started it must be ensured that the remote view in which you selected some studies is a view on the active archive. As this could not be ensured, the operation has been cancelled. Consult your system administrator.
One or more of the volumes is already lent or marked as lost	You are trying to borrow a volume that is not marked as present, which is not possible. Deselect this volume and try again.
The verification operation was not performed correctly	The contents of the archive buffer and a volume may match, but this could not be checked because the verify job could not be started. The archive was possibly occupied by a maintenance process. Also, the Database Service may not be responding or the archive might have been disabled due to a consistency error. After a number of retries, ask your administrator to check the archive.
Error during deleting volume	An error occurred while deleting the selected volumes. Restart the Archive Index Tool and check for any inconsistencies.
Currently a Job is Running. Please retry after this job has finished	This message should not appear. RadWorks is apparently not aware that an archive operation is still running. Please consult your system administrator.
Could not start Flush process	The flush-tool executable or batch file cannot be properly started. You possibly exited RadWorks before the flush process was started. Check the flush tool field in the Configuration | Archiving | Module tab, restart RadWorks and try it again.
Volume(s) successfully deleted	The selected volumes have been deleted from the Archive Index.
Only studies from a remote archive view can be moved back	Select the remote view on the active archive to select studies to move back or delete.
Only studies from a remote archive view can be deleted.	
Only studies from the archive ‘<name>’ can be deleted	You clicked the **Delete** button but the active remote view did not show the contents of the active archive. Select the studies from an appropriate remote view.
Only studies from the archive ‘<name>’ can be moved back	You clicked the **Move Back** button but the active remote view did not show the contents of the active archive. Select the studies from an appropriate remote view.

Error message	Cause of message
Could not resume	The Resume operation is essentially the same as starting a new move or export job. This job could not however be started. Possibly the archive was occupied by a maintenance process. Also, the Database Service may not be responding or the archive might have been disabled due to a consistency error.
Move to archive failed	The move job could not be started. Possibly the archive was occupied by a maintenance process. Also, the Database Service may not be responding or the archive might have been disabled due to a consistency error. After a number of retries, ask your administrator to check the archive.
Export to archive failed	The export job could not be started. Possibly the archive was occupied by a maintenance process. Also, the Database Service may not be responding or the archive might have been disabled due to a consistency error. After a number of retries, ask your administrator to check the archive.

Quality Control

Error message	Cause of message
Data entered is not valid	The date entered for this origin is not complete. Specify the origin name, destination name(s) and action.
Could not delete modality	Could not delete the edit demographics settings for this modality type.
No study loaded	No study to list the status history from is currently loaded.
It is not allowed to delete the Generic modality level	You cannot delete the default 'Generic' edit demographics configuration.
You cannot delete the last series of a study	You are not allowed to delete the last series from a study.
Can only view local/worklist data	Only studies from the local database of entries from the worklist can be processed.
Modality should not exceed two characters	A modality cannot be specified with more than two characters.
Please select a single Worklist entry	No multiple selection of worklist entries is allowed while working within Quality Control.
You cannot set the Patient Orientation of images that have a valid image orientation	When images have a valid image orientation, the patient orientation is derived from it. In this case, no patient orientation can be specified.
No valid data entered	The data entered is not complete or is invalid.
No valid selection	No valid selection available to open for Quality Control.
No series selection supported	Series selections cannot be opened for Quality Control.
Please enter a valid orientation	The patient orientation specified is not correct.
No active study to load	The QCM module attempted and failed to load a study because there was no study active.
Cannot modify field <number> of item. Other fields will be modified	It was attempted to edit a non-editable field in the QCM Configuration. The action will be ignored.
The match rule is not correctly specified	You made a syntax error in the match rule you just specified.
No Initial Worklist View selected	In the QCM origin configuration, it is illegal to leave the Initial Worklist View blank.

Error message	Cause of message
Do you want to send the study to its destination immediately?	Please confirm the auto transmit action. You dialog can be bypassed by changing the configuration.
Unable to display image format	Loading the study has failed because the study contained an unsupported or corrupt image format.
Can only match local study data	You can only match studies available on your workstation's local study list.
Could not retrieve information from the Connection Service. To prevent accidental damage to your system settings, some property pages are unavailable	It is essential to collect the correct origin table from the connection service for some parts of the QC Module configuration to work correctly.
Cannot automatically match locked studies. Please unlock study first	The selection of studies that you tried to AutoMatch contained locked studies. Unlock them before attempting to automatch.
Cannot initialize because no Initial Worklist view is specified	Specify an Initial worklist view before attempting this part of the QCM Configuration.
The application must be restarted for the changes to take effect	When you leave the QCM Configuration, you will need to restart RadWorks to ensure all settings changes take effect.
The operation failed for at least one study: <error message>	The Automatic match process has failed automatically match all studies.
No selection available;	Cannot insert multiple studies;
Cannot add selection(s) to active study;	Cannot insert study as images because it contains multiple series;
Cannot insert images because duplicates already exist;	When you try to insert images/series from other studies, you may get the error messages above if the selection can not correctly be inserted in the active study.
Cannot insert images because the image type (SOP Class) differs from the images in the active series	If you want to insert images from a different study in an existing series, the modalities of the images must match that of the series.
Could not load selection	When you try to insert images/series from other studies, and the study you copy from fails to load, you get the above message.
Could not insert worklist data into study;	Series could not be inserted.;

Error message	Cause of message
Cannot write study data to disk (while preparing for AddData/ReplaceData);	The study could not be saved. This may be due to a full hard disk. If the errors persist, contact your service engineer or distributor.
Cannot save study, internal error (UpdateData failed);	
Cannot save study, internal error (AddData failed);	
Cannot save study, internal error (ReplaceData failed);	
Cannot save a non-linear VOI LUT	Non-linear VOI LUT's cannot be saved by the QCM Module.
Cannot save rotation/flip actions to lossy compressed or multiframe images	Flip and rotate actions can not be saved for all image types.
Cannot connect to the local database	The database service can not be reached. Shutdown and reboot your system before continuing to use RadWorks.
Cannot save: Study UID already in local database	The study UID was already found in the local database. Most likely the UID has been inserted due to a erroneous match action.
Cannot save: not all viewing contexts found	An error occurred collecting the possible save status for this study
These errors can not be resolved by the user. If they persist, contact your service engineer or distributor.	In order to assure data consistency the current study will be unloaded
A new and empty study will be created that contains the worklist data. Do you want to proceed?	When a study is matched multiple times with multiple worklist entries, data consistency cannot be guaranteed.
You cannot open a copy of a Worklist entry	Opening a copy of a worklist entry is not allowed.
You cannot set the Patient Orientation due to Flip or Rotate actions you have performed.	You tried to set the patient orientation after you performed flip and rotate actions on images in the study. If you need to do both, set patient orientation first.
Do you want to send the study to its destination immediately?	Please confirm the auto transmit action. You dialog box can be bypassed by changing the configuration.
No active Worklist available	No worklist available or active.
Match Failed: <reason>	The reason indicates why the insertion of worklist information in the study failed.
Do you want to save the changes? (Changes are irreversible after saving)	All changes are irreversible after saving. No undo is possible after the study has been saved.

Error message	Cause of message
Set the study status back from <status> to <status>?	Confirm that the study status is to be set back from one status to another.
Are you sure you want to save all changes and close the patient demographics dialog?	Click **OK** to accept the changes you have made, **Cancel** to discard them.
Could not get access to origins and/or destinations. Please verify if the Connection Service is running	No access to the Connection Service Origin and Destination table was possible. Verify that the service is running properly.
Cannot load data	Cannot load the data for Quality Control (Generic error message)
Save Error: <reason>	The reason specifies why the study could not be saved.
Cannot add item because it is already in list	You are trying to add an item that is already present in the list.
Your existing settings will be overwritten. Do you want to proceed?	The current Worklist to DICOM tag mapping configuration will be overwritten when you proceed.
Please use characters L, P, H, R, A, or F only	The specified characters are the only ones which can be used when setting the patient orientation.
Could not get access to user queries	The queries you have specified on the Queries property sheet are not accessible. Do you have the initial worklist view set correctly?
The origin was not correctly specified	The origin that was added was not described correctly.
No image selection supported	No images can be opened for Quality Control (study selections only).
Please select a Worklist entry	The match action failed because there was no worklist entry selected.
The system must be rebooted for the changes to take effect	This appears after configuration when the system settings have been changed. Reboot the system as recommended.
Multiple selections not allowed, only first one will be opened	Only single study selections are allowed. The first study in the selection will be used.
The edit item was not correctly specified	The item is not correctly/completely specified.
The query was not correctly specified	The query is not correctly/completely specified.
No Patient level selection allowed	No patient level selections allowed when opening study for Quality Control.
Only one QC Viewing desktop allowed at a time	Only one quality control desktop (screen) is allowed at any one time.
You cannot delete the last image of a study	A study must contain at least one image.

Configuration

Error message	Cause of message
No selection available	Select an item before performing the action.

Monitor configuration

Error message	Cause of message
Enter value for Rows and value for Columns.	You need to enter a valid value for Rows and for Columns.
Please enter the correct number of monitors	You must specify the correct number of monitors as the number of rows followed by the number of columns (<rows> <columns>).
DUAL PACS Viewers allow max. 2 monitors.	A DUAL PACS Viewer has a maximum of 2 monitors.
Invalid monitor configuration. Value of Rows and Columns should be greater than zero.	Monitor configurations need to have at least one row and one column.
Monitor Id not within boundaries of monitor configuration.	The configured monitor Id needs to be within the bounds of the overall monitor configuration.
Monitor ID not within the boundaries of the system monitor configuration	The configured monitor ID was not within the boundaries of the system monitor configuration.
First monitor ID should be less than or equal to last monitor ID.	The first monitor ID should have a number less than or equal to the last monitor ID.
Registry settings are invalid.	The registry settings for the monitor configuration are invalid.
You specified an incorrect monitor row count and/or monitor column count	The monitor configuration is not within the boundaries of the system monitor configuration.

HIS/RIS configuration

Error message	Cause of message
Removing this implementation will also remove the Local Studies and Local Patients lists. Remove the HIS/RIS implementation?	Click Yes to remove the DLL anyway, No to back out.

Error message	Cause of message
Remove implementation?	Click Yes to remove the HIS/RIS implementation DLL, No not to do so.
Could not open HIS/RIS dll	The HIS/RIS dll that was selected is not valid for the system.

License configuration

Error message	Cause of message
Not a valid host name entered. File will not be created	A valid host name should be entered in the dialog box. A host name is the name of a computer within the same domain on the network. Host names can be listed by, for example, opening the 'Network Neighborhood' folder in Windows.
Error creating file <file>	During the generation of a license file it was not possible to create the file. The file could already exist and set to read-only or shared with another application.
The file <file> already exists. Overwrite?	The file pointed to already exists. If you choose to overwrite the file, the contents of the existing file will be lost and overwritten by the contents of the file to be generated.
Could not locate directory (or no permission for any of the (sub)directories)	The license file (or directory) could not be located.
Please enter the full path name	A full path name must be specified (e.g. C:\AMI_60\License).
Please enter a filename	Enter a filename in the dialog edit box.

APPENDIX B

Listings of DICOM Tags

This appendix provides two lists of DICOM tags. The first list places the tags in ascending, numerical order. The second gives the tag names in alphabetical order.

DICOM tags listed in numerical order

Group	Element	VR	Name
0000	0002	UI	Affected SOP Class UID.
0000	0003	UI	Requested SOP Class UID
0000	0100	US	Command Field
0000	0110	US	Message ID
0000	0120	US	Message ID Being Responded To
0000	0600	AE	Move Destination
0000	0700	US	Priority
0000	0800	US	Data Set Type
0000	0900	US	Status
0000	0901	AT	Offending Element
0000	0902	LO	Error Comment
0000	0903	US	Error ID
0000	1000	UI	Affected SOP Instance UID
0000	1001	UI	Requested SOP Instance UID
0000	1002	US	Event Type ID
0000	1005	AT	Attribute Identifier List
0000	1008	US	Action Type ID
0000	1020	US	Number of Remaining Sub-operations
0000	1021	US	Number of Completed Sub-operations
0000	1022	US	Number of Failed Sub-operations
0000	1023	US	Number of Warning Sub-operations
0000	1030	AE	Move Originator Application Entity Title
0000	1031	US	Move Originator Message ID
0002	0001	OB	File Meta Information Version
0002	0002	UI	Media Storage SOP Class UID
0002	0003	UI	Media Storage SOP Instance UID
0002	0010	UI	Transfer Syntax UID
0002	0012	UI	Implementation Class UID
0002	0013	SH	Implementation Version Name
0002	0016	AE	Source Application Entity Title
0002	0100	UI	Private Information Creator UID
0002	0102	OB	Private Information
0004	1130	CS	File-set ID
0004	1141	CS	File-set Descriptor File ID
0004	1142	CS	Specific Character Set of File-set Descriptor File
0004	1200	UL	Root Directory Entity's First Directory Record Offset
0004	1202	UL	Root Directory Entity Last Directory Record Offset
0004	1212	US	File-set Consistency Flag
0004	1220	SQ	Directory Record Sequence
0004	1400	UL	Offset of the Next Directory Record
0004	1410	US	Record In-use Flag
0004	1420	UL	Offset of Referenced Lower-Level Directory Entity
0004	1430	CS	Directory Record Type
0004	1432	UI	Private Record UID
0004	1500	CS	Referenced File ID
0004	1504	UL	MRDR Directory Record Offset
0004	1510	UI	Referenced SOP Class UID in File
0004	1511	UI	Referenced SOP Instance UID in File
0004	1512	UI	Referenced Transfer Syntax UID in File
0004	1600	UL	Number of References
0008	0005	CS	Specific Character Set
0008	0008	CS	Image Type
0008	0012	DA	Instance Creation Date
0008	0013	TM	Instance Creation Time
0008	0014	UI	Instance Creator UID
0008	0016	UI	SOP Class UID
0008	0018	UI	SOP Instance UID
0008	0020	DA	Study Date
0008	0021	DA	Series Date
0008	0022	DA	Acquisition Date

Group	Element	VR	Name
0008	0023	DA	Content Date
0008	0024	DA	Overlay Date
0008	0025	DA	Curve Date
0008	002A	DT	Acquisition Datetime
0008	0030	TM	Study Time
0008	0031	TM	Series Time
0008	0032	TM	Acquisition Time
0008	0033	TM	Content Time
0008	0034	TM	Overlay Time
0008	0035	TM	Curve Time
0008	0042	CS	Nuclear Medicine Series Type (RET)
0008	0050	SH	Accession Number
0008	0052	CS	Query/Retrieve Level
0008	0054	AE	Retrieve AE Title
0008	0056	CS	Instance Availability
0008	0058	UI	Failed SOP Instance UID List
0008	0060	CS	Modality
0008	0061	CS	Modalities in Study
0008	0064	CS	Conversion Type
0008	0068	CS	Presentation Intent Type
0008	0070	LO	Manufacturer
0008	0080	LO	Institution Name
0008	0081	ST	Institution Address
0008	0082	SQ	Institution Code Sequence
0008	0090	PN	Referring Physician's Name
0008	0092	ST	Referring Physician's Address
0008	0094	SH	Referring Physician's Telephone Numbers
0008	0100	SH	Code Value
0008	0102	SH	Coding Scheme Designator
0008	0103	SH	Coding Scheme Version
0008	0104	LO	Code Meaning
0008	0105	CS	Mapping Resource
0008	0106	DT	Context Group Version
0008	0107	DT	Context Group Local Version
0008	010B	CS	Code Set Extension Flag
0008	010C	UI	Private Coding Scheme Creator UID
0008	010D	UI	Code Set Extension Creator UID
0008	010F	CS	Context Identifier
0008	0201	SH	Timezone Offset From UTC
0008	1010	SH	Station Name
0008	1030	LO	Study Description
0008	1032	SQ	Procedure Code Sequence
0008	103E	LO	Series Description
0008	1040	LO	Institutional Department Name
0008	1048	PN	Physician(s) of Record
0008	1050	PN	Performing Physician's Name
0008	1060	PN	Name of Physician(s) Reading Study
0008	1070	PN	Operators' Name
0008	1080	LO	Admitting Diagnoses Description
0008	1084	SQ	Admitting Diagnosis Code Sequence
0008	1090	LO	Manufacturer's Model Name
0008	1100	SQ	Referenced Results Sequence
0008	1110	SQ	Referenced Study Sequence
0008	1111	SQ	Referenced Study Component Sequence
0008	1115	SQ	Referenced Series Sequence
0008	1120	SQ	Referenced Patient Sequence
0008	1125	SQ	Referenced Visit Sequence
0008	1130	SQ	Referenced Overlay Sequence
0008	1140	SQ	Referenced Image Sequence
0008	1145	SQ	Referenced Curve Sequence
0008	1150	UI	Referenced SOP Class UID
0008	1155	UI	Referenced SOP Instance UID
0008	115A	UI	SOP Classes Supported
0008	1160	IS	Referenced Frame Number
0008	1195	UI	Transaction UID
0008	1197	US	Failure Reason
0008	1198	SQ	Failed SOP Sequence
0008	1199	SQ	Referenced SOP Sequence
0008	2110	CS	Lossy Image Compression (RET)
0008	2111	ST	Derivation Description
0008	2112	SQ	Source Image Sequence
0008	2120	SH	Stage Name
0008	2122	IS	Stage Number
0008	2124	IS	Number of Stages
0008	2128	IS	View Number
0008	2129	IS	Number of Event Timers
0008	212A	IS	Number of Views in Stage
0008	2130	DS	Event Elapsed Time(s)
0008	2132	LO	Event Timer Name(s)
0008	2142	IS	Start Trim
0008	2143	IS	Stop Trim
0008	2144	IS	Recommended Display Frame Rate
0008	2200	CS	Transducer Position (RET)
0008	2204	CS	Transducer Orientation (RET)
0008	2208	CS	Anatomic Structure (RET)
0008	2218	SQ	Anatomic Region Sequence
0008	2220	SQ	Anatomic Region Modifier Sequence
0008	2228	SQ	Primary Anatomic Structure Sequence
0008	2229	SQ	Anatomic Structure. Space or Region Sequence
0008	2230	SQ	Primary Anatomic Structure Modifier Sequence
0008	2240	SQ	Transducer Position Sequence
0008	2242	SQ	Transducer Position Modifier Sequence
0008	2244	SQ	Transducer Orientation Sequence
0008	2246	SQ	Transducer Orientation Modifier Sequence
0009	0010	LO	BlockID = "GEIIS"
0009	1010	SQ	GE IIS Thumbnail Sequence
0010	0010	PN	Patient's Name
0010	0020	LO	Patient ID
0010	0021	LO	Issuer of Patient ID
0010	0030	DA	Patient's Birth Date
0010	0032	TM	Patient's Birth Time
0010	0040	CS	Patient's Sex
0010	0050	SQ	Patient's Insurance Plan Code Sequence
0010	1000	LO	Other Patient IDs
0010	1001	PN	Other Patient Names
0010	1005	PN	Patient's Birth Name
0010	1010	AS	Patient's Age
0010	1020	DS	Patient's Size
0010	1030	DS	Patient's Weight
0010	1040	LO	Patient's Address
0010	1060	PN	Patient's Mother's Birth Name
0010	1080	LO	Military Rank

Group	Element	VR	Name
0010	1081	LO	Branch of Service
0010	1090	LO	Medical Record Locator
0010	2000	LO	Medical Alerts
0010	2110	LO	Contrast Allergies
0010	2150	LO	Country of Residence
0010	2152	LO	Region of Residence
0010	2154	SH	Patient's Telephone Numbers
0010	2160	SH	Ethnic Group
0010	2180	SH	Occupation
0010	21A0	CS	Smoking Status
0010	21B0	LT	Additional Patient History
0010	21C0	US	Pregnancy Status
0010	21D0	DA	Last Menstrual Date
0010	21F0	LO	Patient's Religious Preference
0010	4000	LT	Patient Comments
0018	0010	LO	Contrast/Bolus Agent
0018	0012	SQ	Contrast/Bolus Agent Sequence
0018	0014	SQ	Contrast/Bolus Administration Route Sequence
0018	0015	CS	Body Part Examined
0018	0020	CS	Scanning Sequence
0018	0021	CS	Sequence Variant
0018	0022	CS	Scan Options
0018	0023	CS	MR Acquisition Type
0018	0024	SH	Sequence Name
0018	0025	CS	Angio Flag
0018	0026	SQ	Intervention Drug Information Sequence
0018	0027	TM	Intervention Drug Stop Time
0018	0028	DS	Intervention Drug Dose
0018	0029	SQ	Intervention Drug Code Sequence
0018	002A	SQ	Additional Drug Sequence
0018	0030	LO	Radionuclide (RET)
0018	0031	LO	Radiopharmaceutical
0018	0032	DS	Energy Window Centerline (RET)
0018	0033	DS	Energy Window Total Width (RET)
0018	0034	LO	Intervention Drug Name
0018	0035	TM	Intervention Drug Start Time
0018	0036	SQ	Interventional Therapy Sequence
0018	0037	CS	Therapy Type
0018	0038	CS	Interventional Status
0018	0039	CS	Therapy Description
0018	0040	IS	Cine Rate
0018	0050	DS	Slice Thickness
0018	0060	DS	KVP
0018	0070	IS	Counts Accumulated
0018	0071	CS	Acquisition Termination Condition
0018	0072	DS	Effective Series Duration
0018	0073	CS	Acquisition Start Condition
0018	0074	IS	Acquisition Start Condition Data
0018	0075	IS	Acquisition Termination Condition Data
0018	0080	DS	Repetition Time
0018	0081	DS	Echo Time
0018	0082	DS	Inversion Time
0018	0083	DS	Number of Averages
0018	0084	DS	Imaging Frequency
0018	0085	SH	Imaged Nucleus
0018	0086	IS	Echo Number(s)

Group	Element	VR	Name
0018	0087	DS	Magnetic Field Strength
0018	0088	DS	Spacing Between Slices
0018	0089	IS	Number of Phase Encoding Steps
0018	0090	DS	Data Collection Diameter
0018	0091	IS	Echo Train Length
0018	0093	DS	Percent Sampling
0018	0094	DS	Percent Phase Field of View
0018	0095	DS	Pixel Bandwidth
0018	1000	LO	Device Serial Number
0018	1004	LO	Plate ID
0018	1010	LO	Secondary Capture Device ID
0018	1011	LO	Hardcopy Creation Device ID
0018	1012	DA	Date of Secondary Capture
0018	1014	TM	Time of Secondary Capture
0018	1016	LO	Secondary Capture Device Manufacturer
0018	1017	LO	Hardcopy Device Manufacturer
0018	1018	LO	Secondary Capture Device Manufacturer's Model Name
0018	1019	LO	Secondary Capture Device Software Version(s)
0018	101A	LO	Hardcopy Device Software Version
0018	101B	LO	Hardcopy Device Manfuacturer's Model Name
0018	1020	LO	Software Version(s)
0018	1022	SH	Video Image Format Acquired
0018	1023	LO	Digital Image Format Acquired
0018	1030	LO	Protocol Name
0018	1040	LO	Contrast/Bolus Route
0018	1041	DS	Contrast/Bolus Volume
0018	1042	TM	Contrast/Bolus Start Time
0018	1043	TM	Contrast/Bolus Stop Time
0018	1044	DS	Contrast/Bolus Total Dose
0018	1045	IS	Syringe Counts
0018	1046	DS	Contrast Flow Rate(s)
0018	1047	DS	Contrast Flow Duration(s)
0018	1048	CS	Contrast/Bolus Ingredient
0018	1049	DS	Contrast/Bolus Ingredient Concentration
0018	1050	DS	Spatial Resolution
0018	1060	DS	Trigger Time
0018	1061	LO	Trigger Source or Type
0018	1062	IS	Nominal Interval
0018	1063	DS	Frame Time
0018	1064	LO	Framing Type
0018	1065	DS	Frame Time Vector
0018	1066	DS	Frame Delay
0018	1067	DS	Image Trigger Delay
0018	1068	DS	Multiplex Group Time Offset
0018	1069	DS	Trigger Time Offset
0018	106A	CS	Synchronization Trigger
0018	106C	US	Synchronization Channel
0018	106E	UL	Trigger Sample Position
0018	1070	LO	Radiopharmaceutical Route
0018	1071	DS	Radiopharmaceutical Volume
0018	1072	TM	Radiopharmaceutical Start Time
0018	1073	TM	Radiopharmaceutical Stop Time
0018	1074	DS	Radionuclide Total Dose
0018	1075	DS	Radionuclide Half Life
0018	1076	DS	Radionuclide Positron Fraction
0018	1077	DS	Radiopharmaceutical Specific Activity

Group	Element	VR	Name
0018	1080	CS	Beat Rejection Flag
0018	1081	IS	Low R-R Value
0018	1082	IS	High R-R Value
0018	1083	IS	Intervals Acquired
0018	1084	IS	Intervals Rejected
0018	1085	LO	PVC Rejection
0018	1086	IS	Skip Beats
0018	1088	IS	Heart Rate
0018	1090	IS	Cardiac Number of Images
0018	1094	IS	Trigger Window
0018	1100	DS	Reconstruction Diameter
0018	1110	DS	Distance Source to Detector
0018	1111	DS	Distance Source to Patient
0018	1114	DS	Estimated Radiographic Magnification Factor
0018	1120	DS	Gantry/Detector Tilt
0018	1121	DS	Gantry/Detector Slew
0018	1130	DS	Table Height
0018	1131	DS	Table Traverse
0018	1134	CS	Table Motion
0018	1135	DS	Table Vertical Increment
0018	1136	DS	Table Lateral Increment
0018	1137	DS	Table Longitudinal Increment
0018	1138	DS	Table Angle
0018	113A	CS	Table Type
0018	1140	CS	Rotation Direction
0018	1141	DS	Angular Position
0018	1142	DS	Radial Position
0018	1143	DS	Scan Arc
0018	1144	DS	Angular Step
0018	1145	DS	Center of Rotation Offset
0018	1146	DS	Rotation Offset (RET)
0018	1147	CS	Field of View Shape
0018	1149	IS	Field of View Dimension(s)
0018	1150	IS	Exposure Time
0018	1151	IS	X-ray Tube Current
0018	1152	IS	Exposure
0018	1153	IS	Exposure in uAs
0018	1154	DS	Average Pulse Width
0018	1155	CS	Radiation Setting
0018	1156	CS	Rectification Type
0018	115A	CS	Radiation Mode
0018	115E	DS	Image Area Dose Product
0018	1160	SH	Filter Type
0018	1161	LO	Type of Filters
0018	1162	DS	Intensifier Size
0018	1164	DS	Imager Pixel Spacing
0018	1166	CS	Grid
0018	1170	IS	Generator Power
0018	1180	SH	Collimator/grid Name
0018	1181	CS	Collimator Type
0018	1182	IS	Focal Distance
0018	1183	DS	X Focus Center
0018	1184	DS	Y Focus Center
0018	1190	DS	Focal Spot(s)
0018	1191	CS	Anode Target Material
0018	11A0	DS	Body Part Thickness
0018	11A2	DS	Compression Force
0018	1200	DA	Date of Last Calibration
0018	1201	TM	Time of Last Calibration
0018	1210	SH	Convolution Kernel
0018	1242	IS	Actual Frame Duration
0018	1243	IS	Count Rate
0018	1244	US	Preferred Playback Sequencing
0018	1250	SH	Receiving Coil
0018	1251	SH	Transmitting Coil
0018	1260	SH	Plate Type
0018	1261	LO	Phosphor Type
0018	1300	DS	Scan Velocity
0018	1301	CS	Whole Body Technique
0018	1302	IS	Scan Length
0018	1310	US	Acquisition Matrix
0018	1312	CS	Phase Encoding Direction
0018	1314	DS	Flip Angle
0018	1315	CS	Variable Flip Angle Flag
0018	1316	DS	SAR
0018	1318	DS	dB/dt
0018	1400	LO	Acquisition Device Processing Description
0018	1401	LO	Acquisition Device Processing Code
0018	1402	CS	Cassette Orientation
0018	1403	CS	Cassette Size
0018	1404	US	Exposures on Plate
0018	1405	IS	Relative X-ray Exposure
0018	1450	CS	Column Angulation
0018	1460	DS	Tomo Layer Height
0018	1470	DS	Tomo Angle
0018	1480	DS	Tomo Time
0018	1490	CS	Tomo Type
0018	1491	CS	Tomo Class
0018	1495	IS	Number of Tomosynthesis Source Images
0018	1500	CS	Positioner Motion
0018	1508	CS	Positioner Type
0018	1510	DS	Positioner Primary Angle
0018	1511	DS	Positioner Secondary Angle
0018	1520	DS	Positioner Primary Angle Increment
0018	1521	DS	Positioner Secondary Angle Increment
0018	1530	DS	Detector Primary Angle
0018	1531	DS	Detector Secondary Angle
0018	1600	CS	Shutter Shape
0018	1602	IS	Shutter Left Vertical Edge
0018	1604	IS	Shutter Right Vertical Edge
0018	1606	IS	Shutter Upper Horizontal Edge
0018	1608	IS	Shutter Lower Horizontal Edge
0018	1610	IS	Center of Circular Shutter
0018	1612	IS	Radius of Circular Shutter
0018	1620	IS	Vertices of the Polygonal Shutter
0018	1622	US	Shutter Presentation Value
0018	1623	US	Shutter Overlay Group
0018	1700	CS	Collimator Shape
0018	1702	IS	Collimator Left Vertical Edge
0018	1704	IS	Collimator Right Vertical Edge
0018	1706	IS	Collimator Upper Horizontal Edge
0018	1708	IS	Collimator Lower Horizontal Edge

Group	Element	VR	Name
0018	1710	IS	Center of Circular Collimator
0018	1712	IS	Radius of Circular Collimator
0018	1720	IS	Vertices of the Polygonal Collimator
0018	1800	CS	Acquisition Time Synchronized
0018	1801	SH	Time Source
0018	1802	CS	Time Distribution Protocol
0018	2001	IS	Page Number Vector
0018	2002	SH	Frame Label Vector
0018	2003	DS	Frame Primary Angle Vector
0018	2004	DS	Frame Secondary Angle Vector
0018	2005	DS	Slice Location Vector
0018	2006	SH	Display Window Label Vector
0018	2010	DS	Nominal Scanned Pixel Spacing
0018	2020	CS	Digitizing Device Transport Direction
0018	2030	DS	Rotation of Scanned Film
0018	5000	SH	Output Power
0018	5010	LO	Transducer Data
0018	5012	DS	Focus Depth
0018	5020	LO	Processing Function
0018	5021	LO	Postprocessing Function
0018	5022	DS	Mechanical Index
0018	5024	DS	Thermal Index
0018	5026	DS	Cranial Thermal Index
0018	5027	DS	Soft Tissue Thermal Index
0018	5028	DS	Soft Tissue-focus Thermal Index
0018	5029	DS	Soft Tissue-surface Thermal Index
0018	5050	IS	Depth of Scan Field
0018	5100	CS	Patient Position
0018	5101	CS	View Position
0018	5104	SQ	Projection Eponymous Name Code Sequence
0018	5210	DS	Image Transformation Matrix
0018	5212	DS	Image Translation Vector
0018	6000	DS	Sensitivity
0018	6011	SQ	Sequence of Ultrasound Regions
0018	6012	US	Region Spatial Format
0018	6014	US	Region Data Type
0018	6016	UL	Region Flags
0018	6018	UL	Region Location Min X 0
0018	601A	UL	Region Location Min Y 0
0018	601C	UL	Region Location Max X 1
0018	601E	UL	Region Location Max Y 1
0018	6020	SL	Reference Pixel X 0
0018	6022	SL	Reference Pixel Y 0
0018	6024	US	Physical Units X Direction
0018	6026	US	Physical Units Y Direction
0018	6028	FD	Reference Pixel Physical Value X
0018	602A	FD	Reference Pixel Physical Value Y
0018	602C	FD	Physical Delta X
0018	602E	FD	Physical Delta Y
0018	6030	UL	Transducer Frequency
0018	6031	CS	Transducer Type
0018	6032	UL	Pulse Repetition Frequency
0018	6034	FD	Doppler Correction Angle
0018	6036	FD	Steering Angle
0018	6038	UL	Doppler Sample Volume X Position
0018	603A	UL	Doppler Sample Volume Y Position
0018	603C	UL	TM-Line Position X 0
0018	603E	UL	TM-Line Position Y 0
0018	6040	UL	TM-Line Position X 1
0018	6042	UL	TM-Line Position Y 1
0018	6044	US	Pixel Component Organization
0018	6046	UL	Pixel Component Mask
0018	6048	UL	Pixel Component Range Start
0018	604A	UL	Pixel Component Range Stop
0018	604C	US	Pixel Component Physical Units
0018	604E	US	Pixel Component Data Type
0018	6050	UL	Number of Table Break Points
0018	6052	UL	Table of X Break Points
0018	6054	FD	Table of Y Break Points
0018	6056	UL	Number of Table Entries
0018	6058	UL	Table of Pixel Values
0018	605A	FL	Table of Parameter Values
0018	7000	CS	Detector Conditions Nominal Flag
0018	7001	DS	Detector Temperature
0018	7004	CS	Detector Type
0018	7005	CS	Detector Configuration
0018	7006	LT	Detector Description
0018	7008	LT	Detector Mode
0018	700A	SH	Detector ID
0018	700C	DA	Date of Last Detector Calibration
0018	700E	TM	Time of Last Detector Calibration
0018	7010	IS	Exposures on Detector Since Last Calibration
0018	7011	IS	Exposures on Detector Since Manufactured
0018	7012	DS	Detector Time Since Last Exposure
0018	7014	DS	Detector Active Time
0018	7016	DS	Detector Activation Offset From Exposure
0018	701A	DS	Detector Binning
0018	7020	DS	Detector Element Physical Size
0018	7022	DS	Detector Element Spacing
0018	7024	CS	Detector Active Shape
0018	7026	DS	Detector Active Dimension(s)
0018	7028	DS	Detector Active Origin
0018	7030	DS	Field of View Origin
0018	7032	DS	Field of View Rotation
0018	7034	CS	Field of View Horizontal Flip
0018	7040	LT	Grid Absorbing Material
0018	7041	LT	Grid Spacing Material
0018	7042	DS	Grid Thickness
0018	7044	DS	Grid Pitch
0018	7046	IS	Grid Aspect Ratio
0018	7048	DS	Grid Period
0018	704C	DS	Grid Focal Distance
0018	7050	CS	Filter Material
0018	7052	DS	Filter Thickness Minimum
0018	7054	DS	Filter Thickness Maximum
0018	7060	CS	Exposure Control Mode
0018	7062	LT	Exposure Control Mode Description
0018	7064	CS	Exposure Status
0018	7065	DS	Phototimer Setting
0018	8150	DS	Exposure Time in mS
0018	8151	DS	X-Ray Tube Current in mA
0020	000D	UI	Study Instance UID

Group	Element	VR	Name
0020	000E	UI	Series Instance UID
0020	0010	SH	Study ID
0020	0011	IS	Series Number
0020	0012	IS	Acquisition Number
0020	0013	IS	Instance Number
0020	0014	IS	Isotope Number (RET)
0020	0015	IS	Phase Number (RET)
0020	0016	IS	Interval Number (RET)
0020	0017	IS	Time Slot Number (RET)
0020	0018	IS	Angle Number (RET)
0020	0019	IS	Item Number
0020	0020	CS	Patient Orientation
0020	0022	IS	Overlay Number
0020	0024	IS	Curve Number
0020	0026	IS	Lookup Table Number
0020	0032	DS	Image Position (Patient)
0020	0037	DS	Image Orientation (Patient)
0020	0052	UI	Frame of Reference UID
0020	0060	CS	Laterality
0020	0062	CS	Image Laterality
0020	0100	IS	Temporal Position Identifier
0020	0105	IS	Number of Temporal Positions
0020	0110	DS	Temporal Resolution
0020	0200	UI	Synchronization Frame of Reference UID
0020	1000	IS	Series in Study
0020	1002	IS	Images in Acquisition
0020	1004	IS	Acquisitions in Study
0020	1040	LO	Position Reference Indicator
0020	1041	DS	Slice Location
0020	1070	IS	Other Study Numbers
0020	1200	IS	Number of Patient Related Studies
0020	1202	IS	Number of Patient Related Series
0020	1204	IS	Number of Patient Related Instances
0020	1206	IS	Number of Study Related Series
0020	1208	IS	Number of Study Related Instances
0020	1209	IS	Number of Series Related Instances
0020	4000	LT	Image Comments
0028	0002	US	Samples per Pixel
0028	0004	CS	Photometric Interpretation
0028	0006	US	Planar Configuration
0028	0008	IS	Number of Frames
0028	0009	AT	Frame Increment Pointer
0028	0010	US	Rows
0028	0011	US	Columns
0028	0012	US	Planes
0028	0014	US	Ultrasound Color Data Present
0028	0030	DS	Pixel Spacing
0028	0031	DS	Zoom Factor
0028	0032	DS	Zoom Center
0028	0034	IS	Pixel Aspect Ratio
0028	0051	CS	Corrected Image
0028	0100	US	Bits Allocated
0028	0101	US	Bits Stored
0028	0102	US	High Bit
0028	0103	US	Pixel Representation
0028	0106	XS	Smallest Image Pixel Value
0028	0107	XS	Largest Image Pixel Value
0028	0108	XS	Smallest Pixel Value in Series
0028	0109	XS	Largest Pixel Value in Series
0028	0110	XS	Smallest Image Pixel Value in Plane
0028	0111	XS	Largest Image Pixel Value in Plane
0028	0120	XS	Pixel Padding Value
0028	0300	CS	Quality Control Image
0028	0301	CS	Burned In Annotation
0028	1040	CS	Pixel Intensity Relationship
0028	1041	SS	Pixel Intensity Relationship Sign
0028	1050	DS	Window Center
0028	1051	DS	Window Width
0028	1052	DS	Rescale Intercept
0028	1053	DS	Rescale Slope
0028	1054	LO	Rescale Type
0028	1055	LO	Window Center & Width Explanation
0028	1090	CS	Recommended Viewing Mode
0028	1101	XS	Red Palette Color Lookup Table Descriptor
0028	1102	XS	Green Palette Color Lookup Table Descriptor
0028	1103	XS	Blue Palette Color Lookup Table Descriptor
0028	1199	UI	Palette Color Lookup Table UID
0028	1201	US	Red Palette Color Lookup Table Data
0028	1202	US	Green Palette Color Lookup Table Data
0028	1203	US	Blue Palette Color Lookup Table Data
0028	1221	OW	Segmented Red Palette Color Lookup Table Data
0028	1222	OW	Segmented Green Palette Color Lookup Table Data
0028	1223	OW	Segmented Blue Palette Color Lookup Table Data
0028	1300	CS	Implant Present
0028	1350	CS	Partial View
0028	1351	ST	Partial View Description
0028	2110	CS	Lossy Image Compression
0028	2112	DS	Lossy Image Compression Ratio
0028	3000	SQ	Modality LUT Sequence
0028	3002	XS	LUT Descriptor
0028	3003	LO	LUT Explanation
0028	3004	LO	Modality LUT Type
0028	3006	US	LUT Data
0028	3010	SQ	VOI LUT Sequence
0028	3110	SQ	Softcopy VOI LUT Sequence
0028	5000	SQ	Bi-Plane Acquisition Sequence
0028	6010	US	Representative Frame Number
0028	6020	US	Frame Numbers of Interest (FOI)
0028	6022	LO	Frame(s) of Interest Description
0028	6030	US	Mask Pointer(s)
0028	6040	US	R Wave Pointer
0028	6100	SQ	Mask Subtraction Sequence
0028	6101	CS	Mask Operation
0028	6102	US	Applicable Frame Range
0028	6110	US	Mask Frame Numbers
0028	6112	US	Contrast Frame Averaging
0028	6114	FL	Mask Sub-pixel Shift
0028	6120	SS	TID Offset
0028	6190	ST	Mask Operation Explanation
0029	0060	LO	RadWorksMarconi
0029	6024	US	DCM_MARCONIKEYFRAMEINDICES
0032	000A	CS	Study Status ID

Group	Element	VR	Name
0032	000C	CS	Study Priority ID
0032	0012	LO	Study ID Issuer
0032	0032	DA	Study Verified Date
0032	0033	TM	Study Verified Time
0032	0034	DA	Study Read Date
0032	0035	TM	Study Read Time
0032	1000	DA	Scheduled Study Start Date
0032	1001	TM	Scheduled Study Start Time
0032	1010	DA	Scheduled Study Stop Date
0032	1011	TM	Scheduled Study Stop Time
0032	1020	LO	Scheduled Study Location
0032	1021	AE	Scheduled Study Location AE Title(s)
0032	1030	LO	Reason for Study
0032	1032	PN	Requesting Physician
0032	1033	LO	Requesting Service
0032	1040	DA	Study Arrival Date
0032	1041	TM	Study Arrival Time
0032	1050	DA	Study Completion Date
0032	1051	TM	Study Completion Time
0032	1055	CS	Study Component Status ID
0032	1060	LO	Requested Procedure Description
0032	1064	SQ	Requested Procedure Code Sequence
0032	1070	LO	Requested Contrast Agent
0032	4000	LT	Study Comments
0038	0004	SQ	Referenced Patient Alias Sequence
0038	0008	CS	Visit Status ID
0038	0010	LO	Admission ID
0038	0011	LO	Issuer of Admission ID
0038	0016	LO	Route of Admissions
0038	001A	DA	Scheduled Admission Date
0038	001B	TM	Scheduled Admission Time
0038	001C	DA	Scheduled Discharge Date
0038	001D	TM	Scheduled Discharge Time
0038	001E	LO	Scheduled Patient Institution Residence
0038	0020	DA	Admitting Date
0038	0021	TM	Admitting Time
0038	0030	DA	Discharge Date
0038	0032	TM	Discharge Time
0038	0040	LO	Discharge Diagnosis Description
0038	0044	SQ	Discharge Diagnosis Code Sequence
0038	0050	LO	Special Needs
0038	0300	LO	Current Patient Location
0038	0400	LO	Patient's Institution Residence
0038	0500	LO	Patient State
0038	4000	LT	Visit Comments
003A	0004	CS	Waveform Originality
003A	0005	US	Number of Waveform Channels
003A	0010	UL	Number of Waveform Samples
003A	001A	DS	Sampling Frequency
003A	0020	SH	Multiplex Group Label
003A	0200	SQ	Channel Definition Sequence
003A	0202	IS	Waveform Channel Number
003A	0203	SH	Channel Label
003A	0205	CS	Channel Status
003A	0208	SQ	Channel Source Sequence
003A	0209	SQ	Channel Source Modifiers Sequence

Group	Element	VR	Name
003A	020A	SQ	Source Waveform Sequence
003A	020C	LO	Channel Derivation Description
003A	0210	DS	Channel Sensitivity
003A	0211	SQ	Channel Sensitivity Units Sequence
003A	0212	DS	Channel Sensitivity Correction Factor
003A	0213	DS	Channel Baseline
003A	0214	DS	Channel Time Skew
003A	0215	DS	Channel Sample Skew
003A	0218	DS	Channel Offset
003A	021A	US	Waveform Bits Stored
003A	0220	DS	Filter Low Frequency
003A	0221	DS	Filter High Frequency
003A	0222	DS	Notch Filter Frequency
003A	0223	DS	Notch Filter Bandwidth
0040	0001	AE	Scheduled Station AE Title
0040	0002	DA	Scheduled Procedure Step Start Date
0040	0003	TM	Scheduled Procedure Step Start Time
0040	0004	DA	Scheduled Procedure Step End Date
0040	0005	TM	Scheduled Procedure Step End Time
0040	0006	PN	Scheduled Performing Physician's Name
0040	0007	LO	Scheduled Procedure Step Description
0040	0008	SQ	Scheduled Action Item Code Sequence
0040	0009	SH	Scheduled Procedure Step ID
0040	0010	SH	Scheduled Station Name
0040	0011	SH	Scheduled Procedure Step Location
0040	0012	LO	Pre-Medication
0040	0020	CS	Scheduled Procedure Step Status
0040	0100	SQ	Scheduled Procedure Step Sequence
0040	0220	SQ	Referenced Standalone SOP Instance Sequence
0040	0241	AE	Performed Station AE Title
0040	0242	SH	Performed Station Name
0040	0243	SH	Performed Location
0040	0244	DA	Performed Procedure Step Start Date
0040	0245	TM	Performed Procedure Step Start Time
0040	0250	DA	Performed Procedure Step End Date
0040	0251	TM	Performed Procedure Step End Time
0040	0252	CS	Performed Procedure Step Status
0040	0253	SH	Performed Procedure Step ID
0040	0254	LO	Performed Procedure Step Description
0040	0255	LO	Performed Procedure Type Description
0040	0260	SQ	Performed Action Item Sequence
0040	0270	SQ	Scheduled Step Attributes Sequence
0040	0275	SQ	Request Attributes Sequence
0040	0280	ST	Comments on the Performed Procedure Steps
0040	0293	SQ	Quantity Sequence
0040	0294	DS	Quantity
0040	0295	SQ	Measuring Units Sequence
0040	0296	SQ	Billing Item Sequence
0040	0300	US	Total Time of Fluoroscopy
0040	0301	US	Total Number of Exposures
0040	0302	US	Entrance Dose
0040	0303	US	Exposed Area
0040	0306	DS	Distance Source to Entrance
0040	0307	DS	Distance Source to Support
0040	0310	ST	Comments on Radiation Dose
0040	0312	DS	X-Ray Output

Group	Element	VR	Name
0040	0314	DS	Half Value Layer
0040	0316	DS	Organ Dose
0040	0318	CS	Organ Exposed
0040	0320	SQ	Billing Procedure Step Sequence
0040	0321	SQ	Film Consumption Sequence
0040	0324	SQ	Billing Supplies and Devices Sequence
0040	0330	SQ	Referenced Procedure Step Sequence
0040	0340	SQ	Performed Series Sequence
0040	0400	LT	Comments on the Scheduled Procedure Step
0040	050A	LO	Specimen Accession Number
0040	0550	SQ	Specimen Sequence
0040	0551	LO	Specimen Identifier
0040	0555	SQ	Acquisition Context Sequence
0040	0556	ST	Acquisition Context Description
0040	059A	SQ	Specimen Type Code Sequence
0040	06FA	LO	Slide Identifier
0040	071A	SQ	Image Center Point Coordinates Sequence
0040	072A	DS	X offset in Slide Coordinate System
0040	073A	DS	Y offset in Slide Coordinate System
0040	074A	DS	Z offset in Slide Coordinate System
0040	08D8	SQ	Pixel Spacing Sequence
0040	08DA	SQ	Coordinate System Axis Code Sequence
0040	08EA	SQ	Measurement Units Code Sequence
0040	1001	SH	Requested Procedure ID
0040	1002	LO	Reason for the Requested Procedure
0040	1003	SH	Requested Procedure Priority
0040	1004	LO	Patient Transport Arrangements
0040	1005	LO	Requested Procedure Location
0040	1006	SH	Placer Order Number / Procedure (RET)
0040	1007	SH	Filler Order Number / Procedure (RET)
0040	1008	LO	Confidentiality Code
0040	1009	SH	Reporting Priority
0040	1010	PN	Names of Intended Recipients of Results
0040	1400	LT	Requested Procedure Comments
0040	2001	LO	Reason for the Imaging Service Request
0040	2004	DA	Issue Date of Imaging Service Request
0040	2005	TM	Issue Time of Imaging Service Request
0040	2006	SH	Placer Order Number / Imaging Service Request (RET)
0040	2007	SH	Filler Order Number / Imaging Service Request (RET)
0040	2008	PN	Order Entered By
0040	2009	SH	Order Enterer's Location
0040	2010	SH	Order Callback Phone Number
0040	2016	LO	Placer Order Number / Imaging Service Request
0040	2017	LO	Filler Order Number / Imaging Service Request
0040	2400	LT	Imaging Service Request Comments
0040	3001	LO	Confidentiality Constraint on Patient Data Description
0040	8302	DS	Entrance Dose in mGy
0040	A010	CS	Relationship Type
0040	A027	LO	Verifying Organization
0040	A030	DT	Verification DateTime
0040	A032	DT	Observation DateTime
0040	A040	CS	Value Type
0040	A043	SQ	Concept-name Code Sequence
0040	A050	CS	Continuity Of Content
0040	A073	SQ	Verifying Observer Sequence
0040	A075	PN	Verifying Observer Name
0040	A088	SQ	Verifying Observer Identification Code Sequence
0040	A0B0	US	Referenced Waveform Channels
0040	A120	DT	DateTime
0040	A121	DA	Date
0040	A122	TM	Time
0040	A123	PN	Person Name
0040	A124	UI	UID
0040	A130	CS	Temporal Range Type
0040	A132	UL	Referenced Sample Positions
0040	A136	US	Referenced Frame Numbers
0040	A138	DS	Referenced Time Offsets
0040	A13A	DT	Referenced Datetime
0040	A160	UT	Text Value
0040	A168	SQ	Concept Code Sequence
0040	A180	US	Annotation Group Number
0040	A195	SQ	Modifier Code Sequence
0040	A300	SQ	Measured Value Sequence
0040	A30A	DS	Numeric Value
0040	A360	SQ	Predecessor Documents Sequence
0040	A370	SQ	Referenced Request Sequence
0040	A372	SQ	Performed Procedure Code Sequence
0040	A375	SQ	Current Requested Procedure Evidence Sequence
0040	A385	SQ	Pertinent Other Evidence Sequence
0040	A491	CS	Completion Flag
0040	A492	LO	Completion Flag Description
0040	A493	CS	Verification Flag
0040	A504	SQ	Content Template Sequence
0040	A525	SQ	Identical Documents Sequence
0040	A730	SQ	Content Sequence
0040	B020	SQ	Annotation Sequence
0040	DB00	CS	Template Identifier
0040	DB06	DT	Template Version
0040	DB07	DT	Template Local Version
0040	DB0B	CS	Template Extension Flag
0040	DB0C	UI	Template Extension Organization UID
0040	DB0D	UI	Template Extension Creator UID
0040	DB73	UL	Referenced Content Item Identifier
0045	0010	LO	BlockID = "GE LUT Asymmetry Parameter"
0045	1067	DS	LUT Assymetry
0050	0004	CS	Calibration Image
0050	0010	SQ	Device Sequence
0050	0014	DS	Device Length
0050	0016	DS	Device Diameter
0050	0017	CS	Device Diameter Units
0050	0018	DS	Device Volume
0050	0019	DS	Inter-marker Distance
0050	0020	LO	Device Description
0054	0010	US	Energy Window Vector
0054	0011	US	Number of Energy Windows
0054	0012	SQ	Energy Window Information Sequence
0054	0013	SQ	Energy Window Range Sequence
0054	0014	DS	Energy Window Lower Limit
0054	0015	DS	Energy Window Upper Limit
0054	0016	SQ	Radiopharmaceutical Information Sequence
0054	0017	IS	Residual Syringe Counts
0054	0018	SH	Energy Window Name

Group	Element	VR	Name
0054	0020	US	Detector Vector
0054	0021	US	Number of Detectors
0054	0022	SQ	Detector Information Sequence
0054	0030	US	Phase Vector
0054	0031	US	Number of Phases
0054	0032	SQ	Phase Information Sequence
0054	0033	US	Number of Frames in Phase
0054	0036	IS	Phase Delay
0054	0038	IS	Pause Between Frames
0054	0050	US	Rotation Vector
0054	0051	US	Number of Rotations
0054	0052	SQ	Rotation Information Sequence
0054	0053	US	Number of Frames in Rotation
0054	0060	US	R-R Interval Vector
0054	0061	US	Number of R-R Intervals
0054	0062	SQ	Gated Information Sequence
0054	0063	SQ	Data Information Sequence
0054	0070	US	Time Slot Vector
0054	0071	US	Number of Time Slots
0054	0072	SQ	Time Slot Information Sequence
0054	0073	DS	Time Slot Time
0054	0080	US	Slice Vector
0054	0081	US	Number of Slices
0054	0090	US	Angular View Vector
0054	0100	US	Time Slice Vector
0054	0101	US	Number of Time Slices
0054	0200	DS	Start Angle
0054	0202	CS	Type of Detector Motion
0054	0210	IS	Trigger Vector
0054	0211	US	Number of Triggers in Phase
0054	0220	SQ	View Code Sequence
0054	0222	SQ	View Modifier Code Sequence
0054	0300	SQ	Radionuclide Code Sequence
0054	0302	SQ	Administration Route Code Sequence
0054	0304	SQ	Radiopharmaceutical Code Sequence
0054	0306	SQ	Calibration Data Sequence
0054	0308	US	Energy Window Number
0054	0400	SH	Image ID
0054	0410	SQ	Patient Orientation Code Sequence
0054	0412	SQ	Patient Orientation Modifier Code Sequence
0054	0414	SQ	Patient Gantry Relationship Code Sequence
0054	1000	CS	Series Type
0054	1001	CS	Units
0054	1002	CS	Counts Source
0054	1004	CS	Reprojection Method
0054	1100	CS	Randoms Correction Method
0054	1101	LO	Attenuation Correction Method
0054	1102	CS	Decay Correction
0054	1103	LO	Reconstruction Method
0054	1104	LO	Detector Lines of Response Used
0054	1105	LO	Scatter Correction Method
0054	1200	DS	Axial Acceptance
0054	1201	IS	Axial Mash
0054	1202	IS	Transverse Mash
0054	1203	DS	Detector Element Size
0054	1210	DS	Coincidence Window Width

Group	Element	VR	Name
0054	1220	CS	Secondary Counts Type
0054	1300	DS	Frame Reference Time
0054	1310	IS	Primary (Prompts) Counts Accumulated
0054	1311	IS	Secondary Counts Accumulated
0054	1320	DS	Slice Sensitivity Factor
0054	1321	DS	Decay Factor
0054	1322	DS	Dose Calibration Factor
0054	1323	DS	Scatter Fraction Factor
0054	1324	DS	Dead Time Factor
0054	1330	US	Image Index
0054	1400	CS	Counts Included
0054	1401	CS	Dead Time Correction Flag
0060	3000	SQ	Histogram Sequence
0060	3002	US	Histogram Number of Bins
0060	3004	XS	Histogram First Bin Value
0060	3006	XS	Histogram Last Bin Value
0060	3008	US	Histogram Bin Width
0060	3010	LO	Histogram Explanation
0060	3020	UL	Histogram Data
0070	0001	SQ	Graphic Annotation Sequence
0070	0002	CS	Graphic Layer
0070	0003	CS	Bounding Box Annotation Units
0070	0004	CS	Anchor Point Annotation Units
0070	0005	CS	Graphic Annotation Units
0070	0006	ST	Unformatted Text Value
0070	0008	SQ	Text Object Sequence
0070	0009	SQ	Graphic Object Sequence
0070	0010	FL	Bounding Box Top Left Hand Corner
0070	0011	FL	Bounding Box Bottom Right Hand Corner
0070	0012	CS	Bounding Box Text Horizontal Justification
0070	0014	FL	Anchor Point
0070	0015	CS	Anchor Point Visibility
0070	0020	US	Graphic Dimensions
0070	0021	US	Number of Graphic Points
0070	0022	FL	Graphic Data
0070	0023	CS	Graphic Type
0070	0024	CS	Graphic Filled
0070	0041	CS	Image Horizontal Flip
0070	0042	US	Image Rotation
0070	0052	SL	Displayed Area Top Left Hand Corner
0070	0053	SL	Displayed Area Bottom Right Hand Corner
0070	005A	SQ	Displayed Area Selection Sequence
0070	0060	SQ	Graphic Layer Sequence
0070	0062	IS	Graphic Layer Order
0070	0066	US	Graphic Layer Recommended Display Grayscale Value
0070	0067	US	Graphic Layer Recommended Display RGB Value
0070	0068	LO	Graphic Layer Description
0070	0080	CS	Presentation Label
0070	0081	LO	Presentation Description
0070	0082	DA	Presentation Creation Date
0070	0083	TM	Presentation Creation Time
0070	0084	PN	Presentation Creator's Name
0070	0100	CS	Presentation Size Mode
0070	0101	DS	Presentation Pixel Spacing
0070	0102	IS	Presentation Pixel Aspect Ratio
0070	0103	FL	Presentation Pixel Magnification Ratio

Group	Element	VR	Name
0088	0130	SH	Storage Media File-set ID
0088	0140	UI	Storage Media File-set UID
0088	0200	SQ	Icon Image Sequence
0088	0904	LO	Topic Title
0088	0906	ST	Topic Subject
0088	0910	LO	Topic Author
0088	0912	LO	Topic Key Words
0100	0410	CS	SOP Instance Status
0100	0420	DT	SOP Authorization Date and Time
0100	0424	LT	SOP Authorization Comment
0100	0426	LO	Authorization Equipment Certification Number
2000	0010	IS	Number of Copies
2000	001E	SQ	Printer Configuration Sequence
2000	0020	CS	Print Priority
2000	0030	CS	Medium Type
2000	0040	CS	Film Destination
2000	0050	LO	Film Session Label
2000	0060	IS	Memory Allocation
2000	0061	IS	Maximum Memory Allocation
2000	0062	CS	Color Image Printing Flag
2000	0063	CS	Collation Flag
2000	0065	CS	Annotation Flag
2000	0067	CS	Image Overlay Flag
2000	0069	CS	Presentation LUT Flag
2000	006A	CS	Image Box Presentation LUT Flag
2000	00A0	US	Memory Bit Depth
2000	00A1	US	Printing Bit Depth
2000	00A2	SQ	Media Installed Sequence
2000	00A4	SQ	Other Media Available Sequence
2000	00A8	SQ	Supported Image Display Formats Sequence
2000	0500	SQ	Referenced Film Box Sequence
2000	0510	SQ	Referenced Stored Print Sequence
2010	0010	ST	Image Display Format
2010	0030	CS	Annotation Display Format ID
2010	0040	CS	Film Orientation
2010	0050	CS	Film Size ID
2010	0052	CS	Printer Resolution ID
2010	0054	CS	Default Printer Resolution ID
2010	0060	CS	Magnification Type
2010	0080	CS	Smoothing Type
2010	00A6	CS	Default Magnification Type
2010	00A7	CS	Other Magnification Types Available
2010	00A8	CS	Default Smoothing Type
2010	00A9	CS	Other Smoothing Types Available
2010	0100	CS	Border Density
2010	0110	CS	Empty Image Density
2010	0120	US	Min Density
2010	0130	US	Max Density
2010	0140	CS	Trim
2010	0150	ST	Configuration Information
2010	0152	LT	Configuration Information Description
2010	0154	IS	Maximum Collated Films
2010	015E	US	Illumination
2010	0160	US	Reflected Ambient Light
2010	0376	DS	Printer Pixel Spacing
2010	0500	SQ	Referenced Film Session Sequence
2010	0510	SQ	Referenced Image Box Sequence
2010	0520	SQ	Referenced Basic Annotation Box Sequence
2020	0010	US	Image Position
2020	0020	CS	Polarity
2020	0030	DS	Requested Image Size
2020	0040	CS	Requested Decimate/Crop Behavior
2020	0050	CS	Requested Resolution ID
2020	00A0	CS	Requested Image Size Flag
2020	00A2	CS	Decimate/Crop Result
2020	0110	SQ	Basic Grayscale Image Sequence
2020	0111	SQ	Basic Color Image Sequence
2020	0130	SQ	Referenced Image Overlay Box Sequence (RET)
2020	0140	SQ	Referenced VOI LUT Box Sequence (RET)
2030	0010	US	Annotation Position
2030	0020	LO	Text String
2040	0010	SQ	Referenced Overlay Plane Sequence
2040	0011	US	Referenced Overlay Plane Groups
2040	0020	SQ	Overlay Pixel Data Sequence
2040	0060	CS	Overlay Magnification Type
2040	0070	CS	Overlay Smoothing Type
2040	0072	CS	Overlay or Image Magnification
2040	0074	US	Magnify to Number of Columns
2040	0080	CS	Overlay Foreground Density
2040	0082	CS	Overlay Background Density
2040	0090	CS	Overlay Mode (RET)
2040	0100	CS	Threshold Density (RET)
2040	0500	SQ	Referenced Image Box Sequence (RET)
2050	0010	SQ	Presentation LUT Sequence
2050	0020	CS	Presentation LUT Shape
2050	0500	SQ	Referenced Presentation LUT Sequence
2100	0010	SH	Print Job ID
2100	0020	CS	Execution Status
2100	0030	CS	Execution Status Info
2100	0040	DA	Creation Date
2100	0050	TM	Creation Time
2100	0070	AE	Originator
2100	0140	AE	Destination AE
2100	0160	SH	Owner ID
2100	0170	IS	Number of Films
2100	0500	SQ	Referenced Print Job Sequence
2110	0010	CS	Printer Status
2110	0020	CS	Printer Status Info
2110	0030	LO	Printer Name
2110	0099	SH	Print Queue ID
2120	0010	CS	Queue Status
2120	0050	SQ	Print Job Description Sequence
2120	0070	SQ	Referenced Print Job Sequence
2130	0010	SQ	Print Management Capabilities Sequence
2130	0015	SQ	Printer Characteristics Sequence
2130	0030	SQ	Film Box Content Sequence
2130	0040	SQ	Image Box Content Sequence
2130	0050	SQ	Annotation Content Sequence
2130	0060	SQ	Image Overlay Box Content Sequence
2130	0080	SQ	Presentation LUT Content Sequence
2130	00A0	SQ	Proposed Study Sequence
2130	00C0	SQ	Original Image Sequence

Group	Element	VR	Name
3002	0002	SH	RT Image Label
3002	0003	LO	RT Image Name
3002	0004	ST	RT Image Description
3002	000A	CS	Reported Values Origin
3002	000C	CS	RT Image Plane
3002	000D	DS	X-Ray Image Receptor Translation
3002	000E	DS	X-Ray Image Receptor Angle
3002	0010	DS	RT Image Orientation
3002	0011	DS	Image Plane Pixel Spacing
3002	0012	DS	RT Image Position
3002	0020	SH	Radiation Machine Name
3002	0022	DS	Radiation Machine SAD
3002	0024	DS	Radiation Machine SSD
3002	0026	DS	RT Image SID
3002	0028	DS	Source to Reference Object Distance
3002	0029	IS	Fraction Number
3002	0030	SQ	Exposure Sequence
3002	0032	DS	Meterset Exposure
3004	0001	CS	DVH Type
3004	0002	CS	Dose Units
3004	0004	CS	Dose Type
3004	0006	LO	Dose Comment
3004	0008	DS	Normalization Point
3004	000A	CS	Dose Summation Type
3004	000C	DS	Grid Frame Offset Vector
3004	000E	DS	Dose Grid Scaling
3004	0010	SQ	RT Dose ROI Sequence
3004	0012	DS	Dose Value
3004	0040	DS	DVH Normalization Point
3004	0042	DS	DVH Normalization Dose Value
3004	0050	SQ	DVH Sequence
3004	0052	DS	DVH Dose Scaling
3004	0054	CS	DVH Volume Units
3004	0056	IS	DVH Number of Bins
3004	0058	DS	DVH Data
3004	0060	SQ	DVH Referenced ROI Sequence
3004	0062	CS	DVH ROI Contribution Type
3004	0070	DS	DVH Minimum Dose
3004	0072	DS	DVH Maximum Dose
3004	0074	DS	DVH Mean Dose
3006	0002	SH	Structure Set Label
3006	0004	LO	Structure Set Name
3006	0006	ST	Structure Set Description
3006	0008	DA	Structure Set Date
3006	0009	TM	Structure Set Time
3006	0010	SQ	Referenced Frame of Reference Sequence
3006	0012	SQ	RT Referenced Study Sequence
3006	0014	SQ	RT Referenced Series Sequence
3006	0016	SQ	Contour Image Sequence
3006	0020	SQ	Structure Set ROI Sequence
3006	0022	IS	ROI Number
3006	0024	UI	Referenced Frame of Reference UID
3006	0026	LO	ROI Name
3006	0028	ST	ROI Description
3006	002A	IS	ROI Display Color
3006	002C	DS	ROI Volume
3006	0030	SQ	RT Related ROI Sequence
3006	0033	CS	RT ROI Relationship
3006	0036	CS	ROI Generation Algorithm
3006	0038	LO	ROI Generation Description
3006	0039	SQ	ROI Contour Sequence
3006	0040	SQ	Contour Sequence
3006	0042	CS	Contour Geometric Type
3006	0044	DS	Contour Slab Thickness
3006	0045	DS	Contour Offset Vector
3006	0046	IS	Number of Contour Points
3006	0048	IS	Contour Number
3006	0049	IS	Attached Contours
3006	0050	DS	Contour Data
3006	0080	SQ	RT ROI Observations Sequence
3006	0082	IS	Observation Number
3006	0084	IS	Referenced ROI Number
3006	0085	SH	ROI Observation Label
3006	0086	SQ	RT ROI Identification Code Sequence
3006	0088	ST	ROI Observation Description
3006	00A0	SQ	Related RT ROI Observations Sequence
3006	00A4	CS	RT ROI Interpreted Type
3006	00A6	PN	ROI Interpreter
3006	00B0	SQ	ROI Physical Properties Sequence
3006	00B2	CS	ROI Physical Property
3006	00B4	DS	ROI Physical Property Value
3006	00C0	SQ	Frame of Reference Relationship Sequence
3006	00C2	UI	Related Frame of Reference UID
3006	00C4	CS	Frame of Reference Transformation Type
3006	00C6	DS	Frame of Reference Transformation Matrix
3006	00C8	LO	Frame of Reference Transformation Comment
3008	0010	SQ	Measured Dose Reference Sequence
3008	0012	ST	Measured Dose Description
3008	0014	CS	Measured Dose Type
3008	0016	DS	Measured Dose Value
3008	0020	SQ	Treatment Session Beam Sequence
3008	0022	IS	Current Fraction Number
3008	0024	DA	Treatment Control Point Date
3008	0025	TM	Treatment Control Point Time
3008	002A	CS	Treatment Termination Status
3008	002B	SH	Treatment Termination Code
3008	002C	CS	Treatment Verification Status
3008	0030	SQ	Referenced Treatment Record Sequence
3008	0032	DS	Specified Primary Meterset
3008	0033	DS	Specified Secondary Meterset
3008	0036	DS	Delivered Primary Meterset
3008	0037	DS	Delivered Secondary Meterset
3008	003A	DS	Specified Treatment Time
3008	003B	DS	Delivered Treatment Time
3008	0040	SQ	Control Point Delivery Sequence
3008	0042	DS	Specified Meterset
3008	0044	DS	Delivered Meterset
3008	0048	DS	Dose Rate Delivered
3008	0050	SQ	Treatment Summary Calculated Dose Reference seq.
3008	0052	DS	Cumulative Dose to Dose Reference
3008	0054	DA	First Treatment Date
3008	0056	DA	Most Recent Treatment Date

Group	Element	VR	Name
3008	005A	IS	Number of Fractions Delivered
3008	0060	SQ	Override Sequence
3008	0062	AT	Override Parameter Pointer
3008	0064	IS	Measured Dose Reference Number
3008	0066	ST	Override Reason
3008	0070	SQ	Calculated Dose Reference Sequence
3008	0072	IS	Calculated Dose Reference Number
3008	0074	ST	Calculated Dose Reference Description
3008	0076	DS	Calculated Dose Reference Dose Value
3008	0078	DS	Start Meterset
3008	007A	DS	End Meterset
3008	0080	SQ	Referenced Measured Dose Reference Sequence
3008	0082	IS	Referenced Measured Dose Reference Number
3008	0090	SQ	Referenced Calculated Dose Reference Sequence
3008	0092	IS	Referenced Calculated Dose Reference Number
3008	00A0	SQ	Beam Limiting Device Leaf Pairs Sequence
3008	00B0	SQ	Recorded Wedge Sequence
3008	00C0	SQ	Recorded Compensator Sequence
3008	00D0	SQ	Recorded Block Sequence
3008	00E0	SQ	Treatment Summary Measured Dose Reference Sequence
3008	0100	SQ	Recorded Source Sequence
3008	0105	LO	Source Serial Number
3008	0110	SQ	Treatment Session Application Setup Sequence
3008	0116	CS	Application Setup Check
3008	0120	SQ	Recorded Brachy Accessory Device Sequence
3008	0122	IS	Referenced Brachy Accessory Device Number
3008	0130	SQ	Recorded Channel Sequence
3008	0132	DS	Specified Channel Total Time
3008	0134	DS	Delivered Channel Total Time
3008	0136	IS	Specified Number of Pulses
3008	0138	IS	Delivered Number of Pulses
3008	013A	DS	Specified Pulse Repetition Interval
3008	013C	DS	Delivered Pulse Repetition Interval
3008	0140	SQ	Recorded Source Applicator Sequence
3008	0142	IS	Referenced Source Applicator Number
3008	0150	SQ	Recorded Channel Shield Sequence
3008	0152	IS	Referenced Channel Shield Number
3008	0160	SQ	Brachy Control Point Delivered Sequence
3008	0162	DA	Safe Position Exit Date
3008	0164	TM	Safe Position Exit Time
3008	0166	DA	Safe Position Return Date
3008	0168	TM	Safe Position Return Time
3008	0200	CS	Current Treatment Status
3008	0202	ST	Treatment Status Comment
3008	0220	SQ	Fraction Group Summary Sequence
3008	0223	IS	Referenced Fraction Number
3008	0224	CS	Fraction Group Type
3008	0230	CS	Beam Stopper Position
3008	0240	SQ	Fraction Status Summary Sequence
3008	0250	DA	Treatment Date
3008	0251	TM	Treatment Time
300A	0002	SH	RT Plan Label
300A	0003	LO	RT Plan Name
300A	0004	ST	RT Plan Description
300A	0006	DA	RT Plan Date
300A	0007	TM	RT Plan Time
300A	0009	LO	Treatment Protocols
300A	000A	CS	Treatment Intent
300A	000B	LO	Treatment Sites
300A	000C	CS	RT Plan Geometry
300A	000E	ST	Prescription Description
300A	0010	SQ	Dose Reference Sequence
300A	0012	IS	Dose Reference Number
300A	0014	CS	Dose Reference Structure Type
300A	0015	CS	Nominal Beam Energy Unit
300A	0016	LO	Dose Reference Description
300A	0018	DS	Dose Reference Point Coordinates
300A	001A	DS	Nominal Prior Dose
300A	0020	CS	Dose Reference Type
300A	0021	DS	Constraint Weight
300A	0022	DS	Delivery Warning Dose
300A	0023	DS	Delivery Maximum Dose
300A	0025	DS	Target Minimum Dose
300A	0026	DS	Target Prescription Dose
300A	0027	DS	Target Maximum Dose
300A	0028	DS	Target Underdose Volume Fraction
300A	002A	DS	Organ at Risk Full-volume Dose
300A	002B	DS	Organ at Risk Limit Dose
300A	002C	DS	Organ at Risk Maximum Dose
300A	002D	DS	Organ at Risk Overdose Volume Fraction
300A	0040	SQ	Tolerance Table Sequence
300A	0042	IS	Tolerance Table Number
300A	0043	SH	Tolerance Table Label
300A	0044	DS	Gantry Angle Tolerance
300A	0046	DS	Beam Limiting Device Angle Tolerance
300A	0048	SQ	Beam Limiting Device Tolerance Sequence
300A	004A	DS	Beam Limiting Device Position Tolerance
300A	004C	DS	Patient Support Angle Tolerance
300A	004E	DS	Table Top Eccentric Angle Tolerance
300A	0051	DS	Table Top Vertical Position Tolerance
300A	0052	DS	Table Top Longitudinal Position Tolerance
300A	0053	DS	Table Top Lateral Position Tolerance
300A	0055	CS	RT Plan Relationship
300A	0070	SQ	Fraction Group Sequence
300A	0071	IS	Fraction Group Number
300A	0078	IS	Number of Fractions Planned
300A	0079	IS	Number of Fractions Per Day
300A	007A	IS	Repeat Fraction Cycle Length
300A	007B	LT	Fraction Pattern
300A	0080	IS	Number of Beams
300A	0082	DS	Beam Dose Specification Point
300A	0084	DS	Beam Dose
300A	0086	DS	Beam Meterset
300A	00A0	IS	Number of Brachy Application Setups
300A	00A2	DS	Brachy Application Setup Dose Specification Point
300A	00A4	DS	Brachy Application Setup Dose
300A	00B0	SQ	Beam Sequence
300A	00B2	SH	Treatment Machine Name
300A	00B3	CS	Primary Dosimeter Unit
300A	00B4	DS	Source-Axis Distance
300A	00B6	SQ	Beam Limiting Device Sequence
300A	00B8	CS	RT Beam Limiting Device Type

Group	Element	VR	Name
300A	00BA	DS	Source to Beam Limiting Device Distance
300A	00BC	IS	Number of Leaf/Jaw Pairs
300A	00BE	DS	Leaf Position Boundaries
300A	00C0	IS	Beam Number
300A	00C2	LO	Beam Name
300A	00C3	ST	Beam Description
300A	00C4	CS	Beam Type
300A	00C6	CS	Radiation Type
300A	00C8	IS	Reference Image Number
300A	00CA	SQ	Planned Verification Image Sequence
300A	00CC	LO	Imaging Device-Specific Acquisition Parameters
300A	00CE	CS	Treatment Delivery Type
300A	00D0	IS	Number of Wedges
300A	00D1	SQ	Wedge Sequence
300A	00D2	IS	Wedge Number
300A	00D3	CS	Wedge Type
300A	00D4	SH	Wedge ID
300A	00D5	IS	Wedge Angle
300A	00D6	DS	Wedge Factor
300A	00D8	DS	Wedge Orientation
300A	00DA	DS	Source to Wedge Tray Distance
300A	00E0	IS	Number of Compensators
300A	00E1	SH	Material ID
300A	00E2	DS	Total Compensator Tray Factor
300A	00E3	SQ	Compensator Sequence
300A	00E4	IS	Compensator Number
300A	00E5	SH	Compensator ID
300A	00E6	DS	Source to Compensator Tray Distance
300A	00E7	IS	Compensator Rows
300A	00E8	IS	Compensator Columns
300A	00E9	DS	Compensator Pixel Spacing
300A	00EA	DS	Compensator Position
300A	00EB	DS	Compensator Transmission Data
300A	00EC	DS	Compensator Thickness Data
300A	00ED	IS	Number of Boli
300A	00EE	CS	Compensator Type
300A	00F0	IS	Number of Blocks
300A	00F2	DS	Total Block Tray Factor
300A	00F4	SQ	Block Sequence
300A	00F5	SH	Block Tray ID
300A	00F6	DS	Source to Block Tray Distance
300A	00F8	CS	Block Type
300A	00FA	CS	Block Divergence
300A	00FC	IS	Block Number
300A	00FE	LO	Block Name
300A	0100	DS	Block Thickness
300A	0102	DS	Block Transmission
300A	0104	IS	Block Number of Points
300A	0106	DS	Block Data
300A	0107	SQ	Applicator Sequence
300A	0108	SH	Applicator ID
300A	0109	CS	Applicator Type
300A	010A	LO	Applicator Description
300A	010C	DS	Cumulative Dose Reference Coefficient
300A	010E	DS	Final Cumulative Meterset Weight
300A	0110	IS	Number of Control Points
300A	0111	SQ	Control Point Sequence
300A	0112	IS	Control Point Index
300A	0114	DS	Nominal Beam Energy
300A	0115	DS	Dose Rate Set
300A	0116	SQ	Wedge Position Sequence
300A	0118	CS	Wedge Position
300A	011A	SQ	Beam Limiting Device Position Sequence
300A	011C	DS	Leaf/Jaw Positions
300A	011E	DS	Gantry Angle
300A	011F	CS	Gantry Rotation Direction
300A	0120	DS	Beam Limiting Device Angle
300A	0121	CS	Beam Limiting Device Rotation Direction
300A	0122	DS	Patient Support Angle
300A	0123	CS	Patient Support Rotation Direction
300A	0124	DS	Table Top Eccentric Axis Distance
300A	0125	DS	Table Top Eccentric Angle
300A	0126	CS	Table Top Eccentric Rotation Direction
300A	0128	DS	Table Top Vertical Position
300A	0129	DS	Table Top Longitudinal Position
300A	012A	DS	Table Top Lateral Position
300A	012C	DS	Isocenter Position
300A	012E	DS	Surface Entry Point
300A	0130	DS	Source to Surface Distance
300A	0134	DS	Cumulative Meterset Weight
300A	0180	SQ	Patient Setup Sequence
300A	0182	IS	Patient Setup Number
300A	0184	LO	Patient Additional Position
300A	0190	SQ	Fixation Device Sequence
300A	0192	CS	Fixation Device Type
300A	0194	SH	Fixation Device Label
300A	0196	ST	Fixation Devi ce Description
300A	0198	SH	Fixation Device Position
300A	01A0	SQ	Shielding Device Sequence
300A	01A2	CS	Shielding Device Type
300A	01A4	SH	Shielding Device Label
300A	01A6	ST	Shielding Device Description
300A	01A8	SH	Shielding Device Position
300A	01B0	CS	Setup Technique
300A	01B2	ST	Setup Technique Description
300A	01B4	SQ	Setup Device Sequence
300A	01B6	CS	Setup Device Type
300A	01B8	SH	Setup Device Label
300A	01BA	ST	Setup Device Description
300A	01BC	DS	Setup Device Parameter
300A	01D0	ST	Setup Reference Description
300A	01D2	DS	Table Top Vertical Setup Displacement
300A	01D4	DS	Table Top Longitudinal Setup Displacement
300A	01D6	DS	Table Top Lateral Setup Displacement
300A	0200	CS	Brachy Treatment Technique
300A	0202	CS	Brachy Treatment Type
300A	0206	SQ	Treatment Machine Sequence
300A	0210	SQ	Source Sequence
300A	0212	IS	Source Number
300A	0214	CS	Source Type
300A	0216	LO	Source Manufacturer
300A	0218	DS	Active Source Diameter

Group	Element	VR	Name
300A	021A	DS	Active Source Length
300A	0222	DS	Source Encapsulation Nominal Thickness
300A	0224	DS	Source Encapsulation Nominal Transmission
300A	0226	LO	Source Isotope Name
300A	0228	DS	Source Isotope Half Life
300A	022A	DS	Reference Air Kerma Rate
300A	022C	DA	Air Kerma Rate Reference Date
300A	022E	TM	Air Kerma Rate Reference Time
300A	0230	SQ	Application Setup Sequence
300A	0232	CS	Application Setup Type
300A	0234	IS	Application Setup Number
300A	0236	LO	Application Setup Name
300A	0238	LO	Application Setup Manufacturer
300A	0240	IS	Template Number
300A	0242	SH	Template Type
300A	0244	LO	Template Name
300A	0250	DS	Total Reference Air Kerma
300A	0260	SQ	Brachy Accessory Device Sequence
300A	0262	IS	Brachy Accessory Device Number
300A	0263	SH	Brachy Accessory Device ID
300A	0264	CS	Brachy Accessory Device Type
300A	0266	LO	Brachy Accessory Device Name
300A	026A	DS	Brachy Accessory Device Nominal Thickness
300A	026C	DS	Brachy Accessory Device Nominal Transmission
300A	0280	SQ	Channel Sequence
300A	0282	IS	Channel Number
300A	0284	DS	Channel Length
300A	0286	DS	Channel Total Time
300A	0288	CS	Source Movement Type
300A	028A	IS	Number of Pulses
300A	028C	DS	Pulse Repetition Interval
300A	0290	IS	Source Applicator Number
300A	0291	SH	Source Applicator ID
300A	0292	CS	Source Applicator Type
300A	0294	LO	Source Applicator Name
300A	0296	DS	Source Applicator Length
300A	0298	LO	Source Applicator Manufacturer
300A	029C	DS	Source Applicator Wall Nominal Thickness
300A	029E	DS	Source Applicator Wall Nominal Transmission
300A	02A0	DS	Source Applicator Step Size
300A	02A2	IS	Transfer Tube Number
300A	02A4	DS	Transfer Tube Length
300A	02B0	SQ	Channel Shield Sequence
300A	02B2	IS	Channel Shield Number
300A	02B3	SH	Channel Shield ID
300A	02B4	LO	Channel Shield Name
300A	02B8	DS	Channel Shield Nominal Thickness
300A	02BA	DS	Channel Shield Nominal Transmission
300A	02C8	DS	Final Cumulative Time Weight
300A	02D0	SQ	Brachy Control Point Sequence
300A	02D2	DS	Control Point Relative Position
300A	02D4	DS	Control Point 3D Position
300A	02D6	DS	Cumulative Time Weight
300C	0002	SQ	Referenced RT Plan Sequence
300C	0004	SQ	Referenced Beam Sequence
300C	0006	IS	Referenced Beam Number
300C	0007	IS	Referenced Reference Image Number
300C	0008	DS	Start Cumulative Meterset Weight
300C	0009	DS	End Cumulative Meterset Weight
300C	000A	SQ	Referenced Brachy Application Setup Sequence
300C	000C	IS	Referenced Brachy Application Setup Number
300C	000E	IS	Referenced Source Number
300C	0020	SQ	Referenced Fraction Group Sequence
300C	0022	IS	Referenced Fraction Group Number
300C	0040	SQ	Referenced Verification Image Sequence
300C	0042	SQ	Referenced Reference Image Sequence
300C	0050	SQ	Referenced Dose Reference Sequence
300C	0051	IS	Referenced Dose Reference Number
300C	0055	SQ	Brachy Referenced Dose Reference Sequence
300C	0060	SQ	Referenced Structure Set Sequence
300C	006A	IS	Referenced Patient Setup Number
300C	0080	SQ	Referenced Dose Sequence
300C	00A0	IS	Referenced Tolerance Table Number
300C	00B0	SQ	Referenced Bolus Sequence
300C	00C0	IS	Referenced Wedge Number
300C	00D0	IS	Referenced Compensator Number
300C	00E0	IS	Referenced Block Number
300C	00F0	IS	Referenced Control Point Index
300E	0002	CS	Approval Status
300E	0004	DA	Review Date
300E	0005	TM	Review Time
300E	0008	PN	Reviewer Name
3101	0010	LO	BlockID = "AMI Annotations_02"
3101	0011	LO	BlockID = "AMI Annotations_01"
3101	1020	SQ	AMI Annotation Sequence (RET)
3101	1110	SQ	AMI Annotation Sequence (RET)
3103	0010	LO	BlockID = "AMI Sequence Annotations_02"
3103	0011	LO	BlockID = "AMI Sequence Annotations_01"
3103	1010	CS	AMI Annotation Sequence (RET)
3103	1020	UI	AMI Annotation UID (RET)
3103	1030	US	AMI Annotation Color (RET)
3103	1050	CS	AMI Annotation Line Style (RET)
3103	1060	SQ	AMI Annotation Elements (RET)
3103	1070	SH	AMI Annotation Label (RET)
3103	1080	PN	AMI Annotation Creator (RET)
3103	1090	PN	AMI Annotation Modifiers (RET)
3103	10A0	DA	AMI Annotation Creation Date (RET)
3103	10B0	TM	AMI Annotation Creation Time (RET)
3103	10C0	DA	AMI Annotation Modification Dates (RET)
3103	10D0	TM	AMI Annotation Modification Times (RET)
3103	10E0	US	AMI Annotation Frame Number (RET)
3103	1110	CS	AMI Annotation Sequence (RET)
3103	1120	UI	AMI Annotation UID (RET)
3103	1130	US	AMI Annotation Color (RET)
3103	1150	CS	AMI Annotation Line Style (RET)
3103	1160	SQ	AMI Annotation Elements (RET)
3103	1170	SH	AMI Annotation Label (RET)
3103	1180	PN	AMI Annotation Creator (RET)
3103	1190	PN	AMI Annotation Modifiers (RET)
3103	11A0	DA	AMI Annotation Creation Date (RET)
3103	11B0	TM	AMI Annotation Creation Time (RET)
3103	11C0	DA	AMI Annotation Modification Dates (RET)

Group	Element	VR	Name
3103	11D0	TM	AMI Annotation Mofification Times (RET)
3103	11E0	US	AMI Annotation Frame Number (RET)
3105	0010	LO	BlockID = "AMI Sequence AnnotElements_01"
3105	1010	DS	AMI Annotation Element Position
3105	1020	LT	AMI Annotation Element Text
3107	0010	LO	BlockID = "AMI ImageTransform_01"
3107	0011	LO	BlockID = "AMI ImageContextExt_01"
3107	1010	DS	AMI Transformation Matrix (RET)
3107	1020	DS	AMI Center Offset (RET)
3107	1030	DS	AMI Magnification (RET)
3107	1040	CS	AMI Magnification Type (RET)
3107	1050	DS	AMI Displayed Area (RET)
3107	1060	DS	AMI Calibration Factor (RET)
3107	11A0	CS	AMI Window Function (RET)
3107	11B0	DS	AMI Window Slope (RET)
3109	0010	LO	BlockID = "Applicare/RadWorks/Version 5.0"
3109	0011	LO	BlockID = "AMI ImageContext_01"
3109	0012	LO	BlockID = "Applicare/RadWorks/Version 6.0/Summary"
3109	1001	ST	DCM_WORKLISTFILENAME <internal>
3109	1002	SH	DCM_AMI_STATUS: NEW/SEEN Status
3109	1003	CS	Delete Lock: Flag indicating study is locked.
3109	1004	CS	DCM_AMI_STATUS2: <internal>
3109	1005	CS	DCM_AMI_STATUS3: <internal>
3109	1006	CS	DCM_AMI_STATUS4: <internal>
3109	1007	UL	DCM_AMI_STATUSBITS: <internal>
3109	1008	LO	DCM_AMI_ORIGIN: Receive Origin
3109	1009	LO	Folder
3109	100A	DA	Receive Date
3109	100B	TM	Receive Time
3109	100C	CS	Prior
3109	100D	CS	STAT Study: Flag indicating study is STAT. '
3109	100E	CS	<internal>. Flag indicating study/image is KEY.
3109	1010	CS	DCM_AMI_LOCALSTUDY: <internal>
3109	1011	LO	DCM_AMI_RESULT_MSG: <internal>
3109	1012	LO	DCM_AMI_CURRENT_USER: <internal>
3109	1013	DA	DCM_AMI_SYSTEM_DATE: <internal>
3109	1014	TM	DCM_AMI_SYSTEM_TIME: <internal>
3109	1020	UI	<internal>. Refers to the UID of the Worklist item.
3109	1021	CS	DCM_AMI_HOSTNAME: <internal>
3109	1022	AE	DCM_AMI_DICOM_AE_TITLE: <internal>
3109	1023	US	DCM_AMI_DICOM_PORT_NUMBER: <internal>
3109	1024	LO	DCM_AMI_DESTINATION_NAME: <internal>
3109	1025	LO	<internal>. AMI origin name
3109	1026	UI	<internal>. Study instance uid generated by modality
3109	1027	SQ	<internal>. Sequence (AE Host Port Stor. Comm.)
3109	102A	LO	Send Flag
3109	102B	LO	Print Flag
3109	102C	LO	Archive Flag
3109	1030	LO	<internal>. Requesting Facility Name
3109	1031	CS	<internal>. Requesting Procedure Name
3109	1032	CS	<internal>. Requesting Procedure Code
3109	1033	CS	Request Storage Commitment.
3109	1034	CS	Requested Compression.
3109	1035	SQ	<internal>. Study seq. for replies to PATIENT queries
3109	1036	LO	<internal>. Origin of update (used by Local Worklist)
3109	1036	LO	Origin of update

Group	Element	VR	Name
3109	1037	UI	<internal>. Study UID that is being replaced
3109	1038	SH	ACR code for teaching "folder" worklists
3109	1039	SH	<internal>. Special Interest Code (for teaching worklist)
3109	1040	IS	<internal>. Number of Study Related Images
3109	1041	CS	<internal>. Study locked
3109	1042	CS	<internal>. Contains workstation name
3109	1110	CS	AMI Window Invert (RET)
3109	1120	IS	AMI Window Center (RET)
3109	1130	IS	AMI Window Widith (RET)
3109	1140	CS	AMI Pixel Aspect Ratio Swap (RET)
3109	1150	CS	AMI Enable Averaging (RET)
3109	1160	CS	AMI Quality (RET)
3109	1170	CS	AMI Viewport Annotation Level (RET)
3109	1180	CS	AMI Show Image Annotation (RET)
3109	1190	CS	AMI Show Image Overlay (RET)
3109	1201	SH	DCM_AMI_STATUS
3109	1211	ST	DCM_AMI_ORIGIN
3109	1212	ST	Receive Origin Description
3109	1215	DA	DCM_AMI_RECEIVEDATE
3109	1216	TM	DCM_AMI_RECEIVETIME
3111	0010	LO	BlockID = "AMI StudyExtensions_01"
3111	0011	LO	BlockID = "RadWorksTBR"
3111	1001	UL	AMI Last Released Annot Label (RET)
3111	1102	CS	AMI Compression Type (RET)
3111	11FF	SQ	DCM_AMI_QUERY_RESULT: <internal>
3113	0010	LO	BlockID = "Applicare/RadStore/Version 1.0"
3113	0020	LO	BlockID = "Applicare/Workflow/Version 1.0"
3113	1001	SL	OBSOLETE
3113	1002	SL	Id1
3113	1003	SL	Id2
3113	1004	SL	Id3
3113	1011	LO	OBSOLETE
3113	1012	CS	State: image archiving state
3113	1013	DA	DateLastModified
3113	1014	DA	DateLastAccessed
3113	1015	CS	OBSOLETE
3113	1016	FD	ByteSize
3113	1017	LO	LibraryId
3113	1018	LO	Pathnames
3113	1019	LO	CachePathnames
3113	101A	LO	Source
3113	101B	LO	Destination
3113	101C	SL	MediumId
3113	101D	LO	ArchiveId
3113	101E	LO	Origin
3113	1031	IS	OBSOLETE
3113	1032	IS	OBSOLETE
3113	1033	IS	OBSOLETE
3113	1035	LO	ImageMediumLocation
3113	1036	LO	ImageMediumLabel
3113	1037	CS	ImageMediumState
3113	1038	LO	SeriesMediumLocation
3113	1039	LO	SeriesMediumLabel
3113	103a	CS	SeriesMediumState
3113	103b	LO	StudyMediumLocation
3113	103c	LO	StudyMediumLabel

Group	Element	VR	Name
3113	103d	CS	StudyMediumState
3113	1052	CS	StudyState: binary composition of image states
3113	1053	CS	SeriesState: binary composition of image states
3113	1055	CS	ImageStateText: textual description of image state
3113	1056	CS	SeriesStateText: textual description combined series state
3113	1057	CS	StudyStateText: textual description combined study state
3113	1060	DT	Expiration: determines lifetime of internal worklist items
3113	1068	SQ	DeltaSets
3113	2001	CS	OrderControl: <internal>
3113	2010	SH	ScheduledActionItemCodeValue: <internal>
3113	2011	SH	Sch.ActionItemCodingSchemeDesignator: <internal>
3113	2012	LO	ScheduledActionItemCodeMeaning: <internal>
3113	2015	SH	RequestedActionItemCodeValue: <internal>
3113	2016	SH	Req.ActionItemCodingSchemeDesignator: <internal>
3113	2017	LO	RequestedActionItemCodeMeaning: <internal>
3113	2020	SH	PerformedActionItemCodeValue: <internal>
3113	2021	SH	Perf.ActionItemCodingSchemeDesignator: <internal>
3113	2022	LO	PerformedActionItemCodeMeaning: <internal>
3113	2025	SH	PerformedProcedureCodeValue: <internal>
3113	2026	SH	Perf.ProcedureCodingSchemeDesignator: <internal>
3113	2027	LO	PerformedProcedureCodeMeaning: <internal>
3113	2030	UI	ReferencedImageSOPClassUID: <internal>
3113	2031	UI	ReferencedImageSOPInstanceUID: <internal>
3113	20E0	CS	LockedByHostname: <internal>
3113	20E1	CS	LockedByUser: <internal>
3113	20E2	CS	KfEditLockUser: <internal>.
4008	0040	SH	Results ID
4008	0042	LO	Results ID Issuer
4008	0050	SQ	Referenced Interpretation Sequence
4008	0100	DA	Interpretation Recorded Date
4008	0101	TM	Interpretation Recorded Time
4008	0102	PN	Interpretation Recorder
4008	0103	LO	Reference to Recorded Sound
4008	0108	DA	Interpretation Transcription Date
4008	0109	TM	Interpretation Transcription Time
4008	010A	PN	Interpretation Transcriber
4008	010B	ST	Interpretation Text
4008	010C	PN	Interpretation Author
4008	0111	SQ	Interpretation Approver Sequence
4008	0112	DA	Interpretation Approval Date
4008	0113	TM	Interpretation Approval Time
4008	0114	PN	Physician Approving Interpretation
4008	0115	LT	Interpretation Diagnosis Description
4008	0117	SQ	Interpretation Diagnosis Code Sequence
4008	0118	SQ	Results Distribution List Sequence
4008	0119	PN	Distribution Name
4008	011A	LO	Distribution Address
4008	0200	SH	Interpretation ID
4008	0202	LO	Interpretation ID Issuer
4008	0210	CS	Interpretation Type ID
4008	0212	CS	Interpretation Status ID
4008	0300	ST	Impressions
4008	4000	ST	Results Comments
4101	0010	LO	BlockID = "Applicare/Print/Version 5.1"
4101	1001	UL	DCM_PRINT_MASKSTATE: <internal>
4101	1002	SQ	DCM_PRINT_ANNOTS: <internal>
4101	1003	LO	DCM_PRINT_FONT: <internal>
4101	1004	UL	DCM_PRINT_FONTSIZE: <internal>
4101	1005	FD	DCM_PRINT_FONTRELSIZE: <internal>
4101	1006	US	DCM_PRINT_OVERLAY: <internal>
4101	1007	US	DCM_PRINT_PIXELREP: <internal>
4105	0010	LO	BlockID = "Applicare/RadWorks/Version 6.0"
4105	1001	CS	Annotation Type
4105	1002	DS	Annotation Value
4105	1003	UI	Cutline Image UID
4105	1004	UI	Cutline Group UID
4105	1005	US	Annotation Color
4105	1006	CS	Annotation Line Style
4105	1007	SH	Annotation Label
4105	1008	PN	Annotation Creator
4105	1009	DA	Annotation Creation Date
4105	100A	TM	Annotation Creation Time
4105	100B	SQ	Annotation Modification Sequence
4105	100C	PN	Annotation Modifier
4105	100D	DA	Annotation Modification Date
4105	100E	TM	Annotation Modification Time
4105	100F	LO	Palette Color LUT Name
4105	1010	US	Annotation Number
4107	0010	LO	BlockID = "Applicare/RadWorks/Version 6.0"
4107	1001	SQ	Requested Palette Color LUT
5000	0005	US	Curve Dimensions
5000	0010	US	Number of Points
5000	0020	CS	Type of Data
5000	0022	LO	Curve Description
5000	0030	SH	Axis Units
5000	0040	SH	Axis Labels
5000	0103	US	Data Value Representation
5000	0104	US	Minimum Coordinate Value
5000	0105	US	Maximum Coordinate Value
5000	0106	SH	Curve Range
5000	0110	US	Curve Data Descriptor
5000	0112	US	Coordinate Start Value
5000	0114	US	Coordinate Step Value
5000	1001	CS	Curve Activation Layer
5000	2000	US	Audio Type
5000	2002	US	Audio Sample Format
5000	2004	US	Number of Channels
5000	2006	UL	Number of Samples
5000	2008	UL	Sample Rate
5000	200A	UL	Total Time
5000	200C	OW	Audio Sample Data
5000	200E	LT	Audio Comments
5000	2500	LO	Curve Label
5000	2600	SQ	Referenced Overlay Sequence
5000	2610	US	Referenced Overlay Group
5000	3000	OW	Curve Data
5400	0100	SQ	Waveform Sequence
5400	0110	OW	Channel Minimum Value
5400	0112	OW	Channel Maximum Value
5400	1004	US	Waveform Bits Allocated
5400	1006	CS	Waveform Sample Interpretation
5400	100A	OW	Waveform Padding Value

Group	Element	VR	Name
5400	1010	OW	Waveform Data
6000	0010	US	Overlay Rows
6000	0011	US	Overlay Columns
6000	0012	US	Overlay Planes
6000	0015	IS	Number of Frames in Overlay
6000	0022	LO	Overlay Description
6000	0040	CS	Overlay Type
6000	0045	LO	Overlay Subtype
6000	0050	SS	Overlay Origin
6000	0051	US	Image Frame Origin
6000	0052	US	Overlay Plane Origin
6000	0060	CS	Compression Code (RET)
6000	0100	US	Overlay Bits Allocated
6000	0102	US	Overlay Bit Position
6000	1001	CS	Overlay Activation Layer
6000	1100	US	Overlay Descriptor - Gray (RET)
6000	1101	US	Overlay Descriptor - Red (RET)
6000	1102	US	Overlay Descriptor - Green (RET)
6000	1103	US	Overlay Descriptor - Blue (RET)
6000	1200	US	Overlays - Gray (RET)
6000	1201	US	Overlays - Red (RET)
6000	1202	US	Overlays - Green (RET)
6000	1203	US	Overlays - Blue (RET)
6000	1301	IS	ROI Area
6000	1302	DS	ROI Mean
6000	1303	DS	ROI Standard Deviation
6000	1500	LO	Overlay Label
6000	3000	OW	Overlay Data
6000	4000	LO	Comments (RET)
7FD1	0010	LO	BlockID = "GEIIS"
7FD1	1010	UL	GE IIS Compression ID
7FD1	1020	UL	GE IIS Multiframe Offsets
7FE0	0010	OW	Pixel Data

DICOM tags listed alphabetically

Name	Group	Element	VR
Affected SOP Class UID.	0000	0002	UI
Requested SOP Class UID	0000	0003	UI
Command Field	0000	0100	US
Message ID	0000	0110	US
Message ID Being Responded To	0000	0120	US
Move Destination	0000	0600	AE
Priority	0000	0700	US
Data Set Type	0000	0800	US
Status	0000	0900	US
Offending Element	0000	0901	AT
Error Comment	0000	0902	LO
Error ID	0000	0903	US
Affected SOP Instance UID	0000	1000	UI
Requested SOP Instance UID	0000	1001	UI
Event Type ID	0000	1002	US
Attribute Identifier List	0000	1005	AT
Action Type ID	0000	1008	US
Number of Remaining Sub-operations	0000	1020	US
Number of Completed Sub-operations	0000	1021	US
Number of Failed Sub-operations	0000	1022	US
Number of Warning Sub-operations	0000	1023	US
Move Originator Application Entity Title	0000	1030	AE
Move Originator Message ID	0000	1031	US
File Meta Information Version	0002	0001	OB
Media Storage SOP Class UID	0002	0002	UI
Media Storage SOP Instance UID	0002	0003	UI
Transfer Syntax UID	0002	0010	UI
Implementation Class UID	0002	0012	UI
Implementation Version Name	0002	0013	SH
Source Application Entity Title	0002	0016	AE
Private Information Creator UID	0002	0100	UI
Private Information	0002	0102	OB
File-set ID	0004	1130	CS
File-set Descriptor File ID	0004	1141	CS
Specific Character Set of File-set Descriptor File	0004	1142	CS
Root Directory Entity’s First Directory Record Offset	0004	1200	UL
Root Directory Entity Last Directory Record Offset	0004	1202	UL
File-set Consistency Flag	0004	1212	US
Directory Record Sequence	0004	1220	SQ
Offset of the Next Directory Record	0004	1400	UL
Record In-use Flag	0004	1410	US
Offset of Referenced Lower-Level Directory Entity	0004	1420	UL
Directory Record Type	0004	1430	CS
Private Record UID	0004	1432	UI
Referenced File ID	0004	1500	CS
MRDR Directory Record Offset	0004	1504	UL
Referenced SOP Class UID in File	0004	1510	UI
Referenced SOP Instance UID in File	0004	1511	UI
Referenced Transfer Syntax UID in File	0004	1512	UI
Number of References	0004	1600	UL
Specific Character Set	0008	0005	CS

Name	Group	Element	VR
Image Type	0008	0008	CS
Instance Creation Date	0008	0012	DA
Instance Creation Time	0008	0013	TM
Instance Creator UID	0008	0014	UI
SOP Class UID	0008	0016	UI
SOP Instance UID	0008	0018	UI
Study Date	0008	0020	DA
Series Date	0008	0021	DA
Acquisition Date	0008	0022	DA
Content Date	0008	0023	DA
Overlay Date	0008	0024	DA
Curve Date	0008	0025	DA
Acquisition Datetime	0008	002A	DT
Study Time	0008	0030	TM
Series Time	0008	0031	TM
Acquisition Time	0008	0032	TM
Content Time	0008	0033	TM
Overlay Time	0008	0034	TM
Curve Time	0008	0035	TM
Nuclear Medicine Series Type (RET)	0008	0042	CS
Accession Number	0008	0050	SH
Query/Retrieve Level	0008	0052	CS
Retrieve AE Title	0008	0054	AE
Instance Availability	0008	0056	CS
Failed SOP Instance UID List	0008	0058	UI
Modality	0008	0060	CS
Modalities in Study	0008	0061	CS
Conversion Type	0008	0064	CS
Presentation Intent Type	0008	0068	CS
Manufacturer	0008	0070	LO
Institution Name	0008	0080	LO
Institution Address	0008	0081	ST
Institution Code Sequence	0008	0082	SQ
Referring Physician's Name	0008	0090	PN
Referring Physician's Address	0008	0092	ST
Referring Physician's Telephone Numbers	0008	0094	SH
Code Value	0008	0100	SH
Coding Scheme Designator	0008	0102	SH
Coding Scheme Version	0008	0103	SH
Code Meaning	0008	0104	LO
Mapping Resource	0008	0105	CS
Context Group Version	0008	0106	DT
Context Group Local Version	0008	0107	DT
Code Set Extension Flag	0008	010B	CS
Private Coding Scheme Creator UID	0008	010C	UI
Code Set Extension Creator UID	0008	010D	UI
Context Identifier	0008	010F	CS
Timezone Offset From UTC	0008	0201	SH
Station Name	0008	1010	SH
Study Description	0008	1030	LO
Procedure Code Sequence	0008	1032	SQ

Name	Group	Element	VR
Series Description	0008	103E	LO
Institutional Department Name	0008	1040	LO
Physician(s) of Record	0008	1048	PN
Performing Physician's Name	0008	1050	PN
Name of Physician(s) Reading Study	0008	1060	PN
Operators' Name	0008	1070	PN
Admitting Diagnoses Description	0008	1080	LO
Admitting Diagnosis Code Sequence	0008	1084	SQ
Manufacturer's Model Name	0008	1090	LO
Referenced Results Sequence	0008	1100	SQ
Referenced Study Sequence	0008	1110	SQ
Referenced Study Component Sequence	0008	1111	SQ
Referenced Series Sequence	0008	1115	SQ
Referenced Patient Sequence	0008	1120	SQ
Referenced Visit Sequence	0008	1125	SQ
Referenced Overlay Sequence	0008	1130	SQ
Referenced Image Sequence	0008	1140	SQ
Referenced Curve Sequence	0008	1145	SQ
Referenced SOP Class UID	0008	1150	UI
Referenced SOP Instance UID	0008	1155	UI
SOP Classes Supported	0008	115A	UI
Referenced Frame Number	0008	1160	IS
Transaction UID	0008	1195	UI
Failure Reason	0008	1197	US
Failed SOP Sequence	0008	1198	SQ
Referenced SOP Sequence	0008	1199	SQ
Lossy Image Compression (RET)	0008	2110	CS
Derivation Description	0008	2111	ST
Source Image Sequence	0008	2112	SQ
Stage Name	0008	2120	SH
Stage Number	0008	2122	IS
Number of Stages	0008	2124	IS
View Number	0008	2128	IS
Number of Event Timers	0008	2129	IS
Number of Views in Stage	0008	212A	IS
Event Elapsed Time(s)	0008	2130	DS
Event Timer Name(s)	0008	2132	LO
Start Trim	0008	2142	IS
Stop Trim	0008	2143	IS
Recommended Display Frame Rate	0008	2144	IS
Transducer Position (RET)	0008	2200	CS
Transducer Orientation (RET)	0008	2204	CS
Anatomic Structure (RET)	0008	2208	CS
Anatomic Region Sequence	0008	2218	SQ
Anatomic Region Modifier Sequence	0008	2220	SQ
Primary Anatomic Structure Sequence	0008	2228	SQ
Anatomic Structure. Space or Region Sequence	0008	2229	SQ
Primary Anatomic Structure Modifier Sequence	0008	2230	SQ
Transducer Position Sequence	0008	2240	SQ
Transducer Position Modifier Sequence	0008	2242	SQ
Transducer Orientation Sequence	0008	2244	SQ
Transducer Orientation Modifier Sequence	0008	2246	SQ
BlockID = "GEIIS	"0009	0010	LO
GE IIS Thumbnail Sequence	0009	1010	SQ
Patient's Name	0010	0010	PN
Patient ID	0010	0020	LO

Name	Group	Element	VR
Issuer of Patient ID	0010	0021	LO
Patient's Birth Date	0010	0030	DA
Patient's Birth Time	0010	0032	TM
Patient's Sex	0010	0040	CS
Patient's Insurance Plan Code Sequence	0010	0050	SQ
Other Patient IDs	0010	1000	LO
Other Patient Names	0010	1001	PN
Patient's Birth Name	0010	1005	PN
Patient's Age	0010	1010	AS
Patient's Size	0010	1020	DS
Patient's Weight	0010	1030	DS
Patient's Address	0010	1040	LO
Patient's Mother's Birth Name	0010	1060	PN
Military Rank	0010	1080	LO
Branch of Service	0010	1081	LO
Medical Record Locator	0010	1090	LO
Medical Alerts	0010	2000	LO
Contrast Allergies	0010	2110	LO
Country of Residence	0010	2150	LO
Region of Residence	0010	2152	LO
Patient's Telephone Numbers	0010	2154	SH
Ethnic Group	0010	2160	SH
Occupation	0010	2180	SH
Smoking Status	0010	21A0	CS
Additional Patient History	0010	21B0	LT
Pregnancy Status	0010	21C0	US
Last Menstrual Date	0010	21D0	DA
Patient's Religious Preference	0010	21F0	LO
Patient Comments	0010	4000	LT
Contrast/Bolus Agent	0018	0010	LO
Contrast/Bolus Agent Sequence	0018	0012	SQ
Contrast/Bolus Administration Route Sequence	0018	0014	SQ
Body Part Examined	0018	0015	CS
Scanning Sequence	0018	0020	CS
Sequence Variant	0018	0021	CS
Scan Options	0018	0022	CS
MR Acquisition Type	0018	0023	CS
Sequence Name	0018	0024	SH
Angio Flag	0018	0025	CS
Intervention Drug Information Sequence	0018	0026	SQ
Intervention Drug Stop Time	0018	0027	TM
Intervention Drug Dose	0018	0028	DS
Intervention Drug Code Sequence	0018	0029	SQ
Additional Drug Sequence	0018	002A	SQ
Radionuclide (RET)	0018	0030	LO
Radiopharmaceutical	0018	0031	LO
Energy Window Centerline (RET)	0018	0032	DS
Energy Window Total Width (RET)	0018	0033	DS
Intervention Drug Name	0018	0034	LO
Intervention Drug Start Time	0018	0035	TM
Interventional Therapy Sequence	0018	0036	SQ
Therapy Type	0018	0037	CS
Interventional Status	0018	0038	CS
Therapy Description	0018	0039	CS
Cine Rate	0018	0040	IS
Slice Thickness	0018	0050	DS

Name	Group	Element	VR
KVP	0018	0060	DS
Counts Accumulated	0018	0070	IS
Acquisition Termination Condition	0018	0071	CS
Effective Series Duration	0018	0072	DS
Acquisition Start Condition	0018	0073	CS
Acquisition Start Condition Data	0018	0074	IS
Acquisition Termination Condition Data	0018	0075	IS
Repetition Time	0018	0080	DS
Echo Time	0018	0081	DS
Inversion Time	0018	0082	DS
Number of Averages	0018	0083	DS
Imaging Frequency	0018	0084	DS
Imaged Nucleus	0018	0085	SH
Echo Number(s)	0018	0086	IS
Magnetic Field Strength	0018	0087	DS
Spacing Between Slices	0018	0088	DS
Number of Phase Encoding Steps	0018	0089	IS
Data Collection Diameter	0018	0090	DS
Echo Train Length	0018	0091	IS
Percent Sampling	0018	0093	DS
Percent Phase Field of View	0018	0094	DS
Pixel Bandwidth	0018	0095	DS
Device Serial Number	0018	1000	LO
Plate ID	0018	1004	LO
Secondary Capture Device ID	0018	1010	LO
Hardcopy Creation Device ID	0018	1011	LO
Date of Secondary Capture	0018	1012	DA
Time of Secondary Capture	0018	1014	TM
Secondary Capture Device Manufacturer	0018	1016	LO
Hardcopy Device Manufacturer	0018	1017	LO
Secondary Capture Device Manufacturer's Model Name	0018	1018	LO
Secondary Capture Device Software Version(s)	0018	1019	LO
Hardcopy Device Software Version	0018	101A	LO
Hardcopy Device Manfuacturer's Model Name	0018	101B	LO
Software Version(s)	0018	1020	LO
Video Image Format Acquired	0018	1022	SH
Digital Image Format Acquired	0018	1023	LO
Protocol Name	0018	1030	LO
Contrast/Bolus Route	0018	1040	LO
Contrast/Bolus Volume	0018	1041	DS
Contrast/Bolus Start Time	0018	1042	TM
Contrast/Bolus Stop Time	0018	1043	TM
Contrast/Bolus Total Dose	0018	1044	DS
Syringe Counts	0018	1045	IS
Contrast Flow Rate(s)	0018	1046	DS
Contrast Flow Duration(s)	0018	1047	DS
Contrast/Bolus Ingredient	0018	1048	CS
Contrast/Bolus Ingredient Concentration	0018	1049	DS
Spatial Resolution	0018	1050	DS
Trigger Time	0018	1060	DS
Trigger Source or Type	0018	1061	LO
Nominal Interval	0018	1062	IS
Frame Time	0018	1063	DS
Framing Type	0018	1064	LO
Frame Time Vector	0018	1065	DS
Frame Delay	0018	1066	DS

Name	Group	Element	VR
Image Trigger Delay	0018	1067	DS
Multiplex Group Time Offset	0018	1068	DS
Trigger Time Offset	0018	1069	DS
Synchronization Trigger	0018	106A	CS
Synchronization Channel	0018	106C	US
Trigger Sample Position	0018	106E	UL
Radiopharmaceutical Route	0018	1070	LO
Radiopharmaceutical Volume	0018	1071	DS
Radiopharmaceutical Start Time	0018	1072	TM
Radiopharmaceutical Stop Time	0018	1073	TM
Radionuclide Total Dose	0018	1074	DS
Radionuclide Half Life	0018	1075	DS
Radionuclide Positron Fraction	0018	1076	DS
Radiopharmaceutical Specific Activity	0018	1077	DS
Beat Rejection Flag	0018	1080	CS
Low R-R Value	0018	1081	IS
High R-R Value	0018	1082	IS
Intervals Acquired	0018	1083	IS
Intervals Rejected	0018	1084	IS
PVC Rejection	0018	1085	LO
Skip Beats	0018	1086	IS
Heart Rate	0018	1088	IS
Cardiac Number of Images	0018	1090	IS
Trigger Window	0018	1094	IS
Reconstruction Diameter	0018	1100	DS
Distance Source to Detector	0018	1110	DS
Distance Source to Patient	0018	1111	DS
Estimated Radiographic Magnification Factor	0018	1114	DS
Gantry/Detector Tilt	0018	1120	DS
Gantry/Detector Slew	0018	1121	DS
Table Height	0018	1130	DS
Table Traverse	0018	1131	DS
Table Motion	0018	1134	CS
Table Vertical Increment	0018	1135	DS
Table Lateral Increment	0018	1136	DS
Table Longitudinal Increment	0018	1137	DS
Table Angle	0018	1138	DS
Table Type	0018	113A	CS
Rotation Direction	0018	1140	CS
Angular Position	0018	1141	DS
Radial Position	0018	1142	DS
Scan Arc	0018	1143	DS
Angular Step	0018	1144	DS
Center of Rotation Offset	0018	1145	DS
Rotation Offset (RET)	0018	1146	DS
Field of View Shape	0018	1147	CS
Field of View Dimension(s)	0018	1149	IS
Exposure Time	0018	1150	IS
X-ray Tube Current	0018	1151	IS
Exposure	0018	1152	IS
Exposure in uAs	0018	1153	IS
Average Pulse Width	0018	1154	DS
Radiation Setting	0018	1155	CS
Rectification Type	0018	1156	CS
Radiation Mode	0018	115A	CS
Image Area Dose Product	0018	115E	DS

Name	Group	Element	VR
Filter Type	0018	1160	SH
Type of Filters	0018	1161	LO
Intensifier Size	0018	1162	DS
Imager Pixel Spacing	0018	1164	DS
Grid	0018	1166	CS
Generator Power	0018	1170	IS
Collimator/grid Name	0018	1180	SH
Collimator Type	0018	1181	CS
Focal Distance	0018	1182	IS
X Focus Center	0018	1183	DS
Y Focus Center	0018	1184	DS
Focal Spot(s)	0018	1190	DS
Anode Target Material	0018	1191	CS
Body Part Thickness	0018	11A0	DS
Compression Force	0018	11A2	DS
Date of Last Calibration	0018	1200	DA
Time of Last Calibration	0018	1201	TM
Convolution Kernel	0018	1210	SH
Actual Frame Duration	0018	1242	IS
Count Rate	0018	1243	IS
Preferred Playback Sequencing	0018	1244	US
Receiving Coil	0018	1250	SH
Transmitting Coil	0018	1251	SH
Plate Type	0018	1260	SH
Phosphor Type	0018	1261	LO
Scan Velocity	0018	1300	DS
Whole Body Technique	0018	1301	CS
Scan Length	0018	1302	IS
Acquisition Matrix	0018	1310	US
Phase Encoding Direction	0018	1312	CS
Flip Angle	0018	1314	DS
Variable Flip Angle Flag	0018	1315	CS
SAR	0018	1316	DS
dB/dt	0018	1318	DS
Acquisition Device Processing Description	0018	1400	LO
Acquisition Device Processing Code	0018	1401	LO
Cassette Orientation	0018	1402	CS
Cassette Size	0018	1403	CS
Exposures on Plate	0018	1404	US
Relative X-ray Exposure	0018	1405	IS
Column Angulation	0018	1450	CS
Tomo Layer Height	0018	1460	DS
Tomo Angle	0018	1470	DS
Tomo Time	0018	1480	DS
Tomo Type	0018	1490	CS
Tomo Class	0018	1491	CS
Number of Tomosynthesis Source Images	0018	1495	IS
Positioner Motion	0018	1500	CS
Positioner Type	0018	1508	CS
Positioner Primary Angle	0018	1510	DS
Positioner Secondary Angle	0018	1511	DS
Positioner Primary Angle Increment	0018	1520	DS
Positioner Secondary Angle Increment	0018	1521	DS
Detector Primary Angle	0018	1530	DS
Detector Secondary Angle	0018	1531	DS
Shutter Shape	0018	1600	CS

Name	Group	Element	VR
Shutter Left Vertical Edge	0018	1602	IS
Shutter Right Vertical Edge	0018	1604	IS
Shutter Upper Horizontal Edge	0018	1606	IS
Shutter Lower Horizontal Edge	0018	1608	IS
Center of Circular Shutter	0018	1610	IS
Radius of Circular Shutter	0018	1612	IS
Vertices of the Polygonal Shutter	0018	1620	IS
Shutter Presentation Value	0018	1622	US
Shutter Overlay Group	0018	1623	US
Collimator Shape	0018	1700	CS
Collimator Left Vertical Edge	0018	1702	IS
Collimator Right Vertical Edge	0018	1704	IS
Collimator Upper Horizontal Edge	0018	1706	IS
Collimator Lower Horizontal Edge	0018	1708	IS
Center of Circular Collimator	0018	1710	IS
Radius of Circular Collimator	0018	1712	IS
Vertices of the Polygonal Collimator	0018	1720	IS
Acquisition Time Synchronized	0018	1800	CS
Time Source	0018	1801	SH
Time Distribution Protocol	0018	1802	CS
Page Number Vector	0018	2001	IS
Frame Label Vector	0018	2002	SH
Frame Primary Angle Vector	0018	2003	DS
Frame Secondary Angle Vector	0018	2004	DS
Slice Location Vector	0018	2005	DS
Display Window Label Vector	0018	2006	SH
Nominal Scanned Pixel Spacing	0018	2010	DS
Digitizing Device Transport Direction	0018	2020	CS
Rotation of Scanned Film	0018	2030	DS
Output Power	0018	5000	SH
Transducer Data	0018	5010	LO
Focus Depth	0018	5012	DS
Processing Function	0018	5020	LO
Postprocessing Function	0018	5021	LO
Mechanical Index	0018	5022	DS
Thermal Index	0018	5024	DS
Cranial Thermal Index	0018	5026	DS
Soft Tissue Thermal Index	0018	5027	DS
Soft Tissue-focus Thermal Index	0018	5028	DS
Soft Tissue-surface Thermal Index	0018	5029	DS
Depth of Scan Field	0018	5050	IS
Patient Position	0018	5100	CS
View Position	0018	5101	CS
Projection Eponymous Name Code Sequence	0018	5104	SQ
Image Transformation Matrix	0018	5210	DS
Image Translation Vector	0018	5212	DS
Sensitivity	0018	6000	DS
Sequence of Ultrasound Regions	0018	6011	SQ
Region Spatial Format	0018	6012	US
Region Data Type	0018	6014	US
Region Flags	0018	6016	UL
Region Location Min X 0	0018	6018	UL
Region Location Min Y 0	0018	601A	UL
Region Location Max X 1	0018	601C	UL
Region Location Max Y 1	0018	601E	UL
Reference Pixel X 0	0018	6020	SL

Name	Group	Element	VR
Reference Pixel Y 0	0018	6022	SL
Physical Units X Direction	0018	6024	US
Physical Units Y Direction	0018	6026	US
Reference Pixel Physical Value X	0018	6028	FD
Reference Pixel Physical Value Y	0018	602A	FD
Physical Delta X	0018	602C	FD
Physical Delta Y	0018	602E	FD
Transducer Frequency	0018	6030	UL
Transducer Type	0018	6031	CS
Pulse Repetition Frequency	0018	6032	UL
Doppler Correction Angle	0018	6034	FD
Steering Angle	0018	6036	FD
Doppler Sample Volume X Position	0018	6038	UL
Doppler Sample Volume Y Position	0018	603A	UL
TM-Line Position X 0	0018	603C	UL
TM-Line Position Y 0	0018	603E	UL
TM-Line Position X 1	0018	6040	UL
TM-Line Position Y 1	0018	6042	UL
Pixel Component Organization	0018	6044	US
Pixel Component Mask	0018	6046	UL
Pixel Component Range Start	0018	6048	UL
Pixel Component Range Stop	0018	604A	UL
Pixel Component Physical Units	0018	604C	US
Pixel Component Data Type	0018	604E	US
Number of Table Break Points	0018	6050	UL
Table of X Break Points	0018	6052	UL
Table of Y Break Points	0018	6054	FD
Number of Table Entries	0018	6056	UL
Table of Pixel Values	0018	6058	UL
Table of Parameter Values	0018	605A	FL
Detector Conditions Nominal Flag	0018	7000	CS
Detector Temperature	0018	7001	DS
Detector Type	0018	7004	CS
Detector Configuration	0018	7005	CS
Detector Description	0018	7006	LT
Detector Mode	0018	7008	LT
Detector ID	0018	700A	SH
Date of Last Detector Calibration	0018	700C	DA
Time of Last Detector Calibration	0018	700E	TM
Exposures on Detector Since Last Calibration	0018	7010	IS
Exposures on Detector Since Manufactured	0018	7011	IS
Detector Time Since Last Exposure	0018	7012	DS
Detector Active Time	0018	7014	DS
Detector Activation Offset From Exposure	0018	7016	DS
Detector Binning	0018	701A	DS
Detector Element Physical Size	0018	7020	DS
Detector Element Spacing	0018	7022	DS
Detector Active Shape	0018	7024	CS
Detector Active Dimension(s)	0018	7026	DS
Detector Active Origin	0018	7028	DS
Field of View Origin	0018	7030	DS
Field of View Rotation	0018	7032	DS
Field of View Horizontal Flip	0018	7034	CS
Grid Absorbing Material	0018	7040	LT
Grid Spacing Material	0018	7041	LT
Grid Thickness	0018	7042	DS

Name	Group	Element	VR
Grid Pitch	0018	7044	DS
Grid Aspect Ratio	0018	7046	IS
Grid Period	0018	7048	DS
Grid Focal Distance	0018	704C	DS
Filter Material	0018	7050	CS
Filter Thickness Minimum	0018	7052	DS
Filter Thickness Maximum	0018	7054	DS
Exposure Control Mode	0018	7060	CS
Exposure Control Mode Description	0018	7062	LT
Exposure Status	0018	7064	CS
Phototimer Setting	0018	7065	DS
Exposure Time in mS	0018	8150	DS
X-Ray Tube Current in mA	0018	8151	DS
Study Instance UID	0020	000D	UI
Series Instance UID	0020	000E	UI
Study ID	0020	0010	SH
Series Number	0020	0011	IS
Acquisition Number	0020	0012	IS
Instance Number	0020	0013	IS
Isotope Number (RET)	0020	0014	IS
Phase Number (RET)	0020	0015	IS
Interval Number (RET)	0020	0016	IS
Time Slot Number (RET)	0020	0017	IS
Angle Number (RET)	0020	0018	IS
Item Number	0020	0019	IS
Patient Orientation	0020	0020	CS
Overlay Number	0020	0022	IS
Curve Number	0020	0024	IS
Lookup Table Number	0020	0026	IS
Image Position (Patient)	0020	0032	DS
Image Orientation (Patient)	0020	0037	DS
Frame of Reference UID	0020	0052	UI
Laterality	0020	0060	CS
Image Laterality	0020	0062	CS
Temporal Position Identifier	0020	0100	IS
Number of Temporal Positions	0020	0105	IS
Temporal Resolution	0020	0110	DS
Synchronization Frame of Reference UID	0020	0200	UI
Series in Study	0020	1000	IS
Images in Acquisition	0020	1002	IS
Acquisitions in Study	0020	1004	IS
Position Reference Indicator	0020	1040	LO
Slice Location	0020	1041	DS
Other Study Numbers	0020	1070	IS
Number of Patient Related Studies	0020	1200	IS
Number of Patient Related Series	0020	1202	IS
Number of Patient Related Instances	0020	1204	IS
Number of Study Related Series	0020	1206	IS
Number of Study Related Instances	0020	1208	IS
Number of Series Related Instances	0020	1209	IS
Image Comments	0020	4000	LT
Samples per Pixel	0028	0002	US
Photometric Interpretation	0028	0004	CS
Planar Configuration	0028	0006	US
Number of Frames	0028	0008	IS
Frame Increment Pointer	0028	0009	AT

Name	Group	Element	VR
Rows	0028	0010	US
Columns	0028	0011	US
Planes	0028	0012	US
Ultrasound Color Data Present	0028	0014	US
Pixel Spacing	0028	0030	DS
Zoom Factor	0028	0031	DS
Zoom Center	0028	0032	DS
Pixel Aspect Ratio	0028	0034	IS
Corrected Image	0028	0051	CS
Bits Allocated	0028	0100	US
Bits Stored	0028	0101	US
High Bit	0028	0102	US
Pixel Representation	0028	0103	US
Smallest Image Pixel Value	0028	0106	XS
Largest Image Pixel Value	0028	0107	XS
Smallest Pixel Value in Series	0028	0108	XS
Largest Pixel Value in Series	0028	0109	XS
Smallest Image Pixel Value in Plane	0028	0110	XS
Largest Image Pixel Value in Plane	0028	0111	XS
Pixel Padding Value	0028	0120	XS
Quality Control Image	0028	0300	CS
Burned In Annotation	0028	0301	CS
Pixel Intensity Relationship	0028	1040	CS
Pixel Intensity Relationship Sign	0028	1041	SS
Window Center	0028	1050	DS
Window Width	0028	1051	DS
Rescale Intercept	0028	1052	DS
Rescale Slope	0028	1053	DS
Rescale Type	0028	1054	LO
Window Center & Width Explanation	0028	1055	LO
Recommended Viewing Mode	0028	1090	CS
Red Palette Color Lookup Table Descriptor	0028	1101	XS
Green Palette Color Lookup Table Descriptor	0028	1102	XS
Blue Palette Color Lookup Table Descriptor	0028	1103	XS
Palette Color Lookup Table UID	0028	1199	UI
Red Palette Color Lookup Table Data	0028	1201	US
Green Palette Color Lookup Table Data	0028	1202	US
Blue Palette Color Lookup Table Data	0028	1203	US
Segmented Red Palette Color Lookup Table Data	0028	1221	OW
Segmented Green Palette Color Lookup Table Data	0028	1222	OW
Segmented Blue Palette Color Lookup Table Data	0028	1223	OW
Implant Present	0028	1300	CS
Partial View	0028	1350	CS
Partial View Description	0028	1351	ST
Lossy Image Compression	0028	2110	CS
Lossy Image Compression Ratio	0028	2112	DS
Modality LUT Sequence	0028	3000	SQ
LUT Descriptor	0028	3002	XS
LUT Explanation	0028	3003	LO
Modality LUT Type	0028	3004	LO
LUT Data	0028	3006	US
VOI LUT Sequence	0028	3010	SQ
Softcopy VOI LUT Sequence	0028	3110	SQ
Bi-Plane Acquisition Sequence	0028	5000	SQ
Representative Frame Number	0028	6010	US
Frame Numbers of Interest (FOI)	0028	6020	US

Name	Group	Element	VR
Frame(s) of Interest Description	0028	6022	LO
Mask Pointer(s)	0028	6030	US
R Wave Pointer	0028	6040	US
Mask Subtraction Sequence	0028	6100	SQ
Mask Operation	0028	6101	CS
Applicable Frame Range	0028	6102	US
Mask Frame Numbers	0028	6110	US
Contrast Frame Averaging	0028	6112	US
Mask Sub-pixel Shift	0028	6114	FL
TID Offset	0028	6120	SS
Mask Operation Explanation	0028	6190	ST
RadWorksMarconi	0029	0060	LO
DCM_MARCONIKEYFRAMEINDICES	0029	6024	US
Study Status ID	0032	000A	CS
Study Priority ID	0032	000C	CS
Study ID Issuer	0032	0012	LO
Study Verified Date	0032	0032	DA
Study Verified Time	0032	0033	TM
Study Read Date	0032	0034	DA
Study Read Time	0032	0035	TM
Scheduled Study Start Date	0032	1000	DA
Scheduled Study Start Time	0032	1001	TM
Scheduled Study Stop Date	0032	1010	DA
Scheduled Study Stop Time	0032	1011	TM
Scheduled Study Location	0032	1020	LO
Scheduled Study Location AE Title(s)	0032	1021	AE
Reason for Study	0032	1030	LO
Requesting Physician	0032	1032	PN
Requesting Service	0032	1033	LO
Study Arrival Date	0032	1040	DA
Study Arrival Time	0032	1041	TM
Study Completion Date	0032	1050	DA
Study Completion Time	0032	1051	TM
Study Component Status ID	0032	1055	CS
Requested Procedure Description	0032	1060	LO
Requested Procedure Code Sequence	0032	1064	SQ
Requested Contrast Agent	0032	1070	LO
Study Comments	0032	4000	LT
Referenced Patient Alias Sequence	0038	0004	SQ
Visit Status ID	0038	0008	CS
Admission ID	0038	0010	LO
Issuer of Admission ID	0038	0011	LO
Route of Admissions	0038	0016	LO
Scheduled Admission Date	0038	001A	DA
Scheduled Admission Time	0038	001B	TM
Scheduled Discharge Date	0038	001C	DA
Scheduled Discharge Time	0038	001D	TM
Scheduled Patient Institution Residence	0038	001E	LO
Admitting Date	0038	0020	DA
Admitting Time	0038	0021	TM
Discharge Date	0038	0030	DA
Discharge Time	0038	0032	TM
Discharge Diagnosis Description	0038	0040	LO
Discharge Diagnosis Code Sequence	0038	0044	SQ
Special Needs	0038	0050	LO
Current Patient Location	0038	0300	LO

Name	Group	Element	VR
Patient's Institution Residence	0038	0400	LO
Patient State	0038	0500	LO
Visit Comments	0038	4000	LT
Waveform Originality	003A	0004	CS
Number of Waveform Channels	003A	0005	US
Number of Waveform Samples	003A	0010	UL
Sampling Frequency	003A	001A	DS
Multiplex Group Label	003A	0020	SH
Channel Definition Sequence	003A	0200	SQ
Waveform Channel Number	003A	0202	IS
Channel Label	003A	0203	SH
Channel Status	003A	0205	CS
Channel Source Sequence	003A	0208	SQ
Channel Source Modifiers Sequence	003A	0209	SQ
Source Waveform Sequence	003A	020A	SQ
Channel Derivation Description	003A	020C	LO
Channel Sensitivity	003A	0210	DS
Channel Sensitivity Units Sequence	003A	0211	SQ
Channel Sensitivity Correction Factor	003A	0212	DS
Channel Baseline	003A	0213	DS
Channel Time Skew	003A	0214	DS
Channel Sample Skew	003A	0215	DS
Channel Offset	003A	0218	DS
Waveform Bits Stored	003A	021A	US
Filter Low Frequency	003A	0220	DS
Filter High Frequency	003A	0221	DS
Notch Filter Frequency	003A	0222	DS
Notch Filter Bandwidth	003A	0223	DS
Scheduled Station AE Title	0040	0001	AE
Scheduled Procedure Step Start Date	0040	0002	DA
Scheduled Procedure Step Start Time	0040	0003	TM
Scheduled Procedure Step End Date	0040	0004	DA
Scheduled Procedure Step End Time	0040	0005	TM
Scheduled Performing Physician's Name	0040	0006	PN
Scheduled Procedure Step Description	0040	0007	LO
Scheduled Action Item Code Sequence	0040	0008	SQ
Scheduled Procedure Step ID	0040	0009	SH
Scheduled Station Name	0040	0010	SH
Scheduled Procedure Step Location	0040	0011	SH
Pre-Medication	0040	0012	LO
Scheduled Procedure Step Status	0040	0020	CS
Scheduled Procedure Step Sequence	0040	0100	SQ
Referenced Standalone SOP Instance Sequence	0040	0220	SQ
Performed Station AE Title	0040	0241	AE
Performed Station Name	0040	0242	SH
Performed Location	0040	0243	SH
Performed Procedure Step Start Date	0040	0244	DA
Performed Procedure Step Start Time	0040	0245	TM
Performed Procedure Step End Date	0040	0250	DA
Performed Procedure Step End Time	0040	0251	TM
Performed Procedure Step Status	0040	0252	CS
Performed Procedure Step ID	0040	0253	SH
Performed Procedure Step Description	0040	0254	LO
Performed Procedure Type Description	0040	0255	LO
Performed Action Item Sequence	0040	0260	SQ
Scheduled Step Attributes Sequence	0040	0270	SQ

Name	Group	Element	VR
Request Attributes Sequence	0040	0275	SQ
Comments on the Performed Procedure Steps	0040	0280	ST
Quantity Sequence	0040	0293	SQ
Quantity	0040	0294	DS
Measuring Units Sequence	0040	0295	SQ
Billing Item Sequence	0040	0296	SQ
Total Time of Fluoroscopy	0040	0300	US
Total Number of Exposures	0040	0301	US
Entrance Dose	0040	0302	US
Exposed Area	0040	0303	US
Distance Source to Entrance	0040	0306	DS
Distance Source to Support	0040	0307	DS
Comments on Radiation Dose	0040	0310	ST
X-Ray Output	0040	0312	DS
Half Value Layer	0040	0314	DS
Organ Dose	0040	0316	DS
Organ Exposed	0040	0318	CS
Billing Procedure Step Sequence	0040	0320	SQ
Film Consumption Sequence	0040	0321	SQ
Billing Supplies and Devices Sequence	0040	0324	SQ
Referenced Procedure Step Sequence	0040	0330	SQ
Performed Series Sequence	0040	0340	SQ
Comments on the Scheduled Procedure Step	0040	0400	LT
Specimen Accession Number	0040	050A	LO
Specimen Sequence	0040	0550	SQ
Specimen Identifier	0040	0551	LO
Acquisition Context Sequence	0040	0555	SQ
Acquisition Context Description	0040	0556	ST
Specimen Type Code Sequence	0040	059A	SQ
Slide Identifier	0040	06FA	LO
Image Center Point Coordinates Sequence	0040	071A	SQ
X offset in Slide Coordinate System	0040	072A	DS
Y offset in Slide Coordinate System	0040	073A	DS
Z offset in Slide Coordinate System	0040	074A	DS
Pixel Spacing Sequence	0040	08D8	SQ
Coordinate System Axis Code Sequence	0040	08DA	SQ
Measurement Units Code Sequence	0040	08EA	SQ
Requested Procedure ID	0040	1001	SH
Reason for the Requested Procedure	0040	1002	LO
Requested Procedure Priority	0040	1003	SH
Patient Transport Arrangements	0040	1004	LO
Requested Procedure Location	0040	1005	LO
Placer Order Number / Procedure (RET)	0040	1006	SH
Filler Order Number / Procedure (RET)	0040	1007	SH
Confidentiality Code	0040	1008	LO
Reporting Priority	0040	1009	SH
Names of Intended Recipients of Results	0040	1010	PN
Requested Procedure Comments	0040	1400	LT
Reason for the Imaging Service Request	0040	2001	LO
Issue Date of Imaging Service Request	0040	2004	DA
Issue Time of Imaging Service Request	0040	2005	TM
Placer Order Number / Imaging Service Request (RET)	0040	2006	SH
Filler Order Number / Imaging Service Request (RET)	0040	2007	SH
Order Entered By	0040	2008	PN
Order Enterer's Location	0040	2009	SH
Order Callback Phone Number	0040	2010	SH

Name	Group	Element	VR
Placer Order Number / Imaging Service Request	0040	2016	LO
Filler Order Number / Imaging Service Request	0040	2017	LO
Imaging Service Request Comments	0040	2400	LT
Confidentiality Constraint on Patient Data Description	0040	3001	LO
Entrance Dose in mGy	0040	8302	DS
Relationship Type	0040	A010	CS
Verifying Organization	0040	A027	LO
Verification DateTime	0040	A030	DT
Observation DateTime	0040	A032	DT
Value Type	0040	A040	CS
Concept-name Code Sequence	0040	A043	SQ
Continuity Of Content	0040	A050	CS
Verifying Observer Sequence	0040	A073	SQ
Verifying Observer Name	0040	A075	PN
Verifying Observer Identification Code Sequence	0040	A088	SQ
Referenced Waveform Channels	0040	A0B0	US
DateTime	0040	A120	DT
Date	0040	A121	DA
Time	0040	A122	TM
Person Name	0040	A123	PN
UID	0040	A124	UI
Temporal Range Type	0040	A130	CS
Referenced Sample Positions	0040	A132	UL
Referenced Frame Numbers	0040	A136	US
Referenced Time Offsets	0040	A138	DS
Referenced Datetime	0040	A13A	DT
Text Value	0040	A160	UT
Concept Code Sequence	0040	A168	SQ
Annotation Group Number	0040	A180	US
Modifier Code Sequence	0040	A195	SQ
Measured Value Sequence	0040	A300	SQ
Numeric Value	0040	A30A	DS
Predecessor Documents Sequence	0040	A360	SQ
Referenced Request Sequence	0040	A370	SQ
Performed Procedure Code Sequence	0040	A372	SQ
Current Requested Procedure Evidence Sequence	0040	A375	SQ
Pertinent Other Evidence Sequence	0040	A385	SQ
Completion Flag	0040	A491	CS
Completion Flag Description	0040	A492	LO
Verification Flag	0040	A493	CS
Content Template Sequence	0040	A504	SQ
Identical Documents Sequence	0040	A525	SQ
Content Sequence	0040	A730	SQ
Annotation Sequence	0040	B020	SQ
Template Identifier	0040	DB00	CS
Template Version	0040	DB06	DT
Template Local Version	0040	DB07	DT
Template Extension Flag	0040	DB0B	CS
Template Extension Organization UID	0040	DB0C	UI
Template Extension Creator UID	0040	DB0D	UI
Referenced Content Item Identifier	0040	DB73	UL
BlockID = "GE LUT Asymmetry Parameter	"0045	0010	LO
LUT Assymetry	0045	1067	DS
Calibration Image	0050	0004	CS
Device Sequence	0050	0010	SQ
Device Length	0050	0014	DS

Name	Group	Element	VR
Device Diameter	0050	0016	DS
Device Diameter Units	0050	0017	CS
Device Volume	0050	0018	DS
Inter-marker Distance	0050	0019	DS
Device Description	0050	0020	LO
Energy Window Vector	0054	0010	US
Number of Energy Windows	0054	0011	US
Energy Window Information Sequence	0054	0012	SQ
Energy Window Range Sequence	0054	0013	SQ
Energy Window Lower Limit	0054	0014	DS
Energy Window Upper Limit	0054	0015	DS
Radiopharmaceutical Information Sequence	0054	0016	SQ
Residual Syringe Counts	0054	0017	IS
Energy Window Name	0054	0018	SH
Detector Vector	0054	0020	US
Number of Detectors	0054	0021	US
Detector Information Sequence	0054	0022	SQ
Phase Vector	0054	0030	US
Number of Phases	0054	0031	US
Phase Information Sequence	0054	0032	SQ
Number of Frames in Phase	0054	0033	US
Phase Delay	0054	0036	IS
Pause Between Frames	0054	0038	IS
Rotation Vector	0054	0050	US
Number of Rotations	0054	0051	US
Rotation Information Sequence	0054	0052	SQ
Number of Frames in Rotation	0054	0053	US
R-R Interval Vector	0054	0060	US
Number of R-R Intervals	0054	0061	US
Gated Information Sequence	0054	0062	SQ
Data Information Sequence	0054	0063	SQ
Time Slot Vector	0054	0070	US
Number of Time Slots	0054	0071	US
Time Slot Information Sequence	0054	0072	SQ
Time Slot Time	0054	0073	DS
Slice Vector	0054	0080	US
Number of Slices	0054	0081	US
Angular View Vector	0054	0090	US
Time Slice Vector	0054	0100	US
Number of Time Slices	0054	0101	US
Start Angle	0054	0200	DS
Type of Detector Motion	0054	0202	CS
Trigger Vector	0054	0210	IS
Number of Triggers in Phase	0054	0211	US
View Code Sequence	0054	0220	SQ
View Modifier Code Sequence	0054	0222	SQ
Radionuclide Code Sequence	0054	0300	SQ
Administration Route Code Sequence	0054	0302	SQ
Radiopharmaceutical Code Sequence	0054	0304	SQ
Calibration Data Sequence	0054	0306	SQ
Energy Window Number	0054	0308	US
Image ID	0054	0400	SH
Patient Orientation Code Sequence	0054	0410	SQ
Patient Orientation Modifier Code Sequence	0054	0412	SQ
Patient Gantry Relationship Code Sequence	0054	0414	SQ
Series Type	0054	1000	CS

Name	Group	Element	VR
Units	0054	1001	CS
Counts Source	0054	1002	CS
Reprojection Method	0054	1004	CS
Randoms Correction Method	0054	1100	CS
Attenuation Correction Method	0054	1101	LO
Decay Correction	0054	1102	CS
Reconstruction Method	0054	1103	LO
Detector Lines of Response Used	0054	1104	LO
Scatter Correction Method	0054	1105	LO
Axial Acceptance	0054	1200	DS
Axial Mash	0054	1201	IS
Transverse Mash	0054	1202	IS
Detector Element Size	0054	1203	DS
Coincidence Window Width	0054	1210	DS
Secondary Counts Type	0054	1220	CS
Frame Reference Time	0054	1300	DS
Primary (Prompts) Counts Accumulated	0054	1310	IS
Secondary Counts Accumulated	0054	1311	IS
Slice Sensitivity Factor	0054	1320	DS
Decay Factor	0054	1321	DS
Dose Calibration Factor	0054	1322	DS
Scatter Fraction Factor	0054	1323	DS
Dead Time Factor	0054	1324	DS
Image Index	0054	1330	US
Counts Included	0054	1400	CS
Dead Time Correction Flag	0054	1401	CS
Histogram Sequence	0060	3000	SQ
Histogram Number of Bins	0060	3002	US
Histogram First Bin Value	0060	3004	XS
Histogram Last Bin Value	0060	3006	XS
Histogram Bin Width	0060	3008	US
Histogram Explanation	0060	3010	LO
Histogram Data	0060	3020	UL
Graphic Annotation Sequence	0070	0001	SQ
Graphic Layer	0070	0002	CS
Bounding Box Annotation Units	0070	0003	CS
Anchor Point Annotation Units	0070	0004	CS
Graphic Annotation Units	0070	0005	CS
Unformatted Text Value	0070	0006	ST
Text Object Sequence	0070	0008	SQ
Graphic Object Sequence	0070	0009	SQ
Bounding Box Top Left Hand Corner	0070	0010	FL
Bounding Box Bottom Right Hand Corner	0070	0011	FL
Bounding Box Text Horizontal Justification	0070	0012	CS
Anchor Point	0070	0014	FL
Anchor Point Visibility	0070	0015	CS
Graphic Dimensions	0070	0020	US
Number of Graphic Points	0070	0021	US
Graphic Data	0070	0022	FL
Graphic Type	0070	0023	CS
Graphic Filled	0070	0024	CS
Image Horizontal Flip	0070	0041	CS
Image Rotation	0070	0042	US
Displayed Area Top Left Hand Corner	0070	0052	SL
Displayed Area Bottom Right Hand Corner	0070	0053	SL
Displayed Area Selection Sequence	0070	005A	SQ

Name	Group	Element	VR
Graphic Layer Sequence	0070	0060	SQ
Graphic Layer Order	0070	0062	IS
Graphic Layer Recommended Display Grayscale Value	0070	0066	US
Graphic Layer Recommended Display RGB Value	0070	0067	US
Graphic Layer Description	0070	0068	LO
Presentation Label	0070	0080	CS
Presentation Description	0070	0081	LO
Presentation Creation Date	0070	0082	DA
Presentation Creation Time	0070	0083	TM
Presentation Creator's Name	0070	0084	PN
Presentation Size Mode	0070	0100	CS
Presentation Pixel Spacing	0070	0101	DS
Presentation Pixel Aspect Ratio	0070	0102	IS
Presentation Pixel Magnification Ratio	0070	0103	FL
Storage Media File-set ID	0088	0130	SH
Storage Media File-set UID	0088	0140	UI
Icon Image Sequence	0088	0200	SQ
Topic Title	0088	0904	LO
Topic Subject	0088	0906	ST
Topic Author	0088	0910	LO
Topic Key Words	0088	0912	LO
SOP Instance Status	0100	0410	CS
SOP Authorization Date and Time	0100	0420	DT
SOP Authorization Comment	0100	0424	LT
Authorization Equipment Certification Number	0100	0426	LO
Number of Copies	2000	0010	IS
Printer Configuration Sequence	2000	001E	SQ
Print Priority	2000	0020	CS
Medium Type	2000	0030	CS
Film Destination	2000	0040	CS
Film Session Label	2000	0050	LO
Memory Allocation	2000	0060	IS
Maximum Memory Allocation	2000	0061	IS
Color Image Printing Flag	2000	0062	CS
Collation Flag	2000	0063	CS
Annotation Flag	2000	0065	CS
Image Overlay Flag	2000	0067	CS
Presentation LUT Flag	2000	0069	CS
Image Box Presentation LUT Flag	2000	006A	CS
Memory Bit Depth	2000	00A0	US
Printing Bit Depth	2000	00A1	US
Media Installed Sequence	2000	00A2	SQ
Other Media Available Sequence	2000	00A4	SQ
Supported Image Display Formats Sequence	2000	00A8	SQ
Referenced Film Box Sequence	2000	0500	SQ
Referenced Stored Print Sequence	2000	0510	SQ
Image Display Format	2010	0010	ST
Annotation Display Format ID	2010	0030	CS
Film Orientation	2010	0040	CS
Film Size ID	2010	0050	CS
Printer Resolution ID	2010	0052	CS
Default Printer Resolution ID	2010	0054	CS
Magnification Type	2010	0060	CS
Smoothing Type	2010	0080	CS
Default Magnification Type	2010	00A6	CS
Other Magnification Types Available	2010	00A7	CS

Name	Group	Element	VR
Default Smoothing Type	2010	00A8	CS
Other Smoothing Types Available	2010	00A9	CS
Border Density	2010	0100	CS
Empty Image Density	2010	0110	CS
Min Density	2010	0120	US
Max Density	2010	0130	US
Trim	2010	0140	CS
Configuration Information	2010	0150	ST
Configuration Information Description	2010	0152	LT
Maximum Collated Films	2010	0154	IS
Illumination	2010	015E	US
Reflected Ambient Light	2010	0160	US
Printer Pixel Spacing	2010	0376	DS
Referenced Film Session Sequence	2010	0500	SQ
Referenced Image Box Sequence	2010	0510	SQ
Referenced Basic Annotation Box Sequence	2010	0520	SQ
Image Position	2020	0010	US
Polarity	2020	0020	CS
Requested Image Size	2020	0030	DS
Requested Decimate/Crop Behavior	2020	0040	CS
Requested Resolution ID	2020	0050	CS
Requested Image Size Flag	2020	00A0	CS
Decimate/Crop Result	2020	00A2	CS
Basic Grayscale Image Sequence	2020	0110	SQ
Basic Color Image Sequence	2020	0111	SQ
Referenced Image Overlay Box Sequence (RET)	2020	0130	SQ
Referenced VOI LUT Box Sequence (RET)	2020	0140	SQ
Annotation Position	2030	0010	US
Text String	2030	0020	LO
Referenced Overlay Plane Sequence	2040	0010	SQ
Referenced Overlay Plane Groups	2040	0011	US
Overlay Pixel Data Sequence	2040	0020	SQ
Overlay Magnification Type	2040	0060	CS
Overlay Smoothing Type	2040	0070	CS
Overlay or Image Magnification	2040	0072	CS
Magnify to Number of Columns	2040	0074	US
Overlay Foreground Density	2040	0080	CS
Overlay Background Density	2040	0082	CS
Overlay Mode (RET)	2040	0090	CS
Threshold Density (RET)	2040	0100	CS
Referenced Image Box Sequence (RET)	2040	0500	SQ
Presentation LUT Sequence	2050	0010	SQ
Presentation LUT Shape	2050	0020	CS
Referenced Presentation LUT Sequence	2050	0500	SQ
Print Job ID	2100	0010	SH
Execution Status	2100	0020	CS
Execution Status Info	2100	0030	CS
Creation Date	2100	0040	DA
Creation Time	2100	0050	TM
Originator	2100	0070	AE
Destination AE	2100	0140	AE
Owner ID	2100	0160	SH
Number of Films	2100	0170	IS
Referenced Print Job Sequence	2100	0500	SQ
Printer Status	2110	0010	CS
Printer Status Info	2110	0020	CS

Name	Group	Element	VR
Printer Name	2110	0030	LO
Print Queue ID	2110	0099	SH
Queue Status	2120	0010	CS
Print Job Description Sequence	2120	0050	SQ
Referenced Print Job Sequence	2120	0070	SQ
Print Management Capabilities Sequence	2130	0010	SQ
Printer Characteristics Sequence	2130	0015	SQ
Film Box Content Sequence	2130	0030	SQ
Image Box Content Sequence	2130	0040	SQ
Annotation Content Sequence	2130	0050	SQ
Image Overlay Box Content Sequence	2130	0060	SQ
Presentation LUT Content Sequence	2130	0080	SQ
Proposed Study Sequence	2130	00A0	SQ
Original Image Sequence	2130	00C0	SQ
RT Image Label	3002	0002	SH
RT Image Name	3002	0003	LO
RT Image Description	3002	0004	ST
Reported Values Origin	3002	000A	CS
RT Image Plane	3002	000C	CS
X-Ray Image Receptor Translation	3002	000D	DS
X-Ray Image Receptor Angle	3002	000E	DS
RT Image Orientation	3002	0010	DS
Image Plane Pixel Spacing	3002	0011	DS
RT Image Position	3002	0012	DS
Radiation Machine Name	3002	0020	SH
Radiation Machine SAD	3002	0022	DS
Radiation Machine SSD	3002	0024	DS
RT Image SID	3002	0026	DS
Source to Reference Object Distance	3002	0028	DS
Fraction Number	3002	0029	IS
Exposure Sequence	3002	0030	SQ
Meterset Exposure	3002	0032	DS
DVH Type	3004	0001	CS
Dose Units	3004	0002	CS
Dose Type	3004	0004	CS
Dose Comment	3004	0006	LO
Normalization Point	3004	0008	DS
Dose Summation Type	3004	000A	CS
Grid Frame Offset Vector	3004	000C	DS
Dose Grid Scaling	3004	000E	DS
RT Dose ROI Sequence	3004	0010	SQ
Dose Value	3004	0012	DS
DVH Normalization Point	3004	0040	DS
DVH Normalization Dose Value	3004	0042	DS
DVH Sequence	3004	0050	SQ
DVH Dose Scaling	3004	0052	DS
DVH Volume Units	3004	0054	CS
DVH Number of Bins	3004	0056	IS
DVH Data	3004	0058	DS
DVH Referenced ROI Sequence	3004	0060	SQ
DVH ROI Contribution Type	3004	0062	CS
DVH Minimum Dose	3004	0070	DS
DVH Maximum Dose	3004	0072	DS
DVH Mean Dose	3004	0074	DS
Structure Set Label	3006	0002	SH
Structure Set Name	3006	0004	LO

Name	Group	Element	VR
Structure Set Description	3006	0006	ST
Structure Set Date	3006	0008	DA
Structure Set Time	3006	0009	TM
Referenced Frame of Reference Sequence	3006	0010	SQ
RT Referenced Study Sequence	3006	0012	SQ
RT Referenced Series Sequence	3006	0014	SQ
Contour Image Sequence	3006	0016	SQ
Structure Set ROI Sequence	3006	0020	SQ
ROI Number	3006	0022	IS
Referenced Frame of Reference UID	3006	0024	UI
ROI Name	3006	0026	LO
ROI Description	3006	0028	ST
ROI Display Color	3006	002A	IS
ROI Volume	3006	002C	DS
RT Related ROI Sequence	3006	0030	SQ
RT ROI Relationship	3006	0033	CS
ROI Generation Algorithm	3006	0036	CS
ROI Generation Description	3006	0038	LO
ROI Contour Sequence	3006	0039	SQ
Contour Sequence	3006	0040	SQ
Contour Geometric Type	3006	0042	CS
Contour Slab Thickness	3006	0044	DS
Contour Offset Vector	3006	0045	DS
Number of Contour Points	3006	0046	IS
Contour Number	3006	0048	IS
Attached Contours	3006	0049	IS
Contour Data	3006	0050	DS
RT ROI Observations Sequence	3006	0080	SQ
Observation Number	3006	0082	IS
Referenced ROI Number	3006	0084	IS
ROI Observation Label	3006	0085	SH
RT ROI Identification Code Sequence	3006	0086	SQ
ROI Observation Description	3006	0088	ST
Related RT ROI Observations Sequence	3006	00A0	SQ
RT ROI Interpreted Type	3006	00A4	CS
ROI Interpreter	3006	00A6	PN
ROI Physical Properties Sequence	3006	00B0	SQ
ROI Physical Property	3006	00B2	CS
ROI Physical Property Value	3006	00B4	DS
Frame of Reference Relationship Sequence	3006	00C0	SQ
Related Frame of Reference UID	3006	00C2	UI
Frame of Reference Transformation Type	3006	00C4	CS
Frame of Reference Transformation Matrix	3006	00C6	DS
Frame of Reference Transformation Comment	3006	00C8	LO
Measured Dose Reference Sequence	3008	0010	SQ
Measured Dose Description	3008	0012	ST
Measured Dose Type	3008	0014	CS
Measured Dose Value	3008	0016	DS
Treatment Session Beam Sequence	3008	0020	SQ
Current Fraction Number	3008	0022	IS
Treatment Control Point Date	3008	0024	DA
Treatment Control Point Time	3008	0025	TM
Treatment Termination Status	3008	002A	CS
Treatment Termination Code	3008	002B	SH
Treatment Verification Status	3008	002C	CS
Referenced Treatment Record Sequence	3008	0030	SQ

Name	Group	Element	VR
Specified Primary Meterset	3008	0032	DS
Specified Secondary Meterset	3008	0033	DS
Delivered Primary Meterset	3008	0036	DS
Delivered Secondary Meterset	3008	0037	DS
Specified Treatment Time	3008	003A	DS
Delivered Treatment Time	3008	003B	DS
Control Point Delivery Sequence	3008	0040	SQ
Specified Meterset	3008	0042	DS
Delivered Meterset	3008	0044	DS
Dose Rate Delivered	3008	0048	DS
Treatment Summary Calculated Dose Reference seq.	3008	0050	SQ
Cumulative Dose to Dose Reference	3008	0052	DS
First Treatment Date	3008	0054	DA
Most Recent Treatment Date	3008	0056	DA
Number of Fractions Delivered	3008	005A	IS
Override Sequence	3008	0060	SQ
Override Parameter Pointer	3008	0062	AT
Measured Dose Reference Number	3008	0064	IS
Override Reason	3008	0066	ST
Calculated Dose Reference Sequence	3008	0070	SQ
Calculated Dose Reference Number	3008	0072	IS
Calculated Dose Reference Description	3008	0074	ST
Calculated Dose Reference Dose Value	3008	0076	DS
Start Meterset	3008	0078	DS
End Meterset	3008	007A	DS
Referenced Measured Dose Reference Sequence	3008	0080	SQ
Referenced Measured Dose Reference Number	3008	0082	IS
Referenced Calculated Dose Reference Sequence	3008	0090	SQ
Referenced Calculated Dose Reference Number	3008	0092	IS
Beam Limiting Device Leaf Pairs Sequence	3008	00A0	SQ
Recorded Wedge Sequence	3008	00B0	SQ
Recorded Compensator Sequence	3008	00C0	SQ
Recorded Block Sequence	3008	00D0	SQ
Treatment Summary Measured Dose Reference Sequence	3008	00E0	SQ
Recorded Source Sequence	3008	0100	SQ
Source Serial Number	3008	0105	LO
Treatment Session Application Setup Sequence	3008	0110	SQ
Application Setup Check	3008	0116	CS
Recorded Brachy Accessory Device Sequence	3008	0120	SQ
Referenced Brachy Accessory Device Number	3008	0122	IS
Recorded Channel Sequence	3008	0130	SQ
Specified Channel Total Time	3008	0132	DS
Delivered Channel Total Time	3008	0134	DS
Specified Number of Pulses	3008	0136	IS
Delivered Number of Pulses	3008	0138	IS
Specified Pulse Repetition Interval	3008	013A	DS
Delivered Pulse Repetition Interval	3008	013C	DS
Recorded Source Applicator Sequence	3008	0140	SQ
Referenced Source Applicator Number	3008	0142	IS
Recorded Channel Shield Sequence	3008	0150	SQ
Referenced Channel Shield Number	3008	0152	IS
Brachy Control Point Delivered Sequence	3008	0160	SQ
Safe Position Exit Date	3008	0162	DA
Safe Position Exit Time	3008	0164	TM
Safe Position Return Date	3008	0166	DA
Safe Position Return Time	3008	0168	TM

Name	Group	Element	VR
Current Treatment Status	3008	0200	CS
Treatment Status Comment	3008	0202	ST
Fraction Group Summary Sequence	3008	0220	SQ
Referenced Fraction Number	3008	0223	IS
Fraction Group Type	3008	0224	CS
Beam Stopper Position	3008	0230	CS
Fraction Status Summary Sequence	3008	0240	SQ
Treatment Date	3008	0250	DA
Treatment Time	3008	0251	TM
RT Plan Label	300A	0002	SH
RT Plan Name	300A	0003	LO
RT Plan Description	300A	0004	ST
RT Plan Date	300A	0006	DA
RT Plan Time	300A	0007	TM
Treatment Protocols	300A	0009	LO
Treatment Intent	300A	000A	CS
Treatment Sites	300A	000B	LO
RT Plan Geometry	300A	000C	CS
Prescription Description	300A	000E	ST
Dose Reference Sequence	300A	0010	SQ
Dose Reference Number	300A	0012	IS
Dose Reference Structure Type	300A	0014	CS
Nominal Beam Energy Unit	300A	0015	CS
Dose Reference Description	300A	0016	LO
Dose Reference Point Coordinates	300A	0018	DS
Nominal Prior Dose	300A	001A	DS
Dose Reference Type	300A	0020	CS
Constraint Weight	300A	0021	DS
Delivery Warning Dose	300A	0022	DS
Delivery Maximum Dose	300A	0023	DS
Target Minimum Dose	300A	0025	DS
Target Prescription Dose	300A	0026	DS
Target Maximum Dose	300A	0027	DS
Target Underdose Volume Fraction	300A	0028	DS
Organ at Risk Full-volume Dose	300A	002A	DS
Organ at Risk Limit Dose	300A	002B	DS
Organ at Risk Maximum Dose	300A	002C	DS
Organ at Risk Overdose Volume Fraction	300A	002D	DS
Tolerance Table Sequence	300A	0040	SQ
Tolerance Table Number	300A	0042	IS
Tolerance Table Label	300A	0043	SH
Gantry Angle Tolerance	300A	0044	DS
Beam Limiting Device Angle Tolerance	300A	0046	DS
Beam Limiting Device Tolerance Sequence	300A	0048	SQ
Beam Limiting Device Position Tolerance	300A	004A	DS
Patient Support Angle Tolerance	300A	004C	DS
Table Top Eccentric Angle Tolerance	300A	004E	DS
Table Top Vertical Position Tolerance	300A	0051	DS
Table Top Longitudinal Position Tolerance	300A	0052	DS
Table Top Lateral Position Tolerance	300A	0053	DS
RT Plan Relationship	300A	0055	CS
Fraction Group Sequence	300A	0070	SQ
Fraction Group Number	300A	0071	IS
Number of Fractions Planned	300A	0078	IS
Number of Fractions Per Day	300A	0079	IS
Repeat Fraction Cycle Length	300A	007A	IS

Name	Group	Element	VR
Fraction Pattern	300A	007B	LT
Number of Beams	300A	0080	IS
Beam Dose Specification Point	300A	0082	DS
Beam Dose	300A	0084	DS
Beam Meterset	300A	0086	DS
Number of Brachy Application Setups	300A	00A0	IS
Brachy Application Setup Dose Specification Point	300A	00A2	DS
Brachy Application Setup Dose	300A	00A4	DS
Beam Sequence	300A	00B0	SQ
Treatment Machine Name	300A	00B2	SH
Primary Dosimeter Unit	300A	00B3	CS
Source-Axis Distance	300A	00B4	DS
Beam Limiting Device Sequence	300A	00B6	SQ
RT Beam Limiting Device Type	300A	00B8	CS
Source to Beam Limiting Device Distance	300A	00BA	DS
Number of Leaf/Jaw Pairs	300A	00BC	IS
Leaf Position Boundaries	300A	00BE	DS
Beam Number	300A	00C0	IS
Beam Name	300A	00C2	LO
Beam Description	300A	00C3	ST
Beam Type	300A	00C4	CS
Radiation Type	300A	00C6	CS
Reference Image Number	300A	00C8	IS
Planned Verification Image Sequence	300A	00CA	SQ
Imaging Device-Specific Acquisition Parameters	300A	00CC	LO
Treatment Delivery Type	300A	00CE	CS
Number of Wedges	300A	00D0	IS
Wedge Sequence	300A	00D1	SQ
Wedge Number	300A	00D2	IS
Wedge Type	300A	00D3	CS
Wedge ID	300A	00D4	SH
Wedge Angle	300A	00D5	IS
Wedge Factor	300A	00D6	DS
Wedge Orientation	300A	00D8	DS
Source to Wedge Tray Distance	300A	00DA	DS
Number of Compensators	300A	00E0	IS
Material ID	300A	00E1	SH
Total Compensator Tray Factor	300A	00E2	DS
Compensator Sequence	300A	00E3	SQ
Compensator Number	300A	00E4	IS
Compensator ID	300A	00E5	SH
Source to Compensator Tray Distance	300A	00E6	DS
Compensator Rows	300A	00E7	IS
Compensator Columns	300A	00E8	IS
Compensator Pixel Spacing	300A	00E9	DS
Compensator Position	300A	00EA	DS
Compensator Transmission Data	300A	00EB	DS
Compensator Thickness Data	300A	00EC	DS
Number of Boli	300A	00ED	IS
Compensator Type	300A	00EE	CS
Number of Blocks	300A	00F0	IS
Total Block Tray Factor	300A	00F2	DS
Block Sequence	300A	00F4	SQ
Block Tray ID	300A	00F5	SH
Source to Block Tray Distance	300A	00F6	DS
Block Type	300A	00F8	CS

Name	Group	Element	VR
Block Divergence	300A	00FA	CS
Block Number	300A	00FC	IS
Block Name	300A	00FE	LO
Block Thickness	300A	0100	DS
Block Transmission	300A	0102	DS
Block Number of Points	300A	0104	IS
Block Data	300A	0106	DS
Applicator Sequence	300A	0107	SQ
Applicator ID	300A	0108	SH
Applicator Type	300A	0109	CS
Applicator Description	300A	010A	LO
Cumulative Dose Reference Coefficient	300A	010C	DS
Final Cumulative Meterset Weight	300A	010E	DS
Number of Control Points	300A	0110	IS
Control Point Sequence	300A	0111	SQ
Control Point Index	300A	0112	IS
Nominal Beam Energy	300A	0114	DS
Dose Rate Set	300A	0115	DS
Wedge Position Sequence	300A	0116	SQ
Wedge Position	300A	0118	CS
Beam Limiting Device Position Sequence	300A	011A	SQ
Leaf/Jaw Positions	300A	011C	DS
Gantry Angle	300A	011E	DS
Gantry Rotation Direction	300A	011F	CS
Beam Limiting Device Angle	300A	0120	DS
Beam Limiting Device Rotation Direction	300A	0121	CS
Patient Support Angle	300A	0122	DS
Patient Support Rotation Direction	300A	0123	CS
Table Top Eccentric Axis Distance	300A	0124	DS
Table Top Eccentric Angle	300A	0125	DS
Table Top Eccentric Rotation Direction	300A	0126	CS
Table Top Vertical Position	300A	0128	DS
Table Top Longitudinal Position	300A	0129	DS
Table Top Lateral Position	300A	012A	DS
Isocenter Position	300A	012C	DS
Surface Entry Point	300A	012E	DS
Source to Surface Distance	300A	0130	DS
Cumulative Meterset Weight	300A	0134	DS
Patient Setup Sequence	300A	0180	SQ
Patient Setup Number	300A	0182	IS
Patient Additional Position	300A	0184	LO
Fixation Device Sequence	300A	0190	SQ
Fixation Device Type	300A	0192	CS
Fixation Device Label	300A	0194	SH
Fixation Devi ce Description	300A	0196	ST
Fixation Device Position	300A	0198	SH
Shielding Device Sequence	300A	01A0	SQ
Shielding Device Type	300A	01A2	CS
Shielding Device Label	300A	01A4	SH
Shielding Device Description	300A	01A6	ST
Shielding Device Position	300A	01A8	SH
Setup Technique	300A	01B0	CS
Setup Technique Description	300A	01B2	ST
Setup Device Sequence	300A	01B4	SQ
Setup Device Type	300A	01B6	CS
Setup Device Label	300A	01B8	SH

Name	Group	Element	VR
Setup Device Description	300A	01BA	ST
Setup Device Parameter	300A	01BC	DS
Setup Reference Description	300A	01D0	ST
Table Top Vertical Setup Displacement	300A	01D2	DS
Table Top Longitudinal Setup Displacement	300A	01D4	DS
Table Top Lateral Setup Displacement	300A	01D6	DS
Brachy Treatment Technique	300A	0200	CS
Brachy Treatment Type	300A	0202	CS
Treatment Machine Sequence	300A	0206	SQ
Source Sequence	300A	0210	SQ
Source Number	300A	0212	IS
Source Type	300A	0214	CS
Source Manufacturer	300A	0216	LO
Active Source Diameter	300A	0218	DS
Active Source Length	300A	021A	DS
Source Encapsulation Nominal Thickness	300A	0222	DS
Source Encapsulation Nominal Transmission	300A	0224	DS
Source Isotope Name	300A	0226	LO
Source Isotope Half Life	300A	0228	DS
Reference Air Kerma Rate	300A	022A	DS
Air Kerma Rate Reference Date	300A	022C	DA
Air Kerma Rate Reference Time	300A	022E	TM
Application Setup Sequence	300A	0230	SQ
Application Setup Type	300A	0232	CS
Application Setup Number	300A	0234	IS
Application Setup Name	300A	0236	LO
Application Setup Manufacturer	300A	0238	LO
Template Number	300A	0240	IS
Template Type	300A	0242	SH
Template Name	300A	0244	LO
Total Reference Air Kerma	300A	0250	DS
Brachy Accessory Device Sequence	300A	0260	SQ
Brachy Accessory Device Number	300A	0262	IS
Brachy Accessory Device ID	300A	0263	SH
Brachy Accessory Device Type	300A	0264	CS
Brachy Accessory Device Name	300A	0266	LO
Brachy Accessory Device Nominal Thickness	300A	026A	DS
Brachy Accessory Device Nominal Transmission	300A	026C	DS
Channel Sequence	300A	0280	SQ
Channel Number	300A	0282	IS
Channel Length	300A	0284	DS
Channel Total Time	300A	0286	DS
Source Movement Type	300A	0288	CS
Number of Pulses	300A	028A	IS
Pulse Repetition Interval	300A	028C	DS
Source Applicator Number	300A	0290	IS
Source Applicator ID	300A	0291	SH
Source Applicator Type	300A	0292	CS
Source Applicator Name	300A	0294	LO
Source Applicator Length	300A	0296	DS
Source Applicator Manufacturer	300A	0298	LO
Source Applicator Wall Nominal Thickness	300A	029C	DS
Source Applicator Wall Nominal Transmission	300A	029E	DS
Source Applicator Step Size	300A	02A0	DS
Transfer Tube Number	300A	02A2	IS
Transfer Tube Length	300A	02A4	DS

Name	Group	Element	VR
Channel Shield Sequence	300A	02B0	SQ
Channel Shield Number	300A	02B2	IS
Channel Shield ID	300A	02B3	SH
Channel Shield Name	300A	02B4	LO
Channel Shield Nominal Thickness	300A	02B8	DS
Channel Shield Nominal Transmission	300A	02BA	DS
Final Cumulative Time Weight	300A	02C8	DS
Brachy Control Point Sequence	300A	02D0	SQ
Control Point Relative Position	300A	02D2	DS
Control Point 3D Position	300A	02D4	DS
Cumulative Time Weight	300A	02D6	DS
Referenced RT Plan Sequence	300C	0002	SQ
Referenced Beam Sequence	300C	0004	SQ
Referenced Beam Number	300C	0006	IS
Referenced Reference Image Number	300C	0007	IS
Start Cumulative Meterset Weight	300C	0008	DS
End Cumulative Meterset Weight	300C	0009	DS
Referenced Brachy Application Setup Sequence	300C	000A	SQ
Referenced Brachy Application Setup Number	300C	000C	IS
Referenced Source Number	300C	000E	IS
Referenced Fraction Group Sequence	300C	0020	SQ
Referenced Fraction Group Number	300C	0022	IS
Referenced Verification Image Sequence	300C	0040	SQ
Referenced Reference Image Sequence	300C	0042	SQ
Referenced Dose Reference Sequence	300C	0050	SQ
Referenced Dose Reference Number	300C	0051	IS
Brachy Referenced Dose Reference Sequence	300C	0055	SQ
Referenced Structure Set Sequence	300C	0060	SQ
Referenced Patient Setup Number	300C	006A	IS
Referenced Dose Sequence	300C	0080	SQ
Referenced Tolerance Table Number	300C	00A0	IS
Referenced Bolus Sequence	300C	00B0	SQ
Referenced Wedge Number	300C	00C0	IS
Referenced Compensator Number	300C	00D0	IS
Referenced Block Number	300C	00E0	IS
Referenced Control Point Index	300C	00F0	IS
Approval Status	300E	0002	CS
Review Date	300E	0004	DA
Review Time	300E	0005	TM
Reviewer Name	300E	0008	PN
BlockID = "AMI Annotations_02"	3101	0010	LO
BlockID = "AMI Annotations_01"	3101	0011	LO
AMI Annotation Sequence (RET)	3101	1020	SQ
AMI Annotation Sequence (RET)	3101	1110	SQ
BlockID = "AMI Sequence Annotations_02"	3103	0010	LO
BlockID = "AMI Sequence Annotations_01"	3103	0011	LO
AMI Annotation Sequence (RET)	3103	1010	CS
AMI Annotation UID (RET)	3103	1020	UI
AMI Annotation Color (RET)	3103	1030	US
AMI Annotation Line Style (RET)	3103	1050	CS
AMI Annotation Elements (RET)	3103	1060	SQ
AMI Annotation Label (RET)	3103	1070	SH
AMI Annotation Creator (RET)	3103	1080	PN
AMI Annotation Modifiers (RET)	3103	1090	PN
AMI Annotation Creation Date (RET)	3103	10A0	DA
AMI Annotation Creation Time (RET)	3103	10B0	TM

Name	Group	Element	VR
AMI Annotation Modification Dates (RET)	3103	10C0	DA
AMI Annotation Modification Times (RET)	3103	10D0	TM
AMI Annotation Frame Number (RET)	3103	10E0	US
AMI Annotation Sequence (RET)	3103	1110	CS
AMI Annotation UID (RET)	3103	1120	UI
AMI Annotation Color (RET)	3103	1130	US
AMI Annotation Line Style (RET)	3103	1150	CS
AMI Annotation Elements (RET)	3103	1160	SQ
AMI Annotation Label (RET)	3103	1170	SH
AMI Annotation Creator (RET)	3103	1180	PN
AMI Annotation Modifiers (RET)	3103	1190	PN
AMI Annotation Creation Date (RET)	3103	11A0	DA
AMI Annotation Creation Time (RET)	3103	11B0	TM
AMI Annotation Modification Dates (RET)	3103	11C0	DA
AMI Annotation Mofification Times (RET)	3103	11D0	TM
AMI Annotation Frame Number (RET)	3103	11E0	US
BlockID = "AMI Sequence AnnotElements_01	3105	0010	LO
AMI Annotation Element Position	3105	1010	DS
AMI Annotation Element Text	3105	1020	LT
BlockID = "AMI ImageTransform_01	3107	0010	LO
BlockID = "AMI ImageContextExt_01	3107	0011	LO
AMI Transformation Matrix (RET)	3107	1010	DS
AMI Center Offset (RET)	3107	1020	DS
AMI Magnification (RET)	3107	1030	DS
AMI Magnification Type (RET)	3107	1040	CS
AMI Displayed Area (RET)	3107	1050	DS
AMI Calibration Factor (RET)	3107	1060	DS
AMI Window Function (RET)	3107	11A0	CS
AMI Window Slope (RET)	3107	11B0	DS
BlockID = "Applicare/RadWorks/Version 5.0"	3109	0010	LO
BlockID = "AMI ImageContext_01"	3109	0011	LO
BlockID = "Applicare/RadWorks/Version 6.0/Summary”	3109	0012	LO
DCM_WORKLISTFILENAME <internal>	3109	1001	ST
DCM_AMI_STATUS: NEW/SEEN Status	3109	1002	SH
Delete Lock: Flag indicating study is locked.	3109	1003	CS
DCM_AMI_STATUS2: <internal>	3109	1004	CS
DCM_AMI_STATUS3: <internal>	3109	1005	CS
DCM_AMI_STATUS4: <internal>	3109	1006	CS
DCM_AMI_STATUSBITS: <internal>	3109	1007	UL
DCM_AMI_ORIGIN: Receive Origin	3109	1008	LO
Folder	3109	1009	LO
Receive Date	3109	100A	DA
Receive Time	3109	100B	TM
Prior	3109	100C	CS
STAT Study: Flag indicating study is STAT.	3109	100D	CS
<internal>. Flag indicating study/image is KEY.	3109	100E	CS
DCM_AMI_LOCALSTUDY: <internal>	3109	1010	CS
DCM_AMI_RESULT_MSG: <internal>	3109	1011	LO
DCM_AMI_CURRENT_USER: <internal>	3109	1012	LO
DCM_AMI_SYSTEM_DATE: <internal>	3109	1013	DA
DCM_AMI_SYSTEM_TIME: <internal>	3109	1014	TM
<internal>. Refers to the UID of the Worklist item.	3109	1020	UI
DCM_AMI_HOSTNAME: <internal>	3109	1021	CS
DCM_AMI_DICOM_AE_TITLE: <internal>	3109	1022	AE
DCM_AMI_DICOM_PORT_NUMBER: <internal>	3109	1023	US
DCM_AMI_DESTINATION_NAME: <internal>	3109	1024	LO

Name	Group	Element	VR
<internal>. AMI origin name	3109	1025	LO
<internal>. Study instance uid generated by modality	3109	1026	UI
<internal>. Sequence (AE Host Port Stor. Comm.)	3109	1027	SQ
Send Flag	3109	102A	LO
Print Flag	3109	102B	LO
Archive Flag	3109	102C	LO
<internal>. Requesting Facility Name	3109	1030	LO
<internal>. Requesting Procedure Name	3109	1031	CS
<internal>. Requesting Procedure Code	3109	1032	CS
Request Storage Commitment.	3109	1033	CS
Requested Compression.	3109	1034	CS
<internal>. Study seq. for replies to PATIENT queries	3109	1035	SQ
<internal>. Origin of update (used by Local Worklist)	3109	1036	LO
Origin of update	3109	1036	LO
<internal>. Study UID that is being replaced	3109	1037	UI
ACR code for teaching "folder" worklists	3109	1038	SH
<internal>. Special Interest Code (for teaching worklist)	3109	1039	SH
<internal>. Number of Study Related Images	3109	1040	IS
<internal>. Study locked	3109	1041	CS
<internal>. Contains workstation name	3109	1042	CS
AMI Window Invert (RET)	3109	1110	CS
AMI Window Center (RET)	3109	1120	IS
AMI Window Widith (RET)	3109	1130	IS
AMI Pixel Aspect Ratio Swap (RET)	3109	1140	CS
AMI Enable Averaging (RET)	3109	1150	CS
AMI Quality (RET)	3109	1160	CS
AMI Viewport Annotation Level (RET)	3109	1170	CS
AMI Show Image Annotation (RET)	3109	1180	CS
AMI Show Image Overlay (RET)	3109	1190	CS
DCM_AMI_STATUS	3109	1201	SH
DCM_AMI_ORIGIN	3109	1211	ST
Receive Origin Description	3109	1212	ST
DCM_AMI_RECEIVEDATE	3109	1215	DA
DCM_AMI_RECEIVETIME	3109	1216	TM
BlockID = "AMI StudyExtensions_01"	3111	0010	LO
BlockID = "RadWorksTBR"	3111	0011	LO
AMI Last Released Annot Label (RET)	3111	1001	UL
AMI Compression Type (RET)	3111	1102	CS
DCM_AMI_QUERY_RESULT: <internal>	3111	11FF	SQ
BlockID = "Applicare/RadStore/Version 1.0"	3113	0010	LO
BlockID = "Applicare/Workflow/Version 1.0"	3113	0020	LO
OBSOLETE	3113	1001	SL
Id1	3113	1002	SL
Id2	3113	1003	SL
Id3	3113	1004	SL
OBSOLETE	3113	1011	LO
State: image archiving state	3113	1012	CS
DateLastModified	3113	1013	DA
DateLastAccessed	3113	1014	DA
OBSOLETE	3113	1015	CS
ByteSize	3113	1016	FD
LibraryId	3113	1017	LO
Pathnames	3113	1018	LO
CachePathnames	3113	1019	LO
Source	3113	101A	LO
Destination	3113	101B	LO

Name	Group	Element	VR
MediumId	3113	101C	SL
ArchiveId	3113	101D	LO
Origin	3113	101E	LO
OBSOLETE	3113	1031	IS
OBSOLETE	3113	1032	IS
OBSOLETE	3113	1033	IS
ImageMediumLocation	3113	1035	LO
ImageMediumLabel	3113	1036	LO
ImageMediumState	3113	1037	CS
SeriesMediumLocation	3113	1038	LO
SeriesMediumLabel	3113	1039	LO
SeriesMediumState	3113	103a	CS
StudyMediumLocation	3113	103b	LO
StudyMediumLabel	3113	103c	LO
StudyMediumState	3113	103d	CS
StudyState: binary composition of image states	3113	1052	CS
SeriesState: binary composition of image states	3113	1053	CS
ImageStateText: textual description of image state	3113	1055	CS
SeriesStateText: textual description combined series state	3113	1056	CS
StudyStateText: textual description combined study state	3113	1057	CS
Expiration: determines lifetime of internal worklist items	3113	1060	DT
DeltaSets	3113	1068	SQ
OrderControl: <internal>	3113	2001	CS
ScheduledActionItemCodeValue: <internal>	3113	2010	SH
Sch.ActionItemCodingSchemeDesignator: <internal>	3113	2011	SH
ScheduledActionItemCodeMeaning: <internal>	3113	2012	LO
RequestedActionItemCodeValue: <internal>	3113	2015	SH
Req.ActionItemCodingSchemeDesignator: <internal>	3113	2016	SH
RequestedActionItemCodeMeaning: <internal>	3113	2017	LO
PerformedActionItemCodeValue: <internal>	3113	2020	SH
Perf.ActionItemCodingSchemeDesignator: <internal>	3113	2021	SH
PerformedActionItemCodeMeaning: <internal>	3113	2022	LO
PerformedProcedureCodeValue: <internal>	3113	2025	SH
Perf.ProcedureCodingSchemeDesignator: <internal>	3113	2026	SH
PerformedProcedureCodeMeaning: <internal>	3113	2027	LO
ReferencedImageSOPClassUID: <internal>	3113	2030	UI
ReferencedImageSOPInstanceUID: <internal>	3113	2031	UI
LockedByHostname: <internal>	3113	20E0	CS
LockedByUser: <internal>	3113	20E1	CS
KfEditLockUser: <internal>.	3113	20E2	CS
Results ID	4008	0040	SH
Results ID Issuer	4008	0042	LO
Referenced Interpretation Sequence	4008	0050	SQ
Interpretation Recorded Date	4008	0100	DA
Interpretation Recorded Time	4008	0101	TM
Interpretation Recorder	4008	0102	PN
Reference to Recorded Sound	4008	0103	LO
Interpretation Transcription Date	4008	0108	DA
Interpretation Transcription Time	4008	0109	TM
Interpretation Transcriber	4008	010A	PN
Interpretation Text	4008	010B	ST
Interpretation Author	4008	010C	PN
Interpretation Approver Sequence	4008	0111	SQ
Interpretation Approval Date	4008	0112	DA
Interpretation Approval Time	4008	0113	TM
Physician Approving Interpretation	4008	0114	PN

Name	Group	Element	VR
Interpretation Diagnosis Description	4008	0115	LT
Interpretation Diagnosis Code Sequence	4008	0117	SQ
Results Distribution List Sequence	4008	0118	SQ
Distribution Name	4008	0119	PN
Distribution Address	4008	011A	LO
Interpretation ID	4008	0200	SH
Interpretation ID Issuer	4008	0202	LO
Interpretation Type ID	4008	0210	CS
Interpretation Status ID	4008	0212	CS
Impressions	4008	0300	ST
Results Comments	4008	4000	ST
BlockID = "Applicare/Print/Version 5.1"	4101	0010	LO
DCM_PRINT_MASKSTATE: <internal>	4101	1001	UL
DCM_PRINT_ANNOTS: <internal>	4101	1002	SQ
DCM_PRINT_FONT: <internal>	4101	1003	LO
DCM_PRINT_FONTSIZE: <internal>	4101	1004	UL
DCM_PRINT_FONTRELSIZE: <internal>	4101	1005	FD
DCM_PRINT_OVERLAY: <internal>	4101	1006	US
DCM_PRINT_PIXELREP: <internal>	4101	1007	US
BlockID = "Applicare/RadWorks/Version 6.0"	4105	0010	LO
Annotation Type	4105	1001	CS
Annotation Value	4105	1002	DS
Cutline Image UID	4105	1003	UI
Cutline Group UID	4105	1004	UI
Annotation Color	4105	1005	US
Annotation Line Style	4105	1006	CS
Annotation Label	4105	1007	SH
Annotation Creator	4105	1008	PN
Annotation Creation Date	4105	1009	DA
Annotation Creation Time	4105	100A	TM
Annotation Modification Sequence	4105	100B	SQ
Annotation Modifier	4105	100C	PN
Annotation Modification Date	4105	100D	DA
Annotation Modification Time	4105	100E	TM
Palette Color LUT Name	4105	100F	LO
Annotation Number	4105	1010	US
BlockID = "Applicare/RadWorks/Version 6.0"	4107	0010	LO
Requested Palette Color LUT	4107	1001	SQ
Curve Dimensions	5000	0005	US
Number of Points	5000	0010	US
Type of Data	5000	0020	CS
Curve Description	5000	0022	LO
Axis Units	5000	0030	SH
Axis Labels	5000	0040	SH
Data Value Representation	5000	0103	US
Minimum Coordinate Value	5000	0104	US
Maximum Coordinate Value	5000	0105	US
Curve Range	5000	0106	SH
Curve Data Descriptor	5000	0110	US
Coordinate Start Value	5000	0112	US
Coordinate Step Value	5000	0114	US
Curve Activation Layer	5000	1001	CS
Audio Type	5000	2000	US
Audio Sample Format	5000	2002	US
Number of Channels	5000	2004	US
Number of Samples	5000	2006	UL

Name	Group	Element	VR
Sample Rate	5000	2008	UL
Total Time	5000	200A	UL
Audio Sample Data	5000	200C	OW
Audio Comments	5000	200E	LT
Curve Label	5000	2500	LO
Referenced Overlay Sequence	5000	2600	SQ
Referenced Overlay Group	5000	2610	US
Curve Data	5000	3000	OW
Waveform Sequence	5400	0100	SQ
Channel Minimum Value	5400	0110	OW
Channel Maximum Value	5400	0112	OW
Waveform Bits Allocated	5400	1004	US
Waveform Sample Interpretation	5400	1006	CS
Waveform Padding Value	5400	100A	OW
Waveform Data	5400	1010	OW
Overlay Rows	6000	0010	US
Overlay Columns	6000	0011	US
Overlay Planes	6000	0012	US
Number of Frames in Overlay	6000	0015	IS
Overlay Description	6000	0022	LO
Overlay Type	6000	0040	CS
Overlay Subtype	6000	0045	LO
Overlay Origin	6000	0050	SS
Image Frame Origin	6000	0051	US
Overlay Plane Origin	6000	0052	US
Compression Code (RET)	6000	0060	CS
Overlay Bits Allocated	6000	0100	US
Overlay Bit Position	6000	0102	US
Overlay Activation Layer	6000	1001	CS
Overlay Descriptor - Gray (RET)	6000	1100	US
Overlay Descriptor - Red (RET)	6000	1101	US
Overlay Descriptor - Green (RET)	6000	1102	US
Overlay Descriptor - Blue (RET)	6000	1103	US
Overlays - Gray (RET)	6000	1200	US
Overlays - Red (RET)	6000	1201	US
Overlays - Green (RET)	6000	1202	US
Overlays - Blue (RET)	6000	1203	US
ROI Area	6000	1301	IS
ROI Mean	6000	1302	DS
ROI Standard Deviation	6000	1303	DS
Overlay Label	6000	1500	LO
Overlay Data	6000	3000	OW
Comments (RET)	6000	4000	LO
BlockID = "GEIIS"	7FD1	0010	LO
GE IIS Compression ID	7FD1	1010	UL
GE IIS Multiframe Offsets	7FD1	1020	UL
Pixel Data	7FE0	0010	OW

APPENDIX C

Hazards: analysis & mitigation

Due to the clinical environment in which RadWorks is used, careful consideration should be given to potential hazards when deploying RadWorks and how to mitigate these as far as possible. This appendix contains an analysis of hazards along with actions which can be taken to minimize them. Those involved in setting up and administering RadWorks should read this appendix carefully.

Hardware hazards

Complete system failure due to power loss.

Run RadWorks from a computer on a place where power is always available, or use an uninterruptable power supply (UPS). If the system is used in critical situations, have a backup system and (auxiliary) power supply ready for immediate use.

If you do not have the RadWorks sample studies installed on your system, you can use a similar case which is available in your local database.

Complete system out of operation due to the general failure of a hardware component of the system.

Trace malfunctioning hardware component and replace it or run RadWorks on another computer.

Have a backup system available and (auxiliary) power supply ready for immediate use.

Graphics card displays fewer than 256 gray-levels, in contrast to what it reports. (During start up, graphics cards report how many gray levels they can display to the computer. Some graphics cards, however, report more gray levels than they can actually display.)

Replace graphics card with a card that meets the requirements.

Applicare provides all distributors/customers with a software utility called checkpal.exe which checks the ability of the graphics card to display 256 gray levels. Applicare also has a list of tested and approved graphics cards.

Inability to send or receive images over the network due to general network failure.

A network failure can have many different causes, including malfunctioning hardware. Examples of this are disconnected network cables and malfunctioning network cards or routers. It usually takes a skilled engineer to find the cause of the problems and resolve it. Images can be stored on a medium such as CD ROM.

Complete system out of operation and loss of data due to hard disk crash.

To have RadWorks up and running again, either the hard disk will have to be replaced or the RadWorks software will have to be run on another computer. The risk of losing data as a result of a hard disk crash can be minimized by regularly making backups. Most of the (image) data will, however, already be stored more than once (on the workstation of the originating modality for example).

Inability to work with peripheral device (such as a digitizer, archive, modality or laser imager) due to general failure of the device.

A failure of a peripheral device can be due to a number of causes and normally presents itself in the form of communication errors between the device and RadWorks system. It usually takes a skilled engineer to find out what caused the problem and take corrective measures. Standard tests normally include substitution of the device with a replacement that is known to work and replacing the RadWorks system with another system that can communicate with the device. In addition, most peripheral devices contain status indicators.

Whenever exchange of status information is supported by the peripheral device, the RadWorks system checks the status of the device when applicable.

Software hazards

Software problems can be categorized into problems that are related to other sources than RadWorks, such as the operating system, and problems that relate to RadWorks. In general, RadWorks has little or no effect on problems of the first category.

Software hazards not related to RadWorks

No longer being able to run RadWorks and/or incorrect functioning of the system due to a general software failure such as an operating system failure.

Run RadWorks on another computer or reinstall malfunctioning software if the cause of the problem is traceable.

No longer being able to run RadWorks *due to a software configuration failure.*

Reconfiguration or possibly complete reinstallation of all (or part) of the software on the computer.

This manual describes how to configure the RadWorks software and other relevant software.

Set proper configuration permissions.

Unpredictable functioning of the system due to virus attack.

Remove virus with the aid of special anti-virus software and/or possibly reinstall complete system. Another option is to work on another, virus free computer.

Windows 2000/NT 4 is a stable and safe operating system, compliant with the US Department of Defense C2 security standard. The risk remains, however, that the security features of Windows 2000/NT 4 are not properly employed. Applicare describes how to use these features, but cannot prevent the system administrator from changing security settings.

There are numerous virus checkers on the market. System administrators should check their computer systems regularly to ensure they do not contain viruses.

Either malfunctioning or non- functioning of RadWorks *or missing data due to unintentional deletion of program or data files.*

If (parts of) the RadWorks software have been deleted, it must be reinstalled. If data is missing, it must be recopied from an archive. For many reasons, it is recommended that regular backup copies of the contents of the hard disk are made.

When RadWorks is run, it is launched by another program which first checks that all the files necessary for RadWorks to function properly are present. If one or more files are missing, RadWorks will not start.

One of the features of Windows 2000/NT 4 is its ability to start applications automatically after logging in. Permission to delete data sets is set (by the administrator) on a per user basis and administered and controlled by Windows 2000/NT 4. If the administrator has set all permissions rights properly, it will only be possible for administrators to delete data sets.

Software hazards related to RadWorks

In general, Applicare's software development process guarantees as far as possible the avoidance of hazards. The process is a well documented in the Quality System Handbook.

Error in translation routine from DICOM to the Applicare format or vice versa.

Conversion to and from DICOM is based on documentation produced by ACR-NEMA. In addition, manufacturers of devices with DICOM capabilities have a DICOM Conformance Statement describing their exact implementation of the DICOM standard. Applicare makes use of this documentation.

A medical data set typically contains alphanumeric data (patient information) and numerical data (the image itself). All alphanumeric data can be displayed on the screen and thus be checked for correctness. Viewing the image itself is the main function of RadWorks and this can therefore also be checked.

Note that the information is translated (stored in another data structure). The information itself remains unchanged in this process.

Error in translation routine from non-DICOM source to the Applicare format.

Conversion of non-DICOM data sets to the Applicare format is based on information provided by the manufacturer of the device providing these data sets. Preventive measures are basically the same as described for DICOM data sets.

Transmission error while sending/receiving images from one RadWorks *system to another due to system hardware failure or receiving system out of resources.*

When sending/receiving images from one RadWorks system to another, the results are validated by means of a CRC checksum. Data is only added to the database of the receiving system after the calculated checksum of the data matches that of the sending site.

If transmission is cancelled for one reason or another, such as a bad connection or shutdown of one of the computer systems, this has no effect on data sets on the sending and receiving systems because data is only accepted after the CRC check has assured complete and correct transmission. Intermediate results are stored in a separate working directory and are never stored together with the data already on the system.

A teleradiology error warning indicator, error message in log file and backup destinations are provided.

Incorrect data entry due to human error.

At points in the RadWorks application users can enter data manually. Where applicable, user input is validated and only accepted when within specified bounds, though this only prevents users from entering syntactically incorrect data and not semantically incorrect data. It is not possible to automatically check that data is semantically correct.

Inability to write information to hard disk due to lack of free space.

If too many data sets are added to a RadWorks system, the hard disk could become full. Data can be added to a system from both local sources (when digitizing images) and remote sources (using the send/receive option).

If images are digitized and there is not enough free disk space, the user is warned that it is not possible to store the images. The user should manually delete images so that it becomes possible again to store new images on the system.

The user is not warned in real time if images from a remote system could not be received, since receiving images is a background task. The logging file does, however, contain warnings, so the administrator of the system will be able to tell if the hard disk is (almost) full.

The Data Selector includes a ‘gauge’, which graphically displays the free disk space left on the system.

The system is also capable of automatically deleting data using certain configurable rules.

Incorrect correspondence between data listed in the Data Selector and data actually on disk due to file being replaced or deleted by human intervention.

During start up and maintenance, the RadWorks system finds all data sets available on the system. Only those data sets are displayed in the Data Selector. It is possible to specify a time interval after which this check is repeated.

When working with the RadWorks system, the RadWorks software manages all operations that influence the contents of the Data Selector. These include updating the Data Selector, which is tested by means of system tests as described in the Software Test Plan.

Should the data in the Data Selector does not match the contents of the hard disk, then either data is listed although it is not available or data is not listed although it is available. In the former case, when the user wants to view the data set, the RadWorks system issues a warning that the data is not available. In the second case, the data set will be listed after the regular checks (such as after start up or a specified time interval) have been performed.

Discrepancies between the Data Selector and the contents of the hard disk should be extremely rare, if they exist at all, because they can only occur due to actions outside the RadWorks application. The proper use of standard Windows 2000/NT 4 security options makes this virtually impossible.

Error in the automatic deletion of data option due to configuration error. (One of the options of the RadWorks *system is automatic deletion of data sets. Images can be deleted after a specified period of time, based on the amount of free disk space left on the system.)*

The source code for this option is thoroughly examined in code review sessions. Its functionality is tested as described in the Software Test Plan.

Algorithmic error with regard to image manipulation.

Industry-wide accepted algorithms are used for image manipulation (such as zooming in/out). These algorithms, when implemented in RadWorks, are checked during code reviews.

Images on disk are never manipulated directly. Only copies of these images in the computer memory (RAM) are manipulated to prevent unintentional corruption of data.

Image data is corrupt and lost after archiving images. (When archiving studies from the local database to a DICOM Part 10 Archive using the DICOM JPEG Lossless transfer syntax and not using the archive full verification option, the original study will be removed even if the copy is not completely lossless. The image data may be corrupt.)

Use the full verification option in the archive to ensure that the image data can be decompressed losslessly.

Image data may be corrupt after exporting images (When exporting studies from the local database to a DICOM Part 10 Archive using the DICOM JPEG Lossless transfer syntax and not using the archive full verification option, the exported study may not be completely lossless. The image data may be corrupt or distorted.)

Use the full verification option in the archive to ensure that the image data can be decompressed losslessly.

When performing computations on CR images, distances and areas measured are not correct due to stored image size differ from cassette size.

Use calibration/measurement tools.

The system is unable to match automatically because it is unable to receive images. This is detected at the sending host because send actions fail. (Either the receiving system is out of order (power failure, breakdown, network error, etc.) or its Connection Service is not running or refusing the images.)

Provide a UPS to the system to prevent power loss.

Incoming study data is matched with the wrong patient information. (Either the rules that are entered into the RadWorks *system are such that an incorrect but matching patient is selected from a Worklist. Or the HIS/RIS system that is responsible for filling the Worklist does not supply the correct data.).*

Check the match process after changes are made to the system configuration. Verify the data that is received from the HIS/RIS system and check the matching log.

The patient orientation of an image is not correctly adjusted. (Within the QC Module the user is allowed to change the patient orientation information in an image. The user might thus supply the system with incorrect data.)

Only allow authorized users to use the QC module.

Images in a study are irreversibly deleted. (Within the QC Module the user is allowed to delete images from a study. After the study is saved this action is irreversible.)

Only allow authorized users to use the QC module.

During a manual match incorrect patient information is inserted in the image. (Either the user selects an incorrect entry from a Worklist, or the HIS/RIS system that is responsible for filling the Worklist does not supply the correct date.)

Verify the correctness of all information items on Worklists that are provided by the RIS/HIS system. Use a test case to verify this. Only allow authorized users to use the QC module.

APPENDIX D

Declaration of Conformity

medical devices class I annex VII

We hereby declare that the distributed CE marked products specified below conform to the required technical documentation in accordance with Annex VII of the 'EC Directive', the Council Directive 93/42/EEC of 14 June 1993, concerning medical devices.

In addition, we ensure and declare that the distributed CE marked products, as mentioned and falling within Class I, meet the provisions of the EC Directive which apply to them.

This Declaration of Conformity covers the complete RadWorks 6.0 release and is valid for all products concerned bearing the CE mark and manufactured at the following site:

GEMS IT Applicare B.V,
Sparrenheuvel 38
3708 JE Zeist,
The Netherlands

Harm-Jan Wessels
Managing Director
GEMS IT Applicare BV
March 2002

APPENDIX E

License agreement

Below are stated the licensing provisions of Applicare Medical Imaging B.V., owner of all intellectual property rights as vested in the software RadWorks medical imaging system for (medical) datasets and RadStore digital archiving software. The End User is bound to these conditions when using the RadWorks and/or RadStore software.

1 End-User shall mean the party which settled with a fully authorized distributor of Applicare (hereinafter "Distributor") a delivery and/or support agreement in relation to the Software, as described hereinafter.

2 The term the "Software" has the following meaning: the commercially available version of the software known as RadWorks, medical imaging system for medical datasets and/or RadStore, digital archiving software for (medical) datasets, supporting information, documentation and manuals. The source code of the Software will not be supplied.

3 The term the "Installation" has the following meaning: The date of the written notice in which Distributor notifies End-User that the agreed upon connectivity, the operational testing and verification of the Software at the location of End-User have been carried out satisfactory.

4 Upon condition that all agreed license fees for the use of the software are paid to Distributor, Applicare hereby grants to End-User and End-User hereby accepts from Applicare a non-transferable and non-exclusive license to use the Software on one processing unit as an end-user for the internal business of End-User, for the sole benefit of the End-User and at the location of End-User. End-User is not entitled to use the Software for commercial purposes. Third parties shall not be permitted by End-User to use or have access to the Software.

End-User is only allowed to permit use to subsidiaries and affiliated companies after the prior written approval of Distributor.

5 Licensee acknowledges that a license to use the Software can be bound up with a voluntary subscription to the support as delivered by Distributor for which a separate support fee has to be paid. Subscription to the support has to be made for a minimum period of three (3) years.

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7 In consideration of the rights as granted, End-User will pay to Distributor a license fee as agreed between Distributor and End-User. End-User will pay Distributor separately for the support as to the Software if a support subscription has been agreed upon.

8 In the event the Distributor takes care of the installation of the Software on the hardware system of the End-User, the Distributor is responsible/liable for the proper installation of the Software on the hardware system according his warranty terms and conditions.

9 Whether or not the hardware system as described in paragraph 8 is delivered by Distributor, Distributor hereby refers to the warranties of the ancillary supplier/ manufacturer concerned of the hardware system. Applicare nor Distributor shall have any liability to End-User on account of condition or operation of the hardware system warranties provided by the ancillary supplier/manufacturer concerned. Applicare shall not be liable for warranty support which shall be the responsibility of the ancillary supplier/ manufacturer of the hardware system.

10 End-User shall not modify, adapt, dissemble, translate, vary, copy, reproduce or alter the Software in any way, without the prior written approval of Applicare.

End-User is allowed to copy or reproduce the Software for the purposes only of archive and for the back-up, provided that no more than two (2) copies per numbered version will be in existence at one time. End-User shall maintain the copyright notice on the Software and shall reproduce such copyright notice on any copy of the Software.

11 Applicare warrants that the Software has been designed and developed with professional competence and in accordance with the technical engineering practices and standards commensurate with those

observed in the computer software industry and, when used in accordance with the procedures specified in the related documentation and the applicable amendments and supplements thereto shall perform as specified therein.

12 If any failure to conform such specifications appears in the warranty period of twelve months as of Installation, Distributor shall, according to the terms and conditions of the agreed support agreement, use its best efforts to provide valuable assistance (correction or replacement). In case a correction is not possible within short time, Distributor and Applicare shall use its best endeavors to provide a provisional solution without any undue delay. Distributor and/or Applicare may charge the costs of repair in the event of errors made by End-User or any other cause for which Distributor/Applicare cannot be blamed. Recovery of any data which may have been lost will not be covered by the guarantee.

13 The warranty as indicated, shall be limited in such a way that Applicare nor Distributor shall not be liable for any malfunction or error resulting from a modification made with or without the prior written explicit approval of Distributor and/or Applicare or resulting from improper use of the Software.

14 In no event shall Applicare be liable for any loss, damage or expense whatsoever including, without limitation, time, money or good-will arising from or in connection with the use, non-use, performance or non-performance or inability to use, and operation of the Software.

15 Distributor's and Applicare's sole and exclusive liability is to provide programming services to replace or correct defects in the Software which cause the Software to fail to conform to Applicare's warranty set forth in this Agreement. Applicare and Distributor disclaim any and all implied warranties, except to the extent that it is unlawful to exclude such liability.

16 RadWorks and RadStore are 'software only products', meaning that End-User is free to choose its own hardware and media (such as RAID and a DLT, CD or DVD library). In no event shall Applicare be liable to End-User for the proper installation of the Software, the choice of hardware by either End-User or Distributor and/or the proper installation and functioning of additional software (such as toolkits) necessary to obtain access to the hardware devices used to store the data.

17 In no event shall Applicare/Distributor be liable to End-User for incidental, exemplary, punitive or consequential damages for any

reason whatsoever, except to the extent that it is unlawful to exclude such liability. End-User hereby waives, for itself and its successors and assigns, any and all claims for direct, special, incidental, or consequential damages.

18 Applicare/Distributor expressly exclude any kind of liability for damages, including but not limited to death or bodily injury, incurred because of medical decisions or refraining of the same based upon use of the Software. End-User acknowledges that Applicare/Distributor is never responsible/liable for any consequence due to any medical decision or refraining from any decision based upon use of the Software.

19 In the event that a limitation of liability in the above said warranty provisions (12-18) shall be held to be invalid for any reason and Applicare/Distributor becomes liable for loss or damage that would otherwise have been excluded, such total liability shall never exceed the amount of the license fee per event, a series of interconnected events being regarded as a single event.

20 In the event Applicare or Distributor or their employees committing any tort for which Distributor and/or Applicare can be held liable in law, Distributor and/or Applicare will only be liable to make compensation for any loss caused by death or bodily injury and for any other loss as far as these have arisen through wilful intent or gross negligence. In these cases damages will not exceed 1,000,000 Dutch Guilders per event causing a loss, a series of interconnected events being regarded as a single event.

21 The termination of the appointment of Distributor will not influence the effectiveness of this license. In such event, Applicare agrees to use its best efforts in order to continue the support to End-User.

22 End-User and its employees shall keep strictly confidential any and all information relating to the Software and other information, as confidentially disclosed. End-User shall take all necessary steps to ensure the confidentiality of the Software.

23 This license shall be governed by the laws of the Netherlands within the jurisdiction of the competent court of Amsterdam.

24 End-User confirms and acknowledges that any and all of the trademark(s), trade names, copyrights, patents and other intellectual property rights used or embodied in or in connection with the Software (including any future additions, releases, enhancements, updates,

translations or modifications) shall be and remain the sole property of Applicare.

25 Applicare may terminate this license by a one (1) month prior written notice upon failure of End-User to remedy a breach of any of its obligations hereunder within ten (10) days of being notified of such breach. End-User shall discontinue all use of the Software and return the Software to Distributor and not keep any copies of the Software. Under no circumstances End-User shall be entitled to claim any indemnification as a result of the termination of this license. In the event of bankruptcy of End-User, this license is terminated automatically with immediate effect and the Software shall be returned without any undue delay.

The Netherlands, 2002

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